

**GOVERNMENT OF SINDH**  
**Directorate of Alternative Energy**  
**ENERGY DEPARTMENT**

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**Revised PC-1**

**ADP Scheme No. 1155 (Financial Year 2023-24)**

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**SINDH SOLAR ENERGY PROJECT (SSEP)**  
**Financed by the World Bank 98% and Government of Sindh 2%**



**REVISED PC – 1: August 2023**  
**RS. 27,418.13 million**

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## ABBREVIATIONS AND ACRONYMS

<b>ADB</b>	Asian Development Bank	<b>M&amp;E</b>	Monitoring and Evaluation
<b>AEDB</b>	Alternative Energy Development Board	<b>MFB</b>	Micro-Finance Bank
<b>CAPEX</b>	Capital Expenditure	<b>MFI</b>	Micro-Finance Institution
<b>CCC</b>	Concept Clearance Committee	<b>MFP</b>	Micro-Finance Provider
<b>CDWP</b>	Central Development Working Party	<b>MIS</b>	Management Information Systems
<b>CPEC</b>	China Pakistan Economic Corridor	<b>MTF</b>	Multi-Tier Framework
<b>CPPA-G</b>	Central Power Purchase Agency	<b>OPEX</b>	Operating Expense
<b>DISCO</b>	Distribution Company	<b>NEPRA</b>	National Electric Power Regulatory Authority
<b>DS</b>	Distributed Solar	<b>NFC</b>	National Finance Commission
<b>EAD</b>	Economic Affairs Division	<b>NGO</b>	Non-Governmental Organization
<b>ECC</b>	Economic Coordination Committee	<b>NTDC</b>	National Transmission and Dispatch Company
<b>ECNEC</b>	Executive Committee of the National Economics Council	<b>MIS</b>	Management Information System
<b>EIRR</b>	Economic Internal Rate of Return	<b>O&amp;M</b>	Operation and Maintenance
<b>EPA</b>	Energy Purchase Agreement	<b>PAYG</b>	Pay As You Go
<b>EPC</b>	Engineering, Procurement and Construction	<b>PDWP</b>	Provincial Development Working Party
<b>ESMF</b>	Environmental & Social Management Framework	<b>PSC</b>	Project Steering Committee
<b>ESMP</b>	Environmental & Social Management Plan	<b>PDO</b>	Program Development Objectives
<b>FA</b>	Financial Advisors	<b>PEPCO</b>	Pakistan Electric Power Company
<b>FDI</b>	Foreign Direct Investment	<b>PIU</b>	Project Implementation Unit
<b>FIRR</b>	Financial Internal Rate of Return	<b>PO</b>	Partner Organization
<b>FIT</b>	Feed-in-Tariff	<b>PPA</b>	Power Purchase Agreement
<b>FM</b>	Financial Management	<b>PPAF</b>	Pakistan Poverty Alleviation Fund
<b>FS</b>	Feasibility Study	<b>PPP</b>	Public Private Partnership
<b>GCA</b>	Controller General of Account	<b>PPSD</b>	Project Procurement Strategy for Development
<b>GDP</b>	Gross National Product	<b>QCBS</b>	Consultants Quality and Cost-based Selection
<b>GENCO</b>	Generation Company	<b>RAP</b>	Resettlement Action Plan
<b>GIS</b>	Geographic Information System	<b>RPF</b>	Resettlement Policy Framework
<b>GoS</b>	Government of Sindh	<b>RBF</b>	Result-Based Financing
<b>GRC</b>	Grievance Redress Committee	<b>SED</b>	Sindh Energy Department
<b>GRM</b>	Grievance Redress Mechanism	<b>SHA</b>	Shareholder Agreement
<b>GRS</b>	Grievance Redress Service	<b>SHS</b>	Solar Home System
<b>HESCO</b>	Hyderabad Electric Supply Company	<b>SREC</b>	Sindh Renewable Energy Company
<b>HDI</b>	Human Development Index	<b>SSEP</b>	Sindh Solar Energy Project
<b>ICT</b>	Information and Communication Technology	<b>SSP</b>	Solar Service Providers
<b>IDA</b>	International Development Association	<b>STDC</b>	Sindh Transmission & Dispatch Company
<b>IEA</b>	International Energy Agency	<b>STEP</b>	Systematic Tracking of Exchanges in Procurement
<b>IEC</b>	International Electrotechnical Commission	<b>T&amp;D</b>	Transmission and Distribution
<b>IFC</b>	International Finance Cooperation	<b>USS</b>	Utility-Scale Solar
<b>IMF</b>	International Monetary Fund	<b>VRE</b>	Variable Renewable Energy
<b>IPP</b>	Independent Power Producer	<b>WADPA</b>	Water and Power Development Authority
<b>IRR</b>	Internal Rate of Return	<b>WBG</b>	World Bank Group

**GOVERNMENT OF SINDH**  
**PLANNING & DEVELOPMENT DEPARTMENT**  
**PC-1 FORM**

**(INFRASTRUCTURE SECTORS)**  
**ENERGY (FUEL & POWER)**

1.	<b>Name of Project:</b>	Sindh Solar Energy Project (SSEP)
2.	<b>Location:</b>	<p><b>Entire Sindh Province.</b></p> <p>1. <b>Component – I: Utility-Scale Solar with target of at least 400 MW Solar Parks:</b> Initially 50 MW project at Manjhband near Khanot Grid Station, Taluka Manjhband, District Jamshoro to be developed under the prevailing Alternative &amp; Renewable Energy Policy 2019, closely followed by two or more sites for a planned capacity of <math>\geq 350</math> MW on the outskirts of Karachi for which K-Electric will be the power off-taker. Development of any further sites, including possible solar-wind hybrid locations, will be informed by the Variable Renewable Energy Locational Study published by the World Bank in February 2021, and by comprehensive geospatial and grid capacity analysis carried out under the project.</p> <p>(Copies of Allotment orders is enclosed as <b>Annexure A</b>). The tentative location Map of all sites are enclosed as <b>Annexure- A1</b>).</p> <p>2. <b>Component – II: Distributed Solar with a target of at least 50MW Roof Top:</b> Public buildings (such as administrative, community, educational, healthcare, religious, and social buildings, amongst others) in Sindh province, including those belonging to autonomous bodies, semi-government buildings, and public corporations under the administrative control of Government of Sindh. Humanitarian and social sector buildings administered by non-profit organizations, trusts or independent bodies shall also be considered, subject to the approval of the PSC.</p> <p>3. <b>Component – III: Solar Home Systems:</b> Provision of affordable off-grid solar home systems (SHS) to approx. 200,000 households to help create a thriving market for high quality SHS through Last Mile Distributors (LMDs) with an option of bulk procurement.</p> <p>4. <b>Component – IV: Technical Assistance &amp; Capacity Building:</b> Implementation support to Energy Department, Government of Sindh, and other relevant entities in Government of Sindh. Not location specific. The technical studies, feasibility studies, trainings of solar technicians and establishment of laboratories for quality assurance of solar related equipment's, hiring of the consultants and purchase the technical equipment's for Renewable Energy and Energy efficiency activities.</p>
3.	<b>Authorities Responsible For:</b>	
a.	<b>Sponsor:</b>	Energy Department, Government of Sindh



b.	<b>Execution:</b>	Project Management Unit (PMU), Sindh Solar Energy Project (SSEP)
c.	<b>Operation &amp; Maintenance:</b>	<p>1. <b>Utility Scale Solar:</b> The O&amp;M for any solar park infrastructure financed under the project is the responsibility of Energy Department, Government of Sindh (via SPV) till the smooth transfer of project assets to selected IPP; the O&amp;M for the actual solar power plants constructed within the solar parks is the responsibility of the winning independent power producers (IPPs) selected under the project.</p> <p>2. <b>Distributed Solar:</b> The initial design, supply and construction contracts will include one or more years of O&amp;M on a PKR/kWh basis. Responsibility for long-term O&amp;M going beyond this project falls to Energy Department, Government of Sindh or the respective facility management and all arrangements shall be in place and finalized prior to the project end date. The project shall explore several options, including passing all the assets and the O&amp;M responsibilities to a company owned by the Energy Department (e.g., Sindh Renewable Energy Company Ltd) or by issuing a long-term O&amp;M contract on a performance-based model by the owners/ management of the respective buildings</p> <p>3. <b>Solar Home Systems:</b> The suppliers of solar home systems shall be responsible for all O&amp;M under their contract with the purchasing households, with a requirement for at least one year of O&amp;M provision – in addition to the required warranties – for suppliers to be eligible to participate in the project.</p> <p>4. <b>Technical Assistance &amp; Capacity Building:</b> Not applicable.</p>
d.	<b>Concerned Federal Ministry:</b>	Ministry of Energy (Power Division) and affiliated and relevant agencies (i.e., NTDC, AEDB, CPPA-G) as per prevailing institutional framework.
4.	<b>Plan Provision:</b>	
a.	<b>If the project is included in the medium term/five-year plan, specify actual allocation:</b>	<p>Initially Project was reflected at Sr. No. 609 in provincial ADP of FY 2017 – 18 and in subsequent years. At present, the Project is at serial number 1155 in current year ADP 2023–24.</p> <p>Estimated cost of the project is US\$102 million, of which the World Bank share is US\$100 million soft loan (IDA credit), Out of which US\$ 22 million has been released by WB till to date. The share of the Government of Sindh is PKR 554.01 million (Equivalent to US\$2 million). The project agreements, financial agreements are in place through EAD.</p> <p>Allocation for the Year 2023 – 24 is Rs 8500 million from WB funds. GoS allocation for counterpart funding is Rs.117.88 million FY 2023 – 24.</p>
b.	<b>If not included in the current Plan, how is</b>	N/A



	it now proposed to be accommodated?	
c.	If the project is proposed to be financed out of block provision for a program, indicate:	N/A
5.	<b>Project Objectives and its relationship with sector objectives</b>	The objective of the project is to increase solar power generation and access to electricity in Sindh Province and to improve energy security and help fulfil Pakistan's international commitments on climate change.
6.	<b>Description, Justification, Technical Parameters and Technology Transfer Aspects:</b>	
a.	<b>Project Description:</b>	<p>This World Bank financed project includes four components, with the following results targets.</p> <ol style="list-style-type: none"> <li>1. <b>Utility-Scale Solar:</b> Development of <b>at least 400 MW</b> of utility-scale solar by private sector IPPs in Sindh, selected using international tariff-based competitive bidding, and supporting development of solar park infrastructure under the project.</li> <li>2. <b>Distributed Solar:</b> Installation of <b>at least 50 MW</b> of distributed solar on and around public, Semi –Govt, autonomous bodies, humanitarian and social sector buildings and facilities in Sindh, with provisions made for long-term O&amp;M.</li> <li>3. <b>Solar Home Systems:</b> Provision of grants to support the bulk procurement of high quality, off-grid, solar home systems to <b>200,000</b> lower-income households in Sindh.</li> <li>4. <b>Technical Assistance &amp; Capacity Building:</b> Provision of technical assistance and capacity building within the Energy Department, but also to other stakeholders critical to the development of solar power and renewable energy in Sindh. Funds may also be used by the Energy Department to carry out studies or prepare concepts for future project financing.</li> </ol> <p>Further details of the project are at <b>Annexure C</b>.</p> <p>Feasibility studies were attached as <b>Annexure C1, C2 &amp; C3</b></p>




b.	<b>Project Justification:</b>	<p>The General public of the province suffers from a lack of reliable electricity for grid-connected consumers, rising bills, non-payment of electricity by some public consumers, and a lack of access to electricity, especially in the rural areas. The project will improve energy security and help fulfil Pakistan's international commitments on climate change. It will also help provide electricity to the 27% of the population that do not have access (Report on National Action Plan Sustainable Energy for All, January 2018 by UNDP and Ministry of Planning Development &amp; Reform, Govt. of Pakistan), which currently results in poor socio-economic conditions and unavailability of health and education facilities. Further details are at <b>Annexure D</b>.</p>
c.	<b>Technical Parameters:</b>	<p>In Sindh, annual average Global Tilted Irradiance (GTI) ranges from around 5.7 to 6.4 kWhr/m<sup>2</sup>/day (source: Global Solar Atlas). As a result of this excellent solar potential, solar power is a least cost form of electricity generation, as confirmed by the Indicative Generation Capacity Expansion Plan 2021-2030, which envisages significant additions of solar power to the Pakistani electricity grid over the coming decade. Further details are at <b>Annexure E</b>.</p>
d.	<b>Technology Transfer Aspect:</b>	<p>This project will lead to introduction of new technologies and business models to Pakistan, including state of the art solar power and plant control systems (including potential, hybrid operation with wind, floating solar and other potential innovations) under Components 1 and 2, and Solar Home Systems (SHS) that meet the needs of populations in remote areas under Component 3.</p> <p>There will be substantial opportunities for technology transfer through joint ventures with local entrepreneurs. There will also be direct job opportunities created under the Project, a large percentage of which will be permanent new jobs in the renewable energy sector. The project will generate demand for balance of system components (fans, wiring, batteries) that will be manufactured in Pakistan.</p> <p>The project also includes a substantial capacity building program, including training for project staff and other stakeholders. The World Bank has previously secured grant funds under the project for technical assistance activities at the national level, including training and study tours.</p>
e.	<b>Inputs and Outputs of the Project:</b>	<p><b>Inputs:</b> US\$102 million shall be committed to the Project, of which <b>\$98</b> million shall be for the investment components (Component I – III), <b>\$2m</b> for capacity building and technical assistance (Component – IV), and <b>PKR 554.01 million (Equivalent to USD 2 Million)</b> for establishment of PMU staffing and other costs (Administrative Budget provided by GoS under ADP). Of the total budget of \$102 million, the World Bank shall provide US\$100 million in the form of concessional loan financing (covering Components I – IV), and Government of Sindh shall provide PKR 554.01 million (to cover the PMU costs).</p>



		<p><b>Outputs:</b></p> <ul style="list-style-type: none"> <li>i. Development of solar parks to support private sector development of at least 400 MW of solar power capacity under IPP mode. The project will be financing the implementation of international competitive bidding for solar power production, starting with an initial 50 MW solar auction (under NEPRA framework) at a site near Manjhand, district Jamshoro in addition to approximately 270 MW in Karachi Division. The project will also explore opportunities for further development of solar-wind hybrid sites and projects in the existing wind corridors or any other suitable location in the province through PPP or IPP mode under prevailing NEPRA framework to cover up minimum 80 MW solar.</li> <li>ii. Development of at least 50 MW of solar power on and around public sector, Semi Govt, autonomous bodies, humanitarian, and social sector buildings in Sindh province, of which around 20 MW has already been constructed under a special COVID emergency sub-component under the project. The project will also develop and put in place a model for long-term O&amp;M.</li> <li>iii. Provision of SHS to at least 200,000 households in Sindh (1.2 million people), by providing installation of eligible, high-quality SHS products from verified suppliers.</li> <li>iv. Capacity building and technical assistance activities to support the design and implementation of the project, improve the skills in the sector, and prepare for future sustainable energy projects including support to establish solar standard Laboratories.</li> </ul>
f.	Provide details of civil works, equipment, machinery, and physical facilities required for the project:	<p><b>Comp – I: Utility Scale Solar:</b> For development of solar parks, Government of Sindh will identify sites with grid access and conduct the required project development studies and make provision, as needed on a site-by-site basis, for roads access, security, fencing, resettlements expenditures, water provision, and any other necessary infrastructure to facilitate a reduction in the bid tariffs and accelerate the development of solar power projects by the winning developers. The exact requirements for each solar park site shall be advised by independent consultants appointed under the project.</p> <p>For the development, construction, and operation of the solar power plants, within the solar parks, private sector IPP will be responsible for provision for all necessary equipment and works.</p> <p><b>Comp – II: Distributed Solar:</b> For development of distributed solar on public buildings, equipment and necessary civils works, infrastructure development, solar panels and balance of system components will be supplied and installed under EPC contracts.</p>





		<p><b>Comp – III: Solar Home Systems:</b> The PMU plans to engage in direct bulk procurement whereby SHS kits shall be procured, imported, combined with other domestically supplied components, and stored in bidder's owned/rented warehouse in Karachi. The kits will then be evenly distributed to all districts of the province on an established criteria using a network of Last Mile Distributors (LMDs).</p> <p><b>Comp – IV: Technical Assistance &amp; Capacity Building:</b> Not applicable since no works or equipment are involved. The capacity building support to public sector universities to establish Solar Standards laboratories will be operated and maintained by respective institutions.</p>
g.	Indicate governance issues of the sector relevant to the project and strategy to resolve them:	<p><b>Utility Scale Solar (Component – I)</b> is designed to put competitive bidding into practice through solar auctions at identified sites. This will result in a new benchmark on both process and pricing and attracting private sector investment, including foreign direct investment (FDI). As per the NEPRA decision on competitive bidding for renewable energy projects [NEPRA/LA(Leg.)/NCBT-01/6072], Government of Sindh is one of several 'Relevant Agencies' for carrying out a competitive bidding process.</p> <p>For <b>Distributed Solar (Component – II)</b> there are outstanding issues with implementing the net metering policy, due to uncertainties of the Distribution Companies (DISCOs) on how it would impact them and the breakup of power supply during load shedding and system breakdowns. Component 2 shall primarily target buildings that do not require electricity export and shall benefit the DISCOs by reducing losses to certain non-paying public sector consumers. In some cases, for buildings that experience heavy load-shedding that would impact the economic viability of the solar installation (which is unable to operate under such a scenario), mitigation options including an “express line”, linking to existing backup generators, or installation of battery storage, may be explored.</p> <p>For <b>Solar Home Systems (Component – III)</b> it is important to have a robust verification process in place to check the credentials of suppliers, check the eligibility of their products, and ensure that SHS installations are implemented correctly and that any fault, issues or customer complaints are dealt with. This verification process has already been put in place under the project and the PMU will continue to refine and improve it.</p> <p>The project will be executed by the PMU with World Bank implementation support and fiduciary supervision. The World Bank brings to the project international experience from other similar interventions, including on solar auctions, distributed generation, and SHS from a range of other countries.</p>
7.	Capital Cost Estimates:	<p>PKR 27,418.13 million</p> 



a.	<b>Indicate date of estimation of project cost:</b>	July 2023
b.	<b>Basis of determining the capital cost be provided. It includes survey, schedule rates, estimation on the basis of previous work etc.:</b>	Capital cost for all components is estimated on the basis of market costs, or from previous open bid prices or NEPRA determinations where relevant.
c.	<b>Provide year-wise estimation of physical activities as per following:</b>	Details of Government of Sindh activities/expenditures relating to the PMU establishment and staffing are provided at <b>Annexure F</b> . For the investment activities the Project will utilize World Bank lending.
d.	<b>Phasing of capital cost be worked out on the basis of each item of work as stated above and provide as per following:</b>	At Annexure – F
e.	<b>Comparative Statements of original &amp; revised PC-1</b>	At Annexure – G
f.	<b>Year wise releases and expenditure</b>	At Annexure – H
g.	<b>Changes in revision PC-I and reasons for changes</b>	<p>PC-I has been revised due to the following changes:</p> <ul style="list-style-type: none"> <li>(i) Results targets: the targets have been updated to make them more flexible (“at least...”), and to increase the target for C – II from 20 MW to 50 MW.</li> <li>(ii) Project description and modalities: quantum of works and other details updated to reflect the current project design. Allowance made for development of solar projects at wind power sites (“solar-wind hybrid operation”). Clarification of O&amp;M plans, especially under C – II.</li> </ul>



		<p>(iii) Expansion of building types and eligibility under C2: addition of non-government buildings in the social sector, at the discretion of the PSC.</p> <p>(iv) Target districts under C3: initially this was limited, but due to the flooding situation and in consultation with the WB this limitation has been removed.</p> <p>(v) Implementation strategy has been changed from direct subsidy to indirect subsidy through bulk procurement by the PMU. The estimated cost of financing for each SHS system is US\$ 160 has been reserved in the Project as subsidy amount. The systems will not be provided on free of cost. The LMD costs will be recovered from the beneficiaries and the available budget of the project.</p> <p>(vi) Number of PMU staff: updated in light of implementation experience and requirements.</p> <p>(vii) Project duration: updated to include a proposed project extension to ensure that the results targets can be met.</p> <p>(viii) Simplification: editing to simplify the entries provided.</p>
8.	<b>Annual Operating and Maintenance Cost After Completion of The Project:</b>	<p><b>Component I:</b> The operating cost (OPEX) for the solar power projects is estimated to be relatively low, at \$0.002/kWh, but will be covered by the IPPs (part of the bid tariff), and therefore will not impose a burden on the public sector. The operating costs of any solar park infrastructure shall be more than covered by the “solar park fee” to be charged to the IPPs.</p> <p><b>Component II:</b> The OPEX for distributed solar is estimated to be around 5% of the CAPEX value (which includes third party insurance cover) and will need to be budgeted for by Sindh Energy Department or the owner /management of respective beneficiary once the O&amp;M cover under the EPC contracts signed under the project expiry. However, this cost is easily recovered by the electricity cost savings that are generated by the solar power outputs.</p> <p><b>Component III:</b> The OPEX for the SHS is assumed to be 20% of CAPEX and is part of the contractual relationship between the household and the LMDs. In many countries, households enter into a long-term relationship with LMDs, gradually upgrading their SHS over time.</p> <p>There is no OPEX cost under <b>Component IV</b>. However, if any will be borne by the respective entity.</p>
8 (a)	<b>Project Approval History</b>	<p>The Project was approved by ECNEC on 14<sup>th</sup> November 2018 at a total cost of Rs.12,848.11 million (FEC=Rs.12,408.00 million, Local=Rs.440.11 million) (USD conversion rate 1 US\$=Rs.124.08).</p>



		<p>(The Loan agreements with World Bank was signed on 9<sup>th</sup> January 2019 and the Finance Department, Govt of Sindh conveyed administrative approval on 20<sup>th</sup> May 2019 for a period of 5 years up to 2022-23.</p> <p>The revised Project PC-1 is approved by ECNEC on 11<sup>th</sup> July 2023 at a total cost of Rs.27,418.13 million (<b>FEC=Rs.24265.77 million, Local=Rs.3152.28 million</b>) (USD conversion rate 1 US\$=Rs.285.48). The WB share is <b>USD100 Million</b> and the GoS counterpart funding for establishment of PMU is <b>PKR 554.01 million</b>.</p>
9.	<b>Demand and Supply Analysis:</b>	N/A.
10.	<b>Financial Plan and Mode of Financing:</b>	The Project has been designed with the lending support of the World Bank and is being submitted for a US\$100 million International Development Association (IDA) loan on concessional terms. The remaining PKR 554.01 million (Equivalent to US\$2 million) shall be contributed by Government of Sindh as 'counterpart funding', to cover the cost of the PMU. World Bank financing shall be disbursed to the PMU in accordance with World Bank procedures, and according to Project physical progress and achievements.
a.	<b>Equity:</b>	2% (Government of Sindh PKR 554.01 million (Equivalent to US\$ 2 Million) contribution for PMU Establishment of PMU).
b.	<b>Debt:</b>	98% (World Bank concessional loan for \$100 million).
11.	<b>Project Benefits and Analysis:</b>	The Project is expected to yield significant economic, financial, and social benefits for Sindh. All of the Components deliver positive economic returns well above 20%.
a.	<b>Financial:</b>	Financial benefits of the Project are provided at <b>Annexure I</b>
b.	<b>Economic:</b>	Economic benefits of the Project are provided at <b>Annexure I</b>
c.	<b>Social Benefits with Indicators</b>	<p>The Project will help to scale-up solar power in Sindh and increase access to electricity especially among poorer communities. Specific targets and indicators are:</p> <ul style="list-style-type: none"> <li>• At least 450 MW of new solar power capacity facilitated under Component – I and Component – II.</li> <li>• 1,200,000 people will be provided with improved electricity access.</li> </ul>



d.	<b>Employment Generation (direct or indirect):</b>	<p><b>Component I:</b> Direct employment generation in rural areas is expected through construction of Solar Parks, construction of the solar power projects (by IPPs), and long-term O&amp;M.</p> <p><b>Component II:</b> Direct employment generation through construction and O&amp;M of distributed solar facilities within the entire Sindh province.</p> <p><b>Component III:</b> Direct employment generation in rural areas for installation and servicing solar home systems &amp; subsequent O&amp;M.</p> <p><b>Component IV:</b> Direct employment for operation of the Solar standard laboratories on sustainable basis.</p> <p><b>All Components:</b> Indirect employment generation in sectors supplying the solar PV market, such as provision of raw materials.</p>
e.	<b>Environmental Impact:</b>	<p>The installation of solar PV technology is a measure to reduce the GHG emissions produced through conventional fossil fuel power plants. The Project will have very minimal environmental impacts. Since the exact locations and nature of the sub-projects to be implemented under the Project are not known at this stage, a framework approach is being followed and Environmental and Social Management Framework (ESMF) has been prepared which highlights generic environmental impacts of the Project. At that time, site specific ESMPs will also be prepared for each sub-project and disclosed appropriately. Component 1 is likely to cause air, soil, and water contamination, increase noise pollution, damage existing infrastructure, additional pressure on local resources particularly drinking water, environmental aspects of labor influx, loss of natural vegetation and habitat, and displacement of and disturbance to the wildlife. Most of these potential impacts are however low to moderate in intensity/significance and are reversible and localized in nature - and therefore can easily be mitigated with help of appropriate mitigation and control measures or any ARAPs Similarly, Component 2 can cause air, soil, and water contamination, noise generation, blockage of building access routes, damage to the buildings and other infrastructure, and water requirements during plant operation. Component 3 is likely to cause only minor environmental impacts including damage to houses and noise. Most of these impacts are mild in nature and intensity and can therefore be addressed through simple mitigation and precautionary measures.</p>
f.	<b>Impact of delays on project cost and viability:</b>	<p>The project was designed as a five-year intervention to mitigate the impact of delays, however, due to Covid-19 and Floods 2022, an extension of 22 months, till 31<sup>st</sup> July 2025 has been approved by the competent Forum of ECNEC without any change in cost overruns. other than the cost increases due to Rupee-Dollar disparity, which is already covered.</p>



12.	<b>Implementation Schedule:</b>	<p>Date of commencement: 20<sup>th</sup> May 2019.</p> <p>Original date of completion: 30<sup>th</sup> September 2023</p> <p>Revised date of completion: 31<sup>st</sup> July 2025</p> <p>The project implementation was started from 20<sup>th</sup> May 2019 upon receipt of administrative approval. The project activities started one year late due to opening of financial accounts and establishment of Project PMU. Further the project activities were significantly delayed due to COVID-19 pandemic since March 2020 and then the catastrophic flooding in July 2022 (which particularly impacted Component III).</p> <p>The active project implementation time has been less than three years, that is why an extension of 22 months till 31<sup>st</sup> July 2025 has been approved. Based on the lessons learnt and price variations, the resulting targets for Component 1 and Component II have been revised. The project is already approved by the WB Board and loan agreements was signed on 9<sup>th</sup> January 2019 which was also the effectiveness date of the project. No additional financing is required, only reallocation of amounts between various components have been made. A full implementation schedule is available at <b>Annexure – J</b>.</p>
13.	<b>Management Structure and Manpower Requirements Including Specialized Skills During Construction and Operational Phases:</b>	<p>A Project Management Unit ("PMU") headed by a Project Director has been established to implement and ensure completion of the Project under the administrative control of Energy Department, Government of Sindh. Procurement, safeguards, and fiduciary controls, and related expenditures, will comply with the requirements and processes of the World Bank. The specific purpose of the PMU is as follows:</p> <ol style="list-style-type: none"> <li>The PMU will be responsible for execution, implementation, monitoring and controlling of the project as per approved PC-I, and in line with the World Bank guidelines and procedures.</li> <li>Ensure the schedule, budget, and scope of the project.</li> <li>Preparing status and progress reports and updating all the concerned stakeholders regarding project status.</li> <li>Delivering support to the stakeholders by providing guidance on project management processes and methodologies in an efficient and consistent manner.</li> <li>Providing necessary support and monitoring and ensuring that the bidders/contractors performance meets requirements for quality deliverables.</li> <li>Providing mentoring and assessing the performance of the project execution.</li> </ol>



		<p>g. Providing updates, briefings, and preparing proposals for any significant decisions that would require approval from the Project Steering Committee (PSC), followed by any requisite communication to stakeholders or follow-up with the relevant agencies or authorities.</p> <p>h. The scope of PMU is limited to the ongoing project.</p> <p>i. A Project Operations Manual has been prepared detailing PMU processes and procedures, and outlining the composition, roles and responsibilities of the PSC. In line with the Project Agreement signed with the World Bank, the Operations Manual is a “living document”, and any iterations or changes need to be formally agreed by the World Bank.</p> <p>j. Following approval of this revised PC-I, all future decision-making on the detailed design and implementation of the project, consistent with the letter and spirit of the PC-I, shall be delegated to the PMU, overseen by the PSC, and after obtaining any required “no objections” under WB Procurement Regulations from the World Bank.</p>
a.	<b>Justification:</b>	<p>The purpose of the PMU is to control and execute the Project implementation activities and to ensure the progress in the project as per approved plan. The Project Director will head the PMU and will be responsible for financial and physical progress of the Project. All matters related to the Project implementation will be monitored by the PMU, with regular reporting to the PSC. It is critical for smooth implementation of the project that the PD is responsible for day-to-day decision-making, staffing, and authorizations, with the PSC as the ultimate decision-making authority for the project. World Bank oversight, and associated compliance with WB regulations and procedures, provides an additional level of assurance when it comes to use of WB resources.</p>
b.	<b>Operating Cost of PMU:</b>	<p>The operating cost of the PMU is detailed at <b>Annexure F</b>. This cost shall be fully covered by Government of Sindh as the 'counterpart funding' provided to the Project.</p> <p>The expenditures include staff salaries, purchase of auxiliaries, and accommodation during field activities only, monitoring costs and any other costs deemed necessary for the project with the prior approval of Project Director.</p> <p>The project is being executed under WB procurement regulations, whereas counterpart funding has been subject to SPPRA Rules, resulting in double procurement procedures. Therefore, going forward, all the procurement under counterpart funding will also be executed under WB procurement regulations.</p>





c.	Human Resource for PMU:	Human Resource requirement for managing the project is through PMU is as under: <table><tr><th>S/No.</th><th>Title of Post</th><th>No. of Posts</th></tr><tr><td>1</td><td>Project Director (PPS-10)</td><td>1</td></tr><tr><td>2</td><td>Procurement Manager (PPS-9)</td><td>1</td></tr><tr><td>3</td><td>Manager Utility Scale (PPS-9)</td><td>1</td></tr><tr><td>4</td><td>Manager Distributed Solar (PPS-9)</td><td>1</td></tr><tr><td>5</td><td>Manager Solar Home Systems (PPS-9)</td><td>1</td></tr><tr><td>6</td><td>Monitoring &amp; Evaluation Specialist (PPS-9)</td><td>1</td></tr><tr><td>7</td><td>IT Database Manager (PPS-9)</td><td>1</td></tr><tr><td>8</td><td>Accounting Officer (PPS-8)</td><td>1</td></tr><tr><td>9</td><td>Environment &amp; Social Development Officer (PPS-8)</td><td>1</td></tr><tr><td>10</td><td>Database Analyst (PPS-8)</td><td>1</td></tr><tr><td>11</td><td>Communication Officer / PS to Project Director (PPS-7)</td><td>1</td></tr><tr><td>12</td><td>Admin Officer (PPS-7)</td><td>1</td></tr><tr><td>13</td><td>Office Assistant (PPS-6)</td><td>2</td></tr><tr><td>14</td><td>Computer Operator (PPS-5)</td><td>2</td></tr><tr><td>15</td><td>Receptionist (PPS-5)</td><td>1</td></tr><tr><td>15</td><td>Drivers (PPS-4)</td><td>4</td></tr><tr><td>16</td><td>Naib Qasid /Chowkidar (PPS-I)</td><td>4</td></tr><tr><td colspan="2">Total</td><td>25</td></tr></table> <p>The posts proposed for the project are in accordance with the needs of the project while keeping in view the level and skills required for the successful execution of the project. The total number of staff which will be hired for this project is twenty-Four (25) and they will be hired on contract basis and further renewals on performance basis. TORs of project staff are at <b>Annexure K</b>. The staff salary structure is based on Standard Pay Package notified by Finance Department Government of Sindh vide No. FD (SR-III)5-29/2008 dated 29<sup>th</sup> July 2022 and as amended from time to time. (Copy at <b>Annexure L</b>). The salaries of the existing staff will be revised in line with above notifications with effective from 1<sup>st</sup> April 2022. The Project Director can further hire the services on short term basis for smooth execution of day-to-day affairs within available contingency budget.</p>					S/No.	Title of Post	No. of Posts	1	Project Director (PPS-10)	1	2	Procurement Manager (PPS-9)	1	3	Manager Utility Scale (PPS-9)	1	4	Manager Distributed Solar (PPS-9)	1	5	Manager Solar Home Systems (PPS-9)	1	6	Monitoring & Evaluation Specialist (PPS-9)	1	7	IT Database Manager (PPS-9)	1	8	Accounting Officer (PPS-8)	1	9	Environment & Social Development Officer (PPS-8)	1	10	Database Analyst (PPS-8)	1	11	Communication Officer / PS to Project Director (PPS-7)	1	12	Admin Officer (PPS-7)	1	13	Office Assistant (PPS-6)	2	14	Computer Operator (PPS-5)	2	15	Receptionist (PPS-5)	1	15	Drivers (PPS-4)	4	16	Naib Qasid /Chowkidar (PPS-I)	4	Total		25
S/No.	Title of Post	No. of Posts																																																													
1	Project Director (PPS-10)	1																																																													
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16	Naib Qasid /Chowkidar (PPS-I)	4																																																													
Total		25																																																													
14.	Result Based Monitoring Indicators (RBM)	Input	Output	Outcome		Targeted impacts																																																									
				Baseline indicator	Targets after completion of project																																																										
		The project accounts	807 GWh/A num	i. 27% of the population do not have	200,000 households will be	i. Provision of electricity to 200,000																																																									



		<p>a total budget of Rs. 27,418.13 million</p> <p>generation of grid connected electricity and 91.25 MWh/A num generation of standalone based electricity</p> <p>access to electricity (Report on National Action Plan Sustainable Energy for all January 2018 by UNDP and Ministry of Planning Development &amp; Reform, Govt. of Pakistan)</p> <p>ii. Reduction of average cost of generation, diversity away from imported fossil fuels, and realize the climate change, air pollution, and water conservation benefits of transitioning to renewable sources of electricity.</p> <p>benefited with solar home systems and will receive cheap, sustainable source of electricity. 450 MW will be connected with the Grid this will generate 18,695 GWh over 25 years.</p> <p>households in rural areas will improve socio-economic activities within the community and improve the living standards.</p> <p>ii. Improve the literacy rate in rural areas.</p> <p>iii. And will save cost of grid construction in those rural villages.</p> <p>iv. Access to Greene energy will mitigate the climate change effects.</p> <p>v. Will establish 1<sup>st</sup> Solar Auction practice in Pakistan, to reduce the basket price of electricity.</p>
15.	<b>Additional Projects / Decision's Required:</b>	<p>Following approval of this revised PC-1, the revised document shall be communicated to the World Bank through the formal channels so that they may complete their own project restructuring process.</p>






15. Certificate

**CERTIFIED THAT THE PROJECT PROPOSAL HAS BEEN PREPARED ON THE BASIS OF INSTRUCTIONS PROVIDED BY THE PLANNING COMMISSION FOR THE PREPARATION OF PC-I FOR INFRASTRUCTURE SECTOR (FUEL & ENERGY) PROJECTS:**

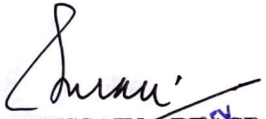
**Prepared by:**

  
**(NIAZ AHMED JANJHI)**  
Deputy Director  
Sindh Solar Energy Project (SSEP)  
Energy Department, Government of Sindh  
Contact # 0332-2646524

**Checked by:**

  
**(ENGR. MEHFOOZ A QAZI)**  
Project Director  
Sindh Solar Energy Project (SSEP)  
Energy Department, Government of Sindh  
Contact # 0333-8558111

**Approved by:**

  
**(FAYAZ HUSSAIN ABBASI)**  
Secretary Energy  
Energy Department, Government of Sindh

**Countersigned by:**

  
**(SHAKEEL AHMED MANGNEJO)**  
Chairman  
Planning & Development Board  
Government of Sindh  
**Chairman**  
Planning & Development Board  
Government of Sindh

## **Allotment Orders**



To

The Deputy Commissioner (Malir),  
**KARACHI.**

**SUBJECT: ALLOTMENT OF LAND ADMEASURING 600-00 ACRES ON 30 YEARS LEASE IN FAVOUR OF M/S SINDH SOLAR ENERGY PROJECT-II FOR ESTABLISHMENT OF 175 MW SOLAR PROJECT IN DISTRICT MALIR KARACHI.**

In exercise of the powers conferred under Section 10 (1) of the Colonization of Government Lands Act 1912, read with Condition No.3 of the Statement of Conditions notified under notification vide No.01-32-2015/SO-VI/354, dated 11-06-2015, and constituted under condition No.7 of the Statement of Conditions on the recommendation of Scrutiny Committee in its meeting held on 08-09-2022, and with the approval of the Government (Provincial Cabinet) in its meeting held on 16-11-2022 (**copy enclosed**). The Land Utilization Department has been pleased to direct the Deputy Commissioner (Malir), Karachi, to lease out an area of **600-00** acres N.C. No.41 situated in Deh Mitha Ghar, Taluka Shah Mureed, District (Malir) Karachi, on 30 years lease in favour of **M/S Sindh Solar Energy Project-II** for establishment of 175 MW Solar Project. The sponsor shall pay the lease amount in three (03) installments payable at the start of each ten (10) years subject to the following rates and conditions:-

Cost of 1 acre for (1 <sup>st</sup> 10 years)	3030.30 x 10 = Rs.30303.03/-
Cost of 1 acre for (2 <sup>nd</sup> 10 years)	30303.03 x 2 = Rs.60606.06/-
Cost of 1 acre for (3 <sup>rd</sup> 10 years)	60606.06 x 2 = Rs.121212.12/-

2. **The terms and conditions of the lease are as under:-**

- The lessee has to pay the lease company within six (6) months from the date of issue of allotment order, (as provided under Sub-Section 5 (a) of Section 10 of the Colonization of Government Lands Act, 1912) failure to pay the lease money the allotment order automatically cancelled / withdrawn.
- The lessee failed to use the land for the purpose for which it was granted or allotted within five (5) years from the date of grant, allotment, conversion or lease has expired the grant, allotment, conversion or lease of the land shall automatically stand cancelled and the amount deposited shall stand forfeited etc as provided under Sub-Section 5 (b) of Section (10 of the Colonization of Government Lands Act, 1912).
- The land shall only be used for the purpose for which applied and approved.

Contd.....P/2



- iv. The Lessee has paid the lease money, the prescribed Lease Deed for the allotted Area shall be executed, stamped and registered by the lessee at his own cost.
- v. If it is found that the lease order has been obtained through misrepresentation of facts or by producing bogus and fraudulent the land shall be liable for resumption.
- vi. Inter-alia all restrictions and conditions laid-down in the Statement of Conditions notified vide No.01-32-2015/SO-VI/354 dated 11-06-2015, shall be compiled strictly Terms & Conditions in this lease order are binding on both the parties.
- vii. The leased out land shall not be transferred or sold in any case. Provided that the Lessee shall be free to create a mortgage in favour of the financial institutions that will fund the project and Lessor shall sign the customary direct agreements(S) in relation there to if required by such financial institutions".

**Detail of Schedule**

Price for 1 Acre for (99 years)	$1 \times 4840 \times 413.22314 = \text{Rs.}20,00,000/-$
Price for 1 acre for 1 year	$20,00,000/99 = \text{Rs.}20202.02/-$
Cost of land (1 acre / year (15% as per RoE)	$20202.02 \times 15\% = \text{Rs.}3030.30/-$
Cost of 1 acre for (1 <sup>st</sup> 10 years)	$3030.30 \times 10 = \text{Rs.}30303.03/-$
Cost of 1 acre for (2 <sup>nd</sup> 10 years)	$30303.03 \times 2 = \text{Rs.}60606.06/-$
Cost of 1 acre for (3 <sup>rd</sup> 10 years)	$60606.06 \times 2 = \text{Rs.}121212.12/-$

\*1 Acre = 4840 square yards

\*RoE = Return on Equity


3. You are, therefore, requested to recover the amount as approved by the competent authority and all other legal formalities be completed after proper verification of any litigation etc, provided that there is no any legal hitch, stay/ restraining orders of any competent court and free from all encumbrances, under intimation to this Department. Also furnish attested copies of paid Challan duly verified by the Treasury Office, lease agreement deed, copy of Form-II / VF-VII, sketch of land for record of this Department.



SECRETARY TO GOVERNMENT OF SINDH  
LAND UTILIZATION DEPARTMENT

**A copy is forwarded to:-**

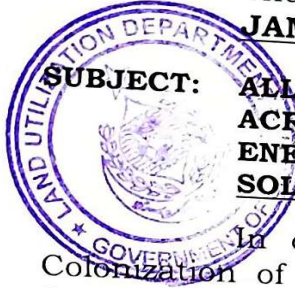
1. The Senior Member, Board of Revenue, Sindh, Karachi.
2. The Principle Secretary, to Chief Minister Sindh Karachi.
3. The (Staff) Officer to Chief Secretary Sindh Government of Sindh Karachi.
4. The Secretary, Energy Department Government of Sindh.
5. The Commissioner, Karachi, Division Karachi.
6. The Project Director, Sindh Solar Energy Project, Government of Sindh, Karachi.

  
SECTION OFFICER  
Land Utilization Department  
Government of Sindh



To

The Deputy Commissioner,  
**JAMSHORO.**



**SUBJECT: ALLOTMENT OF LAND ADMEASURING 250-00 ACRES (OUT OF 2500-00 ACRES) ON 30 YEARS LEASE IN FAVOUR OF M/S SINDH RENEWABLE ENERGY COMPANY LIMITED (SRECL) FOR ESTABLISHMENT OF 50 MW SOLAR PROJECT IN DISTRICT JAMSHORO.**

In exercise of the powers conferred under Section 10 (1) of the Colonization of Government Lands Act 1912, read with Condition No.3 of the Statement of Conditions notified under notification vide No.01-32-2015/SO-VI/354, dated 11-06-2015, and constituted under condition No.7 of the Statement of Conditions on the recommendation of Scrutiny Committee in its meeting held on 08-09-2022, and with the approval of the Government (Provincial Cabinet) in its meeting held on 16-11-2022 (**copy enclosed**). The Land Utilization Department has been pleased to direct the Deputy Commissioner Jamshoro, to lease out an area of **250-00** acres (out of 2500-00 acres) Un-surveyed land situated in Deh Dhabri, Tapa Meeting, Taluka Manjhand, District Jamshoro, on 30 years lease in favour of **M/S Sindh Renewable Energy Company Limited (SRECL)** for establishment of 50 MW Solar Project. The sponsor shall pay the lease amount in three (03) installments payable at the start of each ten (10) years subject to the following rates and conditions:-

Cost of 1 acre for (1 <sup>st</sup> 10 years)	484.84 x 10 = Rs.4848.48/-
Cost of 1 acre for (2 <sup>nd</sup> 10 years)	4848.48 x 2 = Rs.9696.96/-
Cost of 1 acre for (3 <sup>rd</sup> 10 years)	9696.96 x 2 = Rs.19393.92/-

2. **The terms and conditions of the lease are as under:-**

- i. The lessee has to pay the lease company within six (6) months from the date of issue of allotment order, (as provided under Sub-Section 5 (a) of Section 10 of the Colonization of Government Lands Act, 1912) failure to pay the lease money the allotment order automatically cancelled / withdrawn.
- ii. The lessee failed to use the land for the purpose for which it was granted or allotted within five (5) years from the date of grant, allotment, conversion or lease has expired the grant, allotment, conversion or lease of the land shall automatically stand cancelled and the amount deposited shall stand forfeited etc as provided under Sub-Section 5 (b) of Section (10 of the Colonization of Government Lands Act, 1912).
- iii. The land shall only be used for the purpose for which applied and approved.

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- iv. The Lessee has paid the lease money, the prescribed Lease Deed for the allotted Area shall be executed, stamped and registered by the lessee at his own cost.
- v. If it is found that the lease order has been obtained through misrepresentation of facts or by producing bogus and fraudulent the land shall be liable for resumption.
- vi. Inter-alia all restrictions and conditions laid-down in the Statement of Conditions notified vide No.01-32-2015/SO-VI/354 dated 11-06-2015, shall be compiled strictly Terms & Conditions in this lease order are binding on both the parties.
- vii. The leased out land shall not be transferred or sold in any case. Provided that the Lessee shall be free to create a mortgage in favour of the financial institutions that will fund the project and Lessor shall sign the customary direct agreements(s) in relation there to if required by such financial institutions".

**Detail of Schedule**

Price for 1 Acre for (99 years)	$1 \times 4840 \times 66.11570 = \text{Rs.}3,20,000/-$
Price for 1 acre for 1 year	$3,20,000/99 = \text{Rs.}3232.32/-$
Cost of land (1 acre / year (15% as per RoE)	$3232.32 \times 15\% = \text{Rs.}484.84/-$
Cost of 1 acre for (1 <sup>st</sup> 10 years)	$484.84 \times 10 = \text{Rs.}4848.48/-$
Cost of 1 acre for (2 <sup>nd</sup> 10 years)	$4848.48 \times 2 = \text{Rs.}9696.96/-$
Cost of 1 acre for (3 <sup>rd</sup> 10 years)	$9696.96 \times 2 = \text{Rs.}19393.92/-$

\*1 Acre = 4840 square yards

\*RoE = Return on Equity

3. You are, therefore, requested to recover the amount as approved by the competent authority and all other legal formalities be completed after proper verification of any litigation etc, provided that there is no any legal hitch, stay/ restraining orders of any competent court and free from all encumbrances, under intimation to this Department. Also furnish attested copies of paid Challan duly verified by the Treasury Office, lease agreement deed, copy of Form-II / VF-VII, sketch of land for record of this Department.



SECRETARY TO GOVERNMENT OF SINDH  
LAND UTILIZATION DEPARTMENT

**A copy is forwarded to:-**

1. The Senior Member, Board of Revenue, Sindh, Karachi.
2. The Principle Secretary, to Chief Minister Sindh Karachi.
3. The (Staff) Officer to Chief Secretary Sindh Government of Sindh Karachi.
4. The Secretary, Energy Department Government of Sindh.
5. The Commissioner, Hyderabad, Division Hyderabad.
6. The Project Director, Sindh Solar Energy Project, Government of Sindh, Karachi.

SECTION OFFICER.





To

The Deputy Commissioner (West),  
**KARACHI.**

**SUBJECT: ALLOTMENT OF LAND ADMEASURING 612-00 ACRES ON 30 YEARS LEASE IN FAVOUR OF M/S SINDH SOLAR ENERGY PROJECT-I FOR ESTABLISHMENT OF 175 MW SOLAR PROJECT IN DISTRICT WEST KARACHI.**

In exercise of the powers conferred under Section 10 (1) of the Colonization of Government Lands Act 1912, read with Condition No.3 of the Statement of Conditions notified under notification vide No.01-32-2015/SO-VI/354, dated 11-06-2015, and constituted under condition No.7 of the Statement of Conditions on the recommendation of Scrutiny Committee in its meeting held on 08-09-2022, and with the approval of the Government (Provincial Cabinet) in its meeting held on 16-11-2022 (**copy enclosed**). The Land Utilization Department has been pleased to direct the Deputy Commissioner (West), Karachi, to lease out an area of **612-00** acres N.C. No.240 situated in Deh Halkani, within radius of 20 to 25 KM N.C. No.56 of Deh Bund Murad within radius of 10 to 15 KM & N.C. No.56 of Deh Hub within radius of 10 to 15 KM, Taluka Manghopir, District (West) Karachi, on 30 years lease in favour of **M/S Sindh Solar Energy Project-I** for establishment of 175 MW Solar Project. The sponsor shall pay the lease amount in three (03) installments payable at the start of each ten (10) years subject to the following rates and conditions:-

Cost of 1 acre for (1 <sup>st</sup> 10 years)	9090.90 x 10 = Rs.90909.09/-
Cost of 1 acre for (2 <sup>nd</sup> 10 years)	90909.09 x 2 = Rs.181818.182/-
Cost of 1 acre for (3 <sup>rd</sup> 10 years)	181818.182 x 2 = Rs.363,636/-

2. **The terms and conditions of the lease are as under:-**

- The lessee has to pay the lease company within six (6) months from the date of issue of allotment order, (as provided under Sub-Section 5 (a) of Section 10 of the Colonization of Government Lands Act,1912) failure to pay the lease money the allotment order automatically cancelled / withdrawn.
- The lessee failed to use the land for the purpose for which it was granted or allotted within five (5) years from the date of grant, allotment, conversion or lease has expired the grant, allotment, conversion or lease of the land shall automatically stand cancelled and the amount deposited shall stand forfeited etc as provided under Sub-Section 5 (b) of Section (10 of the Colonization of Government Lands Act,1912).
- The land shall only be used for the purpose for which applied and approved.

Contd.....P/2



- iv. The Lessee has paid the lease money, the prescribed Lease Deed for the allotted Area shall be executed, stamped and registered by the lessee at his own cost.
- v. If it is found that the lease order has been obtained through misrepresentation of facts or by producing bogus and fraudulent the land shall be liable for resumption.
- vi. Inter-alia all restrictions and conditions laid-down in the Statement of Conditions notified vide No.01-32-2015/SO-VI/354 dated 11-06-2015, shall be compiled strictly Terms & Conditions in this lease order are binding on both the parties.
- vii. The leased out land shall not be transferred or sold in any case. Provided that the Lessee shall be free to create a mortgage in favour of the financial institutions that will fund the project and Lessor shall sign the customary direct agreements(S) in relation there to if required by such financial institutions".

**Detail of Schedule**

Price for 1 Acre for (99 years)	$1 \times 4840 \times 1239.66942 = \text{Rs.}60,00,000/-$
Price for 1 acre for 1 year	$60,00,000/99 = \text{Rs.}60606.06/-$
Cost of land (1 acre / year (15% as per RoE)	$60606.06 \times 15\% = \text{Rs.}9090.90/-$
Cost of 1 acre for (1 <sup>st</sup> 10 years)	$9090.90 \times 10 = \text{Rs.}90909.09/-$
Cost of 1 acre for (2 <sup>nd</sup> 10 years)	$90909.09 \times 2 = \text{Rs.}181818.182/-$
Cost of 1 acre for (3 <sup>rd</sup> 10 years)	$181818.182 \times 2 = \text{Rs.}363,636/-$

\*1 Acre = 4840 square yards

\*RoE = Return on Equity

3. You are, therefore, requested to recover the amount as approved by the competent authority and all other legal formalities be completed after proper verification of any litigation etc, provided that there is no any legal hitch, stay/ restraining orders of any competent court and free from all encumbrances, under intimation to this Department. Also furnish attested copies of paid Challan duly verified by the Treasury Office, lease agreement deed, copy of Form-II / VF-VII, sketch of land for record of this Department.



SECRETARY TO GOVERNMENT OF SINDH  
LAND UTILIZATION DEPARTMENT

**A copy is forwarded to:-**

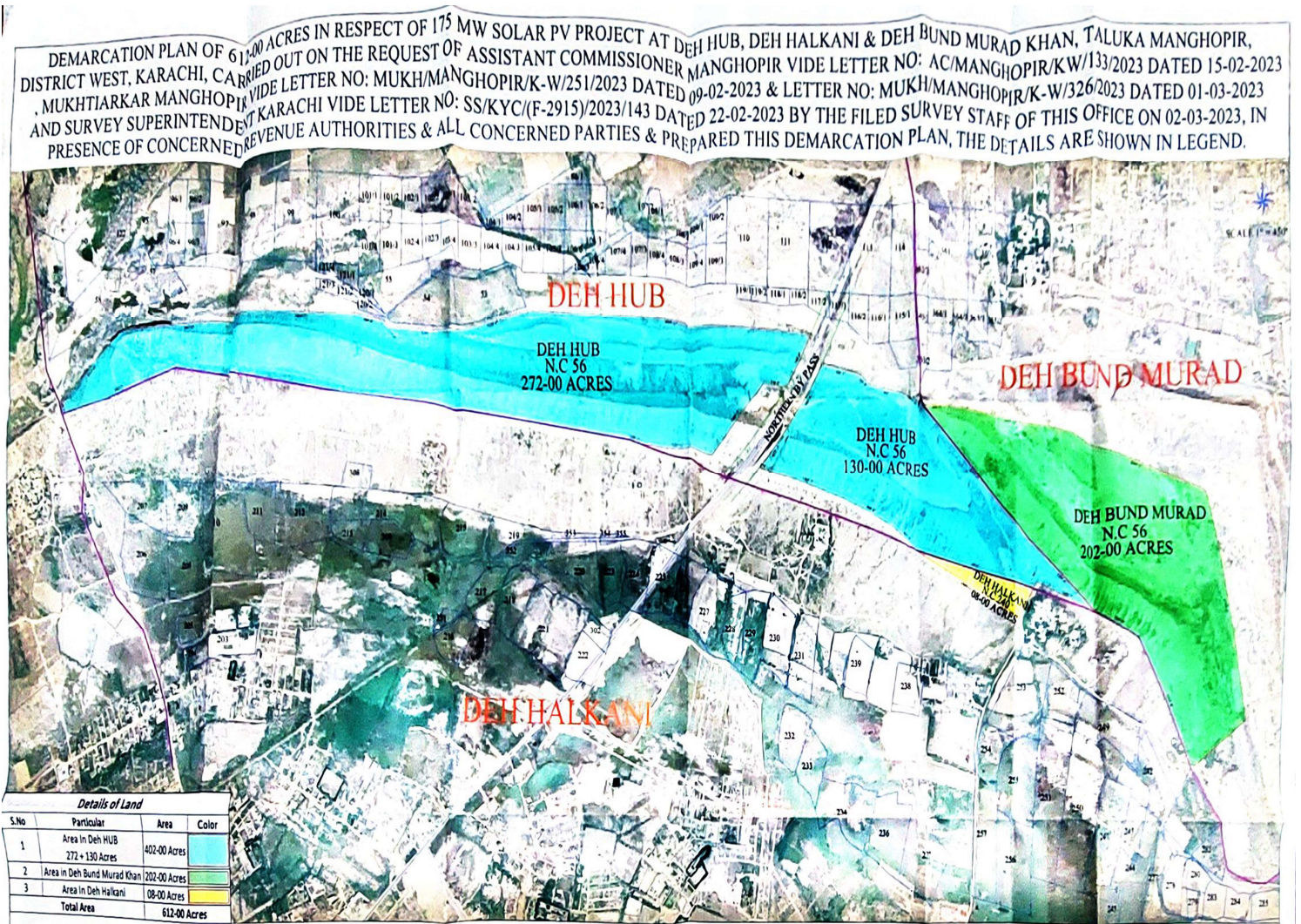
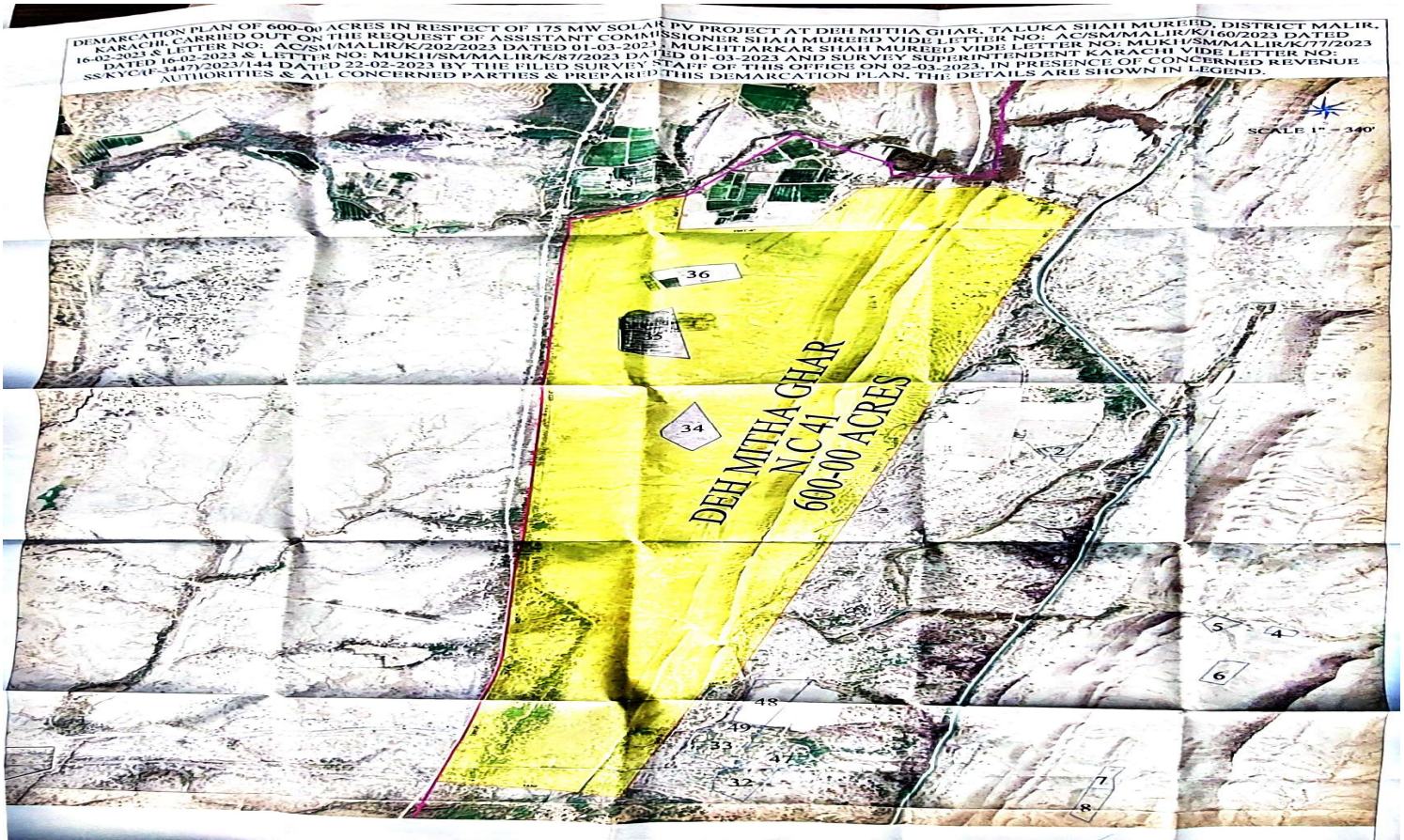
1. The Senior Member, Board of Revenue, Sindh, Karachi.
2. The Principle Secretary, to Chief Minister Sindh Karachi.
3. The (Staff) Officer to Chief Secretary Sindh Government of Sindh Karachi.
4. The Secretary, Energy Department Government of Sindh.
5. The Commissioner, Karachi, Division Karachi.
6. The Project Director, Sindh Solar Energy Project, Government of Sindh, Karachi.

SECTION OFFICER  
Land Utilization Department  
Government of Sindh



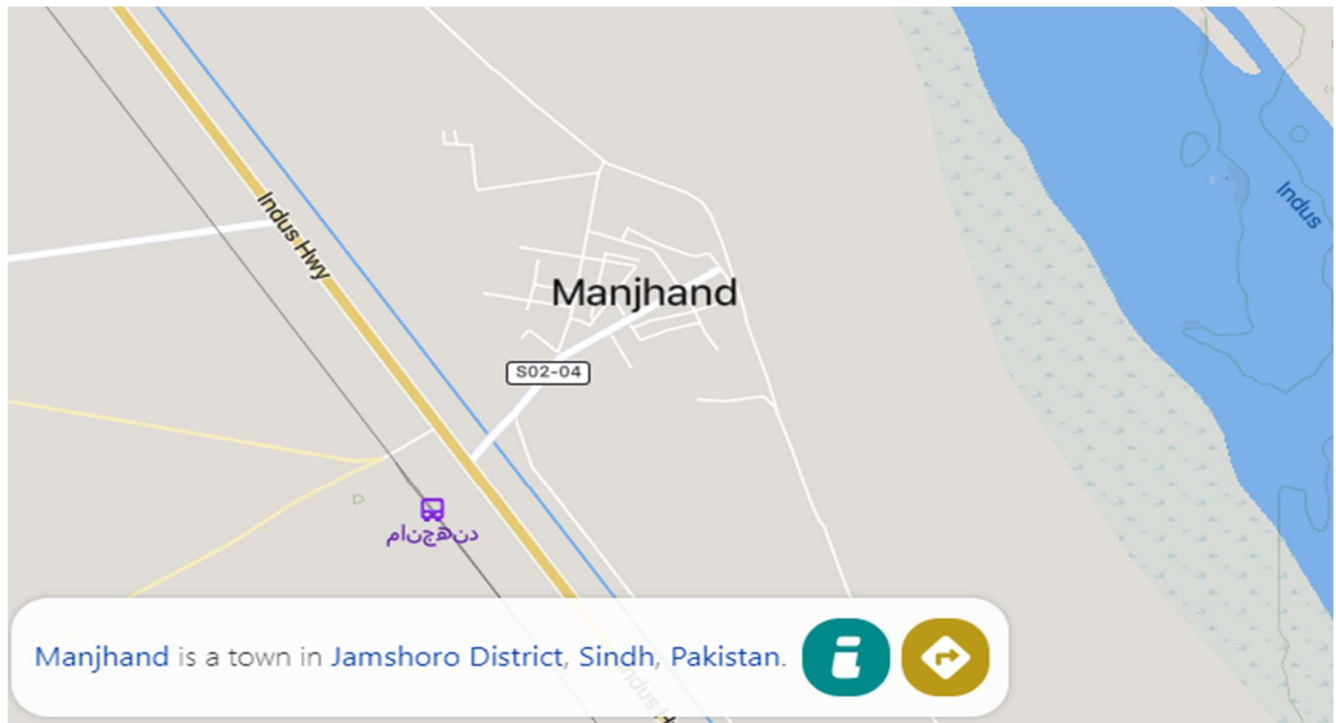
## **Tentative Location Map**







## 50MW SOLAR PARK MANJHAND DISTRICT JAMSHORO



**PROJECT APPROVAL DOCUMENTS**

1. Para Wise Replies of Pre – PDWP Working Paper
2. Minutes of PDWP Meeting 30<sup>th</sup> November 2022
3. Para Wise Replies of PDWP Meeting Decision
4. Minutes of Pre – CDWP Meeting 15<sup>th</sup> May 2023
5. Certificate of the compliance of PDWP
6. Para wise replies of Pre – CDWP meeting
7. Minutes of CDWP Meeting 01<sup>st</sup> June 2023
8. Para Wise Replies of CDWP meeting
9. Summary for the ECNEC (Position Paper
10. ECNEC Approval of 11<sup>th</sup> July 2023 meeting
11. Reply of ECNEC Observations
12. Decision of the ECNEC (Position Paper) 9<sup>th</sup> August 2023
13. Authorization Letter

**Original PC – 1 Approvals**

1. Minutes of CDWP meeting
2. Minutes & Decision of ECNEC meeting
3. Administrative Approval
4. Authorization Letter

## Para Wise replies of Pre – PDWP Working Paper

Observations of Technical Section	Replies
<p>i. Scheme has not been submitted on the Performa prescribed for revised schemes accordingly para-7) Or PCI lacks the following information. A.D to mention the same in Para-7 of PC-.</p> <ul style="list-style-type: none"> <li>➤ Project approval history of the scheme i.e., when &amp; from which forum earlier PC-I of this scheme was approved and what was the cost of last approved PC-I &amp; when was A.A of the scheme was issued. Plan period of the scheme.</li> <li>➤ Component-wise reasons for revisions of the scheme, year wise PSDP allocations, releases &amp; expenditure up to June 2022.</li> <li>➤ Exchange Rate used to work out FEC in original and revised PC-1.</li> <li>➤ Comparative statement of the work done &amp; to be done and amount incurred &amp; to be incurred.</li> <li>➤ Besides year wise physical &amp; Financial phasing of the scheme are also not given in para-to PC-I &amp; list of ACRONYMS used in this PC-I with their full form and table of contents (Toc) may be incorporated in the PC-1.</li> </ul> <p>ii. It is mandatory for the clearance / approval of a development scheme that the names of the Administrative District(s) wherein project area falls be mentioned in para-2 of PC-I under the title "location" and in house feasibility report as per revised location &amp; quantum of scope need to be incorporated in the PC-I. However requisite information is missing in PC-I A.D may provide the same.</p> <p>iii. Further instead of 15 paras Planning Commission's PC-I, A.D has submitted the PC-I with 14 paras. A.D may carryout necessary correction in the PC-I. Further A.D may clearly mention in all the changes made in the revised PC-I with proper justification i.e., changes in (i) number of districts, (ii) % of subsidy amount (ii) Quantum of works of component I, I &amp; ii (v) number of PMU staff (i) Financial Year for the execution of this scheme etc &amp; one page abstract of the cost of this scheme may also be attached.</p> <p>iv. Unsigned PC-I has been submitted by department A.D may provide the signed copy of PC-I reflecting the names, designations and contact numbers of the officers who have prepared and checked and approved the PC-I for submission to P&amp;D Department.</p> <p>v. Number of districts wherein project area falls and quantum of work of components I, II &amp; has been</p>	<p>1) The scheme has been revised and submitted in the prescribed Performa.</p> <ul style="list-style-type: none"> <li>a. The project approval history has been incorporated at Para 8(a), Page -14 of the revised PC-1 Performa.</li> <li>b. The Administrative approval was issued on 20 May 2019 and Plan period was up to September 2023.</li> <li>c. The Component wise reasons have been incorporated and attached as <b>Annexure – F</b>.</li> <li>d. The exchange rate has been revised as Rs.270/- per USD.</li> <li>e. The Comparative Statement is attached as <b>Annexure – G</b>.</li> <li>f. The list of ACRONYMS Attached in PC-1 at Page 4 (In Roman).</li> </ul> <p>2) In the revised PC-1 the location of project execution has been enhanced to the entire province and incorporated in the project Location data. The PAD is WB Document and WB has provided No Objection on the revised PC-1 (<b>Annexure – M</b>).</p> <p>3) The Format of PC-1 has been changed and revised submission, all the 15 paras has been filled.</p> <p>The requisite changes are placed at the following pages of revised PC-1:</p> <ul style="list-style-type: none"> <li>a. Changes in subsidy amount: At page No. 51</li> <li>b. Quantum of works C-2: List at page 31.</li> <li>c. Number of PMU Staff: Para 13 © at page 16.</li> <li>d. Financial year changes: <b>Annexure – H</b>.</li> </ul> <p>4) The PC-1 duly signed by the Administrative Department is submitted for onward submission to Planning Commission of Pakistan, Islamabad.</p> <p>5) The number of beneficiaries in Component – III will remain same as 12 million as the quantity of SHS is same as 200,000.</p> <p>6) The PC-1 is being uploaded on the PCFMS website.</p> <p>7) The RMB and sector strategy has been mentioned para 14 of the PC-1 page 19.</p> <p>8) The original plan for component-III was excluding the Karachi city, being urban area,</p>

<p>increased, as such A.D may mention the number of beneficiaries as per revised scheme.</p> <p>vi. A.D may upload the PC-I in PCFMS system.</p> <p>vii. Result Based Monitoring (RBM) Indicators &amp; Sector Strategy are Not Mentioned in PCI. A.D may incorporate the same in PC-I. Further table of contents (Toc) list of Acronyms with their full form may be incorporated in PC-. Furthermore, pages of PC- needs to be number in continuous sequence so that reference of a particular page during the consideration of the scheme may be the given easily.</p> <p>viii. As per decision of 8th Steering committee meeting of this project steering committee allowed 25 Districts for the revised scheme, however in the PC-I Submitted by Department location of the project has been reflected entire province. I.e. all the districts of Sindh A.D may justify the same. Further project steering committee 1or the revised scheme allowed extension of project time period for 2 years. As such revised plan period of the scheme should be from financial year 2018-19 to 2022-23. However, in the PC-1 submitted by department revised plan period has been reflected as 2018-19 to 2025-26. A. D may carryout necessary correction.</p>	<p>however, the PSC recommended 2 districts of Karachi, i-e: Malir and Kiamari and only 5 districts were excluded. In the larger interest, the AD recommending the revised PC-1 with all districts and the same has been endorsed by the PDWP Forum on 30<sup>th</sup> November 2022.</p> <p>FY: The original Plan period was five years up to September 2023, however, with the consent of WB, being the project financier, an extension of 22 months from October 2023 to 31<sup>st</sup> July 2023 has been requested. The necessary correction has been made in revised PC-1.</p>
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## MINUTES OF PDWP MEETING ON 30<sup>TH</sup> NOV 2022



GOVERNMENT OF SINDH  
PLANNING & DEVELOPMENT BOARD SINDH  
PLANNING & DEVELOPMENT DEPARTMENT  
(INDUSTRIES & ENERGY SECTION)

**MINUTES OF PROVINCIAL DEVELOPMENT WORKING PARTY (PDWP) MEETING HELD ON 30-11-2022 UNDER THE CHAIRMANSHIP OF CHAIRMAN PLANNING & DEVELOPMENT BOARD, IN THE COMMITTEE ROOM OF PLANNING & DEVELOPMENT DEPARTMENT, GOVERNMENT OF SINDH, KARACHI.**

*(List of Participants is attached)*

**Item # 29 SINDH SOLAR ENERGY PROJECT ( TOTAL EST COST RS. 22005.600 MILLION. THE WORLD BANK SHARE: RS. 21451.637MILLION & GOVT OF SINDH'S SHARE RS. 553.972 MILLION) REFLECTED AT SR. NO.884 ADP 2022-23. (UNDER REVISION)**

The Senior Chief (Ind&Energy) apprised the Committee that Sindh Solar Energy project was approved at cost of Rs.12848.11 million including FEC of Rs:7952.90 million (1US\$=124.08) by ECNEC in its meeting held on 14-11-2018 with objective to support the scale-up of the solar power projects in Sindh Province and to increase electricity through renewable Energy. The scope of the approved scheme consists on the following four units.

- (i) Utility scale solar (Development a series of Solar Parks to facilitate a total of 400 MW of Solar Power Capacity)
- (ii) Distributed Solar (Solarization of Public Sector Buildings at least 20 MW)
- (iii) Solar Home Systems (Solar Systems on subsidized to be provided to at least 200,000 households, benefiting around 1.2 million people of off Grid Area People)
- (iv) Capacity Building & Technical Assistance.

The Administrative Approval of this scheme was issued on 20-5-2019 mentioning the plan period of the scheme as 60 months (FY-2018-19 to FY- 2022-23). Wherein share of GoS is mentioned as 3.43% i.e. Rs.440.11 million of local component and World Bank Financing as 96.5% i.e. Rs.12408.00 million. Details of estimated cost of Rs.12848.11 million mentioned in A.A are as under.

Project	Local (Rs. Million)/%	FEC (Rs. Million)%	Total (Rs. Million)%
Government of Sindh Share (Revenue Component)	440.11 (8.99%)	NIL	440.11 (3.43%)
World Bank Share	4455.10(91.1%)	7952.90(100%)	12408.00(96.57%)
<b>Total Cost</b>	<b>4895.21</b>	<b>7952.90</b>	<b>12.848.11</b>



Comparative Statement of original approved & revised proposed PC-I cost & scope in the light of the minutes / decisions of 8<sup>th</sup> Project Steering Committee Meeting held on 12-10-2022 is that the Project cost has been enhanced as per share decided in the original agreement i.e 95.3% and 4.3 % WB and GOS share respectively. The World Bank and Govt of Sindh Share had been increased due to PKR depreciation. Currently, World Bank share (PkR) has increased from Rs.12,408million to Rs.21451.637 Million and Govt of Sindh share has also been enhanced from Rs. 440.11million to Rs.553.972 million. *Total cost of project is enhanced from Rs. 12,408 million to Rs. 22,005.600 million.*

The scope as considered by the PSC are also reproduced as under:

Original PC-I	Revised PC-I recommendations by PSC	Remarks
Costs: No Change in \$ value Rs. 12408.00million	Costs: No Change in \$ value Rs.22006.000million	Overall 43.61% increase in PKR value.
Scope: C1: 400 MW C2: 20 MW C3: 200000 SHS	Scope:C1: 800 MW (Solar, Wind Hybrid) C2: 50 MW C3: 250000 SHS	C1 Hybrid with wind C3: Subject to availability of funds
Time Period: 5 years	Time Period: 8 Years	
Funds Allocations: C1:40 Million USD C2: 26 Million USD C3: 30 Million USD C4: 05 Million USD Total: 100 Million USD	Funds Allocations: C1:15 Million USD C2: 50 Million USD C3: 33 Million USD C4: 02 Million USD Total: 100 Million USD	NOL from The WORLD BANK NOT RECEIVED
Local fund: 3.42 Million USD	Local fund: 3.42 Million USD	
Subsidy under C3: up to 40%	Subsidy under C3: 50% for Urban areas & cities and 90% for Rural areas.	The Subsidy amount may be justified. Basis of subsidy may be also attached.
No. of Districts C3: 10	No. of Districts C3: 25	
Building under C2: public sector	Building under C2: public sector/ Semi Govt. Autonomous bodies and humanitarian and social sector mosque	

It was apprised that PC-I of the scheme does not include cost break-up of components under donor funds, locations of the project along with GPS coordinates, specifications of solar equipment their warranty period, feasibility study for scope, justification for increasing different repurposing under components, detailed physical and financial progress, list of new buildings, drawings designs for scope of remaining work under PC-I, number of beneficiaries, O&M mechanism for long term sustainability, O&M cost required

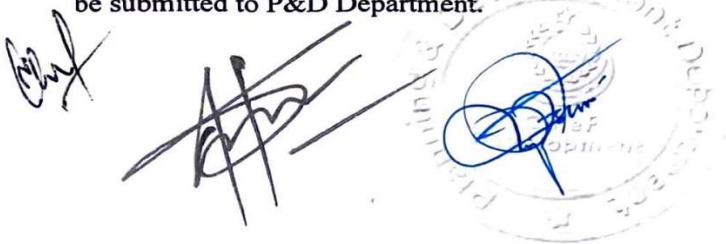


under the project and recurring cost under the PC-I. It was further highlighted that S/A has not shared No Objection Letter from the Donor agency i.e World Bank.

The Secretary Energy Department informed the forum that the proposed changes under the scope of work were discussed during visit of World Bank mission in number of meetings including meeting with Chief Minister, Sindh and as such Chief Minister, Sindh has already given approval during those meeting. He further informed that Project Steering Committee in its 8<sup>th</sup> meeting held on 12-10-2022 had also approved proposed changes under the scope. Secretary Energy further replied that Component I is planned to be executed with the help of Public Private Partnership, Finance Department Govt of Sindh. Under the allocated funds, technical support / cost of land and such other funds would be borne. The actual project equity would be financed through Independent investor or as approved by the Honorable Chief Minister, Sindh. In reply to queries raised by the section, he replied that component II covers solar installation on public sector buildings and in first phase various hospitals were solarized through competitive process.

The forum enquired as to why Energy Department has increased subsidy on Solar Home System and justify the mechanism by which subsidy will be disbursed to the people, he replied that subsidy amount already approved was up to 40% of the cost, however, due to floods and damages of crops, the buying capacity of the people has been reduced drastically. Thus Energy Department / PSC has approved subsidy of 90% to people living in rural area and 50% to those living in cities / towns. The Project Director SSEP stated that a consulting firm was hired to prepare poverty score card to identify potential person under the subsidy dispersion. The forum discussed in depth and directed the Secretary Energy Department and Project Director to devise comprehensive mechanism for disbursing subsidy to only deserving people and it shall be ensured by the team that subsidy amount to undeserving people should not be made, it was agreed.

The Secretary Energy Department & the Project Director SSEP further agreed to provide replies to queries of the technical section raised in the Working Paper for PDWP and upload PC-I on the PCFMS software. Regarding O&M mechanism, he stated that currently O&M is being carried out by the contractors however, regarding long term O&M, Energy Department would provide details in modified PC-I. Regarding, NOL by the World Bank, Project Director stated that modified PC-I has been shared with the World Bank and NOL will be submitted to P&D Department.



The representative of MEC P&D Department informed that as per their record, MEC has visited various installations by Project Directorate and their visit report is found unsatisfactory. The Chair directed PD SSEP to get the initial report and comply with the observations of MEC, P&D Department before forwarding the PC-I to Planning Commission, Pakistan.

After detailed discussion & deliberations, the following decisions were taken:

**Decisions:**

- (i) The scheme was cleared subject to modification.
- (ii) Energy Department will submit modified PC-I duly incorporating breakup of cost of world bank share in PC-I of Component, I, II, III and IV.
- (iii) The physical progress, drawings designs of already executed scope, proposed future scope, updated releases expenditure position, number of beneficiaries, RBM indicators, NOL by World Bank, feasibility study for districts will be made part of PC-I.
- (iv) The Project Director will rectify MEC reports.
- (v) Energy Department and PMU would prepare comprehensive methodology for providing subsidy and ensure transparency in utilizing subsidy amount & identification of legitimate beneficiaries for subsidy.
- (vi) The replies to observations, relevant in-house feasibility studies, work done and work to be statement, O&M methodology, O&M cost under various components, Certificates for already completed schemes etc would be provided.
- (vii) The quality, specification of solar panels and their system, would be provided alongwith locations of project sites already approved.



### **Para Wise replies of PDWP Meeting Decisions**

Observations of PDWP	Para wise replies
<p><b>i.</b> The scheme was cleared subject to modification.</p> <p><b>ii.</b> Energy Department will submit modified PC-1 duly incorporating breakup of cost of World Bank share in PC-1 of Component, I, II, III and IV.</p> <p><b>iii.</b> The physical progress, drawings design of already executed scope, proposed future scope, updated releases expenditure position, number of beneficiaries, RBM indicators, NOL by World Bank, feasibility studies for districts will be made part of PC-1.</p> <p><b>iv.</b> The Project Director will rectify MEC reports.</p> <p><b>v.</b> Energy Department and PMU would prepare comprehensive methodology for providing subsidy and ensure transparency in utilizing subsidy amount &amp; identification of legitimate beneficiaries for subsidy.</p> <p><b>vi.</b> The replies to observations, relevant in-house feasibility studies, work done and work to be statement, O&amp;M methodology, O&amp;M cost under various components, Certificates for already completed schemes etc would be provided.</p> <p><b>vii.</b> The quality, specification of Solar panels and their system, would be provided along with locations of project sites already approved.</p>	<p><b>i.</b> The modifications have been incorporated in the revised PC-1 and is submitted for consideration of Planning &amp; Development Department.</p> <p><b>ii.</b> The detailed break up along with WB Share and GOS is attached as <b>Annexure – H</b>.</p> <p><b>iii.</b> Physical Progress</p> <ul style="list-style-type: none"> <li>• Physical Progress and Scope are attached as <b>Annexure – G</b>.</li> <li>• Drawings designs, Comp-I feasibility studies are attached as <b>Annexure – C1</b></li> <li>• Comp-II Engineer's report are attached as <b>Annexure – P</b></li> <li>• Comp-III Criteria of SHS are attached as <b>Annexure – S</b></li> <li>• Release expenditure position are attached as <b>Annexure – T</b>.</li> <li>• Number of beneficiaries: 12 million people under Comp-III.</li> <li>• RBM indicators: RBM Table at Para No. 14 of PC-1</li> <li>• NOL by World Bank is attached as <b>Annexure – M</b>.</li> <li>• Feasibility Studies: at <b>Annexure - C1, C2 &amp; C3</b>.</li> </ul> <p><b>iv.</b> The MEC report is attached as <b>Annexure – N</b>.</p> <p><b>v.</b> The comprehensive methodology for providing subsidy is attached at <b>Annexure - C3</b>.</p> <p>For the identification of legitimate beneficiaries, a poverty score card has been developed, which will be monitored through an independent third-party monitoring firm. <b>Annexure – O</b>.</p> <p><b>vi.</b> Replies to Observations: at Page 17 to 19 of PC – 1. In-house feasibility studies: at <b>Annexure - C1, C2 &amp; C3</b>. Work done and work to be done at <b>Annexure – G</b>. O&amp;M Methodology: at para no. 3.c of PC-1 Certificate for already completed schemes: at <b>Annexure – P</b>.</p> <p><b>vii.</b> The specifications for solar systems are attached as <b>Annexure – Q</b>.</p>

# **MINUTES OF PRE – CDWP MEETING ON 15<sup>TH</sup> MAY 2022**

**Government of Pakistan  
Ministry of Planning, Development & Special Initiatives**

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**Minutes of Pre-CDWP Meeting Held On 15.05.2023**

**Subject** **Sindh Solar Energy Project (SSEP) (Revised PC-I)**  
(Total Cost: Rs. 22.005 billion with Rs. 18.853 billion FEC)

A meeting on subject project was held under the Chairmanship of Sr. Chief (Energy), M/o PD&SI in Conference Room, 1<sup>st</sup> Floor, P-Block, Pak Secretariat, Islamabad (list of participants attached at Annex-I).

2. Chief Energy (Power), M/o PD&SI apprised the forum that objective of the project is to support the scale-up of solar power in Sindh Province and increase access to electricity. The scope of work comprises of four components including development of at least 400 MW of utility-scale solar in Sindh, installation of at least 50 MW of distributed solar on and around public buildings, provision of off-grid, solar home systems to 200,000 lower-income households and technical assistance and support to Energy Department, Government of Sindh. The Original PC-I of the project was approved by ECNEC on 14th November 2018 at a total cost of Rs.12,848.11 million while the sponsors have now submitted revised PC-I at a total cost of Rs. 22.006 billion due to delay in execution, change in cost and scope of the project. Chief Energy (Power) pointed out that Energy Wing has raised number of observations on the revised PC-I regarding proposed change in cost and scope, implementation schedule, compliance of PDWP directions and updated feasibility study. He proposed that Secretary, Energy Department, Gov of Sindh may certify the compliance made by sponsors in respect of PDWP directions on the revised PC-I. He also pointed out that the original date of completion of the project was 30th September 2023 which is proposed to be extended till 31st July 2025. He pointed out that the sponsors may furnish justification for about 2 years extension.
3. In response to the queries, Project Director, SSEP apprised that there has been no change in the overall approved dollar cost of the project. The cost in the PC-1 has been revised due to PKR depreciation. Similarly, there has been no change in scope of the four components, but the component-wise cost has been re-appropriated and the reasons have been justified in the revised PC-1. He further informed that an extension of 22 months from October 2023 to July 2025 has been requested because project delayed due to; late issuance of Administrative Approval, Lockdowns in Covid Emergency in 2020 and the Devastating Floods in June 2022. All the land acquisition (required under component 1) is completed while the RFP Documents are under consideration of NEPRA. SSEP has completed the Pre-Qualification process of the IPPs under Component-1 so that bidding process may be initiated as soon as RFP documents are approved by NEPRA and completed within the stipulated timeline.
4. To a query by Chief Energy (Power) regarding progress under component 2 and 3, PD SSEP apprised that the targets under component 2 have been 100% achieved, however, the targets under component 3 have not been achieved. Initially 40% subsidy was to be provided for solar home systems in component 3 but due to substandard equipment available in the market, the solar systems remained expensive instead of the subsidy and the customer were reluctant to purchase them. The PDWP, subsequently, increased the subsidy share to 90%. Most of the equipment for solar home system are to be imported, so the recent ban on opening of LC by Gov. of Pakistan may also serve as an impediment in the implementation of component 3. Deputy Secretary, World Bank, EAD apprised that they have taken up the issue of opening of LC with Finance Division.
5. Chief (Energy Finance and Economics), M/o PD&SI apprised that O&M cost of the project has also been not reflected in the revised PC-I. He also enquired that the rate of interest at which the World Bank is or will provide the loan for the project may also be indicated in the PC-I. Chief, Economic Appraisal, M/o PD&SI observed that land acquisition issue was beyond the control of project team and supported the time extension.
6. The chair observed that World Bank made only 20% disbursement of funds in the past 4 years and in order to complete the project within stipulated timelines, remaining 80% needs to be done in the



forthcoming 23 months. He enquired regarding criteria for selection of households for provision of solar home systems under component-3. He advised sponsors to furnish compliance of all observations of Energy Wing, raised in part-B of the working paper, especially those related details of work done and to be done and comparison of original and revised scope viz-a-viz cost.

7. Director (Tariff), NEPRA observed that utility scale solar IPPs proposed under the PC-I should be submitted for inclusion under Indicative Generation Capacity Expansion Plan (IGCEP).

8. In response to the queries, PD SSEP apprised that the poverty scorecard provided by Benazir Income Support Program (BISP) were utilized and the population having scores between 20-50 were selected for provision of solar home systems, as per the recommendation of World Bank. He further informed that 50 MW Manjhand IPP is already included in the IGCEP as committed project while 350 MW IPPs will be installed in Karachi and are included in the K-Electric generation expansion plan.

9. Deputy Secretary, Finance Division apprised that most of the districts of Rural Sindh are deprived of electricity and living below the poverty line, as compared to Urban Sindh. Therefore, they should be prioritized for distribution of solar home systems under component-3. Deputy Secretary, World Bank, EAD endorsed the viewpoint of Finance Division regarding prioritization of rural Sindh Districts for distribution of solar home systems. He supported the proposed revision of PC-I in respect of the subject project.

10. Secretary, Energy Department, Gov of Sindh endorsed the proposed revision of PC-I and ensure that Energy Department, Gov of Sindh will furnish certificate of the compliance of PDWP directions.

**DECISIONS:**

11. The Revised Project PC-I, at a total cost of Rs. Rs. 22.005.64 billion including FEC of Rs. 18.853 billion, will be submitted for consideration of CDWP, along with recommendation for prioritization of rural areas for distribution of solar home systems under component-3.

**CERTIFICATE OF THE COMPLIANCE OF PDWP**



021-99332107

**No. SSEP/PD/PC-1/01-2023  
OFFICE OF THE PROJECT DIRECTOR  
SINDH SOLAR ENERGY PROJECT  
ENERGY DEPARTMENT, GOVERNMENT OF SINDH**

**Karachi dated: 22<sup>nd</sup> May, 2023**

To,

**The Senior Chief (Energy)**  
Energy Wing,  
Ministry of Planning Development & Special Initiatives,  
Government of Pakistan  
Islamabad

Subject: **CERTIFICATE (REVISED PC-1 OF SINDH SOLAR ENERGY PROJECT)**

Reference: Minutes of Pre-CDWP meeting held on 15<sup>th</sup> May 2023.

It is certified that the decisions of the PDWP meeting held on 30<sup>th</sup> November 2022, for Sindh Solar Energy Project have been incorporated in the revised PC-1.

The same has been submitted for consideration of CDWP meeting through Planning & Development Board, Government of Sindh, Karachi.

This certificate is issued in compliance of the minutes of pre-CDWP meeting.

**Abu Bakar Madni**  
Secretary Energy  
Energy Department, GoS

**Mehfooz Ahmed Qazi**  
Project Director  
Sindh Solar Energy Project

**PARA WISE REPLIES OF PRE – CDWP MEETING**

S. NO.	OBSERVATIONS OF M/O PD&SI	RESPONSES OF SPONSORS
1	COST OF THE PROJECT	
a	<p>As per revised PC-I, the cost of project has been increased from Rs.12,848.11 million to Rs. 22,006 million due to number of reasons including dollar impact. The sponsors are requested to provide justification for increase in the cost and change in scope of the four components. Moreover, the sponsors are requested to furnish cost estimates of the project in terms of FEC &amp; Local components.</p>	<p>i) The cost of project has been increased from Rs. 12,848.11 million to Rs. 27,418.13 million due to the only reason of dollar impact. It is pertinent to mention that there has been no change in the overall approved dollar cost of the project.</p> <p><b><u>Justification for cost increase:</u></b> The dollar rate at the time of original PC-1 was equal to Rs.124.08 and the total FPA share was Rs. 12,408.00 million and GOS share was Rs.440.11 million. However, at the time of preparation of the revised PC-1, the dollar rate was taken at Rs.220/\$ which was also agreed in the PDWP meeting which increased the FPA share to Rs. 21,451.637 million and GOS share to Rs.554.00 million. Furthermore, as per the CDWP meeting the dollar rate is taken at Rs.285.48/\$ which has further increased the FPA share to Rs. 26,864.12 million and GOS share is Rs.554.01 million. The total cost of the Project as per revised PC-1 is now Rs. 27,418.13 million.</p> <p>There has been no change in scope of the four components, but the component-wise cost has been reappropriated and the reasons have been justified in the Annex-G of the revised PC-1. Moreover, the PC-1 has been revised due to the following changes other than the dollar impact:</p> <ul style="list-style-type: none"> <li>• Results targets: the targets have been updated to make them more flexible, and to increase the target for C2 from 20 MW to 50 MW.</li> <li>• Project description and modalities: quantum of works and other details updated to reflect the current project design. Allowance made for development of solar projects at wind power sites (“solar-wind hybrid operation”). Clarification of O&amp;M plans, especially under C2.</li> <li>• Expansion of building types and eligibility under C2: addition of non-government buildings in the social sector, at the discretion of the PSC.</li> <li>• Target districts under C3: initially this was limited to 10 districts, but due to the devastated floods of 2022 and in consultation with the WB this limitation has been removed and all districts are considered.</li> <li>• Subsidy amount under C3: flexibility provided to PSC to vary the subsidy amount to up to USD 160 and USD 110 on each SHS cost (delivered into the country including DC Fan, Frame and all duties and taxes, but excluding distribution costs) to account for significant affordability issues (especially in rural areas) as a result of the flooding situation. Subsidy amount to be</li> </ul>



		<p>set in USD based on PMU calculations, in consultation with the WB, and varied in response to market conditions.</p> <ul style="list-style-type: none"><li>• A Bulk supply Procurement Model shall also be considered to address the challenges observed under the existing SHS supplier Model. The estimated costs will cover the entire supply chain costs of the SHS to the eligible beneficiaries. In this model, there will be no role of subsidy and the systems will be procured by the Project PMU</li><li>• Number of PMU staff: updated considering implementation experience and requirements.</li><li>• Project duration: updated to include a proposed project extension to ensure that the results targets can be met.</li></ul> <p>Furthermore, the cost estimates of the project in terms of FEC and Local both are attached at Annex – H of the revised PC-1. The Summary is a sunder:</p> <table><tr><th>COST</th><th>Local</th><th>FEC</th><th>Total</th></tr><tr><td>Original PC – 1 @Rs.124.08/USD</td><td>4,895.21</td><td>7,952.90</td><td>12,848.11</td></tr><tr><td>Revised PC – 1 @Rs.220/USD</td><td>3,151.69</td><td>18,853.84</td><td>22,005.53</td></tr><tr><td>Updated rate as of July @ Rs285.48/USD</td><td>3,152.28</td><td>24,265.77</td><td>27,418.13</td></tr></table>	COST	Local	FEC	Total	Original PC – 1 @Rs.124.08/USD	4,895.21	7,952.90	12,848.11	Revised PC – 1 @Rs.220/USD	3,151.69	18,853.84	22,005.53	Updated rate as of July @ Rs285.48/USD	3,152.28	24,265.77	27,418.13
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b	<p>As per revised PC-I (page-3), World Bank has released USD 22 million out of USD 100 million. However, incurred amount shown in PC-I(page-64) is USD 16.14 million. The sponsors are requested to furnish details as well as utilization of balance amount of USD 5.86 million.</p>	<p>The total disbursement of the World Bank till date is USD 21.276 million which included service charges of USD 0.985 million, direct payments of USD 0.291 million and USD 20 million in the designated account out of which a utilization of USD 16.14 million was up till Nov 2022 and the cumulative utilization till May 12<sup>th</sup>, 2023, is USD 19.55 million, as shown below:</p> <table><tr><th>Component</th><th>Utilization from Dec’22 to May’23 (\$ million)</th></tr><tr><td>Component 1</td><td>0.091.00</td></tr><tr><td>Component 2</td><td>3.284.00</td></tr><tr><td>Component 3</td><td>0.0185.00</td></tr><tr><td>Component 4</td><td>0.0188.00</td></tr><tr><td>Total</td><td>3.4123</td></tr></table>	Component	Utilization from Dec’22 to May’23 (\$ million)	Component 1	0.091.00	Component 2	3.284.00	Component 3	0.0185.00	Component 4	0.0188.00	Total	3.4123				
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c	<p>It is mentioned in the revised PC-1 that date of commencement of the project was 20<sup>th</sup> May 2019 and original date of completion was 30<sup>th</sup> September 2023. Now, the revised date of completion is 31<sup>st</sup> July 2025. which shows that project is delayed by three years. The sponsors are requested to furnish the details of such abnormal delay due to which the cost overrun occurred in the implementation of the project and fix responsibility accordingly.</p>	<p>An extension of 22 months from October 2023 to July 2025 has been requested due to project delay due to the following circumstances:</p> <p>i) After the approval of ECNEC on 14<sup>th</sup> November 2018, the administrative approval was issued on 20th May 2019. Further, it was closure of financial year and as per financial procedures, there was no time period to release funds for new schemes.</p> <p>ii) Further, due to lockdowns in Covid Emergency in 2020, the project activities were severely hampered and the devastating floods in June 2022 considerable time was wasted to complete the project activities in different areas of the province under Comp-I and Comp-II.</p>																

		<p>iii) The allotment of land for Comp-I was also delayed for 3 years due to process formalities on land allotments and court matters.</p> <p>Since, the above factors were beyond the control of Administrative Department, the project needs an extension of time. Moreover, there is no impact of cost over runs, due to Dollar rupee disparity and the scope of work has been enhanced under component – II of the projects.</p>
<b>2</b>	<b>SCOPE OF THE PROJECT</b>	
a	<p>As per revised PC-I, the scope of Component-1 i.e., Utility scale solar aims to develop at least 400 MW of utility-scale solar by private sector IPPs in Sindh. However, at page-64 of the revised PC-I, it is mentioned that scope of work has been increased from 400 MW parks to 800 MW parks with simulation of Wind. The sponsors are requested to clarify the change in the scope of work under C-1 of the Revised PC-I and other component without proper feasibility study and furnish detailed justification in quantified terms.</p>	<p>The scope of the project in original PC-1 was up to 400MW under Component-I, which has been retained same. However, the solar park technology has been improved from fixed tilted plates to rotating angles for increased solar radiation yield on the basis of feasibility studies conducted by the Transaction advisor of the project. This increases more land requirements. Out of the 350 MW suggested on Karachi Sites, the final installed capacity will be 270MW, thus reduction of 80 MW Capacity. In order to accommodate the balance 80 MW, the feasibility studies will be carried out for solar wind hybrid in Jhampir area to convert it as solicited site as an option to meet the scope of the project or any other suitable site will be selected with the prior approval of Project steering Committee.</p>
b	<p>The scope of component-2 i.e., Distributed Solar has been increased from 20 MW to 50 MW with addition of USD 25million, shifted from Component-1 of the project. The sponsors are requested to furnish basis as well as justification for this change of scope in quantified terms.</p>	<p>The scope of the project under Roof top solar has been increased due to the high return of the solar roof top installations on public sector buildings. At the time of project approvals in 2018, the average per unit cost of electricity was around 18-20 rupees, which is now around 33 rupees, and the project returns are doubled. the average project payback period in 2.5 year and the rest of 22 years is the benefit. Moreover, under, 20MW only 30 Buildings has been solarized. Due to power breakdowns, there is dire need of electricity mostly in hospitals and water supply stations, therefore, the scope of the project has been enhanced from the 20 MW to 50 MW. A sample case of civil hospital Karachi is attached for ready reference.</p>
c	<p>As per revised PC-I, the scope of Component-3 includes provision of Solar Home System (SHS) to 200,000 households in Sindh having amount of USD 30 million. The sponsors are requested to furnish eligibility criteria for selection eligible HHI. Further, as per recommendations of PSC, the subsidy may be 50% for Urban &amp; 90% for Rural areas. However, as per PC-I (page-61), the subsidy in rural will be equivalent of USD 160 per SHS and in urban areas it will be USD 110 per SHS. The sponsors are requested to justify the allocated amount for SHS and its basis.</p>	<p>For the selection of the eligible beneficiaries, BISP data will be used and on the basis of BISP poverty score, the eligibility criteria will be used.</p> <p>In the original PC-1 the subsidy amount was up to 40%, however, this strategy did not obtain public acceptance, due to substandard material available in market on cheaper rates. The PSC suggested the revision of subsidy amount in October 2022 after witnessing the devastating floods of June 2022 and suggested the increase in subsidy amount up to 90% and 50% in rural and urban areas, which was estimated around Rs.35,200/- in rural and Rs 25,000/- in urban areas. During the last quarter of the year 2022, the PKR was further devalued substantially, and Dollar rate was reached up to Rs.285/-. The revised proposal, developed with the advice of the WB team drawing on experience in other countries, is to explore a “<b>Bulk Procurement</b>” model whereby the subsidy would cover up the imported SHS cost, plus the cost of the domestic DC fan, frame,</p>

		and all duties and taxes. The distribution costs would be recovered from the consumer by the appointed Last Mile Distributors (LMDs), subject to a cap determined by the PSC. The estimated fully delivered cost of the SHS is currently \$165, but the precise figure will not be known until after international competitive procurement is carried out. The LMD cost is currently uncertain, but additional work is ongoing to set an upper limit for that cost, thereby allowing LMDs to compete with each other and offer discounts where possible. The project intends to refine these costs through implementation and may also pass on some of the SHS cost to the LMDs once consumer demand picks up. Hence the intention is to gradually reduce the subsidy per SMS installed over time. Further, USD 3 million were also shifted from Comp-IV to Comp-III to meet the financial gaps. It may be noted that in case of the Bulk procurement by PMU, there will be no subsidy involved and subsequently no disparity between Rural and Urban. The estimated supply chain cost up to USD 160 will be for both rural and urban areas.
d	As per revised PC-I, land for 50 MW at Manjhand, Jamshoro is acquired for Component-1. The sponsors are requested to furnish status of land for development of solar parks under IPP mode as per Revised PC-I. Moreover, the work on this component is very slow and no justification is mentioned in the revised PC-I. The sponsors are requested to provide justification for delay and cost/time overrun during last five years and share progress in this regard.	Land: All the three lands has been allotted to the Project and allotment orders has been issued and attached as Annex-A of the PC-1. Work Slow: After the allotment in January 2023, the Feasibility studies were carried out. As per NEPRA Regulations, the RFP Document needs to be approved from NEPRA. All the three RFP Documents are under consideration of NEPRA, once they are received, the Bidding process will be initiated as per NEPRA approved timelines mentioned in the RFP Document. Further, the Pre-Qualification process of the SPVs/IPPs has already been completed.
<b>3</b>	<b>FEASIBILITY STUDY</b>	
a	The sponsors are requested to clarify that change of scope as well as allocated amount for each component under the revised PC-I are based on updated feasibility study and share the recommendations of the updated feasibility study/criteria regarding change in scope & cost of the revised PC-I.	The allocation under Comp-I was USD 40 Million, out of which USD 25 million has been suggested to be shifted to Comp-II based on their increasing returns under NEPRA net Metering policy. The estimated Project Developments Costs for solar parks are relatively low and will be to the selected IPPs based on the competitive tariff quoted by them. The initial project development costs were mandatory for land, topography and feasibility studies including environmental approvals from SEPA to make the solicited site for bidding purpose. It was not possible to obtain a true lower tariff through bidding on an unsolicited site, where RE potential is not confirmed.
<b>4</b>	<b>ENVIRONMENTAL IMPACT ASSESSMENT (EIA)</b>	
a	The sponsors are requested to furnish status of EIA Study for the proposed project regarding each component of the project during last five years.	The EIA Studies are approved from Sindh EPA and are attached for ready reference as <b>Annexure – B &amp; Annexure – C</b>
<b>5.</b>	<b>IMPLEMENTATION SCHEDULE</b>	

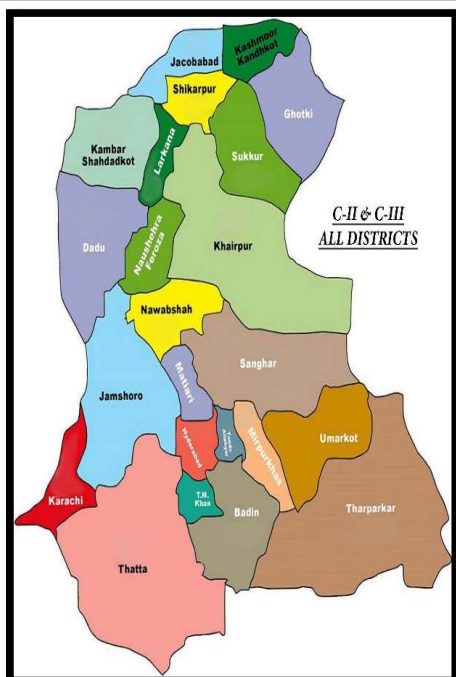
a	Implementation schedule mentioned at Annex-J of the PC-I, is very generic. The sponsors are requested to furnish the implementation schedule along with financing plan & time lines with proper due diligence otherwise the project will be further delayed as proposed.	Gantt Chart is attached as <b>Annexure – C</b> .	
6	PDWP Minutes		
a	It is observed that PDWP has cleared the revised PC-I conditionally during it meeting held on 30.11. 2022.The sponsors are requested to clarify whether decisions of PDWP are compiled or not and furnish proper certificate duly vetted by Government of Sindh.	<b>Observations of PDWP</b>	<b>Para Wise Replies</b>
The scheme was cleared subject to modification.		The modifications have been incorporated in the revised PC-1 and is submitted for consideration of Planning & Development Department.	
Energy Department will submit modified PC-1 duly incorporating breakup of cost of World Bank share in PC-1 of Component, I, II, III and IV.		The detailed break up along with WB Share and GOS is attached as <b>Annexure – D</b> .	
The physical progress, drawings design of already executed scope, proposed future scope, updated releases expenditure position, number of beneficiaries, RBM indicators, NOL by World Bank, feasibility studies for districts will be made part of PC-1.		Physical Progress: <ul style="list-style-type: none"><li>• Physical Progress and Scope are attached as <b>Annexure – E</b> of PC-1.</li><li>• Drawings designs, Comp-I feasibility studies are attached as <b>Annexure – F</b> of PC-1</li><li>• Comp-II Engineer’s report are attached as <b>Annexure – G</b> of PC-1</li><li>• Comp-III Criteria of SHS are attached as <b>Annexure – H</b> of PC-1</li><li>• Release expenditure position are attached as <b>Annexure – I</b> of PC-1</li><li>• Number of beneficiaries: 12 million people under Comp-III.</li><li>• RBM indicators: RBM Table at Para No. 14 of PC-1</li><li>• NOL by World Bank is attached as <b>Annexure – J</b>.</li><li>• Feasibility Studies: at <b>Annexure - C1, C2 &amp; C3</b> of PC-1</li></ul>	
The Project Director will rectify MEC reports.		The MEC report is attached as <b>Annexure – K</b> .	
Energy Department and PMU would prepare comprehensive methodology for providing subsidy and ensure transparency in utilizing subsidy amount & identification of legitimate beneficiaries for subsidy.	The comprehensive methodology for providing subsidy is attached at <b>Annexure – F</b> .  For the identification of legitimate beneficiaries, a poverty score card has been developed, which will be monitored through an independent third-party monitoring firm. <b>Annexure – L</b> .		



		The replies to observations, relevant in-house feasibility studies, work done and work to be statement, O&M methodology, O&M cost under various components, Certificates for already completed schemes etc. would be provided.		Replies to Observations: at Page 17 to 19 of PC-1. In-house feasibility studies: at <b>Annexure - C1, C2 &amp; C3</b> of PC-1. Work done and work to be done at <b>Annexure – E</b> . O&M Methodology: at para no. 3.c of PC-1 Certificate for already completed schemes: at <b>Annexure – M</b> .																																																																														
		The quality, specification of Solar panels and their system, would be provided along with locations of project sites already approved.		The specifications for solar systems are attached as <b>Annexure – N</b>																																																																														
		The Certificate regarding Compliance of DDWP meeting is attached as <b>Annex-D</b>																																																																																
7.	The following additional information’s also need to be provided by the sponsors:																																																																																	
a	Breakdown of the cost estimates on the given format:		<table><tr><th rowspan="2">Item</th><th colspan="2">Local</th><th colspan="2">FEC</th><th colspan="2">Total</th></tr><tr><th>Rs. Million</th><th>In</th><th>Rs. Million</th><th>In</th><th>Rs. Million</th><th>In</th></tr><tr><td>Salaries of PMU Staff</td><td>212.86</td><td></td><td>0.00</td><td></td><td>212.86</td><td></td></tr><tr><td>Purchase of Office Equipment</td><td>16.91</td><td></td><td>0.00</td><td></td><td>16.91</td><td></td></tr><tr><td>Purchase of Vehicles</td><td>42.00</td><td></td><td>0.00</td><td></td><td>42.00</td><td></td></tr><tr><td>Operating Expenses</td><td>282.24</td><td></td><td>0.00</td><td></td><td>282.24</td><td></td></tr><tr><td>Utility-Scale Solar</td><td>1,109.62</td><td></td><td>3,203.51</td><td></td><td>4,313.13</td><td></td></tr><tr><td>Distributed Solar</td><td>1,054.77</td><td></td><td>11,777.94</td><td></td><td>12,832.79</td><td></td></tr><tr><td>Solar Home Systems</td><td>216.38</td><td></td><td>8,957.39</td><td></td><td>9,173.77</td><td></td></tr><tr><td>Technical Assistance &amp; Capacity Building</td><td>217.51</td><td></td><td>326.93</td><td></td><td>544.44</td><td></td></tr><tr><td>Total</td><td>3,152.28</td><td></td><td>24,265.77</td><td></td><td>27,418.13</td><td></td></tr></table>				Item	Local		FEC		Total		Rs. Million	In	Rs. Million	In	Rs. Million	In	Salaries of PMU Staff	212.86		0.00		212.86		Purchase of Office Equipment	16.91		0.00		16.91		Purchase of Vehicles	42.00		0.00		42.00		Operating Expenses	282.24		0.00		282.24		Utility-Scale Solar	1,109.62		3,203.51		4,313.13		Distributed Solar	1,054.77		11,777.94		12,832.79		Solar Home Systems	216.38		8,957.39		9,173.77		Technical Assistance & Capacity Building	217.51		326.93		544.44		Total	3,152.28		24,265.77		27,418.13	
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			The above figures are calculated on 30 <sup>th</sup> November 2022 @Rs.220/USD, however, the parity has further increased and project costs as per existing rates of Rs.285.48/USD will be as under:																																																																															
			Total (Updated @ Rs285.48/USD)		3,152.28	24,265.77	27,418.13																																																																											

b	Physical and Financial Scheduling:								Sr. No	Item of Activity	Unit	Year-I (2023-24)		Year-2 (2024-25)		Year-3 (2025-26)	
												Phy	Fin	Phy	Fin	Phy	Fin
									1			C1: 270 MW,	6852.85	C1: 50 MW	7067.24	Transfer of project assets	898
	Sr. No	Item of Activity	Unit	Year-I		Year-2		Year-3									
				P h y	F i n	P h y	F i n	P h y	F i n								
c	Requirement of Vehicles:								Sr No	Make and Model of vehicles	Existing owned by the Executing Agency	Requirement under the project	Justifications for additional requirement				
									1	Toyota Wagon R	Borrowed from Admin Department	2	The locations of the public sector buildings are in all districts of the province. Moreover, the scope has also been increased from 20 MW to 50MW. The need of vehicles for frequent monitoring is necessary. At present 2 vehicles borrowed from Administrative Department on need basis, which will be returned upon purchase of project vehicles.				
	Sr #	Make and Model of vehicles	existing owned by the Executing Agency	Requirement under the project	Justifications for additional requirement												
	2	Motorcycles		4													
d	Lesson Learnt and incorporated in design of the project:								i) The EIRR and FIRR for rooftop solar are above 50% and increasing due to increase in cost of fossil fuels, thus the fuel replacement policy towards green energy is the need of hour. Accordingly, in the design of project, the scope of Comp – II roof top buildings increased from 20 MW to 50 MW. ii) The Comp-I and Comp-III are still under execution and lessons learnt will be shared at the time of PC – IV.								
e	Overall unit cost with basis of cost estimates:								Comp – II: Installation costs ISD 1000/KW Comp – III: SHS Cost is Rs.55,000/- excluding taxes and supply chain costs.								
f	Exchange Rate (1US\$=Rs.)								285.48/-								

g	Detail of Work done and to be done in case of revised project:						Details mentioned in the <b>Annex – G</b> of the revised PC-1.						
	S r #	Item of Activit y/ Output	Unit	Revised Scope		Financial Scope							
				Work done	To be done	Exp. incu rred							To be incu rred
h	Comparison of original and revised scope of physical / financial targets in case of revised project:						Sr #	Item of Activity/ Output	Unit	Scope		Financial Allocation	
										Original	Revised	Original	Revised
							1	Comp – I, Utility Scale Solar	MW	400 MW	400 MW	USD 40 M	USD 15 M
							2	Comp – II: Distribute d Solar	MW	20 MW	50MW	USD 25	USD 50
							3	Comp – III Solar Home System	SHS	200,000	200,000	USD 30 M	USD 33 M
							4	Comp-IV Capacity Building	Trai ning s & Lab	2 Lab	2 Lab	USD 5 M	USD 2 M
							5	No of Distt for SHS	Distr icts	10	30	-	-
							6	Selection of Roof top Buildings	Buil ding s	Public sector	Public, autonomo us bodies & Social sector	-	-
							7	Amount of subsidy for SHS	SHS	40%	USD 160 fixed	-	-
							8	GoS Counterpa rt funding		3.42%	2.5%	440.11M	554.01 M
							9	Dollar Variation	I USD	Rs.124.0 8	Rs.285.48	12808.11 M	27,418.1 3M
	10	Project time period	Mon ths	60	82	Up to Sept 2023	Up to July 2025						
	11	Any impact on PSDP	Rup ees	Nil	Nil	Nil	Nil						
	i	Existing facilities on the given format:						Sr #	Facility/ Input/ Services	Existing with Executin g Agency	Proposed under the project	Justification for additional requirement	
		S r #	Facility/ Input/ Services	Existing with Executing Agency	Propose d under the project	Justificatio n for additional requiremen t		1	Toyota Fortuner (GSF – 789)	Sindh Solar Energy Project (SSEP)	2 Vehicles & 4 Motorcycles	The project is in full swing and for official visits by the project staff and 2 vehicles borrowed from Administrative Department on need basis.	

		<table><tr><td>2</td><td>Toyota Hilux Revo (GSF – 888)</td><td>SSEP</td><td></td><td></td></tr><tr><td>3</td><td>Toyota Hilux Revo (GSF – 363)</td><td>SSEP</td><td></td><td></td></tr><tr><td>4</td><td>Toyota Hilux Revo (GSF – 456)</td><td>SSEP</td><td></td><td></td></tr><tr><td>5</td><td>Toyota Corolla XLI (GS – 794)</td><td>SSEP</td><td></td><td></td></tr><tr><td>6</td><td>Suzuki Cultus (GS – 9226)</td><td>SSEP</td><td></td><td></td></tr></table>	2	Toyota Hilux Revo (GSF – 888)	SSEP			3	Toyota Hilux Revo (GSF – 363)	SSEP			4	Toyota Hilux Revo (GSF – 456)	SSEP			5	Toyota Corolla XLI (GS – 794)	SSEP			6	Suzuki Cultus (GS – 9226)	SSEP		
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5	Toyota Corolla XLI (GS – 794)	SSEP																									
6	Suzuki Cultus (GS – 9226)	SSEP																									
j	<p>Ownership of project assets after completion on the given format:</p> <table><tr><th>Sr No</th><th>Assets Description</th><th>Ownership to be transferred to</th><th>Justification</th></tr><tr><td></td><td></td><td></td><td></td></tr></table>	Sr No	Assets Description	Ownership to be transferred to	Justification					<p>Asset Description:</p> <p>1) Comp – I: To IPP Companies incorporated under SECP regulations and return to Energy department after 25 years of project life at a notional cost of Rs.1</p> <p>2) Comp – II: Energy Department will manage through SPV or handover to relevant Department through a performance Contract.</p> <p>3) Comp – III SHS to the eligible Household beneficiaries with 1 year warranty</p> <p>4) Comp – IV: Laboratories to Public sector universities for Operations in Commercial mode.</p>																	
Sr No	Assets Description	Ownership to be transferred to	Justification																								
k	Risk and Mitigation measures taken by the sponsors:																										
l	Location map (component wise)	<div></div> <p>Comp – I:</p> <p>i) 50 MW Distt Jamshoro</p> <p>ii) 120 MW, Distt West, Karachi</p> <p>iii) 150 MW, Distt Malir, Karachi</p> <p>Comp – II:</p> <p>Entire province, public sector buildings (List attached)</p> <p>Comp – III:</p> <p>Entire province, All Districts with 6666 SHS to each district.</p>																									



# **MINUTES OF CDWP MEETING ON 01<sup>ST</sup> JUNE 2022**

Government of Pakistan  
Planning Commission  
Ministry of Planning, Development & Special Initiatives

\*\*\*\*

## **MINUTES OF CDWP MEETING HELD ON 01-06-2023**

**Item-2: SINDH SOLAR ENERGY PROJECT (SSEP) (Revised)**  
**(Total Cost Rs 22,005.64 million with FEC of Rs 18,853.84 million @ 1US\$=Rs.220)**


The CDWP meeting was held under the chairmanship of Minister for Planning Development & Special Initiatives/Deputy Chairman Planning Commission. Chief Energy (Power), M/o PD&SI apprised the forum that objective of the project is to support scale-up of solar power in Sindh Province and increase access to clean power. He informed that Original PC-I of the project was approved by ECNEC on 14<sup>th</sup> November 2018 at a total cost of Rs12,848.11 million including FEC of Rs12,408 million (@1 US\$=Rs.124.08). The loan agreements with World Bank was signed on 9<sup>th</sup> January 2019 and the Finance Department, Govt of Sindh(GoS) conveyed administrative approval on 20<sup>th</sup> May 2019 for a period of 5 years up to 2023. The Energy Department, GoS submitted revised PC-I at a total cost of Rs 22.6 billion with FEC of Rs 21.452 billion seeking 22 months' time extension and approval for change in originally approved cost and scope of work. The change in the scope and cost of work includes four Components. For Component-1 i.e Utility-Scale Solar, the revised allocated amount is US\$15 million (Original amount was US\$40 million), For Component-2 i.e Distributed Solar, the revised allocated amount is US\$50 million (Original amount was US\$26 million) with increase of scope from Installation of 20 MW to 50 MW distributed solar on and around public buildings. For component-3 i.e Solar Homes System (SHS), the revised allocated amount is US\$33million (Original amount was US\$30 million) and regarding Component-4 i.e Technical Assistance & Capacity Building, the revised allocated amount is US\$02 million (Original amount was US\$05 million).

2. Chief Energy (Power) further informed that revised PC-I was discussed in pre-CDWP meeting held on 15.05.2023 under the chairmanship of Sr. Chief (Energy). In the meeting, the observations of Energy Wing regarding proposed change in cost and scope, implementation schedule, compliance of PDWP directions and updated feasibility study were discussed in detail. It was decided in the meeting that the revised PC-I will be submitted for consideration of CDWP, along with recommendation for prioritization of rural areas for distribution of solar home systems under component-3.

3. Chief Economist, Planning Commission pointed out that the battery life for SHS are 3-5 years while the panels' life is around 20 years. He observed that there is no mechanism for replacement of batteries after their expiry and asked Energy Deptt., GoS to devise a proper mechanism for project sustainability. The representative of GoS apprised that batteries included in the SHS systems will be of good quality (Lithium-Ion) with average life of around 5 years. In order to make the project sustainable, the local community will be sensitized and facilitated for the replacement of batteries after their expiry, through their own resources/savings resulting from reduction in electricity bills.

4. Member (Food Security & Climate Change), Planning Commission informed that National Energy Efficiency and Conservation Authority has formulated energy conservation codes for buildings. She recommended that component 2 of the project should be implemented in the light of NEECA building codes. Secretary, Energy Dept, GoS assured the compliance of NEECA building codes during implementation of component 2 i.e. solarization of public buildings.

5. To a query by the Chair regarding criteria for selection for distribution of SHS under component 3, the representative of GoS apprised that Benazir Income Support Programme (BISP) poverty scorecard will be used and the population having poverty score of 21-50 will be selected. He informed that 200,000

  
Hafiz Shahid Abbas  
Chief (PIA)

SHS systems will be distributed across the 30 districts of Sindh Province, with each district having a share of 6,666 SHS as per BISP poverty scorecard.

6. Member (Social Sector & Devolution), Planning Commission remarked that BISP criteria is not appropriate for distribution of SHS systems and suggested GoS that independent survey needs to be carried out for mapping the population not having access to national grid in the Sindh Province. The poor people having no access to electricity should be prioritized. Additional Secretary, EAD pointed out that the scope of work and cost regarding each component has already been finalized with World Bank and at this stage, substantial change in the design of component-3 will require concurrence of the World Bank. He supported the recommendations of pre-CDWP meeting regarding prioritization of rural Sindh districts for distribution of SHS.

7. Project Director, Monitoring & Evaluation, M/o PD&SI opined that criteria for distribution of SHS should be poverty line even if they have access to electricity. He pointed out that cost of the SHS is on higher side (Rs 55,000 for 100W) as compared to prevalent market rates in the country. He also recommended that the specification of battery and solar panels should be specified and the cost of SHS needs to be rationalized. The Chair endorsed the viewpoint of PD, M/o PD&SI regarding cost rationalization of SHS.

8. Member (S&T), Planning Commission suggested the deployment of micro grid concept for component 3 rather than stand-alone systems. The representative of GoS apprised that micro grid concept will require major design changes which cannot be accommodated at this stage of implementation of the project. Additional Secretary, M/o PD&SI endorsed the viewpoint of GoS and observed that incorporating elementary design changes at this stage may alter the entire scope of the project.

9. Sr. Chief (Energy), M/o PD&SI apprised the forum that only 20% disbursement of funds have been made in the past 4 years and in order to complete the project, remaining 80% needs to be done in the proposed extended timeline of 23 months. Energy Deptt., Govt. of Sindh being the implementing agency should ensure utilization of 80% funds for the remaining scope of project under different components.

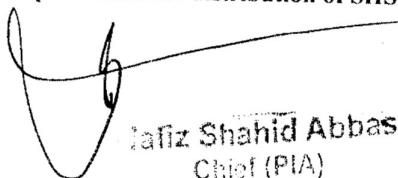
10. Chief (Energy), M/o PD&SI apprised that so far the observations are related to component 3 of the project which costs only US\$ 33 million out of total cost of US\$ 105 million, however there are no major observations on remaining 3 components of the project costing US\$ 72 million.

11. The Chair while concluding the discussion, advised that the project be approved in principle and directed Energy Department, Govt. of Sindh to review the suggestions/observations made by members of CDWP regarding component 3 in consultation with EAD and World Bank. Accordingly, GoS will furnish their recommendation regarding implementation of component-3 in the light of suggestion/observation raised during CDWP meeting.

**Decision:**

12. The CDWP, in principle, recommended the project to ECNEC with the directions that Energy Department, Government of Sindh will review the following observations in consultation with EAD & World Bank and will furnish their recommendations, accordingly before submission of Summary for consideration of ECNEC:

- i. The cost of SHS under component-3 will be rationalized;
- ii. The present criteria for distribution of SHS under component-3 will be reviewed; and
- iii. Rural Sindh districts will be prioritized for distribution of SHS under component-3.

  
Jafiz Shahid Abbas  
Chief (PIA)

## **PARA WISE REPLY OF CDWP MEETING**

**GOVT OF SINDH  
ENERGY DEPARTMENT  
PROJECT MANAGEMENT UNIT  
SINDH SOLAR ENERGY PROJECT**

\*\*\*\*\*

<b>Sr No.</b>	<b>CDWP Observations</b>	<b>Para Wise Replies of Energy Department , Govt of Sindh after consultation with Stakeholders</b>
<b>1.</b>	The cost of SHS under Component-3 will be rationalized.	The shared cost is an estimated / tentative amount and is subject to change. In order to procure 200,000 Solar Home System (SHS) kits in bulk, a competitive bidding process will be conducted in accordance with World Bank Regulations. Energy Department, Sindh highly optimistic that this process will help to rationalize the cost of the SHS kits, however, the final cost will only be determined once the bidding process is successfully completed.
<b>2.</b>	The present criteria for distribution of SHS under Component-3 will be reviewed.	The Benazir Income Support Program (BISP) has provided data of 13,200 households for each district of Sindh. SSEP is targeting households on the basis of poverty scores between 21-50, however, priority will be given to those households who do not have electricity connection or are borrowing from others. Data received from BISP includes the above mentioned criteria also.
<b>3.</b>	Rural Sindh districts will be prioritized for distribution of SHS under Component-3.	Although the PC1 envisages equal distribution of SHS kits in all districts of Sindh. The project team is directed to devise a strategy to reduce the number of eligible households in urban districts and specifically focus on households that lack access to electricity or rely on borrowing energy needs from others resources. This targeted approach aims to address the specific needs of these households and provide them with sustainable solar energy solutions through the project.

\*\*\*\*\*

## **ECNEC OBSERVATIONS OF 11<sup>TH</sup> JULY 2023 MEETING**

**Most Immediate**

Government of Pakistan  
Ministry of Planning, Development and Special Initiatives  
(Energy Wing)  
\*\*\*\*\*

No. 20(123) Energy/PC/2023

Islamabad, the 27<sup>th</sup> July, 2023

### **OFFICE MEMORANDUM**

Subject: **Sindh Solar Energy Project (SSEP) (Revised)**

The undersigned is directed to refer to Public Investment Authorization Section, M/o PD&SI's Memo No. 14(713)PIA-III/PC/2023 dt 26.07.2023 on the above cited subject (copy enclosed) and to request to submit compliance of ECNEC decision dt 11.07.2023, for onward submission to the quarter concerned.

Encl: As above

  
(Engr. Fahad Shuja)  
Assistant Chief (Power)

- 1) **Secretary**, Energy Department, Govt. of Sindh, **Karachi**
- 2) **Project Director**, Sindh Solar Energy Project, Energy Department, Govt. of Sindh, **Karachi.**

CC:

- i. Chief Energy (Power), M/o PD&SI, Islamabad.
- ii. Assistant Chief (PIA Section), M/o PD&SI w.r.t. above referred Memo dt 26.07.2023



MOST IMMEDIATE

Government of Pakistan  
Planning Commission  
M/o Planning, Development and Special Initiatives  
(Public Investment Authorization-III Section)  
\*\*\*\*\*

No. 14(713) PIA-III/PC/2023

Islamabad, the 26<sup>th</sup> July, 2023

MEMORANDUM

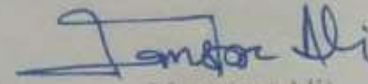
Subject: SINDH SOLAR ENERGY PROJECT (SSEP) (REVISED)

The subject project was considered by Executive Committee of the National Economic Council (ECNEC) in its meeting held on 11<sup>th</sup> July, 2023 vide case No. ECNEC-41/05/2023 and following decision was taken: -

"The Executive Committee of the National Economic Council (ECNEC) considered the Summary dated 7<sup>th</sup> July 2023 submitted by the Ministry of Planning Development and Special Initiatives titled "Sindh Solar Energy Project (SSEP) (Revised)" and approved the proposal / submission given at para-18 of the summary. The ECNEC directed Project Directorate of the SSEP to share:

- i. The site where this project stands implemented.
- ii. The savings in electricity units by the hospitals where solarization has been implemented

2. Energy Wing is requested to take-up this matter with the Sponsors compliance of the decision of ECNEC at the earliest, please.

  
(Mansoor Ali)  
Assistant Chief

Chief (Power) Energy Wing

Copy to:

- i. Chief (PIA Section), M/o PD&SI, Islamabad
- ii. Mr. Jahangir Khan, (PIA- I Section) for database updation.

## **ECNEC OBSERVATIONS REPLY OF 11<sup>TH</sup> JULY 2023 MEETING**



021-99332107

**MOST IMMEDIATE**  
**NO. SSEP/PD/ADP/01/2022-23/ 781**  
**PROJECT MANAGEMENT UNIT**  
**SINDH SOLAR ENERGY PROJECT**  
**ENERGY DEPARTMENT GOVERNMENT OF SINDH**  
Karachi, dated: 27<sup>th</sup> July, 2023

**SAY NO TO CORRUPTION**

✓ To,

**Engr. Fahad Shuja**  
Assistant Chief (Power), Energy Wing  
M/O Planning Development & Special Initiatives  
Islamabad.

Subject: **COMPLIANCE REPORT OF THE OBSERVATIONS OF THE ECNEC MEETING HELD ON 11-07-2023 FOR SINDH SOLAR ENERGY PROJECT.**

The undersigned is directed to refer the MoPD&SI Letter No. 14(713)/PIA-III/PC/2023, dated: 26<sup>th</sup> July 2023 along with the Decisions of the ECNEC meeting on the subject noted above.


2. It is informed that the para wise replies of the observations of the ECNEC meeting on the Sindh Solar Energy Project are hereby submitted as under:

- i) **Annex-A:** List of 32 Buildings with 20.48 MW solar installed.
- ii) **Annex-B:** Month wise electricity units (Kwh) generated on each site till June 2023.
- iii) **Annex-C:** Photographs /electricity Bills/Consumption of Hospitals.

3. The Ministry of Planning Development & Special Initiatives is requested that the process of PC-1 approval may be further expedited. Please feel free to contact us for any further query in this regard.

Encl: Enclosed as above.



  
**Mehfooz Ahmed Qazi**  
Project Director  
Sindh Solar Energy Project

Copy for information to:

1. Secretary, Energy Department, Government of Sindh, Karachi
2. Senior Chief Energy, MoPD&SI, Govt of Pakistan, Islamabad.
3. Chief (Power), MoPD&SI, Govt of Pakistan, Islamabad.
4. Chief (Foreign Aid), P&D Department, Govt. of Sindh, Karachi
5. Mr. Mansoor Ahmed, Asstt. Chief (PIA-III), Mo PD&SI, Islamabad.
6. PS to Chairman, P&D Board, Govt. of Sindh, Karachi
7. DS (Staff)/PS to Minister for Energy, Government of Sindh
8. Office Copy



Annex-A

## SINDH SOLAR ENERGY PROJECT

### LIST OF BUILDINGS / SOLARIZED HOSPITALS

#### COMPONENT – II (ROUND – 1)

S.no	Name of Site	Location	System Capacity (KW)/Contract
1	Aseefa Bibi Dental College	Larkana	150
2	Civil Hospital Karachi	Karachi	1651.7
3	Sindh Govt Hospital Saudabad Malir		200.25
4	Dumba Goth Hospital		50.16
5	JPMC Karachi		1590
6	Sindh Govt Hospital Liaquatabad		245.16
7	Sindh Govt Hospital Korangi No.5		239.76
8	25 Bedded Hospital Korangi ½		64.46
9	DUHS Ojha Campus		2798
10	50 Bedded DHQ Hospital Gadap		400.18
11	Liyari General Hospital		685.50
12	LUMHS Hospital Hyderabad	Hyderabad	767.63
13	Kohsar Hospital Hyderabad		275.1
14	DHQ Hospital Matiari	Matiari	93.38
15	DHQ Hospital Kotri	Jamshoro	250.65
16	Abdullah Shah Institute – Sehwan		200.25
17	Civil Hospital Dadu	Dadu	344.43
18	Hepatitis Center Dadu		56.07
19	DHQ Hospital Qamber ShadadKot	Qamber ShadadKot	401.40
20	DHQ Mirpur Mathelo	Ghotki	550
21	RBUT Shikarpur	Shikarpur	549.98
22	Civil Hospital Sujawal	Sujawal	501.85
23	Indus Hospital	Badin	1500
24	DHQ Umerkot	Umerkot	676.40
25	DHQ Tando Allahyar	Tando Allahyar	534.19
26	Shahdampur Institute of Medical Sciences	Sanghar	630
27	PSAQSJ Medical Institute, Gambat	Khairpur	1279.82
28	KMC Civil Hospital		1176.53
29	PMCH Benazir Abad	S. Benazirabad	894.36
30	Civil Hospital N. Feroz	N. Feroz	407
31	GMCC Hospital Sukkur	Sukkur	816.04
32	Tando M. Khan Hospital	T, M. Khan	500
	<b>Total</b>		<b>20480.25 KW</b>



*(Signature)*

**Mehfooz Ahmed Qazi**  
Project Director  
Sindh Solar Energy Project



### Annex -c

**Commission Date:** 30-03-2022

S.No	Month	Hospital Consumption From Grid (kWh/Month) a*	Solar Generation in (kWh/Month) b**	Total Consumption (kWh/Month) a+b	Solar Proportion in Total Consumption (%)
1	April 2022	24463	29751.3	54214.3	54.9%
2	May 2022	31467	24860.1	56327.1	44.1%
3	June 2022	14400	19095.3	33495.3	57.0%
4	July 2022	844	10494.9	11338.9	92.6%
5	August 2022	1288	6364.1	7652.1	83.2%
6	September 2022	45906	2091.3	47997.3	4.4%
7	October 2022	11975	8803.1	20778.1	42.4%
8	November 2022	19993	9616.3	29609.3	32.5%
9	December 2022	18831	15897	34728	45.8%
10	January 2023	19182	15346.9	34528.9	44.4%
11	February 2023	23728	18007.1	41735.1	43.1%
12	March 2023	22274	16300.5	38574.5	42.3%
13	April 2023	23885	18929.4	42814.4	44.2%

\*\*Solar Generation data is extracted from Web-Portal (access) provided by contractor.



Annex - C

[illegible]

<https://bill.pitc.com.pk/hescobill/industrial?refno=28371530098091>

1/2





Annex-c

### Energy Generation Report (Draft)

Site Name: Lumhs Hospital Hyderabad

EPC Contractor: Pantera

System Capacity: 767.63 KW

Commission Date: 29-12-2021

Month wise Units Generated from January 2022 and Onwards

S.No	Month	Hospital Consumption From Grid (kWh/Month) a*	Solar Generation in (kWh/Month) b**	Total Consumption (kWh/Month) a+b	Solar Proportion in Total Consumption (%)
1	January	232720	4859.4	237579.4	2.0%
2	February	227440	8147.8	235587.8	3.5%
3	March	236160	10098.8	246258.8	4.1%
4	April	493360	7320.4	500680.4	1.5%
5	May	673280	8167.4	681447.4	1.2%
6	June	743680	9816.3	753496.3	1.3%
7	July	792160	78164.2	870324.2	9.0%
8	August	691040	60846.9	751886.9	8.1%
9	September	672800	94560.6	767360.6	12.3%
10	October	733920	81652.1	815572.1	10.0%
11	November	635200	77106.5	712306.5	10.8%
12	December	437600	75592.8	513192.8	14.7%
13	January'23	276400	73725.5	350125.5	21.1%
14	February'23	260160	78040.1	338200.1	23.1%



15	March'23	312080	85305.5	397385.5	21.5%
16	April'23	487040	59434.1	546474.1	10.9%

\*Disco Consumption data is extracted from Utility Bill

\*\*Solar Generation data is extracted from Web-Portal (access) provided by contractor.



11/8/22, 1:37 PM

HESCO ONLINE BILL

Annex-c

**HESCO**  
HYDERABAD ELECTRIC SUPPLY COMPANY ELECTRICITY CONSUMER BILL - (MDI)  
www.hesco.co.za

CONNECTION DATE: 29  
MNF/G. CD: NO OF AC: ED@: BILL MONTH: OCT 22  
READING DATE: 01 OCT 22  
ISSUE DATE: 13 OCT 22  
DUE DATE: 28 OCT 22

CONSUMER ID / UNIQUE KEY: 2370014993 / 37010672245  
TARIFF: A-3a(66)  
SANG LOAD: 1564  
OLD A/C NUMBER: 20371131169700

FEEDER NAME: 1TKV CIVIL HOSPITAL

MONTH: MDI: KWH UNITS: BILL: PAYMENT

Oct21: 0: 767920: 117786122: 0  
Nov-21: 0: 591280: 135514117: 2160181  
Dec21: 0: 355920: 127787736: 22328978  
Jan22: 0: 232720: 116032283: 17727995  
Feb22: 0: 227440: 105041605: 23445022  
Mar22: 0: 236160: 89637779: 7734121  
Apr22: 0: 493360: 96609926: 8040642  
May22: 0: 673280: 107668764: 33799081  
Jun22: 0: 743680: 97256831: 0  
Jul22: 0: 792160: 126489823: 23364054  
Aug22: 0: 691040: 133665766: 31145509  
Sep22: 0: 672800: 132912267: 3055244

REFERENCE NO: 28 37113 1169700 U  
DIVISION: GARIKHATA  
SUB DIVISION: SARFARAZ COLONY

NAME & ADDRESS: NEW CARDIAC UNIT, LAQUAT MEDICAL COLLEGE, HOSPITAL, SARFARAZ COLONY, HYDERABAD  
CNCT LOAD = 1564  
MCO Date: 01-Dec-2019

SAY NO TO CORRUPTION  
GOVT CONNECTION

Full Price Adjustment for Aug-22 @ 0.1916/KWH  
FT FPA = 00 ET FPA = 00  
VAR FPA = 132541.47 GST FPA = 22532.00  
ED FPA = 00 IT FPA = 00  
STAX FPA = 00  
Total FPA: 155073

WATTAGE: LINE LENGTH:

PRV CUMM MDI: PRS CUMM MDI: RESET NO: MONTHLY ADV BILL: POWER FACT: 0

KWH: METER NO: PREVIOUS: PRESENT: MF: KWH METER READING: PREVIOUS: PRESENT: MF: MDI METER READING: PREVIOUS: PRESENT: MF: METER STATUS

002999000976: 1873.59: 1949.87: 8000: 0: 0: 0: 0: 0: 0

002999000976: 301.34: 376.8: 8000: 0: 0: 0: 0: 0: 0

UNITS CONSUMED: 733920  
ENERGY CHARGES: 21210288  
TAX CHARGES: 0  
LPP PENALTY: 0  
SEASONAL CHARGES: 0  
METER RENT: 7.50  
SERVICE RENT: 0  
VAR FPA: 132541.47  
QTR TARIFF ADJ: 3642738.54  
TOTAL: 24865575.51

GOVT CHARGES: E.D.: 0  
TV FEE: 0  
GST: 4278665  
INCOME TAX: 0  
EXTRA TAX: 0  
FURTHER TAX: 0  
ITS: 0  
STAX - 2014: 0  
N.J. SUBCHARGE: 0  
SALES TAX: 0  
FC SURCHARGE: 315585.80  
TR SURCHARGE: 0  
TAXES ON FPA: 22532  
TOTAL: 4616782.6  
GST ADJ: 22532  
DEFERRED AMOUNT: 0  
OUTSTANDING INSTAL: 0

ARREARAGE: 10235702360  
CURRENT BILL: 28447285.47  
BILL ADJUSTMENT: 0  
INSTALLMENT: 0  
TOTAL FPA: 155073  
PAYABLE WITHIN DUE DATE: 131959381  
LPP SURCHARGE: 2518661  
PAYABLE AFTER DUE DATE: 134476242

For Complaint Contact  
SDO #: 9210176 / 63372102817  
XEN #: 9200345 / 63372102814  
SE #:

BILL MONTH: OCT 22  
DUE DATE: 28 OCT 22  
REFERENCE NO: 28 37113 1169700 U  
PAYABLE WITHIN DUE DATE: 131959381  
PAYABLE AFTER DUE DATE: 134476242

https://bill.picc.com.pk/hescobill/industrial?refno=28371131169700

1/2





Annex-c

**Commission Date:** 25-09-2022

S.No	Month	Hospital Consumption From Grid (kWh/Month) a*	Solar Generation in (kWh/Month) b**	Total Consumption (kWh/Month) a-b	Solar Proportion in Total Consumption (%)
1	October	263080	37010	300090	12.3%
2	November	229480	440120	669600	65.7%
3	December	139160	18410	157570	11.7%
4	January'23	95720	1460	97180	1.5%
5	February'23	109920	38850	148770	26.1%
6	March'23	92720	72150	164870	43.8%
7	April'23	137920	57483.6	195403.6	29.4%

\*\*Solar Generation data is extracted from Web-Portal (access) provided by contractor.



Annex -c

# HYDERABAD ELECTRIC SUPPLY COMPANY - ELECTRICITY CONSUMER BILL - (MDI)

www.hesco.gov.pk

HESCO GST # 01-01-2716-002-55

CONTR. DATE		MNPS. CD	NO OF AC	ED#	BILL MONTH	READING DATE	ISSUE DATE	DUE DATE	
26 NOV 12		29			APR 23	01 APR 23	12 APR 23	26 APR 23	
CONSUMER ID / UNIQUE KEY	TARIFF	SANC LOAD	OLD AC NUMBER		FEEDER NAME		11KV PMCH-I		
					MONTH	MDI	KWH UNITS	BILL	PAYMENT
					Apr22	0	100520	29019658	284787
					May-22	0	268320	30741723	12486551
2370028944 / 370300316603	A-3a(86)	300	24373131365702		Jun22	0	305200	27865104	9393125
REFERENCE NO		DIVISION		NAWABSHAH					
28 37313 1365702 U		SUB DIVISION		SOCIETY					
NAME & ADDRESS M/S. PEOPLES MEDICAL HOSPITAL NAWAB SHAH		AMI METER CNCT LOAD = 360 MCO Date 01-Jul-2020		SAY NO TO CORRUPTION		WEB GENERATED BILL			
M/S. PEOPLES MEDICAL HOSPITAL CT-SCAN BLOK NAWAB SHAH				GOVT CONNECTION		Fuel Price Adjustment for Feb 23 @ -0.00000KWH FT. FPA = .00 ET. FPA = .00 VAT. FPA = .45 SE GST FPA = -11.00 STAX FPA = .00 Total FPA = -76			
PRV CUMM MDI	PRS CUMM MDI	RESET NO	MONTHLY ADV.BILL	POWER FACT	WATTAGE LINE LENGTH :				
			0						
KWH	KWH METER READING		KVAH METER READING		MDI METER READING		METER STATUS		
METER NO	PREVIOUS	PRESNT	MF	PREVIOUS	PRESNT	MF	PRESNT	MF	
002999000191	1590.93	1607.72	4000	0	0	0	0	0	
002999000191	320.31	328	4000	0	0	0	0	0	
UNITS CONSUMED 137929									
HESCO CHARGES				GOVT CHARGES				ARRANGEABLE	
UNITS CONSUMED 137920				E.R.				282408/175	
ENERGY CHARGE 4111395.20				TV FEE				6198117.25	
FIX CHARGES				GST				369436.80	
L.P.F. PENALTY				INCOME TAX					
SEASONAL CHARGES				EXTRA TAX					
METER INTL				FURTHER TAX					
SERVICE CHARGE				ITS					
S.M. FPA -65.95				STAX 2014				34815561	
QTR TARIFF ADJ 614392.22				N.J SURCHARGE				525264	
TOTAL 4725721.47				SALES TAX				35340825	
BELL CALCULATION				FC SURCHARGE 526854.40					
GOP				TR SURCHARGE					
Tax# 29.8100 X 10750				TAXES ON FPA -11					
25.8100 X 30762				TOTAL 1472319.4					
150 X 0				QST ADJ. 55107					
DIFFERED AMOUNT				SDD # : 9370014 / 0337125298				For Complaint Contact	
GASTAINDING INST. AMOUNT				XCN # : 9370012 / 0037210290				SE # :	

## HYDERABAD ELECTRIC SUPPLY COMPANY - ELECTRICITY CONSUMER BILL (MDI)

http://hscs.com.pk/hesco/bill/pdf/total?refno=24373131365702

CONSUMER ID	2370028944
BILL NO	5794359

<https://bill.pitc.com.pk/hoscobill/industrial?refno=28373131365702>

1/2



## **ECNEC OBSERVATIONS REPLY OF 27<sup>TH</sup> JULY 2023 LETTER**



021-99332107

**MOST IMMEDIATE**  
**NO. SSEP/PD/ADP/01/2022-23/794**  
**PROJECT MANAGEMENT UNIT**  
**SINDH SOLAR ENERGY PROJECT**  
**ENERGY DEPARTMENT, GOVERNMENT OF SINDH**  
**Karachi dated: 02<sup>nd</sup> August 2023**

**SAY NO TO CORRUPTION**

To,

**Engr. Fahad Shuja**  
Assistant Chief (Power), Energy Wing  
M/O Planning Development & Special Initiatives  
Islamabad.

Subject: **SINDH SOLAR ENERGY PROJECT (SSEP) (REVISED).**

Reference is made to MoPD&SI Letter No. 20(123)/Energy/PC/2023, dated: 1<sup>st</sup> August 2023 on the subject noted above.

2. The requisite information in compliance to the ECNEC Decisions is submitted as under:

Sr No	Comments of Energy Wing, M/o PD&SI	Reply of Energy Department Govt of Sindh	Remarks
1	The sponsors should provide total savings in electricity units, for the hospitals implemented under the project.	The total electricity units saved in hospitals is <b>7886151 kWh.</b> The data is up to 30 <sup>th</sup> June 2023.	The List is attached for ready reference.

3. Please feel free to contact us for any further query in this regard.

Encl: Enclosed as above.



  
**Mehfooz Ahmed Qazi**

Project Director  
Sindh Solar Energy Project

Copy for information to:

1. Secretary, Energy Department, Government of Sindh, Karachi
2. Chief Energy (Power), MoPD&SI, Govt of Pakistan, Islamabad.
3. Chief (Foreign Aid), P&D Department, Govt. of Sindh, Karachi
4. Asstt. Chief (PIA-III), Mo PD&SI, Islamabad.
5. DS (Staff)/PS to Minister for Energy, Government of Sindh
6. Office Copy



**Sindh Solar Energy Project**  
**List of Hospitals/Buildings (Component-II) Round 01 (Operational) - Draft**

S. #	Building Name	System Capacity (kW)/CC	Commissioning Date	Generations (kWh)																		Total Generation from date of Commission upto June 2023
				Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	
1	25 Bedded Korangi 1 1/2	64.46	26-Apr-22	-	-	-	8,123	10,502	6,820	6,194	6,845	-	-	-	-	-	-	-	-	-	-	38,484
2	SGH Korangi No 5	239.76	29-Dec-21	6,144	22,650	20,026	-	-	25,260	21,857	19,015	27,882	30,431	26,293	26,054	27,180	26,009	34,317	33,480	34,278	30,613	411,488
3	SGH Liaquatabad	245.16	29-Dec-21	4,840	24,832	32,045	34,124	28,309	7,692	-	13,662.40	27,839	30,597	25,883	15,879	21,774	27,081	28,444	31,177	33,688	28,188	416,055
4	Sindh Government Lyari General Hospital Karachi	685.50	04-Sep-22	-	-	-	-	-	-	-	-	-	28,090	18,570	10,630	30,840	29,600	56,240	38,290	3,770	42,280	258,310
5	Dr Ruth KM Pfau Civil Hospital Karachi	1,651.70	10-Jun-22	-	-	-	-	-	203.69	207,679.60	221.07	-	-	-	-	-	-	-	-	-	-	208,104
6	SGH Saudabad Malir Karachi	200.25	26-Apr-22	-	-	-	8,698.40	19,068.90	13,504.00	12,675.20	16,412.00	-	-	-	-	-	-	-	-	-	-	70,359
7	Gadap City Hospital Karachi	400.18	10-Jun-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,798	372	9,170
8	Dumha Goth Hospital Karachi	50.16	30-Mar-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20,470
9	Civil Hospital Sujawal	501.85	17-Aug-22	-	-	-	-	-	-	-	-	-	-	16.00	-	4,700	3,780	5,028	3,220	1,993	5,130	23,867
10	D.H.Q Kotri	250.65	30-Mar-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,196	-	5,196
11	LUMHS, Hyderabad	767.63	29-Dec-21	76,673	81,583	99,342	102,886	104,683	100,636	78,164	60,847	94,561	81,652	77,107	75,593	73,726	78,040	85,306	59,434	53,165	81,915	1,465,312
12	Kohsar Hospital Latifabad, Hyderabad	275.10	30-Mar-22	-	-	-	29,751	24,860	19,095	10,495	6,364	2,091	8,803	9,616	15,897	15,347	18,007	16,301	18,929	30,961	24,833	251,352
13	D.H.Q Hospital, Matiari	93.38	29-Dec-21	4,859	8,148	10,099	7,320	8,167	9,816	1,002	-	-	-	-	-	8,065	8,032	4,929	-	2,618	1,731	74,788
14	D.H.Q Tando Allahyar	534.19	24-Apr-22	-	-	-	74.66	79,958	78.66	69,290	68,462	-	-	-	-	-	-	-	-	-	-	217,863
15	D.H.Q Umerkot	676.40	01-Oct-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	Shahdadpur Institute Of Medical Sciences Sanghar	630.00	26-Apr-22	-	-	-	55,609	66	49,438	51,734	54,685	-	-	-	-	-	-	-	-	-	-	211,532
17	PMCH Nawabshah	894.36	25-Sep-22	-	-	-	-	-	-	-	-	-	37,010	26,015	18,410	14,600	38,850	74,150	57,484	46,020	68,640	381,178
18	Syed Abdullah Shah Institiite Sehwan	200.25	31-May-22	-	-	-	-	-	-	-	-	-	-	-	-	-	5,609	7,824	7,124	6,741	4,599	31,897
19	Civil Hospital Dadu	344.43	19-Oct-22	-	-	-	-	-	-	-	-	-	-	2,610	1,640	2,450	5,350	8,490	8,580	6,020	10,170	45,310
20	Hepatitis Center Dadu	56.07	08-Sep-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	KMC Civil Hospital, Khairpur	1,176.53	30-Mar-22	-	-	-	109,795	120,813	110,097	102,726	73,712	103,527	87,904	32,338	44,987	42,443	60,784	73,473	38,338	30,961	24,833	1,056,731
22	GMMMC, Sakkur	816.04	29-Dec-21	46,228	30,949	61,472	51,819	59,175	59,459	41,041	17,538	68,260	44,651	34,543	21,025	29,976	43,665	45,987	38,338	30,961	24,833	749,916
23	RBUH Hospital Shikarpur	549.98	05-Aug-22	-	-	-	-	-	-	-	9,013	-	-	-	-	-	-	-	1,274	858	-	11,146
24	PSAQSI Medical Institute, Ghambat	1,279.82	30-Mar-22	-	-	-	192,734	192,362	181,282	163,723	69,546	139,758	39,075	89,400	108,541	122,920	121,044	159,031	101,587	128,907	117,714	1,927,625
25	DHQ Qumber Shahdadkot	401.40	01-Oct-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	DHQ TMK	500.00	-	Commissioned In July 2023																		
27	Civil Hospital Naushero	407.00	-																			
28	JPMC Karachi	1,590.00	-																			
29	Indus Hospital Badin	1,500.00	-																			
30	Mirpur Mathelo Hospital	550.00	-																			
31	DUHS Ojha	2,798.00	-	Solarized Completely and is under testing phase																		
32	Asifa Dental College	150.00	-																			
Total Capacity:		20,480.25																				



## **SUMMARY FOR THE ECNEC (POSITION PAPER)**

Government of Pakistan  
Ministry of Planning, Development & Special Initiatives

\*\*\*\*\*

### **SUMMARY FOR THE ECNEC (POSITION PAPER)**

**Sector: Energy**  
**Sub-Sector: Power**

1. **Project title:** Sindh Solar Energy Project (SSEP) (Revised)
2. **Location:** Province Sindh
3. **Sponsoring Agency:** Government of Sindh (GoS)
4. **Executing Agency:** Energy Department, Govt. of Sindh
5. **Source of financing:** World Bank: US\$100 million (95.2%) (IDA credit)  
Government of Sindh: US\$5 million (4.7%)

6. **Cost:** (Rs. Million)

Cost	Local	FEC	Total
Original PC-I (14-11-2018)	4,895.21	7,952.90	12,848.11
Revised PC-I (01-06-2023)	3,152.28	18,853.36	22,005.64
Updated Cost	3,152.28	24,265.77	27,418.13

(Details of cost comparison are given at **Annex- I**)

7. **Exchange Rate:**  
1 US\$ = Rs.124.08 (Original PC-I)  
1 US\$ = Rs. 220 (Revised PC-I)  
1 US\$ = Rs. 285.48 (Updated on May 2023)
8. **Date of Consideration by ECNEC:** 11-07-2023
9. **Period of Implementation:**  
Original PC-I: 4 years & 4 months  
Revised PC-I: 6 years & 2 months
10. **ADP Allocation (2023-24):** Rs. 117.8 Million
11. **Brief description of the project:**

The objective of the proposed project is to support the scale-up of solar power in Sindh Province and increase access to electricity. Moreover, the proposed project will improve energy security and fulfil Pakistan's international commitments on climate change

**Scope of Work:**

- i. **Utility-Scale Solar (US\$15 million):** Development of at least 400 MW of utility-scale solar by private sector IPPs in Sindh, selected using international tariff-based competitive bidding and supporting development of solar park infrastructure under the project.
- ii. **Distributed Solar (US\$50 million):** Installation of at least 50 MW of distributed solar on and around public buildings and facilities in Sindh, with provisions made for long-term O&M.
- iii. **Solar Home Systems (US\$33 million):** Provision of results-based grants to support the purchase of high quality, off-grid, solar home systems by 200,000 lower-income households in Sindh.
- iv. **Technical Assistance & Capacity Building (US\$02 million):** Technical assistance and support will be provided to the PMU SSEP, Energy Department, Government of Sindh and other relevant entities in Government of Sindh for introducing state of the art Solar PV based technologies available in developed countries.

**12. Background:**

- a) The Original PC-I of the project was approved by ECNEC on 14th November 2018 at a total cost of Rs.12,848.11 million including FEC=Rs.7952.90 million (@ US\$=Rs.124.08)
- b) The Loan agreements with World Bank was signed on 9th January 2019 and the Finance Department, Govt of Sindh conveyed administrative approval on 20th May 2019 for a period of 5 years up to 2022- 23
- c) The sponsors submitted revised PC-I at a total cost of Rs. 22.006 billion with FEC of Rs. 18.85 billion for consideration of CDWP/ECNEC in April, 2023.
- d) As per Revised PC-I, the project was started in one year late. Due to the Covid-19 shutdowns in 2020, the project activities were delayed. Therefore, 22 Months extension has been requested along with change in already approved amount & scope of work, as summarized below:

Components	Description	Unit	Scope	
			Original	Revised
Comp-I:	Utility Scale Solar	MW	400 MW (US\$40 million)	400 MW (US\$ 15 million)
Comp-II:	Roof top solar	MW	20 MW (US\$26 Million)	50MW (US\$50 million)
Comp-III:	Solar Home System	SHS	200,000 (US\$30 million)	200,000 (US\$33 million)
Comp-IV	Capacity building	Trainings & Lab	2 Labs (US\$05 million)	2 Labs (US\$ 02 million)
	No of Distt for SHS	Districts	10	30
	Selection of Roof top Buildings	Buildings	Public sector	Public, autonomous & Social sector



- e) The Revised PC-I was discussed in CDWP meeting on 01.06.2023 and CDWP, in principle, recommended the project to ECNEC with the directions that Energy Department, Government of Sindh will review the following observations, in consultation with EAD and World Bank and will furnish their recommendations, accordingly:
- The cost of SHS under component-3 will be rationalized.
  - The present criteria for distribution of SHS under component-3 will be reviewed.
  - Rural Sindh districts will be prioritized for distribution of SHS under component-3.
- (Copy of CDWP Minutes is placed at **Annex-II**).

- f) In light of above directions of CDWP, the revised PC-I was submitted to ECNEC on 11.07.2023 and ECNEC approved the proposal submission given at para-18 of the summary with the direction that Project Directorate of SSEP will share:
- The site where this project stands implemented.
  - The savings in electricity units by the hospitals where solarization has been implemented.
- (Copy of ECNEC Decision is placed at **Annex-III**).

**13. Decision of ECNEC dated 11.07.2023:**

ECNEC decision is reproduced below:

"The Executive Committee of the National Economic Council (ECNEC) considered the Summary dated 7th July 2023 submitted by the Ministry of Planning Development and Special Initiatives titled "Sindh Solar Energy Project (SSEP) (Revised)" and approved the proposal submission given at para-18 of the summary. The ECNEC directed Project Directorate of the SSEP to share:

- The site where this project stands implemented
- The savings in electricity units by the hospitals where solarization has been implemented"

Para-18 of the summary is as under:

The project, at an estimated cost of Rs. 27,418.13 million including FEC of Rs. 24,265.57 million (@1USD=Rs.285.48), is submitted for consideration of the ECNEC in light of para 15 of ECNEC Summary dated 11.07.2023.

**14. Compliance of ECNEC Decision:**

S. No.	ECNEC Decision dt 11.7.23	Compliance of ECNEC Decision submitted by Energy Dept. Gov of Sindh
	The Executive Committee of the National Economic Council (ECNEC) considered the Summary dated 7th July 2023 submitted by the Ministry of Planning Development and Special Initiatives titled "Sindh Solar Energy Project (SSEP) (Revised)" and approved the proposal submission given at para-18 of the summary. The ECNEC directed Project Directorate of the SSEP to share:	The sponsors have submitted following compliance of ECNEC decision:

i	The site where this project stands implemented.	A total of 20.48 MW solar system has been installed at 32 x hospitals (details are provided at <b>Annex-IV</b> ).
ii	The savings in electricity units by the hospitals where solarization has been implemented	Total Electricity Units saved in hospitals is 7,886,151 kWh, upto 30.06.2023. (details are provided at <b>Annex-V</b> )

**15. Submission:**

The compliance of ECNEC Decision dt 11.07.2023, submitted by Energy Dept, Govt. of Sindh, is submitted for the consideration of ECNEC.

**16.** The Minister for PD&SI/Deputy Chairman, Planning Commission has seen and authorized submission of the Summary to the ECNEC.

(Syed Zafar Ali Shah)  
Secretary

Islamabad, the 08<sup>th</sup> August, 2023



## **DECISION OF THE ECNEC FOR REVISED PC – 1**

**SECRET**

Addl Item No.2

**Case No. ECNEC-77/9/2023**  
**Dated: 9<sup>th</sup> August, 2023**

**SINDH SOLAR ENERGY PROJECT (SSEP) (REVISED)**

### **DECISION**

The Executive Committee of the National Economic Council (ECNEC) noted the Summary dated 8<sup>th</sup> August, 2023 submitted by the Ministry of Planning, Development and Special Initiatives for the project titled "Sindh Solar Energy Project (SSEP) (Revised)" in compliance of ECNEC decision dated 11-7-2023.

\*\*\*



## **AUTHORIZATION LETTER**

Government of Pakistan  
Planning Commission  
M/o Planning, Development and Special Initiatives  
(Public Investment Authorization-III Section)  
\*\*\*

No. 14(713) PIA-III/PC/2023

Islamabad, the 24<sup>th</sup> August, 2023

**The Chairman**  
Planning and Development Board  
Government of Sindh  
Karachi

Subject: **AUTHORIZATION: SINDH SOLAR ENERGY PROJECT (SSEP) (REVISED)**

I am directed to refer to the Planning and Development Board, Government of Sindh, Karachi's project received through Intelligent Project Automation System (iPAS) dated 13-04-2023 on the above subject and to say that the project was considered by the ECNEC in its meeting held on 9<sup>th</sup> August, 2023 vide case No. ECNEC77/9/2023 and following decision was taken:-

**"The Executive Committee of the National Economic Council (ECNEC) noted the summary dated 8<sup>th</sup> August, 2023 submitted by the Ministry of Planning Development and Special Initiatives titled "Sindh Solar Energy Project (SSEP) (Revised)" in compliance of ECNEC decision dated 11-07-2023."**

**Decision of ECNEC dated 11-07-2023 is reproduced below:**

**"The Executive Committee of the National Economic Council (ECNEC) considered the Summary dated 7<sup>th</sup> July 2023 submitted by the Ministry of Planning Development and Special Initiatives titled "Sindh Solar Energy Project (SSEP) (Revised)" and approved the proposal / submission given at para-18 of the summary. The ECNEC directed Project Directorate of the SSEP to share:**

- i. **The site where this project stands implemented.**
- ii. **The savings in electricity units by the hospitals where solarization has been implemented."**

**Para-18 of the summary is as under:**

The project at an estimated cost of Rs.27,418.13 million including FEC of Rs.24,265.57 million @ 1US D = Rs.285.48), is submitted for consideration of the ECNEC in light of para 15 of ECNEC Summary dated 11-07-2023.

2. In response to the ECNEC decision dated 11-07-2023, the Sponsors have furnished the compliance status of ECNEC decision which was submitted to ECNEC through Summary on 08-08-2023 which was noted by the ECNEC in its meeting dated 09-08-2023 as per above, on referenced of para-1 of this Authorization letter.

3. Approved cost summary of the project is given as under: (Rs. Million)

S. No.	Item	Total Approved Cost		
		Local	F.E.C	Total
1.	Salaries of PMU Staff	212.86	-	212.86
2.	Purchase of Office Equipment	16.91	-	16.91
3.	Purchase of Vehicles	42.00	-	42.00
4.	Operating Expenses	282.24	-	282.24
5.	Utility-Scale Solar (Com-I)	1109.62	3203.51	4313.13
6.	Distributed Solar (Comp-II)	1054.77	11777.94	12832.79
7.	Solar Home System (Com-III)	216.38	8957.39	9173.77
8.	Technical Assistance & Capacity Building (Com-V)	217.51	326.93	544.44
Total Approved Cost		3,152.28	24,265.77	27,418.13

Contd..... P-2

4. The sponsoring agency may issue administrative approval of the project in accordance with the above stated decision of the ECNEC. The implementation period of the project is 74 months(i.e. upto July, 2025) which may be reflected in administrative approval accordingly. A copy of administrative approval, as and when issued may be endorsed, inter-alia, to this Ministry.

5. The receipt of this letter may kindly be acknowledged.

  
(Noureen Fatima)  
Assistant Chief

Copy to:

- i. Secretary, Economic Affairs Division, Government of Pakistan, Islamabad
- ii. Joint Secretary (Dev.), Finance Division, Government of Pakistan, Islamabad
- iii. Joint Secretary (Committees), Cabinet Division, Govt. of Pakistan, Islamabad
- iv. Section Officer (Progress-II), Cabinet Division, Islamabad
- v. Assistant Chief (Dev.) P&D Department, Government of Sindh, Karachi

  
Assistant Chief

Copy for information to:

- i. Member (Energy), Planning Commission, Islamabad
- ✓ ii. Senior Chief (Energy) Energy Wing, M/o PD&SI, Islamabad
- iii. Director General (Monitoring), M/o PD&SI, Islamabad
- iv. Chief (Economic Appraisal Section), M/o PD&SI, Islamabad
- v. Chief (PIA Section), M/o PD&SI, Islamabad
- vi. Chief (PIP Section), M/o PD&SI, Islamabad
- vii. SPS to Deputy Chairman, Planning Commission, Islamabad
- viii. SPS to Secretary, M/o PD&SI, Islamabad
- ix. APS to JCE (Ops), M/o PD&SI, Islamabad
- x. Mr. Jahangir Khan PIA-I Section for data up-dation.





**BY SPECIAL MESSENGER**

No. PO (Dev.)-ECNEC-77/09-P&D/2023  
**GOVERNMENT OF SINDH**  
**PLANNING & DEVELOPMENT DEPARTMENT**

Karachi, dated September 11, 2023

To,

**The Secretary to Govt. of Sindh,**  
 Energy Department,  
 Government of Sindh,  
**Karachi**

**SUBJECT: AUTHORIZATION: SINDH SOLAR ENERGY PROJECT (SSEP) (REVISED)**

I am directed to enclose herewith a copy of letter No. 14(713)PIA-III/ PC/2023, dated August 24<sup>th</sup>, 2023 received from Ministry of Planning, Development and Special Initiatives Government of Pakistan, Islamabad on the subject noted above and to state that the above mentioned project was considered by the ECNEC in its meeting held on August 09<sup>th</sup>, 2023 with the following decision:

*"The Executive Committee of the National Economic Council (ECNEC) noted the Summary dated August 08<sup>th</sup>, 2023 submitted by the Ministry of Planning Development and Special Initiative titled "Sindh Solar Energy Project (SSEP)(Revised)" in compliance of ECNEC decision dated 11.07.2023."*

Decision of ECNEC dated 11.07.2023 is reproduced below:-

*"The Executive Committee of the National Economic Council (ECNEC) noted the Summary dated July 07<sup>th</sup>, 2023 submitted by the Ministry of Planning Development and Special Initiative titled "Sindh Solar Energy Project (SSEP)(Revised)" and approved the proposal / submission given at para -18 of the summary. The ECNEC directed Project Directorate of the SSEP to share."*

- i. *The site where this project stands implemented.*
- ii. *The savings in electricity units by the hospitals where solarization has been implemented."*

2/- The Sponsoring agency/Government of Sindh may issue administrative approval of the project in accordance with the above stated decision of the ECNEC. The implementation period of the project is **74 months (i.e. upto July, 2025)** which should also be reflected in the administrative approval accordingly. A copy of administrative approval, as and when issued may be endorsed, inter-alia, to all stake-holders.

Encl: As Above

**(TOUFIQUE AHMED SHAIKH)**  
 CHIEF (DEVELOPMENT)

*A copy forwarded for information to:-*

- The Chief (Industries & Energy), P&D Department, GoS Karachi.
- The Assistant Chief (PIA-III Section), M/o Planning, Development and Special Initiatives, GoP, Block "P" Pak Secretariat, Islamabad w/r to his letter quoted above.

*C.C.to:-*

- The PSO to Chairman, P&D Board, Sindh
- The PS to Member (Development/E&I), P&D Board, Sindh.

**CHIEF (DEVELOPMENT)**



## Minutes of CDWP meeting for Original PC – 1

Government of Pakistan  
Planning Commission  
Ministry of Planning, Development and Reform  
\*\*\*\*\*

### MINUTES OF CDWP MEETING HELD ON 24-5-2018

PP-2:

#### Sindh Solar Energy Project (SEEP)

(Total Cost: Rs. 11,440.21 million including FEC of Rs. 6,545.00 million)


Chief (Energy) informed the forum that CDWP in its meeting held on 2<sup>nd</sup> May, 2018 constituted a Committee under Member (Energy) to address the highlighted issues of power evacuation, project design and feasibility studies. The Committee will present its recommendation after stakeholders' consultation before submission of Summary to ECNEC.

2. Member (Energy) informed that in compliance of the CDWP decision, a review meeting was held on 15<sup>th</sup> May, 2018 and the stakeholders including HESCO, SEPCO, CPPA and AEDB reached consensus to support the project subject to compliance with the prevalent framework for approval of solar power projects in the country. The project is therefore supported as updated feasibility report regarding component 1, component 2 and component 3 has been submitted by Energy Department, Government of Sindh along with clarification of project implementation mechanism by World Bank. Moreover, World Bank has also assured that further financing of any of the investment/implementation activities would not be released unless the detailed design and fiduciary controls are in place.

3. The Chair observed that there is an allocation of Rs115.5 million for Third party monitoring, the sponsors were asked to explain the mechanism. The sponsors informed that a third party vendor will be hired to carry out operation and maintenance through a long term contract for the sustainability of the project.

#### Decision

The CDWP recommended the project at a total cost of Rs11,440.21 million including FEC of Rs6,545.00 million for consideration of the ECNEC.

  
MUSHTAQ AHMED RAJA  
Chief (PIA)

  
for SC (2nd)  
10-11-18  
27/18  
27/18

## Minutes & Decision of ECNEC meeting for Original PC – 1

2018 03 19 pm

CABINET COMMITTEE

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Page 01

PRO Deptt  
**SECRET**  
Govt of Sindh

### MINUTES AND DECISIONS OF THE MEETING OF EXECUTIVE COMMITTEE OF THE NATIONAL ECONOMIC COUNCIL (ECNEC) HELD ON 14<sup>th</sup> NOVEMBER, 2018

A meeting of the Executive Committee of the National Economic Council (ECNEC) was held on 14<sup>th</sup> November, 2018 in the Committee Room of the Cabinet Division, Islamabad. The Minister for Finance, Revenue and Economic Affairs presided over the meeting. The meeting commenced with recitation from the Holy Quran by Mr. Fazal Abbas Maken, Cabinet Secretary. Thereafter, the ECNEC took up the agenda.

\*\*\*

Case No. ECNEC-42/6/2018  
Dated: 14<sup>th</sup> November 2018

#### SINDH SOLAR ENERGY PROJECT (SSEP)

#### MINUTES

The Ministry of Planning, Development & Reform informed that objective of the project is to support the scale-up of solar power in Sindh Province and increase access to electricity. Moreover, the project will improve energy security, and fulfill Pakistan's International commitments on climate change. The scope of project consists of the following four components:

- i. Utility-Scale Solar
- ii. Distributed Solar
- iii. Solar Home System (SHS)
- iv. Capacity Building and Technical Assistance

2. The Ministry of Planning, Development & Reform further informed that the CDWP in its meeting held on 02-05-2018 constituted a Committee under Member (Energy) to address the highlighted issues of power evacuation, project design and feasibility studies. The Committee was to present its recommendation after stakeholders' consultation before submission of summary to ECNEC. In compliance of CDWP decision, a review meeting was held on 15-5-2018 under Member (Energy) and it was decided that the stakeholders including HESCO, SEPCO, CPPA and AEDB reached consensus to support the project subject to compliance with the prevalent framework for approval of solar power projects in the country. An updated feasibility report regarding component-1, component-2 and component-3 has been submitted by Energy Department Government of Sindh along with clarification of project implementation mechanism by World Bank. The World Bank has indicated that financing of any of the investment/implementation activities would not be released unless the detailed design and



## SECRET

fiduciary controls are in place. Accordingly, a position paper was submitted to CDWP on 24-5-2018 and CDWP recommended the project for consideration of ECNEC.

3. The Ministry of Planning, Development & Reform apprised that the project was again considered by the CDWP in its meeting held on 24-5-2018 and recommended for consideration of ECNEC at a total cost of Rs.11,440.21 million including FEC of Rs.5,545.00 million.

4. The Ministry of Planning, Development & Reform submitted the project for consideration of the ECNEC at an updated cost of Rs.12,848.11 million including FEC of Rs.7,952.90 million (1US\$ = Rs.124.08).

5. During the ensuing discussion, it was observed that FEC component of the project has been calculated at old exchange rate i.e. 1 US\$ = Rs.124.08. Now the exchange rate has changed significantly which will ultimately increase the cost of the project and for this purpose a fresh approval of the competent forum might be required according to current exchange rate. The meeting was informed that ECNEC in its earlier decision vide letter No.171/CF/84, dated 27<sup>th</sup> June, 1984 instructed all Ministries/Divisions that it will not be necessary to obtain fresh approval for ongoing schemes if the cost goes up only because of the fluctuation of exchange rate.

### DECISION

The Executive Committee of the National Economic Council considered the summary dated 7<sup>th</sup> November, 2018 submitted by the Ministry of Planning, Development & Reform regarding the Sindh Solar Energy Project (SSEP) and approved the project at an updated cost of Rs.12,848.11 million including FEC of Rs.7,952.90 million (1US\$ = Rs.124.08). In view of the recent sharp adjustments in exchange rate, ECNEC directed Planning Commission to incorporate the updated cost in the case of each Project.

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NO. SO(Dev)3-1022/2019/SEEP  
GOVERNMENT OF SINDH  
ENERGY DEPARTMENT

Karachi dated: 20<sup>th</sup> February, 2019

**Subject:** SINDH SOLAR ENERGY PROJECT (SSEP) (SDG#7) Total cost Rs. 12,848.11 MILLION INCLUDING RS.7,952.90 MILLION AS FEC (1 US \$= RS.124.08/-) Where share of Government of Sindh is 3.43% i.e. RS.440.11 million of local component and Word Bank Financing is 96.57% i.e. Rs.12408 million including FEC and Local Component (NEW) (ADP # 2229) 2018-19.

2. The Details of estimated cost of Rs.12, 848.11 million is as under:

Project	Local (Rs. Million) / %	FEC (Rs. Million) %	Total (Rs. Million) %
Government of Sindh Share (Revenue Component)	440.11 (8.99%)	NIL	440.11(3.43%)
World Bank Share	4,455.10 (91.1%)	7,952.90 (100%)	12,408.00 (96.57%)
<b>Total Cost</b>	4,895.21	7,952.90	12,848.11

6. The Executive Committee of the National Economic Council (ECNEC) in its meeting held on 14.11.2018 approved the scheme for a period of 5 years (FY: 2018-19 to FY: 2022-23) with the cost of Rs.12, 846.11 million. This Administrative Approval is issued with reference to the authorization issued by the Planning Commission, Ministry of Planning, and Development and Reform vide letter No. 14(713) P-III/PC/2018 dated 23<sup>rd</sup> November, 2018 and communicated by Planning and Development department Government of Sindh vide letter No.SO(DEV)-ENCEC-11/115-P&D/2018 dated 29<sup>th</sup> November, 2018.

Secretary to Government of Sindh  
Energy Department

Karachi dated 20-5, 2019

Finance Department

A copy is forwarded for information and necessary action to the Accountant General, Sindh, Karachi.  
No. SO (Dev) 3-102/2018/SSEP Karachi dated 11/01/2019

1. The Chairman, P&D Board, Govt. of Sindh, Karachi
2. The Secretary, Economic Affairs Division, Islamabad
3. The Secretary, Finance Department, Govt. of Sindh, Karachi
4. Chief (PIA), Ministry of Planning, and Development and Reform, Govt. of Pakistan, Islamabad
5. Chief (Energy), Ministry of Planning, and Development and Reform, Govt. of Pakistan, Islamabad
6. Director Alternative Energy/Project Director (SSEP), Energy Department, Govt. of Sindh, Karachi
7. Chief Energy, P&D Department, Govt. of Sindh, Karachi
8. The office order file

Section Officer (Dev)  
Energy Department



## Authorization Letter



No.SO(Dev)-ECNEC/2018 P&D/2018

GOVERNMENT OF SINDH  
PLANNING & DEVELOPMENT  
DEPARTMENT

Karachi, dated the 29<sup>th</sup> November, 2018

**Most Immediate**  
**By special Messenger**

The Secretary,  
Energy Department,  
Government of Sindh,  
Karachi

Subject: **AUTHORIZATION: SINDH SOLAR ENERGY PROJECT (SSEP) (SDG # 7)**  
**TOTAL COST OF RS. 12,848.11 MILLION INCLUDING RS.7, 952.90 MILLION**  
**AS FEC) (1 US \$ = Rs.124.08/-) (NEW) (ADP # 2229) 2018-19.**

I am directed to enclose herewith a copy of letter No. 14(713)/PIA-III/PC/2018, dated 23<sup>rd</sup> November, 2018 received from Ministry of Planning, Development & Reform, Planning Commission Government of Pakistan, Islamabad, on the subject noted above and to state that the above mentioned project was considered by the ECNEC on 14.11.2018 with the following decision:

*"The Executive Committee of the National Economic Council considered the summary dated 07<sup>th</sup> November, 2018, submitted by the Ministry of Planning, Development and Reform regarding Sindh Solar Energy Project (SSEP) and Approved the project at an updated cost of Rs. 12,848.11 million including FEC of Rs.7,952.90 million (US \$ = Rs. 124.08 million). In view of the recent sharp adjustments in exchange rate, ECNEC directed Planning Commission to incorporate the updated cost in the case of such project"*

2. It is requested that the Administrative Approval in accordance with the above mentioned decision of the ECNEC may kindly be issued at a cost of Rs.12,848.11 million. (Local: Rs. 4,895.21 million + FEC: Rs. 7, 952.90 million) for the period of 60 months which may be reflected in A.A for onward transmission to the Ministry of Planning Development & Reform accordingly.

3. This may kindly be assigned **Top Priority**  
Encl.: **As Above**

(SHAHNAZ SIDDIQUI)  
SR.CHIEF (DEVELOPMENT)

Copy forwarded along with enclosure for information and necessary action to:

- The Assistant Chief, (Industries) Section, P&D Dept. GOS Karachi
- The Chief, (F. Aid) Section, P&D Dept. GOS Karachi

SR.CHIEF (DEVELOPMENT)

C.C.O:-

- The Joint Secretary (Development) M/o Finance Division, Government of Pakistan, Islamabad.
- The Chief (Energy), Energy Wing M/o Planning, Development & Reform, Islamabad.
- The Assistant Chief, (PIA-III Section) Ministry of Planning, Development & Reform Division, Government of Pakistan w/r to her above quoted letter.
- PS to Chairman, P&D Board, Sindh
- PA to Member (E&I), P&D Board, Sindh
- PA to Member (Development), P&D Board, Sindh

SR.CHIEF (DEVELOPMENT)

## Project Description

**1. The Project aims to support the deployment of solar power in Sindh Province spanning three market segments: utility-scale, distributed generation, and at the household level.**

Public funding shall be used to leverage private sector investment and/or expertise in the three segments, with an emphasis on long-term sustainability, developing domestic solar PV experience, and the emergence of self-sustaining markets. Although focused on Sindh Province, the Project is explicitly designed to provide national benefits by demonstrating new approaches. The Project will introduce and showcase international best practice with renewable energy auctions, reduce the headline cost of solar deployment, create sustainable business models for potential replication in other provinces, build institutional capacity, and identify opportunities for future renewable energy deployment that address issues of grid integration. In the context of potential new investment in fossil fuel-fired generation capacity, and lack of conviction over the long-term role and integration of renewable energy, the Project is designed to help steer Province towards a lower carbon path to development.

**Component 1: Utility-Scale Solar (\$15 million)**

**2. Component 1 will finance a series of Solar Parks to leverage private sector development of solar PV through the use of competitive bidding, starting with an initial 400 MW projects in Manjhand and Karachi that would launch the first international solar auction in Pakistan.** The Solar Park concept helps to reduce the risk profile for private sector developers by ensuring that land is secured, permits obtained, and power off-take is pre-arranged. Solar Parks also include upfront development of shared infrastructure such as the grid connection, roads, security and water supply, which helps to reduce the capital cost for each project within the Solar Park. As a result, Solar Parks allow for a carefully planned and coordinated approach to solar deployment that helps eliminate some of the risks associated with unsolicited projects and helps reduce the risk profile and cost of project development, leading to highly competitive power prices under competitive bidding. Three sites for 320 MW have been already identified and assessed by SED, with land secured, and will be taken forward as a pilot solar auction in the first phase of the Project. Further Solar Parks (including Wind solar hybrid) of at least 400 MW would be subsequently developed to facilitate a total of 400 MW of solar power hybrid capacity, following a comprehensive geospatial planning and dispatch analysis.

**Component 2: Distributed Solar (\$50 million)**

**3. Component 2 will finance at least 50 MW of distributed solar PV on the rooftops and other available space on and around public sector buildings, semi Govt, Autonomous bodies, humanitarian and social sector buildings / facilities in Sindh as approved by PSC which may include hybrid with wind, hydro or floating models.** By utilizing spare rooftop and other available space on and around these buildings, the program is expected to create a win-win situation for the public sector, DISCOs, and electricity consumers by: (i) reducing recurrent expenditure on electricity by GoS, freeing up budget for other priorities; (ii) providing the DISCOs with cost-effective power during periods of high air conditioning load, while allowing the payments to be netted off against outstanding public sector debts; (iii) private sector

involvement through third party contract operating large distributed solar PV installations, thereby reducing costs; and (iv) improving the supply of affordable power to consumers, without the need for ancillary transmission investment. At least 50 MW of capacity would be installed under this component, in a phased manner. SED would identify portfolios of candidate sites and would liaise with other departments for installation of solar equipment. The portfolios would be awarded to private sector solar developers for installation under an EPC contract that includes performance-based provision for O&M or any other applicable model. The Project would initially target sites where no export of electricity is required but could be expanded to larger sites once an agreement with the DISCO(s) is secured. The sites will be handed over to respective Departments or to the SRECL or any other SPV of Energy Department for secure and safe operations of these public solar assets.


#### **Component 3: Solar Home Systems (\$33 million)**

**4. Component 3 will provide results-based grants to scale up the provision of SHS in areas with low access to electricity, reaching at least 200,000 households to achieve sustainable development goals and access to electricity for all.** Under this component SHS will be provided to households in prioritized areas. The SHS will be distributed through Bulk procurement and Last mile Distribution Model for supply and O&M contract of at least one year and Households will benefit from high quality systems. The LMDs will be selected, and an agreement will be signed to provide SHS along with warranties to ensure servicing and repairs / replacement. The component of the project would be complemented a strong third-party independent Monitoring and Evaluation mechanism under IVA Model.

#### **Component 4: Capacity Building and Technical Assistance (\$2 million)**

**5. Component 4 consists of a range of capacity building and technical assistance activities to support the design and implementation of the Project.** Through this component technical assistance and support will be provided to the PMU SSEP, Energy Department, Government of Sindh and other relevant entities in Government of Sindh for introducing state of the art Solar PV based technologies available in developed countries. The expenditures funded under Component 4 will include activities such as: (i) training for PMU, SED and other GoS entities; (ii) participation in World Bank capacity building events and liaison with relevant experts; (iii) consultation with key stakeholders and community groups (iii) Exposure to state-of-the-art solar PV technologies available in developed countries. iv) Hiring of consultants for RE and EE related activities. v) Establishment of independent regulatory laboratories for quality assurance of solar related supplies.

## *Feasibility of 50 MW Utility-Scale Solar Project [Component 1]*

	<p align="center"><b>Feasibility Study Report — Vol. I</b>  <b>Main Report — Part I</b>  <b>50 MW Solar PV Power Project at Taluka</b>  <b>Manjhand, Jamshoro</b></p>	<p>Document No. 170-0786-01  Rev No. / Date 170-0796-01  Issue No. / Date 4<sup>th</sup> July 2017  Effective Date 10<sup>th</sup> September 2017  Page No. 21 of 124  Originally Prepared by Welt Kconnect (Pvt.) Ltd.</p>
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### **EXECUTIVE SUMMARY OF THE PROJECT**

The objective of this study is to assess the feasibility of developing a 50 MWp ground-mounted solar PV facility (Project) at a suitable location within the designated solar park at Taluka Manjhand, Jamshoro, Sindh.


The analysis of prevailing and collected data reveal that the conditions on ground including but not limited to solar resource (irradiation), road access, security, proximity to grid with capacity for evacuation of power, geological surroundings and environment are suitable for development of such a MW scale solar PV power project. Whereas the numerous site visits, topographic survey and geo-technical investigations conducted further confirm the hypothesis.

The project is located at 25°46'18.65"N 68°15'10.96"E encompassing an area of approximately two hundred fifty (250) Acres within the designated Solar Park at Taluka Manjhand, Jamshoro Sindh. It is one of 50MW projects in the park cumulatively adding up to 1 GW. The Solar Park is the first of its kind initiated by the Sindh Government.

After having duly modelled and conducted simulations of all available modules and technologies, for fixed tilt, single axis and dual axis rotation mounting systems respectively, the thin film (CdTe) panel technology has been selected for the base case with fixed tilt mounting structures, in view of its optimum comparative performance. System simulations for yield analysis of the selected technologies for the base case show that the power project generates up to 108317 MWh/year of electricity over the project life cycle of twenty five (25) years. The P (90), P (75) and P (50) figures are 103426, 105755 and 108317 MWh/year respectively. To allow for uncertainty in the solar resource (irradiation), equipment performance and power generation modelling the P (50) yield output numbers have been used for the base case.

The financial calculations of the base case result in a tariff for the generated electricity supplied to the national grid for the first ten (10) years as 6.5121 PKR/kWh, (6.2020 USE) whereas 2.7670 PKR/kWh (2.6352 USE/kWh) for the remaining fifteen (15) years. The project financing structure is assumed to be on a seventy-five twenty-five debt equity ratio (75:25) with the total project cost being \$40,701,984. The financial analysis is based on an IRR of seventeen percent (17%) resulting in a payback period of 10 years.



	<p style="text-align: center;"><b>Feasibility Study Report — Vol. I</b>  <b>Main Report — Part I</b>  <b>50 MW Solar PV Power Project at Taluka</b>  <b>Manjhand, Jamshoro</b></p>	<p>Document No. 170-0786-01  Rev No. / Date 170-0796-01  Issue No. / Date 4<sup>th</sup> July 2017  Effective Date 10<sup>th</sup> September 2017  Page No. 21 of 124  Originally Prepared by Welt Connect (Pvt.) Ltd.</p>
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The most significant factors in preparation of the financial model are the debt financing conditions, resource potential, equipment performance, yield assessment and the corresponding tariff. To account for uncertainties in then' parameters though yield values at P (50) were taken for comparison of various technologies, post equipment/technology selection an uncertainty analysis was conducted computing.

P (50), P (75) and P (90) values, while P (75) yield value was selected given the long-term irradiation uncertainties and possible annual fluctuations.

Taking into the different mounting possibilities the fixed installation shall be implemented as it has the least capital and operational risks. The tracking devices require more maintenance due to their moving parts, whereas the additional yield does not offset the associated incremental costs. It is recommended to develop small areas of MW scale parks with tracking systems, so that experience with this technology can be gathered and used to decide if tracking systems should be considered in future PV park developments in Pakistan.

The project time plan is aggressive. The main risks for the time plan are delays for necessary approvals in the design phase and the delivery time for the equipment including the high voltage Substation. The construction of the solar field itself is not critical as the site is ideal for installation and can be ready with minimal land works.

The designated Solar Park will be very beneficial to the people of Sindh, Pakistan receiving more power from one of the most economical sources of power generation today. Detailed Feasibility Study report of 50 MW Solar Power Project is enclosed as CD.

## **Solar PV Capacity at SSEP Sites**

Sindh Solar Energy Project (SSEP), Energy Department, Government of Sindh is planning to implement Utility Scale Solar PV power generation projects in Sindh province. As part of the program, two sites, one is KARACHI DISTRICT WEST, SINDH, PAKISTAN – ‘KARACHI SITE 01’ and the other is KARACHI DISTRICT MALIR, SINDH, PAKISTAN – ‘KARACHI SITE 02’ are being assessed for their technical adequacy for the project.

Tractable Engineering GmbH (TEG) and Renewable Resources Pvt. Ltd (RE2) are preparing the feasibility study including all technical studies for these two sites.

The Solar Resource Assessment for the Project sites is in process. It involves among others solar data and other data from databases that are commonly being used in the current PV market for this type of study. Solar data provided by SolarGIS at the location of the project sites are used among others for calculation of the PV plant capacities on the available and suitable project area.

Based on the ongoing Solar Resource Assessment, which includes conceptual planning of each PV power plant, simulation of suitable installed capacities and expected electrical energy production the calculated installed plant capacities for Fixed tilt and Single Axis tracker plant design are as follows:

Sr. No	Site Name	Allocated Land (Acres)	Installed Capacity (MW)	
			Fixed Tilt Orientation	Single Axis Tracking
1	KARACHI DISTRICT WEST, SINDH, PAKISTAN – ‘KARACHI SITE 01’	612	200	120
2	KARACHI DISTRICT MALIR, SINDH, PAKISTAN – ‘KARACHI SITE 02’	600	200	150

### **Note:**

Tentative capacities can change at later project stage approximately +/- 5% of total project size based on detailed studies and preparation of the final plant design by the project developer and the awarded EPC contractor.

## *Feasibility of Distributed Solar in Sindh* *[Component 2]*

### **Feasibility Study of Distributed Solar for Public Buildings in Sindh**

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#### **A. PROJECT TITLE**

Sindh Solar Energy Project: Component 2 Distributed Solar for Public Buildings in Sindh.

#### **B. INTRODUCTION**

Solar development in Pakistan to date has been primarily limited to larger, ground based IPP projects, in countries with more developed solar markets, such as Germany, Japan, and the United States, a significant portion of solar capacity is produced by rooftop and distributed solar photovoltaic applications with 1 kW to 10 MW capacities. Given the fast pace of urbanization and corresponding residential, commercial, and industrial markets, there is a significant potential for distributed solar deployment in Pakistan.

Under Component 2 of the Sindh Solar Energy Project (SSEP, or the Project) and with World Bank technical and financial support, a distributed solar program of at least 20 MW in Sindh Province was initiated focusing on public sector buildings, with a target of 20 MW installed capacity over five years. The target is deliberately set low in comparison to the likely available potential to allow for lesson learning but may be scaled up in future years if the program is successful and pending additional financing.

An initial feasibility study, carried out as part of the Project approval process, is intended to provide high-level responses to a number of critical issues.

#### **C. Distributed Solar In Pakistan**

For the promotion of distributed solar in Pakistan, regulation was introduced in September 2015 by NEPRA to incentivize distributed solar. The policy mandates all distribution companies to connect distributed generation to the grid and lays out certain provisions for the installation and execution of distributed systems.

Japan was estimated to have 36 GW of installed residential and commercial PV capacity by the end of 2017, the most of any country worldwide. Germany was next with 30 GW, then came the U.S. on 18 GW, followed by China and Italy with 17 GW and 15 GW, respectively. Australia trailed the major nations with 6 GW. The rapid build-out in these countries, together with more moderate growth in France, Belgium and India, has been driven chiefly by government policy, mainly in the form of financial subsidies.

Investment in small-scale solar projects of less than 1MW capacity increased by \$6.3 billion in 2017. An estimated \$49.4 billion was spent building about 28 GW of such power plants. This dollar value was up 15% on the \$43.1 billion invested the year before. Nevertheless, this was a considerably smaller amount than in years prior to that --- between 2010 and 2015, the average invested in small-scale renewables were \$63 billion a year, with a peak of \$75.2 billion in 2011 (as illustrated in Figure 2).

Any comparison of investment over time needs to take account of falling PV costs --- \$1 invested in 2017 bought considerably more solar PV generating capacity than it did at the start of the decade. In 2010, the average cost per Watt of a residential PV system in Germany

was \$3.90, but by the end of 2017 it had fallen 57% to \$1.68. In Australia, the decline was even more pronounced. A 4kW PV system cost an average of \$6.40 per Watt in 2010, yet by the end of 2017 it had plummeted 78% to just \$1.40 per Watt, & in 2022, it is around \$ 1.1 per watt.

The electricity utility costs are increasing gradually due to increase in fuel price costs.

#### **D. Lessons from International Experience**

Distributed solar can play an important role in achieving significant level of solar generation. In countries with developed solar markets, distributed generation has made a significant contribution to the total installed capacities. Examples include Germany, USA, Japan and the emerging economies of China and India. As the distributed generation sector in Pakistan is still developing, a number of valuable lessons can be learned from established solar markets. In the following section, some of the more critical lessons from these countries have been identified.

China has the world's largest PV market, with almost 46% of the global solar PV capacity. As of 2016, it had an installed PV capacity of 77.4 GW. The rapid growth in China's solar sector has been the result of the government's declaration that any projects operational by June 30, 2016 would be eligible for a Fit rate of roughly 15 US cents/kWh. Projects completed after this date would receive a lower Fit rate. This led to a significantly high-capacity addition in 2015. According to the National Energy Administration, the country aims to add over 110 GW in solar PV in the period of 2016-2020. The Fit incentives that led to the boom in the Chinese solar market were especially tailored to include distributed generation. Further enablers to the growth of the solar market included low-cost materials and human resources, an increased electricity tariff and soft loans provided by state-owned Chinese banks.

Japan had an early lead in the solar PV technology market. In 1994, subsidies for solar systems were available for 50% of the system cost. These incentives were gradually reduced to 33% in 1999. As a result, over 250,000 residential PV systems were set up and increased the cumulative solar PV capacity from 43.3 MW (1994) to 1,422 MW (1999)<sup>13</sup>. The country has set a target of 64 GW of solar PV by 2030. In 2012, Japan introduced a Fit scheme. This led to an increase in solar PV installation and added significant PV capacity across all consumer segments. As a result, installed PV capacity in Japan increased from 3.81 GW in 2012 to 8.55 GW in 2013.

Up until mid-2014, a total of 10.5 GW of new PV capacity was installed. Cumulative rooftop capacity stood at 16.3 GW out of 23.3 GW total solar PV installed in 2014.

#### **KEY LESSONS LEARNED**

Following are key lessons and features from these five countries which can help inform the policy and strategy for accelerating the installation of distributed solar in Pakistan:

- Promote Net Metering schemes, as practiced in the other regions of the world.
- Consider additional incentives when justified, such as China, which offered an additional financial incentive (roughly 6 US cents/kWh) over the retail electricity tariff to encourage self-consumption.



- Improve access to financing. In developed markets, such as the United States, Japan and Germany, access to financing from commercial banks was important. In developing markets, access to low-cost financing, such as from state banks in China or through International Financial Institutions for India, for the distributed solar sector were needed.
- Streamline licensing and permitting. Pre-defined and streamlined procedures, as was done in Germany and the United States is important. California introduced the Expedited Solar Permitting Act (solar bill AB 2188) in 2014 to streamline and encourage adoption of distributed solar, giving a deadline of one year. While the last few years have seen an exponential increase in solar installations in Pakistan.

### NET-METERING POLICY

NEPRA announced the official National Electric Power Regulatory Authority (Alternative & Renewable Energy) Distributed Generation and Net Metering Regulations on September 1, 2015. As per these regulations, any customer of the national grid (having three-phase connection) can avail net-metering, facility for small-scale (1kW to 1 MW) renewable energy installations. In Pakistan, net-metering is the first policy mechanism of the Policy for Development of Renewable Energy for Power Generation 2006, which has been fully implemented. Section 8.4.2 of the RE Policy provides that subject to technical considerations and without discrimination and upon request by distribution end-users. DISCOs shall enter into a net-metering agreement with qualified end-users, interested in installing the RE system.

#### **E. Lessons learnt from Project Execution:**

A List of 22 Hospitals energized for more than 6 months has been analyzed and it has been revealed that the average Pay back period is around 3 years and the project life is 25 years. Moreover, the Pakistan energy mix of 65% is on thermal and utility cost of per unit cost of energy has been doubled during the last four year. At the time of project approval in 2018, the IRR of the project was envisaged as 28.8%, whereas, today the project IRR based on the unit generation and cost savings, it is more than 50%. The gradual increase in energy costs from power utility is further increasing the returns on these investments. Therefore, the project scope may also need to be increased. A detailed facility wise analysis is attached as Annexure - C 2 (A)

The list of the power generation of Solarized buildings is attached as under:

### **Site Capacity and Commissioning Status**

S. No.	Site Name	Total PV Capacity (KWp)	Date of Commissioning
1	Civil Hospital	1,651.70	10-Jun-2022
2	SGH Saudabad Malir	200.25	26-Apr-2022
3	SIMS	630.00	26-Apr-2022
4	DHQ Mirpur Mathelo	550.00	-
5	25 Bedded Hospital	64.46	26-Apr-2022
6	DHQ Qambar Shahdadt	401.40	01-Oct-2022
7	DHQ Umerkot	676.40	01-Oct-2022
8	New DHQ Mirpurkhas	654.00	-
9	DHQ Tando Allahyar	534.19	26-Apr-2022
10	LUMHS, Hyderabad	767.63	29-Dec-2021
11	Kohsar Hospital, Hyderabad	275.10	30-Mar-2022
12	KMC Civil Hospital, Khairpur	1,176.53	30-Mar-2022
13	PSAQSJ Medical Institute, Khairpur	1,279.82	30-Mar-2022
14	GMMC Hospital, Sukkur	816.04	30-Mar-2022
15	DHQ Hospital, Matiari	93.38	29-Dec-2021
16	SGH - Liaquatabad, Karachi	245.16	29-Dec-2021
17	SGH - Korangi 5, Karachi	239.76	29-Dec-2021
18	Bibi Asifa Dental College, Larkana	300.24	-
19	Civil Hospital Dadu	344.43	19-Oct-2022
20	Civil Hospital NFZ	448.56	24-Jul-2023
21	PMCH, Nawab Shah	894.36	25-Sep-2022
22	DUHS Ojha Campus	2,323.58	-
23	Lyari General Hospital	685.50	06-Sep-2022
24	Hepatitis Centre Dadu	56.07	08-Sep-2022
25	Jacobabad	1,496.00	-
26	Abdullah Shah Institute	200.25	31-May-22
27	DHQ Hospital Kotri	250.65	30-Mar-22
28	Hospital Dumba Goth	51.60	30-Mar-22
29	RBUT Hospital, Shikarpur	549.98	05-Aug-22
30	Gadap City Hospital	400.18	10-Jun-22
31	JPMC Karachi	1,441.97	19-Jul-2023
32	DHQ Tando Mohammad Khan	517.59	19-Jul-2023
33	Sujawal Taluka Hospital	501.84	17-Oct-2022
34	Civil Hospital, Indus Badin	996.30	24-Jul-2023
<b>TOTAL</b>		<b>21,714.92</b>	

## *Feasibility of Solar Home Systems in Sindh*

### *[Component 3]*

#### **Feasibility Study of Solar Home Systems for Households with No / Low Access to Electricity**

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#### **A. PROJECT TITLE:**

Sindh Solar Energy Project: Component 3 – Solar Home Systems for Households with No/Low Access to Electricity

#### **B. INTRODUCTION:**

At present energy crisis in Pakistan is of serious concern as it is affecting the economic growth of the country. The power sector in Pakistan is largely dependent on imported fuel based thermal power generation. Though, the installed capacity in Pakistan is nearly equal to the current demand, however, capacity of most of the installed power plants has de-rated and some are not running to their full capacity due to fuel constraints.

Besides this, 1/3<sup>rd</sup> of the population in Pakistan is not connected to the grid supplied electricity<sup>1</sup>. As per the statistics available with the federal and provincial government departments, there are more than 40,000 villages all over Pakistan which are yet to be connected to the national grid; out of which 8,000 villages are situated way beyond locations where it is technically and financially unviable to extend the national grid<sup>2</sup>. The communities residing in these remote areas are still relying upon kerosene, conventional lanterns, candles and cell batteries as the lighting source.

Similarly, the piped natural gas is available to 25% of the population of Pakistan<sup>3</sup>. Remaining 79% (mostly in villages) are dependent on alternate options like burning of biomass, fuelwood, cow dung, kerosene oil etc. for meeting their heating requirements.

This is one of the reasons that these communities have remained underdeveloped. Burning of these conventional fuels is also causing huge health hazards to the population of these areas, especially to the women and the children. It is reported that in Pakistan, more than 110,000 deaths occur annually due to indoor air pollution<sup>4</sup>.

**Project Rationale:** According to census 2017 figures released by Pakistan Bureau of Statistics division, the total number of households in Sindh was 8,585,610. NEPRA in 2017, reported a total number of domestic connections of 3,400,260 in Sindh. This translates into an electricity access rate of 39.6% for Sindh, with roughly 5,185,350 households without electricity connections. It has been challenging to locate these households, as they are scattered in various pockets across Sindh. Currently, national level estimates and survey-based studies do not provide the precise level of geographic detail to enable the government to efficiently target their increase in energy access efforts. Acknowledging this problem, Government of Sindh has initiated village electrification program in Sindh Province through clean solar energy solutions. World Bank has very kindly agreed to support Government of Sindh in this regard.

In a bid to alleviate poverty and improve standard of living of masses residing in remote areas of Pakistan, which are still deprived of basic energy needs, this feasibility study is prepared that

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<sup>1</sup> NTDC

<sup>2</sup> WAPDA, DISCOs and Provincial Energy Departments

<sup>3</sup> OGRA

<sup>4</sup> WHO

compares various options for electrifying remote off grid or low energy access households of the Sindh province and provides a workable solution for including in as a Component 3 of the overall Sindh Solar Energy Project (SSEP, or the ‘Project’) being undertaken by Government of Sindh supported by World Bank financing. This Component aims to provide electricity access to 200,000 households (representing 1.2 million people on average) through provision of solar home systems (SHSs) by bulk procurement and distribution by third party private sector ‘Last Mile Distributors’ (LMDs).

### C. OPTIONS TO PROVIDE ENERGY SUPPLIES TO REMOTE VILLAGES:

There are basically three options or scenarios for the provision of energy supplies through off-grid applications: utility network grid-connection via grid extension, off-grid solar stand-alone systems and distributed-grid systems (often known as mini-grid systems).

**Table 2.** Electricity interventions and their potential effect on access

	Project type	Grid connections	Legality	Peak capacity (W)	Duration (hours)	Evening supply	Quality (voltage)	Reliability (outages)	Affordability
Typical energy access projects	Grid electrification	↑	↑	↑	↑				↑
	Mini-grid electrification	↑		↑	↑	↑	↑	↑	↑
	Off-grid and solar lanterns			↑	↑	↑		↑	↑
Other energy projects	Generation and X-border T/M	↑			↑	↑	↑	↑	↑
	Transmission and distribution	↑	↑				↑	↑	↑
	Rural feeder segregation		↑		↑	↑	↑	↑	↑
	Energy efficiency			↑	↑	↑			↑
	Regulations and market reform	↑	↑	↑	↑	↑	↑	↑	↑

↑ Positive impact of intervention on energy attributes

Source: ESMAP 2014.

Pakistan is blessed with a huge renewable energy (solar, wind, small hydro, biomass/waste to energy etc.) potential. The potential is feasible for various applications. Solar energy is widely and abundantly available in the country with a huge solar potential of more than 5-6 kWh/m<sup>2</sup>/day of irradiation in many areas. The potential is feasible for both Solar PV and Solar Thermal application. Even the areas with the lowest solar potential of Pakistan have the best solar resource compared to most of Europe thereby ensuring better energy yield.

Various renewable energy applications can be deployed in remote villages. However, under this project solar home solutions are considered to provide electricity to remote villages of the Sindh Province.

#### C.1 Electricity: Basic Amenity of Life

Energy is one of the most significant pillars of any economy. To keep up with modern times, basic energy services are critical for the growth of any economy. The rural electrification in Pakistan is progressing at a slow rate, because remote areas infrastructure is weak, and these are low-income areas that are economically challenged. Pakistan has substantial experience of developing off-grid rural electrification project systems in rural communities. By virtue of its geographical location, Pakistan is highly vulnerable to the threat of climate change because of



global warming. Climate change is an established fact and its impacts on water, agriculture, health, biodiversity, forest and socio-economic sectors are quite visible round the globe.

### **Climate Catastrophe 2022 Floods:**

Following the unprecedented floods, **the assessment estimates worked out by the Government of Pakistan in coordination with World bank, ADB and other development partners, it was revealed that total damages exceeded USD 14.9 billion, and total economic losses to reach about USD 15.2 billion and country , mostly the Sindh province and parts of Baluchistan needs rehabilitation and reconstruction in a resilient way are at least USD 16.3 billion** beyond the affected assets, to support Pakistan's adaptation to climate change and overall resilience of the country to future climate shocks.

*Housing; Agriculture and Livestock; and Transport and Communications* sectors suffered the most significant damage and **Sindh is the worst affected province with close to 70 percent of total damages and losses**, followed by Baluchistan, Khyber Pakhtunkhwa, and Punjab.

The Ministry of Planning, Development and Special Initiatives led the **Post-Disaster Needs Assessment (PDNA)**, which was conducted jointly with the Asian Development Bank (ADB), the European Union (EU), United Nations agencies with technical facilitation by the United Nations Development Program (UNDP), and the World Bank. The PDNA, in addition to estimating damages, economic losses and recovery and reconstruction needs, also assesses broader macro-economic and human impacts and recommends principles along which to develop a comprehensive recovery and reconstruction framework.

**The floods affected 33 million people and more than 1730 lost their lives. And more than 8 million displaced people now facing crisis.** The crisis thus risks having profound and lasting impacts on lives and livelihoods. Loss of household incomes, assets, rising food prices, and disease outbreaks are impacting the most vulnerable groups. Women have suffered notable losses of their livelihoods, particularly those associated with agriculture and livestock.

The PDNA Human Impact Assessment highlights that the national poverty rate may increase by 3.7 to 4.0 percentage points, **potentially pushing between 8.4 and 9.1 million more people below the poverty line.** Multidimensional poverty can potentially increase by 5.9 percentage points, implying that an additional 1.9 million households are at risk of being pushed into non-monetary poverty.

The designated subsidy of 40% is not sufficient as the paying capacity of the poor people severely damaged.

Accordingly, instead of 16 districts, the entire province including the urban areas may also be included and subsidy amount may need to be raised up to 100%. But due to illiteracy rate in rural areas, the provision of full free SHS system will not be a sustainable solution, as the poor people will not care a free facility. Therefore, maximum subsidy with a provision of small amount payment will be beneficial to avoid any misuse of distribution and maintenance of SHS. The provision of SHS system will ensure macroeconomic stability and fiscal sustainability.

The significant support of SHS will complement the Government's own commitment to increase domestic revenue mobilization and save scarce public resources, and to reduce the risk of exacerbating macroeconomic imbalances.

**This tragic disaster can be a turning point, where climate resilience and adaptation, increased domestic revenue mobilization and better public spending, and public policies**

**and investments better targeted to the most vulnerable populations; all figure at the core of policy making going forward.**

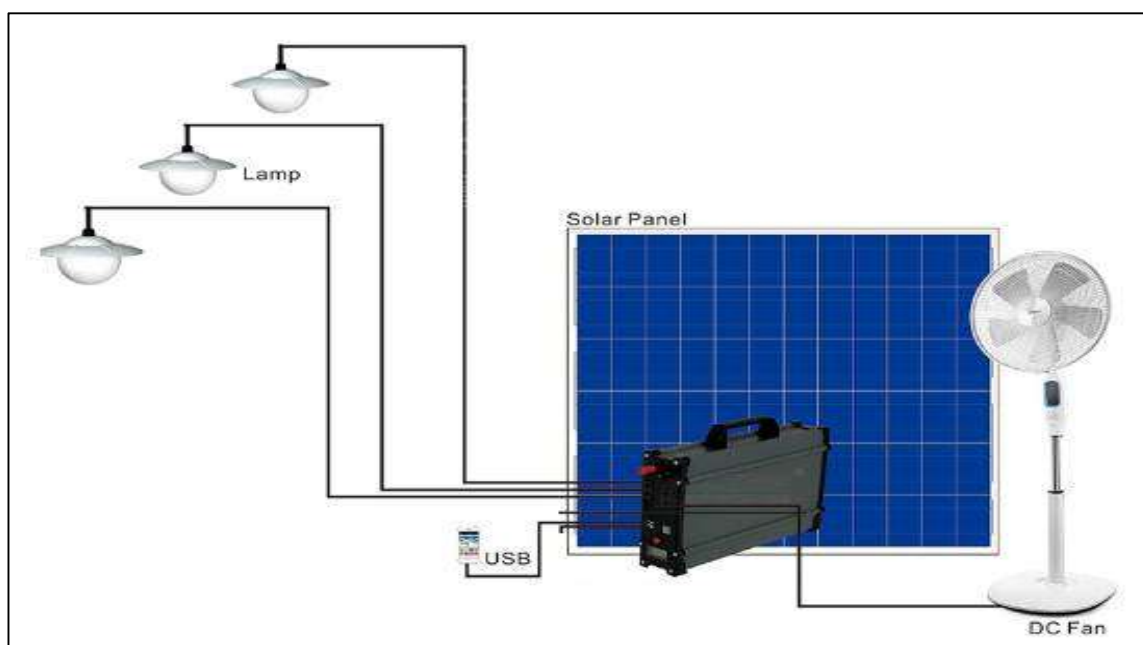
In the short term, targeted mechanisms such as social assistance including provision of SHS without regular electricity bills and programs to restore shelter and restart local economic activities, particularly in agriculture will be strengthened.

## **C.2 Solar Energy: An Opportunity for Electricity generation**

Solar energy is an environmentally friendly source of energy, and it does not cause any negative environmental impact. The use of low-cost technologies keeps costs of electrification under control. Sustained support and long-term funding will guarantee more effective policies. The establishment of a strong market infrastructure to attract private investors ensures the wider use of stand-alone systems in remote areas.

Full involvement of the rural communities in the electrification efforts throughout the decision-making process increases their sense of ownership and brings support to utilities' efforts to encourage customers to use electricity wisely once they are connected. Good management and maintenance of the systems require adequate training, assistance services and customer supply chains for their long-term use. In addition to this, the quality of off-grid solar home systems being used is critical for the success of an off-grid rural electrification program.

The most widely used renewable energy technologies for rural electrification is described below. The global off-grid solar (OGS) sector is providing improved electricity access to an estimated 73 million households, or over 360 million people, thus transforming lives that were previously reliant on kerosene and solid fuels for most of their lighting needs<sup>5</sup>. Particularly attractive for countries with ample sunlight and whose rural electricity grid is poorly developed, PV systems can provide electricity to relatively dispersed populations but also to groups of houses or entire villages. The most common systems used in rural areas in developing countries are solar home systems (SHS), which have the potential to power light bulbs and small appliances such as televisions, radios or fans. Generally, the capacity of the units used in rural household's ranges from 50 to 300 peak watts. However, because of the systems' limited capacity, mechanisms are often needed to prevent excessive consumption by users.



<sup>5</sup> Off-grid Solar Market Trends Report, GOGLA & IFC, 2018

### C.3 Social and Economic Benefits of Rural Electrification

Besides the social benefits, decision makers tend to give more importance to the economic impact of access to electricity as an income-generating process. Electricity use is expected to lead to more productive processes; the growth of businesses or farms using electricity will then increase demand for electricity, leading to a virtuous growth cycle profitable to both electricity providers and rural communities. Such economic growth is obviously an important achievement of any rural electrification programme. Some experts (Barnes, 2007), however, warn that the necessary conditions for such economic growth lie in parallel to or complementary development programs are required for the newly electrified communities. While electricity is indeed an important input to rural businesses, farms or other small rural structures, adequate local conditions such as organized rural markets and sufficient credit are necessary for such businesses to grow. Lack of such complementary development programmes in these regions may hinder their economic growth.

Electric Power helps improve quality of Life, offer opportunities for income generation, and helps reduce the exodus to major cities. At the household level, electricity is mainly used for powering light bulbs, fans, television sets, computers, and phones (when available). For over 30 years the World Bank and other organizations have studied the social benefits of electricity access and have noted that these benefits usually derive from the longer days that powered light bulbs offer to the household. In addition, access to information, communication and health care is facilitated by the powering of computers and phones.

When electricity is used for powering home appliances, household chores tend to become less tedious; when it is used for lighting, the relative brightness of the light bulb as opposed to candlelight allows children to read or study in the later hours of the day, bringing obvious educational benefits. <sup>6</sup>Women and children benefit directly from these improvements, but table or ceiling fans and television sets offer comfort during evening leisure time, increasing the general welfare of all members of the household. Social fairness can be one of the initial driving motivators in the first stages of electrification. Indeed, economic development will follow sooner or later once the households have basic energy access services. Minimizing trial and error through benchmarking and exchanges with other countries accelerate the electrification process. Co-operation in the framework of IEA Implementing Agreements for exchanges on technologies and support in policy formulation will spur the electrification process and facilitate long-term collaboration with other countries on other policy and technology issues of interest. In addition, having access to electricity inspires people to continue to improve their homes and their communities.



<sup>6</sup> It has been proven by a case study in India by Sunny Money, that bright solar lighting successfully **increased daily study time** and **positively impacted test scores**. The background of the students was that they relied on kerosene lamps for studying at night, they experienced power cuts at night, and the district was extremely impoverished and only **67%** of the students passed the Secondary School Leaving Certificate (SSLC) exams. Two months before the SSLC exams, 84 students were lent high-quality off-grid solar lanterns. The results were as follows:

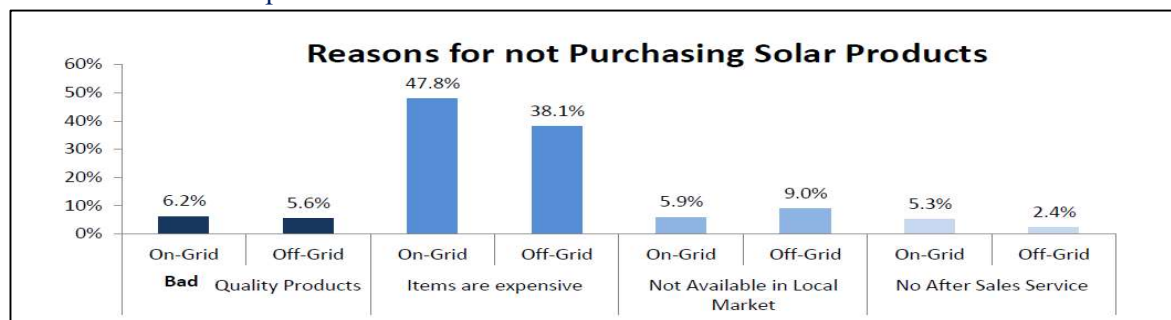
## D. Developmental Implications of Off-Grid Technologies

Real costs are of course the fundamental criterion for identifying technologies. But it also necessary to consider other sustainable development implications of the near and long-term technological options. In particular, their efficiency, accessibility, employment generation potential, their relationship to urban areas and environmental sustainability has to be considered.

### D.1 Key Parameters for Implementing Off-Grid Energy Strategies

- The implementation mechanism should be carefully designed for immediate-term, medium-term and long-term time horizons and should have focus on technology development and dissemination to end users. The immediate requirement at present is improvement of energy services to the end consumers.
- People's participation (in particular for the supply of resources and payment for services) as households and/or as a community in the overall program is imperative. The implementation mechanism should include key role of the end consumers as users, operators, and entrepreneurs in off-grid energy systems.
- Capacity building of the consumers to establish and operate off-grid energy systems is essential for sustainable operations. Training and capacity building of locals in the matter of hardware (technology) and “software” (particularly management) should be part of the implementation mechanism.
- Government should participate in overall implementation to provide an enabling environment. This can be in shape of overall management, training/capacity building, consumers’ soft financing schemes, standardization and creating equal participation opportunities, and grants where needed.
- Institutionalizing the implementation of off-grid energy solutions at the consumer level is important to have transparent, accountable, and regular functioning.
- Community-based supply of energy sources should be a priority when the cost of sources for number of households (i.e., cost of generation) plus the cost of the distribution network is less (i.e., more cost-effective) than the cost of number of household-level sources.
- Unlike conventional energy sources/end-use technologies, most new rural energy technologies are in the process of maturing. Their costs are declining because of technological advances and organizational learning. Hence, it is important to promote **technological advances** and **organizational learning**.
- The grants allowed by the Government as a policy instrument, should be time-bound and must be justified on the basis that they are promoting technological advances and organizational learning.
- The technology options for off-grid energy supplies should be selected on the basis of available resource, technology, ease of use, adaptability and acceptability of the end users.
- For each off-grid energy system, it is vital to have an entire hardware plus “software” implementation package. Such packages must consist of the technology, economics, financing, management, training, institutions, etc. necessary for the dissemination of that system.

### D.2 Barriers to Implementation





### D3. Institutional Issues

#### Institutional Challenges

The key parameters stated above for implementation of off-grid energy strategies require public sector institutional support, financial support mechanism, creation of energy enterprise(s), encouraging financial institutions/banks/donors to participate and establishing conducive market mechanisms through active participation by the technology/solution providers/suppliers. A few institutional challenges that are imperative to address for deployment of off-grid energy solutions are as follows:

- Loans for purchase of energy efficient and off-grid devices (stoves, lamps, drives, boilers/furnaces/kilns, etc.)
- Marketing and public awareness raising of devices
- Leasing/Financing/Grants for devices so that unacceptably high first costs become acceptable
- Establishment and development of micro-entrepreneurs working in SHS space (particularly those run by women)

Institutional issues are important for rural energy development in general and for the promotion of SHS. It is important that micro-finance institutions and/or private-sector off-grid energy service companies at the community or regional-level are involved in providing off-grid devices to consumers, to address the affordability, quality and after-sales issues highlighted above. Quality is a major concern for consumers as well as financiers, and it is important that these issues are addressed.

Practical measures may include market assessments (ensuring that the potential market is more clearly understood), quality checks (quality standards should be set), grants (hence reducing the initial investment required), risk guarantees (this may only be partial to reduce long-term financial risk), and partnerships between government entities and suppliers, and micro-finance institutions and suppliers should be established for effective work on the ground.

#### Grants Scheme for SHS

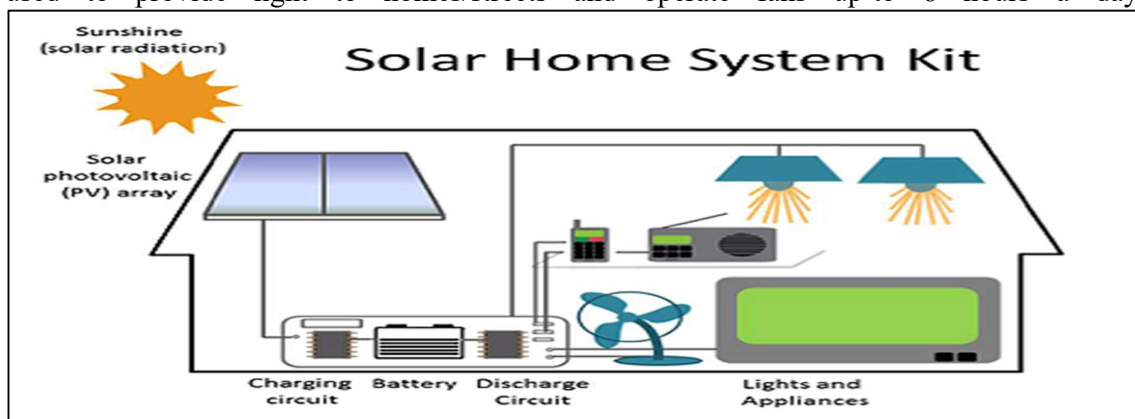
Under the Sindh Solar Energy Project (Component 3), Government of Sindh will provide an enabling environment. The program will be taking a private sector approach to the development of the off-grid SHS market in Sindh, in line with the guidance provided by AEDB or many development partners. Stringent technical criteria for product/system quality will be applied, including adherence to the relevant international standards, and testing procedures. Spot inspections and product testing may be used to ensure compliance. The provision of advance payment of a certain amount may also be considered by the PMU with strict vigilance and any kind of appropriate guarantee.

#### **E. Goal and Objectives of Electrifying Households in Sindh**

The goal for promotion and development of off-grid renewable energy options through SSEP is linked with sustainable development and contribution towards addressing energy crises. The mechanisms that would evolve from this goal should target economic growth that is economically efficient, need-oriented, and equitable, self-reliant, and empowering, and environmentally sound. Besides addressing energy shortages, the off-grid energy supply options should be reliable, safe, high quality and affordable. Renewable energy supply options, given their level of development, modular in nature, cost effective, reliable, and clean in nature are the best suited options for this purpose. The basic objective of the SSEP is to provide each of the target villages with sustainable electricity options.

## F. Solar Home System: A Solution for Rural Electrification

The SHSs provide generation at the point of consumption (e.g., a single building in an off-grid location). This solution often consists of battery based renewable energy systems. Hence, unlike full on-grid based systems a standalone system consists of several components all working together to create, store, and deliver energy for the electric demand. While standalone systems are ideal in cases of a single consumer, they can offer the most economical solution for rural electrification. For example, Pico solar home lighting kits may consist of a 20 to 150 Watt-peak (Wp) solar panel, battery bank, a charge controller and a set of LED lights, along with a fan; each LED light is designed to provide 3-5 hours of lighting a day. The system design caters for placement of solar panels in the form of an array on the rooftop or in open un-shaded areas in each house. The panels will charge batteries during daylight hours and the stored energy will be used to provide light to homes/streets and operate fans up-to 8 hours a day.



Under the SHS program, the following system configurations will be a part of the scheme:

The SHS kit (the “Product”) shall meet the following **technical requirements**:

1. The Product shall include all components required to provide the required energy services and be sold/installed as a kit:
  - i. PV module(s)
  - ii. Charge control unit(s)
  - iii. Battery/batteries
  - iv. Cables, switches, connectors, and protective devices sufficient to connect the PV module(s), charge control unit(s) and battery/batteries
  - v. Loads / Appliances[1]
    - a) Lighting
    - b) Fan
    - c) Mobile phone charging
  - vi. Requisite cables and adaptors for connecting all included loads and appliances
2. The Product and all included appliances shall be direct current (DC) only.
3. The Product shall be plug-and-play. No technicians or electricians are necessary to safely and successfully install and operate the system. All electrical connections can be made without the use of tools. Installation and operation instructions should be presented using language and graphics that can be understood by the typical consumer.
4. The Product shall meet or exceed the daily performance requirements described below.
5. Eligible products should be tested according to IEC TS 62257-9-5 at a laboratory that is ISO 17025 accredited for IEC TS 62257-9-5. Vendors shall provide an official test report showing that the product meets or exceeds the quality requirements outlined in the attached document."

The minimum **output requirement** for the ‘starter’ or ‘basic’ SHS will be 3 lights, one fan and one mobile charging option. Minimum **performance requirements** for stand-alone rechargeable solar home system kit:

	Specification	Remarks
Lighting	System capable of providing at least 1200 lumen-hours per day of lighting service (when used in combination with other required loads)	Daily energy services calculated based on daily solar insolation of 5 kWh/m <sup>2</sup>
Oscillating DC fan	System capable of powering the fan for at least 8 hours per day (when used in combination with other required loads)	
Mobile Phone Charging	System capable of charging at least one smartphone (5.7 Wh) per day (when used in combination with other required loads)	

### F.1 Photovoltaic Array

A PV array is a combination of several PV cells joined together to produce an electric current. The working principle behind this is, when sunlight falls on the PV cells, we see that electrons break free from the atoms and move in a certain direction, the movement of these electrons produces electric current. For a PV array its performance is rated according to the current it produces in Standard Testing Conditions.

### F.2 Charge Controller

The basic purpose of a charge controller is to prevent the batteries from overcharging by keeping a check on the voltage or the current. It regulates the voltage and the current coming from the PV array going into the batteries, preventing the batteries from overcharging and damage.

### F.3 Batteries

These provide the storage option for the power generated by the array; the stored power can be used during the times when there is no sunlight falling on the array. There a different number of batteries, and battery size is chosen depending on system size and requirement.

## G. Location of the Project

Under the scope of SSEP, the program is going to be undertaken in whole of Sindh. For identifying potential areas, a detailed study was carried out by the International Finance Corporation (IFC) that has helped inform this feasibility study. In this study geospatial methods and high-resolution nighttime satellite imagery are used to identify electrified communities across Sindh Province in Pakistan. Building upon an approach that has been demonstrated to reliably detect electrified and electrified communities during previous research, the study uses geospatial techniques to analyze a lengthy time-series of nighttime satellite imagery to detect the presence, absence, and variability of outdoor lighting in rural communities across Sindh Province. This study is the basis for delivering off-grid solar solutions to the identified low energy access areas with solar home solutions to combat the energy access problem across Pakistan. After the devastated floods, the paying capacity in the entire rural areas has been changed, therefore, the entire province is eligible to obtain the SHS, if they fall in the eligibility criteria of the BISP poverty score card envisaged by PMU.

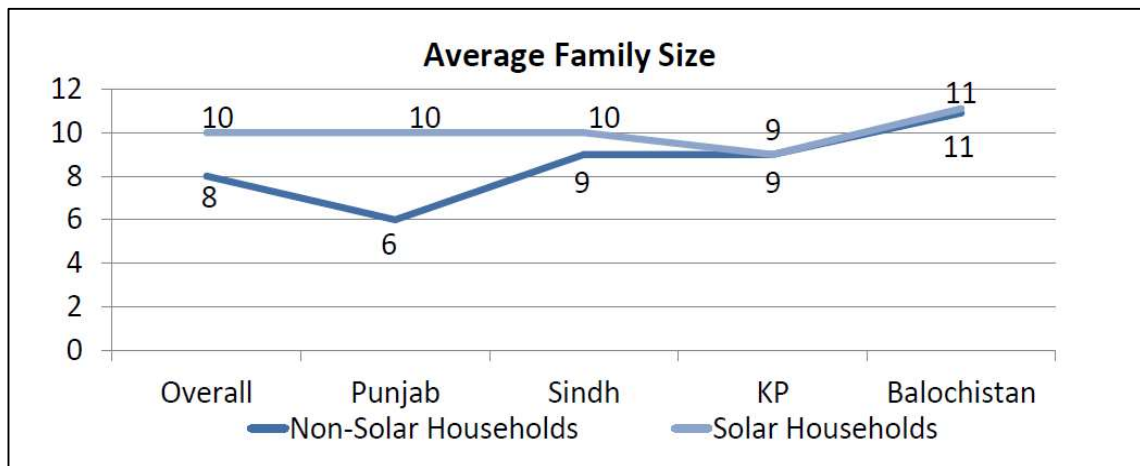
The UNDP Poverty Map for Pakistan is depicted as follows<sup>7</sup>:

## H. Off-Grid RE Applications Promotion Mechanism

In order to promote Off-grid RE applications, a joint holistic effort is required. This mechanism needs to evolve through addressing barriers and implementing key parameters stated above. Under the proposed mechanisms, following off-grid RE applications shall be promoted:



According to a survey report it was observed that in rural Sindh the average room size is 3 and approximately 9 people per household.<sup>8</sup> SHS sizes between 80-100 Watt can suffice their electricity requirements. Each SHS consists of one solar PV panel, one battery, one charge controller, rechargeable fan and two to three LRD bulbs along with complete wiring. The accessories like PV solar panel mounting structure, switches and fuses, cable and wire will be the part of the system. As per requirement of community mobile phone charger is included as part of the system.



## H1. Sustainability of the Private Sector Approach

As discussed previously, research shows that the number one barrier in adoption of SHS in Pakistan is affordability, followed by weak supply chain, quality of products and lack of after sales service. The SHS program in Sindh aims to tackle all the above barriers. It is addressing the affordability barrier by providing a grant amount. The PMU will ensure that the products being sold under this scheme follow a set quality standard (which will reduce O&M requirements. Moreover, this program will also invest in public awareness programs that will aim to change the consumer perception about the technology of SHS and provide awareness about this scheme and how it can benefit them.



According to a survey conducted<sup>9</sup>, an average off-grid household in Sindh spends PKR 1,135 per month on lighting and mobile phone charging needs. This does not include the expenditure on fans, other appliances etc.

	Average Monthly Expenditure on Lighting	Average Monthly Expenditure on Phone Charging	Total
<b>Overall</b>	889	400	1,289
<b>Punjab</b>	1,005	240	1,245
<b>Sindh</b>	485	650	1,135
<b>KPK</b>	639	150	789
<b>Balochistan</b>	1,594	600	2,194

If a PKR 55,000 or above system is installed that can power 3 lights, a fan, and a mobile charging option, we are looking at a pay-back period of 26 months, i.e., roughly a little more than 2 years. With a grant amount involved or provision of SHS through SSEP the payback period will further decrease. It is a matter of switching the consumers to a cleaner and better technology by changing their existing patterns of spending on alternate lighting and mobile phone charging arrangements to SHS. Over time as prices of SHS continue to drop, and technology becomes more advance, the consumers can upgrade to more advance systems.

## **I. IMPLEMENTATION METHODOLOGY / MECHANISM:**

To promote Off-grid RE applications, a joint holistic effort is required. This mechanism needs to evolve through addressing barriers and implementing key parameters stated above. The implementation will be undertaken through a Program Management Unit (PMU). The activities undertaken in this regard will include the following:

To ensure sustainability of the systems, following steps will be undertaken while executing the project:

- Training for installers, people involved in O&M services, on the ground salespeople, for establishing supply chain mechanism will be ensured
- Effective Coordination with provincial government departments and all stakeholders will be ensured

For this project, it is planned that 200,000 households will be provided basic energy access services via Solar Homes Systems in different parts of Sindh Province. The PMU will identify number of households in each village through BISP Data that will be targeted for deployment of SHS's by LMD's. LMDs will be pre-identified against objective criteria before being allowed to participate in the process to obtain the right to service prioritized areas. For each priority area, a price range will be set for SHS. Multiple LMD's will be able to service a single area, if their product falls within a certain pre-determined price range, and the LMD meets the criteria. The LMD will be responsible for recovering the distribution cost from the consumer subject to a cap determined by the PSC.

### **I.1 Program Implementation Steps:**

Discussions with WB Procurement and technical team:

- Three meetings were held with SHS Suppliers for implementation of the Project activities, no one showed positive response to arrange the requisite systems of at

<sup>9</sup> Pakistan Off-Grid Lighting Consumer Perception Study, IFC, 2015

least 5,000 SHS to launch the program in rural areas especially in lieu of the 2022 floods. The suppliers categorically asked for clearing of consignments and opening of LCs by the Government of Sindh. The Energy Department through the Minister office took the matter with the SBP for the sake of the project, but no success.

- ii) The matter also raised by WB team with The Government of Pakistan through Economic Affairs Division for special permission of foreign funded projects, but no positive response.
- iii) In lieu of the above facts and failure to achieve project targets during the last four years, it is clear that the proposed model of implementation through SHS Suppliers needs to be revisited and another effective implementation mechanism may be introduced for execution of Component-III.
- iv) Accordingly, the Project PMU explored various options including the import of systems in bulk through an aggregator or PMU itself.
- v) Under the new implementation strategy, there is need of one or a few importers /aggregators, the import of solar equipment's in bulk may be considered.
- vi) The purchase of SHS Kits in bulk has following strengthens:
  - a. The price will be reduced
  - b. The Quality assurance and monitoring tasks will be easy as unique models will be introduced and different SHS Kits by various SHS suppliers will be discouraged.
  - c. The Direct Consignment in the name of Project PMU and distribution through SHS Supplier or NGOs will save the taxation and make the system affordable.

The GoS and WB is considering to device the role of Bulk Aggregator /importer for supply of SHS Kits with following Roles and responsibilities:

**The Role of PMU SSEP, Energy Department (GoS):**

- The GoS will select an aggregator through public advertisement and sign an agreement with The Aggregator for shipment and supply of SHS Kits in Sindh /Pakistan. Or directly purchase from the manufacturer abroad or arrange the availability of systems by a third party at Karachi.
- The shipment will be in the direct name of PMU of Energy Department for clearance of taxes, customs and other regulatory duties.
- The GoS will pay the partial payments for delivery of products as per supply chain strategy, i-e: purchase order, Bill of landing etc.
- The GoS will make payments directly in USD through an account of the aggregator with the support of WB in line with contract agreement within stipulated time period.
- The GoS will provide all necessary documentation regarding clearance, Freight Management, duties to the aggregator.
- For any technical fault /non-functioning of the SHS Kits “Service after Sale” or replacement option for one year will be the responsibility of the aggregator.
- There should be at least one service Centre for O& M of the Kits.

**Role of Bulk Aggregator:**

- A performance guarantee will be given by Aggregator in addition to Bank Guarantee.
- The product supply will be received at Karachi seaport.

- The responsibility of the shipment at tills the handover to SHS supplier at warehouse will rest with Aggregator.
- The payment for post-sale service including travelling expenses will be paid by the Aggregator for one year.
- The product warranty period will be 2 years.
- To ensure the timely clearance from the port.
- Maintain the warehouse for handing over the solar Kits at Karachi within stipulated time period.
- The transport from Karachi port to warehouse in Karachi.

Criteria for selection of Aggregator will be the responsibility of the PMU in line with procurement Regulations:

## **I.2 Participatory Requirements of the Program**

### **Public Awareness Program:**

The scope of this component is limited in the wake of the revised criteria of identifying the beneficiaries through BISP NSER data. In the 1st instance, BISP has provided a database of around 400,000 poor households consisting of around 13,000 households in each district, which may vary based on any changes in the number of SHS kits on the basis of district level.

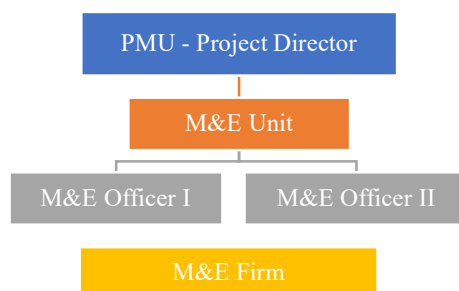
A new public awareness strategy to focus on the targeted households will be envisaged by the PMU for effective implementation. The activities for social mobilization will be initiated by the PMU.

### **Monitoring and Quality Assurance**

To ensure success of the project and confidence building of the community as solar home system is a new technology on such a magnitude in remote area, it is necessary to have continuous monitoring and evaluation during execution and completion of the project by PMU. Strict quality testing standards for SHS will be adopted. Random sampling of SHS of qualified vendors will be done and sent to laboratories for testing. Also, a consumer helpline will be established to answer and follow up on consumer complaints. During implementation phase, the emphasis will be on active end users' participation, quality of the systems and role of users in adhering to the described used of the system. These are crucial factors in the success of project. The monitoring will also highlight the issues like as to what has been intended and what has been achieved, if not, the remedial strategy for their removal, obstacles in implementation, flaws of coordination implementation gaps etc.

Staffing of M&E Unit at the PMU: The PMU will include M&E staff/consultants, and mechanisms will be incorporated into Component 3 to provide real-time tracking of results. Data and statistics on actual project outputs and outcomes will be gathered, analyzed, and included in the quarterly progress reports to be submitted to the WB.

The structure of the M&E Unit within the PMU will look like:



### Activities Conducted Under the M&E Unit.

The M&E firm will be hired to collect data on the ground during project implementation and will be overseen by M&E Officers hired under PMU's M&E Unit.

The M&E Firm will collect the following kinds of data:

- Number of staff trained under the capacity building program
- Check Eligibility of Household
- Physical Verification installed SHS
- Number of households provided energy access
- Performance of LMD provided to beneficiaries
- O&M Performance of LMDs
- Complaints and Issues identified by beneficiaries

Please note that the above data collection will be the responsibility of the PMU at different levels of frequency depending on the indicator, however **the M&E firm will act as an independent third-party verifier of the collected data.** The M&E firm will report the data to the M&E officers, who will then work with other officers in the PMU that are responsible for data collection of the program, and work with them to see if the data is in line with what is being reported, or there are discrepancies. In case of any major discrepancies, the M&E officers will work with the project steering committee to identify solutions to the problem.



### Target Areas under the SHS Program

The program aims to impact 1.2 million people in Sindh, with a target of 200,000 solar-home-systems installed. The criteria for target household will be same i.e., BISP Poverty score as determined by the PMU keeping in view the paying capacity of the beneficiaries for O&M and other additional costs.

### **J. TOTAL COST OF THE PROJECT:**

The cost of the Component 3 is US \$ 33 million. This will suffice in providing SHS kits to 200,000 households based on the projected level of support and the cost of the other parts of Project implementation. The Project has reserved the amount of USD 160 for each SHS kit and its peripheral costs while LMD distribution costs will be recovered from the beneficiaries / end user subject to a cap set by the PSC. Implementation-related issues and detailed design issues (e.g., percentage of SHS cost covered by the project) shall be determined by the PMU, decided by the PD, and captured through revisions to the project's Operations Manual following receipt of a "No Objection" by the WB team.



## PROJECT JUSTIFICATION

**As a result of sustained equipment and construction costs reductions internationally and the experience gained from several early projects, solar power is now a least-cost form of generation in Pakistan, alongside other RE technologies specially wind power.** This offers the potential for Pakistan to reduce its average cost of generation, diversify away from imported fossil fuels, and realize the climate change, air pollution, and water conservation benefits of transitioning to renewable sources of electricity. However, to continue to drive down the cost of solar power Pakistan needs to fully implement competitive bidding through a stable, transparent, and predictable series of solar auctions, leveraging the successful experiences of other countries such as Mexico, UAE and South Africa. There is also a need for future solar and wind projects to be developed more strategically than in the past, considering of land availability, grid capacity, and grid integration issues, which argues in favor of a stronger government role in identifying and pre-developing sites for private sector development of solar power plants.

Based on the lessons learnt during project implementation, the scope of the project targets has been increased from 420 MW to 450MW under Component-I and Component –II within the same project’s costs. An extension of 22 months has been requested as project activities started one year late due to opening of accounts and the lock downs due to Covid Pandemic in the year 2020 and flood emergencies in 2022.

The Tentative Energy Savings are as under:

### **Energy Saving**

<b>Capacity</b>	<b>Tilted Irradiation</b>	<b>Annual Production</b>	<b>Production Total 25 Years</b>
50MW (Distributed)	2,000 KWh/KWp	91 GWh	1,820 GWh
400MW (Pilot Utility Scale)	2,000 KWh/KWp	716 GWh	16,875 GWh
450 MW (Total installed under Component 1 and 2)	(See Above)	807 GWh	18,695 GWh
200000 SHS Each of 50W	2,000 KWh/KWp	18.25 MWh	91.25 MWh (5 Years Life)

## TECHNICAL PARAMETERS

**Pakistan has excellent solar and wind resource potential, but their capacity remains relatively low at 2 GW of wind and 530 MW of solar.** In 2006, the Government of Pakistan released its Policy for Development of Renewable Energy Generation (“**2006 RE Policy**”). The 2006 RE Policy dealt with small hydropower (<50 MW), solar, and wind, and set out an initial plan for development of renewable energy within the country. However, progress has been slow and it has only been in the last seven years that investors’ interest has gained momentum with wind development primarily in Sindh province, and solar photovoltaic (“**PV**”) development primarily taking place in Punjab. Until 2016 NEPRA provided an “up-front tariff” for solar and wind power (equivalent to a feed-in tariff). The Alternative Energy Development Board (“**AEDB**”) was established as an autonomous body with the aim of promoting and facilitating the exploitation of renewable energy projects in Pakistan. The provincial energy departments and AEDB are issuing a Letter of Intent (“**LOI**”) to project sponsors, which was the first step in developing a renewable energy project. Under the 2006 RE Policy, once the developer has secured all requisite approvals in the development process and has signed an EPA with CPPA-G, K-Electric, or another DISCO, it is mandatory for the distribution utility to purchase all of the electricity offered to them by the project. In 2017, NEPRA announced that future solar and wind projects would be awarded tariffs through competitive bidding<sup>10</sup>. However, there is currently a backlog of around 4.5 GW of LOIs issued to project sponsors under the up-front tariff regime leading to uncertainties in the renewable energy sector on how and when future projects will be awarded. The ARE Policy 2019 has been approved by CCI in 2020, which allows the mechanism to cater the remaining projects initiated under 2006 policy through competitive bidding. NEPRA has announced new framework of CTBTM Model for bilateral trading of electric power from single buyer (CPPA-G) to multiple buyers, allowing for open trading of the electricity to become possible.

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<sup>10</sup> Future wind projects will use NEPRA’s Benchmark Levelized Tariff as basis for complete bidding.

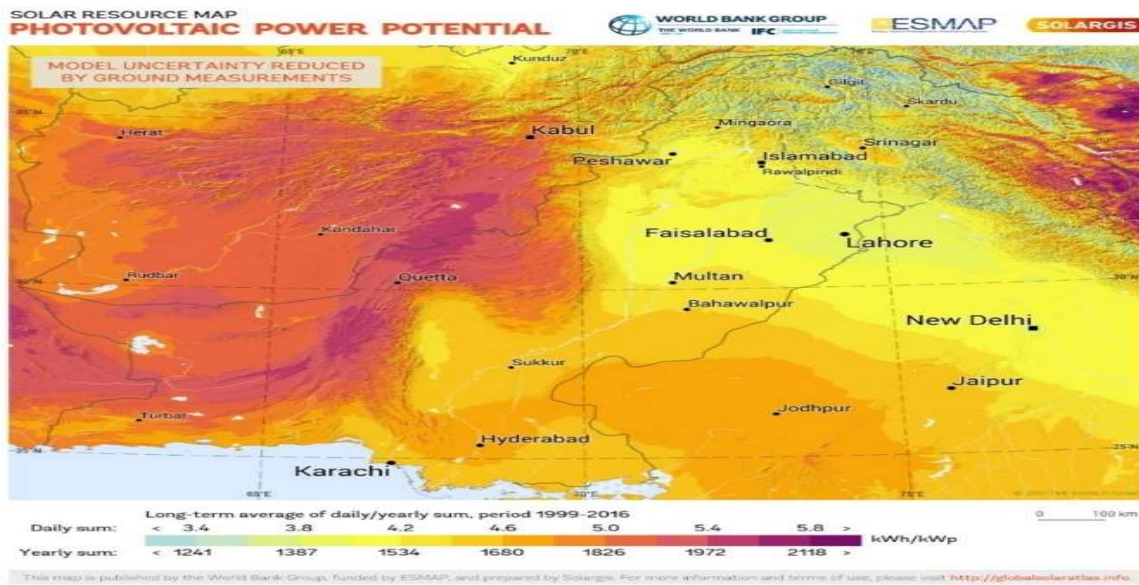


Figure 1: Solar PV power potential in Pakistan (Source: Global Solar Atlas)

**Pre-feasibility and initial surveys were conducted for each Component, and work is relatively advanced on Component 1 and Component 2.**

For the pilot solar auction at the 400 MW at three different sites, a Feasibility Study were commissioned to assess the candidate project area and preparation of the bidding package, including an ESMP for one of the three sites, which is located in Manjhand. The proposed projects would be connected to a nearby substation and power would be connected to HESCO's grid at 132 kV in adherence to NEPRA's grid code regulations. For the remaining two sites, which are estimated at 175 MW each, projects feasibility studies were initiated in Karachi Division with a possible provision for supply of electricity to KE or to any other agency under NEPRA CTBTM Framework.

For Component 2, in addition to net metering the relevant IEC technical standards for solar PV equipment and NEPRA's net metering regulations for interconnection at the distribution level were be followed. Activities under this component will adhere to international and local building code regulations in relation to rooftop static and dynamic loading requirements. The standalone solar systems and solar power supply with battery backup systems, which may be considered, will also be accommodate requirements of the different power loads and other relevant site-specific conditions. The PMU through SED will provide a portfolio of public sector buildings, which will be appropriately surveyed by the project.

For Component 3, it is evident that for small house holds especially in rural areas where there is minimum energy requirement as compared to urban houses, it is appropriate to provide small SHS for lighting few bulbs and a fan instead of extending the grid distribution line. The Plug and Play and the component based SHS systems will be distributed on subsidized rates as duly approved by the PSC or through Bulk procurement process and distribution through Last Mile Distributors (LMDs)

**YEAR WISE ESTIMATION & OPERATING COSTS OF PMU**



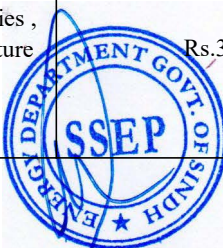
ANNEXURE F																																														
Type of cost	Qty	Year 1 (2018 - 19)					Year 2 (2019 - 20)					Year 3 (2020-21)					Year 4 (2021-22)					Year 5 (2022-23)					Year 6 (2023-24)					Year 7 (2024-25)					Year 8 (2025-26)					Total (2018-26)				
		Unit cost/ Month	Months	Amount	GoS Share	WB Share	Unit cost/ Month	Months	Amount	GoS Share	WB Share	Unit cost/ Month	Months	Amount	GoS Share	WB Share	Unit cost/ Month	Months	Amount	GoS Share	WB Share	Unit cost/ Month	Months	Amount	GoS Share	WB Share	Unit cost/ Month	Months	Amount	GoS Share	WB Share	Unit cost/ Month	Months	Amount	GoS Share	WB Share	Total (2018-26)	Total (2018-26) GoS Share	Total (2018-26) WB Share							
Local Revenue Component																																														
A Implementational & Operational Cost																																														
1	Salaries of PMU Staff							10,788,467	10,788,467					22,009,769	22,009,769					24,540,263	24,540,263															57,338,499	57,338,499									
	1.01 Project Director PPS-10	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	437,500	12	5,250,000	5,250,000	-	459,375	12	5,512,500	5,512,500	-	481,250	12	5,775,000	5,775,000	-	505,313	1	656,906	656,906	-	17,194,406	17,194,406	-		
	1.02 Procurement Manager PPS-9	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	321,565	12	3,858,780	3,858,780	-	336,880	12	4,042,560	4,042,560	-	352,195	12	4,226,340	4,226,340	-	369,805	1	480,746	480,746	-	12,608,426	12,608,426	-		
	1.03 Accounting Officer PPS-8	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	229,690	12	2,756,280	2,756,280	-	240,630	12	2,887,560	2,887,560	-	251,570	12	3,018,840	3,018,840	-	262,510	1	341,263	341,263	-	9,003,943	9,003,943	-		
	1.04 Environment & Social Development Officer PPS-8	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	229,690	12	2,756,280	2,756,280	-	240,630	12	2,887,560	2,887,560	-	251,570	12	3,018,840	3,018,840	-	262,510	1	341,263	341,263	-	9,003,943	9,003,943	-		
	1.05 Admin Officer PPS-7	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	168,000	12	2,016,000	2,016,000	-	175,875	12	2,110,500	2,110,500	-	183,750	12	2,205,000	2,205,000	-	191,625	1	249,113	249,113	-	6,580,613	6,580,613	-		
	1.06 Office Assistant PPS-6	2	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	110,250	12	2,646,000	2,646,000	-	115,500	12	2,772,000	2,772,000	-	120,750	12	2,898,000	2,898,000	-	126,000	1	163,800	163,800	-	8,479,800	8,479,800	-		
	1.07 Drivers PPS-4	4	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	55,125	12	2,646,000	2,646,000	-	57,750	12	2,772,000	2,772,000	-	60,375	12	2,898,000	2,898,000	-	63,000	1	81,900	81,900	12	-	8,397,900	8,397,900	-	
	1.08 Manager Utility Scale Solar PPS-9	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	321,565	12	3,858,780	3,858,780	-	336,880	12	4,042,560	4,042,560	-	352,195	12	4,226,340	4,226,340	-	367,510	1	477,763	477,763	-	12,605,443	12,605,443	-		
	1.09 Manager Distributed Solar PPS-9	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	321,565	12	3,858,780	3,858,780	-	336,880	12	4,042,560	4,042,560	-	352,195	12	4,226,340	4,226,340	-	367,510	1	477,763	477,763	-	12,605,443	12,605,443	-		
	1.10 Manager Solar Home Systems PPS-9	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	321,565	12	3,858,780	3,858,780	-	336,880	12	4,042,560	4,042,560	-	352,195	12	4,226,340	4,226,340	-	367,510	1	477,763	477,763	-	12,605,443	12,605,443	-		
	1.11 Monitoring & Evaluation Specialist PPS-9	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	321,565	12	3,858,780	3,858,780	-	336,880	12	4,042,560	4,042,560	-	352,195	12	4,226,340	4,226,340	-	367,510	1	477,763	477,763	-	12,605,443	12,605,443	-		
	1.12 IT Database Manager PPS-9	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	321,565	12	3,858,780	3,858,780	-	336,880	12	4,042,560	4,042,560	-	352,195	12	4,226,340	4,226,340	-	367,510	1	477,763	477,763	-	12,605,443	12,605,443	-		
	1.13 Database Analyst PPS-8	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	229,690	12	2,756,280	2,756,280	-	240,630	12	2,887,560	2,887,560	-	251,570	12	3,018,840	3,018,840	-	262,510	1	341,263	341,263	-	9,003,943	9,003,943	-		
	1.14 Naib Qasid/dispatch rider/Chokidar (PPS-1)	4	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	-	-	12	-	-	-	-	28,000	12	1,344,000	1,344,000	-	29,400	12	1,411,200	1,411,200	-	30,800	1	40,040	40,040	-	2,795,240	2,795,240	-
	1.15 Computer operator (PPS-5)	2	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	-	-	12	-	-	-	-	70,000	12	1,680,000	1,680,000	-	72,625	12	1,743,000	1,743,000	-	75,250	1	97,825	97,825	-	3,520,825	3,520,825	-
	1.16 Communication Officer / PS to Project Director (PPS-7)	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	-	-	12	-	-	-	-	157,500	12	1,890,000	1,890,000	-	165,375	12	1,984,500	1,984,500	-	173,250	1	225,225	225,225	-	4,099,725	4,099,725	-
	1.17 Receptionist (PPS-5)	1	-	-	-	-	12	-	-	-	-	12	-	-	-	-	12	-	-	-	-	-	-	12	-	-	-	-	70,000	12	840,000	840,000	-	72,625	12	871,500	871,500	-	75,250	1	97,825	97,825	-	1,809,325	1,809,325	-
	Sub. Total			-	-	-		10,788,467	10,788,467	-			22,009,769	22,009,769	-			24,540,263	24,540,263	-			43,979,520	43,979,520	-			51,839,040	51,839,040	-			54,200,760	54,200,760	-			5,505,984	5,505,984	-	212,863,803	212,863,803	-			
2	Project Allowance																																													
Type of cost		Year 1 (2018 - 19)					Year 2 (2019 - 20)					Year 3 (2020-21)					Year 4 (2021-22)					Year 5 (2022-23)					Year 6 (2023-24)					Year 7 (2024-25)					Year 8 (2025-26)									
3	Purchase of Office Equipments	Qty	Unit Cost	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total							
	Purchase of Office Equipments				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
	Personal Computers with LCD Display				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.1	Laptop				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.2	Printers Laser				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.3	Color Copier Heavy Duty (all in one)				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.4	LAN (Server, Switches, Wiring, wifi routers etc)				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.5	PABX, Phone Sets, wiring and accessories				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.6	CISCO Communication System				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.7	Smartphone for on site progress reporting at ADP Progress Dashboard				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.8	Solar System with Battery Backup 10KVA				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
3.9	Sub Total			-	-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
				-	-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
Type of cost		Year 1 (2018 - 19)					Year 2 (2019 - 20)					Year 3 (2020-21)					Year 4 (2021-22)					Year 5 (2022-23)					Year 6 (2023-24)					Year 7 (2024-25)					Year 8 (2025-26)									
4	Purchase of Vehicles	Qty	Unit Cost	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total							
	4.1 Toyota Fortuner A/T with registration, tracker, accessories, tax, insurance etc				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
	4.2 Toyota Hilux Revo AT (double cabin) 4x4 3.0 litre with registration, tracker, accessories, tax, insurance etc				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
	4.3 Suzuki Swift AT / Suzuki Wagon R				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
	4.4 Insurance for vehicles				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
	4.4 Motorcycle				-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
	Sub Total			-	-	-				-	-				-	-				-	-				-	-				-	-				-	-				-	-					
Type of cost		Year 1 (2018 - 19)					Year 2 (2019 - 20)					Year 3 (2020-21)					Year 4 (2021-22)					Year 5 (2022-23)					Year 6 (2023-24)					Year 7 (2024-25)					Year 8 (2025-26)									
5	Operating Expenses	Qty	Unit Cost	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty	Total			Unit Cost	Qty													

**COMPARATIVE STATEMENTS OF ORIGINAL & REVISED**

**PC-1**

**Comperative statement of work done, to be done, amount incurred and to be incurred as per original, approved and proposed revised PC-1**

Comperative statement of work done, to be done, amount incurred and to be incurred as per original, approved and proposed revised PC-1										
Sindh Solar Energy Project										
S.no	Component	Scope	Original PC-1			Revised PC-1			Variation	Justification
			1 US \$ 124.08			1 US \$ 285.48				
			Amount	Work Done / Progress	Amount incurred	Amount	Work To Be Done	Amount to be incurred		
1	COMPONENT - I (Utility-Scale Solar)	Development of Solar Parks to support private sector investment under IPP mode, and launching of Pakistan's first competitive bidding for Solar Power production, starting with an initial 50 MW solar auction (under NEPRA framework) at a site near Manjhand, District Jamshoro. 350 MW in Karachi Division. (Total – 400 MW)	Rs.4,963,200,000 US \$40 M	Land for 50MW at Manjhand, Jamshoro is acquired. Land parcels are ready for Karachi sites for 350MW. FS for Manjhand completed. RFP for Manjhand developed.	US \$ 0.36	US \$15 M	RFP for Karachi sites to be developed. PQD for Manjahnd and KE sites to be developed. Bidding process of all 3 sites. Smooth Transfer of the project to SPV.	US \$14.64	Addition of Solar Wind Hybrid in the Wind Corridor or any other suitable location in the province through PPP or IPP mode under prevailing NEPRA framework.  (Total - 400 MW)	The scope of the project has been enhanced due to the decisison of the Govt regarding execution of power parks in PPP Mode. In this way privte investemnts will also be ensured as baest policy. The final share will be decided by the PPP Unit of the Govt of sindh based on the power price discovered through competitive Bidding.
	Transaction Advisory Services	PKR = 59.4 M		Transaction Advisory Services	PKR = 191.27 M					
	Feasibility Studies	PKR = 1.8 M		Feasibility Studies	PKR = 2.85 M					
	Regulatory Fees	PKR = 3.6 M		Regulatory Fees	PKR = 5.71 M					
				ESMP Studies	PKR = 11.42 M					
				Land Fees	PKR = 1,039.16 M					
				Hybrid/Solar Park	PKR = 1,632.97 M					
				Fencing Cost	PKR = 1,364.95 M					
2	COMPONENT - II (Distributed Solar)	Development of 20 MW of solar power on and around public buildings in Sindh province using competitively-awarded EPC contract and O&M.	Rs. 3,102,000,000 US \$25 M	25 Buildings have been completed (Annex - P)	US \$ 13.69	US \$50 M	23 new buildings under solarization in process. Around 30 new buildings will be solarized with the prior approval of PSC.	US \$36.31 M	Development of at least 50 MW more solar power on and around public buildings in Sindh province using competitively-awarded EPC contract and O&M though 3rd party or an SPV of Energy Department., Govt of Sindh.	The scope of the project has been enhanced in lieu of successful returns. The life of the solar installation is 25 years , whereas payback period is around 3 years. The price of the Power purchase from utility has been doubled during the last four years and the IRR of the project is more than 50%, therefore the scope has been increased from 20MW to 50 MW . The additional amount of 25MUSD has been shifted from Component-I
	Round - 1 (35 Hospitals)	PKR = 2,340.57 M		Round - 3 (Public Sector Buildings)	PKR = 3,109.03 M					
	Round - 1 (O&M and Infra)	PKR = 234.06 M		Round - 3 (O&M and Infra)	PKR = 315.90 M					
	Supervisory Firm	PKR = 72.829 M		Supervisory Firm	PKR = 341.42 M					
	Round - 2 (23 Buildings)	PKR = 2,434.41 M		Round - 4 (Public Sector Buildings)	PKR = 2,197.14 M					
	Round - 2 (O&M and Infra)	PKR = 243.44 M		Round - 4 (O&M and Infra)	PKR = 221.13 M					
	Supervisory Firm	PKR = 88.00 M		Logistic/Vehicles	PKR = 1,234.83 M					
3	COMPONENT - III (Solar Home Systems)	Provision of Solar Home Systems to at least 200,000 households in Sindh (1.2 million people), by providing grants to households. Subsidy upto 40%	Rs. 3,722,400,000 US \$30 M	322 SHS have been provided on subsidized rates out of 200,000. Consumer awareness and M&E firms hired along with transparent a portal website. (Annex - R)	US \$ 1.86	US \$33 M	199,678 SHS provided on subsidized rates	US \$31.14 M	Provision of Solar Home Systems to at least 200,000 households in Sindh (1.2 million people), by providing grants to households. Subsidyfixed for equivalent of USD 160 in Rural areas and equivalent of USD 110 in urban areas with minimum system specification of solar PV Panel, battery backup, 3 LED bulbs , one DC fan and mobile charging facility.	The subsidy amount was 40% and the project could not get public acceptance in rural areas . Due to the recent floods , the economic conditions has been further devastated and paying capacity of the SHS has reduced , that is why , the subsidy in rural areas increased subject to availability of funds. The funds has also been increased due to the dollor rupee variation and additional 3 million USD has been shifted from Componnet-IV to cater the needs. A fixed amount equivalent of USD 160 has been proposed in Rural areas and equivalent of USD 110 is fixed in urban areas subject to the condition that minimum scope of the system will be solar PV Panel, battery backup, 3 LED bulbs , one DC fan and mobile charging facility. The PSCcan increase or decrease the amount subject to availability of funds.
	Consumer Awareness & Social Mobilization	PKR = 290.40 M		Consumer Awareness & Social Mobilization	PKR = 194.13 M					
	Third Party Monitoring	PKR = 3.21 M		Third Party Monitoring	PKR = 220.243 M					
	SHS Dashboard Portal	PKR = 1.17 M		SHS Dashboard Portal	PKR = 25.10 M					
	SHS Sales	PKR = 5.40 M		SHS Sales (Rural) 40,000	PKR = 1,213.23 M					
	Consumer Advocate	PKR = 0.067 M		SHS Sales (Urban) 159,678	PKR = 7220.24 M					
				Consumer Advocate	PKR = 0.58 M					
4	COMPONENT - IV (Technical Assistance and Capacity Building)	Capacity building and technical assistance activities to support the design implementation of the program and to learn state of the art solar PV technologies in practice in developed countries for electricity access. Various national & International trainings and seminars	Rs. 620,400,000 US \$5 M	300 solar technicians have been trained at in 10 Districts with 50% female participation	US \$ 0.23	US \$2 M	Support the public sector Engr universities for implementation of Solar standards as 3rd party independent laboratories. Solar Trainings of stakeholders local and foreign	US \$1.77	Same Scope	The capacity building amount was not utilized due to slow progress on Componenet-I and Componenet-III. The remaining project life is 2 years and it has been ensured that at least solar standards implememntataion through 3rd party independent stakeholder like NED and Mehran university or any other reputable institute may be ensured for sustainability of the exsiting installations.
	Consultancy Services	PKR = 29.76 M		Consultancy Services	PKR = 93.43 M					
	IOC	PKR = 3.12 M		Laboratory / Quality Standards	PKR = 268.44 M					
	Trainings	PKR = 5.64 M		Trainings Local & International	PKR = 31.44 M					
				Technical Studies	PKR = 40.19 M					
				Technology Development	PKR = 36.87 M					
				Workshop/Seminars/Exhibitions	PKR = 12.98 M					
				Others / Misc.	PKR = 22.57 M					
5	Counter part Funding (GoS Funds) Establishment of PMU	The Project Manangement Unit will be established for the execution of Project under the control of Project Director .All incurring costs will be borne	Rs. 440.11	All incurring costs including salaries , Vehcles, Equipment , office furniture and office maintenaince costs	Rs.190 Million	Rs.554.01	All incurring costs including salaries , Vehcles, Equipment , office furniture and office maintenaince costs	Rs.364	No change in scope. Only Rs.113.89 has been increased in PMU costs	The project duration has been increased from 5 years to 7 years . Therefore, the recurring costs including salaries , office maintenance etc has been increased. As agreed in Project Agreements , the couterpart funding in terms of US\$ remains same, only the price indexation due to dollor variation has been adjusted to coup the additional 2 years burden.



**YEAR WISE RELEASES AND EXPENDITURE**



**WORLD BANK AND GOVERNMENT OF SINDH SHARE**

**ANNEXURE - H**

	2018-19			2019-20			2020-21			2021-22			2022-23			2023-24			2024-25			2025-26		
	GoS	WB	Total	GoS	WB	Total	GoS	WB	Total	GoS	WB	Total	GoS	WB	Total	GoS	WB	Total	GoS	WB	Total	GoS	WB	Total
Salaries of PMU Staff	-	-	-	10.79	-	10.79	22.01	-	22.01	24.54	-	24.54	43.98	-	43.98	51.84	-	51.84	54.20	-	54.20	5.51	-	5.50
Project Allowance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purchase of Office Equipments	-	-	-	-	-	-	6.01	-	6.01	-	-	-	7.30	-	7.30	3.60	-	3.60	-	-	-	-	-	-
Purchase of Vehicles	-	-	-	36.00	-	36.00	-	-	-	-	-	-	-	-	-	6.00	-	6.00	-	-	-	-	-	-
Operating Expenses	-	-	-	21.35	-	21.35	30.40	-	30.40	27.91	-	27.91	62.72	-	62.72	56.44	-	56.44	70.92	-	70.92	12.50	-	12.50
Third party monitoring (1%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utility-Scale Solar <b>(Component - I)</b>	-	-	-	-	-	-	-	16.13	16.13	-	23.47	23.47		654.00	654.00		1,896.94	1,896.94		1,722.59	1,722.59	-	-	-
Distributed Solar <b>(Component - II)</b>	-	-	-	-	18.36	18.36	-	1,527.18	1,527.18	-	383.97	383.97		3,444.26	3,444.26		3,267.51	3,267.51		3,620.55	3,620.55		570.97	570.97
Solar Home Systems <b>(Component - III)</b>	-	-	-	-	9.02	9.02	-	184.80	184.80	-	109.74	109.74		1,555.17	1,555.17		3,264.91	3,264.91		3,479.16	3,479.16		570.97	570.97
Technical Assistance & Capacity Building <b>(Component - IV)</b>	-	-	-	-	-	-	-	12.04	12.04	-	10.332	10.33		25.53	25.53		310.33	310.33		186.20	186.20	-	-	-
Total	-	-	-	68.13	27.38	95.51	58.42	1,740.14	1,798.55	52.45	527.51	579.96	114.00	5,678.97	5,792.97	117.880	8,739.69	8,857.57	125.12	9,008.50	9,133.63	18.009	1,141.94	1,159.94
<b>Total GoS Share</b>																						<b>554.01</b>		
<b>Total WB Share</b>																						<b>26,864.12</b>		
<b>G. Total</b>																						<b>27,418.13</b>		



## PROJECT FINANCIAL ANALYSIS

**The Project is financially feasible for both Components 1 and 2.** The initial 500 MW solar plant assumes a debt-to-equity ratio of 75:25 and access to non-recourse project financing through international finance institutions such as the IFC. The feasibility of the solar plant was analyzed based on the cost estimation from the project feasibility study and the plant capacity factor specific to the region. The equity internal rate of return (“IRR”) for the solar plant is 15 percent for an EPA price of \$0.048 per kWh against a weighted average cost of capital (“WACC”) of 8.7 percent. For the rooftop component, assuming 100% debt financing by IDA loan, the FIRR is 33.2 percent and the NPV of the total savings from 50 MW rooftop installation is \$21.3 million, which can be offset against electricity bills.

## PROJECT ECONOMIC ANALYSIS

**The economic analysis confirms net economic benefit from all three project components.** The economic internal rate of return (EIRR) and net present value (NPV) of the benefits for each component are calculated using standard cost-benefit methodology<sup>11</sup>. The economic analysis indicates that the Project’s components are viable even without factoring in the environmental benefits. The total lifetime GHG emissions avoided from the Project is approximately 1,085,117 tons of CO<sub>2</sub> equivalent. The table below shows the breakdown of the analysis per component. As per the approach for climate co-benefits assessment laid out in the 2016 Joint Report on MDB’s Climate Finance<sup>12</sup>, the Project can claim 100 percent climate co-benefits as it is a Category 1.1 Renewable Energy Solar Project.

*Table 1: Summary of economic analysis*

	50 MW Solar PV Plant	20 MW Distributed Solar	Solar home systems
EIRR	18.0%	28.8%	17.1%
EIRR including GHG Emissions	23.0%	36.6%	17.3%
Net Economic Benefits	\$42.64 m	\$29.99 m	\$99.55 m
GHG Emissions Avoided (tons)	683,953	407,879	35,990

<sup>11</sup> Full details of the assumptions and methodology are available here:

<http://wbdocs.worldbank.org/wbdocs/drl/objectId/090224b085716529>

<sup>12</sup> European Investment Bank. 2016. “Joint Report on Multilateral Development Banks’ Climate Finance”.

<http://www.eib.org/attachments/press/2016-joint-report-on-mdbs-climate-finance.pdf>

## IMPLEMENTATION SCHEDULE OF THE PROJECT

After approval of the scheme following implementation schedule will be followed accordingly:

Original PC-1	Revised PC-1
<p><b>Year 1</b></p> <ul style="list-style-type: none"> <li>• <b><u>Component 1</u></b> <ul style="list-style-type: none"> <li>○ The transaction advisor for Grid connected component will be procured.</li> <li>○ All interested private companies invited for workshop on reverse auction methodology.</li> <li>○ Reverse auction for 50MW pilot for Component 1 will take place end of the year.</li> </ul> </li> <li>• <b><u>Component 2</u></b> <ul style="list-style-type: none"> <li>○ Detailed survey of government buildings will be conducted and buildings to be included in the program will be selected.</li> <li>○ Transaction advisor for the component will competitively selected and appointed.</li> <li>○ Feasibility analysis will be conducted for all buildings identified.</li> </ul> </li> <li>• <b><u>Component 3</u></b> <ul style="list-style-type: none"> <li>○ Vendor for M&amp;E, consumer awareness and engagement will be competitively procured.</li> <li>○ Household survey identifying areas for deployment of solar home system will be completed.</li> <li>○ Consumer awareness and engagement including above the line and below the line campaigns will be initiated.</li> <li>○ Pilot SHS deployed.</li> <li>○ Monitoring and Evaluation for the pilot conducted</li> </ul> </li> </ul>	<p><b>Year 5 -7:</b></p> <ul style="list-style-type: none"> <li>○ <b><u>Component 1</u></b> <ul style="list-style-type: none"> <li>○ Reverse auction for 320MW for Component 1 will take place end of the year 2022-23 subject to regulatory approvals by NEPRA.</li> </ul> </li> </ul> <p><b>Year 5-7:</b></p> <ul style="list-style-type: none"> <li>○ <b><u>Component 1</u></b> <ul style="list-style-type: none"> <li>○ Development of 180 MW Solar Wind Hybrid Park under NEPRA CTBTM Model.</li> </ul> </li> </ul> <p><b>Component-II</b></p> <ul style="list-style-type: none"> <li>○ Solarization of additional 30 MW public sector facilities including Semi – Govt and autonomous bodies with options for solar Floating, solar wind, solar Hydro, solar Waste to Energy or any other applicable technology.</li> <li>○ Detailed surveys of the public sector facilities.</li> </ul> <p><b><u>Component 3</u></b></p> <ul style="list-style-type: none"> <li>○ Vendor for M&amp;E, consumer awareness and engagement will be competitively procured.</li> <li>○ Household survey identifying areas for deployment of solar home system will be completed.</li> <li>○ Consumer awareness and engagement including above</li> </ul>

<p><b>Year 2- Year 5</b></p> <ul style="list-style-type: none"> <li>• <b><u>Component 1</u></b> <ul style="list-style-type: none"> <li>○ Reverse auction for round 1 of solar park will take place end of year 2, beginning of year 3.</li> <li>○ Upgrade work on solar park infrastructure including transmission lines, substation upgrades and fencing for round 3 will be started</li> </ul> </li> <li>• <b><u>Component 2</u></b> <ul style="list-style-type: none"> <li>○ Monitoring and evaluation of O&amp;M and installation of round 1 of installations.</li> <li>○ Procurement of EPC for round 1 will take place in year 2 and for round 3 in year 3 with installation in year 3-4.</li> <li>○ Procurement of EPC for round 3 of installations will take place in year 4 with installation in year 4 continuing to year 5.</li> <li>○ Monitoring of work completed and the O&amp;M of the installed distributed solar facilities will continue through period.</li> </ul> </li> <li>• <b><u>Component 3</u></b> <ul style="list-style-type: none"> <li>○ Competitive bidding for the areas identified during initial assessment of the household survey will take place each year.</li> <li>○ Consumer awareness and engagement will be conducted each year.</li> <li>○ Monitoring and Evaluation surveys will continue yearly.</li> </ul> </li> </ul>	<p>the line and below the line campaigns will be initiated.</p> <ul style="list-style-type: none"> <li>○ Satellite based survey was considered instead of household survey for identifying areas.</li> <li>○ The beneficiaries will be identifies on the basis of low electricity areas and poverty score cards through M&amp;E firm.or through BISP Data.</li> </ul>
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## Terms of Reference of Project Staff

**Note: The Age limit for all project posts should be Below 50 years**

### **Project Director:**

**Mode of Appointment:** Full time (on contract basis) or by transfer /Deputation from the Govt Department with strict adherence of Criteria or from the Open Market in case non-availability of eligible Engineering candidate

### **Scope of Work for the PMU Director is but not limited to the following:**

1. Project Director will be an overall in charge of the project in terms of physical and financial progress of the project.
2. Will be responsible to execute the project as per requirements given in the PC-I and guidelines provided by the Government of Sindh and the World Bank.
3. Will be responsible for all aspects of the project implementation and will be supported by Project Supervision and Contract Management staff and/or consultants as well as M&E staff/consultants as required.
4. Will be responsible to (i) design and implementation of the Project activities; (ii) data collection and monitoring, (iii) supervision of procurement related activities (iv) preparation of annual work plan for all Project's activities and annual financial requirements, and (v) supervision and reporting on implementation of Environmental and Social Management Plans ("ESMP") and Resettlement Action Plans ("RAP") as required through project staff hired under the PMU of the project.
5. Responsible for (i) monitoring of the physical progress; (ii) monitoring and evaluation of the project impact; (iii) review and supervision of the environmental and social aspects of the project; and (iv) provision of guidance to the management in early identification and resolution of the Project related issues. The scope of work will include: (i) the establishment of Management Information Systems ("MIS"), Geographic Information System ("GIS") and Information and Communication Technology ("ICT") based monitoring and verification systems for all project components and activities.
6. Provide regular briefing and periodical reports to Sindh Energy Department (SED) and to the World Bank based on the reports received by the PMU staff, other PCU's coordinators and long- and short-term consultants.
7. Assist the SED on setting strategies and targets in order to ensure the achievement of the project objectives.
8. Lead and manage the staff of the PMU and PCU's in carrying out the day-to-day activities in support of implementation of the projects.
9. Coordinate with SED on acquiring of adequate facilities and other recourses to ensure the efficient operation of the PMU and fulfillment of responsibilities.
10. Work in close cooperation with respective line ministries / PCUs to ensure that goods and services under the Credits are procured in accordance with World Bank Guidelines.
11. Supervise the financial management system, including records and accounts, and prepare financial statements in a format acceptable to the International Development Association, adequate to reflect the operations; ensure audit of Project accounts as per rules of the Government of Sindh and the requirements of the IDA stipulated in the Development Credit Agreement and the Sub-Credit Agreement.

### **Duration:**

The initial duration of the contract will be for two years and is extendable upon satisfactory performance.

### **Conflict of Interest:**

The Project Director shall not be involved in another assignment that represents a conflict of interest to the prevailing assignment.

### **Qualification and Experience:**

The Director should have a master's degree in engineering/economics/ management sciences. The Director should have energy sector background with at least 10 years' experience in a responsible management position. In addition, the Project Director will need to have experience in dealing with international and bilateral organizations since the project requires close collaboration with other donors active in the sector. Working knowledge of English and computer skills are required. Knowledge/experience with WB procedures could be an advantage.

**Expected Outputs:**

Successful and timely completion of the Project supported by visible use of project management tools.

**Input by the SED:**

The SED will provide necessary support to the Project Director for establishment of complete office infrastructure, provision of the required equipment, tools of trade, and access to any documentation and information necessary for the performance of Director's tasks.

**Procurement Manager:**

**Mode of Appointment:** Full time (on contract basis)

**Scope of Work for the Procurement Manager is but not limited to the following:**

1. Develop, monitor, and implement need-based Procurement Plan to implement Project ensuring timely completion of all procurement activities
2. Contribute to the development of the Annual Work Plan, ensuring alignment with project's strategies, agreement on annual targets in the work plan with budgeting.
3. Assist technical teams with development of generic and policy compliant Tor's and specifications; as relevant.
4. Carry the overall responsibility for all the Procurement functions at project level.
5. Ensure compliance with legal requirements of project in procurement actions and submissions for engaging consultants, procuring goods and work requirements.
6. Ensure compliance with various fiduciary controls, etc. as stated in the Procurement Operations Manual in the procurement process and propose improvement's; if any.
7. Manage the complete procurement cycle, including advertising process for procurement, procurement correspondence, bids receipt, bids opening, contract negotiations, contract signings etc. in strict accordance with Bank's Procurement and Consultants Guidelines or GoS prevailing rules/policies which so ever is applicable.
8. Receive and review Purchase Request (PR) in accordance with the plan and budget and facilitate.
9. Maximize efficiency of procurement cycle by providing strategic expert advice and implementing necessary controls ensuring transparency cost effectiveness and soundness of all procurements carried out under the project.
10. Address all matters associated e.g., taxation, duties clearance, with support of financial management team
11. Monitor and record the progress of procurement activities by regularly updating Systematic Tracking of Exchanges in Procurement (STEP).
12. Liaise and coordinate with the World Bank and its supervision missions with the approval of the Project Director.
13. Design/ update and facilitate the management of the overall procurement and inventory management record and filing system.
14. Comply with the monitoring system for procurement and ensure the completion of the procurement process according to the procurement plan besides the Contract Management adhering to the Contract Agreements/Supply Orders.
15. Assist various audits/ex-post review outfits in performance of their tasks by ensuring that procurement document is efficiently filed and provide complete track of procurement cycle.
16. Ensure adherence of the ongoing contract agreements/supply orders with all the defined conditionality and processing of the payments after taking compliance report on deliverables from technical experts.
17. Provide assistance to the Programme Manager in following areas related to his/her assignment:

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- a. Looking after the level of transparency in procurement process.
  - b. Dispute Resolution.
  - c. Reviewing the whole supply chain and identification of any gaps and their plugging measures.
  - d. Assessing and identifying the risks like institutional, political, organizational, procedural, etc. that may negatively affect the ability of the agency to carry out the procurement process.
  - e. Managing the process of procurement complaint resolution.
18. Respond adequately and timely to audit queries.
  19. Oversee the preparation and revision of contracts that involve the purchase of goods and services, with support of relevant technical teams.
  20. Oversee administration of contracts.
  21. Negotiate terms and conditions with support of relevant technical teams.
  22. Prepare contract briefs and revision summarizing contractual requirements and budgets.
  23. Prepare contract amendments notices, monitor contract performance, including the reporting and status of contracts.
  24. Perform closing activities as needed.
  25. Any other relevant task assigned by the Competent Authority.

**REPORTING:** Will report directly to the Project Director.

**Qualification and Experience:**

- At least a master's degree from Higher Education Commission recognized University in Management Sciences/Statistics/Economics/Finance/Engineering or Commerce or related field from reputable local or foreign institution. A certificate/diploma/degree in the field of Procurement Management from reputable local or foreign institution shall an advantage.
- Should have at least 10 (ten) years' experiences in the procurement processes with the public / private projects involving procurement of goods and/or works & services
- Excellent knowledge of relevant rules and legislation of World Bank, Sindh Public Procurement Regulatory Authority and other donor agencies including international procurement best practices. Specifically, sound Knowledge of World Bank Procurement Guidelines, Procedures and reporting requirements shall be preferred.
- Should have an in-depth understanding of procurement cycle management.
- Proven ability to work in a collaborative, team environment.
- Should have excellent command on MS office.

**Duration:**

The initial duration of the contract will be for two years and is extendable.

The Procurement Manager shall not be involved in another assignment that represents a conflict of interest to the prevailing assignment.

**Accounting Officer:**

**Scope of Work/Key Responsibilities are but not limited to the following:**

The Accounting Officer will be responsible to undertake following activities:

1. Be responsible for activities related to financial management required for project implementation.
2. Implement sound accounting system and maintain up to date accounts while ensuring that these conform to the World Bank's as well as Government of Sindh's requirements.
3. Ensure the smooth day-to-day administration of the project funds in conformity with the administrative and financial procedures.
4. Assist the Program in opening, management of Segregated Designated Assignment Accounts (local and foreign currency accounts), following the standard procedures and as per the conditions laid out in the project Grant Agreement.
5. Prepare and provide support in preparation, documentation of regular reports on expenditure and budget control, Budget forecast according to the World Bank's and Government of Sindh's

- prescribed formats.
6. Handling of cash Books, Stock Register, Cheque Register, Cash Register, Reconciliation Statements etc. in accordance with the Government of Sindh.
  7. Advise and assist in all aspects related to allowances, salary, travel claims and other financial matters; Verify invoices, bills, and documents in order to ensure the correct payments.
  8. Ensure that all advances and direct payments are well recorded and justified
  9. Prepare the disbursement reports; Periodic implementation progress reports; Annual and Quarterly financial reports on the basis of corresponding work plans and budget.
  10. Liaison and Coordination with the World Bank and its relevant team member on financial matters.
  11. Prepare withdrawal applications using supporting documents that should also be prepared according to the World Bank disbursement procedure (Statements of expenditures and Summary sheets, Reconciliation statements of the Special Account).
  12. Assist in arrangements for audit of the Project whenever required

**DURATION:**

Initial duration of contract will be for two years and extendable based on performance

**REPORTING:**

Will report directly to the Project Director.

**QUALIFICATIONS AND EXPERIENCE:**

The required qualifications and experience are as follows:

1. At least Master's Degree from HEC recognized University preferably in Accounting or Finance, preferably CMA/CPA/CA/ACCA (or equivalent).
2. At least five (5) year's progressive experience of financial management services (post-qualification) in the public and private sector.

**Environment & Social Development Officer:**

**Scope of Work for the Environment & Social Development Officer is but not limited to the following:**

The Social Development Specialist will be responsible for the supervision of the implementation of Environmental and Social Management Framework (ESMF) ESMF, including Resettlement Policy Framework (RPF, if applicable), Environmental and Social Management Plans (ESMPs) and Checklists that will be prepared for the sub-projects.

**Duties of Assignment / Deliverables:**

**The Social Development Specialist** will be responsible for the supervision of the implementation of Environmental and Social Management Framework (ESMF), including Resettlement Policy Framework (if applicable), Environmental and Social Management Plans (ESMP) and checklists that will be prepared for the sub-projects.

The main responsibilities of the Social Safeguards Specialist will include but not limited to the following:

1. Deal with the Social Safeguards aspects and provide feedback to the Project Director on implementation of Environmental and Social Management Framework (ESMF) of the project.
2. provide support to the Project Management Unit (PMU) for ensuring compliance with the World Bank and Government of Sindh conditions and covenants pertaining to the Social Safeguards.
3. Implementation of all aspects identified in ESMF also including the social screening and filling the screening checklists for each sub-project/scheme to be undertaken.
4. Preparation of the mitigation checklists of the infrastructure schemes as required by the ESMF, Environmental and Social Management Plan (ESMP), and Resettlement Action Plans (RAP);
5. Support the Project Management Unit (PMU) and ensure the implementation of the applicable land acquisition procedures developed for the project, if applicable.
6. Carrying out frequent field visits and conduct monitoring of the implementation of mitigation measures outlined in ESMPs and RAP/s.



7. Organize and conduct the trainings on Social Safeguards aspects of the project including ESMF implementation, preparation of mitigation checklists, conducting monitoring, implementation of land acquisition procedures, Grievance Redress Mechanism (GRM), Citizens Engagement, and Community Consultations, etc.
8. Support the functioning of the GRM in accordance with the requirements of the ESMF, GRM procedures and operational manual of the project.
9. Carry out the community and stakeholder consultations in accordance with requirements of ESMF, mitigation checklists and World Bank Social Safeguards.
10. To ensure that the project remains in compliance with the World Bank Social Safeguard policies and guidelines.
11. Prepare the ESMP and RAP Quarterly Progress Report (QPR) and ensure its timely submission to the World Bank.
12. Review and revision of documents and ensuring timely delivery of outputs as agreed between The World Bank and the project.
13. Supervising and supporting all relevant entities in achieving their responsibilities as outlined in the ESMF and ESMPs and Checklists.
14. Implementation of all aspects of ESMF including screening and filling the screening checklists for each subproject to be undertaken under SSEP.
15. Conduct/manage ESMF trainings in accordance with the Training Framework provided in the ESMF.
16. Providing support for and monitoring the performance of the grievance redress system; data analysis; follow-up surveys, etc.).
17. Responding to safeguard incidents and concerns as required.

The Social Development Specialist will ensure that the project remains in compliance with the following World Bank operational policies and guidelines:

- OP / BP 4.12 Involuntary Resettlement
- World Bank Guidance on Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labor Influx
- World Bank Environmental Health and Safety Guidelines

#### **Experience and Qualification:**

The Social Development Specialist should have a master's degree (sixteen years of education) in Social Science, Natural Science or other relevant discipline and have sound knowledge of the social safeguard policies and guidelines of the World Bank and Government of Sindh. S/he should possess a minimum experience of five years in preparing social/community mobilization, social safeguard analyses and relevant documentation, and in their implementation and monitoring in development sector where experience with World Bank funded projects will be an added advantage.

#### **E. Contract Duration**

The Social Development Specialist is expected to commence services initially for two years. The assignment is likely to be extended for life of Program depending upon satisfactory performance of the outputs envisaged in the TORs.

#### **F. Reporting Obligations**

The Consultant will report to Project Director. The Social Development Specialist's performance will be reviewed on annual basis.

#### **Admin Officer:**

**Mode of Appointment:** Full time on contract basis

**Reporting Obligations:** The Admin Officer will report to the Project Director.

**Scope of Work:**

Admin Officer will be responsible to the following but not limited to it:

1. Manage office supplies stock and placing orders
2. Prepare regular financial and administrative reports
3. Administrate of PMU office databases
4. Manage office supplies stock and place orders
5. Prepare regular reports on expenses and office budgets
6. Maintain and update PMU office databases
7. Organize a filing system for important and confidential documents
8. Answer queries by employees
9. Update office policies as needed
10. Maintain a company calendar and schedule appointments
11. Book meeting rooms as required
12. Distribute and store correspondence (e.g., letters, emails and packages)
13. Prepare reports and presentations with statistical data, as assigned
14. Arrange travel and accommodations
15. Schedule in-house and external events
16. Plan and coordinate administrative procedures and systems and devise ways to streamline processes
17. Help in recruitment and train personnel and allocate responsibilities and office space
18. Assess staff performance and provide coaching and guidance to ensure maximum efficiency
19. Ensure the smooth and adequate flow of information within the PMU to facilitate other operations
20. Manage schedules and deadlines
21. Monitor inventory of office supplies and the purchasing of new material with attention to budgetary constraints
22. Monitor costs and expenses to assist in budget preparation
23. Oversee facilities services, maintenance activities and tradespersons
24. Organize and supervise other office activities (recycling, renovations, event planning etc.)
25. Ensure operations adhere to policies and regulations
26. Keep abreast with all organizational changes and business developments.

**Experience and Qualification:**

Adequate proven experience of at least 3 years as administration manager, In-depth understanding of office management procedures and departmental and legal policies, familiarity with financial and facilities management principles, proficient in MS Office, an analytical mind with problem-solving skills, excellent organizational and multitasking abilities, a team player with leadership skills, MBA in business administration or relative field with 10 years of post-qualification working experience.

**Manager Utility Scale Solar:**

**Mode of Appointment:** Full time on contract basis

**Reporting Obligations:** The Manager Utility Scale Solar will report to the Project Director.

**Scope of Work:**

Manager Utility Scale Solar will be responsible for but not limited to the following tasks:

1. To establish series of Solar Parks to leverage private sector development of solar PV through the use of competitive bidding.
2. Carry out international solar auction for an initial 50 MW project, which can be up scaled up to 800 MW in the form of Solar Parks.
3. Arrange necessary permits and provide support to EPC in power evacuation by the utility.
4. Implement the upfront development of shared infrastructure such as the grid connection, roads, security and water supply etc. for solar parks in light of the approved PC-I;
5. Support the Transaction Advisor in the design and implementation a 50 MW solar auction.

6. Implement the Utility scale solar component as described in PC-I, under guidance of Energy Department, Government of Sindh, and WB through Project Director
7. Will evaluate proposals received during solar auctions, will hire consultants for conducting feasibility studies (if any) for establishment of solar parks.
8. Will carry out and monitor all activities pertaining to utility scale solar component of the Project as per guidelines/requirements of GoS and World Bank
9. Any other assignment given by the Project Director pertaining to the utility scale solar component of the project.

#### **Qualification and Experience:**

The Manager should have a bachelor's degree preferably in electrical engineering. He should have a technical background and at least 10 years relevant experience in energy sector in a responsible position in order to effectively deal with utility scale component issues which will arise during the course of implementation. The Manager should have good working relationships at the senior and technical levels of the Government and have proven ability to communicate with high level government officials, staff other ministries and GoP agencies. In addition, the Manager will need to have experience in dealing with international and bilateral organizations since the project requires close collaboration with other donors active in the sector. Working knowledge of English and computer skills are required. Knowledge/experience with WB procedures could be an advantage.

#### **E. Contract Duration**

Manager is expected to commence services initially for two years. The assignment is likely to be extended on satisfactory performance as envisaged in the TORs.

#### **F. Reporting Obligations:** The Manager will report to Project Director.

#### **Manager Distributed Solar:**

**Mode of Appointment:** Full time on contract basis

**Reporting Obligations:** The Manager Distributed Solar will report to the Project Director.

#### **Scope of Work:**

Manager Utility Scale Solar will be responsible for but not limited to the following tasks:

1. Will establish at least 50 MW of distributed solar PV on the rooftops and other available spaces on and around public-sector buildings in Sindh.
2. Will get identified public buildings for utilization of their spare rooftop and other available space.
3. Implement the Distributed Solar component of the project as defined in PC-I to achieve the following goals: (i) reducing recurrent expenditure on electricity by GoS, freeing up budget for other priorities; (ii) providing the DISCOs with cost-effective power during periods of high air conditioning load, while allowing the payments to be netted off against outstanding public sector debts; (iii) building private sector experience in constructing and operating large distributed solar PV installations, thereby reducing costs; and (iv) improving the supply of affordable power to consumers, without the need for ancillary transmission investment.
4. With help of SED identify portfolios of candidate sites and liaise with other GoS departments to establish a leasing agreement for target institutions.
5. Will evaluate proposals received during implementation of the component and hire consultants for conducting feasibility studies (if any).
6. Will carry out and monitor all activities pertaining to distributed solar component of the Project as per guidelines/requirements of GoS and World Bank
7. Carryout any other assignment given by the Project Director pertaining to the Distributed Solar component of the project.

**Qualification and Experience:**

The Manager should have a bachelor's degree preferably in Engineering. He should have energy sector background and at least 10 years relevant experience in a responsible position in order to effectively deal with Distributed Solar component issues which will arise during the course of implementation. The Manager should have good working relationships at the senior and technical levels of the Government and have proven ability to communicate with high level government officials. Working knowledge of English and computer skills are required.

**E. Contract Duration**

The Manager is expected to commence services initially for two years. The assignment is likely to be extended for life of Program depending upon satisfactory performance and the outputs envisaged in the TORs.

**F. Reporting Obligations:** The Consultant will report to Project Director.

**Manager Solar Home Systems:****Scope of Work for the Manager Solar Home Systems:**

The Manager Solar Home Systems will be responsible for but not limited to the following tasks:

1. Design the implementation plan to deliver 200,000 households with solar home systems in Sindh
2. Provide regular briefing and periodical reports to Project Director on the progress of activities related to the deployment and execution of the Solar Home System component.
3. Assist the PMU on setting strategies and targets to ensure the achievement of annual targets for the successful deployment of the Solar Home System component
4. With the assistance of corresponding staff, develop and oversee the implementation of all activities related to the deployment of the Solar Home System component of the project. These activities include but are not limited to, contracting third parties for consumer awareness and engagement, household surveys for market assessment and monitoring and evaluation of the progress of the solar service providers.
5. Work in close cooperation with contracted third parties to ensure that services related to community engagement and awareness, solar service providers are procured in accordance with World Bank Guidelines and project design.
6. Work in close cooperation with the procurement officer, and together with them provide first-line contact with interested solar service providers regarding the status of project-related activities and planned or on-going procurement.
7. Ensure regular monitoring of the status of project activities (through the preparation and updating of implementation plans and schedules, operations manuals, disbursement projections, etc.), including preparation and transmission of comprehensive progress reports as required.

**Duration of job:**

The initial duration of the contract will be two years, extendable by mutual consent for a period agreed between the parties. The Manager shall not be involved in another assignment that represents a conflict of interest to the prevailing assignment.

**Qualification and Experience:**

The Manager should have Bachelor's degree in Electrical Engineering with Masters in Management Sciences and substantial project development and execution experience of at least 5 years. Preferably, the Manager should have a background/experience in provisioning of energy access to off-grid and grid-deficient areas. Experience in micro-finance sector would be a plus. The manager should have good working relationships at the senior and technical levels of the Government and have proven ability to communicate with high level government officials and staff other ministries and local governments. Experience with private sector solar companies will be considered important. In addition, the manager will need to have experience in dealing with international and bilateral organizations since the project requires close collaboration with other donors active in the sector. Working knowledge of English and computer skills are required. Knowledge/experience with WB procedures could be an advantage.



**Expected Outputs**

Monthly management reports, annual budgets, and mid-term review related to the Solar Home System component. Day-to-day management of the project will require the preparation of ad hoc reports and papers as the needs of the project arise.

**Monitoring & Evaluation Specialist:****Scope of Work and Activities to Be Undertaken:**

Specifically, the M&E Specialist will be responsible for the following duties and responsibilities.

- Develop M&E Framework for all three components of the project
- Conduct trainings, awareness programs and develop guidelines required for effective implementation of M&E framework.
- To have knowledge of the existing data sources and instruments available and the type of evidence required to assess progress towards results
- Attain in depth knowledge of the project and understand key parameters. Monitor and analyze key parameters using M&E tools and recommend corrective actions.
- Oversee third party monitoring teams for all three components.
- Lease with third-party monitoring team from Planning and Development Department, Government of Sindh.
- Establish sound and effective M&E mechanisms by supporting; i) third party validation, ii) evaluation, in collaboration with centers of knowledge and excellence, of interventions to assess on-going implementation as well as un-intended consequences; and iii) collection of real-time data directly consolidated into electronic systems and made available through management dashboards
- Liaise with the IT and database team to set up the remote monitoring unit for the Solar Home System Component.
- Interact and liaise with World Bank and arrange regular updates, briefings etc. in the area of M&E
- Supervise and monitor the project's overall implementation and
- Other related tasks that the coordinator may find necessary within this context.

***Deliverables/Specific Outputs Expected***

- Support establishment and operationalizing of the PMU Data Monitoring and Evaluation within 12 months of signing of the contract, in collaboration with the It and Database team
- Support institution of baseline for the evaluation of the Sindh Solar Energy Program, in collaboration with the external M&E firm hired.
- Monitor and coordinate reporting of all activities being implemented through the PMU in the form of monthly progress report, including report on gender-segregated beneficiaries' data on the outcomes of SSEP interventions
- Use innovative data collection tools (Telco and IT based, third party monitoring) to improve governance and accountability. Explore options to link both elements in M & E system.
- Assist in the designing, implementation and monitoring of impact evaluation for all SSEP component activities.
- Timely follow-ups on actions agreed with the World Bank Group Task Team.

***Profile /Qualifications***

- Master's degree in Management Sciences, Public Administration, and Business Administration, Systems designing or a related discipline.
- Solid understanding of monitoring and evaluation tools and mechanisms and its implementation in the field as evidenced in the relevant experience.
- Gender equity and equality would be given weightage.
- Familiarity with government departments and systems would be accorded
- Written and oral fluency in Urdu, and English. Fluency in Pushto shall be accorded due weightage

- Demonstrated Computer Skill (Proficiency in using computer desktop application MS Office (Word, Excel, and Power Point)).

***Institutional Arrangements and Reporting:***

It is recognized that activities may undergo with frequent changes in a view of dynamic environment and implementation operational & ground realities. Therefore, the M&E Specialist is expected to be flexible and adapt to requirement of process. The M&E Specialist will work in SSEP PMU and perform the assigned tasks and will report to the Project Director.

**IT Database Manager:**

***Rationale for hiring the IT Database Manager (ITDM)***

1. To serve as the focal point for all ITDM related activities identified under the program. To work with close liaison with the rest of the Program Managers, project teams, Energy Department, Government of Sindh, and World Bank consultants to achieve the objectives of the project.

***Scope of Work and Activities to Be Undertaken are but not limited to the following:***

Under guidance of the Project Director ITDM is responsible for learning and professional development of Government officials and project staff for improving outcomes of the project, the ITDM will be responsible for the following duties and responsibilities.

- (i) **Develop and document comprehensive Information Systems for information and communication technology related required to be put in place to support program objectives in collaboration with World Bank technical teams.**

To accomplish this manager will:

- a) Develop and document a comprehensive understanding of the fundamental business processes associated with the project.
  - b) Discuss with the vendors regarding business processes and needs for management information systems.
  - c) Review and document the current information systems capabilities, including hardware and software available, in-house data processing organization, resources, staff skills, status of current application systems and assess how well they can serve the ERP's system requirements.
  - d) Develop a citizen engagement strategy
  - e) Develop IT based tools for citizen engagement
  - f) Training staff in citizen engagement, data collection and analysis
- (ii) The consultant would determine the resources required for implementation of technology architecture. It would include:
  - a) Hardware, communications networks, systems software and application development, package customization costs including external and local consulting services.
  - b) Conversion costs, if applicable.
  - c) Ongoing operational, including maintenance costs if applicable; and
  - d) Trainings.
- (iii) The consultant would develop implementation plan for systems developed in house or outsourced, set priorities for systems development based on the strategic objectives and IT opportunities identified by management; and specify tentative implementation schedules.
- (iv) **Assist with the preparation of bidding documents.** In the area of bidding document preparation, the consultant will, among other things, assist the procurement team to review and revise the Technical Requirements Section of the Bidding Documents for clarity and for completeness.
- (v) **Review and comment on specific issues.** The consultant will review and comment on (a) bidder qualification criteria (financial, experience, technical capacities, etc.); (b) technical evaluation criteria and (if appropriate) a technical scoring scheme; (c) post qualification measures; (d) requirements for software development and other matters of intellectual property rights; and (e) conduct briefings and presentations to stakeholders and decision-takers, as required and appropriate.
- (vi) **Assist with bid evaluation.** During the process of bid evaluation, the consultant will, among other things, (a) participate in "Bid Clarification Meetings" related to Technology Architecture between Government and Bidders as part of the first stage technical proposal evaluations; (b)

- assist in the preparation of any addendum to the bidding documents; (c) assist to conduct briefings and presentations to stakeholders and decision-takers, as required and appropriate
- (vii) Monitor day-to-day implementation of the program activities, analyze problems that hamper their implementation and advise the coordinator on appropriate measures to ensure timely delivery of required outputs and achievement of measurable results related to Information and Communication Technology.
- (viii) Strengthen capacity of government and program officials on ICT issues and their preparation towards ICT usage at all levels through development of various training modules and reference materials
- (ix) Develop terms of reference and scope of work of the system assessments envisaged under the program; to assess the quality of the undertaken assessments and to provide operational recommendations for further systems' integration and development including identification of other target databases, institutional strengthening, and hardware procurement investments etc.
- (x) Carry out any additional task(s) assigned by project director to achieve the objectives of project.

#### ***Profile /Qualifications***

- A master's degree in Computer Sciences / MIS / Business Administration (specialization in IT) or with a major in a relevant discipline. MIS related qualification/certifications will be accorded due weightage
- At least 10 years' experience in IT field, after acquiring stipulated qualification, at the national level or with the International Organizations / Donor projects. (Including the Public sector ICT solutions).
- Very good understanding of government functioning, and protocols as evidenced in the past experience of candidate.
- Should have strong communication and problem-solving skills.
- Excellent technical and conceptual knowledge about MIS.
- Excellent grasp of public financial management principles and practices; and
- Prior work experience in crisis affected areas would be given weightage.
- Demonstrated Computer Skill (Proficiency in using computer desktop application MS Office (Word, Excel, and Power Point).
- Written and oral fluency in English is required. Proficiency in, Urdu shall be accorded due weightage
- Experience in information technology assessment and development and knowledge of relevant global practices.
- Experience in the area of information system applications with citizens servicing systems is advantage.

#### ***Institutional Arrangements and Reporting:***

It is recognized that activities may undergo with frequent changes in a view of dynamic environment and implementation operational & ground realities. Therefore, the ITDM is expected to be flexible and adapt to requirement of process. The ITDM will work in PMU to perform the assigned tasks and will report to the Project Director.

#### **Data Analyst:**

##### ***Scope of Work and Activities to Be Undertaken:***

- Assist team members with data collection and analysis pertaining to the performance of all three components.
- Develop monitoring plan in conjunction with latest technology tools such as telco-and GSM based platforms to develop monitoring plan for component 3.
- Coordinate with external consultants and private vendors to collect and compile data particularly that pertaining to component 3, Solar home systems
- Review the data and information systems (collection and maintenance) of the project
- Any other responsibilities assigned to him/her by the Project Director, project managers and Database manager.

#### ***Deliverables/Specific Outputs Expected***

- Monthly progress report of work program pertaining the component 3 and data received regarding number of systems installed, and performance of the systems.
- Minutes of all project meetings and consultations analyzed and kept.
- Analysis of all necessary data and information related to the project
- Improved information and data management systems of the PMU.

#### ***Qualifications***

- At least three years of experience of practical experience in the field
- Bachelor's degree in IT, Economics, Statistics
- Experience in working as part of a multidisciplinary team of experts and consultants.
- Excellent communication, analysis and writing skills.
- Fluency in English (oral and written) is a requirement.
- Excellent data management skills, advanced knowledge of MS Excel and STATA.

#### ***Institutional Arrangements and Reporting:***

It is recognized that activities may undergo frequent changes in a view of dynamic environment and implementation operational & ground realities. Therefore, the Data Analyst is expected to be flexible and adapt to requirement of process. The Data Analyst will work in SSEP PMU and perform the assigned tasks and will report to the Manager of Component 3; Solar Home System.

#### **Communication Officer (PPS-7):**

**Mode of Appointment:** Full time on contract basis

**Reporting Obligations:** The Communication Officer will report to the Project Director.

#### **Scope of Work:**

Communication officer will be responsible for but not limited to the following tasks:

1. Coordination with Stakeholder, Social, electronic media to highlight the project achievements
2. Monitor the Public Awareness campaigns.
3. Suggest the Value addition for benefits of the project.
4. Carryout any other assignment given by the Project Director pertaining to the Project.

#### **Qualification and Experience:**

The Communication Officer should have a bachelor's degree preferably with specialization in Media, Graphics etc. He should have at least 3 years relevant experience in a responsible position and have proven ability to communicate with high level government officials, media etc. Working knowledge of English and computer skills are required.

#### **E. Contract Duration**

The Communication Officer is expected to commence services initially for two years. The assignment is likely to be extended for life of Program depending upon satisfactory performance and the outputs envisaged in the TORs.

#### **Computer Operator (PPS-5):**

**Mode of Appointment:** Full time on contract basis

**Reporting Obligations:** The computer Operator will report to the Project Director.

#### **Scope of Work:**

Computer Operator will be responsible for but not limited to the following tasks:



1. Prepare data reports of all components of the Project.
2. Develop presentations on MS Office and MS Project management.
3. Prepare Monitoring reports on MS Project Software.
4. Carryout any other assignment given by the Project Director pertaining to the Project.

**Qualification and Experience:**

The computer Operator should have a bachelor's degree preferably in IT or Computer sciences with Diploma in Computer Science or IT or relevant field, in case of BCS /IT no need for Diploma course is required. He should have at least 3 years relevant experience in a responsible position and have proven ability to communicate with high level government officials., media etc. Working knowledge of English and computer skills are required.

**E. Contract Duration**

The Computer Operator is expected to commence services initially for one years. The assignment is likely to be extended for life of Program depending upon satisfactory performance and the outputs envisaged in the TORs.

**Receptionist (PPS-5):**

**Mode of Appointment:** Full time on contract basis

**Reporting Obligations:** The receptionist will report to the Administrative Officer.

**Scope of Work:**

Receptionist will be responsible for but not limited to the following tasks:

- i. Keep and maintain visitor's register at the Office reception.
- ii. Make sure that no office staff or visitor should stay at the reception area without any appropriate reason.
- iii. Maintain proper record of long-distance calls and note the personal calls of the staff separately as per procedures.
- iv. Maintain proper record of incoming and outgoing letters. Ensure ordinary letters are placed in mailboxes of relevant staff and urgent letters are passed on the tables of relevant staff.
- v. Regularly update and maintain telephone directory.
- vi. Attend office as and when required by your supervisor.
- vii. Monitor and ensure attendance registers both for the regular staff and interns
- viii. Maintain attendance data record and weekly update.
- ix. Maintain staff leave record and provide record & coordinate with Admin office
- x. Supervise Kitchen staff, coordinate meeting arrangements/refreshment etc.
- xi. Any other relevant duty assigned by the Administration.

**Qualification and Experience:**

The receptionist should have a bachelor's degree. Should have command in M/S Office operating system, with communication skills.

**E. Contract Duration**

The receptionist is expected to commence services initially for one years. The assignment is likely to be extended for life of Program depending upon satisfactory performance and the outputs envisaged in the TORs.

**Naib Qasid (PPS-1):**

**Mode of Appointment:** Full time on contract basis

**Reporting Obligations:** The Naib Qasid will report to the Admin Officer.

**Scope of Work:**

Naib Qasid will be responsible for Housekeeping; office works, and daily routine works assigned by the Administrative Section.

**Qualification and Experience:**

Preference will be given to a matriculate.

**E. Contract Duration**

Initially for one years. The assignment is likely to be extended for life of Program depending upon satisfactory performance and the outputs of the project.



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GOVERNMENT OF SINDH  
FINANCE DEPARTMENT

**OFFICE MEMORANDUM**

No.FD(SR-III)5-29/2008

Karachi, dated the 29<sup>th</sup> July, 2022

**SUBJECT: STANDARD PAY PACKAGE FOR THE PROJECT STAFF DIRECTLY RECRUITED FOR DEVELOPMENT PROJECTS FUNDED FROM PSDP**

In pursuance of Finance Division (Regulation Wing), Government of Pakistan, Islamabad Office Memorandum bearing No.F.4(9)R-14/2008, dated 18<sup>th</sup> April, 2022 and in continuation of this Department's Office Circular letter No.FD(SR-III)5-29/2008 (A), dated 16<sup>th</sup> February, 2009, dated 11<sup>th</sup> March, 2010 and dated 21<sup>st</sup> September, 2017, with the approval of Competent Authority (i.e. Chief Minister Sindh), Government of Sindh has been pleased to revise the Standard Pay package for officers / staff directly recruited from open market on the basis of Competitive Recruitment for the execution of Development Projects/Programs funded from Public Sector Development Program (PSDP) and Foreign Aided Projects/Programs with immediate effect:-

Project Pay Scale (PPS)	Regular BPS	Minimum (Rs.)	Increment @ 5% of the Minimum	Maximum (Rs.)
PPS-1	BPS 1-4	28,000	1400	44,800
PPS-2	BPS 5-8	35,000	1750	57,750
PPS-3	BPS 9-10	43,750	2190	70,030
PPS-4	BPS 11-13	52,500	2625	84,000
PPS-5	BPS 14-15	70,000	3500	112,000
PPS-6	BPS 16	105,000	5250	168,000
PPS-7	BPS 17	157,500	7875	252,000
PPS-8	BPS 18	218,750	10940	350,000
PPS-9	BPS 19	306,250	15315	490,030
PPS-10	BPS 20	437,500	21875	700,000
PPS-11	BPS 21	612,500	30625	980,000
PPS-12	BPS 22	875,000	43750	1400,000

2. The aforesaid pay package will be effective from **01.04.2022** for the new as well as the on-going / old development Projects and Programs shall be admissible subject to following conditions:-



(i) This pay package will be followed for the appointments of officers/staff including Project Directors, Advisors; Specialists; Consultants etc. in the PSDP funded development projects as reflected in the PC-I/PC-II, duly approved by the competent forum. Based on the sensitivity and size of the project, the Provincial Development Working Party (PDWP) shall decide on whether the Project Director is to be placed in PPS-10 or PPS-11 or PPS-12.

Contd.P/2



(2)

- (ii) The above lump sum pay package will be admissible for fresh/direct/existing employees of PSDP Projects. However, pay of the fresh/direct employees shall be fixed at the initial stage and thereafter an annual increase @ 5% of the Initial stage would be admissible.
- (iii) The pay of the existing PSDP funded projects employees shall be fixed to the next higher stage of the above pay package.
- (iv) Annual increment to the Project employees in Standard Pay Package shall be admissible on completion of one year continuous service from the date of appointment on the relevant post and also in the subsequent years in the same manner.
- (v) The above lump sum project pay package shall not in any way be less than the minimum rates of wages as revised from time to time.
- (vi) Government employees may apply for project posts. However, if any Government employee is selected on a project post, he/she will have to resign from Government service before appointment on project post.
- (vii) The relevant project approving forum, i.e PDWP will decide the number and pay scale of project staff.
- (viii) Adoption to Standard Pay Package-2022 shall require revision/approval of PC-1 from the competent forum.
- (ix) The Projects employees will be appointed on contract basis in PSDP projects for an initial period not exceeding two years which will be extendable further till the completion period of the project on yearly basis after evaluation of their performance.
- (x) No additional facility, in addition to the revised Standard Pay Package, shall be admissible for PSDP Projects' employees.
- (xi) This pay package shall not be admissible to those who are re-employed/appointed on contract after their retirement. They may be allowed pay and allowances, as per their terms and conditions of re-employment/re-appointed of the contract policy of the Government of Sindh as amended from time to time.
- (xii) Those retired Government servants who compete with others from the private sector for appointments against projects positions on the basis of open competition and are selected on merit should be entitled to the package, perks and privileges as per policy of Government of Sindh or as revised from time to time.
- (xiii) The project employees appointed through transfer (deputation) on full time basis will get pay in their own pay scales and allowances plus deputation allowance as admissible under the deputation policy as amended from time to time, at the rate of 20% of the basic pay subject to maximum. Rs.12,000/- per month or as revised from time to time.
- (xiv) The officers/officials granted additional charge of the posts of projects in addition to their own duties will be entitled to draw additional charge allowance @ 20% of the basic pay, in addition to their own pay/allowances of their regular posts subject to maximum Rs.12,000/- per month or as revised from time to time.  
This pay package will not be admissible those project employees whose services/posts are transferred to the non-development side after completion of the project, from the date of their transfer.



*[Handwritten signature]*  
29.7.22

Contd.P/3  
AJIAZ (SR-III)

- (xvi) The payment of pay package of project staff will be stopped from the date of transfer of their service/posts to any other Department.
- (xvii) On transfer of project posts to the non-development side, such posts shall be filled in the prescribed manner in regular Basic Pay Scale and incumbents of such posts shall be treated as fresh employees of the Departments and not for the projects.
- (xviii) If an employee of the project is selected on a post of the non-development side, he will be appointed at the initial stage of the relevant Basic Pay Scale, and his pay and service rendered in the project shall not be protected/counted for any purpose i.e. pay, pension and seniority etc.

3. The earlier instructions issued by Finance Department, Government of Sindh shall stand discontinued and replaced by this Office Memorandum to the above extent.



14313

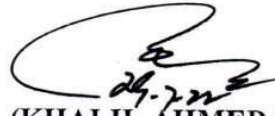
**SAJID JAMAL ABRO**  
**SECRETARY TO GOVT. OF SINDH**

No.FD (SR-III)5-29/2008

Karachi, dated the 29<sup>th</sup> July, 2022

A copy is forwarded for information & necessary action to:

1. The Chairman, Planning & Development Department, Government of Sindh.
2. All Additional Chief Secretaries to Government of Sindh.
3. The Senior Member, Board of Revenue, Sindh.
4. The Principal Secretary to Governor, Sindh, Karachi.
5. The Principal Secretary to Chief Minister Sindh.
6. All Administrative Secretaries to Government of Sindh.
7. The Secretary to Provincial Assembly Sindh.
8. The Section Officer (R-14), Finance Division, Regulation Wing, Government of Pakistan, Islamabad, w.r. to his O.M. number quoted above.
9. All Heads of Attached Departments, Sindh.
10. All Regional Heads of Department, Sindh.
11. All District & Sessions Judges, Sindh.
12. The Registrar, High Court of Sindh.
13. All Commissioners in Sindh.
14. The Registrar, Sindh Services Tribunal, Karachi.
15. The Secretary, Sindh Public Service Commission, Karachi.
16. The Secretary, Provincial Ombudsman Secretariat Sindh, Karachi.

  
(KHALIL AHMED SARAZ)  
Deputy Secretary (SR)



Contd.P/4  
AHJAZ (SR-III)



**Ghani**

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**From:** Oliver Knight <oknight@worldbank.org>  
**Sent:** Tuesday, 7 February 2023 9:30 pm  
**To:** Mehfooz Qazi  
**Cc:** 'Abdul Ghani'; SSEP Core Team  
**Subject:** RE: Revised PC-1 (Draft)  
**Attachments:** Revised PC-1 V12-Compared.docx

Dear Qazi sb,

Thank you for providing a further revised version (attached with tracked changes and some of our outstanding comments), and for the explanatory table below. Based on the fact you are balancing multiple demands, and the fact that we need to keep this process moving, I can confirm that we have No Objection to Version 12 of the revised PC-1. We note that you have sent this version to P&D Department, and we hope that they can approve it soon for onward distribution to federal Planning Commission.

We also provide the following comments for your consideration:

- The role and mandate of the Project Steering Committee is not covered, and we feel it would be good to do so to make clear their delegated authority – thus avoiding potential future need to revise the PC-1 again;
- For C3 you have put an upper cap of \$160. While this may be sufficient, stating a figure in the PC-1 seems unnecessary to us and restricts your flexibility later on;
- We still believe the PMU could be slimmer, and you have not accepted the WB requirement for Environment Officer and Social Development Officer to be separate positions.

Best regards,

Oliver Knight

**Oliver Knight**

Pakistan Energy Program Lead / Senior Energy Specialist

South Asia Energy Unit, World Bank

Phone: +1-202-674-0602

Email: [oknight@worldbank.org](mailto:oknight@worldbank.org)

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NO: /SMEO/(MEC)P&D/23/544.  
 GOVERNMENT OF SINDH  
 PLANNING & DEVELOPMENT DEPARTMENT  
 MONITORING & EVALUATION CELL  
Karachi  
 Dated: 10 January, 2023


To,

The Section Officer (DEV-II),  
 Finance Department,  
 Government of Sindh,  
Karachi.

**SUBJECT: REQUEST FOR MEC REPORT OF ON-GOING DEVELOPMENT SCHEME # 884**  
**NAMELY "SINDH SOLAR ENERGY PROJECT (SSEP)".**

With reference to your letter No.FD.SO(DEV-II)-10(1)/2018-19 dated 06.01.2023 on the subject matter, I am directed to inform that as per our record regarding the ADP Scheme No. 884 (2022-23) namely "Sindh Solar Energy Project (SSEP)" is Satisfactory till date.

2. It is submitted for your information and record please.

 10/Jan/2023  
 (Fatehdin Junejo)

Sector Monitoring & Evaluation Officer (Infra.)  
 (Khi./Hyd. Region)

Copy for Information:-

1. The Secretary, Energy Department, Govt. of Sindh, Karachi.
2. P.S. to AFS (Dev), Finance Department, Govt. of Sindh, Karachi.
3. P.S. to Director General, M&E Cell, Planning & Development Department, Govt. of Sindh, Karachi.
4. Office Copy.

## ANNEXRE – O

2023-24 (Locked)																	
S.#.	Component / Sub-Component	Q1			Q2		Q3			Q4			Allocation Cost (PKR)	Disbursement / Release Cost (PKR)	Expenditure Cost (PKR)		
		July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				
1	Utility Scale Solar													1,786.400	59.508	42.728	
1.1	Transaction Advisory Services													136.690		41.678	
1.2	Construction of Boundary Wall													866.080		0.000	
1.3	Supervision Engineering firm for Boundary wall													22.310		0.000	
1.4	ESMP Studies													5.800		0.000	
1.5	Regulatory Fees/Land fees													30.000		0.000	
1.6	Grid Interconnection Study for 400 MW													1.020		1.050	
1.7	Hybrid / Solar Park													725.000		0.000	
2	Distributed Solar													3,118.945	61.723	46.346	
2.1	Design, Supply, Install & Operate distributed Grid connected Solar PV systems on and around Public Sector Buildings (Round 1)													646.700		0.000	
2.2	Design, Supply, Install & Operate distributed Grid connected Solar PV systems on and around Public Sector Buildings (Round 2)													2,567.190		42.952	
2.3	Design, Supply, Install & Operate distributed Grid connected Solar PV systems on and around Public Sector Buildings (Round 3)													45.680		0.000	
2.4	Planning & Supervision firm - (Round 1)													34.210		3.394	
2.5	Planning & Supervision firm - (Round 2)													9.670		0.000	
2.6	Planning & Supervision firm - (Round 3)													15.410		0.000	
3	Solar Home Systems													3,380.820	15.524	0.000	
3.1	Social Mobilization and Consumer Awareness													115.280		0.000	
3.2	Third Party Monitoring													16.670		0.000	
3.3	Bulk Procurement of 70000 SHS kits													3,248.000		0.000	
3.4	SHS Database Solution													0.870		0.000	
4	Capacity Building and Technical Assistance													214.600	15.431	3.730	
4.1	Consultancy Services													36.950		3.730	
4.2	Internal Audit Firm													1.920		0.000	
4.3	Training of Solar Technicians													8.200		0.000	
4.4	Trainings Local & International													58.000		0.000	
4.5	Operating Expenses													23.200		0.000	
4.6	Laboratory/Quality Standards													86.340		0.000	
5	PMU Costs													117.879	29.469	13.480	
5.1	Project Management Cost													59.880		6.860	
5.2	Operating Expenses													48.400		6.620	
5.3	Physical Assets													9.600		0.000	
	Total													8,618.644	181.655	106.284	

**LIST OF COMMISSIONED CERTIFICATES**

<b>S.no</b>	<b>Name</b>
1	Dr Ruth KM Pfau Civil Hospital Karachi
2	PSAQSJ Medical Institute, Gambat
3	KMC Civil Hospital, Khairpur
4	Sindh Govt Lyari General Hospital Karachi
5	PMCH Nawab Shah
6	GMMMC, Sukkur
7	LUMHS, Hyderabad
8	DHQ Qamber Shahdadkot
9	Shahdadpur Institute of Medical sciences Sanghar
10	Taluka Hospital Sajawal
11	DHQ Umerkot
12	RBUT Hospital Shikarpur
13	DHQ Tando Allahyar
14	JPMC Karachi
15	Gadap City Hospital Karachi
16	Civil Hospital Dadu
17	Kohsar Hospital, Latifabad
18	DHQ Hospital Kotri
19	SGH Liaquatabad
20	SGH Korangi No 5
21	SGH Saudabad Malir Karachi
22	Syed Abdullah Shah Institute Sehwan
23	DHQ Hospital, Matiari
24	25 Bedded Korangi
25	Hepatitis Center Dadu
26	Dumba Goth Hospital Karachi
27	DHQ Tando Muhammad Khan
28	Civil Hospital Nausheroferoze
29	Indus Hospital Badin



## **SOLAR HOME SYSTEM CONFIGURATION & PERFORMANCE, QUALITY SPECIFICATIONS**

Qualifying SHSs must provide lighting, ventilation and mobile phone charging, at a minimum. Products that include appliances in addition to the items described in the below table also meet the minimum system configuration requirements.

The following table describes the minimum system configuration, specifications, and performance for each type of required energy service. Laboratory testing according to IEC TS 62257-9-5:2018 shall be conducted on this minimum system configuration (lighting, ventilation, and mobile phone charging) to validate that the minimum performance requirements are met by the system after one day of solar charging.

<b>Category</b>	<b>Minimum Specifications</b>	<b>Minimum Performance</b>	<b>Remarks</b>
Lighting	System includes at least three (3) fixed light points intended for indoor use.  Cables connecting light points to other system components must be at least 5 m in length	After one day of solar charging, system capable of providing at least 1680 lumen-hours per solar day of lighting service  (When used in combination with DC fan and smartphone charging)	Daily energy services estimated based on daily solar insolation of 5 kWh/m <sup>2</sup> , according to test methods specified in IEC TS 62257-9-5.
Ventilation	System includes at least one (1) DC fan (table, pedestal or ceiling) that has a metal body and base,	After one day of solar charging, system capable of powering included DC fan for at least 8 hours per day  Minimum service value for DC fans:  - Pedestal: 2.27 m <sup>3</sup> /min/W +/- 5%  - Table: 2.8 m <sup>3</sup> /min/W +/- 5%  - Ceiling: 6.66 m <sup>3</sup> /min/W +/- 5%  (When used in combination with lighting and smartphone charging)	DC pedestal and table fan combination solar run time and air flow measured while in oscillating mode.
Mobile Phone Charging	System capable of charging common models of basic mobile phones and smartphones.	After one day of solar charging, system capable of charging at least one smartphone per day  (When used in combination with lighting and ventilation)	Smartphone energy demand assumed to be 5.7 Wh.

Table 1. Quality requirements for SHSs

<b>Category</b>	<b>Metric</b>	<b>Quality Requirement</b>	
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<b>Truth In Advertising</b>	Manufacturer, Product Name and Model No.	Accurately specified	
	Performance Claims: Light Output, Run Time, Appliance Power Consumption	If reported, accurately specified. <sup>11</sup> If there are both pay-as-you-go (PAYG) and non-PAYG versions of a product, each must be truthfully advertised with respect to energy services provided.	
	Lamp Type, PV Power, Battery Capacity, Charger Rating, dc fan power rating, other Aspects	PV power must be accurately reported on the product packaging. All other aspects, if reported, must be accurately specified.	
	Fee-for-service or Pay-as-you-go (PAYG) metering	The PAYG system should be capable of accurately metering service to customers, so they reliably get the service that is paid for.	
	Ports	Port voltage and current specifications, if provided, must be accurate. Included appliances must function when connected to SHSs ports. Power output of ports must be sufficient to power appliances that are advertised but not included. Specific guidelines for USB and 12 V ports are below Ports of included appliances are not required to meet this standard.	
	Functionality	All advertised features must be functional. Any description of the product that appears on the packaging, inside the package and in any other medium (internet, etc.) should be truthful and accurate. No statements should mislead buyers or end users about the features or utility of the product. Any user interfaces (charge indicators, SOC estimates, etc.) must be accurate.	
<b>Lumen Maintenance</b>	Lumen Maintenance at 2,000 Hours	Average relative light output of 4 tested samples $\geq 90\%$ of initial light output at 2,000 hours with only one sample allowed to fall below 85% OR All samples maintain $\geq 95\%$ of light output at 1,000 hours If an included lighting appliance provides $\geq 15$ lumens, it is subject to the lumen maintenance standard.	

<b>Health and Safety</b>	Circuit and Overload Protection	The system must pass an overcurrent and an overload protection test. Products must include a current limiting mechanism to prevent irreversible damage to the system. The mechanism must be easily resettable or replaceable by the user or must automatically reset. If replaceable fuses are used for circuit protection, sizes must be labeled on the device and listed in the user manual, and, if fuses are replaceable by the user, at least one spare fuse must be included with the product. Included appliances are not required to meet this standard unless they have ports that are intended to provide power.	
	AC-DC Charger Safety	Any <i>included</i> AC-DC charger carries approval from a recognized consumer electronics safety certification organization	
	Wiring and Connector Safety	Wires, cables, and connectors must be appropriately sized for the expected current and voltage.	
	DC Fan	Meets IEC 60879:1986 & IEC 60335 standards	
	Hazardous Substances Ban	No battery may contain cadmium or mercury at levels greater than trace amounts (<0.0005% Hg and <0.002% Cd by weight in accordance with the EU Battery Directive)	
<b>Battery</b>	Battery Protection	All 4 tested samples are protected by an appropriate charge controller that prolongs battery life and protects the safety of the user. Lithium batteries must additionally carry UN 38.3 certification and have overcharge protection for individual cells or sets of parallel-connected cells. Batteries of included appliances must also meet this standard. For PAYG systems, appropriate battery protection must remain active regardless of whether the system is in an enabled or disabled state. To avoid damage to a battery during long-term periods of non-payment disabled system status, the solar module must be able to charge the battery even if the product is in a disabled state.	

Quality and Durability	Battery Durability	The average capacity loss of 4 tested samples must not exceed 25% and only one sample may have a capacity loss greater than 35% following the battery durability storage test. If an included lighting appliance provides $\geq 15$ lumens, it is subject to the battery durability standard. All other included appliances are not required to meet this standard.	
	PV Overvoltage Protection	If the battery is disconnected or isolated, the system must not be damaged, and the load terminals will maintain a voltage that is safe for their intended uses.	
	Miswiring Protection	The user interface should be designed to minimize the likelihood of making improper connections. If improper or reversed connections can easily be made, they should cause no damage to the system or harm to the user.	
	Physical Ingress Protection (for components containing electronics or electrical connections)	Fixed Outdoor Components	IP5x
		All PV Modules	IP3x OR IP2x with circuit protection
		All Other Components	IP2x
	Water Protection (For components containing electronics or electrical connections)	Fixed Outdoor Components	Permanent outdoor exposure: <i>IPx5 OR IPx3 with circuit protection</i>
		All PV Modules	Outdoor rooftop installation: <i>Modified IPx4 OR circuit protection</i>
		Portable Integrated Components	Frequent rain, which requires meeting one of: 1) <i>IPx3</i> 2) <i>IPx1 + technical protection</i> 3) <i>IPx1 + warning label</i> 4) <i>Technical protection + warning label</i>
		Portable Separate Components	Occasional rain: <i>IPx1 OR technical protection OR warning label</i>
		Fixed Indoor Components	No requirement
	Switch, Gooseneck, Moving Parts, and Connector Durability	Mechanisms expected to be used regularly	All 4 tested samples and any included appliances are functional after 1000 cycles.
		Mechanisms expected to be used primarily during installation.	All 4 tested samples and any included appliances are functional after 100 cycles.
	Stain Relief	All cables on all tested samples and any included appliances must pass a strain relief test.	



	Drop Test	Portable Components	<p>Portable lighting components: all 4 tested samples are functional after drop test (1 m onto concrete on six faces); none result in dangerous failures.</p> <p>Non-lighting portable appliances (such as fans and lights with light output below 15 lumens): 3 out of 4 samples are functional following a modified drop test requiring only 2 drops per sample rather than the standard 6 drops; none result in dangerous failures. The sides on which the product is dropped will be alternated between samples to ensure that all six sides are dropped at least once.</p>
		Fixed Indoor and Outdoor Components	No requirement
	Soldering and Electronics Quality	The system and any included appliances must be rated “Good” or “Fair” for workmanship quality as defined in Annex F of IEC TS 62257-9-5. At most, one sample may fail to function when initially evaluated.	
	Cable Specifications	Cables must be at least <b>3 m</b> long when connecting a “fixed indoor” or “portable separate” component to the PV module or any other fixed outdoor component. Any outdoor cables must be outdoor rated and UV resistant.	
<b>Consumer Information</b>	User Manual	User manual must present instructions for installation, use, and troubleshooting of the system. Installation instructions must include appropriate placement and installation of the PV module. Basic electrical safety and system maintenance must also be covered. Installation and operation instructions should be presented using language and graphics that can be understood by the typical consumer.	
	Component Specifications and Replacement Methods	<p>Consumer information must provide either:</p> <ol style="list-style-type: none"> <li>1) specifications for components that may require replacement (fuses, lights, PV, batteries) and instructions for replacement, OR</li> <li>2) directions as to how the consumer can get components, including the battery, replaced</li> </ol>	

		<p>at service centers, both during and post warranty, OR</p> <p>3) a clear consumer-facing statement that the batteries and other components are not replaceable.</p> <p>Detailed instructions or descriptions regarding replacing components may be included in the user manual, but a clear statement regarding the battery replacement must be included on the consumer-facing packaging. Accepted phrases are:</p> <ol style="list-style-type: none"> <li>1. Battery is field replaceable</li> <li>2. Battery may be serviced by manufacturer</li> </ol> <p>Battery is not replaceable</p>	
	Minimum Warranty Terms	Accurately specified and consumer-facing; minimum coverage of at least two years for the system and one year for most included appliances. Details are noted below.	

**LIST OF SHS SYSTEMS PROVIDED**

S No	SHS Code	Customer	CNIC	District
1	SHS-1975	Mohammad mehboob	45102-1955192-7	Ghotki
2	SHS-1974	Sher Mohammad	45102-9696375-3	Ghotki
3	SHS-1790	Zakir Hussain	45504-3066909-1	Ghotki
4	SHS-1538	Shazado	45102-6938432-5	Ghotki
5	SHS-1530	Ghulam Mohammad	45102-7376916-9	Ghotki
6	SHS-1477	Dewaan	45102-6786235-7	Ghotki
7	SHS-1451	Abdul Haleem	45102-8088739-3	Ghotki
8	SHS-1426	Fazal Mohammad	45102-7460620-9	Ghotki
9	SHS-1425	Nadir ali	45102-0388529-5	Ghotki
10	SHS-1391	Goss Bux	45102-8371317-1	Ghotki
11	SHS-1384	Mohammad Imran	45102-7622884-7	Ghotki
12	SHS-1351	abdul satar	45102-9632695-5	Ghotki
13	SHS-1350	noor mhamad	45102-2880478-3	Ghotki
14	SHS-633	Mehrab ali	45102-7653785-3	Ghotki
15	SHS-533	Raza Mohammad	45102-1419401-9	Ghotki
16	SHS-493	Ali mohammad	45102-1415710-9	Ghotki
17	SHS-366	Ali Hasan	45102-6292278-7	Ghotki
18	SHS-360	sikandar Ali	45102-0445454-1	Ghotki
19	SHS-316	pehlwan	45102-1443607-7	Ghotki
20	SHS-311	Allah wasayo	45102-6013476-9	Ghotki
21	SHS-2077	Muhammad Mithal	43103-1279393-5	Kashmore
22	SHS-2058	Raja Ram	4310310989733	Kashmore
23	SHS-2056	Rasheed Ahmed	4350303802215	Kashmore
24	SHS-2033	Zulifqar	43104-9696075-3	Kashmore
25	SHS-2030	Fida Hussain	43502-0376741-1	Kashmore
26	SHS-2019	Saeed Ahmed	43503-0413063-3	Kashmore
27	SHS-2009	Abdul Salam	4350305596329	Kashmore
28	SHS-2007	Abid Ali	4350405586159	Kashmore
29	SHS-2001	Dadlo	4310342886571	Kashmore
30	SHS-2000	Hakim U Din	4310312117845	Kashmore
31	SHS-1999	Saeed Khan	4310391324395	Kashmore
32	SHS-1946	Jalal U Din	43504-0445132-5	Kashmore
33	SHS-1963	Ghulam Ali	43503-0348399-7	Kashmore
34	SHS-1954	Mohammed Sachal	4350305011579	Kashmore
35	SHS-1953	Saddam Hussein	4350304669841	Kashmore

36	SHS-1949	Ghulam Server	43103-4106354-7	Kashmore
37	SHS-1933	Mir khan	43103-6415294-1	Kashmore
38	SHS-1932	Sharaf din	43502-0452560-3	Kashmore
39	SHS-1898	Ghulam Yaseen	4310348007225	Kashmore
40	SHS-1588	Zulifqar	4310353123813	Kashmore
41	SHS-1881	Bahdur Ali	4350404536157	Kashmore
42	SHS-1789	Amanullah	43504-0351923-9	Kashmore
43	SHS-1458	azhar ali shah	43503-0404881-7	Kashmore
44	SHS-1682	abdul Sattar	43503-0372834-7	Kashmore
45	SHS-1678	Qamardin	43503-0483089-5	Kashmore
46	SHS-1641	Sajid Ali	4350304941451	Kashmore
47	SHS-1640	Muhammad umar	4350304273407	Kashmore
48	SHS-1635	yar muhammad	43502-0369543-3	Kashmore
49	SHS-1627	Imdad Ali	43103-1408870-7	Kashmore
50	SHS-1626	Malho khan	43103-3514179-9	Kashmore
51	SHS-1623	Ashraf zaman	43503-0440877-3	Kashmore
52	SHS-1618	Ubedullah	43103-2529038-7	Kashmore
53	SHS-1608	Afzal hussain	4310319357821	Kashmore
54	SHS-1607	Luqaman khan	4310322676109	Kashmore
55	SHS-1595	Arbab Ali	43504-0385962-5	Kashmore
56	SHS-1594	Mataro	43504-0430194-7	Kashmore
57	SHS-1593	Ghulam Qadir	43104-056463-5	Kashmore
58	SHS-1547	Nisar Ahmed	4310314088943	Kashmore
59	SHS-1527	Sunder Kahan	43104-4025515-7	Kashmore
60	SHS-1519	Zanib Khatoon	43504-0633764-0	Kashmore
61	SHS-1498	Mhammad Jurial	43103-9808283-3	Kashmore
62	SHS-1493	Niaz Mohammad	43503-0441830-5	Kashmore
63	SHS-1479	Ghulam yasin	4310313976449	Kashmore
64	SHS-1463	Zafar Ali Mahar	4350304984271	Kashmore
65	SHS-1462	Hisham Din	4350203442607	Kashmore
66	SHS-1457	Sadiq Ali	4350404492379	Kashmore
67	SHS-1442	Asif Ali	4350303991377	Kashmore
68	SHS-1394	Parveez ALi	43502-0350128-3	Kashmore
69	SHS-1385	Shahzado Kahan Mangi	43503-0404210-3	Kashmore
70	SHS-1372	Imam Bux	43502-0350476-5	Kashmore
71	SHS-1339	Liaquat Ali	43103-1395492-7	Kashmore
72	SHS-1280	Shahzado	43103-8461033-5	Kashmore
73	SHS-1244	Ameer Muhammad	43503-0391652-7	Kashmore
74	SHS-1027	Jamal khan	43104-8636040-3	Kashmore

75	SHS-923	Nisar din	43504-0509380-9	Kashmore
76	SHS-810	Peer bux	43104-0566194-7	Kashmore
77	SHS-789	Rashadan khatoon	43504-0749273-8	Kashmore
78	SHS-704	Murad Ali	43105-1810665-5	Kashmore
79	SHS-675	Nisar Ahmed	43103-0176706-1	Kashmore
80	SHS-642	Gulbahar	43503-0378348-1	Kashmore
81	SHS-592	irshad Ali	43502-0422040-1	Kashmore
82	SHS-584	Najeebullah	43502-0363492-1	Kashmore
83	SHS-570	Abdul Samad	43503-0440618-3	Kashmore
84	SHS-566	Jumoo Kahan	43105-8238016-3	Kashmore
85	SHS-561	Khanzadi	43504-0611374-6	Kashmore
86	SHS-508	Mir Hussain Ahmed Sundrani	43103-1955933-5	Kashmore
87	SHS-503	Imam Bux	43502-0350556-7	Kashmore
88	SHS-397	Shoukat Ali	43103-5220488-2	Kashmore
89	SHS-381	Ghulam Shabir	43103-8614117-3	Kashmore
90	SHS-379	Mumtaz Ali	43103-3816372-7	Kashmore
91	SHS-332	Nawab Ahmed	43503-0360163-1	Kashmore
92	SHS-331	Barkat Ali	43503-0434646-9	Kashmore
93	SHS-326	Ali sheer	43103-4692270-5	Kashmore
94	SHS-325	Parveez Ali	43103-3870441-5	Kashmore
95	SHS-322	Shahzado	43502-0382685-3	Kashmore
96	SHS-319	Noor Ahmed	43502-0370325-9	Kashmore
97	SHS-286	Ghulam Mustafa	43103-1354339-5	Kashmore
98	SHS-285	Chakar Kahan	43502-0405938-9	Kashmore
99	SHS-273	Ghulam Serwar	43502-0370989-7	Kashmore
100	SHS-196	Ihsan ali	43502-0369650-1	Kashmore
101	SHS-192	Sohrab	43103-3242034-1	Kashmore
102	SHS-191	Asadullah Bajkani	43503-0398359-9	Kashmore
103	SHS-112	Gul Faraz	43504-0445950-3	Kashmore
104	SHS-82	Najam Din	43103-1536588-7	Kashmore
105	SHS-63	Noor Muhammad Golo	43504-0375619-7	Kashmore
106	SHS-60	Ali Asghar	43103-9312307-5	Kashmore
107	SHS-50	Muhammad Esa Chachar	43103-1396386-3	Kashmore
108	SHS-47	Ali Akbar	43503-0374903-1	Kashmore
109	SHS-44	Muhammad Sadique	43103-1401734-9	Kashmore
110	SHS-2335	Dilmurad Ali	43103-5326961-7	Jacobabad
111	SHS-2321	Muhammad Yousif	43105-7103186-9	Jacobabad
112	SHS-2309	Sadar Din	43103-8416126-5	Kashmore
113	SHS-2308	Abdul Ghaffar	43503-0547189-9	Kashmore



114	SHS-2307	Baqa Mohammed	43503-0444072-5	Kashmore
115	SHS-2306	Basit Ali	43503-0466160-3	Kashmore
116	SHS-2305	Gul Hassan	43103-1223898-7	Kashmore
117	SHS-2304	Ghalib Hussain	43504-0557255-3	Kashmore
118	SHS-2300	Afzal khan	43503-0527669-5	Kashmore
119	SHS-2275	Ihsan Ali	4350203867739	Kashmore
120	SHS-2273	Muhamamd Panah	4350303732981	Kashmore
121	SHS-2266	Mohammed Essa	4310385394819	Kashmore
122	SHS-2265	Wajid Ali	4350204729715	Kashmore
123	SHS-2263	Sher Jan	4350303588497	Kashmore
124	SHS-2261	Ali Mardan	4310514342869	Jacobabad
125	SHS-2260	Jan Mohammed	4310394898635	Kashmore
126	SHS-2259	Mazhar Ali	4310354888301	Kashmore
127	SHS-2255	ali gul	43502-0439349-1	Kashmore
128	SHS-2253	Nimatullah	43103-1412373-3	Kashmore
129	SHS-2252	Raja Kahan	43503-0390485-5	Kashmore
130	SHS-2250	Abdullah	43103-1412052-1	Kashmore
131	SHS-2245	Amir Bux ogahi	43103-6560570-1	Kashmore
132	SHS-2244	Khadim Hussain	43105-4621047-3	Jacobabad
133	SHS-2243	Umeed Ali	43503-0470509-3	Kashmore
134	SHS-2237	Ghulam Yadsin	43105-9868924-4	Jacobabad
135	SHS-2234	Dilmurad	43103-1396265-1	Kashmore
136	SHS-2233	Parveezan khatoon	43504-0719023-8	Kashmore
137	SHS-2226	Ghulam Sarwar	43105-7691535-9	Jacobabad
138	SHS-2216	Sadam Hussain	4350404061577	Kashmore
139	SHS-2215	Haneefan	4350406753806	Kashmore
140	SHS-2213	Shahzadi	4350406353190	Kashmore
141	SHS-2212	Rukhsana	4350407533222	Kashmore
142	SHS-2209	Qadir bux	43504-0340582-3	Kashmore
143	SHS-2207	Dhall kahan	43503-0428185-5	Kashmore
144	SHS-2206	Muhammad Aslam	43103-3434356-9	Kashmore
145	SHS-2204	Hussain Ahmed	4310309837273	Kashmore
146	SHS-2187	Arbelo khan	4350303916073	Kashmore
147	SHS-2186	Rafique Ahmed	43503-0456319-7	Kashmore
148	SHS-2175	Saira	43503-0683017-8	Kashmore
149	SHS-2173	Ahsanullah	4310327786973	Kashmore
150	SHS-2164	Jeeal	4350304022951	Kashmore
151	SHS-2155	Mahtab Ali	4350305432547	Kashmore
152	SHS-2146	Mukhtyar Ahmed	4350403913715	Kashmore

153	SHS-2145	Mohammed Rafeeq	4350403901781	Kashmore
154	SHS-2144	Zafar Ali	4350404649865	Kashmore
155	SHS-2143	Abdul Lateef	4350404670003	Kashmore
156	SHS-2142	Mohammed Mital	4350403762141	Kashmore
157	SHS-2141	Qurban Ali	4350403840229	Kashmore
158	SHS-2140	Ghulam Rasool	4350403550783	Kashmore
159	SHS-2139	Khameeso khan	4350404285619	Kashmore
160	SHS-2138	Alif Khan	4350403926489	Kashmore
161	SHS-2137	Wazeer Ahmed	4350403925787	Kashmore
162	SHS-2125	Ali Dost	4350304285539	Kashmore
163	SHS-2124	Liaqat Ali	43503-0555412-5	Kashmore
164	SHS-2123	Abdul Qayoom	4350303687159	Kashmore
165	SHS-2121	Hakim Ali	4310303234055	Kashmore
166	SHS-2119	Dildar	4350303776575	Kashmore
167	SHS-2107	Rasheed Ahmed	4350303604651	Kashmore
168	SHS-2096	zahid kahan	43503-0438969-5	Kashmore
169	SHS-2085	Syd Adil Shah	43504-0405887-9	Kashmore
170	SHS-2076	Deedar ALi	43104-0564176-3	Kashmore
171	SHS-1961	Ghulam Mustafa Mirani	43103-2274214-7	Kashmore
172	SHS-1959	Muhammad Ibrahim	43503-0391803-5	Kashmore
173	SHS-1908	Saleemullah	4310313987365	Kashmore
174	SHS-1863	Asghar Ali	4310405586583	Kashmore
175	SHS-1755	Naddir Ali	43105-5636670-9	Jacobabad
176	SHS-1754	Junid Ahmed	43105-5954475-7	Jacobabad
177	SHS-1592	Ghulam Sarwar	43105-0431414-9	Jacobabad
178	SHS-1556	Israr Ahmed	43105-2001359-3	Jacobabad
179	SHS-1512	Manzoor Ahmed	4310395317547	Kashmore
180	SHS-2225	Ghulam Qadir	4310599047729	Jacobabad
181	SHS-1421	Asghar Ali	43103-0324769-7	Kashmore
182	SHS-1396	Jamal Din	43105-3645842-3	Jacobabad
183	SHS-1393	Ghazi Kahan	43105-4659700-5	Jacobabad
184	SHS-1392	Abdul Hafeez	43105-4899633-9	Jacobabad
185	SHS-1278	RESHMAN	43503-0745475-0	Kashmore
186	SHS-690	Manzoor Ahmed	43103-9795188-1	Kashmore
187	SHS-429	Aijaz Ahmed	43502-0343596-5	Kashmore
188	SHS-162	Dil Murad	43503-0496937-7	Kashmore
189	SHS-114	Shahid Ali Malik	43103-3747485-1	Kashmore
190	SHS-2163	Ashfaq Brohi	4190203397825	Sujawal
191	SHS-1973	Anwar Khaskheli	41904-0362209-7	Sujawal

192	SHS-1966	Muhammad Ashraf Brohi	41405-5486868-3	Sujawal
193	SHS-1680	Allah Bachayo Soho	41405-7376432-5	Sujawal
194	SHS-1679	Riaz Ahmed Mirbehar	41408-5439436-1	Sujawal
195	SHS-1597	Muhammad Khan Abro	41405-3936097-1	Sujawal
196	SHS-1536	Alam Khan Soho	41405-2479755-1	Sujawal
197	SHS-1447	Ali Muhammad Hathyar	41408-1361093-1	Sujawal
198	SHS-2352	Hameedan kunbhar	4420284274078	Sanghar
199	SHS-2332	Naseeban hajam	4420258334844	Sanghar
200	SHS-1277	Maindhro Menghwar	4420582907685	Sanghar
201	SHS-1276	Husna Khaskheli	4420556227298	Sanghar
202	SHS-1275	Khan Mohammad Khaskheli	4420553247083	Sanghar
203	SHS-1274	Amniyo Menghwar	4420346633773	Sanghar
204	SHS-1273	Ghulam Abbas Rind	4420323975939	Sanghar
205	SHS-1272	Naseeb Khatoon	4420395004692	Sanghar
206	SHS-1271	Shanan Chandio	4420373515818	Sanghar
207	SHS-1270	Nawab Ali Chand	4420365514249	Sanghar
208	SHS-1269	Hussain Bux Talpur	4420441580305	Sanghar
209	SHS-1268	Ahmed Ali Chanhion	4420502547903	Sanghar
210	SHS-1267	Muhammad Ishaque Chaniho	4420577815811	Sanghar
211	SHS-1266	Rafiq Talpur	4420597959070	Sanghar
212	SHS-1265	Mukhtiyar Ali Zardari	4420420213967	Sanghar
213	SHS-1264	Lalee Kunbhar	4420243036378	Sanghar
214	SHS-1263	Meena Menghwar	4440182505366	Sanghar
215	SHS-1262	Wishdeev Meghwar	4420236198943	Sanghar
216	SHS-1261	Ramesh Kumar Meghwar	4420207770425	Sanghar
217	SHS-1260	Jarina Bheel	4420209719420	Sanghar
218	SHS-1259	Indran Menghwar	4420254307022	Sanghar
219	SHS-1258	Mumtaz Ali Chanhion	4420201648211	Sanghar
220	SHS-1257	Mismat Jeejal Rajar	4420227775852	Sanghar
221	SHS-1256	Bheemon Bheel	4420296492269	Sanghar
222	SHS-1255	Babu Bheel	4420251564775	Sanghar
223	SHS-1254	Gordan Bheel	4420295271961	Sanghar
224	SHS-1237	Qurban Ali Mangrio	4410903467243	Sanghar
225	SHS-1236	Niaz Muhammad	4420113505049	Sanghar
226	SHS-1235	Soomri	4420510277622	Sanghar
227	SHS-1234	Bhoori	4420242691334	Sanghar
228	SHS-1233	Sameena Dahri	4420401967044	Sanghar
229	SHS-1232	Gulzar Khan Jutt	4420214107823	Sanghar
230	SHS-1201	Soomri Bheel	4420245705882	Sanghar

231	SHS-1200	Giyan	4420278388157	Sanghar
232	SHS-1199	Muhammad Yousif	4420262970493	Sanghar
233	SHS-1198	Molchand Oad	4420229638955	Sanghar
234	SHS-1197	Nawaz Ali Gaju	4420249836797	Sanghar
235	SHS-1196	Zahid Akhter Shah	4420251693665	Sanghar
236	SHS-1195	Nasira	4420301192580	Sanghar
237	SHS-1194	Maria Rind Baloch	4420296179924	Sanghar
238	SHS-1193	Nasiban	4420257891462	Sanghar
239	SHS-1192	Ajat Chanio	4420299431052	Sanghar
240	SHS-1191	Momal Meghwar	4420240644206	Sanghar
241	SHS-1190	Shabana	4420369296870	Sanghar
242	SHS-1189	Aisha Dall	4420290576056	Sanghar
243	SHS-1188	Niaz Muhammad Gajoo	4420286356383	Sanghar
244	SHS-1187	Sundri	4420259917660	Sanghar
245	SHS-1186	Sulah Rajar	4420220222606	Sanghar
246	SHS-1185	Subhan Bheel	4420243506822	Sanghar
247	SHS-1184	Noor Bano	4420343881896	Sanghar
248	SHS-1183	Ajaz Ali	4420370237867	Sanghar
249	SHS-1182	Sarwat Javeed	4420337395174	Sanghar
250	SHS-1181	Shahbaz Hussain	4420397177455	Sanghar
251	SHS-1180	Punhoon Khan	4420381005749	Sanghar
252	SHS-1179	Muhammad Khan	4420295781109	Sanghar
253	SHS-1178	Wadhan Hajam	4420248033862	Sanghar
254	SHS-1177	Chandra Oad	4440148463036	Sanghar
255	SHS-1176	Javed Solangi	4420241253599	Sanghar
256	SHS-1175	Sarwan Oad	4420280397025	Sanghar
257	SHS-1174	Noor Bano	4420192173136	Sanghar
258	SHS-1173	Sodhi Dahri	4420440867060	Sanghar
259	SHS-1172	Saleem Akhtar	4420552979361	Sanghar
260	SHS-1171	Babri Bheel	4420221913434	Sanghar
261	SHS-1170	Udham Das	4420258387801	Sanghar
262	SHS-1169	Awais Akhtar shah	4420205953291	Sanghar
263	SHS-1168	Lali Bheel	4420265436276	Sanghar
264	SHS-1167	Hajyani Hajam	4420204051224	Sanghar
265	SHS-1166	Zubeeda	4420121873820	Sanghar
266	SHS-1165	Bibi Amina Syed	4420282871946	Sanghar
267	SHS-1164	Abida	4420371317630	Sanghar
268	SHS-1163	Eid Hingoro	4420282394180	Sanghar
269	SHS-1162	Muhammad Shoaib	4420305219149	Sanghar

270	SHS-1161	Amina Oad	4420243064646	Sanghar
271	SHS-1160	Khemchand Kolhi	4420276381693	Sanghar
272	SHS-1159	Asmat Rajar	4420220685150	Sanghar
273	SHS-1158	Khushal Das Deewan	4420277956985	Sanghar
274	SHS-1157	Muhammad Rajub Dars	4420252156775	Sanghar
275	SHS-1156	Sakina	4420227776802	Sanghar
276	SHS-1155	Devi	4420299923628	Sanghar
277	SHS-1154	Majeedan Rajar	4420377872626	Sanghar
278	SHS-1153	Latifan Kumbhar	4420208862468	Sanghar
279	SHS-1152	Nimmy	4420409023352	Sanghar
280	SHS-1151	Umat Hingorjo	4420209869766	Sanghar
281	SHS-1150	Shehnaz	4420282699054	Sanghar
282	SHS-1149	Chetan Kolhi	4420271907975	Sanghar
283	SHS-1148	Parsa Oad	4420384838952	Sanghar
284	SHS-1147	Jan Muhammad Dars	4420251298811	Sanghar
285	SHS-1146	Khatijan Shah	4420263584716	Sanghar
286	SHS-1145	Malookan	4420217131308	Sanghar
287	SHS-1144	Bakhti Bheel	4420304011843	Sanghar
288	SHS-1143	Zareena Bheel	4420260618004	Sanghar
289	SHS-1142	Jadal Das	4420219341998	Sanghar
290	SHS-1141	Rukhi	4420273474436	Sanghar
291	SHS-1140	Sahjat	4420299045476	Sanghar
292	SHS-1139	Rustam Mari	4420271661207	Sanghar
293	SHS-1138	Haryan Meghwar	4420213025458	Sanghar
294	SHS-1059	ALMAS BIBI	4420387548528	Sanghar
295	SHS-1052	RAZAQUE MASEEH	4420313233242	Sanghar
296	SHS-1050	ZAHIDAN	4420357475640	Sanghar
297	SHS-1049	AIJAZ HUSSAIN	4420588396211	Sanghar
298	SHS-1048	ISHAQ	4420574892882	Sanghar
299	SHS-1047	RAHEEMAN	4420376622742	Sanghar
300	SHS-1046	GHOURI	4420545800724	Sanghar
301	SHS-1045	UMEDAN	4420509105700	Sanghar
302	SHS-1044	NOOR GUL	4420578371373	Sanghar
303	SHS-1043	ALTAAF	4420507823935	Sanghar
304	SHS-1042	HUBDAR ALI	4420413455781	Sanghar
305	SHS-1041	DILSHAD	4420510765029	Sanghar
306	SHS-1040	MUHAMMAD SHARIF	4420559705615	Sanghar
307	SHS-1039	AMREEN	4420376351674	Sanghar
308	SHS-1038	PANAH KHATOON	4420180425026	Sanghar



309	SHS-1037	GANOOR KHATOON	4420149539812	Sanghar
310	SHS-1036	GHANSHAAM	4420572119057	Sanghar
311	SHS-1035	TEERATH	4420526439479	Sanghar
312	SHS-1034	JULLI	4420147882002	Sanghar
313	SHS-1033	NAWAB ZADI	4420540578206	Sanghar
314	SHS-1023	IMRAN KHAN	4420322847109	Sanghar
315	SHS-1018	PEHLAJ	4420538625669	Sanghar
316	SHS-1011	SHAVO	4420311678807	Sanghar
317	SHS-1007	ZULFIQAR ALI METLO	4420509711737	Sanghar
318	SHS-1001	NAND LAL	4420572061885	Sanghar
319	SHS-998	IMRAN	4420533420871	Sanghar
320	SHS-930	Zaheer Ahmed	4420505046878	Sanghar
321	SHS-928	Rashid Hussain	4420534257449	Sanghar
322	SHS-927	Nazia	4420522338202	Sanghar

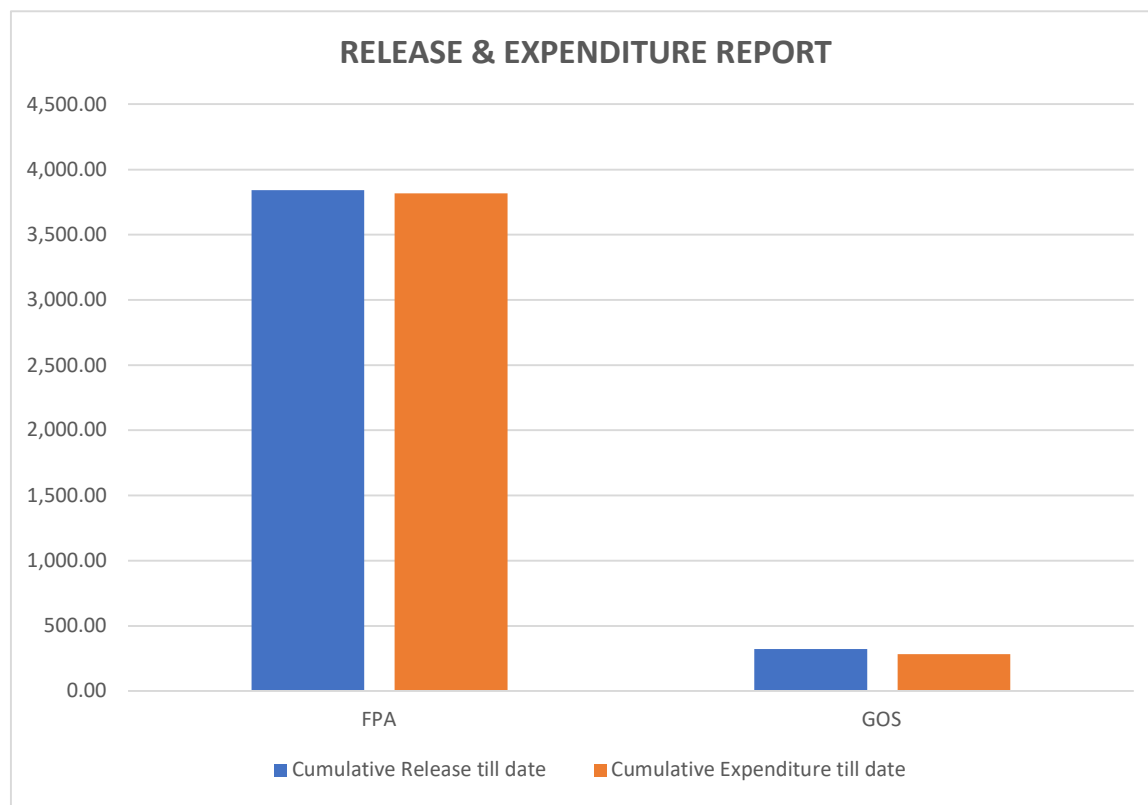
### **SOLAR HOME SYSTEM'S DESIGN CRITERIA**

- 1. All components required to provide basic energy services are installed as a kit:**
  - PV module(s), charge control unit(s), battery/batteries
  - Cables, switches, connectors, and protective devices sufficient to connect the PV module(s), charge control unit(s) and battery/batteries
  - Loads (optional): Lighting and requisite cables, load adapter cables (e.g., for mobile phones), and other appliances (dc fan) and their requisite cables
- 2. The PV module maximum power point voltage and the working voltage of any other components in the kit shall not exceed 35 V DC.**
- 3. Only DC systems, outputs, and loads are covered.** No inverters, systems with AC outputs/outlets, or AC appliances are eligible.
- 4. The peak power rating of the PV module shall be less than or up to 350 watts.**
- 5. No design expertise is required to choose appropriate system components.** All electrical connections, except for permanent connections made at the time of installation, can be made without the use of tools. Installation and operation instructions should be presented using language and graphics that can be understood by the typical consumer.

## **RELEASE EXPENDITURE REPORT**

**AS OF SEPTEMBER 15<sup>TH</sup> 2023**

	Cumulative Release	Cumulative Expenditure
<b>FPA</b>	3,841.74 M	3,815.91 M
<b>GOS</b>	322.47 M	283.04 M



Certificate Reference # Pantera/DHQ/02

**COMMISSIONING CERTIFICATE**

We hereby confirm that **M/s Pantera Energy** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

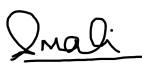
**Project Details:**

**Project Name:** 93.38 KW Grid-Tied Solar System at DHQ Matiari Hospital

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	DHQ Hospital	Jinko Solar 460W	203	GoodWe 80 KW	01	93.38 KWp
<b>Total</b>			203		01	93.38 KWp

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature :   
 Name : Syed Ali  
 Designation : Project Manager/Senior Advisor  
 Certificate Issuance Date : 29<sup>th</sup> December 2021

**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

Certificate Reference # Pantera/Gambat

**COMMISSIONING CERTIFICATE**

We hereby confirm that **M/S Pantera Energy** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

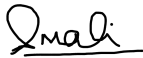
**Project Details:**

Project Name: **1279.82 KW Grid-Tied Solar System at Pir Syed Abdul Qadir Shah Jeelani Medical Institute, Gambat**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	RRC	Longi Solar 445W	326	GoodWe 80kW GoodWe 50kW	1 1	145.07 kWp
2	RRC Parking Area	Longi Solar 445W	132	GoodWe 25kW	2	58.74 kWp
3	Boys Hostel Parking Area	Longi Solar 445W	2418	GoodWe 80kW	12	1076.01 kWp
<b>Total</b>			<b>2876</b>		<b>16</b>	<b>1279.82 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 30<sup>th</sup> March 2022

**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.



Certificate Reference # Pantera/KMC Khaipur

**COMMISSIONING CERTIFICATE**

We hereby confirm that **M/S Pantera Energy** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

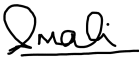
**Project Details:**

Project Name: **1176.53 KW Grid-Tied Solar System at KMC Civil Hospital Khaipur**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	City Hospital	Jinko Solar 525W	286	GoodWe 80kW GoodWe 60kW	1 1	150.15kWp
2	Lady Willington	Jinko Solar 525W	261	GoodWe 60kW	2	137.025 kWp
3	Admin Block	Jinko Solar 525W	48	GoodWe 25kW	1	25.2 kWp
4	ICU	Jinko Solar 525W	51	GoodWe 25kW	1	26.775 kWp
5	Corona Ward	Jinko Solar 525W	67	GoodWe 30kW	1	35.175 kWp
6	KMC Main Building	Jinko Solar 525W	1072	GoodWe 80kW	6	562.8 kWp
7	Building-1/Warehouse	Jinko Solar 525W	232	GoodWe 60kW GoodWe 50kW	1 1	121.8 kWp
8	Eye Ward	Jinko Solar 525W	142	GoodWe 80kW	1	74.55 kWp
9	Building -2/MRI	Jinko Solar 525W	82	GoodWe 36kW	1	43.05 kWp
<b>Total</b>			<b>2241</b>		<b>17</b>	<b>1176.53 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

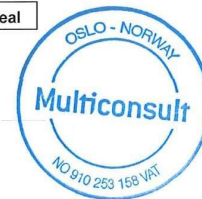
Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 30<sup>th</sup> March 2022

Seal

**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

Certificate Reference # Pantera/Kohsar/05

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Pantera Energy** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

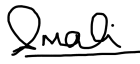
### Project Details:

Project Name: **275.1 KW Grid-Tied Solar System at Kohsar Hospital Latifabad**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Kohsar Hospital	Jinko Solar 525W	524	GoodWe 60 KW	04	275.1 KWp
<b>Total</b>			<b>524</b>		<b>01</b>	<b>275.1 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 30<sup>th</sup> March 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

Certificate Reference # Pantera/SGH/03

**COMMISSIONING CERTIFICATE**

We hereby confirm that **M/s Pantera Energy** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

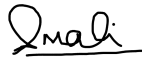
**Project Details:**

**Project Name:** 245.16 KW Grid-Tied Solar System at SGH Liaquatabad

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	DHQ Hospital	Canadian solar 540W	454	GoodWe 100 KW	01	245.16 KWp
				GoodWe 60 KW	01	
<b>Total</b>			454		02	245.16 KWp

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature : 

Name : Syed Ali

Designation : Project Manager/Senior Advisor

Certificate Issuance Date : 29<sup>th</sup> December 2021

**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

Certificate Reference # Pantera/SGH/01

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/s Pantera Energy** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted “Sindh Solar Energy Project – Component II”.

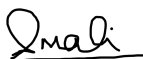
### Project Details:

Project Name: **239.76KW Grid-Tied Solar System at SGH Korangi Hospital**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	SGH Hospital	Canadian Solar 540W	444	GoodWe 80 KW	02	239.76KWp
				GoodWe 50 KW	01	
<b>Total</b>			444		03	239.76KWp

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature : 

Name : Syed Ali

Designation : Project Manager/Senior Advisor

Certificate Issuance Date : **29<sup>th</sup> December 2021**

Seal



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Pantera Energy** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II". Previously, Provisional commissioning certificate was issued for this site due to undersized transformer at site resulting in capping of the inverter at reduced capacity. The transformer has been installed by the concerned DISCO and the inverters are now operating at the full capacity.

### Project Details:

Project Name: **816.04 KW Grid-Tied Solar System at GMCC Hospital Sukkur**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	GMCC Hospital	Jinko Solar 460W	1,774	GoodWe 80kW	6	816.04kWp
				GoodWe 60kW	2	
				GoodWe 50kW	2	
				GoodWe 25kW	2	
<b>Total</b>			<b>1,774</b>		<b>12</b>	<b>816.04 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.



Signature and Stamp : Syed Ali

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 29<sup>th</sup> December 2021 (Provisional) & 21<sup>st</sup> November 2022 (Final Commissioning)

### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.



## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Pantera Energy** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II". Previously, Provisional commissioning certificate was issued for this site due to undersized transformer at site resulting in capping of the inverter at reduced capacity. The transformer has been installed by the concerned DISCO and the inverters are now operating at the full capacity.

### Project Details:

Project Name: **767.63 KW Grid-Tied Solar System at LUMHS Hyderabad**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	LUMHS Hospital	Canadian Solar 445W	1,725	GoodWe 80kW GoodWe 60kW GoodWe 50kW GoodWe 30kW	6 1 3 1	767.63kWp
<b>Total</b>			<b>1,725</b>		<b>11</b>	<b>767.63 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 29<sup>th</sup> December 2021 (Provisional) & 7<sup>th</sup> November 2022 (Final Commissioning)

### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.



Certificate Reference # SolarTech/DG/01

**COMMISSIONING CERTIFICATE**

We hereby confirm that **M/S Solar Tech (Private) Limited** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

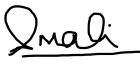
**Project Details:**

Project Name: **50.160 KW Grid-Tied Solar System at Basic Health Unit Dumba Goth, Karachi**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Main Building	JA Solar 440W	114	Sofar Solar 50 KW	01	50.160 KW
<b>Total</b>			<b>114</b>		<b>01</b>	<b>50.160 KW</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 30<sup>th</sup> March 2022

Seal

**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

Certificate Reference # SolarTech/Kotri/01

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Solar Tech (Private) Limited** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

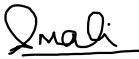
### Project Details:

Project Name: **250.65 KW Grid-Tied Solar System at DHQ Hospital, Kotri**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Main Building	JA Solar 450W	557	Sofar Solar 50 KW	05	250.65 KW
<b>Total</b>			<b>557</b>		<b>05</b>	<b>250.65 KW</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 30<sup>th</sup> March 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Solar Tech (Private) Limited** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

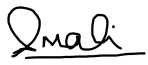
### Project Details:

Project Name: **200.25 KW Grid-Tied Solar System at Abdullah Shah Institute, Sehwan**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Main Building	JA Solar 445W	338	Sofar Solar 50 KW	03	150.41 KWp
2	NICVD	JA Solar 445W	112	Sofar Solar 50 KW	01	49.84 kWp
<b>Total</b>			<b>450</b>		<b>04</b>	<b>200.25 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 31<sup>st</sup> May 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Solar Tech (Private) Limited** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

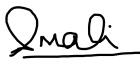
### Project Details:

Project Name: **400.18 KW Grid-Tied Solar System at 50 Bedded DHQ Hospital Gadap, Karachi**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Main Building Ground	JA Solar 535W	748	Sofar Solar 50 KW	07	400.18 KWp
<b>Total</b>			<b>748</b>		<b>07</b>	<b>400.18 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 10<sup>th</sup> June 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.



Certificate Reference # SolarTech/Shikarpur/01

**COMMISSIONING CERTIFICATE**

We hereby confirm that **M/S Solar Tech (Private) Limited** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

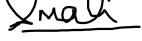
**Project Details:**

Project Name: **549.98 KW Grid-Tied Solar System at RBUT Civil Hospital, Shikarpur**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Main Building	JA Solar 535W	1028	Sofar Solar 110 KW Sofar Solar 50 KW	04 01	549.980 KWp
<b>Total</b>			<b>1028</b>		<b>05</b>	<b>549.980 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 5<sup>th</sup> August 2022

Seal

**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Zonergy (Tianjin) Company Limited** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

### Project Details:

Project Name: **501.84 KW Grid-Tied Solar System at Civil Hospital, Sujawal**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Civil Hospital Building	JA Solar 410W	1,160	Solis Solar 80 KW	06	475.60 KWp
2	TB Center	JA Solar 410W	64			26.24 kWp
<b>Total</b>			<b>1,224</b>		<b>06</b>	<b>501.84 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 17<sup>th</sup> October 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Renewable Power** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted “Sindh Solar Energy Project – Component II”.

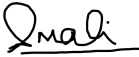
**Project Details:**

Project Name: **1651.7 KW Grid-Tied Solar System at Civil Hospital, Karachi**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Child Ward	Longi Solar 445W	171	Sungrow 50 KW	1	76.1 kWp
2	Cancer Ward	Longi Solar 445W	100	Sungrow 33 KW	1	44.5 kWp
3	Medical OPD	Longi Solar 445W	60	Sungrow 20 KW	1	26.7 kWp
4	PCB	Longi Solar 445W	56	Sungrow 20 KW	1	24.9 kWp
5	Skin Ward	Longi Solar 445W	320	Sungrow 110 KW	1	142.4 kWp
6	Nursing Hostel	Longi Solar 445W	100	Sungrow 33 KW	1	44.5 kWp
7	Orthopedic	Longi Solar 445W	162	Sungrow 50 KW	1	72.1 kWp
8	Burn Center	Longi Solar 445W	60	Sungrow 20 KW	1	26.7 kWp
9	Nursing Hostel+ Doc Hostel C	Longi Solar 445W	320	Sungrow 110 KW	1	142.4 kWp
10	Doctors Hostel A+B	Longi Solar 445W	320	Sungrow 110 KW	1	142.4 kWp
11	OT A	Longi Solar 450W	320	Sungrow 110 KW	1	144.0 kWp
12	OT B	Longi Solar 450W	420	Sungrow 110 KW Sungrow 33 KW	1 1	189.0 kWp
13	SIUT A+B	Longi Solar 450W	960	Sungrow 110 KW	3	432.0 kWp
14	SIUT C	Longi Solar 450W	320	Sungrow 110 KW	1	144.0 kWp
<b>Total</b>			<b>3,689</b>		<b>17</b>	<b>1,651.7 kWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp	:	 _____
Name	:	Syed Ali
Designation	:	Project Manager / Senior Advisor
Certificate Issuance Date	:	10 <sup>th</sup> June 2022

Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

Certificate Reference # RP/Korangi/01

**COMMISSIONING CERTIFICATE**

We hereby confirm that **M/S Renewable Power** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

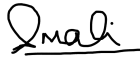
**Project Details:**

Project Name: **64.46 KW Grid-Tied Solar System at 25 Bedded Hospital Korangi 1 ½, Karachi**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Main Building	Longi Solar 445W	69	Sungrow 50kW	1	30.71 kWp
2	Main Building	Longi Solar 450W	75			33.75 kWp
<b>Total</b>			<b>144</b>		<b>1</b>	<b>64.46 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 26<sup>th</sup> April 2022

**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.
- 3) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 4) Net Metering is not under the scope of the supervisory engineering firm.



## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Renewable Power Pvt Ltd** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

### Project Details:

Project Name: **401.40 KW Grid-Tied Solar System at DHQ Hospital KAMBER SHAHDADKOT**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Main Building	Longi Solar 450W	786	Sungrow 110kW	2	353.7KWp
2	Mosque		106	Sungrow 110kW	1	47.7KWp
Total			892		3	401.40 KWp

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : Syed Ali

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 1<sup>st</sup> October 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Renewable Power** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

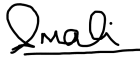
**Project Details:**

Project Name: **200.25 KW Grid-Tied Solar System at SGH Saudabad Malir, Karachi**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	OPD Building	Longi Solar 445W	126	Sungrow 50kW	1	56.07kWp
2	Main Building	Longi Solar 445W	324	Sungrow 110kW	1	144.18 kWp
<b>Total</b>			<b>450</b>		<b>2</b>	<b>200.25 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 26<sup>th</sup> April 2022



**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

Certificate Reference # RP/TandoAllahyar/03

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Renewable Power** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

**Project Details:**

Project Name: **534.19 KW Grid-Tied Solar System at DHQ Tando Allahyar**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Vaccination Center	Longi Solar 445W	780	Sungrow 110 KW = 3 Sungrow 50 KW = 1	4	347.10 kWp
2	Doctor Quarters	Longi Solar 445W	383			170.44 kWp
3	Doctor Quarters	Longi Solar 450W	37			16.65 kWp
<b>Total</b>			<b>1,200</b>		<b>4</b>	<b>534.19 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : \_\_\_\_\_

Name : Syed Ali  
 Designation : Project Manager / Senior Advisor  
 Certificate Issuance Date : 26<sup>th</sup> April 2022

**Note:**

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.



## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Renewable Power Pvt Ltd** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

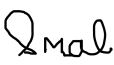
### Project Details:

Project Name: **676.40 KW Grid-Tied Solar System at DHQ Hospital Umerkot**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Hospital Building	Longi Solar 445W	780	Sungrow 110kW Sungrow 50kW	2 1	347.1KWp
2	Outdoor Open Area		740	Sungrow 110kW Sungrow 50kW	2 1	329.3KWp
Total			1,520		6	676.40 KWp

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 1<sup>st</sup> October 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## PROVISIONAL COMMISSIONING CERTIFICATE

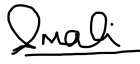
We hereby confirm that M/s Renewable Power has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II". This provisional certificate shall not be deemed as final commissioning certificate since the commissioning at these sites has been done with reduced inverter capacity due to undersized transformer at site. Once the transformer is installed by the concerned DISCOs, the results with full capacity will be determined which will become the basis for issuance of the final commissioning certificate.

### Project Details:

Project Name: **630.0 KW Grid-Tied Solar System at DHQ Shahdadpur**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Vaccine Building	Longi Solar 450W	120	Sungrow 110 KW = 4 Sungrow 50 KW = 1	5	54.0 kWp
2	Family Planning	Longi Solar 450W	60			27.0 kWp
3	Meeting Hall	Longi Solar 450W	60			27.0 kWp
4	LV Room	Longi Solar 450W	4			1.8 kWp
5	Child Ward	Longi Solar 450W	60			27.0 kWp
6	New Building	Longi Solar 450W	260			117.0 kWp
7	New Red Building	Longi Solar 450W	80			36.0 kWp
8	Main Building	Longi Solar 450W	400			180.0 kWp
9	Blood Bank	Longi Solar 450W	60			27.0 kWp
10	Emergency Building	Longi Solar 450W	60			27.0 kWp
11	Vaccination Center	Longi Solar 450W	180			81.0 kWp
12	Doctor Quarters	Longi Solar 450W	40			18.0 kWp
13	Doctor Quarters	Longi Solar 450W	16			7.2 kWp
<b>Total</b>			<b>1,400</b>		<b>5</b>	<b>630.0 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm for the installation performed.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 26<sup>th</sup> April 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.



## COMMISSIONING CERTIFICATE

We hereby confirm that M/S Ningbo Green Light Energy (Pvt) Ltd. has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this covered "Sindh Solar Energy Project – Component II".

### Project Details:

Project Name: 56.07 KW Grid-Tied Solar System at Hepatitis Center, Dadu

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Hospital Building	Longi Solar 445W	126	Huawei 60 KTL	01	56.07 KWp
<b>Total</b>			<b>126</b>		<b>01</b>	<b>56.07 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this covered Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp :

*S. Ali*

Name :

Syed Ali

Designation :

Project Manager / Senior Advisor

Certificate Issuance Date :

8<sup>th</sup> September 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Ningbo Green Light Energy (Pvt) Ltd.** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

### Project Details:

Project Name: **344.43 KW Grid-Tied Solar System at Civil Hospital, Dadu**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Civil Hospital Dadu	Longi Solar 445W	774	Huawei 100 KTL	03	344.43 KWp
<b>Total</b>			<b>774</b>		<b>03</b>	<b>344.43 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 19<sup>th</sup> October 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Ningbo Green Light Energy (Pvt) Ltd.** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".


### Project Details:

Project Name: **894.36 KW Grid-Tied Solar System at Civil Hospital, Nawabshah, Shaheed Benazirabad**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Block A	Longi Solar 435W	324	Huawei 60KTL	02	140.94 KWp
2	Block B	Longi Solar 435W	324	Huawei 100KTL	01	140.94 KWp
3	ICU	Longi Solar 435W	149	Huawei 100KTL	04	64.82 KWp
4	Emergency	Longi Solar 435W	115			50.03 KWp
5	TB Chest	Longi Solar 435W	202			87.87 KWp
6	Block C	Longi Solar 435W	234			101.79 KWp
7	CCU / Covid Ward	Longi Solar 435W	116			50.46 KWp
8	NICVD	Longi Solar 435W	117			50.89 KWp
9	OT	Longi Solar 435W	202			87.87 KWp
10	Girls Hostel	Longi Solar 435W	273	Huawei 100KTL	01	118.75 KWp
<b>Total</b>			<b>2,056</b>		<b>08</b>	<b>894.36 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 25<sup>th</sup> September 2022



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## COMMISSIONING CERTIFICATE

We hereby confirm that M/S Ningbo Green Light Energy (Pvt) Ltd. has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this covered "Sindh Solar Energy Project – Component II".

### Project Details:

Project Name: 685.5 KW Grid-Tied Solar System at Lyari General Hospital, Karachi

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Hospital Building	Longi Solar 540W Longi Solar 435W	792 116	Huawei 100 KTL	04	478.14 KWp
2	NICVD	Longi Solar 540W	384	Huawei 100 KTL Huawei 60 KTL	01 01	207.36 kWp
Total			1,292		06	685.50 KWp

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this covered Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : Syed Ali  
 Name : Syed Ali  
 Designation : Project Manager / Senior Advisor  
 Certificate Issuance Date : 6<sup>th</sup> September 2022



### Note:

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- 2) Net Metering is not under the scope of the supervisory engineering firm.

COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Zonergy (Tianjin) Company Limited** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted “Sindh Solar Energy Project – Component II”.

Project Details:

Project Name: **1,441.97 KW Grid-Tied Solar System at JPMC, Karachi**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Administration Block	JA Solar 410W	90	Solis Solar 50 KW	01	36.90 KWp
2	Oncology Department	JA Solar 410W	268	Solis Solar 50 KW	02	109.88 KWp
3	Ward 5	JA Solar 410W	216	Solis Solar 80 KW	01	88.56 KWp
4	Ward 6	JA Solar 410W	252	Solis Solar 50 KW	02	103.32 KWp
5	Old Mess	JA Solar 410W	144	Solis Solar 50 KW	01	59.04 KWp
6	New Mess	JA Solar 410W	176	Solis Solar 80 KW	01	72.16 KWp
7	Old Chest Ward	JA Solar 410W	211	Solis Solar 80 KW	01	86.51 KWp
8	Eye Department	JA Solar 410W	90	Solis Solar 50 KW	01	36.90 KWp
9	School of Nursing	JA Solar 410W	360	Solis Solar 80 KW	02	147.60 KWp
10	College of Nursing + Hostel	JA Solar 410W	126	Solis Solar 50 KW	01	51.66 KWp
11	Blood Bank Ward	JA Solar 410W	226	Solis Solar 80 KW	01	92.66 KWp
12	Main Parking for Visitors	JA Solar 410W	918	Solis Solar 80 KW	04	376.38 KWp
13	Administration Block Parking	JA Solar 410W	440	Solis Solar 80 KW	02	180.40 KWp
Total			3,517		20	1,441.97 KWp

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : 

Syed Ali

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 19<sup>th</sup> July 2023



**Note:**

1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.

2) Net Metering is not under the scope of the supervisory engineering firm.



## COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Zonergy (Tianjin) Company Limited** has successfully completed their solar installation at the below mentioned site in accordance with the requirements as set out in the RFQ document of this coveted "Sindh Solar Energy Project – Component II".

### Project Details:

Project Name: **517.59 KW Grid-Tied Solar System at DHQ Hospital, Tando Muhammad Khan**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Main Building	JA Solar 405W	414	Solis Solar 80 KW	06	167.67 KWp
2	Building # 2	JA Solar 405W	450			182.25 KWp
3	Colony Buildings	JA Solar 405W	414			167.67 kWp
<b>Total</b>			<b>1,278</b>		<b>06</b>	<b>517.59 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this commissioning certificate encompassing that all the requirements as set out in RFQ document under this coveted Sindh Solar Energy Project – Component II has been complied by the solar installing firm.

The Site is therefore deemed to be commissioned in all respect.

Signature and Stamp : Syed Ali

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 19<sup>th</sup> July 2023



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## PROVISIONAL COMMISSIONING CERTIFICATE

We hereby confirm that **M/S NINGBO GREEN LIGHT ENERGY Company Limited** has made the solar installation at the below mentioned site under the coveted "Sindh Solar Energy Project – Component II". This provisional certificate shall not be deemed as final commissioning certificate since the testing for the commissioning at these sites has been done with reduced inverter capacity due to the issue at main utility panel resulting in tripping of the entire system, when all the inverters are initiated at the full capacity. This has to be rectified by the concerned DISCOs for which PMU-SSEP has been in correspondence with the DISCO and the hospital management. Once this has been rectified, the results with full capacity will be determined and evaluated which will become the basis for the issuance of the final commissioning certificate. Furthermore, the above issues are not exhausted and any observations raised at the time of final commissioning visit shall be the responsibility of the firm to clear prior to the issuance of final commissioning certificate.

### Project Details:

Project Name: **448.56 KW Grid-Tied Solar System at Civil Hospital Naushero Feroze**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Building	Longi Solar 445W	1,008	Huawei 100 KW	04	448.56 KWp
<b>Total</b>			<b>1,008</b>		<b>04</b>	<b>448.56 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this provisional commissioning certificate.

Signature and Stamp : Syed Ali

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 24<sup>th</sup> July 2023



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

## PROVISIONAL COMMISSIONING CERTIFICATE

We hereby confirm that **M/S Zonergy (Tianjin) Company Limited** has made the solar installation at the below mentioned site under the coveted "Sindh Solar Energy Project – Component II". This provisional certificate shall not be deemed as final commissioning certificate since the testing for the commissioning at these sites has been done with reduced inverter capacity due to the issue at main utility panel resulting in tripping of the entire system, when all the inverters are initiated at the full capacity. This has to be rectified by the concerned DISCOs for which PMU-SSEP has been in correspondence with the DISCO and the hospital management. Once this has been rectified, the results with full capacity will be determined and evaluated which will become the basis for the issuance of the final commissioning certificate. Furthermore, the above issues are not exhausted and any observations raised at the time of final commissioning visit shall be the responsibility of the firm to clear prior to the issuance of final commissioning certificate.

### Project Details:

Project Name: **996.3 KW Grid-Tied Solar System at Indus Hospital Badin**

S.R. No	Building Name	PV Modules Specifications		Inverters		Total PV Capacity (KW)
		Brand and Rating	Quantity	Brand and Rating	Quantity	
1	Ground	JA Solar 410W	2,430	Solis Solar 110 KW	08	996.3 KWp
<b>Total</b>			<b>2,430</b>		<b>08</b>	<b>996.3 KWp</b>

Furthermore, completely filled Mechanical Checklist, Functional Checklist and Performance Checklist is annexed with this provisional commissioning certificate.

Signature and Stamp : Syed Ali

Name : Syed Ali

Designation : Project Manager / Senior Advisor

Certificate Issuance Date : 24<sup>th</sup> July 2023



### Note:

- 1) This certificate does not relieve the EPC Firm, directly or indirectly of any contractual and design performance agreement as mentioned in the RFQ document.
- 2) Net Metering is not under the scope of the supervisory engineering firm.

**IEE STUDIES FOR 150MW SOLAR POWER PLANT AT  
DEH MITHA GHAR DISTRICT MALIR**



**INITIAL ENVIRONMENTAL EXAMINATION (IEE)**

**INSTALLATION & COMMISSIONING OF**

**150 MW SOLAR**

**POWER PLANT AT DEH MITHA GHAR  
DISTRICT MALIR**

**FEBRUARY 2023**



**EMC Pakistan  
Private Limited**



**SINDH SOLAR  
ENERGY PROJECT**





## **SINDH SOLAR ENERGY PROJECT**

### **INITIAL ENVIRONMENTAL EXAMINATION (IEE)**

#### **Installation & Commissioning of 150 MW Solar Power Plant at Deh Mitha Ghar – District Malir**

**Final Report  
February 2023**



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## Executive Summary

Sindh Solar Energy Project (SSEP) under Energy Department, Government of Sindh, plans to install and commission a 150MW Solar Power Plant (PP) in Deh Mitha Ghar in District Malir, Karachi. The project will be located on the land of Government of Sindh (GoS).

The electricity generated by the project would be stepped up and sold to K-Electric Limited (KE). Project aims to meet the continuously increasing demand of electricity and at the same time reducing the carbon footprints by the development of this project. EMC Pakistan Pvt. Limited has been engaged by to conduct the Initial Environmental Examination (IEE) of the proposed project and to comply with the provisions of Sindh Environmental Protection Act, 2014 and the Sindh EPA Environmental Assessment Regulations, 2021.

Solar projects are listed in Schedule-II of the Sindh EPA Regulations 2021 therefore, IEE is conducted for solar projects because of their overall minimal impact on environment. Moreover, the SSEP (hereafter referred as proponent) itself initiates the IEE study to address and rectify any potential environmental impacts of the proposed project in design stage and well before the construction proceeds.

The site can be approached by the Hub Dam Road when approaching the Hub dam itself. The Hub Dam Canal travels on the Eastern Side of the demarcated site serving as a source of water.

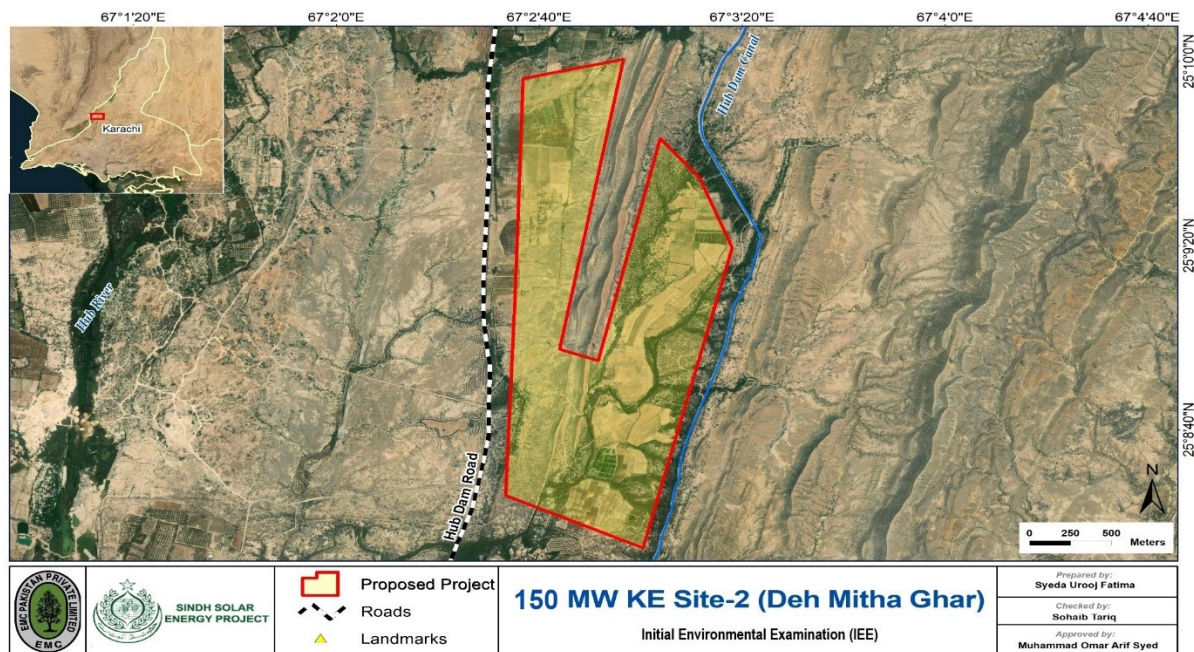
The site consists of undulating terrain along the boundaries of the site, with rising elevations towards the centre where it forms a hill that runs through the middle of the site from North to South.

Due to the presence of the Hub Dam Canal, the area has some agricultural activity as well as some people associated with the fields residing there.

Due to the recent rains in the area, the area had also witnessed the growth of rain fed vegetation, attracting animals for grazing. Project location map is shown in figure ES-1

The project will encompass 1) PV area having arrays of PV modules, tracking and mounting structures, inverters and cables 2) Switchyard having transformers, gantry and gas insulated switchgear (GIS) 3) MW switchgear room for protection and isolation of PV plant with grid 4) housing area for plant personnel 5) cleaning system for panels and 6) Weather station 7) ancillary facilities.





**ES-1: 150MW Solar PV Power Plant Project Location**

Environmental surveys were conducted to collect primary information for the project area. The environmental surveys focused on collection of specific baseline information of the project area including meteorology, air quality and noise assessment, ecology of the area and topography of the area.

The ambient air and noise quality presented in the baseline of this IEE shows that the air quality and noise levels meet the required Sindh Environmental Quality Standards (SEQS) limits. The Hub Dam Canal travels on the Eastern Side of the demarcated site serving as a source of water. Condition of the physical environment described above suggests that it would be difficult for natural vegetation to survive under harsh climatic conditions, accentuated by drought, making Xerophytes the dominant vegetation.

Most of the project's environmental and social impacts will be beneficial, including for example generation of clean electricity, saving of carbon footprint of energy generation, generation of employment for locals etc. However, during construction phase, there will be some negative environmental impacts including, air quality deterioration due to dust and exhaust emissions during construction activities. There are chances of groundwater quality deterioration, in particular during rainy season, due to spills from construction equipment, fuel, inadequate disposal of liquid and solid waste, possible noise emissions from running of construction machinery, community nuisance etc.

These impacts require appropriate mitigation and management measures to contain them. The project specific measures suggested are; a) water should be sprinkled to suppress emission of dust. Wiping and sweeping should be adopted as a continuous activity to keep the site clean; b) machinery operation and high noise activities should be carefully planned and scheduled; c) sign postings, warning signs, diversion signs and barriers will be installed to alert nearby community of all potential hazards including limited access to construction sites; d) construction works related solid waste should be disposed to Landfill site; e) it will be ensured that the wastes generated from construction activities are stored in a proper interim location onsite which should be adequately barricaded and covered to avoid ingress of storm water. The location of onsite waste storage site will be selected by CC as per detailed construction plan; f) fuel oils and lubricants for construction machinery will be stored in covered diked areas, underlain with HDPE membrane; g) damage

to ecology will be avoided by not altering the natural drainage pattern during construction; h) greening of the project site should include the plantation of native/indigenous trees and invasive species should be avoided; i) appropriate personal protective equipment (PPE) will be provided to construction labor to minimize risks, such as appropriate outerwear, safety shoes and gloves, safety helmets, harness etc.; j) extensive consultation with stakeholders will be carried out beforehand and their feedback, concerns and input will be taken into account in the project planning and execution; k) it will be ensured that the construction site is appropriately cordoned off with hard barricade; n) wastewater from discharged through Septic Tank connected with soakage pit. The main impact during operational phase is the disposal of disused and broken solar panels. They will be disposed through an SEPA Certified Waste Contractor.

Environmental Management and Monitoring Plan (EMMP) presents mitigation measures of each environmental effect and monitoring parameters with responsibilities defined separately for each aspect. The environmental management and monitoring plan also presents the proposed corrective measures taken if the monitoring parameter results crosses the prescribed threshold limits defined under Sindh Environmental Quality Standards (SEQS).

*EMMP implementation cost:* The total cost of the EMMP implementation has been estimated to be about Pak Rupees **4.08 million**.

The IEE Study concludes that if the measures recommended in the Environmental Management Plan are implemented and the monitoring is carried out for the aspects in accordance with the monitoring plan, the proposed Solar PV Power Project will be a sustainable development and will provide clean energy over its lifetime.



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## ANNEXURES

<b>Annex-I</b>	:	Sindh Environmental Protection Act, 2014
<b>Annex-II</b>	:	Sindh EPA (Environmental Assessment) Regulations, 2021
<b>Annex-III</b>	:	Sindh Environmental Quality Standards (SEQS)
<b>Annex-IV</b>	:	Environmental Monitoring Reports



## Abbreviations and Acronyms

AC	Alternating Current
ARE	Alternative and Renewable Energy
BNEF	Bloomberg New Energy Finance Limited
CC	Construction Contractor
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
dB	Decibel (Unit of Sound level)
DC	Direct Current
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
EMMP	Environmental Management and Monitoring Plan
EPA	Environmental Protection Agency
GIS	Gas Insulated Switchgear
GS	Grid station
HSE	Health Safety and Environment
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEE	Initial Environmental Examination
ISO	International Organization for Standardization
KE	K-Electric
kV	Kilo Volt
kW	Kilo watt
NO <sub>2</sub>	Nitrogen dioxide
NO	Nitric oxide
NOC	No Objection Certificate
O <sub>3</sub>	Ozone
PCB	Polychlorinated Biphenyl
PM	Particulate Matter
PP	Power Plant
PPE	Personal Protective Equipment
PV	Photovoltaic
SCADA	Supervisory control and data acquisition
SEQS	Sindh Environmental Quality Standards
SF <sub>6</sub>	Sulfur Hexafluoride
SO <sub>2</sub>	Sulfur Dioxide
SO <sub>x</sub>	Sulfur Oxides
SPM	Suspended Particulate Matter
SSEP	Sindh Solar Energy Project
UTC	Coordinated Universal Time
AC	Alternating Current
ARE	Alternative and Renewable Energy
BNEF	Bloomberg New Energy Finance Limited
CC	Construction Contractor





## Chapter 1 INTRODUCTION

Sindh Solar Energy Project (SSEP) under Energy Department, Government of Sindh, plans to install and commission a 150MW Solar Power Plant (PP) in Deh Mitha Ghar in District Malir, Karachi. The project will be located on the land of Government of Sindh (GoS).

The electricity generated by the project would be stepped up and sold to K-Electric Limited (KE). Project aims to meet the continuously increasing demand of electricity and at the same time reducing the carbon footprints by the development of this project. EMC Pakistan Pvt. Limited has been engaged by to conduct the Initial Environmental Examination (IEE) of the proposed project and to comply with the provisions of Sindh Environmental Protection Act, 2014 and the Sindh EPA Environmental Assessment Regulations, 2021.

### 1.1. Project Background

The use of energy has increased significantly due to various inventions and innovations of common use made in last century. Thus, almost all human activities have become more dependent on energy. For developing nations in particular, there is fundamental need for reliable and affordable energy. In these countries, energy demand has been increased due to expansion in industry, modernized agriculture, increased trade and improved transportation. Pakistan is dependent on energy imports because there is lack of investment in indigenous resources of hydro, natural gas and lignite. Biomass is the largest energy source. The government has decided to stop building new coal-fired power plants because of environmental issues.

### 1.2. Pakistan's Electricity Generation Capacity

In 2021, installed capacity of electricity has reached 37,261 MW, posting a growth of 3.6 percent in Pakistan.<sup>1</sup> The total electricity generation capacity during July-April 2022 has increased by 11.5 percent and it reached 41,557 MW from 37261 MW during the same period last fiscal year.

Installed Capacity (MW)	FY2020-21 (July-April)	FY2021-22 (July-April)
	37,261	41,557
Source: Ministry of Energy, (Power Division)		

Thermal has largest share in electricity generation in the country, although its percentage contribution has declined from 62.5 percent during Jul-April FY2021 to 60.9 percent during Jul-April FY2022. Similarly, the percentage contribution of Hydel in electricity generation has also reduced from 27.8 percent in Jul-April FY2021 to 23.7 percent during Jul-April FY2022. The percentage share of Nuclear has increased from 7.2 percent during Jul-April FY2021 to 12.35 percent during Jul-April FY2022. The contribution of renewable in the electricity generation has increased from 2.4 percent during Jul-April FY2021 to 3.02 percent in the first ten months of FY2022.<sup>2</sup>

The country is currently producing 22,000 MW of power against a requirement of 26,000 MW. While this comes out to a 4,000 MW shortfall.

<sup>1</sup> Pakistan Economic Survey 2020-21

<sup>2</sup> Pakistan Economic Survey 2021-22



Renewable energy generation in Pakistan falls far short of realizing its potential, despite the country's considerable resources. Given the growing electricity demand, depleting domestic gas reserves, and increasing dependency on fossil imports, renewable energy generation can help in (i) displacing fuel imports, (ii) reducing electricity price volatility, and (iii) meeting the country's climate change mitigation targets through reductions in projected Greenhouse Gases (GHG) emissions. The World Bank's Renewable Energy Resource Mapping initiative shows considerable solar and wind power resources across Pakistan.

### **1.3. Rationale for the Project**

As a result of sustained equipment and construction cost reductions internationally, and the experience gained from several early projects, solar PV is overall a low-cost option for additional power capacity. Transitioning to renewable energy offers Pakistan the potential to reduce its average cost of generation, diversify away from imported fossil fuels, and realize climate change, air pollution, and water conservation benefits. However, to continue to drive down the cost of solar power Pakistan needs to fully implement competitive bidding through a stable, transparent, and predictable series of solar auctions, leveraging successful international experience. There is also a need for future solar and wind projects to be developed more strategically than in the past, taking account of land availability, grid capacity, and grid integration issues—a fact that argues in favor of a stronger government role in identifying and predeveloping sites for the private sector development of solar power plants.

### **1.4. Project Overview**

The project involves construction, installation, operation, and maintenance of 150 MW Solar Power Plant over an area of about 600 acres. The location of the project is shown in fig 1.1. The project will encompass 1) PV area having arrays of PV modules, tracking and mounting structures, inverters and cables 2) Switchyard having transformers, gantry and gas insulated switchgear 3) MW switchgear room for protection and isolation of PV plant with grid 4) housing area for plant personnel 5) cleaning system for panels 6) Weather station and 7) ancillary facilities



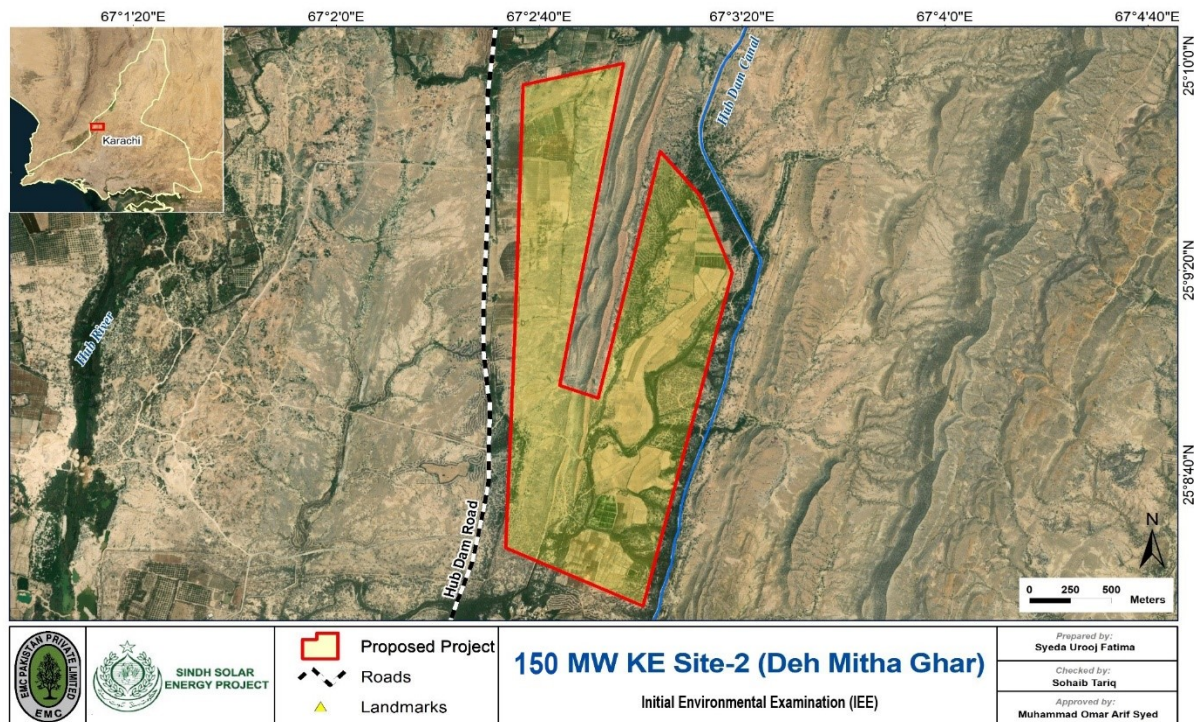


Figure 1.1: Location of 150MW Solar PP project

## 1.5. Project Categorization

Sindh EPA Environmental Assessment Regulations, 2021 categorize projects into three separate schedules depending on whether a project requires an Environmental Checklist (Schedule-I) or an IEE (Schedule-II) or EIA (Schedule III). The Regulations also require that all projects located in environmentally sensitive areas need submission of an EIA.

On the basis of the nature and scope of project, it has been accordingly categorized into Schedule-II

**Schedule-II** – List of projects requiring IEE

### B. Energy

#### 9. All Renewable energy Projects (excluding Protected/Sensitive area under any law)

## 1.6. Objectives of IEE Study

It aims to predict environmental impacts at an early stage in project planning and design, finding ways and means to reduce the adverse impacts, shape projects to suit the local environment, and presenting options to decision-makers.

The main purpose of this IEE Study is to provide and analyze information on the nature and severity of environmental aspects and propose mitigation measures in case of negative impacts arising from the construction and operation of the project and related activities that would take place concurrently or subsequently. The IEE study will, in fact, respond to the provision Sindh Environmental Protection Act, 2014 and Guidelines for the Preparation and Review of Environmental Reports. The Study will:

- Identify all major and minor impacts, negative as well as positive, on the environment (physical and ecological) during its different stages viz. pre-construction, construction and operation of Project;
- Identify Socioeconomic aspects, and
- Devise Environmental Management & Monitoring Plan (EMMP) for sustainable operation of the Project.

### 1.7. Methodology Adopted for IEE Study

This Initial Environmental Examination (IEE) was conducted in the following manner:

#### Scoping

A scoping exercise was undertaken to identify the potential issues that are to be considered in the Initial Environmental Examination (IEE). The scoping exercise included the following tasks:

- **Data Compilation:** A generic description of the proposed activities relevant to this environmental assessment was compiled.
- **Review of Published literature:** All available published and unpublished information pertaining to the micro and macro environment of the study area was obtained and reviewed. It included the earlier studies conducted in the study area, environmental and social baselines and impact assessment studies conducted by different consultants in past. Secondary data was very helpful in understanding the issues that were identified by other consultants.
- **Review of applicable Legislation:** Information on relevant legislation, regulations, guidelines, and standards was reviewed and compiled.
- **Identification of potential impacts:** The information collected in the above procedures was reviewed and potential environmental impacts were identified.
- **Initial site visit:** An initial site visit was conducted to get an overview of site conditions and the surrounding areas.

#### Review of Legislation and Guidelines

National legislation, international agreements and environmental guidelines were reviewed to set environmental standards that the SSEP will be required to follow during construction & operation phase of the project. Sindh Environmental Protection Act 2014, SEPA (Review of IEE/EIA) regulations 2021, Guidelines for the Preparation and Review of Environmental Reports and IFC EHS Guidelines were the basic guiding documents used during the study.

#### Baseline Data Collection

Baseline Data was collected from different sources including electronic and print media, studies previously conducted by EMC Pakistan Pvt. Limited and archives of the experts, and field surveys conducted for this study by the team of EMC Pakistan Pvt. Limited etc.

Previous published and unpublished literature and other information were collected in order to gain a complete understanding of existing environmental conditions in the area including the following:



- **Physical environment:** Topography, geology, soil, water resources, ambient air, noise and climate;
- **Biological environment:** Flora and fauna within the proposed site and its surroundings;
- **Socio-economic environment:** Settlements, socio-economic conditions, infrastructure and land use; and

### Identification of Aspects

Identification of environmental aspects and their significance is fundamentally important for the determination of severity of incidence of impacts at different stages of the project. This step is aimed at obtaining an inventory of the aspects. The aspects identified during this step cover all activities like construction, installation and operation, in order to determine those which, have or can have a significant impact on the environment.

### Impact Assessment & EMMP

Environmental experts at EMC Pakistan Pvt. Limited analyzed and assessed the anticipated impacts that are likely to arise due to the identified aspects. Potential impacts were evaluated using the environmental, ecological, socioeconomic, and project information collected. The impact assessment covers the following aspects:

- Potential change in environmental parameters likely to be affected by Project-related activities;
- Prediction of potential impacts;
- Evaluation of the likelihood and significance of potential impacts;
- Defining of mitigation measures to reduce impacts to as low as reasonably practicable;
- Prediction of any residual impacts, including all long-term and short-term, direct and indirect, and beneficial and adverse impacts; and
- Monitoring of residual impacts.

An environmental management & monitoring plan (EMMP) was developed to oversee the environmental performance of the project, adoption of proposed mitigation measures, to monitor impacts of all activities and performance of mitigation measures and to identify the residual impact, and also the positive/negative changes in the physical, ecological, and socioeconomic environment.

### Documentation & Review

This is the final step of the IEE study. The data generated during and for the study was compiled and examined by experts. Sections of this report were prepared as the study progressed, by consultation with experts. The report was finally reviewed by Team Leader, who analyzed the information, assessed the potential environmental impacts in the light of national and international guidelines, and examined the alternatives in the light of observations on the field as well as meetings with the stakeholders.





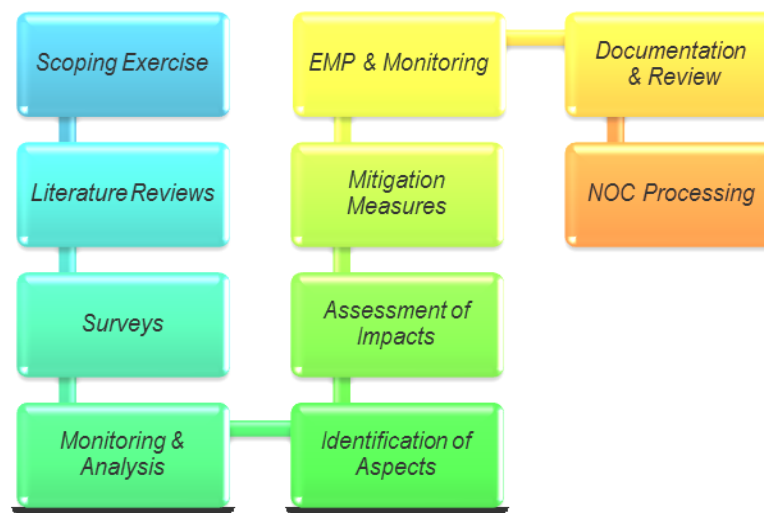


Figure 1-2: IEE Methodology

## 1.8. Structure of IEE

This document is structured as follows:

- **Chapter 1:** Introduction to Project and IEE Processes;
- **Chapter 2:** Provides an overall description of the project;
- **Chapter 3:** Describes the legislative and policy framework governing the project;
- **Chapter 4:** Provides environmental (Physical & Biological) and Social baseline conditions of the macro and microenvironment of the project area;
- **Chapter 5:** Screening of environmental impacts of the project and appropriate mitigation measures;
- **Chapter 6:** Provides environmental management and monitoring plan (EMMP); and
- **Chapter 7:** Provides conclusions and recommendations.

The main text of the report is supported by a series of Annexure which provides supplementary information including respective sections of prominent provincial and national laws and guidelines.

## 1.9. IEE Team

EMC Pakistan Pvt. Limited formed the following team for conducting the Initial Environmental Examination (IEE) of the proposed 150 MW Solar Power Plant at Deh Mitha Ghar – District Malir in Sindh Province..

S. No.	Name of Experts	Position in IEE Team
1.	Mr. Syed Nadeem Arif	Director/Team Lead
2.	Mr. Syed M. Omer Arif	Environmental Engineer
3.	Mr. Sohaib Tariq	Environmental Engineer
4.	Ms. Saira Tariq	Environmental Scientist
5.	Mr. Vijay Kumar	Senior Sociologist

## Chapter 2 PROJECT DESCRIPTION

### 2.1. Project Ownership

150 MW Solar Power Plant Project in Deh Mitha Ghar is being developed by Sindh Solar Energy Project (SSEP), Energy Department, GoS.

### 2.2. Project Location

The project is located in Deh Mitha Ghar, District Malir, Karachi. The Project will be installed at the site allocated by GoS with location shown map shown below;

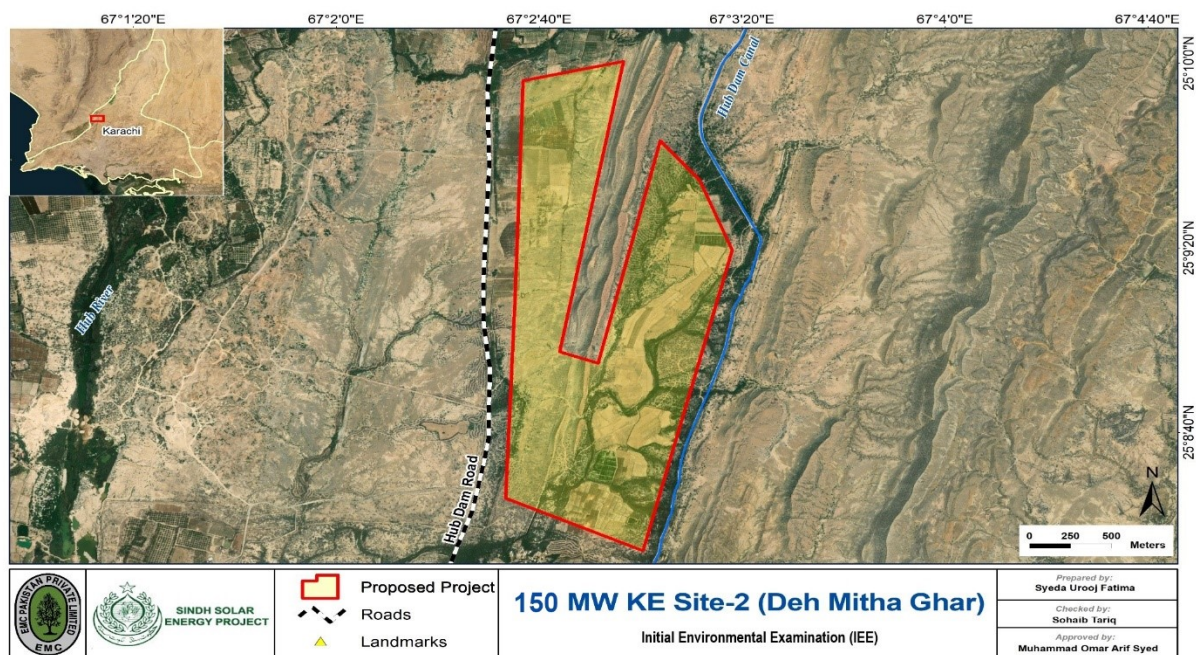


Figure 2.1: Location Map of Solar PP project

### 2.3. Project Technical Details

All plant and equipment shall be new and shall be designed, manufactured, and tested in accordance with the latest IEC or other equivalent standards.

Major equipment/structure that is to be installed at each site is detailed below:

#### Solar Panel

Latest technology including single-axis tracking of panel considering the site/area condition shall be selected.

#### Power Inverters

The project site shall consist of inverters for converting 120MW DC power to AC, which would either be String or central inverters having standard warranty period, efficiency 97% or above and complying with IEC/UL Standards.

#### Power Transformer and other Switchyard Equipment



The Complex design will include the step-up transformers and shall comprise of adequate electrical and mechanical protections to ensure safety and reliability.

### **SCADA, Tele-Communication and Protection Schemes**

SCADA, telecommunication and tele-protection equipment of the Complex side shall be two channels established till load dispatch center for data transfer to SCADA system. Each transmission line will have dedicated protection relays. Bus-bar protection and step-up transformer protection will be as per Complex design.

### **Weather Station**

Weather station will include the equipment to measure wind speed, tilted irradiance, horizontal irradiance, ambient temperature, PV panel temperature etc.

### **Civil/ Mounting Structure**

Mounting system shall be directly anchored into the ground (driven piers, concrete footers, ground screws, etc.). Mounting system shall be selected so as to withstand wind speeds, earthquakes, floods etc. in the region and ensure design operations for the life of the project. Civil design of Plant shall have provision for flood water outlet too.

### **Balance of System:**

The BOS will be selected to ensure that the system is able to service for the life of the project, broadly some of the aspects of the BOS are:

Medium voltage switchgears, MV transformer, DC system, control and protection equipment of adequate capacities and complying with IEC standards. MV and LV Cabling shall be according to site conditions and Plant design.

RO plant (if required) shall be installed for cleaning and plant operational services. Outdoor electronic equipment and panels having Ingress protection class 65. Substation properly equipped with LV Power supplies, back-up power supplies, UPS, Diesel generators, auxiliary transformers, telephone and internet connection, lighting, HVAC, water supplies, drainage, fire and intruder alarms, PV plant earthing, cables protection and insulation monitoring etc.

### **Safety & Security**

Lighting arrestors, proper grounding of all equipment shall be ensured and surge protection shall be provided on all electrical systems. There will be underground interconnecting solar arrays. Fire safety protection and adequate lighting at regular intervals to ensure visibility at all times. Fencing and surveillance to ensure security of the complex, security cameras and microwave sensors etc.

### **Interconnection Requirements**

The interconnection point will be droppers from the terminal tower connected to the gantry of transmission lines and the proposed interconnection scheme will be double circuit in-out from transmission line.



## **Chapter 3 POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK**

This section provides detailed review of policies, legislation, and guidelines that have relevance to the proposed 50MW Solar PV Power Plant Subproject and review of administrative framework as well as institutional set-up relevant to the environmental and social management of the proposed subproject.

### **3.1. National Laws and Regulations**

Pakistan's statute books contain a number of laws related to the regulation and control of the environmental and social aspects. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new practice. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context-specific. After the Eighteenth amendment in the Constitution of Pakistan, many federal subjects devolved to provincial legislation. The Concurrent List in fourth schedule of the Constitution containing entries of subjects wherein federal and provincial legislation could legislate has been abolished. Since project coverage is in province of Sindh; therefore, only those national laws and regulations are discussed here which have application in the project. There are still several federal laws which have not been repealed by the provinces and applicable in provinces with its original titles. The laws relevant to the proposed subproject are briefly reviewed below.

### **3.2. National Environmental Policy, 2005**

The National Environmental Policy, 2005 aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life for the citizens through sustainable development. It provides an overarching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives direction for addressing the cross sectorial issues as well as the underlying causes of environmental degradation and meeting international obligations.

The National Environmental Policy, 2005 while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provide broad guidelines to the Federal Government, Provincial Governments, Federally Administrated Territories and Local Governments for addressing environmental concerns and ensuring effective management of their environmental resources.

### **3.3. National Conservation Strategy, 1992**

The Pakistan National Conservation Strategy (NCS) is the principal policy document for environmental issues in the country. The NCS was developed and approved by the Government of Pakistan in 1992. The NCS works on a ten-year planning and implementation cycle. It deals with fourteen core areas as follows:

- Maintaining soils in cropland;
- Increasing irrigation efficiency;
- Protecting watersheds;
- Supporting forestry and plantations;



- Restoring rangelands and improving livestock;
- Protecting water bodies and sustaining fisheries;
- Conserving of biodiversity;
- Increasing energy efficiency;
- Developing and deploying material and energy renewable;
- Preventing and abating pollution;
- Managing urban wastes;
- Supporting institutions for common resources;
- Integrating population and environmental programs;
- Preserving the cultural heritage

### **3.4. Pakistan Climate Change Act, 2016**

The Prime Minister established Pakistan Climate Change Council which coordinates and supervises the enforcement of the provisions of the Act, monitor implementation of the international agreements relating to climate change, approve and monitor implementation of comprehensive adaptation and mitigation policies, strategies, plans, programs, projects and other measures formulated by the authority to meet Pakistan's international obligations, monitor the implementation of National Adaptation Plan and its constituent provincial and local adaptation action plans, approves guidelines for the protection and conservation of renewable and nonrenewable resources, species, habitats and biodiversity adversely affected or threatened by climate change.

The Act is applicable to proposed project as the proposed project involves the solid waste management activities that may contribute to generation of greenhouse gases.

### **3.5. Pakistan Penal Code, 1860**

The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents.

The provisions of the Penal Code, 1860 are applicable to the Project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.

### **3.6. Land Acquisition Act, 1894 and Land Acquisition (Sindh Amendment) Act 2009**

The primary law for acquisition of land for public purposes in Pakistan is the "Land Acquisition Act (LAA), 1894" (hereinafter referred as the Act). The land acquired under the Act vests in the province and it is only thereafter that the province may transfer it to someone else. The Sindh Amendment 2009 of LAA 1894 specifically related to Section 16, Section 23, Section 24 and Section 28-A.





### **3.7. National Disaster Management Act, 2010**

National Disaster Management Act, 2010 was passed by Parliament of Pakistan in 2010. The Act applies to whole Pakistan. The Act was passed in backdrop of 2010 Floods in Pakistan and strengthens Disaster Management system.

This act is applicable to the proposed Project due to its location. The proposed Project will require special consideration of flood risks and disaster management strategies as per the Act.

### **3.8. Building Code of Pakistan, 2007**

The provision of Building Code of Pakistan shall apply for engineering design of building like structure and related components. The construction in violation of the building code shall be deemed as violation of professional engineering work. Moreover, a certificate for the proposed action will be obtained from Provincial Building Control Authority.

These codes shall be used in structural design of building area components constructed under this proposed Project.

### **3.9. National Action Plan for COVID-19 Pakistan**

Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at <https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf>. The Government of Pakistan has launched the real-time data portal for COVID-19 <http://covid.gov.pk/>. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at <https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf>.

Ensure that works undertaken as part of the project, comply with COVID guidelines to curtail transmission.

### **3.10. Guidelines for the Preparation and Review of Environmental Reports, 1997**

These guidelines describe the format and content of IEE/EIA reports to be submitted to EPA for obtaining NOC/approval.

The guidelines present:

- The environmental assessment report format;
- Assessing impacts;
- Mitigation and impact management and preparing an environmental management plan;
- Reporting;
- Review and decision making;
- Monitoring and auditing; and
- Project Management.

These guidelines serve to describe the format, practices, and procedures to be employed when reporting environmental assessments.



### 3.11. Guidelines for Environmental Assessment

Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development Projects. The guidelines that are relevant to the proposed Project are listed below.

- Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997;
- Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and
- Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997.

### 3.12. Provincial Laws and Regulations

#### 3.12.1 Sindh Strategy for Sustainable Development, 2007

The Sindh Strategy for Sustainable Development (SSSD) proposed a ten-year sustainable development agenda for Sindh. The main focus of SSSD is to promote the sustainable use of natural resources. It targets to reduce poverty and enhance social development through the participation of the people of Sindh.

SSSD recommends for the sustainable development and environmentally complying operations of industries: incentive mechanisms for reducing pollution; awareness raising of industrialists and stakeholders; promote cleaner production; enforce pollution charges as per SEPA 2014; prepare baseline of all industrial estates and sites to establish the pollution levels, waste disposal practices, air emissions, generation of hazardous waste for the preparation of environmental management plans for complying SEPA 2014; preparation of EIAs for all industrial development and infrastructure projects.

No requirement as such, however, recommends projects to strive for greater sustainability in each of their projects.

#### 3.12.2 Sindh Environmental Protection Act, 2014

Legislative assembly of Sindh Province of Pakistan passed the bill on 24<sup>th</sup> February 2014 to enact Sindh Environmental Protection Act 2014. The Act envisages protection, improvement, conservation and rehabilitation of environment of Sindh with the help of legal action against polluters and green awakening of communities. It equally lays emphasis for the preservation of the natural resources of Sindh and to adopt ways and means for restoring the balance in its eco-system by avoiding all types of environmental hazards. This act has also provided for Sindh Sustainable Fund derived from various sources such as voluntary contributions or fees generated etc. This fund is utilized for protection, conservation or improvement of environment.

#### 3.12.3 Sindh Environmental Protection Agency, (Review of EC, IEE and EIA) Regulations, 2021

The Regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in three separate schedules. Schedule I lists projects that may not have significant environmental impacts and therefore require an Environmental Checklist. Schedule II lists projects of considerable environmental impacts requiring preparation of an IEE report. Schedule III lists projects of potentially adverse environmental impacts requiring preparation of an EIA report. The regulation also requires that all projects located in environmentally sensitive areas require preparation of an EIA.



### **3.12.4 Sindh Solid Waste Management Board Act, 2014**

The SSWMB Act, 2014 enacted to establish a board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide pollution free environment and to deal with other relevant matters. The Board established under the Act headed by the Chief Minister or his nominee and constitutes of thirteen other ex officio members of other relevant departments.

### **3.12.5 Sindh Environmental Quality Standards (SEQS), 2016**

SEPA has formulated the Sindh Environmental Quality Standards (SEQS) as per Clause (g) of sub-section (1) of Section 6 of SEPA Act 2014. The SEQS were promulgated in 2016 which includes standards for liquid effluent, industrial gaseous emissions, ambient air, drinking water quality, noise levels and standards for motor vehicle exhaust, diesel vehicle, and petrol vehicles.

Subproject Contractor(s) is liable to follow the SEQS in letter and spirit.

### **3.12.6 Sindh Hazardous Substances Rules, 2014**

The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. General safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are also described in these rules.

This rule is applicable to the proposed Project due to potential involvement of hazardous chemicals handling, use and disposal during different construction activities at the construction stage.

A separate approval shall be obtained from the Sindh EPA if there is any permanent use of any of the hazardous substances that are listed in the Rules.

### **3.12.7 Sindh Cultural Heritage (Preservation) Act, 1994**

Sindh Cultural Heritage (Preservation) Act of 1994 was passed by the Provincial Assembly in February 1994 and was enacted in April 1994. This act aims to preserve and protect ancient places and objects of architectural, historical, archaeological, artistic, ethnological anthropological and national interest in the Province of Sindh.<sup>4</sup>

The act enables the Government to declare any premise or object of architectural, historical, archaeological or national value, after consultation with the Advisory Committee. The act also states that if it is apprehended that any person intends to destroy, remove, alter, deface or imperil the protected heritage or to build on or near the site thereof in contravention of the terms of an agreement for its preservation under section 8 of the act, the Committee may issue an order prohibiting any such contravention.

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<sup>3</sup> Sindh Cultural Heritage (Preservation) Act, 1994 – Gazette of Sindh (April, 1994)

<sup>4</sup> Certain PCRs of Sindh are also covered by the Antiquities Act of 1975 which ensures the protection of nominated PCRs across Pakistan. The law prohibits new construction in the proximity (within a distance of 200 feet) of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain such articles of archaeological significance.



No PCRs as protected under the Sindh Cultural Heritage (Preservation) Act 1994 or Antiquities Act 1975 are located in Subproject area. Therefore, these acts are not applicable to the subproject.

### **3.12.8 Sindh Drinking Water Policy, 2017**

This policy is to provide safely managed drinking water whose supply is adequate, well maintained and sustainable; and to enhance public awareness about health, nutrition and hygiene related to safe drinking water. The basic objective of this policy is to introduce legislative measures and regulations to create an enabling framework for safely managed drinking water supply, regulation of water usage, extraction, treatment transportation and distribution.

This policy is applicable for the Project in terms of quality of drinking water to be provided to laborers.

### **3.12.9 Sindh Public Property Act, 2010**

The act has been passed to avoid illegal encroachments and provide measures for removal of encroachment from public property and to retrieve possession. The City Government will provide continuous oversight and reinforcement to facilitate the properties to remain free from illegal encroachments.

There are no encroachers / squatters living or doing businesses in the subproject area; no any physical structures are found.

### **3.12.10 The Sindh Transparency and Right to Information Act, 2016**

The purpose of this Act to provide transparency and freedom of information to ensure that all citizens have better access to public information, to make the government more accountable to citizens, to enforce the fundamental right to information in all matters of public importance, to ensure transparency in all Government matters. Transparency and access to information are essential principles of democracy which not only enable the citizens to hold the Government and their institutions accountable but also help in improving the system of governance.

This act is applicable as the proposed Project is the public sector Project and shall be transparent for public.

### **3.12.11 Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020**

This Act provides for the preservation, protection, conservation and management of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the Act.

The Act also provides classifications of the protected areas; national parks, wildlife sanctuaries, game reserves and private game reserves, community game reserves. Activities such as hunting and breaking of land for mining are prohibited in national parks, as are removing vegetation or polluting water flowing through the park. Wildlife sanctuaries are areas that have been set aside as undisturbed breeding grounds and cultivation and grazing is prohibited in the demarked areas. Nobody is allowed to reside in a wildlife sanctuary and entrance for the general public is by special dispensation. However, these restrictions may be relaxed for scientific purpose or betterment of the respective area on the discretion of the governing authority in exceptional circumstances. Game reserves are designated as areas where hunting and shooting is not allowed except under special permits.



The project site does not fall in under any protected area.

### **3.13. Labor Laws**

#### **3.13.1 Sindh Occupational Safety and Health Act, 2017**

The Act devised to make provision of occupational safety and health conditions at all workplaces for the protection of persons at work against risk of injury arising out of the activities at work places and for the promotion of safe, healthy and decent working environment adapted to the physical, physiological and psychological needs of all persons at works.

The PMU and Subproject contractor(s) will be bound by the Act to comply the provisions of this Act.

#### **3.13.2 Employment of Child Act, 1991**

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Employment of Child Act (ECA) 1991 disallows child labor in the country. The ECA defines a child to mean a person who has not completed his/her fourteenth years of age. The ECA states that no child shall be employed or permitted to work in any of the occupation set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the Act is carried out.

The PMU and Subproject contractor(s) will be bound by the ECA to not allow any child labor or bonded labor at the Subproject site.

#### **3.13.3 The Bonded Labor System (Abolition) Act, 1992**

Article 11(2) of the Constitution of the Islamic Republic of Pakistan prohibits all forms of forced labor. In accordance with this Article, The Bonded Labor System (Abolition) Act, 1992 provides for the abolition of bonded labor system in the country. Under section 4(2) of this Act, no person shall make any advance under, or in pursuance of, the bonded labor system or compel any person to render any bonded labor or other form of forced labor. The practice of bonded labor has become a punishable offence after enactment of this act (with imprisonment for a term which shall not be less than two years nor more than five years, or with fine which shall not be less than fifty thousand rupees, or with both). Vigilance Committees are formed at the district level to keep an eye on the working of law and help in rehabilitation of freed bonded labor.

The PMU and Subproject contractor(s) will be bound by the Act to compel its labor and the provisions of this Act will be ensured.

#### **3.13.4 Workmen's Compensation Act, 1923**

Workmen's Compensation Act, 1923 provides for the compensation to be paid by employer to workers or their legal heirs in case of death, permanent total disablement, permanent partial disablement and temporary disablement during working.

The Subproject contractor(s) is liable to pay compensation in case of any accidents and PMU will ensure the compensation as per this Act.





### **3.13.5 Minimum Wages Ordinance, 1961**

Section 9 (1) of this ordinance states that no employer shall pay any worker wages at a rate lower than the rate declared under this Ordinance to be the minimum rate of wages for such worker. 9 (2) Any employer who contravenes the provisions of this section shall be punishable with imprisonment for a term which may extend to six months or with fine.

The Subproject contractor(s) is liable to pay at least minimum wages to its unskilled labor and PMU will ensure payment of not less than the minimum wage as specified above.

### **3.13.6 The Industrial and Commercial Employment (Standing Orders) Ordinance, 1968**

The ordinance which applies to construction industry and contractor, does not specify the hours of working in one shift however, standing orders under this act state that The periods and hours of work for all classes of workmen in each shift shall be exhibited in Urdu and in the principal language of workmen employed, in the industrial or commercial establishment on notice boards maintained at or near the main entrance of the establishment and at the time-keeper's office, if any.

The Factories Act, 1934 (Section-34), Mines Act, 1923 (Section 22-B, C), Shops and Establishment Ordinance, 1969 (Section 8) and Road Transport Ordinance, 1961 (Section-4) are used to determine working hours and rest time in different industries which are not applicable for construction works conducted by Contractor. Section 34 of the Factories Act provides that “no adult worker shall be allowed or required) to work in a factory for more than 48 hours in a week; if the factory is seasonal, 50 hours a week and if the work is of continuous nature, he may work for 56 hours in a week. As for the daily hours, these may not be more than 9 hours a day (in case of seasonal; 10 hours). Any adult worker is required to work overtime, if asked, and the rate of overtime payment is double the usual pay (Section 47). Overtime is not payable to the contract workers, employed on piece rate basis.

### **3.13.7 The Protection against Harassment of Women at the Workplace Act 2010**

The Act was promulgated on March 11, 2010 to make provisions for the protection against harassment of women at the workplace. It states that each organization shall constitute an Inquiry Committee within thirty days of the enactment of this Act to enquire into complaints under this Act. The Inquiry Committee shall hold an inquiry against the charges and statement of allegations within three days of receipt of a written complaint. The Inquiry Committee if found the accused to be guilty, shall pose the penalties described in the Act.

The Grievance Redressal Mechanism as described in this ESMP is based on this Act and Grievance Redress Committee formed for this Subproject will cater protection against women harassment at workplace based on the provisions of this Act.

A Code of Conduct at the Workplace will be developed by CC to provide protection and safety to women against harassment and will be followed during the whole construction period.

### **3.13.8 ILO Conventions - Ratifications for Pakistan**

Pakistan has ratified 08 fundamental and 26 technical ILO conventions in which following are relevant to the project:

- C029 - Forced Labor Convention, 1930 (No. 29)



- C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- C138 - Minimum Age Convention, 1973 (No. 138)
- C001 - Hours of Work (Industry) Convention, 1919 (No. 1)

#### **C029 - Forced Labor Convention, 1930 (No. 29)**

Article 1 of the convention states each member undertakes to suppress the use of forced or compulsory labor in all its forms within the shortest possible period. Article 2 of the convention states that the term forced or compulsory labor shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily.

#### **C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)**

For the purpose of this Convention, discrimination includes any distinction, exclusion or preference made on the basis of race, color, sex, religion, political opinion, national extraction or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation.

#### **C138 - Minimum Age Convention, 1973 (No. 138)**

Article 1 of the convention states that Each Member which ratifies this Convention shall specify, in a declaration appended to its ratification, a minimum age for admission to employment or work within its territory and on means of transport registered in its territory; subject to Articles 4 to 8 of this Convention, no one under that age shall be admitted to employment or work in any occupation.

#### **C001 - Hours of Work (Industry) Convention, 1919 (No. 1)**

The term industrial undertaking under this convention includes (c) construction, reconstruction, maintenance, repair, alteration, or demolition of any building, railway, tramway, harbor, dock, pier, canal, inland waterway, road, tunnel, bridge, viaduct, sewer, drain, well, telegraphic or telephonic installation, electrical undertaking, gas work, waterworks or other work of construction, as well as the preparation for or laying the foundations of any such work or structure;

Article 2 of the Convention states that the working hours of persons employed in any public or private industrial undertaking or in any branch thereof, other than an undertaking in which only members of the same family are employed, shall not exceed eight in the day and forty-eight in the week. The limit of hours of work prescribed in Article 2 may be exceeded in case of accident, actual or threatened, or in case of urgent work to be done to machinery or plant, or in case of "force majeure", but only so far as may be necessary to avoid serious interference with the ordinary working of the undertaking.

### **3.13.9 Gender Equality as part of Constitution of Pakistan, 1973**

The Constitution of Pakistan contains a range of provisions regarding gender equality, in particular, provides the principle of equal rights and equal treatment to all citizens/ persons, without any distinction including on the basis of sex:

- Article 3 calls upon the State to eliminate all forms of exploitation.
- Article 4 provides for the right of individual to enjoy the protection of law and to be treated in accordance with the law. This applies to the citizens as well as "to every other person for the time



being within Pakistan” without distinction. This article also clearly states that certain rights cannot be suspended.

- Article 25 ensures equality before the law and equal protection of the law and states that there shall be no discrimination on the basis of sex alone.
- Articles 25(3) and 26(2) allow the state to make special provisions for the protection of women and children.
- Article 26 & 27 provide for equal access to public places and equality of employment in the public and private sector.
- Articles 11 & 37 (g) prohibit trafficking in human beings as well as prostitution.
- Article 32 makes special provisions for the representation of women in local Government.
- Article 34 directs the state to take appropriate measures to enable women to participate in all spheres of life and social activities.
- Article 35 asks the state to protect the marriage, the family, the mother and the child.
- Article 37 (e) directs the state to make provisions for securing just and humane conditions of work ensuring that children and women are not employed in vocations unsuited to their age or sex, and for ensuring maternity benefits for women in employment
- Articles 51 & 106 provide for the reservation of seats for women in the legislatures.

The articles of laws Constitution of Pakistan are relevant as it would deal with employment of male and female labor having different religion, political affiliation, sect, color, caste, creed, ethnic background for the construction of proposed Project.

### **3.13.10 Labor Laws as part of Constitution of Pakistan, 1973**

The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular:

- Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor;
- Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions;
- Article 18 proscribes the right of its citizens to enter upon any lawful profession or occupation and to conduct any lawful trade or business;
- Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and
- Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment.

Labor law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labor laws. The labor laws are a comprehensive set of laws in Pakistan dealing with the following aspects:

- Contract of Employment;
- Termination of Contract;
- Working Time and Rest Time;
- Working hours;
- Paid Leave;
- Maternity Leave and Maternity Protection;



- Other Leave Entitlements;
- Minimum Age and Protection of Young Workers;
- Equality
- Pay Issues;
- Workers' Representation in the Enterprise;
- Trade Union and Employers Association Regulation; and
- Other Laws.

#### **3.13.11 Sindh Bonded Labor (Abolition) Act 2015**

The Act is gender sensitive; an anti-discrimination clause is added to each new proposed Law in accordance with ILO requirement viz: “No discrimination shall be made on the basis of sex, religion, political affiliation, sect, color, caste, creed, ethnic background in considering and disposing of issues relating to the enforcement of this Act”. In all proposed Laws the cognizance has been changed from that of the Judicial Magistrate to the Presiding Officer Labor Courts who is a Session Judge.

Bonded labor will not be allowed or utilized for the project.

#### **3.13.12 The Sindh Minimum Wages Act, 2015**

To provide the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments.

This Act will be applicable to the Project to ensure that the minimum wages and allowances should be given to the Project labor (skill and unskilled employed for the construction of the proposed Project).

#### **3.13.13 Sindh Prohibition of Child Employment Act, 2017**

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines, or any other hazardous employment. In accordance with this Article, the Prohibition of Child Employment Act (PCEA) 2017 disallow child labor in Sindh. The PCEA defines a child as a person who has not completed his/her fourteenth years of age, and an adolescent means a person who has completed fourteenth year of age but has not completed eighteenth years of his age. No child shall be employed or permitted to work in any establishment including construction, but an adolescent can be employed or permitted to work under strict guidelines provided in the PCEA and rules. An adolescent shall not be employed in any hazardous work included in the schedule to the PCEA.

Not allow any child labor in during the project.

### **3.14. IFC General EHS Guidelines**

The EHS guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects; however, these guidelines have been benefited from for other projects as well. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during construction, operation, and decommissioning phase of a project or facility. Environmental issues associated with the



construction and maintenance activities may include, among others, noise and vibration, soil erosion, and threats to biodiversity including habitat alteration and impacts to wildlife.

Examples of the impacts addressed in the General EHS Guidelines include:

- Construction site waste generation;
- Soil erosion and sediment control from materials sourcing areas and site preparation activities;
- Fugitive dust & other emissions (e.g., from vehicle traffic, land clearing activities, & materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities.





## Chapter 4 ENVIRONMENTAL & SOCIAL BASELINE

### 4.1 General

The baseline study is the existing environmental conditions of the project area related to the physical, biological and socio-economic environment prior to the beginning of construction activities. The existing baseline study would assist in understanding the prevalent macro and micro environment of this project and would also enable assessment of possible environmental impacts that may arise as a result of the activities associated with the project. It would also assist the design team in defining the mitigation measures that would be required to minimize the negative impacts which are identified in this study.

The site can be approached by the Hub Dam Road when approaching the Hub dam itself. The Hub Dam Canal travels on the Eastern Side of the demarcated site serving as a source of water.

The site consists of undulating terrain along the boundaries of the site, with rising elevations towards the Centre where it forms a hill that runs through the middle of the site from North to South.

Due to the presence of the Hub Dam Canal, the area has some agricultural activity as well as some people associated with the fields residing there.

The Hub Dam Canal's minimum and maximum distances from the subproject site eastern boundary are 109 meters and 174 meters, respectively.

Due to the recent rains in the area, the area had also witnessed the growth of rain fed vegetation, attracting animals for grazing.





Figure 4.1: Photographs from Microenvironment



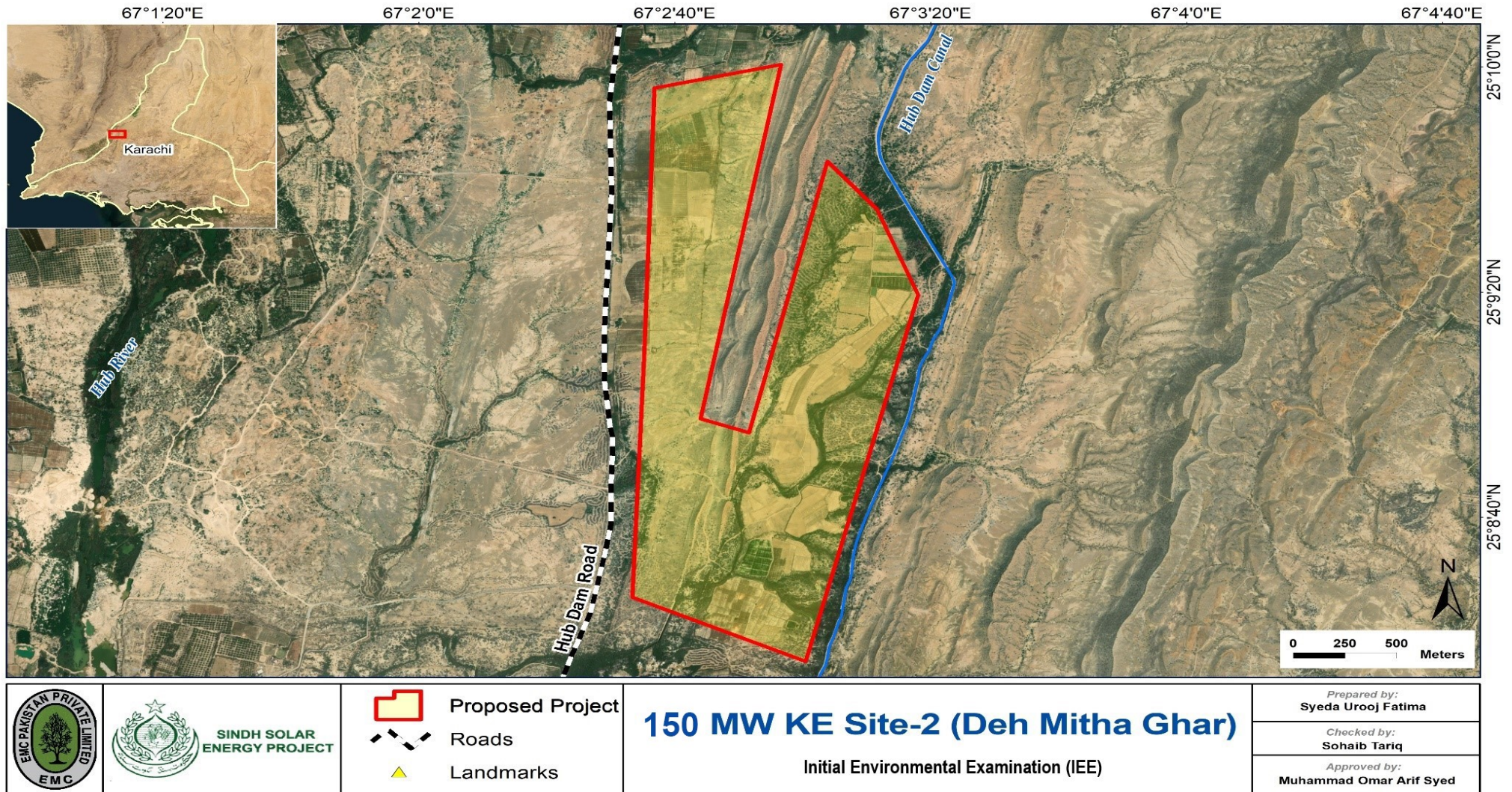


Figure 4.2: Location Map of Proposed 150 MW Solar Power Plant – Deh Mitha Ghar



## 4.2 Geography, Geomorphology and Soil

**Geology:** Karachi is the part of major synclinorium stretching from Ranpathani River in the east to Cape Monze in the west, Mehar and Mole Jabal (Mountains) in the north. Within the synclinorium a number of structures such as Pipri, Gulistan-e-Jauhar, Pir Mango and Cape Monze are exposed. The presence of concealed structures under the Malir River valley, Gadap and Maripur plains can fairly be deduced.

Rock aggregates, sand, limestone and clay are some of the potentials for gainful utilization. The area is underlain by rocks of sedimentary origin ranging in age from Eocene to Recent. Major structural trends and the basin axis strike generally south but with a “bulge” to the east also called Karachi Arc (Bender and Raza 1995).

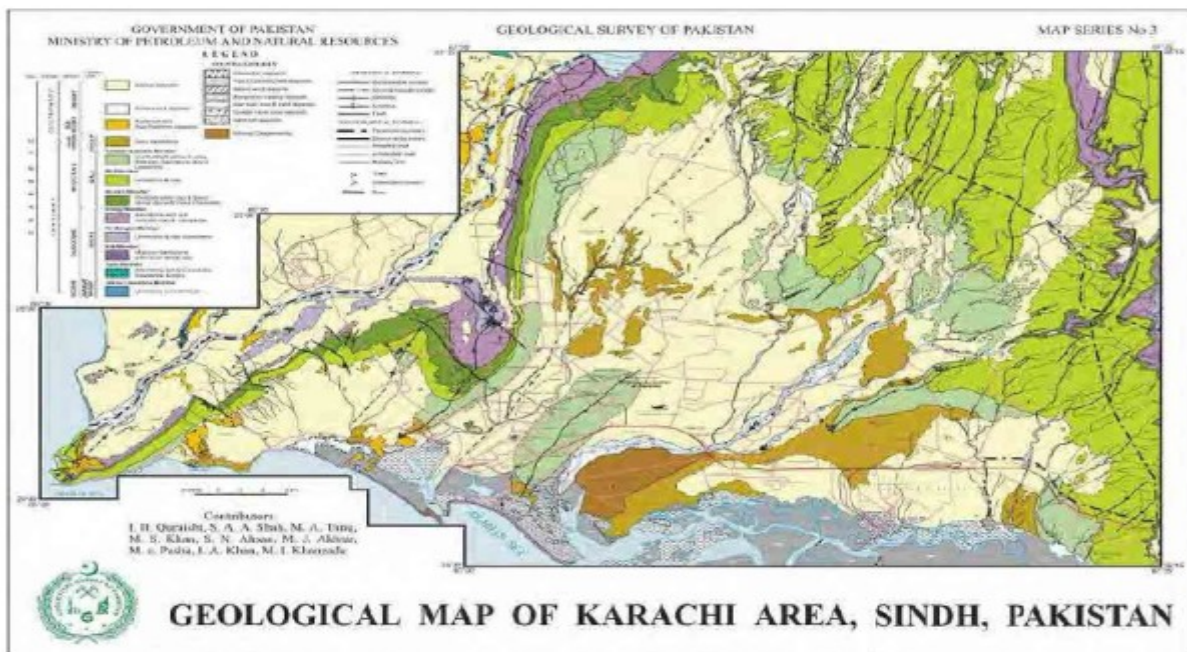


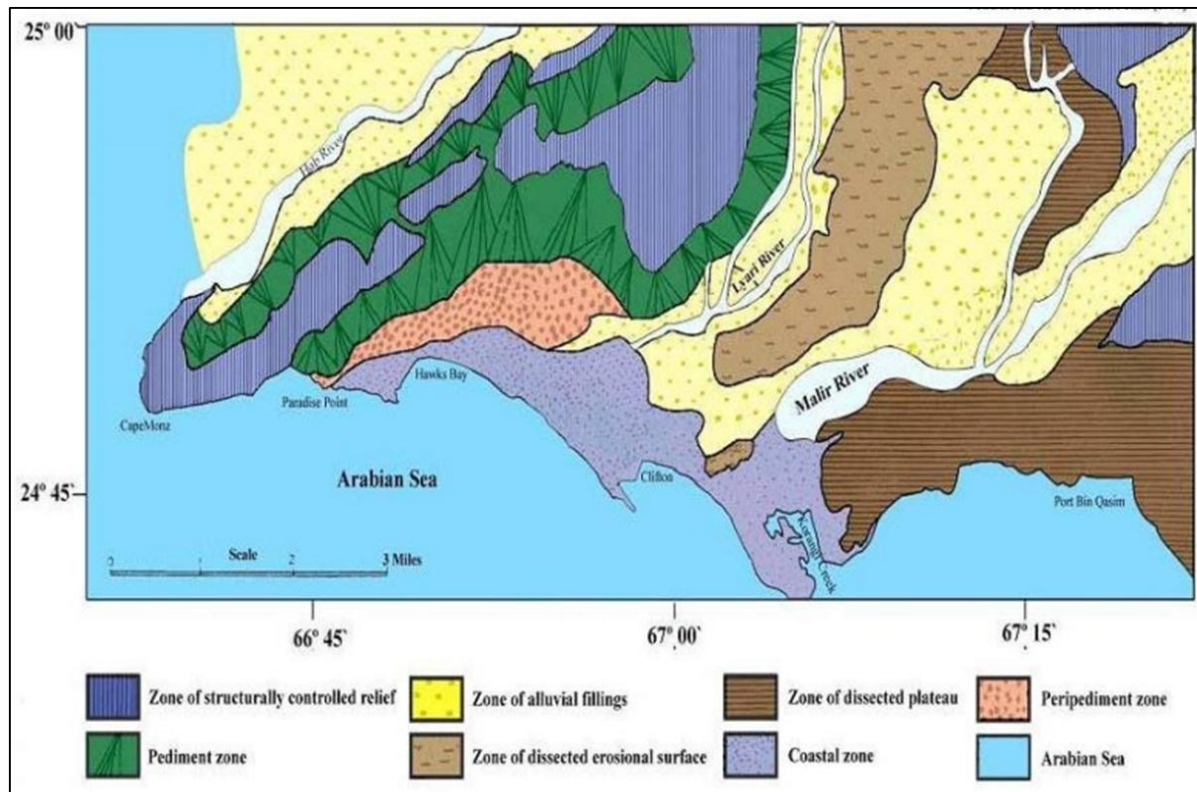
Figure 4.3: Geological map of Karachi

**Geomorphology of Karachi:** Karachi is located in the south of Sindh, on the coast of the Arabian Sea. It covers an area of approximately 3,600 km<sup>2</sup>, comprised largely of flat or rolling plains, with hills on the western and northern boundaries of the urban sprawl. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, hillocks. Classified according to physiographic features, Karachi City District can be divided into three broad categories:

- Hilly Region (Mountain Highland),
- Alluvial Plain (Piedmont Plain), and
- Coastal Areas (Valley Floor).

The metropolitan area is divided by two non-perennial river streams namely Lyari and Malir Rivers. The Malir River flows from the east towards the south and centre, and the Lyari River flows from north to the south west. Gujjar and Orangi are the two main tributaries of the Lyari River while Thaddo and Chakalo

are the main tributaries of the Malir River. The dry weather flow of both rivers carries urban sewage that is ultimately drained in the Arabian Sea. Among the various physiographic features, low flat-topped parallel hills devoid of vegetation, interspersed with widespread plains and dry riverbeds are the main topographic characteristics of the city.



**Figure 4.4: Geomorphological Zones of Karachi Region**

(Source: Hamid et al., 2019<sup>5</sup>)

**Soil:** The rocks belong to Paleozoic, Mesozoic and Tertiary Geological timescale. Soils of river plain are generally loamy, clayey and seasonally flooded soils. Some areas nearby Malir river salt affected soils. These soils found along river i.e., Loamy and some sandy stratified soils (Torrifluvents and Torripsammments) of recent river plains. The Town of Malir situated on the right bank of River Malir shows variable percentages of fine fractions in the soil components and the bulk density values in the range of 1.83-1.95 gm/cm<sup>3</sup>.

<sup>5</sup> Hamid et al. (2019). Soil Classification as a Tool for Evaluating Soil Behavior as Foundation Materials. International Journal of Economic and Environmental Geology, 41-46.





Figure 4.5: Soil Characteristics Map of Karachi

### 4.3 Seismicity

Seismotectonic Study for macro-environment of Project site aims at elucidating the impact of tectonic movement induced seismicity on the microenvironment. Karachi is Pakistan's largest city with population exceeding 18 million and is amongst the top five most congested cities in the world. Karachi has experienced no earthquake related damage in the recorded history of past ~ 175 years. Yet, Karachi is located in a seismically active tectonic setting often compared to Los Angeles with active plate boundary faults and triple junctions within a radius of ~ 150 km. This discrepancy in earthquake history and seismotectonic setting has led to diverse seismic hazard assessments for Karachi ranging from assignment of seismic hazard zones I (least severe) to IV (most severe). Recent assessment adopted in Building Code of Pakistan (2007) assigns an intermediate seismic hazard value of 0.16–0.24 g (Zone IIB) to Karachi, which is broadly accepted but sometimes criticized to be an underestimation.

A recent study entitled “*Seismic sources for southern Pakistan and seismic hazard assessment of Karachi*”<sup>6</sup>, based on a new active fault's compilation and seismic sources definition together with incorporation of maximum possible information on historical earthquakes (up to 893AD), has led to a re-assessment of seismic hazard for Karachi using probabilistic and deterministic seismic hazard assessment approaches. The main findings of this study are:

<sup>6</sup> Waseem, M., Khan, M. A., & Khan, S. (2019). Seismic sources for southern Pakistan and seismic hazard assessment of Karachi. *Natural Hazards*, 99(1), 511-536.

- Karachi is assessed to be prone to ground motions  $\sim 0.25$  g with metropolitan areas having hazard values between 0.21 and 0.25 g for 10% probability of exceedance in 50 years (475-year return period).
- The deterministic seismic hazard analysis suggests maximum that peak ground acceleration (PGA) varies from 0.19 to 0.99 g in Karachi and its higher values are concentrated around the Nagar Parker fault that is controlling and hazardous for Karachi.

Despite a safe seismic history spanning past about 175 years, Karachi is located in a tectonic setting, which is considered amongst the most active in the world. The active Chaman transform fault marking plate boundary between the Indian and Eurasian plates is located only 120 NW of Karachi. Karachi itself is located at the southern tip of N–S trending Kirthar active foreland thrust-fold belt at the western deformed edge of the Indian plate. The triple junction between the Indian, Arabian and Eurasian Plates is located 110 km to the SW of Karachi.

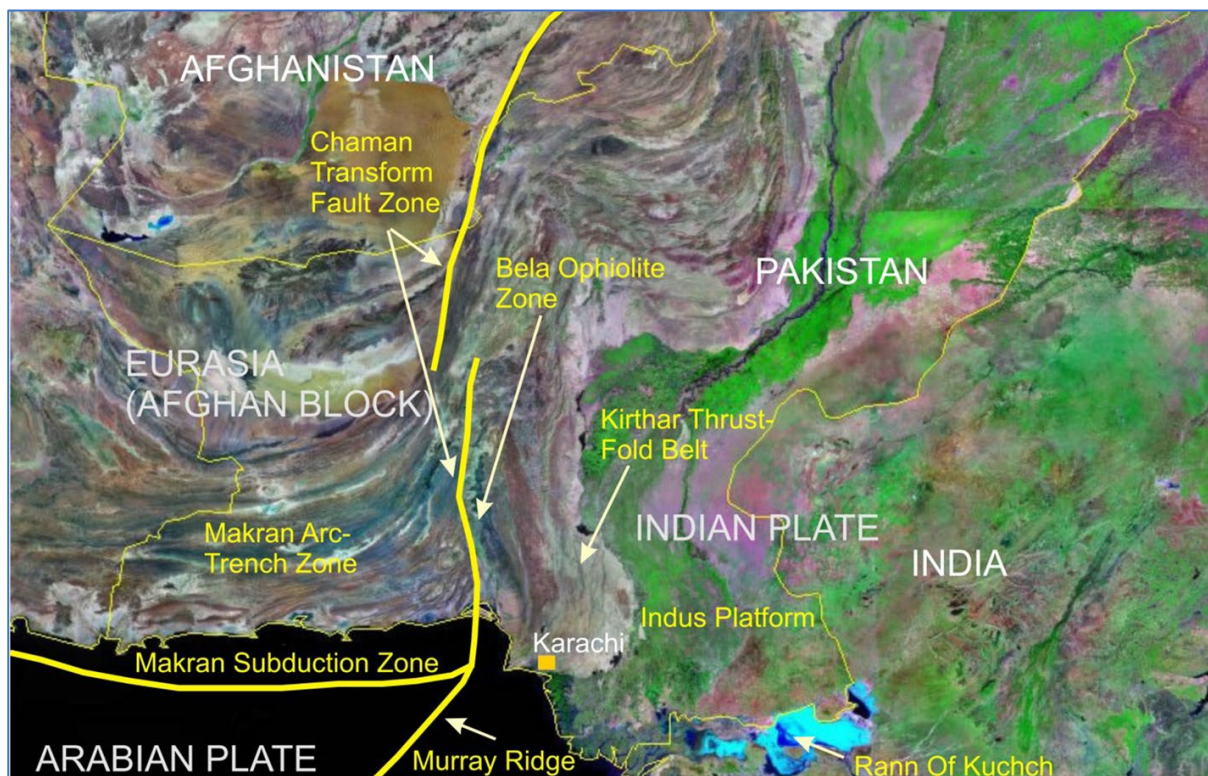


Figure 4.6: Tectonic setting of Karachi<sup>7</sup>

Seismic activity in the region is the result of the triple junction as well as the Karachi Arc, located in southeastern Pakistan, as a large fold and thrust belt that shows Neogene thin-skinned eastward movement. Seismic activity in and around the region shows that the Karachi Arc has been active since long in prompting the eastward movement of the delta. It is possible that the movement is related to the rebound that takes place after mass shift. Sarwar has suggested that the eastward creep of Karachi Arc

<sup>7</sup> Waseem, M., Khan, M. A., & Khan, S. (2019). Seismic sources for southern Pakistan and seismic hazard assessment of Karachi. *Natural Hazards*, 99(1), 511-536.

is directly related to active subsidence of the Hyderabad graben that underlies it and also defines the northern and southern limits of the Karachi Arc.<sup>8</sup>

It may be added that subsidence such as that on Southern coast of Sindh, occurs naturally as a result of plate tectonic activity above active faults, and in places where fluid is expelled from underlying sediments and is common at river deltas that may have receded. Earthquakes arise and result from the release of the force along the growth fault plane. As a result, many different growth faults are created as sediment loads shift basin ward and landward.

**Seismic Coefficient:** According to uniform building code (1997) the soil profile type of the project falls in category "Sc" corresponding to "Soft Rock/Very Dense Soil". Details are annexed in Subsoil Geotechnical Investigation Report. Following parameters can be adopted: Seismic Zone = 2B, Zone Factor = 0.2, Soil Profile Type = Sc, Seismic Coeff "Ca" = 0.24 and Seismic Coeff "Cv" = 0.32

**Earthquakes:** Historically the coastal region has suffered a number of earthquakes. Detailed review of the geological history including the modern time reveals the occurrence of deep-sea earthquakes at different times, throughout history in the North Arabian Sea, as presented below:

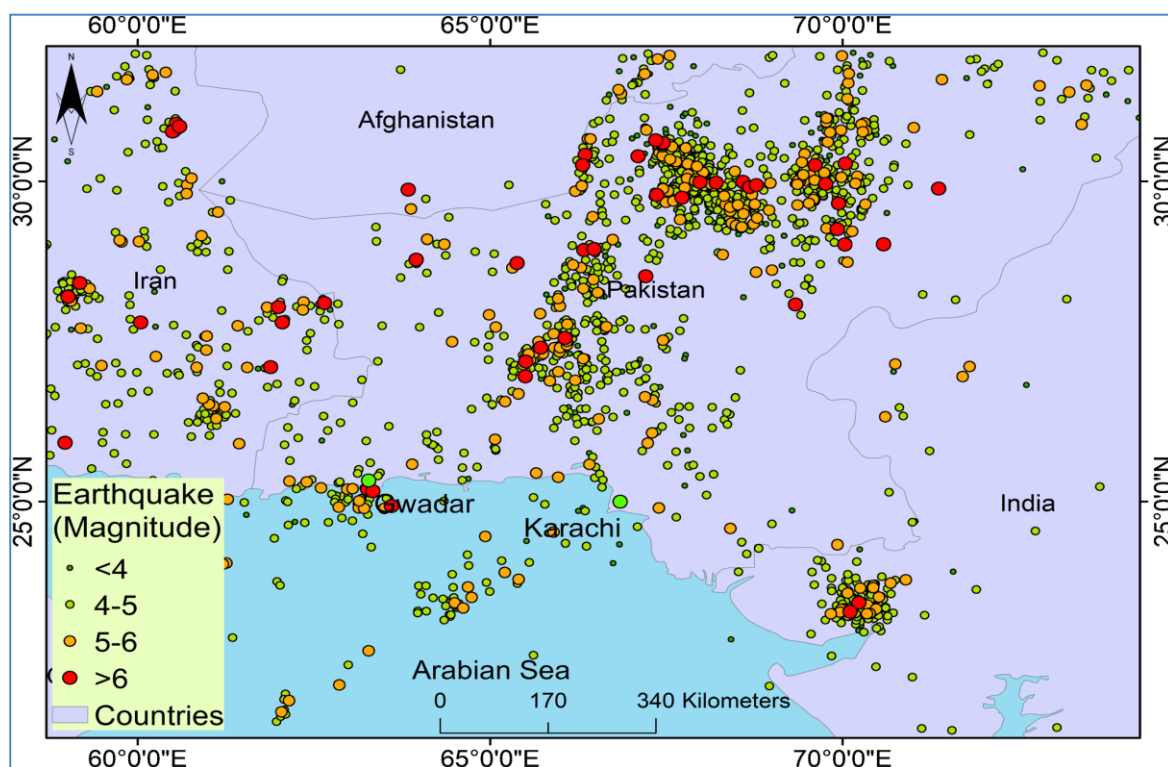


Figure 4.7: Earthquake recorded (1950–2019) in the Arabian Sea and its surroundings<sup>9</sup>

<sup>8</sup> (Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. Pakistan Journal of Hydrocarbon Research, 14, 35-40).

<sup>9</sup> Aslam, B., Ismail, S., & Maqsoom, A. (2020). Geospatial mapping of Tsunami susceptibility of Karachi to Gwadar coastal area of Pakistan. *Arabian Journal of Geosciences*, 13(17), 1-12.

<sup>9</sup> (Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. Pakistan Journal of Hydrocarbon Research, 14, 35-40).



**Seismicity of the Site:** According to the Uniform Building Code (1997), Karachi and its adjoining areas fall in Seismic Zone-2B.

Sarwar and Alizai have compiled a list of earthquakes during the 1902-2013 period and also produced the above map that gives a distribution of hypocenters of earthquakes during the same period. From the distribution of hypocenters, it has been inferred that the entire Karachi Arc and surrounding areas are seismically active with hypocenters ranging in depth from 0-500 kilometers. From the depth of hypocenters, it is inferred that active deformation has taken place at multi-levels ranging from shallow too deep in the basement. Quite a few of the recent epicenters are found within or in close proximity to parts of Karachi that have faced recurrent earthquake activity.

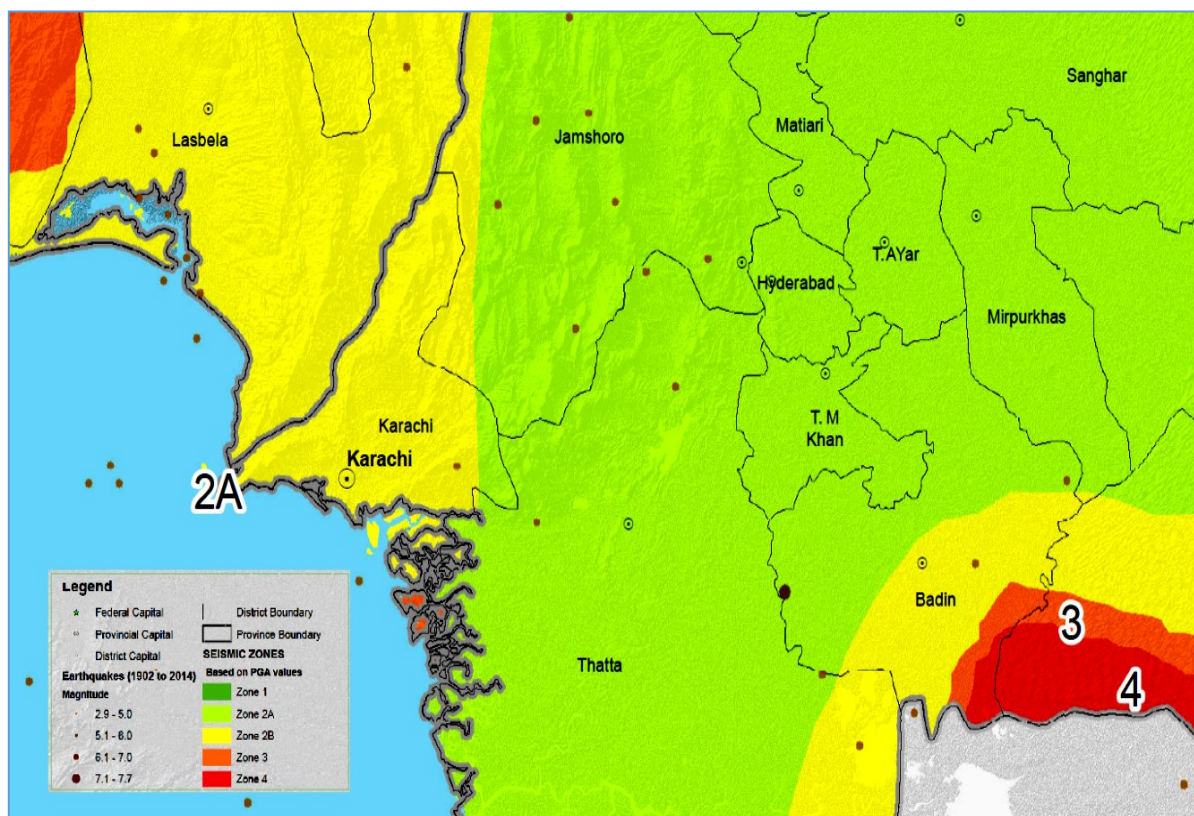


Figure 4.8: Seismic Zones in Karachi<sup>10</sup>

<sup>10</sup> Map data source(s): PMD, GSP, Pakistan Engineering Council – Prepared by Al Hasan Systems Private Ltd.

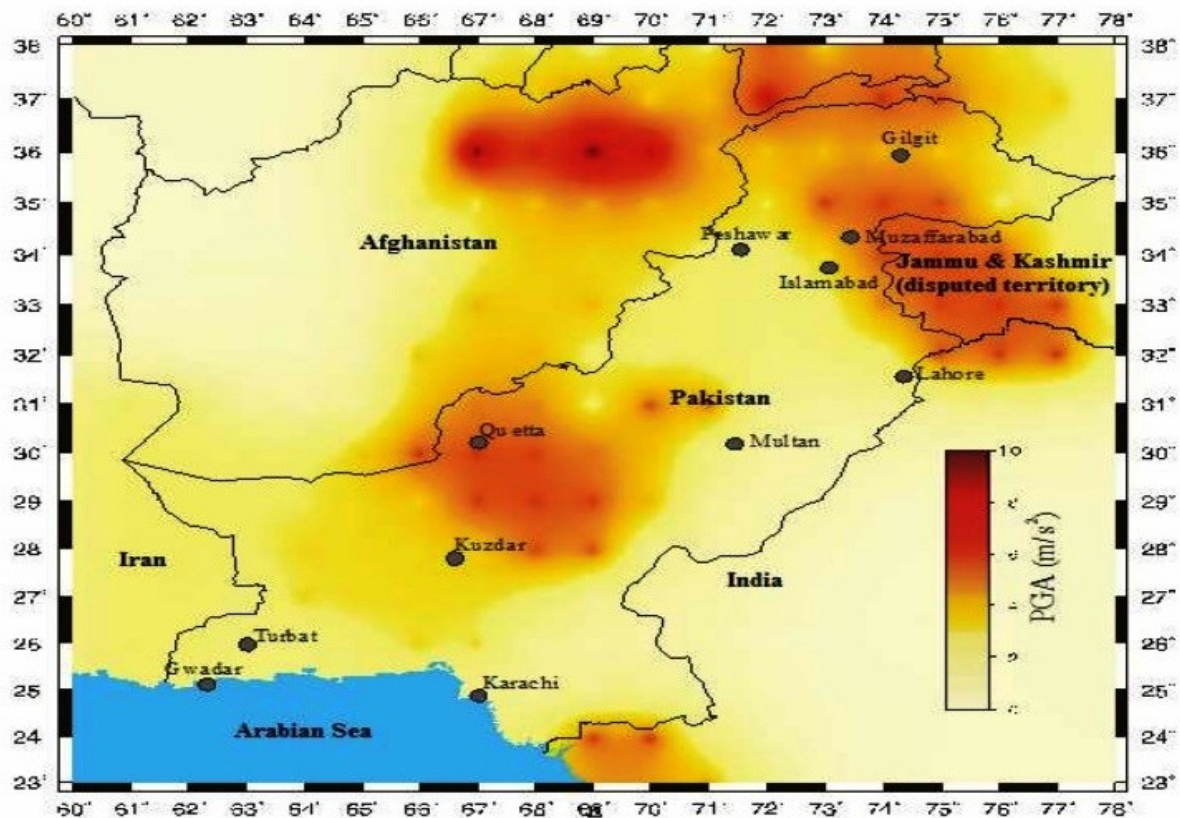


Figure 4.9: Seismic Hazard for Pakistan in terms of Peak Ground Acceleration (PGA)<sup>11</sup>

**Earthquakes:** Historically the coastal region has suffered a number of earthquakes. A list of earthquakes that have affected Karachi and its vicinity has been compiled by the Meteorological Department and listed by Sarwar and Alizai.

Some of the events are listed in Table-4.1.

**Table 4.1: List of Earthquake in Indus Deltaic Region and surrounding within Latitude 23.0-25.0N and Longitude 67.5-71.0E**

Date	Lat-N	Lat-E	Magnitude	
			Depth (km)	Richter Scale
26-09-1977	25.4	68.2	33	4.5
25-11-1982	25.6	67.9	33	4.9
17-12-1985	24.9	67.4	33	4.9
24-12-1985	24.8	67.6	33	4.7
10-09-1991	24.4	67.7	33	4.8
19-09-1991	24.3	68.7	33	4.7
23-04-1992	24.3	68.8	33	3.7
24-12-1992	25.2	67.7	33	3.6
05-02-1993	24.6	68.9	33	4.3
26-01-2001	23.4	70.3	17	7.6

<sup>11</sup> PMD Seismic Monitoring and Early Tsunami Warning Centre -  
<http://seismic.pmd.gov.pk/seismicnew/map2.html>



The largest earthquake that was incident in 1819, had a magnitude of 8.0; it was felt over almost all over the Indian sub-continent. Eastern branch of the Indus River was blocked, long tract of alluvial land was uplifted, and there was surface faulting and subsequent subsidence in the epicenter area. This fault produced a scarp called “The Allah Bund”.

#### 4.4 Liquefaction Features Caused by Earthquake

Liquefaction is a total loss of strength due to undrained restructuring. Disturbance, by shearing or vibration, destroys soil skeleton, with loss of grain contact and decrease of porosity, soil load is transferred to pore water, water pressure > normal stress = 0, and soil acts as a liquid. Drainage reduces pore water pressure, allows grain contact and thixotropic recovery of strength (Waltham, 2002). Strong shaking produces liquefaction in the fine sands and silts during the earthquake. This causes the mineral grains to settle and expel their interstitial water to the surface. If the pore-water pressure rises to a level approaching the weight of overlying soil, the granular layer behaves as a viscous liquid rather than a solid and leads to collapse of even engineered structures. Liquefaction has been abundant in areas, where groundwater lies within 10 meters of the ground surface (Husain et al., 2004). Investigators typically have designated sites as “Liquefied” on the basis of the presence of surficial liquefaction features, such as venting of sediment to the surface (i.e., sand boils), ground cracking associated with liquefaction (e.g., lateral spreading), or surface settlements. Other evidence of liquefaction includes tilting or settling of overlying structures and floating of underground structures (Olson et al., 2002). Mahmood and Shaikh (2008) investigated the “sinking” of a water tower in 2006 near Clifton area and speculated about liquefaction due to mild earthquakes.

#### 4.5 Meteorology and Climatic

The coastal part of Karachi is largely influenced by the subtropical monsoon regime. The strong southwest monsoon period prevails from May to September while the weak northeast monsoon period is restricted to the period between December and January. The period between the two monsoons is considered to be the transitional or calm period with winds of variable speed and direction. The weather during the inter-monsoon periods is uncertain and short spells of dust storms, dry weather, or a humid cool breeze may prevail for short durations.

**Table 4.1: Seasonal Characteristics of the Climate of Karachi**

Season	Temperature	Rainfall	Wind
<b>Summer (Mid-March to Mid-June)</b>	The summer is hot with temperature increasing from 26.2 °C in March, rising up to 40 °C in June.	There are less frequent rain showers in summer with no more than 1 or 2 rainy days in summer. Average total amount of rain in summer is around 10 mm	The wind speed in summer is variable. It is around 2.5 m/s in March and rises upto 18 m/s in April and drops to 4 m/s for the rest of the season. The direction mostly remains blowing from West

<b>Monsoon (Mid-June to mid-September)</b>	The temperature in monsoon remains high but relatively lower than summer and oscillates around 32°C.	Almost 80 % of the yearly rain occurs in the monsoon with July and August being the wettest month.	The wind direction in the monsoon is mostly blowing from East.
<b>Post-Monsoon Summer (Mid-September to November)</b>	The average temperature post monsoon drops and average min temperature may reach 12 °C in November.	The post-monsoon period remains mostly dry and rainfall in November is around 1.8 mm.	The wind speed in September is around 3.7 m/s and drops to 1.4 m/s in November.
<b>Winter (December to mid-March)</b>	The winter is mild with January being the coolest month where average minimum temperature falls to 6 °C.	Like the other seasons, except monsoon, there is little occasional rainfall. The rainfall in winter is less than 50 mm.	The wind speed in the winter season increases from 1.4 m/s in December to 2.6 m/s in March. The wind direction for most part winter season is blowing from NE and changes its course to blowing from West in early March

#### i. Temperature

The air temperature in Karachi Division and its coastal areas are generally moderate throughout the year due to presence of sea. Climate data generated by the meteorological station at Karachi Air Port represents climatic conditions for the region. The mean monthly maximum and minimum temperatures, recorded during the last 20 years in Karachi to describe the weather conditions are shown in Table 4.1(b) and 4.2 respectively.

Table 4.2(a): Mean Monthly Maximum Temperatures (°C) in Karachi													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	27.2	29.6	33.1	34.6	35.1	34.9	32.2	32.3	33.1	36.0	33.5	30.4	32.7
2002	27.0	28.2	33.3	35.4	35.6	35.1	32.2	31.6	31.4	36.5	32.7	28.1	32.3
2003	27.6	28.5	32.4	36.6	35.7	34.9	34.1	32.6	32.5	37.0	32.2	28.3	32.7
2004	26.6	29.9	36.2	35.4	36.8	35.6	33.8	32.7	32.8	33.7	33.1	29.4	33.0
2005	24.9	26.3	31.5	35.3	35.4	36.0	33.2	32.2	34.2	35.2	33.1	28.4	32.1
2006	26.0	31.3	31.8	34.0	34.6	35.3	33.8	31.0	34.2	35.0	33.4	26.3	32.2
2007	26.9	29.4	31.4	37.7	36.0	36.4	N/A	N/A	N/A	N/A	N/A	N/A	33.0
2008	24.4	26.9	34.3	34.4	33.9	35.1	33.5	31.9	34.7	35.5	32.5	27.2	32.0
2009	26.2	29.8	33.0	36.0	36.8	35.7	34.5	33.0	32.8	35.9	33.0	28.6	32.9
2010	27.5	29.2	34	35.7	36.5	34.7	34.6	33.2	34.5	35.9	32.7	28	33.0
2011	26.9	28.5	33.2	35.8	35.3	35.3	34.2	32.8	32.9	N/A	N/A	N/A	N/A
2012	25.7	26.9	31.7	35.1	35.5	34.6	33.2	32.7	33.2	35.0	32.7	28.2	32.0
2013	26.7	28.0	33.3	34.0	35.1	36.5	33.8	32.1	33.0	35.7	32.3	28.3	32.4
2014	25.5	28.0	31.7	35.1	35.9	36.5	34.0	33.7	33.8	36.3	32.9	28.7	32.7
2015	26.3	28.9	31.5	35.9	36.0	37.7	34.1	32.3	34.6	35.8	33.0	28.6	32.9



2016	27.8	30.3	33.3	34.7	35.7	36.1	33.6	33.0	32.9	34.0	33.3	31.0	33.0
2017	25.4	30.2	32.8	35.5	36.2	36.3	33.1	33.8	33.4	36.6	32.3	28.2	32.8
2018	28.5	30.4	34.4	36.2	38.7	35.4	33.8	31.9	32.6	36.8	33.8	28.2	33.4
2019	26.3	26.8	31.3	35.4	36.0	37.2	34.7	32.5	35.7	35.8	31.5	27.1	32.5
2020	24.3	30.1	31.2	36.2	36.6	37.3	36.7	34.6	35.0	36.2	31.4	28.1	33.1
2021	26.6	31.3	34.6	37.3	37.5	36.1	34.5	32.6	36.3	34.8	34.0	27.6	33.6

Source: Pakistan Meteorological Department

Table 4.2(b): Mean Monthly Minimum Temperatures (°C) in Karachi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	11.5	14.9	19.6	23.8	28.1	29.0	27.1	26.5	25.9	24.4	18.6	15.8	22.1
2002	12.8	13.8	19.5	23.9	27.0	28.2	29.6	25.6	24.8	22.5	17.7	14.9	21.7
2003	12.7	16.9	19.8	24.2	26.5	28.2	23.6	27.0	25.3	20.9	15.2	12.0	21.0
2004	12.9	14.5	19.1	24.8	27.3	28.8	27.5	26.3	25.3	22.4	18.0	15.4	21.9
2005	12.3	11.3	20.3	23.0	26.4	28.3	27.2	26.6	26.6	22.9	18.9	13.0	21.4
2006	11.7	18.1	19.6	24.5	27.5	28.5	28.3	26.3	26.8	25.7	19.4	14.0	22.5
2007	13.0	17.3	19.7	24.7	27.6	28.6	N/A	N/A	N/A	N/A	N/A	N/A	21.8
2008	10.1	11.1	19.6	24.0	27.3	29.1	27.9	26.8	26.6	23.8	17.6	14.9	21.6
2009	14.7	16.5	20.8	23.8	27.6	28.7	28.1	27.5	26.5	22.6	17.0	13.9	22.3
2010	12.2	14.7	21.3	25.1	28	28.2	28.3	27.2	25.8	23.9	17.4	11.1	21.9
2011	11	14.5	19.7	23.1	27.1	28.8	27.8	28.6	26.5	N/A	N/A	N/A	N/A
2012	11.2	11.9	19.1	24.5	27.2	28.0	27.9	26.9	26.4	22.7	18.6	14.2	21.5
2013	11.6	15.1	19.2	24.2	27.1	29.3	28.0	26.6	25.5	25.4	18.1	13.0	21.9
2014	9.9	13.1	18.9	24.4	27.0	29.2	28.3	27.1	26.8	23.3	19.5	13.1	21.7
2015	12.6	16.4	19.2	25.7	27.7	29.8	28.4	26.9	26.3	24.9	18.6	12.6	22.4
2016	14.8	14.9	21.7	24.6	27.9	27.9	28.1	27.1	26.4	24.0	17.1	15.5	22.5
2017	12.5	18.2	20.3	24.4	27.8	29.2	27.7	27.0	26.2	23.5	16.8	13.0	22.2
2018	12.9	15.8	20.9	25.3	27.7	28.8	28.1	26.3	25.5	23.0	19.3	13.1	22.2
2019	13.3	15.3	19.0	24.0	26.6	28.9	28.1	26.8	27.2	24.0	19.4	13.7	22.2
2020	10.8	15.3	19.1	24.7	27.7	29.7	29.4	28.1	27.3	22.7	16.0	12.5	21.9
2021	9.2	15.0	21.6	25.1	28.9	29.6	28.5	27.4	28.0	23.1	17.6	13.9	22.3

Source: Pakistan Meteorological Department

## ii. Precipitation

The main source of precipitation is rainfall which is received mostly in the months of July to September during SW Monsoon winds. It is very erratic as some years are dry and others are wetter.

Occasional winter rains are also received in the months of December –February as result of NE winds which count 15-25% of total rainfall.



**Table 4.3: Monthly Amount of Precipitation (mm) at Karachi Airport**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0	0	0	0	0	10.6	73.6	16.2	N/A	0	0	0	100.4
2002	0	2.4	0	0	0	N/A	N/A	52.2	N/A	0	0.5	0.4	55.5
2003	6.4	21.8	0	0	0	16.3	270.4	9.8	N/A	0	0.2	0	324.9
2004	13.7	0	0	0	0	N/A	3	5.6	N/A	39.3	0	4.3	65.9
2005	6.6	12.8	N/A	0	0	N/A	N/A	0.3	54.9	0	0	17.1	91.7
2006	N/A	0	N/A	0	0	0	66.2	148.6	21.9	0	3.1	61.3	301.1
2007	0	13.2	33.4	0	0	110.2	N/A	N/A	N/A	N/A	N/A	N/A	156.8
2008	8	Trace	1.1	0	0	0	54	37.5	Trace	0	0	21	121.6
2009	3	Trace	0	Trace	0	2.6	159.9	44	68.9	0	0	1.5	279.9
2012	0.2	0	0	0	0	Trace	Trace	8.1	121	0	0	22.8	152.1
2013	Trace	20	2.8	30	0	Trace	5.5	105.4	4	1.2	0	0	168.9
2014	Trace	0	12.4	0	1.3	Trace	1.1	9.9	1.4	0	4.6	0	30.7
2015	0.3	2.1	2.8	0	0	Trace	46.6	1.4	Trace	0	0	0	53.2
2016	3.1	0	Trace	0	0	65.8	1.9	96.9	Trace	0	0	0	167.7
2017	41.5	Trace	0	0	0	58.8	33.3	65.6	26.4	0	0	6.6	232.2
2018	Trace	Trace	0	0	0	Trace	Trace	0.8	Trace	0	0	Trace	0.8
2019	39.4	Trace	2.2	0	0	1.6	66.3	204	51.7	1.2	Trace	Trace	367.3
2020	Trace	2.6	0.5	0	0	Trace	101.2	366.8	Trace	0	3.1	0	474.2
2021	0	0	0	0	0	Trace	45.4	Trace	88.3	17.2	0	16.9	167.8

Source: Pakistan Meteorological Department

The wet years have been found to follow a 3-year cycle during the first 9 years of the 3rd Millennium. The year 2010 was among the wettest years since Karachi City had witnessed more than 5 spells of 50 mm each during the month of July, three major spells of 60 to 100 mm in August and two spells of 25 and 10 mm each in the month of September. In July and August 2011 again, there was heavy rainfall



all over Sindh. Hyderabad received about 74 to 103 mm rain in 24 hours and the same amount poured in Karachi and the villages in its outskirts. Among the other July 2020 was considered to be the wettest month among the others and the total annual rainfall records in 2020 higher than other past 19 years. The torrential rains resulted in flooding of several villages in Karachi District. The ongoing monsoon season of 2022 has brought more rains in Karachi than in past twenty years.

### iii. Wind Speed & Direction

The wind direction and speed between the summer and winter monsoon seasons are rather unsettled and large variations are noted both with respect to speed and direction. The wind velocity record (2001-2021) indicates that the velocity varies and ranges between 1.0 m/s to 13.7 m/s. The Tables 4.4 and 4.5 show the wind speed and direction respectively.

**Table 4.4: Wind Speed (m/s) at 12:00UTS**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	2.6	3.4	4.3	5.6	7.5	8.1	6.8	7.3	5.5	3.7	2.0	2.4	4.9
2002	3.6	3.9	4.0	6.5	8.5	8.2	9.8	7.3	7.7	3.3	2.9	3.2	5.7
2003	4.0	5.0	5.4	5.2	7.7	8.8	6.7	7.1	6.0	3.2	3.1	3.0	5.4
2004	3.4	3.7	4.0	6.0	8.0	9.0	10.0	9.5	7.3	3.8	1.0	2.5	5.7
2005	3.6	4.2	4.8	5.1	7.1	7.5	9.0	6.9	6.4	3.9	2.0	1.5	5.2
2006	2.0	3.0	3.0	6.2	8.0	7.7	8.3	6.2	4.7	4.2	2.2	3.0	4.9
2007	2.0	3.7	4.0	4.0	6.0	6.3	N/A	N/A	N/A	N/A	N/A	N/A	4.3
2008	4.3	7.6	8.2	10.5	12.6	7.6	11.0	9.3	8.7	6.6	5.1	3.9	7.9
2009	7.0	7.2	7.9	9.3	9.8	9.7	9.5	9.3	9.1	6.1	5.0	3.9	7.8
2012	5.8	6.6	9.3	9.8	12.3	12.8	13.1	11.2	8.4	7.1	5.7	5.8	9.0
2013	5.2	6.9	9.0	10.3	11.5	10.8	12.0	11.2	10.3	7.7	5.1	4.5	8.7
2014	5.9	8.9	8.6	11.5	12.4	13.4	12.8	11.6	11.7	8.3	6.0	4.5	9.6
2015	6.9	10.3	10.1	11.5	12.8	12.3	13.7	12.3	10.5	8.7	5.6	5.8	10.0
2016	7.5	8.7	4.8	1.1	13.0	11.7	11.8	10.5	12.1	9.2	5.5	5.2	8.4
2017	7.0	8.0	10.8	12.1	12.8	11.5	12.1	10.3	8.7	8.5	5.4	7.4	6.9
2018	6.3	7.0	9.5	10.2	10.8	11.1	12.3	12.4	12.2	8.7	6.1	6.8	9.4



<b>2019</b>	6.7	8.9	10.2	11.7	12.1	11.7	13.7	9.1	8.5	8.0	6.9	7.4	9.6
<b>2020</b>	9.0	9.4	9.0	10.5	13.3	10.9	10.1	8.9	9.4	7.3	6.2	5.5	9.1
<b>2021</b>	6.1	7.6	9.7	8.5	11.7	12.7	12.6	11.1	8.8	8.1	6.7	6.6	9.2
<b>Source: Pakistan Meteorological Department</b>													

**Table 4.5: Wind Direction at 12:00UTS**

<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
<b>2001</b>	S54W	S43W	S42W	S45W	S46W	S45W	N52W	S59W	S44W	N56W	S45W	S06W
<b>2002</b>	S67W	S52W	S51W	S55W	S51W	S42W	S54W	S45W	S48W	S56W	N54W	S41W
<b>2003</b>	S60W	N50W	S45W	S48W	S45W	S68W	S60W	S47W	S43W	S54W	S50W	S27W
<b>2004</b>	N27E	S46W	S53W	S49W	S52W	S54W	S54W	S62W	S56W	S47W	S45W	N86E
<b>2005</b>	N63E	S51W	S50W	S52W	S63W	S48W	S54W	S49W	S87W	S54W	S52W	N23W
<b>2006</b>	S48W	S62W	S50W	S57W	S64W	S60W	S67W	S78W	S51W	S53W	S49W	N79E
<b>2007</b>	S30W	S62W	S47W	S55W	S58W	S47W	S41W	S55W	S60W	S48W	S48W	N45E
<b>2008</b>	N45E	S47W	S54W	S51W	S52W	S39W	S50W	S52W	S46W	S39W	S38W	N
<b>2009</b>	N45E	S45W	S41W	S58W	S46W	S46W	S56W	S49W	S56W	S42W	S39W	S45E
<b>2012</b>	S3E	N56E	S62W	S46W	S61W	S51W	S66W	S51W	S53W	S41W	S41W	N9W
<b>2013</b>	N39W	S54W	S56W	S54W	S61W	S40W	S53W	S52W	S55W	S47W	S17W	N50W
<b>2014</b>	S72E	S54W	S43W	S46W	S46W	S45W	S54W	S48W	S85W	S45W	S49W	S45E
<b>2015</b>	S72E	S54W	S43W	S48W	S50W	S40W	S54W	S55W	S50W	S41W	S	S58W
<b>2016</b>	S43W	S36W	S48W	S54W	S54W	S45W	S48W	S36W	S51W	S45W	S43W	S36W
<b>2017</b>	S83E	S56W	S51W	S45W	S45W	S44W	S66W	S57W	S48W	S51W	S59W	N45E
<b>2018</b>	S54W	S43W	S42W	S45W	S46W	S45W	N52W	S59W	S44W	N56W	S45W	S06W
<b>2019</b>	S67W	S52W	S51W	S55W	S51W	S42W	S54W	S45W	S48W	S56W	N54W	S41W
<b>2020</b>	N31E	S12W	S52W	S55W	S49W	S44W	S47W	S55W	S47W	S38W	S4E	N35E



2021	S21W	S38W	S44W	S42W	S52W	S53W	S55W	S48W	S40W	S41W	S22E	S40E
Source: Pakistan Meteorological Department												

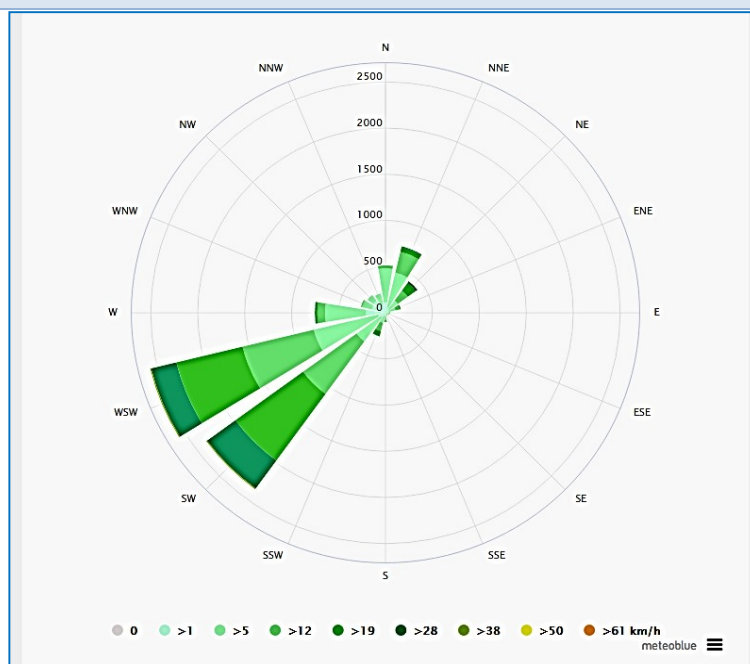


Figure 4.3: Wind rose for Karachi <sup>12</sup>

#### iv. Humidity

The relative humidity typically ranges from 25% (dry) to 70% (humid) over the course of a year, rarely dropping below 20% (very dry) and reaching as high as 90% (very humid).

Table 4.6: Mean Monthly Relative Humidity (Mean) at 1200 UTC (%)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	25.0	27.0	35.0	47.0	57.0	61.0	64.0	61.0	60.0	36.0	36.0	31.0	45.0
2015	38.0	41.0	37.0	45.0	60.0	56.0	69.0	67.0	56.0	47.0	28.0	31.0	47.9
2016	46.0	25.0	41.0	47.0	60.0	60.0	68.0	70.0	63.0	57.0	34.0	38.0	50.8
2017	38.0	25.0	36.0	44.0	59.0	62.0	70.0	67.0	63.0	44.0	29.0	20.0	46.4
2018	36.0	37.0	33.0	45.0	46.0	65.0	65.0	68.0	63.0	40.0	32.0	30.0	46.7
2019	40.4	33.9	36.6	48.0	55.6	58.8	64.8	72.6	67.6	41.1	34.6	29.7	48.6

12. Source: [https://www.meteoblue.com/en/weather/forecast/modelclimate/karachi\\_pakistan\\_1174872](https://www.meteoblue.com/en/weather/forecast/modelclimate/karachi_pakistan_1174872)

2020	29.9	28.1	34.2	44.4	57.1	56.8	65.0	74.8	62.4	38.1	32.9	29.1	46.1
2021	31.3	34.1	41.2	43.3	54.3	60.3	67.5	64.5	63.0	46.5	27.6	38.7	47.7
<b>Source: Pakistan Meteorological Department</b>													

#### 4.6 Urban Heat Island (UHI) Effect

The term "heat island" describes built environment that are hotter than nearby natural areas. An urban heat island refers to a city or metropolitan area that is significantly warmer than its surrounding natural areas due to human activities. The temperature difference usually is larger at night than during the day and is most apparent when winds are weak. UHI is most noticeable during the summer and winter seasons. It is estimated that the annual mean air temperature of a city with 1 million or above inhabitants can be 1–3°C warmer than its surroundings. In the evening, the difference can be as high as 12°C. The heat island can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.

The city of Karachi has been growing exponentially in terms of urbanization and population growth. The city hosts more than 22 million population with a density of 4,115 persons per kilometer square (km<sup>2</sup>). The urban area density has increased from 233 km<sup>2</sup> in 1947 with a population size of 0.4 million to 3,566 km<sup>2</sup> in 2004 with a population size of 14 million (Qureshi et al., 2008). Rapid urbanization and global warming have initiated UHI effect over the city. A strong incidence of UHI is generally associated with a severe heat wave hazard in terms of sensible temperature. UHI effect is the unique feature of the June 2015 heat wave in Karachi. It is expected that with growing global warming incidence and poor coping strategies, UHI would become a major health risk for the vulnerable segment of population in mega-cities around the globe such as Karachi.

**Causes of Urban Heat Island Effect:** The principal reason for the night time warming is the retention of short-wave solar radiation absorbed during the day time by the infrastructural material consisting of concrete and asphalt. These materials are commonly used in urban areas for pavement and roofs that have significantly different thermal and radiative properties compared to the surrounding rural areas. This causes a change in the energy balance of the metropolitan area, often leading to higher temperatures than surrounding rural areas. This energy is then slowly released during the night as a long wave radiation, making cooling a slow process. Because of this phenomenon, the minimum temperatures of Karachi remained extremely high during the heat-wave event.

There are several causes of an urban heat island effect in Karachi.

Reduced and slow process of evapotranspiration due to shrinking green areas and spaces in the city. With a decreased amount of vegetation, the city loses the shade, cooling effect of trees and the removal of carbon dioxide.

Geometric effects in terms of rising number of tall buildings are a significant contributing factor to urban heat island effect. Over the years, the number of tall buildings within the city has increased that provide multiple surfaces for the reflection and absorption of sunlight, and thus increasing the efficiency with which the city is heated. This is called the "urban canyon effect". Another effect of increased

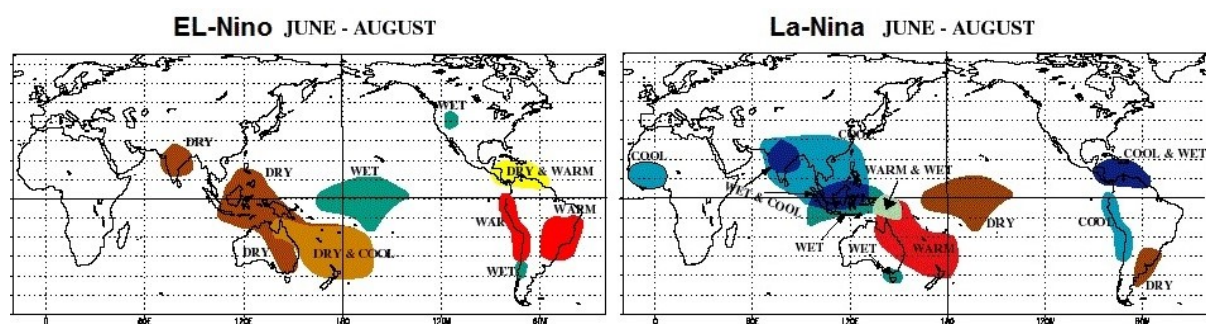
number of buildings is the blockage of wind, which also inhibits cooling by convection and pollution from dissipating.

Waste heat from automobiles, air conditioning, industry, and other sources also contributes to the UHI. High levels of pollution in urban areas can also increase the UHI, as many forms of pollution change the radiative properties of the atmosphere.

Aside from the effect on temperature, UHI can produce secondary effects on local meteorology, including the altering of local wind patterns and humidity, which have been discussed in the previous section. The UHI effect described above has been one of the major causes of unprecedented large number of heats related deaths in Karachi. Future climate scenarios suggest that the frequency of this kind of disasters may increase with the rise of temperature in future.

#### 4.7 Impact of Climate Change - Karachi

A UK-based climate change expert has warned that there will be an exceptional change in the temperatures in Pakistan as a whole in the coming years, but that the province of Sindh will be less affected as compared to the other provinces of the country. Karachi may however face the threat of rising sea levels by the year 2100, at about 8 feet below sea level. The UK-based climate change expert said that climate change could influence monsoon dynamics and cause summer precipitation levels to drop, as well delays in the start of the monsoon season. While another report said that the impact of climate change in Karachi will deepen by 2030. Due to global warming the coastline of Karachi is likely to be flooded due to rising sea levels. Many seminars and public gathering are held in the city to make the government and public fully aware of global warming, speakers at the seminar have urged the government to prepare long and short-term plans to reduce the impact of global warming on natural resources. Karachi also faces the threat from super cyclones which are said to increase their intensity and momentum in years to come.



**List of cyclones that affected Karachi and the Sindh coast:** Cyclones that form in the Arabian Sea do not usually hit Karachi or the Sindh coast, during 1902, 1907, 1944, 1964, 1985, 1999, 2007 and 2010, cyclones made landfall in the Sindh coast including Karachi. Other cyclones that are listed below caused rains as remnants.

- On 12 June 1964, a deadly cyclone made landfall near Karachi.
- On 15 December 1965, a powerful cyclone slammed the city with 10,000 casualties.
- In May 1985, a cyclonic storm made a landfall in the eastern direction of Karachi. The cyclonic storm in 1985 which was moving towards Karachi actually had weakened over the sea while still a few 100 Kilometers away south of Karachi.

- In November 1993, a category 1 cyclone approached the Sindh-Gujarat border but dissipated due to high vertical shear over open waters.
- In June 1998, remnants of the category 3 Gujarati cyclone (the 5th strongest cyclone of the Arabian Sea) killed 12 people near and in the city.
- In May 1999, again a category 3 major cyclone (the 4th strongest cyclone of Arabian Sea) hit near the city; this Cyclone killed 700 people in Sindh including Karachi. It is the strongest cyclone recorded in Pakistan.
- In May 2001, the powerful category 3 cyclone (the 3rd strongest cyclone of the Arabian Sea) hit the Indian border of Gujarat. It caused rain along the Sindh coast, but no damage was reported.
- In October 2004, a severe cyclonic storm, Cyclone Onil, approached the Sindh coast but later recurred back to the sea; it caused heavy rain that killed 9 people in Karachi.
- In early June 2007, super cyclonic storm Gonu (the strongest cyclone in the Arabian Sea) caused strong gusty winds in the metropolis with light rainfall as the storm was moving towards Oman.
- In June 2007, a cyclonic storm, Cyclone Yemyin, passed near the city and killed 200 people before moving towards Balochistan where it killed 380 people.
- In November 2009, remnants of Cyclone Phyan caused gusty winds along the Sindh coast including Karachi. However, six Pakistani fishermen were trapped in the storm later rescued by the Indian Navy.
- In June 2010, Cyclone Phet (the 2nd strongest cyclone in the Arabian Sea), once a powerful category 4 cyclone, made landfall near the city as a weak tropical depression, with a total 14 casualties in and near the city.
- In November 2010, remnants of Cyclone Jal caused drizzle with dusty winds in Karachi while it caused light to moderate rainfall in southeastern Sindh.
- In November 2011, the outer bands of cyclone Keila brought drizzle to the city while moderate showers to the Makran coast.
- In October 2021, the deep depression over northeast Arabian sea intensified into a cyclonic storm “SHAHEEN”, lies centered near latitude 23.2N and longitude 66.5E, at a distance of about 280 km southwest of Karachi, 230km from Ormara and 470km southeast of Gwadar.

**List of Notable floods in Karachi:** Most of the flooding in Karachi occurs due to the monsoon season. But due to the enhancement of the city’s infrastructure flooding has been controlled. But still excessive and irregular rains can lead to major flooding in the metropolis. Following is some of the major floods in the city;

- On 7 August 1953, the city received its record-breaking 24-hour rainfall causing widespread flooding about 278.1 millimeters (10.95 in) rain was recorded.
- On 1 July 1977, Karachi received its third highest rainfall of 207 millimeters (8.1 in) in 24 hours, it caused massive flooding in the city and killed 248 people in the city.
- In 2003, massive flooding during monsoon season devastated the Sindh, two days of rainfall of 284.5 millimeters (11.20 in) created havoc in the city.
- In 2006, after two year of drought period heavy rainfall lashed the city during the monsoon season, but the city came to standstill on 17 August when widespread rainfall of 77 millimeters (3.0 in) created flood-like situation in the city killing 13 people and submerging roads, low-lying areas and underpasses with rainwater.



- In 2007, almost all the rains that occurred in this monsoon season brought flooding with it. During the month of June Cyclone Yemyin created havoc in the city from 21 June to 26 June 2007 110.2 millimeters (4.34 in) of heavy downpour was recorded which killed 228 Karachiites on 23 June, then from 9 August to 11 August a strong tropical depression brought massive flooding in the city with 191 millimeters (7.5 in) of rain killing 21 people and submerging low-lying areas and underpasses. While on 22 August a monsoon depression once again flooded the city with 80 millimeters (3.1 in) of rainfall killing 10 people.
- On 18 July 2009, there was severe flooding due to a tropical depression, in which city's second highest rainfall of 245 mm (9.6 in) occurred in just 4 hours, killing 20 and injuring 150 people. Another flooding event occurred on August 31, 2009 when a well-marked low pressure was present over Sindh, the rainfall was recorded to be around 147 mm (5.7 in).
- On September 13, 2011, life was crippled in the city due heavy rainfall that caused urban flooding in the city. The rainfall was recorded to be around 145 mm (5.7 in).
- In Aug & Sep 2019, life in the city was crippled due to multiple spells of heavy rain that caused urban flooding and loss of life and property.
- 9 Jul 2020, spells of heavy rain caused urban flooding in several areas of city, causing loss of life and property, mainly due to electrocution.
- The hours-long spell, which began before sunrise and continued till night, broke previous records of rainfall recorded in the city during August 2020. The Met department said that Karachi had received 345mm of rainfall so far in August, breaking the previous record of 298mm reported in August 1984.
- In July 2022, the citizens of Karachi witnessed immense hardships when a heavy spell of rain submerged many thoroughfares and low-lying areas of the city. According to details, several areas of Karachi suffered urban flooding as heavy rains continued to batter the metropolis for the fourth consecutive day. Several parts of the city including, Gadap Town, Surjani Town, North Karachi, North Nazimabad, Gulshan-e-Maymar, Jinnah Old Terminal, Tariq Road, Defence View, FC Area, Gulshan-e-Iqbal, Saddar, Guru Mandir, Shahrah-e-Faisal, Gulistan-e-Jauhar, Nazimabad received downpour for several hours. Moreover, rainwater mixed with sewage flowed inside homes, causing severe hardship to citizens, especially women, children and the elderly.



**Figure 4.10: Urban Flooding in Karachi**

**List of droughts in Karachi:** Drought-like conditions in the city are not common but if the Monsoon season fails to deliver rains, then drought emerges. Following is some of worst drought in Karachi city.

- The major drought in Karachi as well as for whole Pakistan was from 1996 till 2002, peaking from 1998 till 2001. While in 2002 drought conditions started to dissipate. The drought of 1998-2001 was considered worst in 50 years.
- In 2004, no rain occurred in the city as well as in Sindh province but during the month of October heavy downpour lashed different parts of Sindh due to Cyclone Onil.
- In 2005, the drought conditions continued, but a post-monsoon low pressure dumped heavy rains during 12 and 13 September.

- In 2009, drought conditions emerged during the summer season in suburban areas of Karachi, due to El Nino phenomenon and caused drought during the winter season but the monsoon rains of 2009 were above-normal.

**List of dust storms in Karachi:** Windstorms generally occur when a monsoon system or tropical storms is moving towards the city. However, dust storms sometimes occur in winter seasons due to Western Disturbance. Dust storms also occur before the onset of monsoon season, they are locally known as ‘Andhi’ in the country. Following is a list of windstorms as well as dust storms that occurred in the city, however windstorm generated by a tropical storm is not mentioned in this list.

- On May 31, 1986, a blinding dust storm hit the city for 15 minutes that toppled trees and advertising signs, overturned vehicles and tore down electrical wiring. It reduced visibility to near zero and blew down flimsy wood and bamboo shanties in Karachi, at least 11 persons were killed and more than 250 injured. The dust storm of 67 mph (108 km/h) occurred due to the interaction between the strong cold airflow and monsoon depression present over north-western Gujarat.
- On July 4, 1994, a windstorm generated by monsoon low pressure system killed 26 people in the city.
- On June 23, 2007, a massive dust storm hit the city followed by a heavy downpour, the interaction between a strong low-pressure system and the outer bands of Cyclone Yemyin which was still over western India as a tropical depression caused 69 mph (111 km/h) windstorm that uprooted billboards, trees, traffic signals and caused 200 deaths in the city due to the collapse of roofs of many houses in the port city.
- On February 22, 2008, a dust storm struck the city which reduced the visibility to merely 500 meters, the dust storm was due to the westerly winds that were coming from the desert regions of Balochistan.
- On March 19, 2012, a mild dust storm hit the city that caused 65 km/h winds to blow in the city while the visibility dropped to just 200 meters.
- On May 19, 2012, a weak dust storm gripped the metropolis with highest wind of 72 km/h.
- At least 4 killed as gusts, dust storm battered Karachi on June 3, 2020.
- Loss of property reported as dust storm battered parts of Karachi on Jul 5, 2020

## 4.8 Ambient Air & Noise Quality

Transportation system and indiscriminate burning of garbage are the dominant sources of air pollution in Karachi. Operation of defective vehicles, use of low-quality fuel, and increase in the number of vehicles beyond the capacity of roads are the main reasons for deterioration of ambient air quality. However, the impact of air pollution emanating from transportation system has been found limited to the roadways and that too at traffic intersections and on the middle of the road. Emissions from stationary sources e.g., residential and business districts associated with fuel combustion for domestic use and power generation are significant but have limited extent.

### Ambient Air Quality at Project Site

An Ambient Air monitoring study was conducted in the proposed project site. The results of Ambient Air quality monitoring are presented in tables below:



<b>Location: A: 25°08'43.53"N 67°02'44.37"E</b>						
<b>Parameter</b>	<b>Unit</b>	<b>Monitoring Duration</b>	<b>Average Obtained Concentration</b>	<b>SEQS</b>	<b>IFC Limits</b>	<b>Methodology</b>
Carbon Monoxide (CO)	mg/m <sup>3</sup>	08 Hours	0.14	5.0	NA	Non-Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m <sup>3</sup>	08 Hours	18.3	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	19.0	80.0	200	
Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	24.4	120.0	20	Ultraviolet Fluorescence Method
Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	01 Hour	16.4	130.0	100	Non-Dispersive UV Absorption Method
Particulate Matter (PM <sub>10</sub> )	µg/m <sup>3</sup>	08 Hours	66.0	150.0	50	β Ray Absorption Method
Particular Matter (PM <sub>2.5</sub> )	µg/m <sup>3</sup>	08 Hours	22.9	75.0	25	
Total Suspended Particles (TSP)	µg/m <sup>3</sup>	08 Hours	220.2	500.0	NA	
Lead	µg/m <sup>3</sup>	08 Hours	ND	1.5	NA	ASS Method

<b>Location: B: 25°09'31.55"N 67°03'08.48"E</b>						
<b>Parameter</b>	<b>Unit</b>	<b>Monitoring Duration</b>	<b>Average Obtained Concentration</b>	<b>SEQS</b>	<b>IFC Limits</b>	<b>Methodology</b>
Carbon Monoxide (CO)	mg/m <sup>3</sup>	08 Hours	0.08	5.0	NA	Non-Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m <sup>3</sup>	08 Hours	18.4	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	22.1	80.0	200	
Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	22.2	120.0	20	Ultraviolet Fluorescence Method
Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	01 Hour	16.8	130.0	100	Non-Dispersive UV Absorption Method
Particulate Matter (PM <sub>10</sub> )	µg/m <sup>3</sup>	08 Hours	80.5	150.0	50	β Ray Absorption Method
Particular Matter (PM <sub>2.5</sub> )	µg/m <sup>3</sup>	08 Hours	21.8	75.0	25	
Total Suspended Particles (TSP)	µg/m <sup>3</sup>	08 Hours	200.6	500.0	NA	
Lead	µg/m <sup>3</sup>	08 Hours	ND	1.5	NA	ASS Method





### Noise Quality at Project Site

Noise monitoring were conducted in the proposed project site. The results of Noise monitoring are presented in tables below:

Noise Level					
S.NO.	Location/Source	Noise Level Readings			
		Minimum	Maximum	Average	SEQS
1	Point -1 25° 8'47.84"N 67° 2'35.99"E	50.4	52.8	51.6	<b>Limits: *65dB(A)</b>
2	Point -2 25° 9'53.28"N 67° 2'38.87"E	48.9	53.4	51.1	
3	Point -3 25° 8'51.76"N 67° 2'52.54"E	50.7	52.0	51.3	
4	Point -4 25° 9'31.15"N 67° 3'9.63"E	48.6	51.9	50.2	
5	Point -5 25° 8'36.56"N 67° 2'56.84"E	51.3	55.0	53.1	





## 4.9 Solar Resource

The district receives abundant sunshine round the year and has good solar PV power potential. World bank group's Energy Sector Management Assistance Program (ESMAP) has developed solar maps for countries including Pakistan. Solar's maps have been developed for Direct Normal Irradiation (DNI), Global Horizontal Irradiation (GHI) and Photovoltaic Power Potential. Maps have been depicted below;

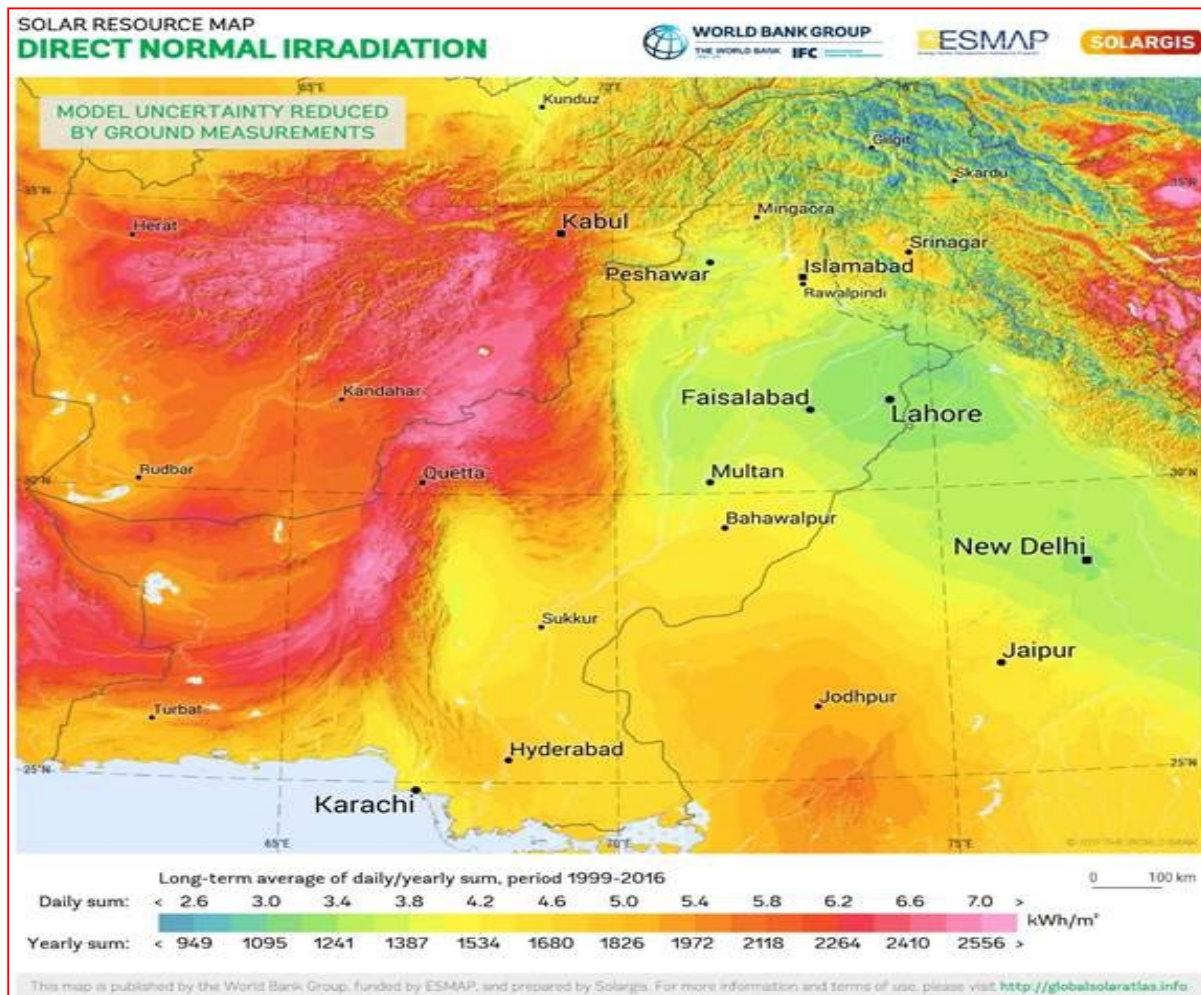


Figure 4.11: Solar Resource Map – Direct Normal Irradiation – Pakistan

DNI value for the Karachi solar power plant site is approx. 1534 kWh/m<sup>2</sup>/year.

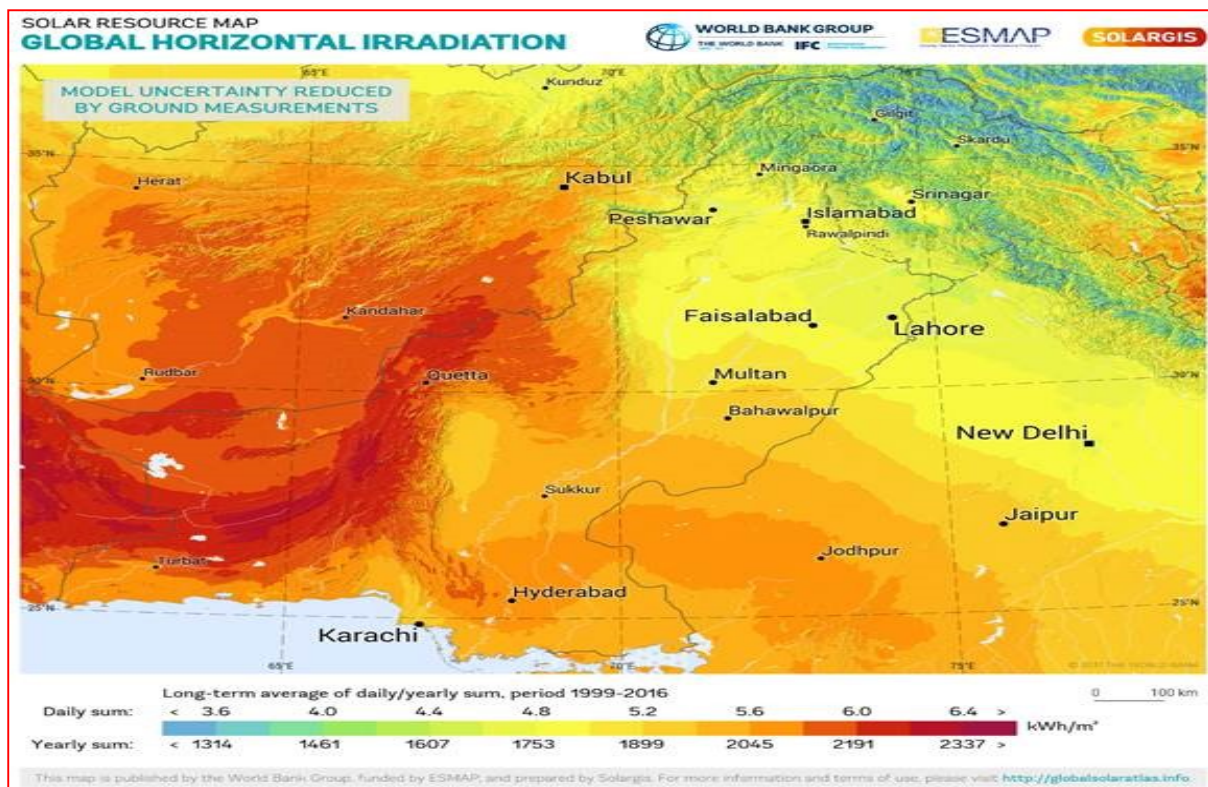


Figure 4.12: Solar Resource Map – Global Horizontal Irradiation – Pakistan

GHI value for Karachi solar power plant site is approx.1899 kWh/m²/year.

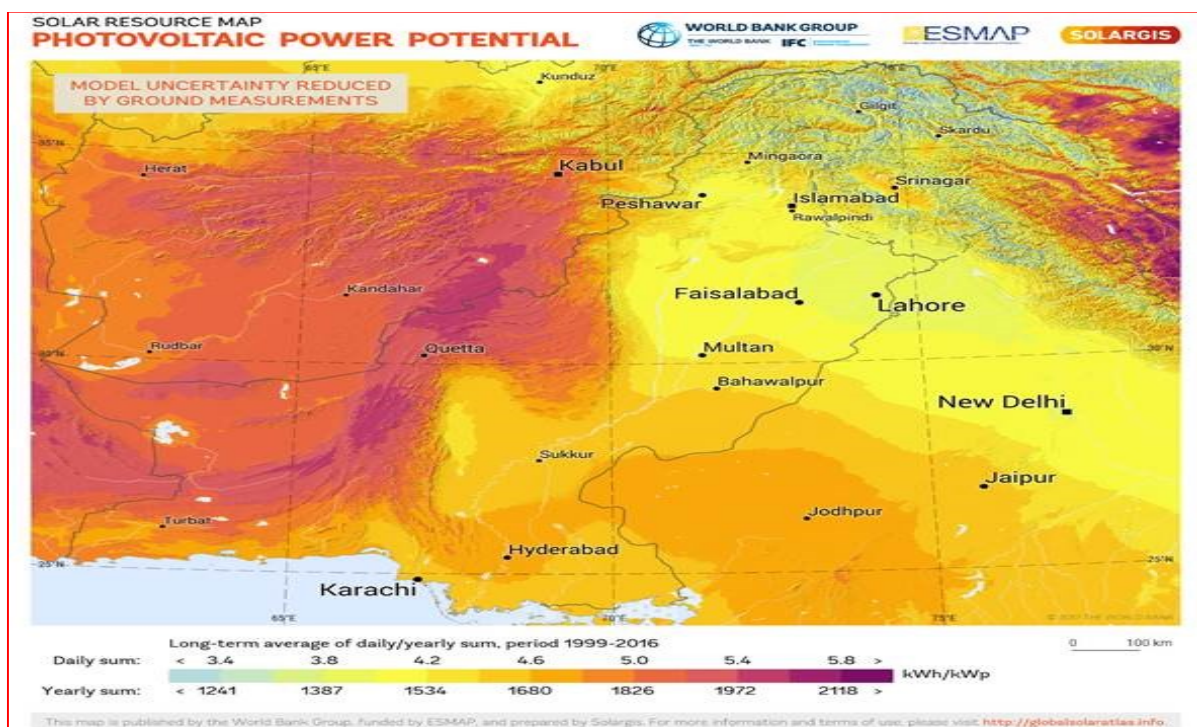


Figure 4.13: Solar Resource Map – PV Power Potential – Pakistan

Total PV Power Potential for Karachi solar power plant site is approx.1680 kWh/kWp.



#### 4.10 Water Resources, Water Quality and Drainage

Hydro geologically, the city of Karachi lies in the Hub River Basin and the Malir River Basin. The Malir River Basin is drained by the Malir River and the Lyari River. The aquifer of Karachi is, therefore, mainly recharged by seepage from Hub River, Hub Dam as well as the Malir and the Lyari Rivers. The Hub River lies on the western frontier of Sindh and for some distance the boundary between Sindh and the Baluchistan provinces. It located about 30 km to the west of Karachi, along the Karachi- Lasbela boundary. It falls into the Arabian Sea near Cape Monze, with a total drainage course length of 336 km. During the past several years, a number of pumping wells have been installed to meet requirements for the irrigation-water supply (to raise vegetables, fruits, dairy and poultry) and drinking-water supply for Karachi. Excessive pumping of groundwater and continuous lowering of water-table is likely to result in intrusion of seawater into the Malir Basin under natural seepage conditions and under artificially induced conditions of recharge of saline seawater in the coastal aquifer(s) of Karachi.

**Recharge Sources:** Five possible water-sources are contributing to the groundwater recharge in Karachi. The first possible source is the rainfall. As the city of Karachi suffers from deficit of precipitation (only rainfall), the contribution to shallow groundwater storage from rain is very little. However, rainfall in the hinterlands and other areas surrounding Karachi may significantly contribute to the groundwater flow-system. The two freshwater sources are the Hub Lake/Hub Dam and the Indus River. Water from Hub Dam and the Indus River is piped to various residential zones in Karachi for drinking and irrigation purposes. The spring water discharges into Malir River and Lyari River and the municipal/industrial waste effluents added to these rivers are also contributing to groundwater storage as a fourth recharge source. Seawater intrusion along Karachi coast is the fifth possible source.

**Shallow Groundwater:** Physico-chemical data of shallow groundwater (depth less than 30 meters) shows that the shallow wells, located in the vicinity of coast and in the proximity of polluted rivers, have relatively higher values of electrical conductivity, salinity and population of Coliform bacteria. The shallow groundwater is moderately saline, representing electrical conductivity values in the range of 1.1 to 1.9 mS/cm and salinity in the range of 1 ppt. The pH of shallow groundwater varies from mildly acidic (~6.3) to mildly alkaline values (~7.9). Areas with quite poor sanitary conditions have relatively low values of pH (~6.3 to 6.8). Shallow groundwater below 20 meters is slightly reducing. The dissolved oxygen is in the range of 1.5 to 7.9 mg/L. Turbidity of shallow groundwater varies between 3.6 NTU and 95 NTU. The concentration of  $\text{HCO}_3^-$  (356-514 ppm, n=4),  $\text{Cl}^-$  (82-169 ppm, n=4) and  $\text{SO}_4^{2-}$  (38-117 ppm, n=4) in shallow groundwater is very reasonable. The mean chemical concentrations of  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$  and  $\text{HCO}_3^-$  in shallow groundwater are as follows:

- Mean  $\text{Cl}^-$  (Shallow Groundwater):  $132.8 \pm 36.5$  ppm (n=4)
- Mean  $\text{SO}_4^{2-}$  (Shallow Groundwater):  $63.3 \pm 36.7$  ppm (n=4)
- Mean  $\text{HCO}_3^-$  (Shallow Groundwater):  $423 \pm 67.4$  ppm (n=4)

The range of variation in stable isotope content of total dissolved inorganic carbon (TDIC) and oxygen in Lyari River water is as follows:

- $\delta^{18}\text{O}$  (Shallow Groundwater) -6.3 to -5.8 ‰ V-SMOW (n=8)



- $\delta^{13}\text{C}$  (TDIC-Shallow Groundwater): -16.5 to -5.5 ‰ PDB (n=8)

The mean stable isotope content of  $^{18}\text{O}$  and  $^{13}\text{C}$  in shallow groundwater is as follows:

- Mean  $\delta^{18}\text{O}$  (Shallow Groundwater):  $-5.9 \pm 0.32$  ‰ V-SMOW (n=8)
- Mean  $\delta^{13}\text{C}$  (TDIC-Shallow Groundwater):  $-10.1 \pm 3.3$  ‰ PDB (n=8)

The stable-isotope results indicate that the shallow / phreatic aquifers are recharged by a mixture of fresh waters of Indus River and Hub River (draining spring water and flooded rainwater), as well as polluted Lyari and Malir rivers and their feeding drains (both under natural infiltration conditions and artificially induced infiltration conditions) and, to a much smaller extent, from direct recharge of local precipitation.

**Deep Groundwater:** In general, Deep groundwater is mostly saline and has high electrical conductivity (range: 1.9- 19.1 ms/cm) and salinity (range: 1.7-7.4 ppt), as compared to shallow groundwater.

Based on hydro chemical data of water samples collected from pumping wells, it is assumed that the shallow mixed deep groundwater discharged by large-scale pumping wells mainly represents the deep groundwater from confined aquifer. The mean chemical concentrations of  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$  and  $\text{HCO}_3^-$  in shallow mixed deep groundwater are as follows:

- Mean  $\text{Cl}^-$  (Deep Groundwater):  $2169.2 \pm 1828.0$  ppm (n=9)
- Mean  $\text{SO}_4^{2-}$  (Deep Groundwater):  $458.4 \pm 691.4$  ppm (n=9)
- Mean  $\text{HCO}_3^-$  (Deep Groundwater):  $353.6 \pm 215.4$  ppm (n=9)

The range of variation in stable isotope content of total dissolved inorganic carbon (TDIC) and oxygen in shallow mixed deep groundwater is as follows:

- $\delta^{18}\text{O}$  (Deep Groundwater): - 6.2 to -4.2 ‰ V-SMOW (n=10)
- $\delta^{13}\text{C}$  (TDIC - Deep Groundwater): -13.2 to -0.3 ‰ PDB (n=10)

The mean stable isotope content of  $^{18}\text{O}$  in shallow mixed deep groundwater is as follows:

- Mean  $\delta^{18}\text{O}$  (Deep Groundwater):  $-5.3 \pm 0.7$  ‰ V-SMOW (n=10)
- Mean  $\delta^{13}\text{C}$  (TDIC- Deep Groundwater):  $-10.5 \pm 3.7$  ‰ PDB (n=10)

The hydro chemical and stable isotope results indicate that the confined aquifer hosts a mixture of rainwater from hinterlands and surrounding regions around coastal Karachi, as well as sea trapped water / seawater, through intrusion under natural infiltration conditions or under induced recharge conditions.

**Groundwater Recharge Characteristics/Sea water Intrusion:** Presently, coastal Karachi is known to have five sources of recharge to its groundwater reserves.

- i. Rainfall,
- ii. Indus River water supply
- iii. Hub-River & Hub Lake water supply



- iv. Polluted Lyari and Malir rivers/ contributory channels draining mixtures of domestic industrial and agricultural wastewater, composed of pre-said three sources
- v. Seawater.

The possibilities of major contribution to groundwater recharge of shallow/phreatic aquifer directly by local rainfall seems very small, due to very poor frequency of rainfall events and rainfall intensities in the Karachi and high evaporation rates. The long-term (15 years annual record) mean monthly average precipitation for Karachi is between 0-15 mm during the months of January to June, 23 - 91 mm during the months of July to September, and 0-7 mm during the months of October to December. The remaining four sources play a significant role in recharge of the shallow aquifer-system and deep groundwater system (confined aquifer) in coastal Karachi.

Unpolluted seawater of Karachi coast is characterized by a  $\delta 18\text{O}$  value of  $\sim +1$  ‰ VSMOW and a chloride content of  $\sim 23000$  ppm. Both the Lyari River and Malir River waters, as well as the Indus River water and the Hub Lake water, have extremely very low aqueous contents of chloride and sulfate ions as compared to seawater.

The average mean value of  $\delta 18\text{O}$  in polluted river waters is  $\sim 5$  ‰ V-SMOW and in shallow groundwater is  $-5.9$  ‰ V-SMOW. The relatively deeper ground waters representing confined aquifer have a mean  $\delta 18\text{O}$  value of  $-4.3$  ‰ VSMOW and excessively high values of aqueous chloride and sulfate.

**Water Supply and Sewerage System:** The water supply and sewerage system is managed by Karachi Water Supply & Sewerage Board (KW&SB). Present water supply system of Karachi City has a supply capacity of 560 MGD. Actually, as of the end of year 2006, the KW&SB supply bulk water of about 630 MGD beyond the capacity as shown in following Table. Out of 630 MGD, water of 209 MGD is supplied without filtration, which is equivalent to one third of actual supply amount of 630 MGD.

Table 4.2: Present Water Supply Capacity			
Supplied from		Rated Capacity	Actual Supply
Gharo Filtration Plant		20 MGD	30 MGD
Pipri Filtration Plant	with Filtration	100 MGD	102 MGD
	without Filtration	-	32 MGD
Dumlottee Conduit (Without Filtration)	from Wells	20 MGD	0 MGD
	from GK/K-III Systems	-	17 MGD
NEK Old Filtration Plant		25 MGD	5 MGD
NEK New Filtration Plant		100 MGD	100 MGD
COD Filtration Plant	with Filtration	115 MGD	104 MGD
	without Filtration	-	48 MGD
Hub Filtration Plant		80 MGD	80 MGD
Supply without Filtration (from K-III System)		100 MGD	95 MGD
Supply without Filtration (from GK System)		-	17 MGD





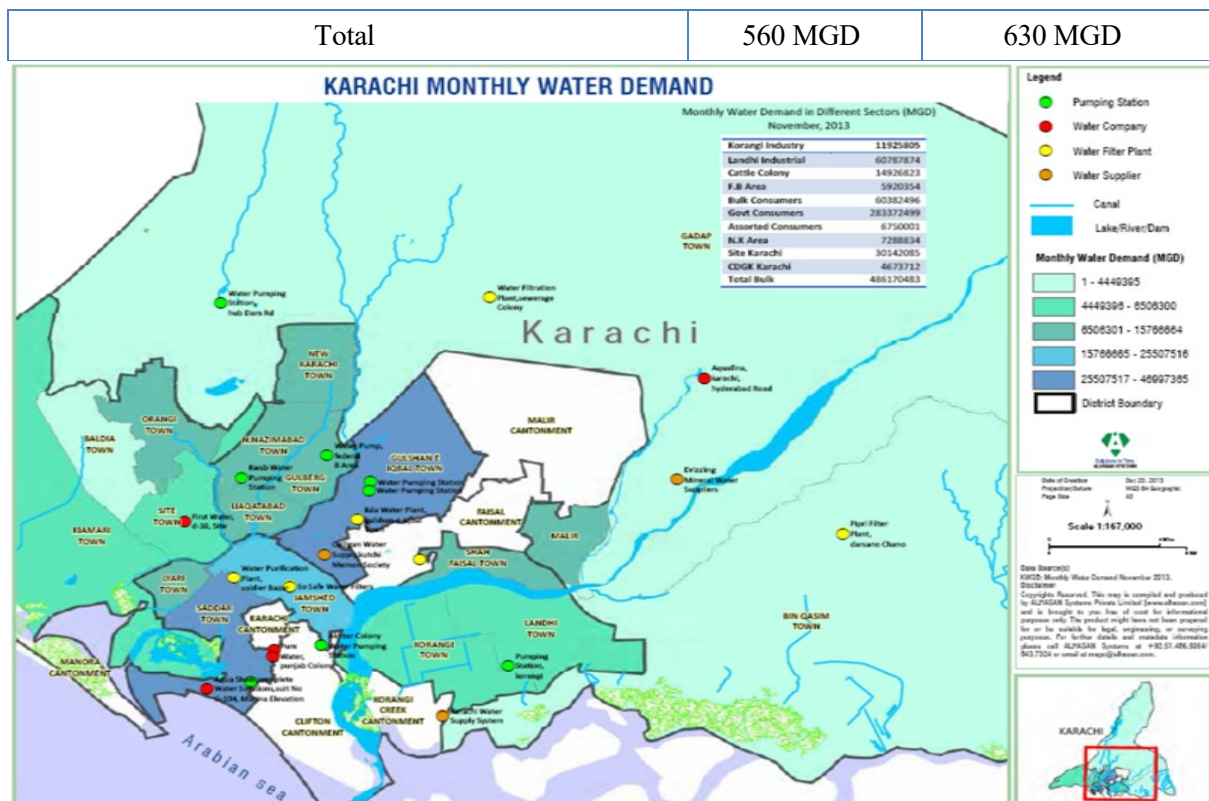


Figure 4.14: Karachi Monthly Water Demand

(Source: Pakistan Development Perspective)

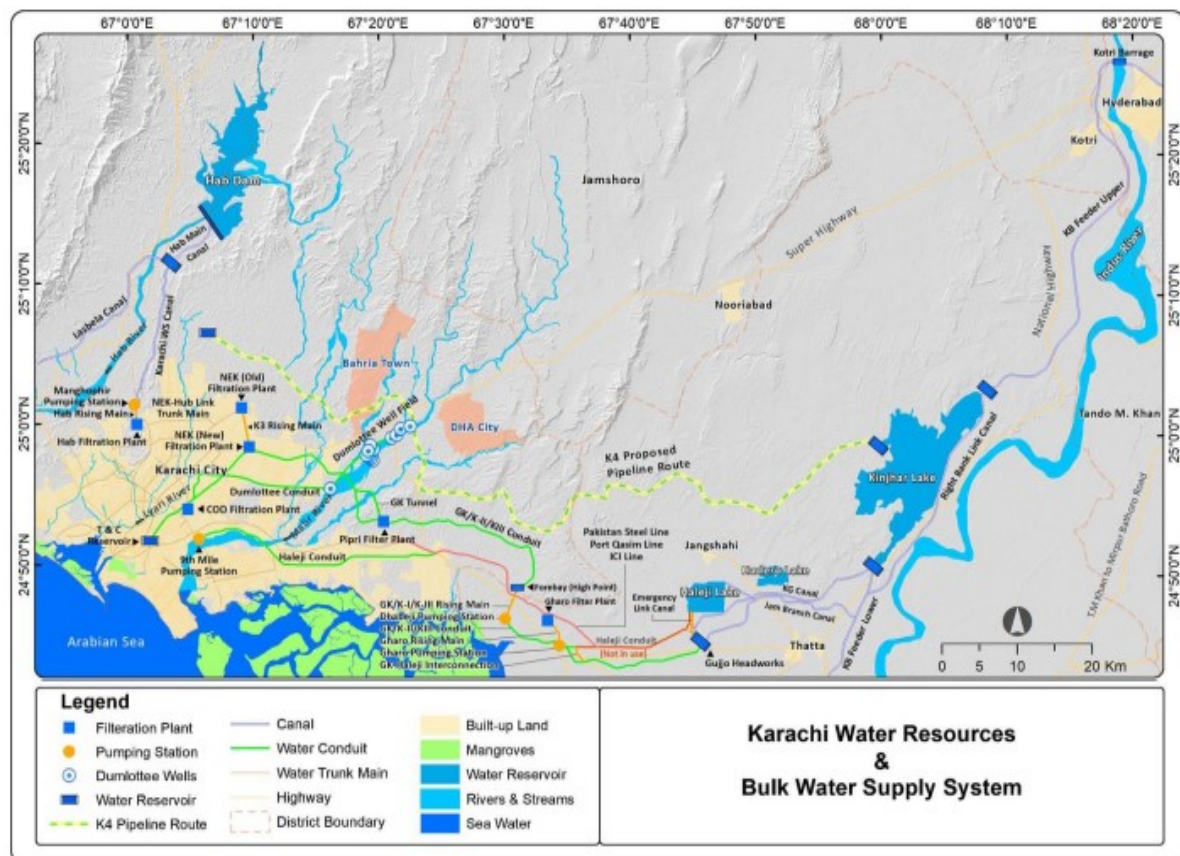


Figure 4.15: Karachi Bulk Water Supply System

The existing sewerage catchment area which covers 18 towns in Karachi city is divided into three districts, namely: respective catchment area of T.P-1, T.P-2 and T.P-3. KW&SB formulated the Master Plan of the water supply and sewerage system in cooperation with JICA in 2008. However, most of the projects for rehabilitation and augmentation proposed in the Master Plan study, etc. have not been carried out due to financial constraint of KW&SB. Due its negligence to maintain and operationalize the treatment plants, not only municipal effluent but industrial effluent also is directly going into sea destroying marine life.

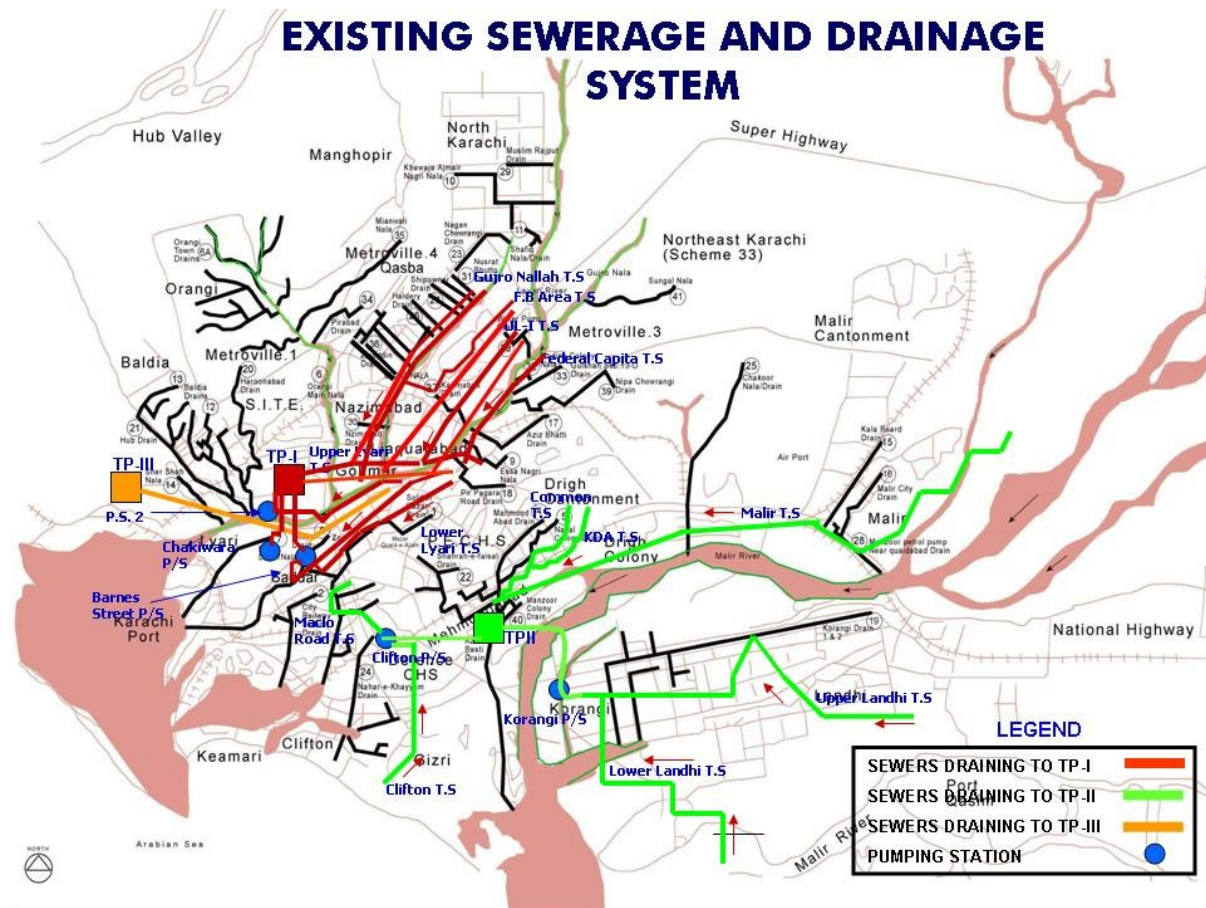


Figure 4.16: Existing Sewerage System of Karachi

**Land use Changes and their Impacts on Natural Drainage System of Karachi:** Rapid urbanization of mega cities in developing countries has been responsible for not only alterations in the natural phenomena but has posed serious health challenges due to insufficient water and sanitation infrastructures, inappropriate waste treatment and disposal facilities and substandard living conditions. Less privileged communities that migrate to big cities are not only victims of several types of communal diseases but are more vulnerable to natural disasters. Rapid urbanization of a city may alter its natural hydrology giving rise to blockage and frequent flooding of the drains.

**Surface Water Drainage and Flooding in Karachi City:** The problem of urban flooding is quite significant in Karachi which is the industrial and business hub of Pakistan. Karachi had experienced severe floods which occurred periodically. In 1977 severe flood occurred in the flood plains of the Lyari River and the Malir River killed 267 people, more than 30,000 were homeless and 100,000 were temporarily dislocated. Houses were destroyed and roads were damaged. The total loss was estimated about 5 billion

rupees (KDA, 1981). The present study deals with urban flooding which has now become a serious problem all over the world, affecting urban life, infrastructure, mobility of people and economy of the city. In this context Karachi has been selected for study which is the largest city of Pakistan.

**Flooding in Karachi:** Urban flooding is caused by heavy rainfall overwhelming drainage capacity. The primary cause of flooding in Karachi city is torrential rainfall due to tropical storm and monsoon which saturate soil and create huge surface runoff. Floods in urban conditions are flashy in nature and occur both on built up surfaces like roads and streets, parking lots, yards, parks etc. and creeks of urban areas like the Lyari, the Gizri, and the Korangi creek.

**Table 4.3: Drainage characteristics of River Basins of Karachi**

River Basin	Length of streams	Basin Area Sq.km	Branching Ratio	Drainage Density km/sq.km
Malir River Basin	725	2167	Dendritic	3.4
Lyari River Basin	180	578	Dendritic	5.6
Budnai Basin	46	95	Dendritic	5.7

**Table 4.4: Catchment Areas and Surface Runoff**

Catchment Area (Sq. km.)	567	596	1205	1985
Mean Annual Runoff	34	45	74	60
Maximum Annual Runoff	187	255	392	424

#### 4.11 Drinking Water Quality at Project Site

Drinking water quality was checked for parameters including pH, turbidity, TDS, hardness, fluoride, chloride, nitrate, nitrite, phenolic compounds, heavy metals and microbial parameters. Drinking water analysis was carried out through Sindh EPA approved Laboratory. The results of drinking water monitoring are presented below.

ANALYTICAL TEST							
S. NO.	PARAMETERS	STANDARDS	STANDARD	LDL	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.40	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.53	APHA-2020 B/C
5	Turbidity	< 5	<5	0.01	NTU	0.51	APHA-2130 B



6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	2420*	Hach 8160
7	Total Hardness as CaCO <sub>3</sub>	< 500	180	0.1	mg/L	804*	EDTA Titration.Hach-8213
8	Fluoride (as F <sup>-</sup> )	≤ 1.5	≤ 1.5	0.01	mg/L	0.43	USEPA 340.1
9	Chloride (as Cl <sup>-</sup> )	< 250	< 250	0.1	mg/L	570*	Hach 8206
10	Nitrate (NO <sub>3</sub> )	≤ 50	≤ 50	0.01	mg/L	0.40	Hach -8039
11	Nitrite (NO <sub>2</sub> )	≤ 3	≤ 3	0.001	mg/L	0.055	Hach - 8153
12	Cyanide (as CN <sup>-</sup> ) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.031	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082
25	Zinc	5.0	3.0	0.01	mg/L	0.05	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.042	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
<b>MICROBIOLOGICAL ANALYSIS REPORT</b>							
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>300*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>150*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>100*	APHA-SM9221F





#### 4.12 Storm Water Drainage

Following Table outlines storm water drainages and nallahs under each township administration. Drainages are artificial water channels for storm water drainage; on the contrary, nallahs are natural water channels. Many drainages are connected to nallahs and some drainages connected to river directly; Nallahs discharge into rivers such as Lyari River and Malir River receiving storm water. As sewage collection system in Karachi City is not enough and its maintenance is not satisfactory, storm water drainage and nallahs have to receive sewage all year long in addition to storm water in rainy season.

**Table 4.5: Town-wise Storm water Drainage/Nallah Length**

Town	Depth (m)	Width (m)	Length (km)
1. Keamari Town	1.21	0.91~3.04	7.62
2. SITE Town	2.13	3.65	16.08
3. Baldia Town	1.22	2.43	11.77
4. Orangi Town	1.52	2.43~3.65	34.1
5. Lyari Town	1.37	0.6~13.7	19.4
6. Saddar Town	1.37	3.05	11.14
7. Jamshed Town	1.5	2.43	33.8
8. Gulshan -e- Iqbal Town	3.64	2.4~15.2	28.0
9. Faisal Town	1.22~4.57	1.52~24.0	20.1
10. Landhi Town	1.22	2.43	35.36
11. Korangi Town	1.52	2.74	36.4
12. North Nazimabad Town	1.22	2.4	30.7
13. North Karachi Town	1.22	2.4	45.1
14. Gulberg Town	1.37	2.4	22.1
15. Liaquatabad Town	1.52	3.65	19.5
16. Malir Town	1.22	3.04	6.15



**Table 4.5: Town-wise Storm water Drainage/Nallah Length**

Town	Depth (m)	Width (m)	Length (km)
17. Bin Qasim Town	1.22	3.64	14.63
18. Gadap Town	1.22	3.65	24.43
Total			416.38
Source: KWSB			

There are no exclusive pumping facilities for storm water drainage in Malir. However, many pumping stations called “ejector” which were constructed for sewage discharge to natural nallahs or rivers have worked as storm water pumping facilities in rainy season. Roadside drains are cleaned by KWSB 1-2 months before the monsoon season. Removed and collected silt/garbage is conveyed to designate solid waste disposal sites.

However, at times roads are cleaned afterwards by town administration and silt/garbage is transferred to drains again. This is said to be how inundation is caused. In addition to the other mentioned issues in Malir Town many drains and nallahs have been already encroached on by illegal houses and buildings. Storage enforcement of building code and other relevant laws.

Another major issue with malfunctioned drains / nallahs is that garbage is easily and routinely dumped to these facilities, which leads to their reduced sections. Comprehensive solid waste management system has to be introduced. There are no exclusive pumping facilities for storm water drainage in Karachi City. However, many pumping stations called “ejector”, which were constructed for sewage discharge to natural nallahs or rivers have worked as storm water pumping facilities in rainy season.

Roadside drains are cleaned by KW&SB one to two months before monsoon season comes every year. Removed and collected silt/garbage is conveyed to designate solid waste disposal sites. However, roads are cleaned afterwards by town administration and silt/garbage is transferred to drains again. This is said to be how inundation is caused. In addition to above mentioned administrative issues, many drains and nallahs have been already encroached on by illegal houses and buildings. Strong enforcement of building code and other relevant laws is expected. Another major issue with malfunctioned drains/nallahs is that garbage is easily and routinely dumped to these facilities, which leads to their reduced sections. Comprehensive solid waste management system has to be introduced.

#### 4.13 Ecology

The ecology of microenvironment and macro environment of the project area has completely changed as a result of continuous emergence of urban conglomerates. Ecological risk of high order has been induced by land clearance and removal of natural vegetation from the plains during the urban sprawl to make room for industrialization and urbanization. This has degraded the physical environment as quantified in the above section & the biological environment in the sense that the entire macro environment has lost its biodiversity. During the survey, there were no fauna species were recorded but few numbers of shrubs were found because site chosen for development of infrastructure is barren land.

The impoverished as well as degraded environment resulting from non-availability of surface as well as groundwater and discharge of untreated wastewater into Lyari and Malir River has irreversibly reduced the biodiversity. It originates very little chance for the survival / growth of fauna in the project area. There are even otherwise no habitats of large and small animals, birds or reptiles within the surveyed area.

#### 4.14 Social Baseline

The social baseline section provides a comprehensive review of the socio-economic conditions of the project area. This socio-economic profile is based on a literature review and several primary data gathering activities including site visits, sample socio-economic survey of stakeholders in the area, and consultations with primary and secondary stakeholders. This social baseline provides an overview of the socio-economic conditions of the people who reside and work in the project vicinity. It also includes an assessment of the public utilities and social services (education and health facilities) in the area.

International best practice for EIA/IEE studies demands an alignment of the proposed project components with the applicable Sustainable Development Goals (SDGs) adopted by all UN Member States in 2015. The SDGs provide broad universal targets for reducing poverty, environmental degradation, and injustice are important pillars of social upheaval that must be achieved by 2030. In March 2017, the global indicator framework was developed and agreed upon by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) to monitor progress towards achievement of these indicators. Moreover, all member states, including Pakistan have developed national indicators linked to the global targets that provide the basis for a national effort of monitoring progress towards fulfillment of the indicators. The proposed project should be aligned with Goal 03 of the SDGs which ensures healthy lives and promote well-being for all.

The social baseline section helps in understanding the existing socioeconomic conditions of the project area as well as the district under which the project is falling. The data in this chapter will be used for the development of a Social Management Plan to mitigate or improve the social impacts arising from the proposed development. The social baseline is divided into the macro and microenvironment of the project area. The macro-environment encompasses District Malir under which the project area is falling. The macro-environment covers the administrative setup, demography, education, and health profile of the area. The immediate neighborhood of the project area has been considered as the micro-environment of the project. The microenvironment covers the land use, education, health, and utility profile of the area.

#### 4.15 Macro Environment

##### Administrative Context

The site can be approached by the Hub Dam Road when approaching the Hub dam itself. The project falls under the jurisdiction of Shah Mureed sub-division of District Malir Karachi. District Malir covers a total area of 2,160 sq. km while Bin Qasim sub-division covers a total area of 447 sq. km, approximately half of the total district area. A total of 6 subdivisions falls under District Malir Karachi which include Airport Sub Division, Bin Qasim Sub Division, Gadap Sub Division, Ibrahim Hyderi Sub Division, Murad Memon Sub Division and Shah Murad Sub Division.

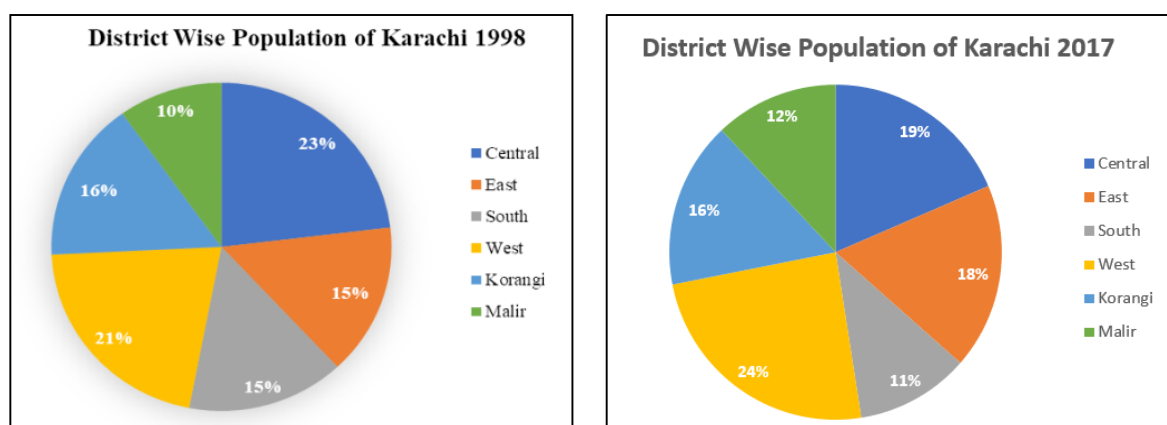


## Demography

The district population comprised of people from various ethnic groups, who are residing in the project area including Sindhi, Punjabi, Pakhtuns, Urdu Speaking and Memons. Malir is the largest District of Karachi by area and is regarded as the countryside of Karachi City due to its open atmosphere and lush green farmlands. The population comprises middle and upper-middle classes while 25 percent falls in the category of lower middle class and the rest belong to the working class.

The total population of District Malir was 914,756 in 1998 which increased to 1,924,346 in 2017, showing an annual growth of 4%.

**Figure 4.17: Comparative Analysis of Population (1998, 2017)**



The above figure illustrates the relative distribution of population in Karachi's districts based on 1998 and 2017 census results. An additional modification to the district wise population of Karachi 2017 has been made to account for the demographic changes that have come about due to splitting of District Korangi. Based on the new findings, one can observe that population distribution of Korangi was 16% in 1998 and 2017. District East and West shows an increase of 3% and District Malir have increase 2%. Meanwhile, District Central & South has shown a decrease of 4%.

## Urban Migration

Karachi has proliferated in the last few decades, and the metropolitan area has more than 23 million people, with a population density of over 24,000 people per square kilometer, or 63,000 per square mile. This means Karachi is denser than any other megacity with an urban population of more than 10 million except Dhaka and Mumbai. Regional and internal migration have also contributed to the substantial increase in the pace and scope of urbanization in Karachi. These population movements have brought rapid transformations in the social, economic and political fabric of Karachi. Urban migration has played a significant role in the rapid population growth of Karachi (Table 4.2).

**Table 4.2: Karachi's Population Growth (1941-2017)**

Year	Population	Increase/ Decrease Over Previous Census / Survey	No. of Years Between Surveys	Increase/ Decrease (%)	Average Annual Growth Rate (%)
1941	435,887	135,108	10	44.9	3.7

<b>1951</b>	1,137,667	701,780	10	161	11.5
<b>1961</b>	2,044,044	906,377	10	79.7	6.1
<b>1972</b>	3,606,746	1,562,702	11	76.5	5
<b>1981</b>	5,437,984	1,831,238	9	50.8	5
<b>1998</b>	9,802,134	4,540,422	17	86.3	3.5
<b>2017</b>	16,051,521	6,249,387	19	62.9	2.6

Source: *Census Reports*, Government of Pakistan

Malir was once famous for its fruit and vegetable farms; but, now due to severe scarcity of groundwater, these farmlands are being converted into residential areas, thus increasing urbanization and environmental degradation. District Malir attracts migrants who come from other districts, rural areas of Karachi and other provinces. Though it has already populated old residential areas like Model Colony, Jaffer Tayyar Society, Shah Faisal Colony, Drigh Colony, Moinabad and Saudabad. Seeing increased demand of the people, Malir Development Authority was established in 1993 by the Government of Sindh in order to develop the area. MDA is specially focusing its energies towards the low-cost housing and design its schemes to give better residential facilities on affordable rates. Another important major development in Malir District is Bahria Town-Karachi with a total area of around 46,000 acres. It offers a quality lifestyle owing to its world-class amenities. Bahria Town, Karachi is located at a distance of 9 km from Super Highway and half an hour drive from Jinnah International Airport.

### Education Facilities

Baqai Medical College, with affiliation of the University of Karachi started in 1988. In 1992, Baqai Foundation established the Baqai Dental College. It goes to the credit of Baqai's, which is the first ever Dental College to be set-up at Karachi. In July 1996 through a bill passed unanimously in Sindh Assembly and then approved by Governor of Sindh, through a special notification promulgated an ordinance, called Baqai Medical University Act of 1996 by virtue of it, Baqai Medical University came into existence. Baqai universities have developed various schools that specialize in those categories. Schools and colleges that come under this institute and are affiliated with it include Baqai Dental College, Institute for Pharmaceutical Sciences, Health Management Sciences, Hematology, Diabetology and Endocrinology. The university offers the best services for undergraduate and postgraduate students. Some of the major degrees and courses cater the field of information technology and medicine. The courses and programs offered by the university totally covers the field of medical. MBBS, D-pharmacy, BDS, BBIT, MSIT, Special training and courses of army, Doctorate in veterinary.

Founded as a Federally Chartered University in July 2000, FAST National University of Computer and Emerging Sciences is a premiere University of Pakistan, renowned for quality and impact of its students in the development of local software and other industries. The university has five modern campuses at Karachi, Lahore, Islamabad, Peshawar and Chiniot-Faisalabad. These campuses provide world class educational environment and recreational facilities to about over 11,000 students, around one quarter are female and over 500 skilled faculty members. For more than 30 years NUCES-FAST continues to



play an important role in educating and fostering its students for their enlightened careers in Computer Science, Electrical Engineering and Management Sciences.

There are a number of schools, colleges and technical training centers in Malir District. The following statistics shows that District Malir has the highest number of schools and enrollment of students is encouraging. Enrollment of boys is higher than girls in Malir District. Similarly, the proportion of male teachers are higher than female teachers in the district.

District wise Number of Schools, Enrollment and Staff in Karachi (2016-17)										
District	No. of Schools				Enrollment			Teacher		
	Boys	Girls	Mixed	Total	Boys	Girls	Total	Male	Female	Total
Central	117	141	348	606	44,822	58,510	103,332	1,803	4,996	6,799
East	51	64	163	278	23,022	29,106	52,128	870	2,271	3,141
South	70	87	173	330	26,122	35,824	61,946	1,079	2,496	3,575
West	128	101	340	569	38,562	45,454	84,016	1,443	1,909	3,352
<b>Malir</b>	<b>136</b>	<b>113</b>	<b>414</b>	<b>663</b>	<b>34,548</b>	<b>32,333</b>	<b>66,881</b>	<b>1,540</b>	<b>1,148</b>	<b>2,688</b>
Korangi	97	94	220	411	35,192	46,918	82,110	1,025	3,082	4,107
Source: Sindh Education Management Information System (SEMIS) Census 2016 – 2017										

Compared to other districts of Karachi, the number of schools with basic and advanced facilities in District Malir comes second in ranking. The table below shows that District Malir has 591 schools comparatively Central 607, South 482, West 363, Korangi 550 and East 264.

Table: District-wise Basic and Advance Facilities in Schools of Karachi							
Districts	Schools	Electricity	Washroom	Drinking Water	Boundary Wall	Lab	Library
Central	607	447	484	507	529	121	56
East	264	223	241	219	238	59	25
South	482	383	426	356	432	49	49
West	363	232	301	256	340	82	27
Korangi	550	397	431	391	509	46	37
<b>Malir</b>	<b>591</b>	<b>240</b>	<b>398</b>	<b>302</b>	<b>479</b>	<b>56</b>	<b>21</b>
Source: SEMIS Census 2016 – 2017							

## Public Health Facilities





There are several public and private healthcare facilities in the Malir District. They include Malir Halt Hospital, Hassan General Hospital, Urban Health Centre Government Hospital, Sindh Heart Hospital, Zia Medical Hospital, Agha Khan University Hospital Medical Centre, Atia General Hospital and TB Chest Hospital are also in the jurisdiction of the district. The following table shows the number of health practitioners, there are 234 doctors and 25 paramedical personnel posted in different government hospitals of Malir District.

CMH (Combined Military Hospital) is located at PAF Rd, Malir Cantt, Karachi. This hospital has in-patient and out-patient facilities. It offers emergency service, specialist OPDs, Surgery, Pediatrics, Orthopedics, Gynae/Obs, ENT and Eye, ICU, Neonatal ICU, Medical ICU and so on. Almost 100 plus qualified consultants from all specialties and sub-specialists are available at CMH Malir Karachi.

District-wise Government Medical and Paramedical Personnel in Karachi 2017											
District	Doctors	Nurses	L.H. V	Dispensers/ Dressers	X-Ray Technicians	Lab Technicians	O.T Technicians	X-Ray Assistants	Lab. Assistants	O.T. Assistants	Midwives
Central	579	207	15	82	12	17	25	0	3	12	26
South	324	115	4	51	14	23	33	0	8	8	2
East	245	18	22	26	4	0	3	0	4	1	6
West	356	83	19	67	12	14	22	5	12	15	19
<b>Malir</b>	<b>234</b>	<b>25</b>	<b>14</b>	<b>53</b>	<b>9</b>	<b>4</b>	<b>6</b>	<b>0</b>	<b>10</b>	<b>5</b>	<b>18</b>
Korangi	252	90	38	-	-	-	-	0	8	8	25
Source: - BOS, Government of Sindh (Development Statistics of Sindh – 2018)											

The table below shows the number of health facilities available to cure different kinds of diseases in District Malir. The public health facilities in Karachi are highly centralized in a few locations and cannot cater to a large part of the population. The above-mentioned public health facilities data is not updated in the government records thus subject to some shortcomings.

District-wise Government Health Facilities with Bed Capacity in Karachi 2017														
District	Hospital		Hospital Beds		Dispensaries		R.H Centers		T.B. Centre		B.H. Units		M.C.H.C.	
	Teaching	Civil, Specialized	Teaching	Civil, Specialized	No.	Beds	No.	Beds	No.	Beds	No.	Beds	No.	Beds
Central	-	-	3,150	-	5	-	-	-	8	-	2	-	3	6
South	2	4	-	960	5	-	-	-	10	5	-	-	-	-
East	-	-	361	-	5	-	-	-	5	97	4	-	4	-

West	1	1	-	248	14	15	4	20	8	-	7	14	5	6
<b>Malir</b>	-	<b>1</b>	-	<b>48</b>	<b>7</b>	-	<b>2</b>	<b>8</b>	<b>4</b>	-	<b>14</b>	<b>22</b>	<b>6</b>	-
Korangi	-	7	-	724	8	-	-	-	7	-	8	16	4	41
Source: BOS, Government of Sindh (Development Statistics of Sindh-2018).														

#### 4.16 Micro Environment

The site can be approached by the Hub Dam Road when approaching the Hub dam itself. The Hub Dam Canal travels on the Eastern Side of the demarcated site serving as a source of water.

The site consists of undulating terrain along the boundaries of the site, with rising elevations towards the centre where it forms a hill that runs through the middle of the site from North to South.

Due to the presence of the Hub Dam Canal, the area has some agricultural activity as well as some people associated with the fields residing there.

The Hub Dam Canal's minimum and maximum distances from the subproject site eastern boundary are 109 metres and 174 meters, respectively.

Due to the recent rains in the area, the area had also witnessed the growth of rain fed vegetation, attracting animals for grazing

## Chapter 5 IMPACTS AND MITIGATION

This Chapter assesses the potential environmental and social impacts of the proposed project on environment and community. Also provided in the Chapter are the project-specific mitigation measures to minimize if not eliminating the potentially negative impacts, in order to ensure that the proposed interventions do not cause environmental and social impacts beyond the acceptable levels.

### 5.1 Environmental Safeguards Processing Steps

Implementation of the mitigation measures will require the following steps closely linking with activity planning, design and implementation steps.

- Step 1: Screening of Projects for impacts
- Step 2: Inclusion of Environmental Specifications and Environmental and Social Management Plan in Contractor(s) bidding documents
- Step 3: Compliance and Monitoring

### 5.2 Screening of Impacts

Project activities proposed for the subproject will undergo initial screening through a number of filters that include screening environmental and social impacts. Subprojects with any significant, long-term or medium term, irreversible environmental and social negative impacts will be avoided to the extent possible. A rapid assessment checklist for screening of impacts of 50 MW Solar project and filled as per the environmental survey conducted for the subproject area.

#### Environmental & Social screening checklist

S. No	Issues	Yes	No	Don't Know	Remarks
1	Does the subproject require land acquisition?				The project will be developed on the land of GoS. Land acquisition is not required.
2	Will the project negatively impact livelihoods				The site consists of undulating terrain along the boundaries of the site, with rising elevations towards the center where it forms a hill that runs through the middle of the site from North to South. Due to the presence of the Hub Dam Canal, the area has some agricultural activity as well as some people associated with the fields residing there. Due to the recent rains in the area, the area had also witnessed the growth of rain fed vegetation, attracting animals for grazing.
3	Is the project located on land with contested ownership?				No land ownership issues are with the project site.

S. No	Issues	Yes	No	Don't Know	Remarks
4	Is the project located in an area with security problems				Project area does not represent substantial security threats.
5	Is the subproject located in a designated protected area?				The subproject is not located within any designated natural reserve.
6	Is the subproject located in an area which would create a barrier for the movement of conservation-worthy wildlife or livestock?				No such barrier for the movement of wildlife or livestock is envisaged. No livestock activity or wildlife was found at the project site during the surveys.
7	Is the project located close to groundwater sources, surface water bodies, water courses or wetlands?				The site can be approached by the Hub Dam Road when approaching the Hub dam itself. The Hub Dam Canal travels on the Eastern Side of the demarcated site serving as a source of water. The Hub Dam Canal's minimum and maximum distances from the subproject site eastern boundary are 109 meters and 174 meters, respectively.
8	Is the project located in an area with designated cultural properties such as archaeological, historical and/or religious sites?				No designated cultural properties exist in the project area.
9	Is the project located in an area from where people have been displaced?				The site consists of undulating terrain along the boundaries of the site, with rising elevations towards the center where it forms a hill that runs through the middle of the site from North to South. Due to the presence of the Hub Dam Canal, the area has some agricultural activity as well as some people associated with the fields residing there.
10	Is the project located on prime agricultural land?				Due to the presence of the Hub Dam Canal, the area has some agricultural activity as well as some people associated with the fields residing there.
11	Is the project located in an area of tourist importance?				Not known or established tourist sites exist in the subproject area nor any tourist activity was observed during surveys.
12	Is the subproject located far from accessible roads?		✓		Primary accessible road to the project area is Hub River Road.



### 5.3 Assessment of Potential Impacts and Generic Mitigation

The positive and potentially negative impacts are assessed in detail in the subsections below for 150MW Solar PV project. The specific mitigation measures for sub-project impacts have also been provided hereunder.

#### 5.3.1 Positive Socio-economic and Environmental Impacts of project

Most of the project's environmental and social impacts will be beneficial, including for example generation of clean electricity, saving of carbon footprint of energy generation, generation of employment for locals etc. The beneficial impacts of the 150MW Solar PV subproject are described briefly hereunder:

- Clean electricity generation by avoiding use of fossil fuels, thereby putting effort towards climate change mitigation and adaptation.
- Savings of CO<sub>2</sub> emissions over the lifetime of the project.
- Generation of short term and long-term direct employment for locals. Estimated workforce for the construction phase will be 100-150 and operational phase will be around 20-30. It is envisaged that the about three-quarter of the workforce during construction phase will be required for unskilled jobs/work. Locals will be preferred for the workforce, expected to be about two-third of the unskilled workforce. For the operational phase, requirement of local unskilled labor is not expected to be more than half of the workforce. Possession of valid National Identity Card will be required to ensure hiring of locals among the workforce.
- Adding cleaner electricity to National grid to reduce the gap between demand and supply, particularly relevant for peak demand.
- Reduction of chronic power shortages.
- Indirect employment generation for the associated businesses such as suppliers & manufacturers of solar panels, inverters, transformers and maintenance service providers is also envisaged from the proposed project.
- The airshed of the area will remain unpolluted as no air emissions are associated with Solar energy generation.

The project area is underdeveloped, as indicated in the socioeconomic profile and lacks reliable supply of water and electricity. It is therefore recommended that community development in the project area being made part of the project developer's scope.

#### 5.3.2 Impacts and Mitigation Measures

The impacts associated with these activities are impacts of dust emissions, water/groundwater contamination, soil contamination, solid waste management, noise pollution, wastewater disposal, traffic management, occupational and community risks with regards to health and safety.

#### 5.3.3 Project Pre-Construction/Design Phase

Following is a description of impacts on each environmental and social component along with specific mitigation measures;





### 5.3.3.1 Impact on Ecology

The project site does not lie in a protected area, Ramsar site, reserved forest, wildlife sanctuary or game reserve. is over 2km away from the subproject location. No endangered faunal specie could be found during surveys or reported at the subproject site. The project site does not have any significant flora. Therefore, no significant impacts are envisaged on the flora during the project construction and operation phase. Natural drainage pattern exists at the project site.

#### *Mitigation Measures:*

- Onsite activities will be so planned that the natural drainage pattern is not disturbed.
- Rainwater drainage system will be connected with natural drainage so as not to alter the site natural drainage pattern.

### 5.3.3.2 Impact on Cultural/Archaeological Sites

No cultural and archaeological sites are located within 2km of the project site.

#### *Mitigation Measures:*

No mitigation measures are required as there is no impact.

### 5.3.3.3 Land Acquisition and Encroachments

The project is located on land leased by GoS therefore no land acquisition is involved. In addition, no encroachers are found at subproject location during surveys. No physical structure is visible within project site boundaries.

#### *Mitigation Measures:*

No mitigation measures are required as there is no impact.

## 5.3.4 Construction Impacts

Project activities will involve earthworks for construction and installation of panels and associated electrical equipment and substation. Following are the potential impacts of the subproject activities;

### 5.3.4.1 Social Impacts

Social concerns and conflicts during the construction project activities may arise if all the primary and secondary stakeholders are not adequately informed, consented and taken into confidence about the project or its schedule of operations, before the commencement of project activities.

- If the proposed construction site is not appropriately cordoned off to restrain outsiders from entering the site, issues of trespassing and safety issues of trespassers may arise, over to the safety and security of the site personnel and equipment.
- Quarrels between commuters due to increased traffic flow may arise if traffic management is not in place.
- Nuisance to nearby communities is envisaged due to increased heavy traffic and movement of construction equipment and dust and noise emissions.

#### *Mitigation Measures*



- Extensive consultation with stakeholders will be carried out and their feedback; concerns and input will be taken into account in the project planning and execution.
- It will be ensured that the construction site is appropriately cordoned off with hard barricade.
- Traffic management will be ensured taking in consideration the nearby community, their access and movement and privacy and optimal access routes to the site from N25.

#### 5.3.4.2 Air Quality Deterioration

The use of construction machinery operated on diesel can generate exhaust emissions including SO<sub>2</sub>, NO<sub>x</sub>, Smoke and Particulate Matter (PM). Site clearance, leveling, minor excavation for solar panels installation and substation foundations and other earthworks will generate dust emissions. Another possible cause of air deterioration is handling and transportation of cement, mortar, concrete, other dusty materials, and handling and storage of aggregates in concrete plants. However, these impacts will be temporary and localized to the construction phase in subproject area.

##### *Mitigation Measures*

Different options are available to control dust and exhaust pollution. They are listed below:

- The exposure of construction workers to dust should be minimized by provision of dust masks and mandating the workers to wear them.

##### ➤ Dust Reduction Measures

- Water should be sprinkled daily to wet all the expose surfaces.
- Use of water suppression for control of loose materials on paved or unpaved internal road surfaces. Oil and oil by-products is not a recommended method to control dust<sup>13</sup>.
- Truck loads should be covered with tarpaulin.
- Construction site including soil and material piles at the site should be adequately barricaded to avoid material escape, generation of dust.
- Ready-mix can be used in the stages of the project wherever and whenever required and deemed appropriate.
- Careful handling and working under moist conditions and monsoon season will be avoided as much as possible.

##### ➤ Exhaust emission reduction measures

- Construction machinery, vehicles should be properly tuned and kept in good working condition, minimizing exhaust and vehicular emissions. It should be ensured that exhausts from these equipment and vehicles comply with relevant SEQS.
- Excessive engine idling should be discouraged and machinery causing excessive pollution (i.e., visible clouds of smoke) should be banned from site.
- Open burning of solid wastes, whether hazardous or nonhazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively<sup>14</sup>.

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<sup>13</sup> WBG EHS Guidelines

<sup>14</sup> WBG EHS Guidelines



### 5.3.4.3 Noise

During the construction works, noise will be generated from the operation of machinery, project-related vehicular and material transport. These activities may cause discomfort to nearby communities and populace. Following table shows the noise levels of different construction equipment that will be used during construction phase of subproject.

Table 5.1: Typical noise levels of construction equipment (noise level in dB (A) at 15 m)			
Clearing		Structure Construction	
Bulldozer	80	Crane	75-77
Front end loader	72-84	Welding generator	71-82
Jack hammer	81-98	Concrete mixer	74-88
Crane with ball	75-87	Concrete pump	81-84
		Concrete vibrator	76
Excavation and Earth Moving		Air compressor	74-87
Bulldozer	80	Pneumatic tools	81-98
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
Grading and Compaction		Landscaping and clean-up	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
Paving		Front and end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94
Source: U.S. Environmental Protection Agency, Noise from Construction Equipment and Operations. Building Equipment and Home Appliance. NJID. December 31, 1971			

Figure 6.5 shows the locations around the subproject area that will be affected from noise during construction activity.

### Mitigation Measures

Different options are available to control noise pollution. They are listed below:

#### ➤ Noise Containment Measures

- PVC Laminated Polyester Fireproof Mesh Sheet can be used with hard barricade to reduce the noise levels and check the noise levels outside the barricade periodically for different type of construction activities through a hand-held noise meter.
- High noise activities should cease between 22:00 and 06:00 hrs.

#### ➤ Noise Reduction Measures

- Equipment and vehicle noise can be reduced at source by regular maintenance & repair of construction machinery and equipment.



- Mufflers or silencers should be mandatory to be equipped by all project-related vehicles.

#### 5.3.4.4 Surface and Ground Water Quality

The potential spills from construction equipment fuel, electrical equipment such as switch gears and transformers, construction vehicles during construction may unlikely result in contamination of groundwater under normal conditions. However, in conditions like post-monsoon season when groundwater table rise, contamination can occur. Also, inadequate storage at construction site and disposal to nearby areas of waste material will result in contamination of land, nuisance to the nearby community. Estimation water consumption from construction and labor camps will be 16,000 – 24,000 gallons per day.

No surface water body exists within 2km of project site; therefore, no contamination is envisaged.

#### *Mitigation Measures*

- It will be ensured that the wastes generated from construction activities should be stored in a proper interim location onsite which should be adequately barricaded and covered to avoid ingress of storm water.
- Excavation material /civil works related solid waste should be reused or disposed to the approved disposal site.
- Porta cabins will be provided for worker residence as well as for shelter for labor during construction and provision of water. Septic tank with soakage pit will be constructed for wastewater disposal.
- During construction phase, water tankers will be used.

#### 5.3.4.5 Waste Management

Typical solid waste generated during construction include waste concrete, empty cement bags, excavated soil, rejected or malfunctioned solar panels etc. The solid waste has the potential to cause negative impact on the surroundings if not properly managed and disposed of. It is likely to block nearby drainage channels that can ultimately cause localized flooding during the monsoon and nuisance to the communities.

Poor waste management practices would result in short term negative impact on the aesthetics of the surrounding. It can also impact air quality.

#### *Mitigation Measures*

- All hazardous waste such as oil-waste will be handled and disposed through incineration via SEPA certified hazardous waste contractor hired by CC.
- Recycling of solid waste will be carried out as far as possible and practical like cement bags, empty drums, discarded bricks etc.
- Rejected or malfunctioned solar panels will be sent back to the distributor/equipment manufacturer as no PV end-of-life treatment/recycling or disposal facility exist in the country as of today and the panels should not be disposed of without disbanding and untreated in the landfills/dumpsites.
- No wastes should be dumped indiscriminately at any location outside the site boundary/designated disposal site.



- Training should be provided to working personnel for identification, segregation, and management of waste.
- The site-specific waste management plan will be developed by CC.

#### *Waste Segregation*

All hazardous waste if found shall be segregated from nonhazardous wastes at the point of generation of waste. During construction phase, suitable containers with following color coding shall be kept to collect and segregate common wastes at all facilities:

Waste material	Color code
Concrete/ Campsite Debris	Blue
Metal	Green
Plastic	White
Oily Rags	Black
Used Oil	Red
Rubbish/Trash	Yellow

#### *Recycling*

Recycling and reuse minimize the quantity of waste requiring disposal. Some of the wastes can be reused within the construction site while others can only be recycled (Table 6.2). There is a great recycling potential for few of these wastes in the recycling market. Waste shall be sold to the third-party contractors/ companies, who have proper recycling facilities.

CC will suggest/recommend recycling of the paper, glass, plastic wastes in their respective processing units. Iron/steel waste would be sent to re-rolling mills.

**Table 5.2: Waste management options (different categories)**

S#	Waste Type	Category	Disposal Options
1.	Septic Tank Sludge	Non-hazardous	Disposed in Landfill site.
2.	Excavation Material	Non-hazardous	Reuse for backfill
3.	Construction debris including Scrap	Non-hazardous	Recycle, reuse or sell to third party contractor.
4.	Metals	Non-hazardous	Store cuttings in designated area for reuse. Remove surplus materials and use them at other sites, where feasible.
5.	Concrete	Non-hazardous	Store unused concrete blocks for later reuse. Recycle, reuse or sell to third party contractor.
6.	Bricks	Non-hazardous	Reuse for footings and broken bricks.
7.	Plastic and vinyl	Non-hazardous	Recycle, reuse or sell to third party contractor.
8.	Corrugated Cardboard	Non-hazardous	Recycle, reuse or sell to third party contractor.





**Table 5.2: Waste management options (different categories)**

S#	Waste Type	Category	Disposal Options
9.	Woods	Non-hazardous	Recycle
10.	Empty Drums and Containers	Non-hazardous	Disposed them off through recycler.
11.	Oil waste (fuel oil, transformer oil, switchgear oil)	Hazardous	Handled and disposed through incineration via EPA certified waste contractor hired by CC.
12.	PV modules	Hazardous	Extract recyclable content and then disposal in landfill site approved by authorities.
13.	Sanitary Wastewater	Non-hazardous	Treat wastewater in septic tanks before disposal.
14.	Trash	Non-hazardous	1. Segregate glass, metal, plastic from trash. 2. Recycle all recyclable items. 3. Designed landfill.

The Waste Tracking Form, attached below shall be used to record this information by CC, while waste is being dispatched outside construction site. It is the responsibility of respective EPA certified waste contractor to assign a suitable person to sign off the record of waste tracking before the waste is dispatched outside.

#### WASTE TRACKING FORM

<b>Location of Generation:</b>	
<b>Reporting Team:</b>	
<b>Submitted by (Name):</b>	
<b>Submitted on (Date):</b>	
<b>Waste</b>	<b>Disposal Location</b>
Excavation Material	
Concrete	
Bricks	
Metal	
Card board	
Wires	
Drums and Containers (Empty)	
Oil Contaminated Soil	
Sanitary Wastewater	
Sludge	
General Trash	

Checked and Signed: \_\_\_\_\_ Dated: \_\_\_\_\_



#### 5.3.4.6 Soil Contamination

Soil at the construction site can get contaminated from either spill, due to stagnant water or degradation due to activities in the microenvironment of the site.

##### *Mitigation Measures*

- Fuel oils, Transformer oils and lubricants for construction machinery will be stored in covered diked areas, underlain with HDPE membrane.
- Washing and maintenance of vehicles will be restricted onsite and contractor is mandated to get entry of well-maintained and cleaned machinery.
- Regular inspections will be carried out to detect leakages in construction vehicles and equipment.
- Appropriate implements such as shovels, plastic bags and absorbent materials will be made available near fuel and oil storage areas for removal of oil and contaminated soil.

#### 5.3.4.7 Traffic Management

Primary accessible road to the project area is Hub River Road. The project site is not frequented with vehicular traffic. Therefore, traffic disruption is not envisaged. However, adequate vehicular traffic management will be undertaken to avoid nuisance to nearby communities.

##### *Mitigation Measures*

- Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid nuisance to nearby areas.
- Appropriate Sign postings may be installed to alert populace of all potential hazards including limited access to construction sites.
- Movement of construction material to the project sites should be planned in a way that it will not hamper major transport activity in the micro and macro environment. The transfer of material should not be done during late hours.

#### 5.3.4.8 Impacts on Flora

The project site does not have any significant flora. Therefore, no significant impacts are envisaged on the flora during the project construction and operation phase.

##### *Mitigation Measures*

- No mitigation measures will be required.

#### 5.3.4.9 Impacts on Local Resources

During project execution, supplies of equipment, material, etc. will be required. As the project area is under developed and has limited commercial activities, supplies are likely to be sourced from population centers such as Hub and Karachi. These centers are far well-developed than the project area and have substantially more commercial and industrial activities and resources. Additionally, supplies for the project will mainly be required during construction phase, which has the limited time period of several months. Therefore, residual adverse impacts of project supplies on local resources are not likely.



#### 5.3.4.10 Labor Issues

- The construction works involving earthworks, excavation, erecting structures, etc. poses an inherent risk of injury to labor from accidents.
- Poor housekeeping practices may lead to stagnant water as breeding grounds for insect vectors (causing malaria etc.).
- Hazards from handling equipment, ergonomic stress, lifting heavy materials etc. may cause injury to the labor.
- Electrical equipment and substation pose electrocution hazard.

#### *Mitigation Measures*

Site-specific labor health and safety hazards are also critical to identify based on job safety analysis or comprehensive hazard or risk assessment. Health and safety management planning should include the adoption of a systematic and structured approach for prevention and control of physical, electrical, chemical, and biological health and safety hazards. Use of PPE should be made mandatory. Only trained and experienced crane, forklift, etc. operators should be hired. CC shall ensure that Job Hazard Analysis (JHA) is performed prior to commencing jobs. It shall also be ensured that the JHA is reviewed after the following:

- Whenever work is stopped
- Every time work conditions or the job scope changes
- Persons working the job shall review and acknowledge the JHA by their signature

#### 5.3.4.11 Crane and Lifting Operations

For all Crane & Lifting Operations CC shall ensure full compliance with standard operating procedures. CC shall develop a site-specific pre-lift checklist which includes the following at minimum:

- Crane rigging capacity adequately for load
- Condition of slings
- Rigging condition adequate for load
- Area of swing or travel unobstructed
- Multiple crane use
- Power line approach distance maintained
- Stability and footing
- Taglines and spotters
- Illumination and weather
- Signal operator
- Job hazard analysis and other permits

All lifting and rigging activities shall be supervised and conducted by a competent person or team, CC shall maintain a lifting gear registry for all lifting gear on-site inclusive of a listing of all lifting gear, copies of equipment certificates (manufacturer, safe working load, serial number) and the inspection/recertification frequency.



#### **5.3.4.12 Forklifts and Non-Road Vehicles**

CC should ensure forklift and non-road vehicles are fit for purpose and operated according to manufacturer's requirements. Only competent operators are permitted to operate forklifts and non-road vehicles.

At minimum, all forklifts and non-road vehicles shall be equipped with following equipment:

- Seat belts
- Horn
- Emergency Brake
- Wheel chock
- Labeled Controls
- Fire Extinguishers
- First Aid Kit
- Back-up Alarm

#### **5.3.4.13 Scaffolding**

CC is responsible to establish periodic inspection, certification and recertification program for scaffold works. Only qualified worker is authorized to erect, inspect and certify scaffold. All scaffolds should have a guardrail system on each open side, up to the access point. It should be equipped with toe boards having suitable access ladder.

#### **5.3.4.14 Over-exertion**

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries at construction site.

#### *Mitigation Measures*

Recommendations for their prevention and control include:

- Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two-person lifts are necessary.
- Work site layout will be planned to minimize the need for manual transfer of heavy loads.
- Tools will be selected and work stations would be designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations.
- Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes.

#### **5.3.4.15 Slips and Falls**

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction site.



### *Mitigation Measures*

Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Good house-keeping practices, such as the sorting and placing loose construction materials in established areas, would be implemented.
- Excessive waste debris and liquid spills will be cleaned up regularly.
- Electrical cords and ropes will be located in common areas and marked corridors.
- Slip retardant footwear will be used.

#### **5.3.4.16 Struck by Objects**

Construction activities of the project may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.

### *Mitigation Measures*

Techniques for the prevention and control of these hazards include:

- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap.
- Temporary fall protection measures in scaffolds and out edges of elevated work surfaces would be used, such as hand rails and toe boards to prevent materials from being dislodged.
- Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be wore.

#### **5.3.4.17 Moving Machinery**

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise.

Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

### *Mitigation Measures*

Techniques for the prevention and control of these impacts include:

- The location of vehicle traffic, machine operation, walking areas, and controlling vehicle traffic will be planned and segregated through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
- The visibility of personnel will be ensured through the use of high visibility vests when working in or walking through heavy equipment operating areas as well as training of workers to verify eye contact with equipment operators before approaching the operating vehicle.





- Inspected and well-maintained lifting devices will be used that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

#### **5.3.4.18 Electrocuting Hazard**

Subproject involves generation of electricity and its evacuation through substation and therefore poses electrocution hazard to the workers. An electrical hazard can be defined as a serious workplace hazard that exposes workers to any of the following:

- Burns
- Electrocution
- Shock
- Arc flash or arc blast
- Fire
- Explosions

List of potential electrical hazard at site is as follows;

- Improper grounding
- Exposed electrical parts
- Inadequate wiring
- Damaged insulation
- Overload circuits
- Damaged tools and equipment

#### *Mitigation Measures*

- Use of ground-fault circuit interrupters
- Periodic inspection of extension cords and portable tools
- Use power tools and equipment as designed
- Proper lockout/tagout procedures will be followed
- Safety signs for electrical hazard will be placed
- Ensuring proper guarding of electrical equipment and facilities

#### **5.3.4.19 Other Site Hazards**

Construction of site may pose a risk of exposure to dust, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms.

#### *Mitigation Measures*

- Only authorized personal should be allowed at the construction site
- Identify and minimize, so far as reasonably practicable, the causes of potential hazards to workers, including communicable diseases and vector borne diseases;
- Avoid stagnation of water and initiate drainage/cleanup of stagnant water;
- Provide for the provision of appropriately stocked first-aid equipment at work sites;



- Provide for appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate outerwear, boots and gloves; safety helmets;
- Provide training for workers for the use of PPE;
- WB Group's Environment, Health and Safety (EHS) Guidelines will be implemented;
- No bonded and child labor will be permitted at site;
- Major labor laws will be followed e.g., Minimum Wage, Hours of work, Overtime Payment.
- Also, laborers will be trained on appropriate interaction with local people;
- Include procedures for documenting and reporting accidents, diseases, and incidents; and
- All safety precautions will be taken to address safety hazards for the nearby community. These precautions may include safety/warning signage, safety barrier around the construction site.
- Lighting provided for labor during night time work should be adequate.
- CC will include appropriate clauses to protect environment and public health. The EMP will be included in the bidding document;

Summary of Recommended Personal Protective Equipment According to Hazard		
Objective	Workplace Hazards	Suggested PPE
Eye and face protection	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation.	Safety Glasses with side-shields, protective shades, etc.
Head protection	Falling objects, inadequate height clearance, and overhead power cords.	Plastic Helmets with top and side impact protection.
Hearing protection	Noise, ultra-sound.	Hearing protectors (ear plugs or ear muffs).
Foot protection	Falling or rolling objects, pointed objects. Corrosive or hot liquids.	Safety shoes and boots for protection against moving & falling objects, liquids and chemicals.
Hand protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures.	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
Respiratory protection	Dust, fogs, fumes, mists, gases, smokes, vapors.	Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available.
	Oxygen deficiency	Portable or supplied air (fixed lines). On-site rescue equipment.
Body/leg protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration.	Insulating clothing, body suits, aprons etc. of appropriate materials.
Source: IFC Environmental, Health, and Safety General Guidelines		



## COVID-19 Prevention

Prevention measures are listed below;

- Assess the hazards to which the workers may be exposed; evaluate the risk of exposure; and select, implement, and ensure workers use controls to prevent exposure.
- Conducting a job hazard analysis can help to determine whether work activities require close contact (within 6 feet) between workers, visitors, or other members of the public.
- When a job hazard analysis identifies activities with higher exposure risks, and those activities are not essential, consider delaying them until they can be performed safely.
- Use closed doors and walls, whenever feasible, as physical barriers to separate workers from any individuals experiencing signs and/or symptoms consistent with COVID-19.
- Use administrative controls, when feasible, to reduce or eliminate the risk of exposure.
- Training for employees on the spread of the disease in the geographic areas in which they work.
- Screening calls when scheduling indoor construction work to assess potential exposures and circumstances in the work environment, before worker entry.
- Appropriate cleaning practices (i.e., washing hands frequently with soap and water for at least 20 seconds, or, if soap and water are not immediately available, using alcohol-based hand sanitizer that contains at least 60% alcohol and rubbing hands until they are dry; sanitizing all surfaces workers will touch).
- The proper way to cover coughs and sneezes following Ministry of Health and WHO recommendations (i.e., sneezing or coughing into a tissue or into the upper sleeve).
- Alternatives to shaking hands upon entry, and the importance of workers not touching their own faces (mouth, nose, eyes).
- Wearing masks over their noses and mouths to prevent them from spreading the virus.
- The need to continue using other normal control measures, including PPE, necessary to protect workers from other job hazards associated with construction activities.
- To the extent possible, screen all visitors on all construction sites in advance of their arrival on the job site for signs and symptoms of COVID-19.
- Adopt staggered work schedules, e.g., provide alternating workdays or extra shifts, to reduce the total number of employees on a job site at any given time and to ensure physical distancing.
- Keep in-person meetings (including toolbox talks and safety meetings) as short as possible, limit the number of workers in attendance, and use social distancing practices.
- Ensure clean toilet and handwashing facilities. Clean and disinfect portable job site toilets regularly. Fill hand sanitizer dispensers regularly. Disinfect frequently touched items (i.e., door pulls and toilet seats) regularly.

### 5.3.5 Project Operation Impacts

Solar PV technology is a clean energy generation technology which does not produce air emissions, effluent generation and noise during operations. However, some potential impacts during project operations are discussed below and mitigation measures have been given where required.

#### 5.3.5.1 Wastewater

Estimation water consumption will be one million litres per day. Wastewater during the operation phase will mainly comprise of sewage and residual water from cleaning of solar PV panels. Both are



wastewater streams are considered non-hazardous and its potential negative impacts will be mitigated as follows;

*Mitigation Measures*

- Adequate separate drainage lines will be provided for the flow of sewage and residual water from panel cleaning.
- Sewage water will be discharged through multi-chamber Septic Tank connected with soakage pit. Alternatively, sewage water can be collected in a concrete-line pit and can be remove on periodic basis through waste contractor for off-site disposal.
- Wastewater from solar panels cleaning can be collected in settling pit and be reused to the extent feasible or it can also be used for dust suppression on exposed surfaces, which will reduce the water requirement for the project during operations. Alternatively, the residual water can be disposed through Septic Tank connected with soakage pit.
- If RO plant is used for groundwater desalination, RO reject will be collected in the concrete-lined evaporation pond and will not be discharged outside the project boundary. Mineral residues after evaporation can be disposed offsite through waste contractor or can be sold if commercially viable. An alternative would be to bore a rejection well and RO brine may be injected deep underground.

#### **5.3.5.2 Solid Waste Disposal**

During operations, solid waste will comprise of broken/disused electrical and electronic equipment such as PV panels, batteries, inverters, transformers; food waste, sewage sludge, etc. PV panels and batteries contain certain number of heavy metals such as Mercury and Cadmium which are considered toxic for environment. Waste will be segregated before disposal.

*Mitigation Measures*

- Several components of the solar panels can be recycled such as glass, plastic and aluminum can be recycled. However, at present, no such facility exists in the country. Disposal of broken and dysfunctional panels to landfills/dumpsites is also not recommended due to the potential of soil and groundwater contamination due to constituents of solar cells. Therefore, the disused panels will be returned to the supplier/manufacturer.
- Disused dry batteries will be returned to the supplier/manufacturer for possible recycling.
- Other electrical equipment as transformers and inverters will be returned to the suppliers/manufacturers.
- No hazardous waste such as food, packaging, sewage sludge etc. will be disposed through waste contractor.

#### **5.3.5.3 Community Health and Safety**

Potential impacts on the community during the operations are minimal as the solar PV plant does not have air emissions, noise generation and effluent discharge, however electrocution hazard remains.

*Mitigation Measures*

- Entry/exit gate(s) of the site will be clearly marked.
- Entrance in the site will only be allowed to the authorize personnel and to the visitors after registration at entrance.



- Site will properly be barricaded through wall/fence of adequate height to minimize chances of trespassing, thereby avoiding the incidents such as electrocution.
- Electrical hazard signs and posters will be adequately marked on the outer face of the barricading wall/fence to alert the passerby.
- Unskilled staff for operational phase will mainly be sourced from the area to avoid any community conflict due to influx of outsiders.

#### **5.3.5.4 Occupational Health and Safety**

There will be significantly lower requirement of onsite staff than construction phase to ensure the smooth plant operations after commissioning. Electrocution will be the main hazard for the onsite workers during operations.

##### *Mitigation Measures*

- Electrical equipment will adequately be grounded for workers safety.
- Electrocution hazard signs will be displayed, particularly for the PV panel area and substation.
- Staff will be required to wear necessary PPE once they are out of their campsite for routine inspection, surveillance and/or monitoring.
- Maintenance at the site will be duly be authorized and be carried out with necessary safety precautions such use of PPE, adequate grounding, etc.

#### **5.3.5.5 Impacts due to spill and leakage of transformer oil, liquid dielectric**

Potential impact for spills and leakage of dielectric includes soil and groundwater contamination if the equipment is mounted on soft surface and fire hazard as the liquid dielectric is usually flammable.

##### *Mitigation Measures*

- Transformers and associated equipment with liquid dielectric will be concrete footing with adequate drain and collection pit in case of spill to avoid soil contamination and ingress into soil.
- Leakages will be prevented through periodic maintenance.
- Spilled oil and dielectric will be disposed through incineration by waste contractor.

#### **5.3.5.6 Visual Impacts**

Project site is the part of vast expanse of uninhabited and barren land. Ground-mounted PV panels will raise only couple of meters from ground so the project is unlikely to cause major visual obstruction for the general landscape.

##### *Mitigation Measures*

- Visual impact of the solar plant will be minimized through adequate landscaping at site.

#### **5.3.5.7 Impact of Sulfur Hexafluoride (SF6) Leak**

SF6 is a non-toxic and non-flammable but a potent greenhouse gas. It is used as gas-dielectric in electrical equipment such as switchgear. Leakage of SF6 in large quantities pose the risk of suffocation in confined and unventilated spaces. Risk of leakage is low with modern robust electrical equipment.

##### *Mitigation Measures*





- SF6 carrying equipment must not be dropped or rolled and must be protected from overheating.
- Leakage detection devices can be installed in the substation area. Handheld detectors can also be used.
- Gas mask is also recommended for the authorize personnel for operation and maintenance to avoid risk of asphyxiation from accidental release of gas in large quantities.

#### 5.3.5.8 Impacts of Electromagnetic Fields (EMF)

As with the other electrical and electronic equipment, Solar PV systems produce Electromagnetic Fields which is the function of electric field and magnetic field. Studies<sup>1516</sup> have shown the EMF values from PV systems are well below the guideline limits by ICNIRP<sup>17</sup>, therefore it will not have negative health impacts for project staff and nearby communities.

#### 5.3.5.9 Flooding

Project area due to minor undulations, would be prone to floods during heavy precipitation events.

##### *Mitigation Measures*

- Improvements in forecasts and warnings
- Sustainable and long-term mitigation policies
- Automated Local Emergency Response in Real Time (ALERT) systems will be developed.

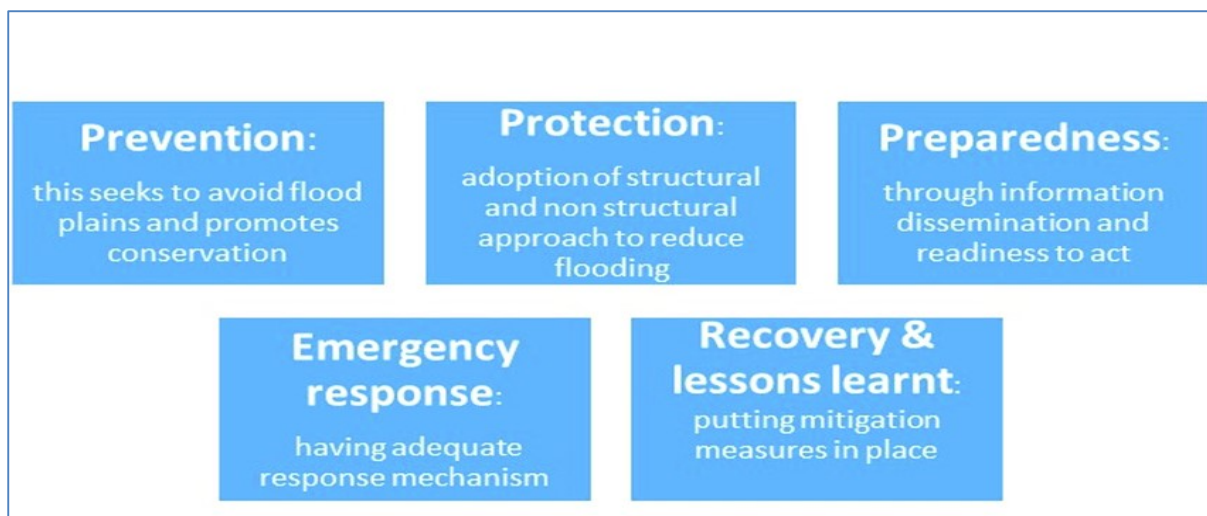


Figure 5.1: Flooding Risk Management Plan<sup>18</sup>

<sup>15</sup> <https://pubmed.ncbi.nlm.nih.gov/26023811/>

<sup>16</sup> <https://nccleantech.ncsu.edu/wp-content/uploads/2019/10/Health-and-Safety-Impacts-of-Solar-Photovoltaics-PV.pdf>

<sup>17</sup> ICNIRP Guidelines. Retrived from <https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf>

<sup>18</sup> EU-Directives-2007-EU-flood-Risk-Management-Plan

## Chapter 6 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

### 6.1 Introduction

#### 6.1.1 General

This section discusses the implementation and management of mitigation measures that are required for proposed project that includes progressive report and techniques to assure that all necessary environmental protection measures are carried out in the future as planned and to reduce residual impact to acceptable levels and achieve the expected outcomes of the project. The Environmental Management and Monitoring Plan (EMMP) are based on the type, extent and duration of the identified environmental impacts. The EMMP has been prepared following the regulatory requirements and guidelines.

Environmental management and monitoring are mandatory activity to be undertaken by the project developer over the entire project cycle showing its commitment towards meeting environmental regulations/standards as well as maintaining health and safety standards.

The environmental management and monitoring programs are implemented from the very early stages of planning and execution phases of the project. In fact, the authorization of the project is the point of initiation of environmental management plan. The monitoring data, observations recorded and test results / analyses are vital and formulate legal documents to be kept in safe custody and may be provided to competent authority as and when required in accordance to Sindh Environmental Protection Act 2014.

EMMP is a dynamic and a live document that is under constant review having periodic revisions and may be updated as required. Any amendments in the procedures, information is notified to the concerned personnel after the approval from the competent authority for subsequent implementation. It also highlights the responsible personnel to work for the implementation of this EMMP.

The Sindh Solar Energy Project (SSEP), formed after competitive bidding, will be responsible for implementing the EMMP and ensuring that all personnel management are informed about the EMMP and the requirement to implement the procedures it contains. The EMMP is intended as a quick reference for Project personnel and regulators to monitor compliance

#### 6.1.2 Objectives of EMMP

The EMMP will serve as a principal execution module of the project that would not only mitigate adverse environmental impacts during the designing, construction, operational and maintenance phase of the project but also ensures that environmental standards and good housekeeping is maintained. Continuous environmental monitoring is exercised to ensure that preventive measures are in place and are effective; to sustain environmental integrity. Some of the key objectives of the EMP are to:

- Outline mitigation measures recommended in the IEE and define the responsibility and implementation of these measures;
- To outline functions and responsibilities of personnel;
- To state and implement standards and guidelines which are required under environmental legislations particular in context to the project,



- Facilitates the implementation of the mitigation measures by providing the technical details of each project impact, and proposing implementation schedule of the proposed mitigation measures;
- Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented; and
- Identify training requirements at various levels and provide a plan for the implementation of training sessions

It is important that the recommendations and mitigation measures are carried out according to the spirit of the environmental assessment process and in line with the guidelines. The EMMP are presented in Table 6.1 and 6.2. Screening of potential environmental and social impacts has played a vital role in reconfirming typical mitigation measures and in identifying any different approaches based on the feasibility and detailed design assumptions and any alternatives available at this stage.

### 6.1.3 Legislation and Guidelines

Legislation and guidelines pertaining to this project have been discussed at length in chapter 3 of this IEE study. It shall ensure that the project activities during designing, construction and operation phases of the project would follow the relevant environmental legislations and guidelines. The staff of the proponent and contractor should also be aware of these laws.

## 6.2 Structure of EMP

The environmental management plan is divided into the following core components:

- Organizational Structure and Roles and responsibilities;
- Implementation of Environmental Management Plan
- Mitigation matrix for each project phase;
- Monitoring plan for the project;
- Worker's Health and Safety Plan
- Waste management plan
- Equipment Maintenance
- Emergency Response Plan
- Site Restoration
- Change Management Plan

## 6.3 Institutional Framework for the Implementation of EMMP

This Framework illustrates the roles & responsibilities required for the implementation of EMMP. Environmental management during construction of proposed project would be performed by CC in supervision of the SSEP. In O&M phase, the implementation of EMMP would be the responsibility of successful SSEP and the same will ensure that all activities during each phase will be in compliance with the EMMP and SEQS.

### *SSEP*

SSEP would perform the following roles and responsibilities:

- Will be responsible for the successful execution of the project;
- Ensure that the project complies with regulatory requirements;



- Ensure that EMMP is followed and staff is properly trained;
- Keep in place emergency and rescue plans for safety of staff and general public;
- Improve the coordination and exchange of information between management, employees and contractors etc.;
- Ensure the health and safety of employees;

## CC

Some roles and responsibilities of Construction Contractor are as under:

- Ensure that the project activities are undertaken in an environment friendly manner and EMMP is implemented;
- Evaluate compliance with SEQS, national and international guidelines for environmental protection;

### 6.4 Environmental Mitigation and Monitoring Plan

The Mitigation and Monitoring Plan has been tabulated in tables 6.1, 6.2 and 6.3. The plan will be used as a management and monitoring tool for implementation of the mitigation measures. The matrix lists down the following.

- Environmental Impacts for various project phases;
- The mitigation measures recommended in the IEE;
- The person/organization directly responsible for adhering to or executing the required mitigation measures;
- The parameters which will be monitored to ensure compliance with the mitigation measures; and
- The timing at which the mitigation or monitoring has to be carried out.
- The person/organization responsible to execute monitoring plan.

It is highlighted that although responsibilities for executing and monitoring mitigation measures have been delegated to different persons/organizations, SSEP holds the primary and overall responsibility for ensuring full implementation of the EMP.

### 6.5 Environmental Training

An environmental training program will be prepared to address the need of contractor's site staff and build their capacity to effectively implement project-specific EMMP. HSE officer (Contractor) will coordinate with contractors to organize training for their staff and to help them establish system /infrastructure for future sustainability. In addition to the training arranged and imparted by the HSE officer (Contractor) for complete project team, the contractor will also plan small training sessions for workers involved in specific jobs. Cost of trainings and mitigation measures will be deemed included in contract cost. Environmental Training Plan is provided in Table 6.3.

### 6.6 Emergency Response Plan

Emergency procedures will be prepared to include all events which have the tendency to create an emergency situation at the solar power plant. It is advisable that emergency procedures are prepared in conjunction with the emergency services such as fire brigade.



The procedures will be readily available to all personnel involved, regularly practiced and checked periodically that they are up to date. Employees likely to be affected will be provided with the knowledge of the actions required to minimize the adverse effects.

The emergency procedures will consider:

- the properties of the raw materials and excipients, solvents used;
- concerns associated with the exposure to the product
- the quantities involved;
- the plant components may cause electric shock hazard

### 6.6.1 Contingency Planning – Incidents and Emergencies

#### A. Fire Contingency Plan

Because flammable / combustible materials, and electrical appliances are present at the site, fire is an ever-present hazard. All personnel and subcontractors are not trained professional fire-fighters. Therefore, if there is any doubt that a fire cannot be quickly contained and extinguished, personnel will notify the Site supervisor and vacate the area. The site supervisor will immediately notify the local Fire Department.

The following procedures will be followed to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be kept away from where flammable materials are handled or stored.
- “No Smoking” signs will be posted at visible areas where flammable materials are present.
- Fire extinguishers will be placed in all areas where a fire hazard may exist.
- Before workers begin operations in an area, the area supervisor will give instruction on exit procedures and assembly points. Exit routes will be displayed through signage in work areas and exit points will be clearly marked.

The following procedures will be implemented in the event of a fire:

- Anyone who sees a fire will notify the supervisor who will then contact the Site Superintendent and the HSE Officer. The HSE Officer will activate the emergency alarm and contact the local Fire Department.
- When the emergency siren sounds, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will comprise of pairs of workers (buddy system) who join each other immediately after hearing the fire alarm and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count.
- When a small fire has been extinguished by a worker, the site superintendent and the Health and Safety Officer will be notified.

#### i. Responsibilities of Fire Safety Officer (Contractor)

The Fire Safety Officer will supervise and perform firefighting activities.

- Responsible for Head Count in the assembly area.





- Conduct Fire drills for the employees and reports the outcomes, suggestions and action plan of such drills.
- Responsible for maintenance and documentation of all fire extinguishers.
- Develop and regularly review building fire exit plans.
- Inspect and test new and existing fire protection systems, fire detection systems and fire safety equipment to ensure that they are operating optimally.
- Action by Staff Detecting the fire or smoke

If any person smells a burning odor or hear any one shouting “Fire, Fire” or sees the fire/smoke, he/she will immediately inform the telephone operator and will:

- Give his/ her name
- Location of Fire
- Type of Fire

Receptionist (Telephone Operator) will

- immediately inform Administration Manager, during and after working hours.
- call security in-charge
- call fire safety officer (contractor).
- call Police and City Government only if told by Security in-charge or fire officer.

Staff on duty will restrict fire by closing doors and windows of affected area, if possible and turn electrical mains to OFF position. If the fire is contained and small, rush towards the nearest fire extinguisher and try to extinguish the fire.

## **B. Evacuation Procedures**

In the event of on-site evacuation of personnel is necessary, the following actions will be taken:

- The emergency signal will be activated (one single long blast on the air horn).
- No further entry of visitors or contractors will be permitted.
- Shut off all machinery if safe to do so.
- All on-site personnel, visitors, and contractors will assemble at the entrance of the site for a head count and await further instruction from the Site Superintendent.
- All persons will be accounted for by their immediate crew leaders (e.g., area supervisor). Crew leaders will determine the safest exits for employees and will choose an alternate exit if the first choice is inaccessible.
- During exit, the crew leader will try to keep the group together. Immediately upon exit, the crew leader will account for all employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the Site Superintendent.

## **C. Evacuation Responsibility**

The decision will be made by the Emergency Rescue team which includes Fire Safety Officer (contractor) & Site In-charge and will be communicated to the Project Manager.



Emergency rescue team will inform the Project Manager and decide if partial or full evacuation is required. Also liaise to mitigate the situation and return the area to normal as soon as possible.

The emergency response team members involved are as follows:

**i. Actions by Site Incharge (Contractor)**

- Manager Administration and the Security officer in co-ordination with specific area in-charge will arrange for evacuation.
- If the fire goes beyond the control of management, the local Fire brigade to be summoned in consultation with Manager Administration.
- He will conduct root cause analysis and log the same on the prescribed incident report form.
- Security in charge will inform Manager Administration as soon as fire is confirmed by him personally.
- Call Fire Department immediately.
- Advise telephone operator to inform all head of departments/in-charges.

**ii. Senior Management/Administration**

- Should reach the place of fire as soon as the news is confirmed.
- Manager Administration will inform all areas of the Grid Station operations if needed.
- Media Handling
- A debriefing session at the end of the disaster.

**iii. House Keeping**

- Open all windows and doors for ventilation.
- Remove obstacles on the way to the fire exit.

### 6.6.2 Fire Detection & Warning

Portable Fire extinguishers will be used in buildings and as protection during "Hot Work" activities throughout the site. As construction progresses and systems are commissioned within specific buildings, personnel will be informed of the different alarm sounds.

Following types of fire extinguishers are generally used:

- ABC (Dry Chemical): Red or Orange in color. All-purpose dry chemical may be used on any type of fire
- CO2: Red in color, Big Black horn on hose. Good for Oil, Grease & Electrical fires.
- Water: Completely red with no color band. Suitable for paper, textiles, wood, most plastics & rubber.

Large office accommodation will be protected by the use of hard-wired smoke detection devices with battery backup.

A suitable means of raising the alarm, in the event of a fire or other emergency at the facility, will be established. The alarm system will be appropriate to ensure all personnel can be notified immediately



of any emergency situation and evacuation, or other actions required. The alarm system will be tested on a regular basis.

### **6.6.3 Fire Fighting Equipment**

The following firefighting equipment will be maintained in good order in the facility:

- Fire Extinguishers of adequate size and Type
- Sand buckets
- Rescue gear (includes stretchers, turnout gear, fire rescue gloves, emergency light, fire boots, fire hoods, etc.)
- Equipment will be maintained and tested to ensure serviceability in the event of a fire.
- Tests will be conducted monthly.

The facility fire suppression system will be prioritized and made serviceable as soon as practical during construction.

### **6.6.4 Fire Drills**

The Fire Safety Coordinator/ Officer will ensure that monthly drills are carried out that ensure all personnel are familiar with the evacuation procedure and their respective muster points.

Simulated fire emergencies will be carried out to ensure the readiness and competency of the fire brigade to fight a major fire. During the drill, equipment will be tested. In the event any equipment should fail it will be immediately replaced.

Review of brigade competency will be determined during the drills. Brigade members will be retrained if any evidence of in-competency exists.

## **6.7 Waste Management Plan**

The waste management plan will be prepared and implemented by the construction contractor for the proposed solar PV project in order to ensure timely collection, handling and disposal of the waste generated during the construction phase. Waste management at the power plant would:

- reduce risk exposure to a minimum,
- protect employees,
- bring the organization into compliance with EPA's requirement

**Table 6.1: Environmental Mitigation and Monitoring Plan during Pre-Construction/Design Stage**

S#	Environmental Effect	Potential Significance	Pre-Construction Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
1.	Compliance with provincial and national environmental regulations	Medium	<ul style="list-style-type: none"> <li>✓ This EMMP to be made part of the bidding/tender documents.</li> <li>✓ The bid documents shall note that Pakistani laws and regulations relating to the environment will be followed during the construction phase.</li> </ul>	CC	Tender documents		SSEP
2.	Impact on ecology	Medium	<ul style="list-style-type: none"> <li>✓ Onsite activities will be so planned that the natural drainage pattern is not disturbed.</li> <li>✓ Rainwater drainage system will be connected with natural drainage so as not to alter the site natural drainage pattern.</li> </ul>	CC	Visual impact and count of floral/faunal species at project site	Once pre-construction	SSEP
3.	Impact on Cultural/archaeological sites	Low	<ul style="list-style-type: none"> <li>✓ No mitigation measures required as no such sites are located at project site and within 1km of project.</li> </ul>	-	-	-	-
4.	Land Acquisition and Encroachments	Medium	<ul style="list-style-type: none"> <li>✓ The project is located on land of GoS. No land acquisition is involved.</li> </ul>	CC	Land documents and land survey	Pre-construction	SSEP



Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase							
S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
1.	Social Impacts	Medium	<ul style="list-style-type: none"> <li>✓ Extensive consultation with stakeholders will be carried out and their feedback; concerns and input will be taken into account in the project planning and execution.</li> <li>✓ It will be ensured that the construction site is appropriately cordoned off with hard barricade.</li> <li>✓ Traffic management will be ensured taking in consideration the nearby community, their access and movement and privacy and optimal access routes to the site from N25.</li> </ul>	CC	Visual observations, feedbacks from project personnel and community	As required keeping in view site conditions	SSEP
2.	Air Quality deterioration due to dust and exhaust emissions	Medium	<ul style="list-style-type: none"> <li>✓ The exposure of construction workers to dust should be minimized by provision of dust masks and mandating the workers to wear them.</li> <li>✓ Truck loads should be covered with tarpaulin.</li> <li>✓ Construction site including soil and material piles at the site should be barricaded to avoid material escape, generation of dust.</li> <li>✓ Ready-mix can be used in the stages of the project wherever and whenever required and deemed appropriate.</li> <li>✓ Construction operations should be carefully planned and scheduled.</li> <li>✓ Careful handling and working under moist conditions and monsoon season will be avoided as much as possible.</li> <li>✓ Construction machinery, vehicles should be properly tuned and kept in good working condition, minimizing exhaust and vehicular emissions. It should be ensured that exhausts from these equipment and vehicles comply with relevant SEQS.</li> </ul>	CC	<p>Ambient Air Quality parameters (SPM, NO, NO<sub>2</sub>, SO<sub>2</sub>, PM<sub>10</sub>, CO, PM<sub>2.5</sub>, O<sub>3</sub>, Lead) – Mobile air quality Van will be used.</p> <p>Vehicular Emissions for Construction Vehicles and equipment exhaust (Smoke, CO, NO<sub>x</sub>, SO<sub>x</sub>, PM, Noise) – Exhaust</p>	Quarterly	SSEP





**Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			<ul style="list-style-type: none"> <li>✓ Excessive engine idling should be discouraged and machinery causing excessive pollution (i.e. visible clouds of smoke) should be banned from sites.</li> <li>✓ Open burning of solid wastes, whether hazardous or nonhazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively.</li> <li>✓ Use of water suppression for control of loose materials on exposed surfaces. Oil and oil by-products are not a recommended method to control dust.</li> <li>✓ Water should be sprinkled daily or whenever there is dust problem on all exposed surfaces to suppress emission of dust.</li> </ul>		<p>analyzers will be used.</p> <p>Monitoring conducted as per SEQS.</p>		
3.	Noise	Medium	<ul style="list-style-type: none"> <li>✓ PVC Laminated Polyester Fireproof Mesh Sheet can be used with hard barricade to reduce the noise levels and check the noise levels outside the barricade periodically for different type of construction activities through a hand-held noise meter.</li> <li>✓ High noise activities should cease between 22:00 and 06:00 hrs.</li> <li>✓ Equipment and vehicle noise can be reduced at source by regular maintenance &amp; repair of construction machinery and equipment.</li> <li>✓ Mufflers or silencers should be mandatory to be equipped by all project-related vehicles.</li> </ul>	CC	Noise monitoring at project site	Monthly	SSEP
4.	Surface and groundwater quality	Medium	<ul style="list-style-type: none"> <li>✓ It will be ensured that the wastes generated from construction activities should be stored in a proper interim location onsite which should</li> </ul>	CC	Water sampling at project site if	Monthly	SSEP



**Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			be adequately barricaded and covered to avoid ingress of storm water. ✓ Excavation material /civil works related solid waste should be reused or disposed to the approved disposal site. ✓ Porta cabins will be provided for worker temporary residence as well as for shelter for labor during construction and provision of water. Septic tank with soakage pit will be constructed for wastewater disposal.		groundwater is used		
5.	Waste Management	Medium	✓ All hazardous waste such as oil-waste will be handled and disposed through incineration via EPA certified hazardous waste contractor hired by CC. ✓ Recycling of solid waste will be carried out as far as possible and practical like cement bags, empty drums, discarded bricks etc. ✓ No wastes should be dumped indiscriminately at any location outside the site boundary/designated disposal site. ✓ Training should be provided to working personnel for identification, segregation, and management of waste. ✓ The site-specific waste management plan will be developed by CC.	CC	Visual observation and waste disposal certificates	Daily/as required	SSEP
6.	Soil Contamination	Medium	✓ Fuel oils, Transformer oils and lubricants for construction machinery will be stored in covered dyked areas, underlain with HDPE membrane. ✓ Washing and maintenance of vehicles will be restricted onsite and contractor is mandated to	CC	Visual observation and track record of disposal of contaminated media	As required	SSEP



**Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			<p>get entry of well-maintained and cleaned machinery.</p> <ul style="list-style-type: none"> <li>✓ Regular inspections will be carried out to detect leakages in construction vehicles and equipment.</li> <li>✓ Appropriate implements such as shovels, plastic bags and absorbent materials will be made available near fuel and oil storage areas for removal of oil and contaminated soil.</li> </ul>				
7.	Traffic management	Low	<ul style="list-style-type: none"> <li>✓ Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid nuisance to nearby villages and congestion at the connecting point to N25 RCD Highway.</li> <li>✓ Appropriate sign postings, warning signs, diversion signs and barriers will be installed to alert public of all potential hazards including limited access to construction sites.</li> <li>✓ Movement of construction material to the project site should be planned in that way it will not hamper major transport activity in the micro and macro environment. The transfer of material should not be carried out during sleeping hours.</li> </ul>	CC	Flow of usual traffic	Daily/as required	SSEP
8.	Impacts on Flora	Low	<ul style="list-style-type: none"> <li>✓ Adequate greening of the site with local plant species will be carried out in accordance with the local climate and soil conditions.</li> </ul>	CC	Visual observations, records of plantation	As required	SSEP

**Table 6.3: Environmental Mitigation and Monitoring Plan during operation phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
1.	Solid Waste (Electrical & Electronic equipment waste, food waste, general waste, sewage sludge)	Medium	<ul style="list-style-type: none"> <li>✓ Several components of the solar panels can be recycled such as glass, plastic and aluminum can be recycled. Other stuff will be disposed in an approved landfill/dumpsite.</li> <li>✓ Disused dry batteries will be returned to the supplier/manufacturer for possible recycling. Disposal through landfills is not recommended as the batteries may contain some quantity of heavy metals such as Mercury, Cadmium and Lead which are considered toxic for environment.</li> <li>✓ No hazardous waste such as food, packaging, sewage sludge etc. will be disposed through waste contractor.</li> </ul>	SSEP	Visual Monitoring onsite, waste record register and waste disposal certificates	Daily/as required	Third-party consultant
2.	Community Health and Safety	Medium	<ul style="list-style-type: none"> <li>✓ Entry/exit gate(s) of the site will be clearly marked.</li> <li>✓ Entrance in the site will only be allowed to the authorize personnel and to the visitors after registration at entrance.</li> <li>✓ Site will properly be barricaded through wall/fence of adequate height to minimize chances of trespassing, thereby avoiding the incidents such as electrocution.</li> <li>✓ Electrical hazard signs and posters will be adequately marked on the outer face of the barricading wall/fence to alert the passerby.</li> <li>✓ Unskilled staff for operational phase will mainly be sourced from the area to avoid any community conflict due to influx of outsiders.</li> </ul>	SSEP	Visual Monitoring and community feedback	Continuous/as required	Third-party consultant
3.	Occupational Health and Safety	Medium	<ul style="list-style-type: none"> <li>✓ Electrical equipment will adequately be grounded for workers safety.</li> </ul>	SSEP	Visual inspection at the project site, incident records	Daily/as required	Third-party consultant



**Table 6.3: Environmental Mitigation and Monitoring Plan during operation phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			<ul style="list-style-type: none"> <li>✓Electrocution hazard signs will be displayed, particularly for the PV panel area and substation.</li> <li>✓Staff will be required to wear necessary PPE once they are out of their campsite for routine inspection, surveillance and/or monitoring.</li> <li>✓Maintenance at the site will be duly be authorized and be carried out with necessary safety precautions such use of PPE, adequate grounding, etc.</li> </ul>				
4.	Ground Water Quality deterioration and soil contamination due to leaks or spills from Transformer oil, liquid dielectric	Low	<ul style="list-style-type: none"> <li>✓Transformers and associated equipment with liquid dielectric will be concrete footing with adequate drain and collection pit in case of spill to avoid soil contamination and ingress into soil.</li> <li>✓Leakages will be prevented through periodic maintenance.</li> <li>✓Spilled oil and dielectric will be disposed through incineration by waste contractor.</li> </ul>	SSEP	Visual inspection, track record of disposal of contaminated media	As required	Third-party consultant
5.	Sulfur hexafluoride (SF6) leak	Low	<ul style="list-style-type: none"> <li>✓SF6 carrying equipment must not be dropped or rolled and must be protected from overheating.</li> <li>✓Leakage detection devices can be installed in the substation area. Handheld detectors can also be used.</li> <li>✓Gas mask is also recommended for the authorize personnel for operation and maintenance to avoid risk of asphyxiation from accidental release of gas in large quantities.</li> </ul>	SSEP	Not required as per SEQS	-	-





Table 6.4: Training Plan			
Staff	Responsibilities	Areas	Schedule
Project staff	Contractor/HSE Officer	<ul style="list-style-type: none"> <li>Findings of IEE</li> <li>Mitigation Measures</li> <li>EMP</li> <li>Waste disposal procedures</li> <li>Camp Operation</li> <li>Social and Cultural values of the Project areas</li> <li>Environmental sensitivity of the Project area</li> <li>Flora and Fauna of the area</li> <li>Emergency Response Plan</li> <li>Community Issues</li> </ul>	✓ Prior to start of Project activities
Drivers	Contractor/HSE Officer	<ul style="list-style-type: none"> <li>Road safety</li> <li>Road restrictions</li> <li>Defensive driving</li> </ul>	✓ Before and during construction activities
Camp/Site Staff	Safety Officer	<ul style="list-style-type: none"> <li>Waste Disposal</li> <li>Housekeeping</li> </ul>	✓ Before and during construction activities



Table 6.5: Estimated Cost of EMP Implementation		
Activity	Cost (PKR)	Remarks
Training Program	500,000	Refer table above
	Environmental Monitoring	
Ambient Air (construction)	$(40,000 \times 4) = 160,000$	Cost for 1-year monitoring at 1 location @Rs.40,000 per monitoring per location per quarter
Exhaust Emissions (construction)	$(1500 \times 6 \times 5 \times 4) = 180,000$	Cost for 1-year monitoring at 5 locations for 6 parameters @Rs.1500 per parameter
Noise (construction)	$(1000 \times 5 \times 12) = 60,000$	Cost for 1-year monitoring at 5 locations @Rs.1000 per location per month
Waste management (construction)	120,000	Estimated cost of 1-year monitoring
Soil contamination (construction)	120,000	Estimated cost of 1-year monitoring
Traffic Management (construction)	120,000	Estimated cost of 1-year monitoring
Ecology (construction)	120,000	Estimated cost of 1-year monitoring
Solid waste (operation)	120,000	Estimated cost of 1-year monitoring
Community and Occupational Health and Safety	240,000	Estimated cost of 1-year monitoring
Soil contamination (construction)	120,000	Estimated cost of 1-year monitoring
Cost of Mitigation (construction)	1,000,000	Initial estimates
Cost of Mitigation (construction)	500,000	Initial estimates
Reporting	500,000	Initial estimates
Sub total	4,460,000	-
Contingency (5%)	223,000	-
Grand total	4,083,000	-



## Chapter 7 CONCLUSION AND RECOMMENDATIONS

### 7.1 Conclusion

This Environmental Impact Assessment study was carried out to identify the environmental and socioeconomic impacts of the proposed 150 MW solar power plant at Deh Mitha Ghar – District Malir in Sindh Province.

During the study, environmental and socioeconomic baseline information was collected from variety of sources including visit of project area, previous environmental reports and studies conducted in the area, published literature and field surveys. All this information was used to compose the profile of the physical, biological and socioeconomic environment of the area which is likely to be affected by the proposed project activities. Information for the project description was provided by the project's developer.

On the basis of the established baseline and the proposed activities described as under project description, the potential environmental impacts were identified on the project area's physical, biological and socioeconomic environments. In summary the potential impacts during the construction phase of the proposed project include the generation of dust and gaseous emissions, noise, construction waste, health and safety and socioeconomic effects. Similarly, the key environmental and social issues during the operation phase included those arising from liquid and solid waste disposal and electrocution hazard.

The IEE process finds that the impacts of the project activities at the design, construction and operation stages have been adequately addressed and mitigation measures have been duly proposed wherever needed. Adoption of mitigation measures will ensure the reduction of any possible impacts on the micro and macroenvironment as well as socio-economic conditions, to acceptable levels. The development of this project will be made compatible with the requirements of the Sindh Environmental Protection Act 2014, SEPA, (Review of EC, IEE and EIA) Regulations, 2021 and Sindh Environmental Quality Standards (SEQS); as well as other regulatory requirements of the Government of Sindh. The issues of environment, health & safety has been duly incorporated in the design, construction & operations phases of the project.

The SSEP shall remain cognizant of the social development of its project surrounding and will contribute to the uplift of the overall social and economic health of the communities around it. To help build a viable society, the SSEP shall facilitate the surrounding communities in conserving energy, environmental protection, health, education, skill development, poverty alleviation and other pertinent areas of social development.

### 7.2 Recommendations

The study recommends and confirms that the project developer shall adopt all environmental management processes in full, as prescribed by the national and international laws and guidelines and given in the IEE document. Following essentials recommendations which are also the part of EMP as mitigation measures will be followed by project developer in letter and spirit:

- Communities in the project area shall be intimated prior to commencing project activities;
- For cutting of trees, compensatory plantation shall be provided at a ratio of 1:3;



- A Comprehensive Waste Management Plan for construction and operation phases should be developed;
- Wastes should be routinely collected from the designated area and disposed in an environmentally friendly manner;
- Protective measures against high noise intensity, soil erosion, traffic problem, land pollution and water contamination will be taken care of;
- Emergency response plan should be prepared and implemented during construction and operation phases;
- Preventive and protective measures including modification, substitution, or elimination of hazardous conditions, with particular attention to live power lines, working at height, EMF, high noise levels, and exposure to chemicals will be made; and
- The Project will thus respond to all aspects of sustainability: Economic, social and environmental and will thus be a sustainably viable project.
- The study therefore recommends that the IEE report should be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

### 7.3 References

- Geological Survey of Pakistan
- IFC General EHS Guidelines
- Pakistan Meteorological Department (PMD)
- Pakistan Bureau of Statistics. Census data 2017.
- PSLM-Survey 2014-15
- Solargis. Energy Sector Management Assistance Program. World Bank Group
- State of Industry Report 2020, NEPRA
- Study of Information Collection and Verification Survey for Renewable Energy Introduction and Grid Stabilization (2016)

# ANNEXURES



# **ANNEXURE – I**

## **Sindh Environmental Protection Act, 2014**



# **The Sindh Government Gazette**

**Published by Authority**

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**KARACHI THURSDAY MARCH 20, 2014**

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## **PART-IV**

**PROVINCIAL ASSEMBLY OF SINDH  
NOTIFICATION  
KARACHI, THE 20<sup>TH</sup> MARCH, 2014.**

**NO.PAS/Legis-B-06/2014-** The Sindh Environmental Protection Bill, 2014 having been passed by the Provincial Assembly of Sindh on 24<sup>th</sup> February, 2014 and assented to by the Governor of Sindh on 19<sup>th</sup> March, 2014 is hereby published as an Act of the Legislature of Sindh.

### **THE SINDH ENVIRONMENTAL PROTECTION ACT, 2014.**

**• SINDH ACT NO. VIII OF 2014.**

#### **AN ACT**

to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development.

**WHEREAS** it is expedient to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, and for matters connected therewith and incidental thereto;

**Preamble.**

#### **PART-I**

It is hereby enacted as follows:-

1. (1) This Act may be called the Sindh Environmental Protection Act, 2014.

**Short title and  
commencement.**

- (2) It extends to the whole of the Province of Sindh.
- (3) It shall come into force at once.

**Definitions.**

2. In this Act, unless there is anything repugnant in the subject or context—

- (i) "adverse environmental effect" means impairment of, or damage to, the environment and includes—
  - (a) impairment of, or damage to, human health and safety or to biodiversity or property;
  - (b) pollution; and
  - (c) any adverse environmental effect as may be specified in the rules or regulations made under this Act;
- (ii) "Agency" means the Sindh Environmental Protection Agency established under section 5 of this Act;
- (iii) "agricultural waste" means waste from farm and agricultural activities including poultry, cattle farming, animal husbandry residues from the use of fertilizers, pesticides and other farm chemicals and agricultural runoff;
- (iv) "air pollutant" means any substance that causes pollution of air and includes soot, smoke, dust particles, odor, light, electro-magnetic radiation, heat, fumes, combustion exhaust, exhaust gases, noxious gases, hazardous substances and radioactive substances;
- (v) "biodiversity" or "biological diversity" means the variability among living organisms from all sources, including inter-alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems;
- (vi) "biosafety" means the mechanism developing through policy and procedure to ensure human health and the environmentally safe application of biotechnology;
- (vii) "Council" means the Sindh Environmental Protection Council established under section 3 of this Act;
- (viii) "discharge" means spilling, leaking, pumping, depositing, seeping, releasing, flowing-out, pouring, emitting, emptying or dumping into the land, water or atmosphere;
- (ix) "ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit;

- (x) "effluent" means any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour;
- (xi) "emission standards" means the permissible standards established by the Agency for emission of air pollutants and noise and for discharge of effluent and waste;
- (xii) "environment" means-
  - (a) air, water, land and natural resources;
  - (b) all layers of the atmosphere;
  - (c) all organic and inorganic matters and living organisms;
  - (d) ecosystems and ecological relationships;
  - (e) buildings, structures, roads, facilities and works;
  - (f) all social and economic conditions affecting community life; and
  - (g) the inter-relationship between any of the factors in sub-clause (a) to (f) made under this Act;
- (xiii) "environmental aspect" means an organization's activities or services that can interact with the environment;
- (xiv) "environment audit" means a systemic scrutiny of environmental performance of an organization, factory, company or manufacturing and production unit regarding to its operations;
- (xv) "environmental impact assessment" means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigation and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed;
- (xvi) "Environmental Management Plan" means a site specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with the environmental legislation;
- (xvii) "Environmental Protection Order" means an order passed under Section 21 made under this Act.
- (xviii) "Environmental Protection Tribunal" means the Environmental Protection Tribunal constituted under section 25 of this Act;



- (xxix) "Environmental Review" means a quantitative and qualitative assessment of documents submitted by proponent, comments from public and Government agencies or organizations;
- (xx) "factory" means any premises in which industrial activity is being undertaken;
- (xxi) "genetically modified organism" means any organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology and which does not occur naturally through mating and or recombination and includes both living and non-living modified organisms;
- (xxii) "Government" means the Government of Sindh;
- (xxiii) "Government Agency" includes:-
- (a) A department, attached department or any other office of Government; and
  - (b) A development authority, local authority, company body corporate established or control by Government;
- (xxiv) "Court" means the Court of the Judicial Magistrate First Class;
- (xxv) "hazardous substance" means-
- (a) a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its chemical activity or toxic, explosive, flammable, corrosive, radioactive or other characteristics, causes, or is likely to cause, directly or in combination with other matters an adverse environmental effect; and
  - (b) any substance which may be prescribed as a hazardous substance;
- (xxvi) "hazardous waste" means waste which is or which contains a hazardous substance or which may be prescribed as hazardous waste, hospital waste, nuclear waste, obsolete pesticides and persistent organic pollutants;
- (xxvii) "hospital waste" means waste medical supplies and materials of all kinds, and waste blood, tissue, organs and other parts of the human and animal bodies, from hospitals, clinics, laboratories and veterinary facilities;



- (xxviii) "industrial activity" means any operation or process for manufacturing, making, formulating, synthesising, altering, repairing, ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal, or for mining, for oil and gas exploration and development, or for pumping water or sewage, or for generating, transforming or transmitting power or for any other industrial or commercial purposes;
- (xxix) "industrial waste" means waste resulting from an industrial activity;
- (xxx) "initial environmental examination" means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an adverse environmental effect for requiring preparation of an environmental impact assessment;
- (xxxi) "local authority" means any agency set up or designated by Government, by notification in the official Gazette, to be a local authority for the purposes of this Act;
- (xxxii) "local council" means a local council constituted or established under a law relating to local government;
- (xxxiii) "motor vehicle" means any mechanically propelled vehicle adapted for use upon land whether its power of propulsion is transmitted thereto from an external or internal source, and includes a chassis to which a body has not been attached, and a trailer, but does not include a vehicle running upon fixed rails;
- (xxxiv) "municipal waste" includes sewage, refuse, garbage, waste from abattoirs, sludge and human excreta and the like;
- (xxxv) "noise" means the intensity, duration and character of sounds from all sources, and includes vibration;
- (xxvi) "non degradable plastic products" means a plastic product which are made from the non-biodegradable substances;
- (xxxvii) "nuclear waste" means waste from any nuclear reactor or nuclear plant or other nuclear energy system, whether or not such waste is radioactive;

(xxxviii) "Oxo-biodegradable Plastic Products" means a plastic product made of a polymer by adding a pro-degrading additive containing a transition metal salt, except cobalt, which cause the plastic to degrade and bio-grade from oxidative and cell mediated phenomena either simultaneously or successfully;

(xxxix) "person" means any natural person or legal entity and includes an individual, firm, association, partnership, society, group, company, corporation, co-operative society, Government Agency, non-governmental organization, community-based organization, village organization, local council or local authority and, in the case of a vessel, the master or other person having for the time being the charge or control of the vessel;

(xl) "pollution" means the contamination of air, land or water by the discharge or emission of effluent or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiational, thermal or radiological or aesthetic

properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious, or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity.

(xii) "prescribed" means prescribed by rules made under this Act;

(xlii) "project" means any activity, plan, scheme, proposal or undertaking involving any change in the environment and includes-

(a) construction or use of buildings or other works;

(b) construction or use of roads or other transport systems;

(c) construction or operation of factories or other installations;

(d) mineral prospecting, mining, quarrying, stone-crushing, drilling and the like;

(e) any change of land use or water use; and

(f) alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations;

- (xlili) "proponent" means the person who proposes or intends to undertake a project;
- (xliv) "regulations" means regulations made under this Act;
- (xlv) "rules" means rules made under this Act;
- (xlvi) "sewage" means liquid or semi-solid wastes and sludge from sanitary conveniences, kitchens, laundries, washing and similar activities and from any sewerage system or sewage disposal works;
- (xlvii) "Schedule Plastic Products" means all types of flexible plastic packaging and disposable plastic products made of Polythene, Polypropylene, Polystyrene and Poly-ethylene Terephthalate (PET), used for food and non-food items, like shopping bags, garbage bags, snacks packs, water and milk packaging, shrink wraps, bubble pellet wraps, films, liners, woven or non-woven bags, mulch films;
- (xlviii) "Sindh Environmental Quality Standards" means standards established by the Agency under clause (e) of sub-section(1) of section 6 and approved by the Council under clause (c) of sub-section(1) of section 4 made under this Act;
- (xlix) "standards" means qualitative and quantitative standards for discharge of effluent and wastes and for emission of air pollutants and noise either for general applicability or for a particular area, or from a particular production process, or for a particular product, and includes the Sindh Environmental Quality Standards, emission standards and other standards established under this Act and the rules and regulations;
- (l) "strategic environmental assessment" mean an analysis of a proposed policy, legislation, plan or programme to determine whether the principles of sustainable development have been integrated therein and to identify its likely environmental effects and such components as require an initial environmental examination or environmental impact assessment;
- (li) "sustainable development" means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs;



- (lii) "trans-boundary environmental impacts" means environmental impact arising from beyond the boundaries or limits of Sindh province and causing any adverse environmental impact or pollution in the air, land, water and coaster water of Sindh province;
- (liii) "waste" means any substance or object which has been, is being or is intended to be, discarded or disposed-of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, nuclear waste, municipal waste, hospital waste, used polyethylene bags and residues from the incineration of all types of waste.
- (liv) "waters (coastal waters, internal waters, territorial waters and historical waters)" means such limits of the waters adjacent to the land territory as may be specified in the Territorial Waters and Maritime Zones Act, 1976 (LXXXII of 1976).

#### PART-II

#### THE SINDH ENVIRONMENTAL PROTECTION COUNCIL.

#### Establishment of the Sindh Environmental Protection Council.

3. (1) The Government of Sindh shall, by notification in the official Gazette, establish a Council to be known as the Sindh Environmental Protection Council consisting of-

- (i) Chief Minister or such other **Chairperson** person as the Chief Minister may nominate in this behalf.
- (ii) Minister-in-charge of the **Vice Chairperson** Environment Protection Department.
- (iii) Additional Chief Secretary, **Ex-officio Member** Planning and Development Department, Government of Sindh.
- (iv) Secretaries of the **Ex-officio Members** Environment, Finance, Public Health Engineering, Irrigation, Health, Agriculture, Local Government, Industries, Live Stock and Fisheries, Forest and Wildlife, Energy, Education, Departments of Government of Sindh and the divisional commissioners of Sindh.

- (v) Such other persons not exceeding twenty-five as Government may appoint from representatives of the Chambers of Commerce and Industry and industrial associations, representatives of the Chambers of Agriculture, the medical and legal professions, trade unions, non-governmental organizations concerned with the environment and sustainable development, and scientists, technical experts and educationists. **Non-official Members**
- (vi) Director General, Sindh Environment Protection Agency **Member / Secretary**
- (vii) **Two Members of the Provincial Assembly of Sindh amongst the eleven Members of the Standing Committee on Environment nominated by the Speaker**

2) The Members of the Council, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-appointment but shall not hold office for more than two terms.

(4) The Council shall frame its own Rules of Procedure.

(5) The Council shall hold meetings, as and when necessary, but not less than two meetings, shall be held in a year.

(6) The Council may constitute committees of its members and entrust them with such functions as it may deem fit, and the recommendations of the committees shall be submitted to the Council for approval.

(7) The Council, or any of its committees, may invite any technical expert or representative of any Government Agency or non-governmental organization or other person possessing specialized knowledge of any subject for assistance in performance of its functions.



**Functions and  
Powers of the  
Council.**

4. (1) The Council shall-
- (a) co-ordinate and supervise the enforcement of the provisions of this Act and other laws relating to the environment in the Province;
  - (b) approve comprehensive provincial environmental and sustainable development policies and ensure their implementation within the framework of a conservation strategy and sustainable development plan as may be approved by Government from time to time;
  - (c) approve the Sindh Environmental Quality Standards;
  - (d) provide guidelines for the protection and conservation of species, habitats, and biodiversity in general, and for the conservation of renewable and non-renewable resources;
  - (e) coordinate integration of the principles and concerns of sustainable development into socio-economic and development policies, plans and programmes at the provincial, district and local levels;
  - (f) consider the annual Sindh Environment report and give appropriate directions thereon and cause it to be laid before the Provincial Assembly;
  - (g) deal with inter-provincial and federal-provincial issues, and liaise and coordinate with other Provinces through appropriate inter-provincial forums regarding formulation and implementation of standards and policies relating to environmental matters with an inter-provincial impact;
  - (h) provide guidelines for biosafety and for the use of genetically modified organisms; and
  - (i) assist the Federal Government or Federal Agency in implementation and or administration of various provision of United Nation Convention on Laws on Seas, 1980 (UNCLOS) in coastal waters of the province;
- (2) The Council may, either itself or on the request of any person or organization, direct the Agency or any Government Agency to prepare, submit, promote or implement projects for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, and the sustainable development of resources or to undertake research in any specified aspect of environment.

## PART-III

## THE SINDH ENVIRONMENTAL PROTECTION AGENCY

5. (1) Government shall, by notification in the Official Gazette, establish the Sindh Environmental Protection Agency, to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made thereunder.

**Establishment  
of the Sindh  
Environmental  
Protection  
Agency.**

(2) The Agency shall be headed by a Director General who shall be appointed by Government on such terms and conditions as it may determine.

(3) The Agency shall have such administrative, technical and legal staff as Government may specify, to be appointed in accordance with such procedure as may be prescribed.

(4) The powers and functions of the Agency shall be exercised and performed by the Director General.

(5) The Director General may, by general or special order, delegate any of these powers and functions to staff appointed under sub-section (3).

(6) For assisting the Agency in the discharge of its functions Government shall establish Advisory Committees for various sectors and appoint as members thereof eminent representatives of the relevant sector, educational institutions, research institutes and non-governmental organizations.

6. (1) The Agency shall –

**Functions of the  
Agency.**

- (a) administer and implement the provisions of this Act and the rules and regulations;
- (b) prepare, in co-ordination with the appropriate Government Agency or local council and, in consultation with the concerned Advisory Committees where established, environmental policies for the approval of the Council;
- (c) take all necessary measures for the implementation of the environmental policies approved by the Council;
- (d) prepare and publish an annual Sindh Environment Report on the state of the environment in the province;
- (e) prepare or revise and establish the Sindh Environmental Quality Standards with approval of the Council.



Provided that before seeking approval of the Council, the Agency shall publish the proposed Sindh Environmental Quality Standards for public opinion in accordance with the prescribed procedure;

(f) ensure enforcement of the Sindh Environmental Quality Standards;

(g) where the quality of ambient air, water, land or noise so requires, the Agency may, by notification in the Official Gazette establish different standards for discharge or emission from different sources and for different areas and conditions as may be necessary:

Provided that where these standards are less stringent than the Sindh Environmental Quality Standards; prior approval of the Council shall be obtained;

(h) establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors;

(i) take measures to promote research and the development of science and technology which may contribute to the prevention of pollution, protection of the environment, and sustainable development;

(j) issue licences, approval for the consignment, handling, transport, treatment, disposal of, storage, handling or otherwise dealing with hazardous substances;

(k) certify laboratories as approved laboratories for conducting tests and analysis and one or more research institutes as environmental research institutes for conducting research and investigation for the purposes of this Act;

(l) identify the needs for and initiate legislation in various sectors of the environment;

(m) provide assistance to relevant Federal and Provincial Government Agencies in the management of environment accidents and natural and environmental disasters, including conduct of inquiry thereto;

(n) render advice and assistance in environmental matters including such information and data available with it as may be required for carrying out the purposes of this Act:

Provided that the disclosure of such information shall be subject to the restrictions specified in Part XI (Access to Information);

- (o) assist Government Agencies, local councils, local authorities and other persons to implement schemes for the proper disposal of wastes so as to ensure compliance with the Sindh Environmental Quality Standards;
  - (p) provide information and guidance to the public on environmental matters;
  - (q) recommend environmental courses, topics, literature and books for incorporation in the curricula and syllabi of educational institutions;
  - (r) promote public education and awareness of environmental issues through mass media and other means including seminars and workshops;
  - (s) establish and maintain mechanisms, including its own website, to disseminate information, subject to the provisions of this Act, regarding policies, plans and decisions of the Government, the Council and the Agency, relating to the environment;
  - (t) specify safeguards for the prevention of accidents and disasters which may cause pollution, collaborate with the concerned persons in the preparation of contingency plans for control of such accidents and disasters, and co-ordinate implementation of such plans;
  - (u) review and approve mitigation plans and give guidance and directions, where necessary, relating to clean up operations ordered under this Act;
  - (v) encourage the formation and working of non-governmental organizations, community organizations and village organizations to prevent and control pollution and promote sustainable development;
  - (w) take or cause to be taken all necessary measures for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution and promotion of sustainable development; and
  - (x) perform any function that the Council may assign to it.
- (2) The Agency may -
- (a) undertake inquiries or investigation into environmental issues, either of its own accord or upon complaint from any person or organization;
  - (b) request any person to furnish any information or data relevant to its functions;



- (c) initiate, with the approval of Government, requests for foreign assistance in support of the purposes of this Act and enter into arrangements with foreign agencies or organizations for the exchange of material or information and participate in international seminars or meetings;
- (d) recommend to Government and the Council the adoption of financial and fiscal programmes, schemes or measures for achieving environmental objectives and goals and the purposes of this Act, including -
  - (i) taxes, duties, cesses and other levies; and
  - (ii) incentives, prizes, awards, rewards, subsidies, tax exemptions, rebates and depreciation allowances;
- (e) establish and maintain laboratories to help in the performance of its functions under this Act and to conduct research in various aspects of the environment and provide or arrange necessary assistance for the establishment of similar laboratories in the private sector;
- (f) arrange, in accordance with such procedure as may be prescribed, financial assistance for projects designed to facilitate in discharge of its functions; and
- (g) acquire assistance of concerned authorities of district administration and other relevant agencies, departments and police assistance for enforcement of this Act.

**Powers of the Agency.**

7. Subject to the provisions of this Act, the Agency may-

- (a) lease, purchase, acquire, own, hold, improve, use or otherwise deal in and with any property both moveable and immovable;
- (b) sell, convey, mortgage, pledge, exchange or otherwise dispose of its property and assets;
- (c) fix and realize fees, rates and charges for rendering any service or providing any facility, information or data under this Act or its rules and regulations;
- (d) enter into contracts, execute instruments, incur liabilities and do all acts or things necessary for proper management and conduct of its business;
- (e) appoint, with the approval of Government and in accordance with such procedures as may be prescribed, such advisers, experts and consultants as it considers necessary for the efficient performance of its functions on such terms and conditions as it may deem fit;
- (f) summon and enforce the attendance of any person and require him to supply any information or document needed for the conduct of any enquiry or investigation into any environmental issue;



- (g) Director General may authorize any officer or official to enter and inspect or under a search warrant issued by Environmental Protection Tribunal or a Court, search at any time, any land, building, premises, vehicle or vessel or other place where or in which there are reasonable grounds to believe that an offence under this Act has been, or is being, or likely to be committed;
- (h) take samples of any materials, products, articles or substances or of the effluent, wastes or air pollutants being discharged or emitted or of air, water or land in the vicinity of the discharge or emission;
- (i) arrange for the testing and analysis of samples at a certified laboratory;
- (j) confiscate any article used in the commission of the offence where the offender is not known or cannot be found within a reasonable time:

Provided that the powers under clauses (f), (g), (h) (i), and (j) shall be exercised in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898) or the rules and regulations and under the direction of the Environmental Protection Tribunal or a Court; and

- (k) establish the Sindh Environmental Co-ordination Committee comprising the Director-General as its Chairman and such other persons as Government shall appoint as its members to exercise such powers and perform such functions as shall be delegated or assigned to it by Government for carrying out the purposes of this Act and for ensuring coordination among Government Agencies in implementation of environmental policies.

#### PART-IV

#### SINDH SUSTAINABLE DEVELOPMENT FUND

**Establishment  
of the Sindh  
Sustainable  
Development  
Fund.**

8. (1) There shall be established a Sindh Sustainable Development Fund.

(2) The Sindh Sustainable Development Fund shall be derived from the following sources, namely—

- (a) allocations and grants made or loans advanced by the Government of Sindh or by the Federal Government;
- (b) aid and assistance, grants, advances, donations and other non-obligatory funds received from foreign governments, national or international agencies, and non-governmental organizations; and

- (c) voluntary contributions from private, corporate, multinational organizations and other persons.
- (d) Any fees generated under the provision of this act including the fines imposed against contraventions including penalties.
- (3) The Sindh Sustainable Development Fund shall be utilized, in accordance with such procedures as may be prescribed for -
  - (a) providing financial assistance to projects designed for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, the sustainable development of resources and for research in any specified aspect of the environment; and
  - (b) any other purposes which, in the opinion of the Board, will help achieve environment objectives and the purposes of this Act.

**Management of  
the Sindh  
Sustainable  
Development  
Fund.**

9. (1) The Sindh Sustainable Development Fund shall be managed by a Board known as the Provincial Sustainable Development Fund Board consisting of—

- (i) Additional Chief Secretary, **Chairperson**  
Planning and Development  
Department, Government of  
Sindh,
- (ii) Such officers of Government, **Ex-officio Members**  
not exceeding five (05), as  
Government may appoint  
including Secretaries of the  
Environment, Finance,  
Industries and Local  
Government Departments,  
Government of Sindh.
- (iii) Such non-official persons, not **Non-official Members**  
exceeding five (05), as  
Government may appoint,  
including representatives of  
the Chambers of Commerce  
and Industry, non-  
governmental organizations  
and major donors.
- (iv) Director General, Sindh **Secretary/ Member**  
Environmental Protection  
Agency.

(2) The members of the Board, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.



(3) A non-official member of the Board, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-nomination, but shall not hold office for more than two terms.

(4) The Board shall frame its own rules of procedure with the approval of Government.

(5) In accordance with such procedures and such criteria as may be prescribed, the Board shall have the power to —

- (a) sanction financial assistance for eligible projects;
- (b) invest moneys held in the Sindh Sustainable Development Fund in such profit-bearing Government bonds, saving schemes and securities as it may deem suitable; and
- (c) take such measures and exercise such powers as may be necessary for utilization of the Sindh Sustainable Development Fund for the purposes specified in sub-section (3) of section 8.

(6) The Board shall constitute committees of its members to undertake regular monitoring of projects financed from the Sindh Sustainable Development Fund and to submit progress reports to the Board which shall publish an Annual Report incorporating its annual audited accounts and performance evaluation based on the progress reports.

10. (1) The Agency shall maintain proper accounts of the Sindh Sustainable Development Fund and other relevant records and prepare annual statement of accounts in such form as may be prescribed. **Accounts.**

(2) The accounts of the Sindh Sustainable Development Fund shall be audited annually by the Auditor General of Pakistan.

#### PART-V PROHIBITIONS AND ENFORCEMENT

11. (1) Subject to the provisions of this Act and the rules and regulations, no person shall discharge or emit or allow the discharge or emission of any effluent, waste, pollutant, noise or any other matter that may cause or likely to cause pollution or adverse environmental effects, as defined in section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards; or, where applicable, the standards established under Section 6(1)(g)(i); or direction issued under Section 17, 19, 20 and 21 of this Act; or any other direction issued, in general or particular, by the Agency. **Prohibition of certain discharges or emissions and compliance with standards.**

(2) All persons, in industrial or commercial or other operations, shall ensure compliance with the Environmental Quality Standards for ambient air, drinking water, noise or any other Standards established under section 6(1)(g)(i); shall maintain monitoring records for such compliances; shall make available these records to the authorized person for inspection; and shall report or communicate the record to the Agency as required under any directions issued, notified or required under any rules and regulations.

(3) Monitoring and analysis under sub-section (1) and (2), shall be acceptable only when carried out by the Environmental Laboratory certified by the Agency as prescribed in the rules.

**Prohibition of  
import of  
hazardous  
waste.**

12. No person shall import hazardous waste into Sindh province or its coastal, internal, territorial or historical waters, except acquiring prior approval of the Agency.

**Handling of  
hazardous  
substances.**

13. Subject to the provisions of this Act, no person shall import, generate, collect, consign, transport, treat, dispose of, store, handle or otherwise use or deal with any hazardous substance except-

(a) under a licence issued by the Agency; or

(b) in accordance with the provisions of any other law, rule, regulation or notification for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Government is a party.

**Prohibition of  
action adversely  
affecting  
Environment.**

14. (1) Subject to the provisions of this Act and the rules and regulations, no person shall cause any act, deed or any activity, including-

(a) recycling or reuse of hospital waste and infectious waste;

(b) disposal of solid and hazardous wastes at unauthorized places as prescribed;

(c) dumping of wastes or hazardous substances into coastal waters and inland water bodies;

(d) release of emissions or discharges from industrial or commercial operations as prescribed;

(e) recycling or reuse or recovery of hazardous wastes or industrial by-products in an unauthorized or non-prescribed manner or procedure; and



- (f) any activity which may cause adverse environmental affect due to trans boundary projects of Province of Sindh.

which lead to pollution or impairment of or damage to biodiversity, ecosystem, aesthetics or any damage to environment and natural resources as defined in section 2 (xxxvi) of this Act.

(2) No person shall generate, handle, transport, dispose of or handle the hospital waste and infections waste except in accordance with the Hospital Waste Management Rules and in such manner as may be prescribed.

(3) No person shall import, manufacture, stockpile, trade, supply, distribute or sell any scheduled plastic product which is non-degradable. The scheduled plastic products must be oxo-biodegradable and the pro-degradant used must be approved by the Agency or any other department or agency and in such manner as prescribed.

15. (1) Subject to the provisions of this Act, no person shall operate or manufacture a motor vehicle or class of vehicles from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Sindh Environmental Quality Standards or, where applicable, the standards established under sub-clause (i) of clause (g) of sub-section (1) of section 6.

**Regulation of motor vehicles.**

(2) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any motor vehicle or class of vehicles shall install such pollution control devices or other equipment or use such fuels or undergo such maintenance or testing as prescribed.

(3) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any manufacturer of motor vehicle or class of vehicles shall use such manufacturing standard or design or pollution control devices or other equipment or undergo such testing as may be prescribed.

(4) Where a direction has been issued by the Agency under sub-section (2) and (3) in respect of any motor vehicles or class of motor vehicles, no person shall operate or manufacture any such vehicle till such direction has been complied with.

16. (1) The monitoring, testing and analysis carried out in compliance or for the enforcement of any provisions of this Act

**Certified Environmental Laboratory.**

(2) The laboratory or organization having any facility for environmental monitoring, testing and analysis and intend to perform under sub-section (1) shall register with the Agency in accordance with the Environmental Laboratory Certification Rules as prescribed.



**Initial  
environmental  
examination and  
environmental  
impact  
assessment.**

**PART-VI  
ENVIRONMENTAL EXAMINATIONS AND ASSESSMENTS**

17. (1) No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof.

(2) The Agency shall –

(a) review the initial environmental examination and accord its approval, subject to such terms and conditions as it may prescribe, or require submission of an environmental impact assessment by the proponent; or

(b) review the environmental impact assessment and accord its approval subject to such terms and conditions as it may deem fit to impose or require that the environmental impact assessment be re-submitted after such modifications as may be stipulated or decline approval of the environmental impact assessment as being contrary to environmental objectives.

(3) Every review of an environment impact assessment shall be carried out with public participation and, subject to the provisions of this Act, after full disclosure of the particulars of the project.

(4) The Agency shall communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations:

(5) The provisions of sub-sections (1), (2), (3) and (4) shall apply to such categories of projects and in such manner as prescribed:

(6) The Agency shall maintain separate registers for initial environmental examination and environmental impact assessment projects, which shall contain brief particulars of each project and a summary of decisions taken thereon, and which shall be open for inspection to the public during office hours.

18. (1) All provincial government agencies, departments, authorities, local councils and local authorities responsible for formulating policies, legislation, plans and programmes to be implemented in Sindh province which may cause any environmental impact in the jurisdiction of the province shall, before submitting the same to the competent authority for approval, forward to the Sindh Environmental Protection Agency a strategic environment assessment containing —

Strategic  
environmental  
assessment.

- (a) description of the objectives and features of the proposed policy, legislation, plan or programme that are in consonance with the principles of sustainable development;
  - (b) assessment of the adverse environmental effects, if any, likely to be caused during implementation of the policy, legislation, plan or programme alongwith proposed preventive, mitigation and compensatory measures;
  - (c) analysis of possible alternatives; and
  - (d) identification of those components of the policy, legislation, plan or programme, if any, in respect of which specific environmental impact assessment need to be carried out in due course.
- (2) The Agency shall, in consultation with the concerned Government Agencies and Advisory Committees where established, review the strategic environment assessment, within sixty (60) days of its filing, and prepare a report containing its comments and recommendations in respect thereof which shall be forwarded to the initiating Government Agency, authority, local council or local authority and duly considered by it and the competent authority before approval or otherwise of the proposed policy, legislation, plan or programme.
- (3) The provisions of sub-sections (1), and (2) shall apply to such categories of policies, plans and programmes and in such manner as may be prescribed.

19. (1) The Agency shall carry out or arrange environmental monitoring of all projects in respect of which it has approved an initial environmental examination or environmental impact assessment to determine whether the actual environmental impact exceeds the level predicted in the assessment and whether the conditions of the approval are being complied with.

Environmental  
monitoring.

(2) For purposes of sub-section (1), the Agency may require the person in charge of a project to furnish such information as it may specify pertaining to the environmental impact of the project, including quantitative and qualitative analysis of -



**Environmental  
Audit and  
Review.**

- (a) discharge of effluents, wastes, emissions of air pollutants, noise and any other matter or action that may be found offensive under section 14 from the project on daily, weekly, monthly or annual basis;
- (b) ambient quality of the air, water, noise and soil before, during and after construction and during operation of the project.
- (3) On review of the data collected by it and information provided, the Agency may issue such directions to the person in charge as it may consider necessary to ensure compliance with the conditions of the approval.

20. (1) The Agency shall from time to time require the person in charge of a project to furnish, within such period as may be specified, an environmental audit or environmental review report or environmental management plan containing a comprehensive appraisal of the environmental aspects of the project.

(2) The report of a project prepared under sub-section (1) shall include -

- (a) analysis of the predicted qualitative and quantitative impact of the project as compared to the actual impact;
- (b) evaluation of the efficacy of the preventive, mitigation and compensatory measures taken with respect to the project; and
- (c) recommendations for further minimizing or mitigating the adverse environmental impact of the project.

(3) Based on its review of the environmental audit report, the Agency may, after giving the person in charge of the project an opportunity of being heard, direct that specified mitigation and compensatory measures be adopted within a specified time period and may also, where necessary, modify the approval granted by it under section 17.

**PART-VII  
ENVIRONMENTAL PROTECTION ORDER**

**Environmental  
Protection  
Order.**

21. (1) Where the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of any provision of this Act, the rules or regulations or of the conditions of a licence, or is likely to cause, or is causing or has caused an adverse environmental effect, the Agency may, after giving the person responsible for such

discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures as the Agency may consider necessary within such period as may be specified in the order.

(2) In particular and without prejudice to the generality of the foregoing power, such measures may include —

- (a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;
- (b) installation, replacement or alteration of any equipment or thing to eliminate, control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;
- (c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances;
- (d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Agency; and
- (e) impose a penalty as prescribed.

(3) Notwithstanding the provisions of sub-section (1), in an emergency situation where, for reasons to be recorded, the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of the provisions of this Act and that circumstances of the case warrant immediate action in the public interest, it may pass an ad-interim order of the nature described in sub-sections (1) and (2) by providing reasonable opportunity of hearing.

#### PART-VIII OFFENCES AND PENALTIES

22. (1) Whoever contravenes or fails to comply with the provisions of sections 11, 17, 18 and 21 or any order issued there under shall be punishable with a fine which may extend to five million rupees, to the damage caused to environment and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues:

**Penalties.**

Provided that if the contravention of the provisions of section 11 also constitutes a contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2).



(2) Whoever contravenes or fails to comply with the provisions of sections 13, 14, 15 and 16 or any rule or regulation or conditions of any license, any order or direction, issued by the Agency, shall be punished with a fine, and in case of continuing contravention or failure with an additional fine which may extend to ten thousand rupees for every day during which such contravention continues.

(3) Where an accused has been convicted of an offence under sub-sections (1) and (2), the Environmental Protection Tribunal and Court shall, as the case may be, in passing sentence, take into account the extent and duration of the contravention or failure constituting the offence and the attendant circumstances.

(4) Where an accused has been convicted of an offence under sub-sections (1) or (2), the Environmental Protection Tribunal or Court, as the case may be, shall endorse a copy of the order of conviction to the concerned trade or industrial association, if any, or the concerned Provincial Chamber of Commerce and Industry or the Federation of Pakistan Chambers of Commerce and Industry.

(5) Where a person convicted under sub-sections (1) and (2) had been previously convicted for any contravention of this Act and its rules or regulations, the Environmental Protection Tribunal, as the case may be, may, in addition to the punishment awarded thereunder-

- (a) sentence him to imprisonment for a term that may extend up to three years;
- (b) order the closure of the factory;
- (c) order confiscation of the facility, machinery and equipment, vehicle or substance, record, document or other object used or involved in contravention of the provisions of this Act;
- (d) order such person to restore the environment at his own cost, to conditions existing prior to the contravention or as close to such conditions as may be reasonable in the circumstances to the satisfaction of the Agency; and
- (e) order that compensation be paid to any person or persons for any loss, or damage to their health or property suffered by such contravention.

(6) The Director General or an officer generally or specially authorised by him in this behalf may, on the application of the accused, compound an offence under this Act with the permission of the Environmental Protection Tribunal or Court in accordance with such procedure as prescribed.



(7) Where the Director General is of the opinion that a person had contravened any provision of this Act, he may, subject to the rules, by notice in writing to that person require him to pay to the Agency a penalty in the amount set out in the notice for each day the contravention continues.

23. Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence has been committed with the consent or connivance of, or is attributed to any negligence on the part of, any director, partner, manager, secretary or other officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly:

**Offences by  
body corporate.**

Provided that in the case of a company as defined under the Companies Ordinance, 1984 (XLVII of 1984), only the Chief Executive as defined in the said Ordinance shall be liable under this section.

*Explanation.*— For the purposes of this Section, "body corporate" includes a firm, association of persons and a society registered under the Societies Registration Act, 1860 (XXI of 1860), or under the Co-operative Societies Act, 1925 (VII of 1925).

24. Where any contravention of this Act has been committed by any Government Agency, local authority or local council, and it is proved that such contravention has been committed with the consent or connivance of, or is attributable to any negligence on the part of, the Head or any other officer of Government Agency, local authority or local council, such Head or other officer shall also be deemed guilty of such contravention along with the Government Agency, local authority or local council and shall be liable to be proceeded against and punished accordingly.

**Offences by  
Government  
Agencies, local  
authorities or  
local councils.**

#### PART-IX

#### ENVIRONMENTAL PROTECTION TRIBUNALS AND COURTS

25. (1) Government may, by Notification in the Official Gazette, establish as many Environmental Protection Tribunals as it considers necessary and, where it establishes more than one Environmental Protection Tribunal, it shall specify territorial limits within which, or the class of cases in respect of which, each one of them shall exercise jurisdiction under this Act.

**Environmental  
Protection  
Tribunals.**

(2) An Environmental Protection Tribunal shall consist of a Chairperson who is, or has been, or is qualified for appointment as a Judge of the High Court to be appointed after consultation with the Chief Justice of the High Court and two members to be appointed by Government, of which at least one shall be a technical member nominated from amongst the officers of the Agency with suitable professional qualifications and experience in the environmental field.

(3) For every sitting of the Environmental Protection Tribunal, the presence of the Chairperson and not less than one Member shall be necessary.

(4) A decision of an Environmental Protection Tribunal shall be expressed in terms of the opinion of the majority of its members, including the Chairperson, or if the case has been decided by the Chairperson and only one of the members and there is a difference of opinion between them, the decision of the Environmental Protection Tribunal shall be expressed in terms of the opinion of the Chairperson.

(5) An Environmental Protection Tribunal shall not, merely by reason of a change in its composition, or the absence of any member from any sitting, be bound to recall and rehear any witness who has given evidence, and may act on the evidence already recorded by, or produced, before it.

(6) An Environmental Protection Tribunal may hold its sittings at such places within its territorial jurisdiction as the Chairperson may decide.

(7) No act or proceeding of an Environmental Protection Tribunal shall be invalid by reason only of the existence of a vacancy in, or defect in the constitution, of, the Environmental Protection Tribunal.

(8) The terms and conditions of service of the Chairperson and members of the Environmental Protection Tribunal shall be such as may be prescribed.

**Jurisdiction and  
powers of  
Environmental  
Protection  
Tribunals.**

26. (1) An Environmental Protection Tribunal shall exercise such powers and perform such functions as are, or may be, conferred upon or assigned to it by or under this Act or the rules and regulations.

(2) All contraventions punishable under sub-section (1) of section 22 shall exclusively be triable by an Environmental Protection Tribunal.

(3) An Environmental Protection Tribunal shall not take cognizance of any offence triable under sub-section (2) except on a complaint in writing by—

(a) the Agency or any Government Agency or Local Council;  
and

(b) any aggrieved person, who has given notice of not less than thirty days to the Agency, of the alleged contravention and of his intention to make a complaint to the Environmental Protection Tribunal.



(4) In exercise of its criminal jurisdiction, the Environmental Protection Tribunal shall have the same powers as are vested under the Code of Criminal Procedure, 1898 (Act V of 1898).

(5) In exercise of the appellate jurisdiction under section 27 the Environmental Protection Tribunal shall have the same powers and shall follow the same procedure as an appellate court in the Code of Civil Procedure, 1908 (Act V of 1908).

(6) In all matters with respect to which no procedure has been provided for in this Act, the Environmental Protection Tribunal shall follow the procedure laid down in the Code of Civil Procedure, 1908 (Act V of 1908).

(7) An Environmental Protection Tribunal may, on application filed by any officer duly authorised in this behalf by the Director General, issue bailable warrant for the arrest of any person against whom reasonable suspicion exists, of his having been involved in contravention punishable under sub-section (1) of section 22:

Provided that such warrant shall be applied for, issued and executed in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898):

Provided further that if the person arrested executes a bond with sufficient sureties in accordance with the endorsement on the warrant he shall be released from custody, failing which he shall be taken or sent without delay to the officer in-charge of the nearest jurisdiction police station.

(8) All proceedings before the Environmental Protection Tribunal shall be deemed to be judicial proceedings within the meaning of sections 193 and 228 of the Pakistan Penal Code (Act XLV of 1860), and the Environmental Protection Tribunal shall be deemed to be a court for the purpose of sections 480 and 482 of the Code of Criminal Procedure, 1898 (Act V of 1898).

(9) No court other than an Environmental Protection Tribunal shall have or exercise any jurisdiction with respect to any matter to which the jurisdiction of an Environmental Protection Tribunal extends under this Act and the rules and regulations.

(10) Where the Environmental Protection Tribunal is satisfied that a complaint made to it under sub-section (3) is false and vexatious to the knowledge of the complainant, it may, by an order, direct the complainant to pay to the person complained against such compensatory costs which may extend to one hundred thousand rupees.

**Appeals to the  
Environmental  
Protection  
Tribunal.**

27. (1) Any person aggrieved by any order or direction of the Agency under any provision of this Act or the rules or regulations may prefer an appeal with the Environmental Protection Tribunal within thirty days of the date of communication of the impugned order or direction to such person.

(2) An appeal to the Environmental Protection Tribunal shall be in such form, contain such particulars and be accompanied by such fees as prescribed.

**Appeals from  
orders of the  
Environmental  
Protection  
Tribunal.**

28. (1) Any person aggrieved by any final order or by any sentence of the Environmental Protection Tribunal passed under this Act may, within thirty days of communication of such order or sentence, prefer an appeal to the High Court.

(2) An appeal under sub-section (1) shall lie before the High Court of Sindh.

**Jurisdiction of  
Judicial  
Magistrate.**

29. (1) Notwithstanding anything contained in the Code of Criminal Procedure, 1898 (Act V of 1898), or any other law for the time being in force, but subject to the provisions of this Act, all contraventions punishable under sub-section (2) of section 22 shall exclusively be triable by the Court of Judicial Magistrate of First Class having of First Class having jurisdiction.

(2) A Judicial Magistrate shall be competent to impose any punishment specified in sub-sections (2) and (4) of section 22.

(3) A Judicial Magistrate shall not take cognizance of an offence triable under sub-section (1) except on a complaint in writing by—

(a) the Agency; and

(b) any aggrieved person.

**Appeals from  
orders of the  
Judicial  
Magistrate.**

30. Any person aggrieved by any final order or sentence passed by a Judicial Magistrate under section 28 may, within thirty days from the date of the communication of such order or sentence, appeal to the Court of the District and Sessions Judge defined as Green Court under this Act, whose decision thereon shall be final.



**PART-X  
PUBLIC PARTICIPATION**

31.(1) The Agency shall cause relevant details of any proposed project regarding which an Environmental Impact Assessment has been received to be published, alongwith an invitation to the public to furnish their comments thereon within a specified period. **Public participation.**

(2) In accordance with such procedure as may be prescribed, the Agency shall hold public hearings to receive additional comments and hear oral submissions.

(3) All comments received under sub-sections (1) and (2) shall be duly considered by the Agency while reviewing the environmental impact assessment or strategic impact assessment, and decision or action taken thereon shall be communicated to the persons who have furnished the said comments.

**PART-XI  
GENERAL**

32. The Agency may, by notification in the official Gazette, make and amend the schedule. **Power to make and amend schedule.**

33. No suit, prosecution or other legal proceedings shall lie against Government, the Council, the Agency, the Director General of the Agency, members, officers, employees, experts, advisors, committees or consultants of the Agency or Environmental Protection Tribunal or Court or any other person for anything which is done or intended to be done in good faith under this Act or rules or regulations. **Indemnity**

34. Any dues recoverable by the Agency under this Act and rules or regulations shall be recoverable as arrears of land revenue. **Dues recoverable as arrears of land revenue.**

35. The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being in force. **Act to override other laws.**

36. The Sindh Environment Protection Agency may, by notification in the Official Gazette, make rules for carrying out the purposes not in consistence of this Act with the approval of Government. **Power to make rules.**

37. (1) For carrying out the purposes of this Act, the Agency may, by Notification in the Official Gazette and with the approval of Government, make regulations not inconsistent with the provisions of this Act or the rules. **Power to make regulations.**



(2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for —

- (a) submission of periodical reports, data or information by any Government Agency, local authority or local council in respect of environmental matters;
- (b) preparation of emergency contingency plans for coping with environmental hazards and pollution caused by accidents, natural disasters and calamities;
- (c) appointment of officers, advisors, experts, consultants and employees **as per prescribed rules**;
- (d) levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented;
- (e) monitoring and measurement of discharges and emissions;
- (f) categorization of projects to which, and the manner in which sections 17, 18 and 20 applies;
- (g) laying down of guidelines for preparation of initial environmental examination, environmental impact assessment and strategic environmental assessment, and development of procedures of their filing, reviews and approval.
- (h) laying down standard operating procedures for environmental sampling, examination of water, waste water, gaseous emissions, solid waste and noise;
- (i) providing procedures for handling hazardous substances; and
- (j) installation of devices in, use of fuels by, and maintenance and testing of motor vehicles for control of air and noise pollution.

**BY ORDER OF THE SPEAKER  
PROVINCIAL ASSEMBLY OF SINDH**

**G.M.UMAR FAROOQ  
SECRETARY  
PROVINCIAL ASSEMBLY OF SINDH**

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# **ANNEXURE – II**

## **Sindh EPA (Environmental Assessment) Regulations, 2021**



**GOVERNMENT OF SINDH  
SINDH ENVIRONMENTAL PROTECTION AGENCY**

Karachi dated the 03<sup>rd</sup> September, 2021

**NOTIFICATION**

**NO.EPA/TECH/739/2021:-** In exercise of the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, is pleased to make the following regulations, namely:-

**1. Short title and commencement**

- (1) These regulations may be called the Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021.
- (2) They shall come into force at once.

**2. Definitions. -**

- (1) In these regulations, unless there is anything repugnant in the subject or context
  - (a) “Act” means the Sindh Environmental Protection Act, 2014 (VIII of 2014);
  - (b) “Agency” means the Sindh Environmental Protection Agency as defined under section 2(ii);
  - (c) “Director General” means the Director General of the Agency;
  - (d) Environmental Checklist means rapid environmental assessment or environmental screening through a prescribed checklist in respect of projects having least/minimal impacts on the environment.
  - (e) "Firm" means the Environmental Consulting Firm registered by the Agency.
  - (f) “Environmentally sensitive area” means a location, large or small, that has significant environmental values that contribute to maintaining biological diversity and integrity, have intrinsic or attributed scientific, historical or cultural heritage value, or are important in providing amenity, harmony or sense of community, ecosystem as declared by Agency.
  - (g) “Protected area” means any area which safeguards the earths precious bio-diversity, protected areas of natural beauty and conservation of cultural significance as declared by relevant authority;
  - (h) “Schedule” means the Schedules provided in these regulations;

- (i) “Urban area” means an area within the limits of a town, municipality or city as determined by the Agency on the basis of population and environmental issues
  - (2) All other words and expressions used but not defined in these regulations shall have the same meaning as are assigned to them in the Act.
- 3. Projects requiring Environmental Checklist (EC)**

A proponent of a project falling in any category listed in Schedule-I shall file environmental checklist with the Agency and the provisions of section 17 shall apply to such projects.
- 4. Projects requiring an Initial Environmental Examination (IEE)**

A proponent of a project falling in any category listed in Schedule-II shall file an IEE with the Agency, and the provisions of section 17 shall apply to such projects.
- 5. Projects requiring an Environmental Impact Assessment (EIA)**

A proponent of a project falling in any category listed in Schedule-III shall file an EIA with the Agency, and the provisions of section 17 shall apply to such projects.
- 6. Projects not requiring an Environmental Assessment**
  - (1) A project not falling in any category listed in Schedules-I, II and III shall not be required to file an EC, IEE or EIA
  - (2) Notwithstanding anything contained in sub-regulation (1), the Agency may direct the proponent of a project, whether or not listed in Schedule I or II or III, to file an EC or IEE or EIA, for reasons to be recorded in such direction:

Provided that no such direction shall be issued without the recommendations in writing of the Advisory Committee constituted under regulations 21.
- 7. Preparation of environmental assessment report**
  - (1) The Agency may issue guidelines for preparation of an EC or IEE or EIA reports including guidelines of general applicability, and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to particular sector.
  - (2) The Agency may issue guidelines for preparation scope of an Environmental Management Plan(EMP) or Environmental Audit(EA).
  - (3) Where guidelines have been issued under sub-regulation (1) & (2), an EC, IEE or EIA or EMP or EA shall be prepared, to the extent practicable, in accordance therewith and the proponent shall justify any departure therefrom.
- 8. Review Fees**

The proponent shall pay, at the time of submission of an EC, IEE or EIA or EMP or BTS tower a non-refundable review fee to the Agency as prescribe in Schedule-IV.

## **9. Filing of report**

- (1) Two hard copies and two electronic copies for an EC or IEE or EIA report shall be filed with the Agency by the proponent. The Agency may require the proponent to submit additional copies, as and when required during the review process.
- (2) Every EC, IEE and EIA shall be accompanied by -
  - (a) an application, in the form prescribed in Schedule-V;
  - (b) Copy of receipt showing payment of review fee as prescribed in Schedule-IV

## **10. Preliminary Scrutiny**

- (1) Any report filed by the proponent or applicant shall be returned, if found incomplete in terms of Regulation 9.
- (2) Notwithstanding anything contained in sub-regulation (1) of regulation 12, the Agency may require the proponent to submit an additional information at any stage during the review process.

## **11. Public participation**

- (1) In the case in an EIA, the Agency shall issue a public notice to be published in widely circulated English or Urdu or Sindhi national newspaper and in a local newspaper of general circulation in the area affected by the project, mentioning the type of project, its exact location, the name and address of the proponent and the date, time and place of public hearing for inviting comments from primary stakeholders.
- (2) The date fixed under sub-regulation (1) shall not be earlier than ten days from the date of publication of the notice.
- (3) The Agency shall also ensure the circulation of the EIA, where necessary, to the concerned Government Agencies and solicit their comments thereon.
- (4) All comments received by the Agency from the public or any Government Agency shall be duly considered before issuance of decision.
- (5) The Agency may issue guidelines indicating the basic techniques and measures to be adopted to ensure effective public consultation, involvement and participation in EIA assessment.

## **12. Review process**

- (1) Notwithstanding anything contained in sub section (4) of Section 17, the Agency shall make every effort to conclude its review process of the EA, EMP or environmental checklist within fifteen days, of the IEE within thirty days, and of the EIA within sixty days after receiving of complete case.
- (2) In reviewing an EIA, the Agency shall consult such Committee of Experts be constituted for the purpose by the Director General, and may also solicit views of concerned Advisory Committee, if any, constituted by the Agency.



- (3) The Director General may, where considers it necessary, constitute a committee to inspect the site of the project and submit its report on such matters as may be specified.
- (4) In reviewing the IEE, the Director General may constitute a committee of the officers from within the Agency, on case to case basis, in view of the jurisdiction and location of the project for the purpose to extend final recommendation about the approval or rejection of the IEE.
- (5) The review of the IEE or EIA by the Agency shall be based on quantitative and qualitative assessment of the documents and data furnished by the proponent, comments from the public and Government Agencies received under regulation 12, and views of the committees mentioned in sub-regulations (2) and (3) above.
- (6) EMP, EA, EC shall be reviewed as per guidelines issued by SEPA

### **13. Decision**

- (1) The documentary evidence in the form of videos (soft copies) of public hearing shall be submitted by the proponent within three days after conclusion of public hearing to the Agency.
- (2) On completion of the review process, the decision of the Agency shall be communicated to the proponent in the form prescribed in Schedule-VI or in case of an IEE or EMP or environmental checklist or environmental audit in the form prescribed in Schedule-VII in case of an EIA.

### **14. Conditions of approval**

- (1) Every approval of an EC or IEE or EIA or EMP or EA shall, in addition to such conditions as may be imposed by the Agency, be subject to the condition that the project shall be designed, constructed or operated and mitigatory and other measures adopted, strictly in accordance with the EC or IEE or EIA or EMP or EA, unless any variations thereto have been specified in the approval by the Agency.
- (2) Where the Agency accords its approval subject to certain conditions, the proponent shall submit an undertaking to the Agency, before commencing operation of the project, in the form prescribed in Schedule-VIII that the conditions of approval, and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures have been duly complied with.

### **15. Validity period of Approval**

- (1) The approval accorded by the Agency under section 17 read with sub-regulation (2) of regulation 15 shall be valid, for commencement of construction, for a period of three years from the date of issue.
- (2) If construction is commenced during the initial three years validity period, the

validity of the approval shall stand extended for a further period of three year.

- (3) The proponent may apply to the Agency for extension in the validity periods mentioned in sub-regulations (1), (2), which may be granted by the Agency in its discretion for such period not exceeding three years at a time, if the conditions of the approval do not require significant change:

Provided that the Agency may require the proponent to submit a fresh IEE or EIA, if in its opinion changes in location, design, construction and operation of the project so warrant.

#### **16. Entry and inspection**

- (1) For the purpose of verification of any matter relating to the review or to the conditions of approval of an EC or IEE or EIA or EMP or EA list prior to, before or during and after commencement of construction or operation of a project, duly authorized staff of the Agency shall be entitled to enter and inspect the project site, factory building and plant and equipment installed therein.
- (2) The proponent shall ensure full cooperation of the project staff at site to facilitate the inspection, and shall provide such information as may be required by the Agency for this purpose and pursuant thereto.

#### **17. Cancellation of approval**

- (1) Notwithstanding anything contained in these regulations, if, at any time, on the basis of information or report received or inspection carried out, the Agency is of the opinion that the conditions of an approval have not been complied with, or that the information supplied by a proponent in the approved EC or IEE or EIA or EMP or EA list is incorrect, it shall issue notice to the proponent for show cause within two weeks of receipt thereof as to why the approval should not be cancelled.
- (2) In case no reply is received or if the reply is considered unsatisfactory, the Agency may, after giving the proponent an opportunity of being heard -
  - (i) require the proponent to take such measures and to comply with such conditions within such period as it may specify, failing which the approval shall stand cancelled; or
  - (ii) cancel the approval.
- (3) On cancellation of the approval, the proponent shall cease construction or operation of the project forthwith.
- (4) Any action taken under this regulation shall be without prejudice to any other action that may be taken against the proponent under the Act or rules or regulations or any other law for the time being in force.

**18. Registers of EC or IEE and EIA projects**

Separate Registers to be maintained by the Agency for EC or IEE and EIA projects shall be in the form prescribed in Schedule-IX.

**19. Environmentally sensitive areas**

- (1) The Agency may designate an area to be an environmentally sensitive area,
- (2) Notwithstanding anything contained in regulations 3 and 5, the proponent of a project situated in an environmentally sensitive area shall be required to file an EIA with the Agency.

**20. Environmental assessment guidelines**

- (1) The Agency may from time to time issue guidelines to assist proponents and other persons involved in the preparation of environmental assessment.
- (2) Where guidelines have been issued under sub-regulation (1), the projects shall be planned and prepared, to the extent practicable, in accordance therewith and any departure therefrom justified in the IEE/EIA pertaining to the project.

**21. Environmental Assessment Advisory Committee. -**

The agency may constitute one or more Committees for the purpose of rendering advice on implementation and enforcement of Section 17, which may include experts of relevant field, civil society, academia, environmental experts, representative of Administrative Department, legal expert and experts from natural resources.

**22. Repeal and Savings.**

- (1) The Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2014, shall, on commencement of these regulations, stand repealed.
- (2) All orders made, notification issued, actions taken under the repealed Regulations shall remain in force until amended, altered or repealed by the provisions of these regulations.

**DIRECTOR GENERAL  
SINDH ENVIRONMENTAL PROTECTION  
AGENCY**

## **SCHEDULE-I**

(See Regulation 3)

### **List of projects requiring Environmental Screening (through check list)**

- a. Subject to the compliance with concerned zoning laws:
  - i. Construction of residential and commercial buildings having total covered area from 60,000 sq.feet to 100,000 sq.feet
  - ii. Housing Schemes covering an area from 05 acres to 15 acres.
  - iii. Ware Houses for Non-Hazardous substances having total area from 1000 sq.yards to 5,000 sq.yards
  - iv. Warehouse for Fertilizers
  - v. Marriage Halls/Banquet/Restaurants/Baking facilities having total area more than 500 sq.yards
  - vi. Motor vehicle workshops/Service Stations having total area of more than 500 sq.yards.
- b. Construction/Reconstruction/Rehabilitation of roads in urban area from 500 meters to 01 kilometres and in rural area from 500 meters to 05 kilometres.
- c. Construction of Flyover, underpasses and bridges of length from 100 meters to 500 meters
- d. On-farm dams and fish farms
- e. Pulses mills
- f. Flour Mills
- g. Lining of existing minor canals and /or water courses.
- h. Canal cleaning
- i. Forest harvesting operations
- j. Rain harvesting projects
- k. Health care units of less than 50 beds
- l. BTS Tower
- m. Lime Kilns
- n. Ice factories and cold storage.
- o. Cotton oil mill
- p. Construction of LPG, CNG, LNG filling station and petrol pumps
- q. Carpet manufacturing units
- r. Rain harvesting projects
- s. Industrial Effluent Treatment Plant
- t. Sanitary Landfill site up to 500 tons/day

**Schedule-II**  
(See Regulation 4)

**List of projects requiring an Initial Environmental Examination**

**A. Agriculture, Livestock and Fisheries**

1. Poultry, livestock and fish farms
2. Warehousing for pesticides and pharmaceuticals
3. Projects involving packaging, formulation, cold storage and warehouse of agricultural, livestock and fish products.
4. Construction & Operation of Slaughter houses

**B. Energy**

1. Hydroelectric power generation up to 25 MW
2. Thermal power generation up to 100 MW
3. Coal fired power plants with capacity up to 50 MW
4. Transmission lines up to 132 KV, and grid stations
5. Waste-to-energy generation projects including bio-mass up to 25 MW
6. Construction of Coal Handling and storage facilities
7. Handling, Transportation & Storage of Biofuel Facility
8. Handling and storage of edible grains and seeds
9. All Renewable energy Projects (excluding Protected/Sensitive area under any law)

**C. Oil and Gas projects:**

1. Oil and gas 2D/3D Seismic survey and drilling activities (on and off shore)
2. Oil and gas extraction projects including exploration and production located outside the environmentally sensitive/protected areas
3. Oil & Gas transmission gathering, storage, separation & transportation system
4. Construction of CNG, LPG Petroleum and LNG bulk storage facility
5. Oil blending and recycling units

**D. Manufacturing and processing**

1. Ceramics and glass units
2. Food processing units
3. Pharmaceutical units.
4. Rice mills, ghee/oil mills, Cotton ginning
5. Man-made fibers and resin projects



6. Tanning and leather finishing projects
7. Manufacturing of apparel, textile garments units, including weaving, spinning, dyeing, bleaching and printing
8. Woodwork units manufacturing products
9. Steel re-rolling mills
10. Waste recycling plants
11. Battery manufacturing plant
12. Brick Kilns
13. Marble processing units
14. Stone Crushing units

**E. Mining and mineral processing**

1. Commercial extraction of sand, gravel, limestone, clay, Sulphur and other minerals not included in Schedule I.
2. Crushing, grinding and separation processes
3. Metal Smelting plant production capacity up to 20 tons/day

**F. Transport**

1. Construction of flyovers, underpasses and bridges having length more than 500 meters to 1000 meters in urban areas and more than 5km in rural areas
2. Bus terminals/ railway station/ metro stops and construction & operation of transport related terminals
3. Rehabilitation or rebuilding or reconstruction of existing roads more than one kilometers in urban areas and more than 5 km from rural areas

**G. Water management, dams, irrigation and flood protection**

1. Dams and reservoirs with storage volume of less than 25 million cubic meters of surface area less than 4 square kilometers
2. Irrigation systems and drainage system with the area of less than 15,000 hectors
3. Flood protection bunds

**H. Water supply and filtration**

Water supply schemes and filtration plants

**I. Waste disposal and wastewater treatment**

1. Solid and Non-hazardous waste with annual capacity up to 10,000 tonnes (excluding municipal landfill sites and commercial facilities) including Garbage Transfer station/composting plant

2. Wastewater treatment for sewerage treatment facility less than 100 mgd
3. Hospital waste disposal facilities including incineration units owned by Hospitals for own use excluding commercial facility.

**J. Urban development**

1. Housing schemes more than 15 acres to 50 acres
2. Residential, Commercial multistory High rise construction projects having covered area more than 100,000 sq.feet to 500,000 sq.feet.
3. Laboratories
4. Hospitals, health care unit of more than 50 beds
5. Construction of Educational and Academic institutions.

**K. Other projects**

Any other project for which filing of an IEE is required by the Agency under sub-regulation (2) of Regulation 6.

### **SCHEDULE III**

(See Regulation 5)

#### **List of projects requiring an EIA**

##### **A. Energy**

1. Hydroelectric power generation more than 50 MW
2. Thermal power generation more than 100 MW
3. Coal power projects more than 50 MW
4. Transmission lines above 132 KVA and distribution projects.
5. Nuclear power plants
6. Wind, Solar or renewable energy projects if falls under any environmental sensitive and protected area.

##### **B. Oil and Gas projects**

1. Oil Petroleum refineries.
2. LPG and LNG Terminals Projects
3. Coal Handling Terminals Projects

##### **C. Manufacturing and processing**

1. Cement plants
2. Chemical manufacturing industries
3. Fertilizer plants
4. Steel Mills
5. Sugar Mills and Distilleries
6. Establishment of Industrial estates & Export processing zones
7. Petrochemicals complex
8. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, printing and publishing, paints and dyes.

##### **D. Mining and mineral processing**

1. Mining and processing of coal, gold, copper, sulphur and precious stones
2. Mining and processing of major non-ferrous metals, iron and steel rolling
3. Metal Smelting plant production capacity more than 20 tons/day

##### **E. Transport**

1. Airports
2. Construction of highway, motor ways, major roads (Intercity roads) more than one km and above

3. Ports and harbor development
4. Mass transit projects
5. Railway works
6. Construction of Flyover, underpass and bridges having total length more than one km.

**F. Water management, dams, irrigation and flood protection**

1. Dams and reservoirs with storage volume of 25 million cubic meters and above having surface area of 4 square kilometers and above
2. Irrigation and drainage projects serving more than 15,000 hectares and above

**G. Water supply and filtration**

Public water supply schemes and **filtration** plants.

**H. Waste Disposal and treatment**

1. Facilities for handling, storage or disposal of hazardous or toxic wastes or radioactive waste (including landfill sites, incineration units, etc.)
2. Solid waste municipal landfill sites.
3. Combine Effluent Treatment Plant
4. Domestic wastewater treatment plant more than 100mgd

**I. Urban development and tourism**

1. Housing schemes above 50 acres
2. Residential, Commercial High rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 sq.feet
3. All Projects located in High Density Zones notified by Government and relevant land controlling organization, irrespective of their size.
4. Commercialization of major corridors/roads in urban centers
5. Large Scale public facilities
6. Large-scale tourism development projects

**J. Environmentally Sensitive Areas**

All projects situated in environmentally sensitive areas being identified by the Agency.

**K. Other projects**

1. Any other project for which filing of an EIA is required by the Agency under sub-regulation (2) of Regulation 5.
2. Any other project likely to cause an adverse environmental effect.

**Schedule-IV**  
**(See Regulation 8)**

<b>Project Cost (in million)</b>	<b>Review Fee</b>
<b>Up to 20</b>	<b>Rs.50,000</b>
<b>Above 20 up to 100</b>	<b>Rs. 100,000</b>
<b>Above 100 up to 200</b>	<b>Rs. 200,000</b>
<b>Above 200 up to 500</b>	<b>Rs. 400,000</b>
<b>Above 500</b>	<b>Rs. 600,000</b>
<b>Review fee for Environmental Checklist or EMP shall be Rs. 40,000/=</b>	
<b>Review fee for BTS Tower shall be 20,000/=</b>	

\*

**Note:**

The fee shall be payable into the “Sindh Sustainable Development Fund” account  
Details are as under:

**A/C Title:** Sindh Sustainable Development Fund

**Account Number:** 03084572626100

**Bank:** Sindh Bank

**Branch Code:** 0308-Korangi Industrial Area



**SCHEDULE V**  
[See Regulation 9(2)(a)]  
**Application Form**

1.	Name and address of Proponent		Phone: Email:	
2.	CNIC No. of proponent			
3.	Brief description of project			
4.	Location of project			
5.	Cost of the Project			
6.	Objectives of project			
7.	IEE/EIA attached?	IEE/EIA: Yes/No		
8.	Have alternative sites/options been considered/ reported in IEE/EIA?	Yes/No		
9.	Title document of the project			
10.	Existing land use		Land requirement	
11.	Is basic site data available, or has it been measured?	(only tick yes if the data is reported in the IEE/EIA)	Available	Measured
		Meteorology (including rainfall)	Yes/No	Yes/No
		Ambient air quality	Yes/No	Yes/No
			Yes/No	Yes/No
12.	Have estimates of the following been reported, especially Quantitative Analysis?	Water balance	Estimated	Reported
		Solid waste disposal	Yes/No	Yes/No
		Liquid waste	Yes/No	Yes/No
13.	Source of power		Power requirement	
14.	Labour force (number)	Construction: Operation:		
15.	Environmental Consulting Firm			

Verification. I do solemnly affirm and declare that the information given above and contained in the attached EC/IEE/EIA is true and correct to the best of my knowledge and belief.

Date

Signature, name \_\_\_\_\_  
of proponent (with official  
stamp/seal)

**SCHEDULE VI**  
*[See Regulation 13(2)]*

**Decision on IEE/Environmental Check List**

1. Name and address of proponent \_\_\_\_\_
  2. Description of project \_\_\_\_\_
  3. Location of project \_\_\_\_\_
  4. Date of filing of IEE \_\_\_\_\_
  5. After careful review of the IEE, the Agency has decided –
    - (a) to accord its approval, subject to the following conditions:  
\_\_\_\_\_  
\_\_\_\_\_
    - or (b) that the proponent should submit an EIA of the project, for the following reasons –  
\_\_\_\_\_  
\_\_\_\_\_
- Dated \_\_\_\_\_

Tracking no. \_\_\_\_

Director-General  
Sindh Environmental Protection Agency  
(with official stamp/seal)

## **SCHEDULE VII**

*[See Regulation 13(2)]*

### **Decision on EIA**

1. Name and address of proponent \_\_\_\_\_
  2. Description of project \_\_\_\_\_  
\_\_\_\_\_
  3. Location of project \_\_\_\_\_
  4. Date of filing of EIA \_\_\_\_\_
  5. After careful review of the EIA, and all comments thereon, the Federation Agency has decided –
    - (a) to accord its approval, subject to the following conditions:  
\_\_\_\_\_  
\_\_\_\_\_
    - or (b) that the proponent should submit an EIA with the following modifications-  
\_\_\_\_\_
    - or (c) to reject the project, being contrary to environmental objectives, for the following reasons:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- Dated \_\_\_\_\_  
\_\_\_\_\_
- Tracking no.\_\_\_\_

Director-General  
Sindh Environmental Protection Agency  
(with official stamp/seal)

**SCHEDULE VIII**  
*[See Regulation 14(2)]*

**Undertaking**

I, (full name and address) as proponent for (name, description and location of project) do hereby solemnly affirm and declare that the conditions of approval and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures and other relevant matters have been duly complied with in the design and construction of the project.

Signature, name and

designation of proponent  
(with official stamp/seal)

Witnesses(full names and addresses)

\_\_\_\_\_

\_\_\_\_\_

**SCHEDULE IX**  
(See Regulation 18)  
**Form of Registers for EC, IEE and EIA projects**

<u>S. No.</u>	<u>Description</u>	<u>Relevant Provisions</u>
1	2	3
1.	Tracking number	
2.	Category type (as per Schedules I or II)	
3.	Name of proponent	
4.	Name and designation of contact person	
5.	Name of consultant	
6.	Description of project	
7.	Location of project	
8.	Date of submission of IEE/EIA	
9.	Date of public hearing / technical presentation	
10.	Date of committee of experts for schedule-II projects	
11.	Approval granted (Yes/No)	
12.	Date of approval granted or refused	



# **ANNEXURE – III**

## **Sindh Environmental Quality Standards (SEQS)**



# The Sindh Government Gazette

Published by Authority

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**KARACHI THURSDAY JANUARY 28, 2016**

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## PART-I

**GOVERNMENT OF SINDH  
SINDH ENVIRONMENT PROTECTION  
AGENCY**

### NOTIFICATION

**NO.EPA/TECH/739/2014:-** In exercise of the powers conferred under clause (g) of sub-section (1) of section of 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the following standards:-

1. (1) These Standards may be called the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015.

(2) These Standards shall come into force at once.

2. In these Standards, unless there is anything repugnant in the subject or context --

(a) "Government" means the Government of Sindh;

(b) "Standards" means the Sindh Environmental Quality Standards.



**SINDH ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND  
LIQUID INDUSTRIAL EFFLUENTS (mg/l, UNLESS OTHERWISE DEFINED)**

S. No.	Parameter	Standards		
		Into Inland Waters 3	Into Sewage Treatment <sup>(5)</sup> 4	Into Sea <sup>(1)</sup> 5
1.	Temperature 40°C or Temperature Increase *	≤3°C	≤3°C	≤3°C
2.	pH value (H <sup>+</sup> )	6-9	6-9	6-9
3.	Biochemical Oxygen Demand (BOD) <sub>5</sub> at 20°C <sup>(1)</sup>	80	250	80**
4.	Chemical Oxygen Demand(COD) <sup>(1)</sup> ..	150	400	400
5.	Total Suspended Solids (TSS) .....	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500
7.	Oil and Grease	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3
9.	Chloride (as Cl <sup>-</sup> )	1000	1000	SC***
10.	Fluoride (as F <sup>-</sup> )	10	10	10
11.	Cyanide (as CN <sup>-</sup> ) total	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS) <sup>(2)</sup>	20	20	20
13.	Sulphate (SO <sub>4</sub> <sup>2-</sup> )	600	1000	SC***
14.	Sulphide (S <sup>2-</sup> )	1.0	1.0	1.0
15.	Ammonia (NH <sub>3</sub> )	40	40	40
16.	Pesticides <sup>(3)</sup>	0.15	0.15	0.15
17.	Cadmium <sup>(4)</sup> ..	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent) <sup>(4)</sup> ..	1.0	1.0	1.0
19.	Copper <sup>(4)</sup> .....	1.0	1.0	1.0
20.	Lead <sup>(4)</sup>	0.5	0.5	0.5
21.	Mercury <sup>(4)</sup>	0.01	0.01	0.01
22.	Selenium <sup>(4)</sup>	0.5	0.5	0.5
23.	Nickel <sup>(4)</sup> ..	1.0	1.0	1.0
24.	Silver <sup>(4)</sup>	1.0	1.0	1.0
25.	Total toxic metals .....	2.0	2.0	2.0
26.	Zinc .....	5.0	5.0	5.0
27.	Arsenic <sup>(4)</sup>	1.0	1.0	1.0
28.	Barium <sup>(4)</sup>	1.5	1.5	1.5
29.	Iron .....	8.0	8.0	8.0
30.	Manganese .....	1.5	1.5	1.5
31.	Boron <sup>(4)</sup>	6.0	6.0	6.0
32.	Chlorine .....	1.0	1.0	1.0



**Explanations:**

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Sindh Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
  2. Methylene Blue Active Substances; assuming surfactant as biodegradable.
  3. Pesticides include herbicides, fungicides, and insecticides.
  4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.
  5. Applicable only when and where sewage treatment is operational and BOD<sub>5</sub>=80mg/l is achieved by the sewage treatment system.
  6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.
- \*. The effluent should not result in temperature increase of more than 3<sup>0</sup>C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.
- \*\* The value for industry is 200 mg/l
- \*\*\* Discharge concentration at or below sea concentration (SC).

- Note: 1. Dilution of liquid effluents to bring them to the STANDARDS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.
2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the STANDARDS limits".

**"SINDH ENVIRONMENTAL QUALITY STANDARDS FOR  
INDUSTRIAL GASEOUS EMISSION (mg/Nm<sup>3</sup>, UNLESS  
OTHERWISE DEFINED)."**

S. No.	Parameter	Source of Emission	Standards
1	2	3	4
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringleman Scale or equivalent smoke number
2.	Particulate matter	(a) Boilers and Furnaces	
	(1)	(i) Oil fired	300
		(ii) Coal fired	500
		(iii) Cement Kilns	300



		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500
3.	Hydrogen Chloride	Any	400
4.	Chlorine	Any	150
5.	Hydrogen Fluoride	Any	150
6.	Hydrogen Sulphide	Any	10
7.	Sulphur Oxides <sup>(2) (3)</sup>	Sulfuric acid/ Sulphonic acid plants	
		Other Plants except power Plants operating on oil and coal	1700
8.	Carbon Monoxide	Any	800
9.	Lead	Any	50
10.	Mercury	Any	10
11.	Cadmium	Any	20
12.	Arsenic	Any	20
13.	Copper	Any	50
14.	Antimony	Any	20
15.	Zinc	Any	200
16.	Oxides of Nitrogen	Nitric acid Manufacturing unit.	3000
	(3)	Other plants except power plants operating on oil or coal:	
		Gas fired	400
		Oil fired	600
		Coal fired	1200

**Explanations:-**

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 percent Sulphur content in fuel oil. Higher content of Sulphur will ease standards to be pro-rated.
3. In respect of emissions of Sulphur dioxide and Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to Standards specified above, comply with the following standards:-



**A. Sulphur Dioxide**

Sulphur Dioxide Background levels Micro-gram per cubic meter ( $\mu\text{g}/\text{m}^3$ ) Standards.

Background Air Quality (SO <sub>2</sub> Basis)	Annual Average	Max. 24-hours Interval	Criterion I Max. SO <sub>2</sub> Emission (Tons per Day Per Plant)	Criterion II Max. ground level increment to ambient (One year Average)
Unpolluted	<50	<200	500	50
Moderately Polluted*				
Low	50	200	500	50
High	100	400	100	10
Very Polluted**	>100	>400	100	10

\* For intermediate values between 50 and 100  $\mu\text{g}/\text{m}^3$  linear interpolations should be used.

\*\* No projects with Sulphur dioxide emissions will be recommended.

**B. Nitrogen Oxide**

Ambient air concentrations of Nitrogen oxides, expressed as NO<sub>x</sub> should not be exceed the following:-

Annual Arithmetic Mean  $100\mu\text{g}/\text{m}^3$   
(0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere should be maintained as follows:-

For fuel fired steam generators as Nanogram ( $10^0$ -gram) per joule of heat input:

Liquid fossil fuel	..	..	..	130
Solid fossil fuel..	..	..	..	300
Lignite fossil fuel	..	..	..	260

Note:- Dilution of gaseous emissions to bring them to the STANDARDS limiting value is not permissible through excess air mixing blowing before emitting into the environment.



Sindh Environmental Quality Standards for Motor  
Vehicle Exhaust and Noise

(i) For in-use Vehicles				
S. No.	Parameter	Standards (maximum permissible limit)	Measuring Method	Applicability
1	2	3	4	5
1.	Smoke	40% or on the Ringleman Scale during engine acceleration mode	To be compared with Ringleman Chart at a distance of 6 meters or more.	Immediate effect
2	Carbon Monoxide	6 %	Under idling conditions: Non- dispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A)	Sound-meter at 7.5 meter from the source.	

For new Vehicles

**EMISSION STANDARDS FOR DIESEL VEHICLES**

(a) For passenger Cars and Light Commercial Vehicles (g/Km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8
Passenger Cars.	M I: with reference mass (RW).	Pak-II, IDI	1.0	0.7	0.08		All imported and local manufactured
	up to 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II DI	1.0	0.9	0.10	NEDC (ECE 15+ EUDCL)	Diesel vehicles with effect from 01-07-2012
Light Commercial Vehicles	NI-I (RW<1250 Kg)	Pak-II IDI	1.0	0.70	0.08		
		Pak-II DI	1.0	0.90	0.10		
	NI-II(1250kg< RW < 1700 Kg)	Pak-II IDI	1.25	1.0	0.12		
		Pak-II DI	1.25	1.3	0.14		
	NI-III(RW< 1700 Kg)	Pak-II IDI	1.50	1.2	0.17		
		Pak-II DI	1.50	1.6	0.20		



## Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the source
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## (b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Category/ Class	Tiers	CO	HC	NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8	9
Heavy Duty Diesel Engines	Turks and Buses	Pak-II	4.0	1.1	7.0	0.15	ECE-R-49	All Imported and local manufactured diesel vehicles with the effect 1-7-2012
Large goods Vehicles	N2(2000 and up	Pak-II	4.0	7.0	1.10	0.15	EDC	

## Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the Source
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## Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/ Class	Tier	Co	HC+ NOx	Measuring Method	Applicability
1	2	3	4	5	6	7
Passenger Cars.	M 1: with reference mass (RW). upto 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II	2.20	0.5	NEDC (ECE 15 + EUDCL)	All imported and new models * locally manufactured petrol vehicles with effect from 1 <sup>st</sup> July, 2009**



Light Commercial Vehicles	NI-I (RW<1250 kg) NI-II (1250kg> kg RW< 1700 Kg)	Pak-II	2.20	0.5	
		Pak-II	4.0	0.65	
		Pak-II	5.0	0.08	
	NI-III(RW> 1700 kg)				
Motor Rickshaws & Motor Cycles	2,4 strokes < 150 cc	Pak-II	5.5	1.5	ECER 40
	2,4 strokes > 150cc	Pak-II	5.5	1.3	

#### Parameter Standards (maximum permissible limit) Measuring method

Noise source                      85 db (A)                      Sound-meter at 7.5 meters from the

#### Explanations:

- DI: Direct Injection.  
 IDI: Indirect Injection.  
 EUDCL: Extra Urban Driving Cycle.  
 NEDC: New European Driving Cycle.  
 ECE: Urban Driving Cycle.  
 M: Vehicles designed and constructed for the carriage of passenger and Comprising no more than eight seats in addition to the driver's seat.  
 N: Motor vehicles with at least four wheels designed and constructed for the carriage of goods.  
 \* New model means both model and engine type change.  
 \*\* The existing models of petrol driven vehicles locally manufactured will immediately switch over to Pak-II emission standards but no late than 30<sup>th</sup> June, 2012.



SINDH ENVIRONMENTAL QUALITY STANDARDS FOR AMBIENT AIR

Pollutants	Time-weight average	Concentration in Ambient Air	Method of measurement
Sulphur Dioxide(SO <sub>2</sub> )	Annual Average*	80 µg/m <sup>3</sup>	Ultraviolet Fluorescence method
Oxides of Nitrogen as (NO)	24 hours**	120 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
Oxides of Nitrogen as (NO <sub>2</sub> )	Annual Average*	40 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
O <sub>3</sub>	24 hours**	40 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
	Annual Average*	80 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
	24 hours**	40 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
	24 hours**	80 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
	1 hour	130 µg/m <sup>3</sup>	Non dispersive UV absorption method
Suspended Particulate Matters(SPM)	Annual Average*	360 µg/m <sup>3</sup>	High Volume Sampling (Average flow rate not less than 1 l in 3/minutes)
Respirable Particulate Matter PM10	24 hours**	500 µg/m <sup>3</sup>	B Ray absorption method
Respirable Particulate Matter PM10	Annual Average*	120 µg/m <sup>3</sup>	B Ray absorption method
Respirable Particulate Matter PM10	24 hours**	150 µg/m <sup>3</sup>	B Ray absorption method
Respirable Particulate Matter PM10	Annual Average*	40 µg/m <sup>3</sup> ***	B Ray absorption method
Respirable Particulate Matter PM10	24 hours**	75 µg/m <sup>3</sup>	B Ray absorption method
Respirable Particulate Matter PM10	Annual Average*	40 µg/m <sup>3</sup> ***	B Ray absorption method
Respirable Particulate Matter PM10	24 hours**	75 µg/m <sup>3</sup>	B Ray absorption method
Respirable Particulate Matter PM10	Annual Average*	40 µg/m <sup>3</sup> ***	B Ray absorption method
Respirable Particulate Matter PM10	24 hours**	75 µg/m <sup>3</sup>	B Ray absorption method
Lead Pb	Annual Average*	1 µg/m <sup>3</sup>	ASS Method after sampling using EPM 2000 or equivalent filter paper
Lead Pb	24 hours**	1.5 µg/m <sup>3</sup>	ASS Method after sampling using EPM 2000 or equivalent filter paper
Carbon Monoxide(CO)	8 hours**	5 mg/m <sup>3</sup>	Non Dispersive Infra Red(NDIR) method
Carbon Monoxide(CO)	1 hours**	10 mg/m <sup>3</sup>	Non Dispersive Infra Red(NDIR) method



\*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly and at uniform interval.

\*\* 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

\*\*\* Annual Average limit of  $40\mu\text{g}/\text{m}^3$  or background annual average concentration plus allowable allowance of  $9\mu\text{g}/\text{m}^3$ , whichever is lower.

### Sindh Standards for Drinking Water Quality

Properties / Parameters	Standard Values for Sindh	WHO Standards	Remarks
<b>Bacterial</b>			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample  In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Must not be detectable in any 100 ml sample  In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Most Asian countries also follow WHO standards
<b>Physical</b>			
Colour	$\leq 15$ TCU	$\leq 15$ TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non	Non	



	objectionable/Acceptable	objectionable/Acceptable
Turbidity	< 5 NTU	< 5 NTU
Total hardness as CaCO <sub>3</sub>	< 500 mg/l	---
TDS	< 1000	< 1000
pH	6.5 – 8.5	6.5 – 8.5
<b>Chemical</b>		
<i>Essential Inorganic</i>	<i>mg/Litre</i>	<i>mg/Litre</i>
Aluminium (Al) mg/l	≤ 0.2	0.2

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
<i>Toxic Inorganic</i>	<i>mg/Liter</i>	<i>mg/Litre</i>	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	
Nickel (Ni)	≤ 0.02	0.02	



Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Nitrate (NO <sub>3</sub> )	≤ 0.50	50	
Nitrite (NO <sub>2</sub> )	≤ 3 (P)	3	
Selenium (SE)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	---	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
<b>Organic</b>			
Pesticides mg/L		PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.***	Annex II
Phenolic compounds (as Phenols) mg/L		≤ 0.002	
Polynuclear aromatic hydrocarbons (as PAH g/L)		0.01 (By GC/MS method)	
<b>Radioactive</b>			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

\*\*\* PSQCA: Pakistan Standards Quality Control Authority

### Proviso:

The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The Arsenic concentrations in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centers are generally old and will take significant resources and time to get them replaced. In the recent past, Lead was completely phased out from petroleum



products to cut down Lead entering into environment. These steps will enable to achieve WHO guidelines for Arsenic, Lead, Cadmium and Zinc. However, for bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

### Sindh Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1 <sup>st</sup> Jan, 2015		Effective from 1 <sup>st</sup> January, 2015	
		Limit in dB(A) Leq *			
		Day Time	Night Time	Day Time	Night Time
1.	Residential Area (A)	65	50	55	45
2.	Commercial Area (B)	70	60	65	55
3.	Industrial Area (C)	80	75	75	65
4.	Silence Zone (D)	55	45	50	45

- Note: 1. Day time hours: 6:00 a.m to 10:00 p.m  
 2. Night time hours: 10:00 p.m to 6:00 a.m  
 3. Silence zone; Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts  
 4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.  
 \* dB(A) Leq; Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

### 3. Repeal and Savings.

- (1) The provisions of the Statutory Notification dated 10<sup>th</sup> August, 2000 and 18<sup>th</sup> October, 2010, issued by the Ministry of Environment, Government of Pakistan, to the extent of the Province of Sindh are hereby repealed.
- (2) All actions taken, proceedings initiated shall be deemed to have been taken and initiated validly under the the provisions of these Rules.

DIRECTOR GENERAL  
SINDH ENVIRONMENTAL PROTECTION  
AGENCY



# **ANNEXURE – IV**

## **Environmental Monitoring Reports**

Lab Report Ref. No.: QTS/SPP/22/5476

Reporting Date: 12/12/2022

Project Name: ESMP 175 MW Solar Power Plant Deh Mitha Ghar.

**SAMPLE DESCRIPTION**

Sample ID: Drinking water (Deh Mitha Ghar)  
Sample Type: Grab Sample  
Sample Collected/Submitted by: QTS Representative  
Sampling Date: 03/12/2022  
Sample Receipt at QTS - Date: 03/12/2022

**ANALYTICAL TEST REPORT**

S. NO.	PARAMETERS	STANDARDS	STANDARD	LDL	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.40	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.53	APHA-2020 B/C
5	Turbidity	< 5	< 5	0.01	NTU	0.51	APHA-2130 B
6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	2420*	Hach 8160
7	Total Hardness as CaCO <sub>3</sub>	< 500	180	0.1	mg/L	804*	EDTA Titration.Hach-8213
8	Fluoride (as F <sup>-</sup> )	≤ 1.5	≤ 1.5	0.01	mg/L	0.43	USEPA 340.1
9	Chloride (as Cl <sup>-</sup> )	< 250	< 250	0.1	mg/L	570*	Hach 8206
10	Nitrate (NO <sub>3</sub> )	≤ 50	≤ 50	0.01	mg/L	0.40	Hach -8039
11	Nitrite (NO <sub>2</sub> )	≤ 3	≤ 3	0.001	mg/L	0.055	Hach - 8153
12	Cyanide (as CN <sup>-</sup> ) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.031	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082
25	Zinc	5.0	3.0	0.01	mg/L	0.05	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.042	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
<b>MICROBIOLOGICAL ANALYSIS REPORT</b>							
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>300*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>150*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>100*	APHA-SM9221F

SSDWQ=Sindh Standard for Drinking Water Quality  
USEPA=United State Environmental Protection Agency method  
Hach USA, method  
BDL=Below Detection Limit  
NS= Not Specified

**Term & Condition:**

- This report is not valid for any negotiations.
- Report is valid for current batch(sample).
- The remaining portion of the sample will be discarded after 07 days unless otherwise instructed.
- This report is intended only for your guidance & not for legal purpose or for advertisement.

**Comments:**

\*Tested parameters are not within the SSDWQ and WHO Standards.

Sample Analyzed by: Hareem Zehra

Signature of Laboratory In charge:  
Name : Ali Raza



### Ambient Air Quality Test Report

Project Name:	ESMP 175 MW Solar Power Plant Deh Mitha Ghar	Test Report No:	QTS/SPP/22/5477-A
		Sample Duration:	24hr's
Sample Description:	Ambient Air Quality Test	Location: A	25°08'43.53"N 67°02'44.37"E

PARAMETERS								
Date	Time	NO (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SPM (µg/m <sup>3</sup> )	Lead (µg/m <sup>3</sup> )
06.12.2022	10:00	16.4	16.8	26.6	82	26	245	ND
	11:00	21.1	19.4	30.3	74	29	248	
	12:00	29.0	18.1	21.2	72	32	255	
	13:00	29.8	18.9	29.9	66	31	260	
	14:00	24.2	14.1	30.4	68	38	255	
	15:00	27.4	18.0	18.0	90	34	242	
	16:00	34.9	11.4	17.7	95	41	241	
	17:00	25.0	17.2	24.6	82	32	244	
	18:00	12.5	22.0	29.4	74	36	248	
	19:00	10.9	23.5	31.0	65	20	251	
	20:00	13.2	24.8	34.2	63	14	235	
	21:00	11.6	19.4	31.8	60	12	229	
	22:00	21.3	21.9	29.0	62	13	220	
	23:00	22.6	20.7	26.9	60	16	217	
07.12.2022	00:00	16.0	25.3	12.4	51	19	206	
	01:00	14.8	12.0	14.8	49	21	200	
	02:00	10.0	16.5	18.6	54	12	172	
	03:00	12.2	11.3	21.0	48	14	168	
	04:00	12.4	19.4	14.4	50	17	161	
	05:00	10.6	24.6	19.6	51	19	188	
	06:00	16.5	22.0	22.4	54	16	196	
	07:00	12.7	21.4	26.4	61	18	201	
	08:00	14.0	19.6	31.0	68	16	209	
	09:00	13.9	20.4	26.4	75	17	214	
MIN		10.0	11.3	12.4	48	12	161	
MAX		34.9	25.3	34.2	95	41	260	
AVG		18.3	19.0	24.4	66.0	22.9	220.2	
SEQS		40	80	120	150	75	500	1.5



### Ambient Air Quality Test Report

<b>Project Name:</b>	<b>ESMP 175 MW Solar Power Plant</b> Deh Mitha Ghar	<b>Test Report No:</b>	<b>QTS/SPP/22/5477-A</b>
		<b>Sample Duration:</b>	<b>24hr's</b>
<b>Sample Description:</b>	<b>Ambient Air Quality Test</b>	<b>Location: A</b>	<b>25°08'43.53"N</b> <b>67°02'44.37"E</b>

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m <sup>3</sup>	08 Hours	0.14	5.0	NA	Non Dispersive Infra Red (NDIR)
Nitrogen oxide (NO)	µg/m <sup>3</sup>	08 Hours	18.3	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	19.0	80.0	200	
Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	24.4	120.0	20	Ultraviolet Fluorescence Method
Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	01 Hour	16.4	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM <sub>10</sub> )	µg/m <sup>3</sup>	08 Hours	66.0	150.0	50	β Ray Absorption Method
Particulate Matter (PM <sub>2.5</sub> )	µg/m <sup>3</sup>	08 Hours	22.9	75.0	25	
Total Suspended Particles (TSP)	µg/m <sup>3</sup>	08 Hours	220.2	500.0	NA	
Lead	µg/m <sup>3</sup>	08 Hours	ND	1.5	NA	ASS Method

\*SEQS= Sindh Environmental Quality Standards.

\*IFC= International Finance Corporation

(24 Hours Standard for all the parameters Except O<sub>3</sub> and CO),

µg/m<sup>3</sup>= Micrograms per Cubic Meter

mg/m<sup>3</sup>= Milligrams per Cubic Meter

ppm = Parts per million

ND= Not Detected

**Remarks:**

The average concentration calculated for the 08 hours are well within guideline values set by SEQs

<b>Sample Analyzed By:</b> <u>Sajid Ali</u>	<b>Signature of Laboratory Incharge:</b> <b>Name : <u>Ali Raza</u></b>
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## Ambient Air Quality Test Report

<b>Project Name:</b>	<b>ESMP 175 MW Solar Power Plant</b> Deh Mitha Ghar	<b>Test Report No:</b>	<b>QTS/SPP/22/5477-B</b>
		<b>Sample Duration:</b>	<b>24hr's</b>
<b>Sample Description:</b>	<b>Ambient Air Quality Test</b>	<b>Location: B</b>	<b>25°09'31.55"N</b> <b>67°03'08.48"E</b>

PARAMETERS								
Date	Time	NO (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SPM (µg/m <sup>3</sup> )	Lead (µg/m <sup>3</sup> )
07.12.2022	10:00	22.2	33.8	22.4	77	21	215	ND
	11:00	24.7	29.4	20.3	94	19	224	
	12:00	18.0	28.1	31.2	102	22	225	
	13:00	17.2	28.9	34.9	116	21	234	
	14:00	14.2	24.1	26.4	118	31	245	
	15:00	17.4	28.0	27.0	102	34	236	
	16:00	14.9	31.4	27.7	95	28	230	
	17:00	15.0	27.2	14.6	92	22	226	
	18:00	22.5	32.0	19.4	86	26	218	
	19:00	20.9	26.5	21.0	75	22	211	
	20:00	19.2	20.8	24.2	73	24	205	
	21:00	21.4	16.4	21.8	80	16	199	
	22:00	14.2	11.9	19.0	74	18	190	
	23:00	12.6	12.7	16.9	70	15	184	
08.12.2022	00:00	13.8	15.3	22.0	62	14	186	
	01:00	16.9	22.0	24.8	68	19	180	
	02:00	20.0	19.5	19.6	74	22	172	
	03:00	22.6	16.3	12.4	68	24	158	
	04:00	14.4	18.6	19.9	60	21	144	
	05:00	16.2	14.2	22.6	61	16	158	
	06:00	18.4	12.9	26.4	64	19	186	
	07:00	19.7	13.6	16.3	66	19	198	
	08:00	22.0	22.8	21.8	68	22	201	
	09:00	23.4	24.3	19.4	70	26	204	
MIN		12.6	11.9	12.4	60	14	144	
MAX		24.7	33.8	34.9	118	34	245	
AVG		18.4	22.1	22.2	80.5	21.8	200.6	
SEQS		40	80	120	150	75	500	1.5





### Ambient Air Quality Test Report

<b>Project Name:</b>	<b>ESMP 175 MW Solar Power Plant</b> Deh Mitha Ghar	<b>Test Report No:</b>	<b>QTS/SPP/22/5477-B</b>
		<b>Sample Duration:</b>	<b>24hr's</b>
<b>Sample Description:</b>	<b>Ambient Air Quality Test</b>	<b>Location: B</b>	<b>25°09'31.55"N</b> <b>67°03'08.48"E</b>

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m <sup>3</sup>	08 Hours	0.08	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m <sup>3</sup>	08 Hours	18.4	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	22.1	80.0	200	
Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	22.2	120.0	20	Ultraviolet Fluorescence Method
Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	01 Hour	16.8	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM <sub>10</sub> )	µg/m <sup>3</sup>	08 Hours	80.5	150.0	50	β Ray Absorption Method
Particulate Matter (PM <sub>2.5</sub> )	µg/m <sup>3</sup>	08 Hours	21.8	75.0	25	
Total Suspended Particles (TSP)	µg/m <sup>3</sup>	08 Hours	200.6	500.0	NA	
Lead	µg/m <sup>3</sup>	08 Hours	ND	1.5	NA	ASS Method

\*SEQS= Sindh Environmental Quality Standards.

\*IFC= International Finance Corporation

(24 Hours Standard for all the parameters Except O<sub>3</sub> and CO),

µg/m<sup>3</sup>= Micrograms per Cubic Meter

mg/m<sup>3</sup>= Milligrams per Cubic Meter

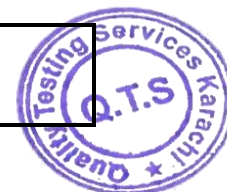
ppm = Parts per million

ND= Not Detected

#### Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQs

<b>Sample Analyzed By:</b> <u>Sajid Ali</u>	<b>Signature of Laboratory Incharge:</b> _____ <b>Name :</b> <u>Ali Raza</u>
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Lab Report Ref. No. : QTS/SPP/22/5479

Reporting Date: 12/12/2022

Project Name: ESMP 175 MW Solar Power Plant, Deh Mitha Ghar

SAMPLE DESCRIPTION	
Sample ID: <u>Noise Level Test</u>	
Sample Description: <u>Ambient Noise</u>	
No. of samples: <u>05</u>	
Sample Collected/Submitted by: <u>QTS representative</u>	
Sampling Date: <u>07/12/2022</u>	
Sample Receipt at QTS - Date: <u>07/12/2022</u>	

NOISE LEVEL TEST REPORT						
S.NO	LOCATION/SOURCE	Noise Level Readings				
		Minimum	Maximum	Average	SEQS	WHO
1	Point -1 25° 8'47.84"N 67° 2'35.99"E	50.4	52.8	51.6	Limits: *65dB(A)	Limits: *70dB(A)
2	Point -2 25° 9'53.28"N 67° 2'38.87"E	48.9	53.4	51.1		
3	Point -3 25° 8'51.76"N 67° 2'52.54"E	50.7	52.0	51.3		
4	Point -4 25° 9'31.15"N 67° 3'9.63"E	48.6	51.9	50.2		
5	Point -5 25° 8'36.56"N 67° 2'56.84"E	51.3	55.0	53.1		

SEQS = Sindh Environmental Quality Standards (Outside Noise Level)

dB (A) Leq=Time weighted average of the level of sound in decibel on scale which is relatable to human hearing.

**Term & Condition:**

- This report is not valid for any negotiations
- Report is valid for current batch(sample)
- This report is intended only for your guidance & not for legal purpose or for advertisement.

**Comments:**

The Noise Level from the sources is within acceptable level as describe in SEQs.

Sample Analyzed by: <u>Sajid Ali</u>	Signature of Laboratory In charge:  Name : <u>Ali Raza</u>
--------------------------------------	--



**IEE STUDIES FOR 120MW SOLAR POWER PLANT AT  
DEH BAND MURAD DISTRICT WEST, KARACHI**

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

INSTALLATION & COMMISSIONING OF  
**120 MW SOLAR**  
POWER PLANT IN DEH HALKANI  
AND DEH BAND MURAD DISTRICT  
WEST, KARACHI

FEBRUARY 2023



**EMC Pakistan  
Private Limited**



**SINDH SOLAR  
ENERGY PROJECT**



INITIAL ENVIRONMENTAL EXAMINATION (IEE)

INSTALLATION & COMMISSIONING OF  
**150 MW SOLAR**  
POWER PLANT IN DEH HALKANI  
AND DEH BAND MURAD DISTRICT  
WEST, KARACHI

FEBRUARY 2023



**EMC Pakistan  
Private Limited**



**SINDH SOLAR  
ENERGY PROJECT**





## **SINDH SOLAR ENERGY PROJECT**

### **INITIAL ENVIRONMENTAL EXAMINATION (IEE)**

**Installation and Commissioning of 120 MW Solar  
Power Plant in Deh Halkani and Deh Band Murad,  
District West, Karachi**

**Final Report  
Feb 2023**



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## Executive Summary

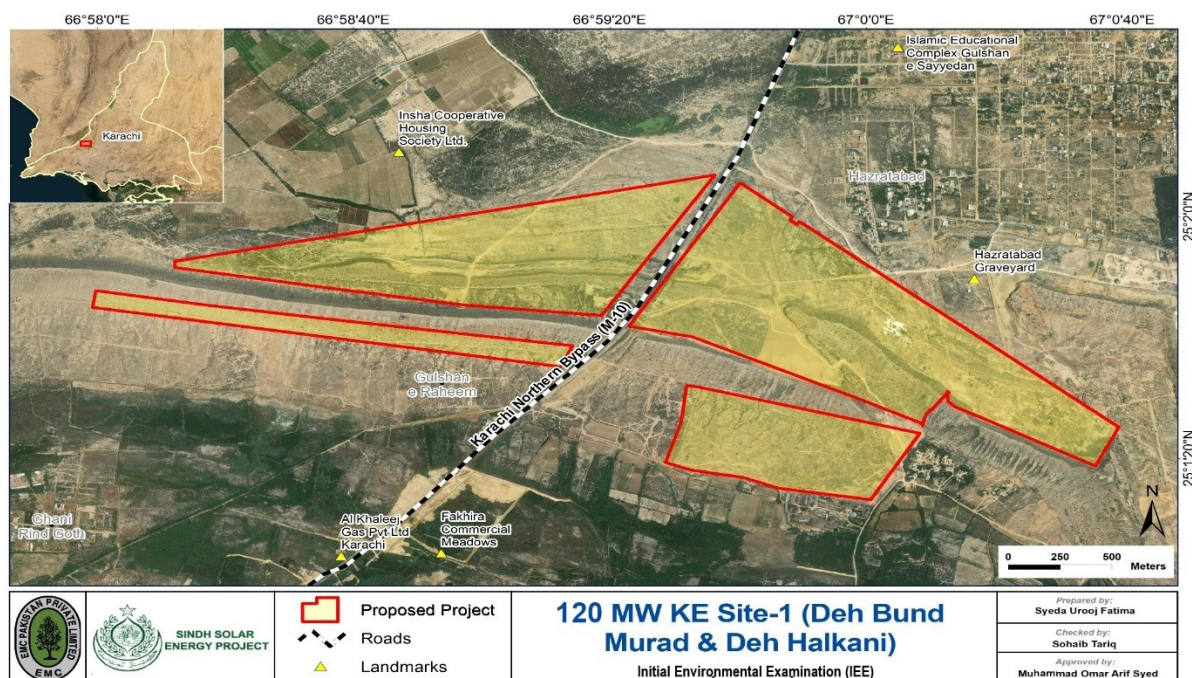
Sindh Solar Energy Project (SSEP) under Energy Department, Government of Sindh, plans to install and commission a 120MW Solar Power Plant (PP) in Deh Halkani and Deh Band Murad in District West, Karachi. The project will be located on the land of Government of Sindh (GoS).

The electricity generated by the project would be stepped up and sold to K-Electric Limited (KE). Project aims to meet the continuously increasing demand of electricity and at the same time reducing the carbon footprints by the development of this project. EMC Pakistan Pvt. Limited has been engaged by to conduct the Initial Environmental Examination (IEE) of the proposed project and to comply with the provisions of Sindh Environmental Protection Act, 2014 and the Sindh EPA Environmental Assessment Regulations, 2021.

Solar projects are listed in Schedule-II of the Sindh EPA Regulations 2021 therefore, IEE is conducted for solar projects because of their overall minimal impact on environment. Moreover, the SSEP (hereafter referred as proponent) itself initiates the IEE study to address and rectify any potential environmental impacts of the proposed project in design stage and well before the construction proceeds.

The microenvironment of the proposed project site is located in Deh Halkani and Deh Band Murad, District West, Karachi. Project location map is shown in figure ES-1.

The project will encompass 1) PV area having arrays of PV modules, tracking and mounting structures, inverters and cables 2) Switchyard having transformers, gantry and gas insulated switchgear (GIS) 3) MW switchgear room for protection and isolation of PV plant with grid 4) housing area for plant personnel 5) cleaning system for panels and 6) Weather station 7) ancillary facilities.



ES-1: Solar PV Power Plant Project Location

Environmental surveys were conducted to collect primary information for the project area. The environmental surveys focused on collection of specific baseline information of the project area including meteorology, air quality and noise assessment, ecology of the area and topography of the area.

The project site is open land, separated by Northern Bypass (M10) and by hills. The ambient air and noise quality presented in the baseline of this IEE shows that the air quality and noise levels meet the required Sindh Environmental Quality Standards (SEQS) limits. There is no surface water available in the close vicinity of the project site. Condition of the physical environment described above suggests that it would be difficult for natural vegetation to survive under harsh climatic conditions, accentuated by drought, making Xerophytes the dominant vegetation.

Most of the project's environmental and social impacts will be beneficial, including for example generation of clean electricity, saving of carbon footprint of energy generation, generation of employment for locals etc. However, during construction phase, there will be some negative environmental impacts including, air quality deterioration due to dust and exhaust emissions during construction activities. There are chances of groundwater quality deterioration, in particular during rainy season, due to spills from construction equipment, fuel, inadequate disposal of liquid and solid waste, possible noise emissions from running of construction machinery, community nuisance etc. These impacts require appropriate mitigation and management measures to contain them. The project specific measures suggested are; a) water should be sprinkled to suppress emission of dust. Wiping and sweeping should be adopted as a continuous activity to keep the site clean; b) machinery operation and high noise activities should be carefully planned and scheduled; c) sign postings, warning signs, diversion signs and barriers will be installed to alert nearby community of all potential hazards including limited access to construction sites; d) construction works related solid waste should be disposed to Landfill site; e) it will be ensured that the wastes generated from construction activities are stored in a proper interim location onsite which should be adequately barricaded and covered to avoid ingress of storm water. The location of onsite waste storage site will be selected by CC as per detailed construction plan; f) fuel oils and lubricants for construction machinery will be stored in covered diked areas, underlain with HDPE membrane; g) damage to ecology will be avoided by not altering the natural drainage pattern during construction; h) greening of the project site should include the plantation of native/indigenous trees and invasive species should be avoided; i) appropriate personal protective equipment (PPE) will be provided to construction labor to minimize risks, such as appropriate outerwear, safety shoes and gloves, safety helmets, harness etc.; j) extensive consultation with stakeholders will be carried out beforehand and their feedback, concerns and input will be taken into account in the project planning and execution; k) it will be ensured that the construction site is appropriately cordoned off with hard barricade; n) wastewater from discharged through Septic Tank connected with soakage pit. The main impact during operational phase is the disposal of disused and broken solar panels. They will be disposed through an EPA Certified Waste Contractor.

Environmental Management and Monitoring Plan (EMMP) presents mitigation measures of each environmental effect and monitoring parameters with responsibilities defined separately for each aspect. The environmental management and monitoring plan also presents the proposed corrective measures taken if the monitoring parameter results crosses the prescribed threshold limits defined under Sindh Environmental Quality Standards (SEQS).

*EMMP implementation cost:* The total cost of the EMMP implementation has been estimated to be about Pak Rupees **4.08 million**.



The IEE Study concludes that if the measures recommended in the Environmental Management Plan are implemented and the monitoring is carried out for the aspects in accordance with the monitoring plan, the proposed Solar PV Power Project will be a sustainable development and will provide clean energy over its lifetime.





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## Abbreviations and Acronyms

AC	Alternating Current
ARE	Alternative and Renewable Energy
BNEF	Bloomberg New Energy Finance Limited
CC	Construction Contractor
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
dB	Decibel (Unit of Sound level)
DC	Direct Current
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
EMMP	Environmental Management and Monitoring Plan
EPA	Environmental Protection Agency
GIS	Gas Insulated Switchgear
GS	Grid station
HSE	Health Safety and Environment
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEE	Initial Environmental Examination
ISO	International Organization for Standardization
KE	K-Electric
kV	Kilo Volt
kW	Kilo watt
NO <sub>2</sub>	Nitrogen dioxide
NO	Nitric oxide
NOC	No Objection Certificate
O <sub>3</sub>	Ozone
PCB	Polychlorinated Biphenyl
PM	Particulate Matter
PP	Power Plant
PPE	Personal Protective Equipment
PV	Photovoltaic
SCADA	Supervisory control and data acquisition
SEQS	Sindh Environmental Quality Standards
SF <sub>6</sub>	Sulfur Hexafluoride
SO <sub>2</sub>	Sulfur Dioxide
SO <sub>x</sub>	Sulfur Oxides
SPM	Suspended Particulate Matter
SSEP	Sindh Solar Energy Project
UTC	Coordinated Universal Time





## Chapter 1 INTRODUCTION

Sindh Solar Energy Project (SSEP) under Energy Department, Government of Sindh, plans to install and commission a 120MW Solar Power Plant (PP) in Deh Halkani and Deh Band Murad in District West, Karachi. The project will be located on GoS land.

The electricity generated by the project would be stepped up and sold to K-Electric Limited (KE). Project aims to meet the continuously increasing demand of electricity and at the same time reducing the carbon footprints by the development of this project. EMC Pakistan Pvt. Limited has been engaged by to conduct the Initial Environmental Examination (IEE) of the proposed project and to comply with the provisions of Sindh Environmental Protection Act, 2014 and the Sindh EPA Environmental Assessment Regulations, 2021.

### 1.1. Project Overview

The project involves construction, installation, operation, and maintenance of 120 MW Solar Power Plant over an area of about 612. The location of the project is shown in fig 1.1. The project will encompass 1) PV area having arrays of PV modules, tracking and mounting structures, inverters and cables 2) Switchyard having transformers, gantry and gas insulated switchgear 3) MW switchgear room for protection and isolation of PV plant with grid 4) housing area for plant personnel 5) cleaning system for panels 6) Weather station and 7) ancillary facilities.

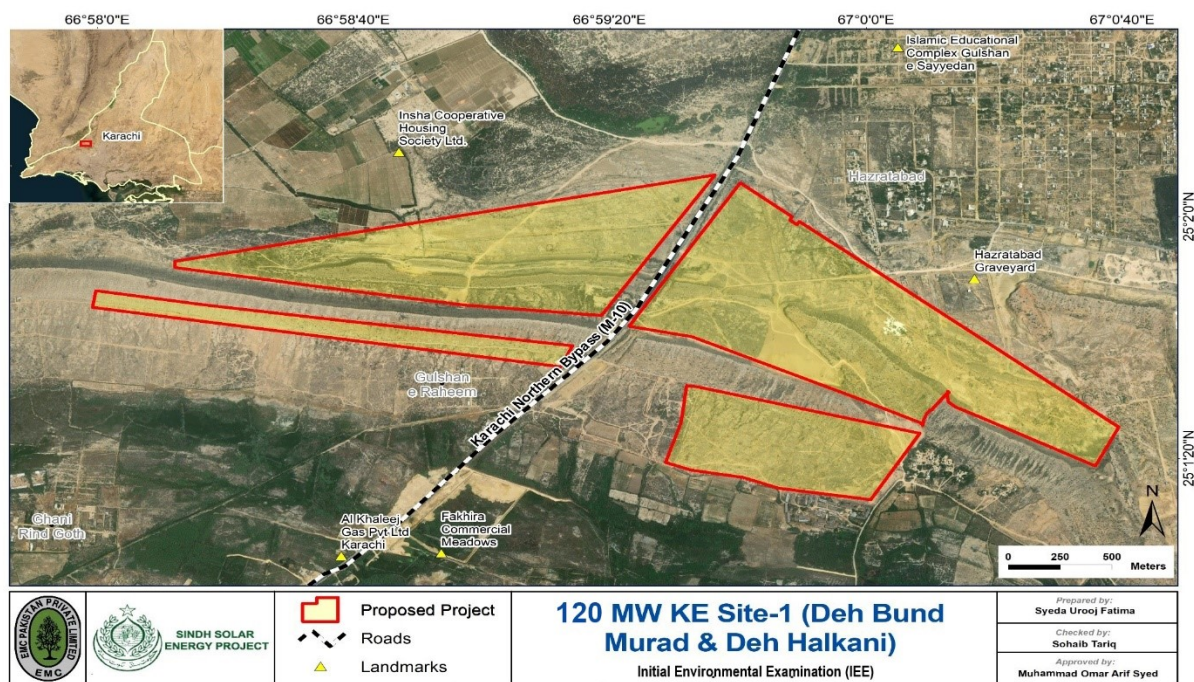


Figure 1.1: Location of Solar PP project

### 1.2. Project Categorization

Solar projects are listed in Schedule-II, therefore, IEE is conducted for solar projects because of their overall minimal impact on environment as per Sindh EPA Environmental Assessment Regulations 2021.

Project is categorized as;

Schedule-II – List of projects requiring IEE

B. Energy

9. All Renewable energy Projects (excluding Protected/Sensitive area under any law)

### 1.3.Objectives of IEE Study

It aims to predict environmental impacts at an early stage in project planning and design, finding ways and means to reduce the adverse impacts, shape projects to suit the local environment, and presenting options to decision-makers.

The main purpose of this IEE Study is to provide and analyze information on the nature and severity of environmental aspects and propose mitigation measures in case of negative impacts arising from the construction and operation of the project and related activities that would take place concurrently or subsequently. The IEE study will, in fact, respond to the provision Sindh Environmental Protection Act, 2014 and Guidelines for the Preparation and Review of Environmental Reports. The Study will:

- Identify all major and minor impacts, negative as well as positive, on the environment (physical and ecological) during its different stages viz. pre-construction, construction and operation of Project;
- Identify Socioeconomic aspects, and
- Devise Environmental Management & Monitoring Plan (EMMP) for sustainable operation of the Project.

### 1.4.Methodology Adopted for IEE Study

This Initial Environmental Examination (IEE) was conducted in the following manner:

#### Scoping

A scoping exercise was undertaken to identify the potential issues that are to be considered in the Initial Environmental Examination (IEE). The scoping exercise included the following tasks:

- **Data Compilation:** A generic description of the proposed activities relevant to this environmental assessment was compiled.
- **Primary data collection:** Primary data was collected through reconnaissance surveys and onsite environmental monitoring.
- **Review of Published literature:** All available published and unpublished information pertaining to the micro and macro environment of the study area was obtained and reviewed. It included the earlier studies conducted in the study area, environmental and social baselines and impact assessment studies conducted by different consultants in past. Secondary data was very helpful in understanding the issues that were identified by other consultants.
- **Review of applicable Legislation:** Information on relevant legislation, regulations, guidelines, and standards was reviewed and compiled.



- **Identification of potential impacts:** The information collected in the above procedures was reviewed and potential environmental impacts were identified.
- **Initial site visit:** An initial site visit was conducted to get an overview of site conditions and the surrounding areas.

### Review of Legislation and Guidelines

National legislation, international agreements and environmental guidelines were reviewed to set environmental standards that the SSEP will be required to follow during construction & operation phase of the project.

### Baseline Data Collection

Baseline Data was collected from different sources including electronic and print media, studies previously conducted by EMC Pakistan Pvt. Limited and archives of the experts, and field surveys conducted for this study by the team of EMC Pakistan Pvt. Limited etc.

Previous published and unpublished literature and other information were collected in order to gain a complete understanding of existing environmental conditions in the area including the following:

- **Physical environment:** Topography, geology, soil, water resources, ambient air, noise and climate;
- **Biological environment:** Flora and fauna within the proposed site and its surroundings;
- **Socio-economic environment:** Settlements, socio-economic conditions, infrastructure and land use; and

### Identification of Aspects

Identification of environmental aspects and their significance is fundamentally important for the determination of severity of incidence of impacts at different stages of the project. This step is aimed at obtaining an inventory of the aspects. The aspects identified during this step cover all activities like construction, installation and operation, in order to determine those which, have or can have a significant impact on the environment.

### Impact Assessment & EMMP

Environmental experts at EMC Pakistan Pvt. Limited analyzed and assessed the anticipated impacts that are likely to arise due to the identified aspects. Potential impacts were evaluated using the environmental, ecological, socioeconomic, and project information collected. The impact assessment covers the following aspects:

- Potential change in environmental parameters likely to be affected by Project-related activities;
- Prediction of potential impacts;
- Evaluation of the likelihood and significance of potential impacts;
- Defining of mitigation measures to reduce impacts to as low as reasonably practicable;
- Prediction of any residual impacts, including all long-term and short-term, direct and indirect, and beneficial and adverse impacts; and



- Monitoring of residual impacts.

An environmental management & monitoring plan (EMMP) was developed to oversee the environmental performance of the project, adoption of proposed mitigation measures, to monitor impacts of all activities and performance of mitigation measures and to identify the residual impact, and also the positive/negative changes in the physical, ecological, and socioeconomic environment.

### Documentation & Review

This is the final step of the IEE study. The data generated during and for the study was compiled and examined by experts. Sections of this report were prepared as the study progressed, by consultation with experts. The report was finally reviewed by Team Leader, who analyzed the information, assessed the potential environmental impacts in the light of national and international guidelines, and examined the alternatives in the light of observations on the field as well as meetings with the stakeholders.

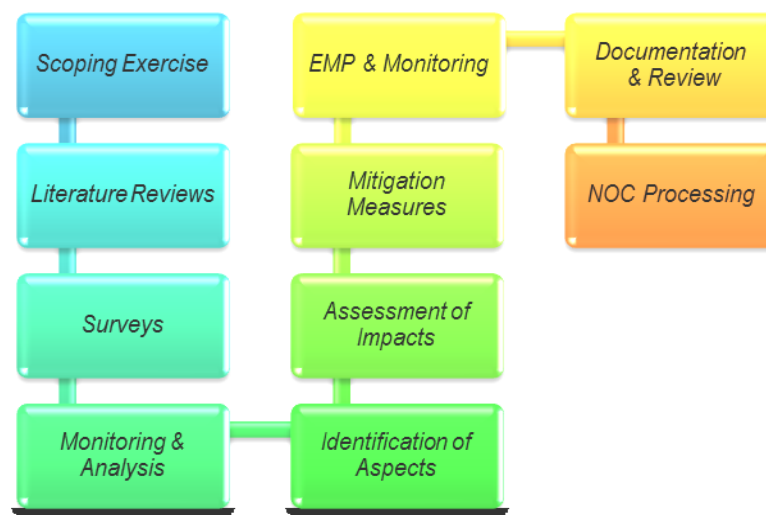


Figure 1-2: IEE Methodology

### 1.5. Structure of IEE

This document is structured as follows:

- **Chapter 1:** Introduction to Project and IEE Processes;
- **Chapter 2:** Provides an overall description of the project;
- **Chapter 3:** Describes the legislative and policy framework governing the project;
- **Chapter 4:** Provides environmental (Physical & Biological) and Social baseline conditions of the macro and microenvironment of the project area;
- **Chapter 5:** Screening of environmental impacts of the project and appropriate mitigation measures;
- **Chapter 6:** Provides environmental management and monitoring plan (EMMP); and
- **Chapter 7:** Provides conclusions and recommendations.

The main text of the report is supported by a series of Annexure which provides supplementary information including respective sections of prominent provincial and national laws and guidelines.



## 1.6.IEE Team

EMC Pakistan Pvt. Limited formed the following team for conducting the Initial Environmental Examination (IEE) of the proposed Solar Power Plant in District West, Karachi.

Table 1-1: List of IEE Study Team		
S. No.	Name of Experts	Position in IEE Team
1.	Mr. Syed Nadeem Arif	Director/Team Lead
2.	Mr. Ahmed Zohair Siddiqui	Deputy Team Lead
3.	Mr. Tanvir Ahmed	Senior Sociologist
4.	Mr. Sohaib Tariq	Environmental Engineer
5.	Mr. Syed M. Omer Arif	Environmental Engineer
6.	Ms. Saira Tariq	Environmentalist
7.	Mr. Ather Adil	Field Monitor





## Chapter 2 PROJECT DESCRIPTION

### 2.1. Project Ownership

120MW Solar Power Plant Project in Deh Halkani and Deh Band Murad is being developed by Sindh Solar Energy Project (SSEP), Energy Department, GoS.

### 2.2. Project Location

The project is located in Deh Halkani and Deh Band Murad, District West, Karachi. The Project will be installed at the site allocated by GoS with location shown map shown below;

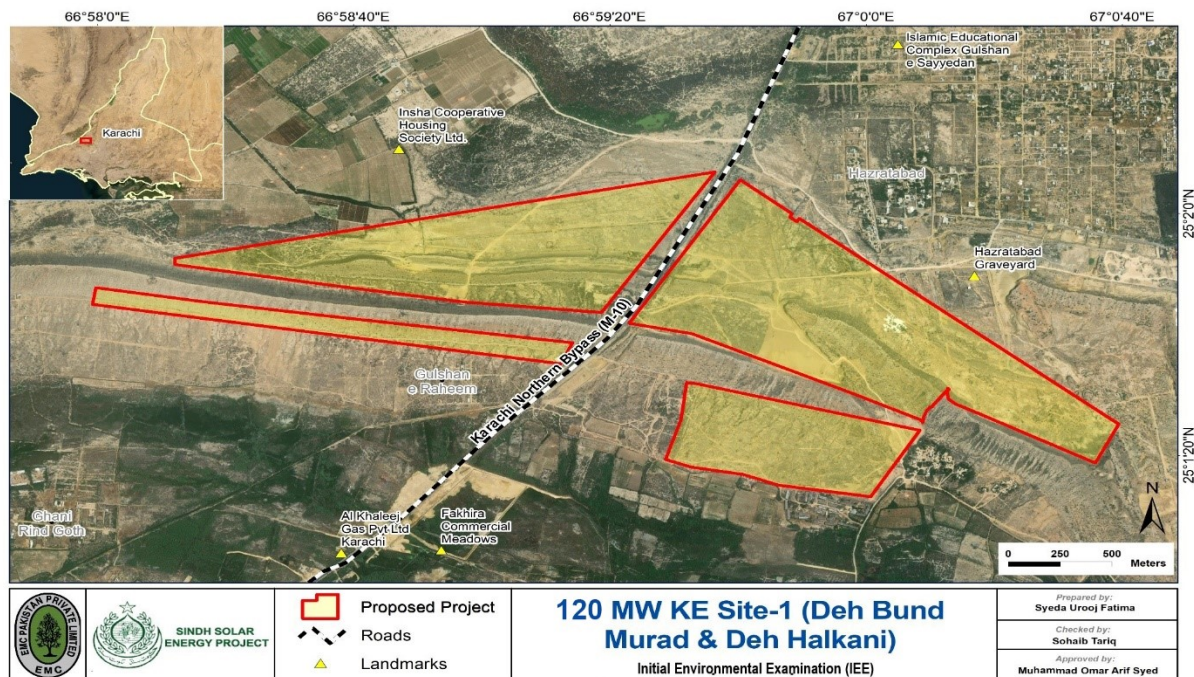


Figure 2.1: Satellite Imagery of Location of Solar PP project

### 2.3. Project Technical Details

All plant and equipment shall be new and shall be designed, manufactured, and tested in accordance with the latest IEC or other equivalent standards.

Major equipment/structure that is to be installed at each site is detailed below:

#### Solar Panel

Latest technology including single-axis tracking of panel considering the site/area condition shall be selected.

#### Power Inverters

The project site shall consist of inverters for converting 120MW DC power to AC, which would either be String or central inverters having standard warranty period, efficiency 97% or above and complying with IEC/UL Standards.

### **Power Transformer and other Switchyard Equipment**

The Complex design will include the step-up transformers and shall comprise of adequate electrical and mechanical protections to ensure safety and reliability.

### **SCADA, Tele-Communication and Protection Schemes**

SCADA, telecommunication and tele-protection equipment of the Complex side shall be two channels established till load dispatch center for data transfer to SCADA system. Each transmission line will have dedicated protection relays. Bus-bar protection and step-up transformer protection will be as per Complex design.

### **Weather Station**

Weather station will include the equipment to measure wind speed, tilted irradiance, horizontal irradiance, ambient temperature, PV panel temperature etc.

### **Civil/ Mounting Structure**

Mounting system shall be directly anchored into the ground (driven piers, concrete footers, ground screws, etc.). Mounting system shall be selected so as to withstand wind speeds, earthquakes, floods etc. in the region and ensure design operations for the life of the project. Civil design of Plant shall have provision for flood water outlet too.

### **Balance of System:**

The BOS will be selected to ensure that the system is able to service for the life of the project, broadly some of the aspects of the BOS are:

Medium voltage switchgears, MV transformer, DC system, control and protection equipment of adequate capacities and complying with IEC standards. MV and LV Cabling shall be according to site conditions and Plant design.

RO plant (if required) shall be installed for cleaning and plant operational services. Outdoor electronic equipment and panels having Ingress protection class 65. Substation properly equipped with LV Power supplies, back-up power supplies, UPS, Diesel generators, auxiliary transformers, telephone and internet connection, lighting, HVAC, water supplies, drainage, fire and intruder alarms, PV plant earthing, cables protection and insulation monitoring etc.

### **Safety & Security**

Lighting arrestors, proper grounding of all equipment shall be ensured and surge protection shall be provided on all electrical systems. There will be underground interconnecting solar arrays. Fire safety protection and adequate lighting at regular intervals to ensure visibility at all times. Fencing and surveillance to ensure security of the complex, security cameras and microwave sensors etc.

### **Interconnection Requirements**

The interconnection point will be droppers from the terminal tower connected to the gantry of transmission lines and the proposed interconnection scheme will be double circuit in-out from transmission line.



## **Chapter 3 ENVIRONMENTAL LAWS, POLICIES AND GUIDELINES**

This section provides detailed review of policies, legislation, and guidelines that have relevance to the proposed Solar PV Power Plant project and review of administrative framework as well as institutional set-up relevant to the environmental and social management of the proposed subproject.

### **3.1. National Laws and Regulations**

Pakistan's statute books contain a number of laws related to the regulation and control of the environmental and social aspects. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new practice. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context-specific. After the Eighteenth amendment in the Constitution of Pakistan, many federal subjects devolved to provincial legislation. The Concurrent List in fourth schedule of the Constitution containing entries of subjects wherein federal and provincial legislation could legislate has been abolished. Since project coverage is in province of Sindh; therefore, only those national laws and regulations are discussed here which have application in the project. There are still several federal laws which have not been repealed by the provinces and applicable in provinces with its original titles. The laws relevant to the proposed subproject are briefly reviewed below.

#### **3.1.1 National Environmental Policy, 2005**

The National Environmental Policy, 2005 aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life for the citizens through sustainable development. It provides an overarching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives direction for addressing the cross sectorial issues as well as the underlying causes of environmental degradation and meeting international obligations.

The National Environmental Policy, 2005 while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provide broad guidelines to the Federal Government, Provincial Governments, Federally Administrated Territories and Local Governments for addressing environmental concerns and ensuring effective management of their environmental resources.

#### **3.1.2 National Conservation Strategy, 1992**

The Pakistan National Conservation Strategy (NCS) is the principal policy document for environmental issues in the country. The NCS was developed and approved by the Government of Pakistan in 1992. The NCS works on a ten-year planning and implementation cycle. It deals with fourteen core areas as follows:

- Maintaining soils in cropland;
- Increasing irrigation efficiency;
- Protecting watersheds;
- Supporting forestry and plantations;
- Restoring rangelands and improving livestock;



- Protecting water bodies and sustaining fisheries;
- Conserving of biodiversity;
- Increasing energy efficiency;
- Developing and deploying material and energy renewable;
- Preventing and abating pollution;
- Managing urban wastes;
- Supporting institutions for common resources;
- Integrating population and environmental programs;
- Preserving the cultural heritage

### **3.1.3 Land Acquisition Act, 1894**

This Act is a colonial legacy which provides law for the acquisition of land needed for public purposes. The Act provides complete mechanism for determining the amount of compensation for land, trees, horticulture, to be made on account of such acquisitions. The law provides details of various peculiarities involved in acquisition of land such as preliminary investigation, objection to acquisition, declaration of intended acquisition, enquiry into measurements, value & claims, taking possession, reference to court and procedure thereon, apportionment of compensation, payment, temporary occupation of land, acquisition of land for companies, disputes resolutions, penalties and exemptions, etc. This Act has 55 sections addressing different areas. Section 4(2) of the Act mentions that it shall be lawful for any official authorized by the Collector to enter upon and survey, to dig or to do all other acts necessary to ascertain whether the land is suitable for such purpose.

The LAA and its implementation rules require that impacts assessment/valuation effort, land and crops are compensated in cash at market rate to titled land owners and registered land tenants/users, respectively.

Based on the LAA, only legal owners/title holders and tenants registered with Land Revenue Department or possessing formal lease agreements, are eligible for compensation or livelihood support. However, other national projects, have been awarded compensation and assistance, in good faith, to non-title holders and other forms of PAPs (squatters /encroachers) based on their own resettlement policies.

The project will be developed on the land of GoS. Land acquisition is not required.

## **3.2 Provincial Laws and Regulations**

### **3.2.1 Sindh Environmental Protection Act, 2014**

Sindh Environmental Protection Agency as a part of Sindh Act No. VIII of 2014 prepared Sindh Environmental Protection Act (SEPA), 2014 which was passed by the provincial assembly of Sindh on 24th February, 2014 and asserted by the Governor of Sindh on 19th March, 2014 and notified on 20th March, 2014. It is a fairly comprehensive legislation and provides legislative framework for protection, conservation, rehabilitation and improvement of the environment. It contains concrete action plans and programs for the prevention of pollution and promotes sustainable development.

Act has 11 parts with 37 Sections followed by sub-sections and clauses. Part VI is related to the environmental examinations and assessments while part X is related to the public participation.



### **3.2.2 Sindh EPA (Environmental Assessment) Regulations, 2021**

These regulations set out:

- Key policy and procedural requirements for filing an EIA;
- The purpose of environmental assessment;
- The goals of sustainable development;
- The requirement that environmental assessment be integrated with feasibility studies;
- The jurisdiction of the Provincial EPA and Planning & Development (P&D) Departments;
- The responsibilities of proponents;
- Duties of responsible authorities;
- Provides schedules of proposals that the Project requires either EC, IEE or an EIA;
- The environmental screening process of the projects under schedule I, II and III; and
- The procedure for the environmental approval for filing the case with the Sindh EPA for the granting of the NOC.

### **3.2.3 Sindh Environmental Quality Standards (SEQS)**

SEPA has formulated the Sindh Environmental Quality Standards (SEQS) as per Clause (g) of sub-section (1) of Section 6 of SEPA Act 2014. The SEQS were promulgated in 2016 which includes standards for liquid effluent, industrial gaseous emissions, ambient air, drinking water quality, noise levels and standards for motor vehicle exhaust, diesel vehicle, and petrol vehicles.

### **3.2.4 Sindh Wildlife (Protection, Preservation, Conservation and Management) Act, 2020**

This Act provides for the preservation, protection, conservation and management of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the Act.

The Act also provides classifications of the protected areas; national parks, wildlife sanctuaries, game reserves and private game reserves, community game reserves. Activities such as hunting and breaking of land for mining are prohibited in national parks, as are removing vegetation or polluting water flowing through the park. Wildlife sanctuaries are areas that have been set aside as undisturbed breeding grounds and cultivation and grazing is prohibited in the demarked areas. Nobody is allowed to reside in a wildlife sanctuary and entrance for the general public is by special dispensation. However, these restrictions may be relaxed for scientific purpose or betterment of the respective area on the discretion of the governing authority in exceptional circumstances. Game reserves are designated as areas where hunting and shooting is not allowed except under special permits.

The project site does not fall in under any protected area.





### **3.2.5 Sindh Occupational Health and Safety Act, 2017**

The act makes provisions for occupational safety and health conditions at all workplaces in the province for the protection of workers during work. Under the Act, an Occupational Safety and Health Council will be established in Sindh with secretary of Sindh government's Labor and Human Resources Department as its chairperson.

The proposed council lays down penalties in case of death and injury due to violation. In case of death sub-section 01 of section 38 will accord 2 years' imprisonment or a fine of PKR 100,000 or both. Similarly, in case of injury the imprisonment may extend to six months or a fine up to PKR 20,000 or both.

### **3.2.6 Hazardous Substances Rules, 2014**

The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. General safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are also described in these rules.

## **3.3 Administrative Framework**

Environmental issues are governed by Provincial Government. The Government of Sindh (GOS) has designated its Environment Protection Department (SEPA), to administer matters related to the environment in the province.

### **3.3.1 Institutional Setup for Environmental Management**

The highest environmental body in the country is the Pakistan Environmental Protection Council (PEPC), which is presided over by the Chief Executive of the country. Other bodies include the Pakistan Environmental Protection Agency (Pak-EPA), provincial EPAs (for four provinces, AJK and Northern Areas), and Environmental Tribunals. The Federal government has also formed the Federal EPA, which is headed by a Director General and has wide-ranging functions given in PEPA 1997. These include the preparation and coordination of national environmental policy for approval by the PEPC, administering and implementing the PEPA 1997 and preparation, revision or establishment of NEQS. The Provincial Environmental Protection Agencies are formed by the respective Provincial Governments. A Director General who exercises powers delegated to him by the Provincial Government heads each Provincial EPA. IEEs and EIAs are submitted to provincial EPAs for approval.

## **3.4 Environmental and Social Guidelines**

Two sets of guidelines, the Pakistan-EPA's guidelines and the World Bank Guidelines are reviewed here. These guidelines address the environmental as well as social aspects.

### **3.4.1 Environmental Protection Agency's Environmental and Social Guidelines**

The Federal EPA has prepared a set of guidelines for conducting environmental and social assessments. The guidelines derive from much of the existing work done by international donor agencies and NGOs. The package of regulations, of which the environmental and social guidelines form a part, includes the PEPA 1997 and the NEQS. These guidelines are listed below followed by comments on their relevance to proposed project:



- **Policy and Procedures for Filing, Review and Approval of Environmental Assessments, Pakistan Environmental Protection Agency, September 1997:** These guidelines define the policy context and the administrative procedures that govern the environmental assessment process from the project pre-feasibility stage to the approval of the environmental report. The section on administrative procedures has been superseded by the IEE-EIA Regulations, 2000.
- **Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997:** The guidelines on the preparation and review of environmental reports target project proponents and specify:
  - The nature of the information to be included in environmental reports
  - The minimum qualifications of the EIA conductors appointed
  - The need to incorporate suitable mitigation measures at every stage of project implementation
  - The need to specify monitoring procedures.
- The terms of reference for the reports are to be prepared by the project proponents themselves. The report must contain baseline data on the Study Area, detailed assessment thereof, and mitigation measures.
- **Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May 1997:** These guidelines support the two guidelines mentioned above. They deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in any impact assessment study.
- **Guidelines for Sensitive and Critical Areas:** The guidelines identify officially notified protected areas in Pakistan, including critical ecosystems, archaeological sites, etc., and present checklists for environmental assessment procedures to be carried out inside or near such sites. Environmentally sensitive areas include, among others, archaeological sites, biosphere reserves and natural parks, and wildlife sanctuaries and preserves.

### 3.4.2 World Bank Social Guidelines

The principal World Bank publications that contain environmental and social guidelines are listed below.

- Environment, Health, and Safety (EHS) Guidelines prepared by International Finance Corporation and World Bank in 2007
- Pollution Prevention and Abatement Handbook 1998: Towards Cleaner Production
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues.
- Social Analysis Sourcebook

### 3.4.3 IFC General EHS Guidelines

The EHS guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects; however, these guidelines have been benefited from for other projects as well. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during construction,



operation, and decommissioning phase of a project or facility. Environmental issues associated with the construction and maintenance activities may include, among others, noise and vibration, soil erosion, and threats to biodiversity including habitat alteration and impacts to wildlife.

Examples of the impacts addressed in the General EHS Guidelines include:

- Construction site waste generation;
- Soil erosion and sediment control from materials sourcing areas and site preparation activities;
- Fugitive dust & other emissions (e.g., from vehicle traffic, land clearing activities, & materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities.



## Chapter 4 ENVIRONMENTAL & SOCIAL BASELINE

### 4.1 General

The baseline study is the existing environmental conditions of the project area related to the physical, biological and socio-economic environment prior to the beginning of construction activities. The existing baseline study would assist in understanding the prevalent macro and micro environment of this project and would also enable assessment of possible environmental impacts that may arise as a result of the activities associated with the project. It would also assist the design team in defining the mitigation measures that would be required to minimize the negative impacts which are identified in this study.

The microenvironment of the proposed project site is located in Deh Halkani and Deh Band Murad, District West, Karachi. Project surroundings comprise of farmlands, sand quarry, settlements/goths and prospective house societies. Prominent settlement is Hazaratabad. Gulshan e Raheem is a prospective house society in project vicinity. Gul Muhammad Qalandarani Goth is at a distance from the project site northwards. Primary accessible road to the project area is Karachi Northern Bypass (M-10).







Right Portion of project site

Figure 4.1: Photographs from project site



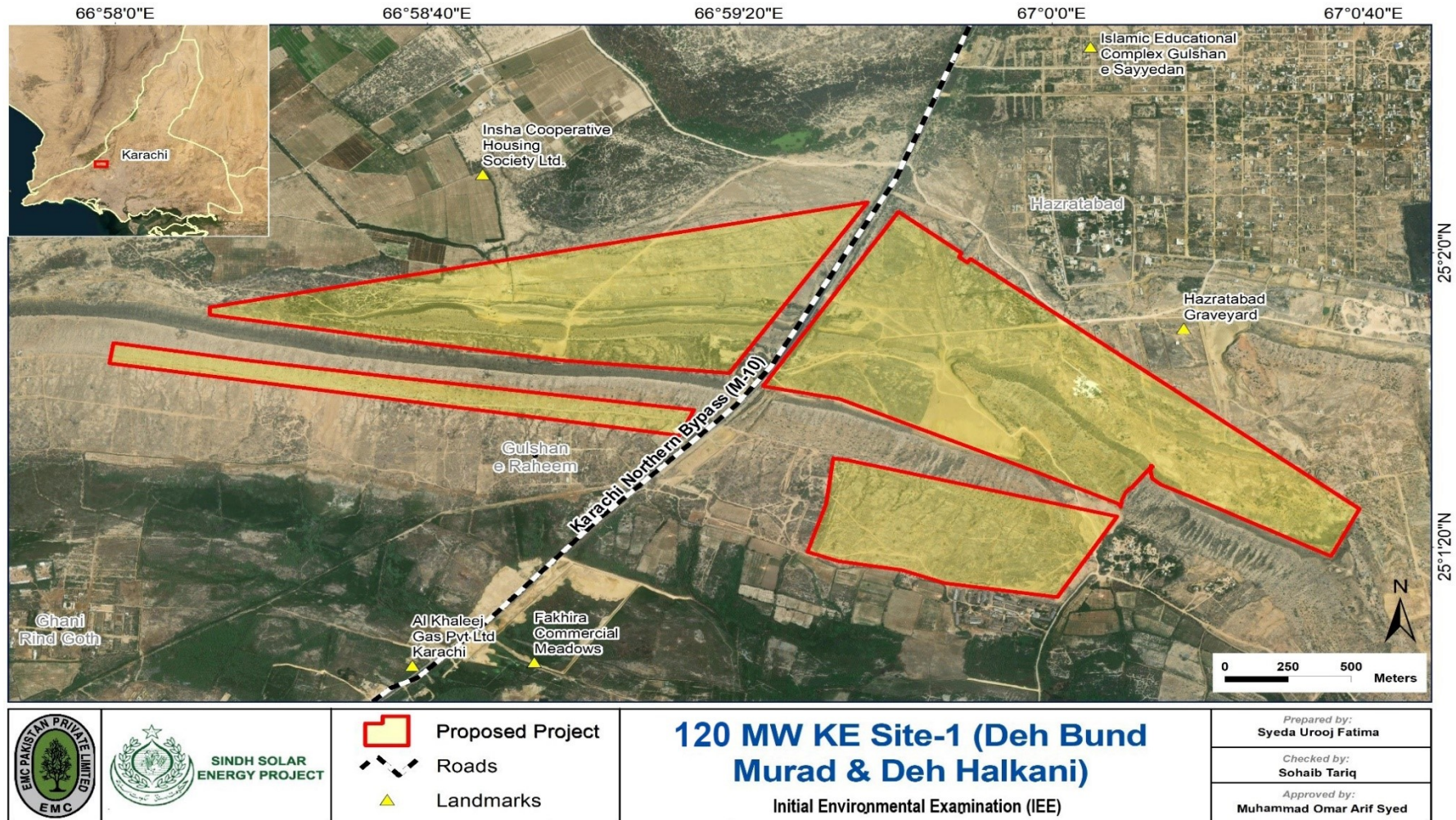


Figure 4.2: Location Map of Proposed power plant

## 4.2 Geography

**Geology:** Karachi is the part of major synclinorium stretching from Ranpathani River in the east to Cape Monze in the west, Mehar and Mole Jabal (Mountains) in the north. Within the synclinorium a number of structures such as Pipri, Gulistan-e-Jauhar, Pir Mango and Cape Monze are exposed. The presence of concealed structures under the Malir River valley, Gadap and Maripur plains can fairly be deduced.

Rock aggregates, sand, limestone and clay are some of the potentials for gainful utilization. Gulistan-e-Jauhar member of the Gaj formation offers groundwater potential for limited use. The area is underlain by rocks of sedimentary origin ranging in age from Eocene to Recent. Major structural trends and the basin axis strike generally south but with a “bulge” to the east also called Karachi Arc (Bender and Raza 1995).

**Geomorphology of Karachi:** Karachi is located in the south of Sindh, on the coast of the Arabian Sea. It covers an area of approximately 3,600 km<sup>2</sup>, comprised largely of flat or rolling plains, with hills on the western and northern boundaries of the urban sprawl. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, hillocks. Classified according to physiographic features, Karachi City District can be divided into three broad categories: Hilly Region (Mountain Highland), Alluvial Plain (Piedmont Plain) and Coastal Areas (Valley Floor). The metropolitan area is divided by two non-perennial river streams namely Lyari and Malir Rivers. The Malir River flows from the east towards the south and centre, and the Lyari River flows from north to the south west. Gujjar and Orangi are the two main tributaries of the Lyari River while Thaddo and Chakalo are the main tributaries of the Malir River. The dry weather flow of both rivers carries urban sewage that is ultimately drained in the Arabian Sea. Among the various physiographic features, low flat-topped parallel hills devoid of vegetation, interspersed with widespread plains and dry riverbeds are the main topographic characteristics of the city.

The greatest height of the region is 250 ft. that gradually decreases to 5 ft above mean sea level along the coastline. The Karachi Harbour is a sheltered bay to the south-west of the city, protected from storms by the Sand spit Beach, the Manora Island and the Oyster Rocks.

The Arabian Sea beach lines the southern coastline of Karachi. Dense mangroves and creeks of the Indus delta can be found towards the south east side of the city. Towards the west and the north is Cape Monze, an area marked with projecting sea cliffs and rocky sandstone promontories.

**Soil:** The soil mainly consists of fill materials brown medium dense to dense, coarse sand, coarse sand and little clayey silt up to the depth of 10 feet from ground surface. Beneath this, substrata comprise of dense to brown hard, conglomerate fractured upto 25 ft.; then followed by the layer of brown soft to medium hard claystone deposits upto the depth of roughly 30ft..





### 4.3 Seismicity

Seismo-tectonic Study for macro-environment of Project site aims at elucidating the impact of tectonic movement induced seismicity on the microenvironment. Karachi is Pakistan's largest city with population exceeding 18 million and is amongst the top five most congested cities in the world. Karachi has experienced no earthquake related damage in the recorded history of past ~ 175 years. Yet, Karachi is located in a seismically active tectonic setting often compared to Los Angeles with active plate boundary faults and triple junctions within a radius of ~ 150 km. This discrepancy in earthquake history and seismo-tectonic setting has led to diverse seismic hazard assessments for Karachi ranging from assignment of seismic hazard zones I (least severe) to IV (most severe). Recent assessment adopted in Building Code of Pakistan (2007) assigns an intermediate seismic hazard value of 0.16–0.24 g (Zone IIB) to Karachi, which is broadly accepted but sometimes criticized to be an underestimation.

A recent study entitled "Seismic sources for southern Pakistan and seismic hazard assessment of Karachi"<sup>1</sup>, based on a new active fault's compilation and seismic sources definition together with incorporation of maximum possible information on historical earthquakes (up to 893AD), has led to a re-assessment of seismic hazard for Karachi using probabilistic and deterministic seismic hazard assessment approaches. The main findings of this study are:

- Karachi is assessed to be prone to ground motions ~ 0.25 g with metropolitan areas having hazard values between 0.21 and 0.25 g for 10% probability of exceedance in 50 years (475-year return period).
- The deterministic seismic hazard analysis suggests maximum that peak ground acceleration (PGA) varies from 0.19 to 0.99 g in Karachi and its higher values are concentrated around the Nagar Parker fault that is controlling and hazardous for Karachi.

Despite a safe seismic history spanning past about 175 years, Karachi is located in a tectonic setting, which is considered amongst the most active in the world. The active Chaman transform fault marking plate boundary between the Indian and Eurasian plates is located only 120 NW of Karachi. Karachi itself is located at the southern tip of N–S trending Kirthar active foreland thrust-fold belt at the western deformed edge of the Indian plate. The triple junction between the Indian, Arabian and Eurasian Plates is located 110 km to the SW of Karachi.

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<sup>1</sup> Waseem, M., Khan, M. A., & Khan, S. (2019). Seismic sources for southern Pakistan and seismic hazard assessment of Karachi. *Natural Hazards*, 99(1), 511-536.



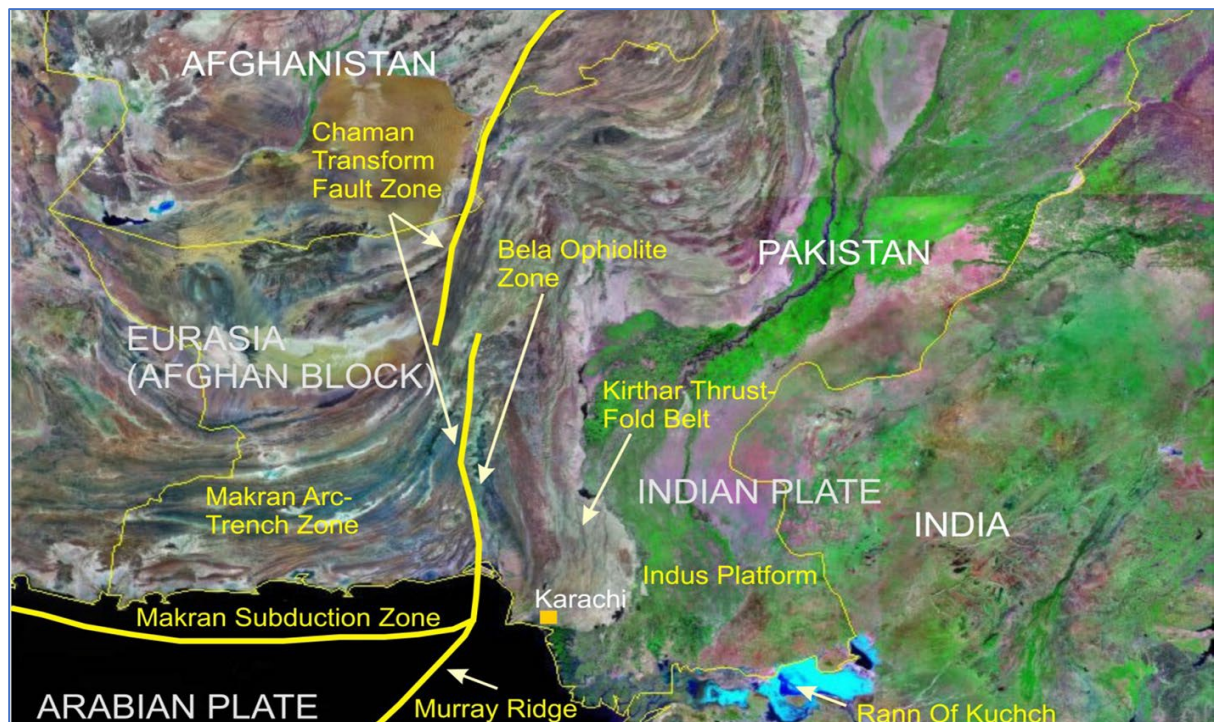


Figure 4.3: Tectonic setting of Karachi<sup>2</sup>

Seismic activity in the region is the result of the triple junction as well as the Karachi Arc, located in southeastern Pakistan, as a large fold and thrust belt that shows Neogene thin-skinned eastward movement. Seismic activity in and around the region shows that the Karachi Arc has been active since long in prompting the eastward movement of the delta. It is possible that the movement is related to the rebound that takes place after mass shift. Sarwar has suggested that the eastward creep of Karachi Arc is directly related to active subsidence of the Hyderabad graben that underlies it and also defines the northern and southern limits of the Karachi Arc.<sup>3</sup>

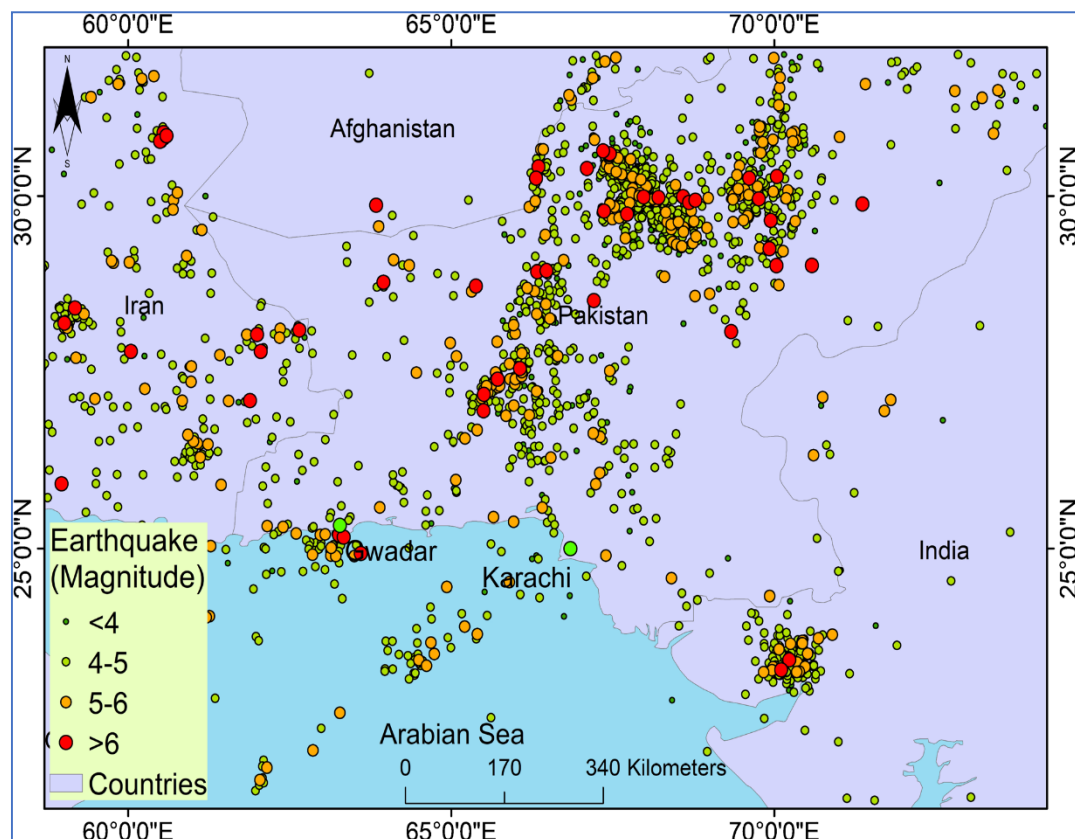
It may be added that subsidence such as that on Southern coast of Sindh, occurs naturally as a result of plate tectonic activity above active faults, and in places where fluid is expelled from underlying sediments and is common at river deltas that may have receded. Earthquakes arise and result from the release of the force along the growth fault plane. As a result, many different growth faults are created as sediment loads shift basin ward and landward.

**Seismic Coefficient:** According to uniform building code (1997) the soil profile type of the project falls in category "Sc" corresponding to "Soft Rock/Very Dense Soil". Details are annexed in Subsoil Geotechnical Investigation Report. Following parameters can be adopted: Seismic Zone = 2B, Zone Factor = 0.2, Soil Profile Type = Sc, Seismic Coeff "Ca" = 0.24 and Seismic Coeff "Cv" = 0.32

**Earthquakes:** Historically the coastal region has suffered a number of earthquakes. Detailed review of the geological history including the modern time reveals the occurrence of deep-sea earthquakes at different times, throughout history in the North Arabian Sea, as presented below:

<sup>2</sup> Waseem, M., Khan, M. A., & Khan, S. (2019). Seismic sources for southern Pakistan and seismic hazard assessment of Karachi. *Natural Hazards*, 99(1), 511-536.

<sup>3</sup> (Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. *Pakistan Journal of Hydrocarbon Research*, 14, 35-40).



**Figure.4: Earthquake recorded (1950–2019) in the Arabian Sea and its surroundings<sup>4</sup>**

**Seismicity of the Site:** According to the Uniform Building Code (1997), Karachi and its adjoining areas fall in Seismic Zone-2B.

Sarwar and Alizai have compiled a list of earthquakes during the 1902-2013 period and also produced the above map that gives a distribution of hypocenters of earthquakes during the same period. From the distribution of hypocenters, it has been inferred that the entire Karachi Arc and surrounding areas are seismically active with hypocenters ranging in depth from 0-500 kilometers. From the depth of hypocenters, it is inferred that active deformation has taken place at multi-levels ranging from shallow too deep in the basement. Quite a few of the recent epicenters are found within or in close proximity to parts of Karachi that have faced recurrent earthquake activity.

<sup>4</sup> Aslam, B., Ismail, S., & Maqsoom, A. (2020). Geospatial mapping of Tsunami susceptibility of Karachi to Gwadar coastal area of Pakistan. *Arabian Journal of Geosciences*, 13(17), 1-12.

<sup>4</sup> (Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. *Pakistan Journal of Hydrocarbon Research*, 14, 35-40).



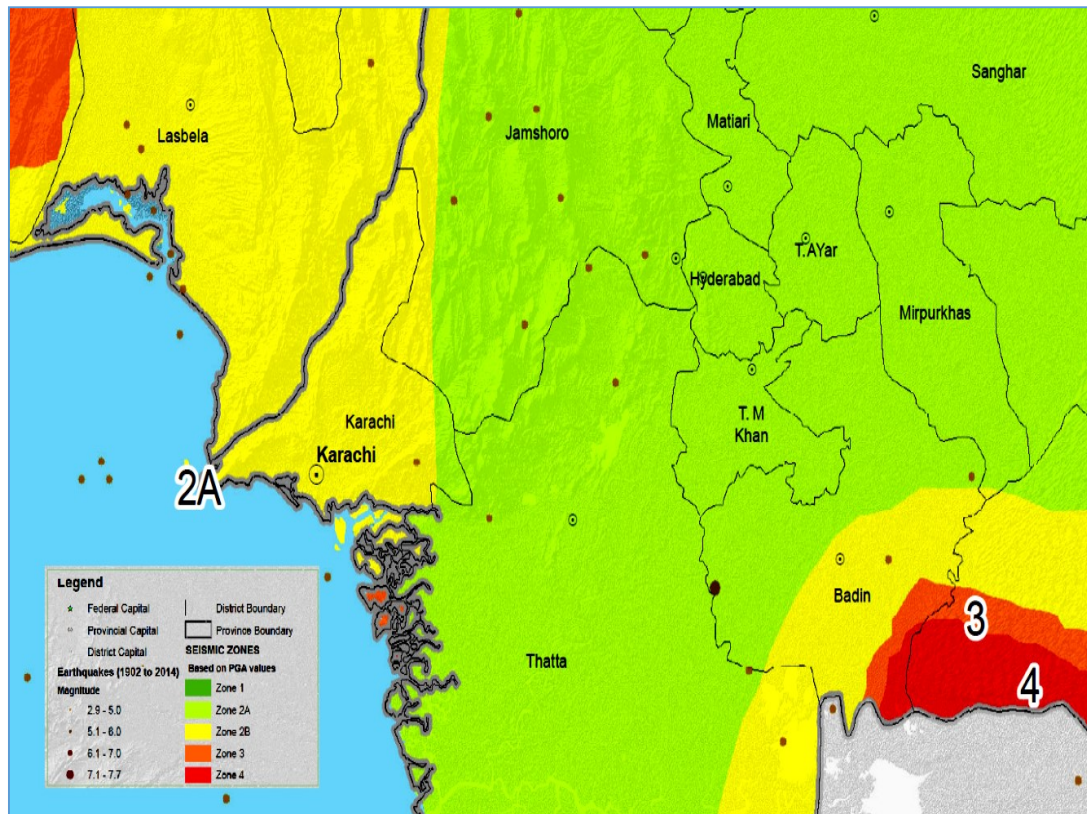


Figure 5: Seismic Zones in Karachi<sup>5</sup>

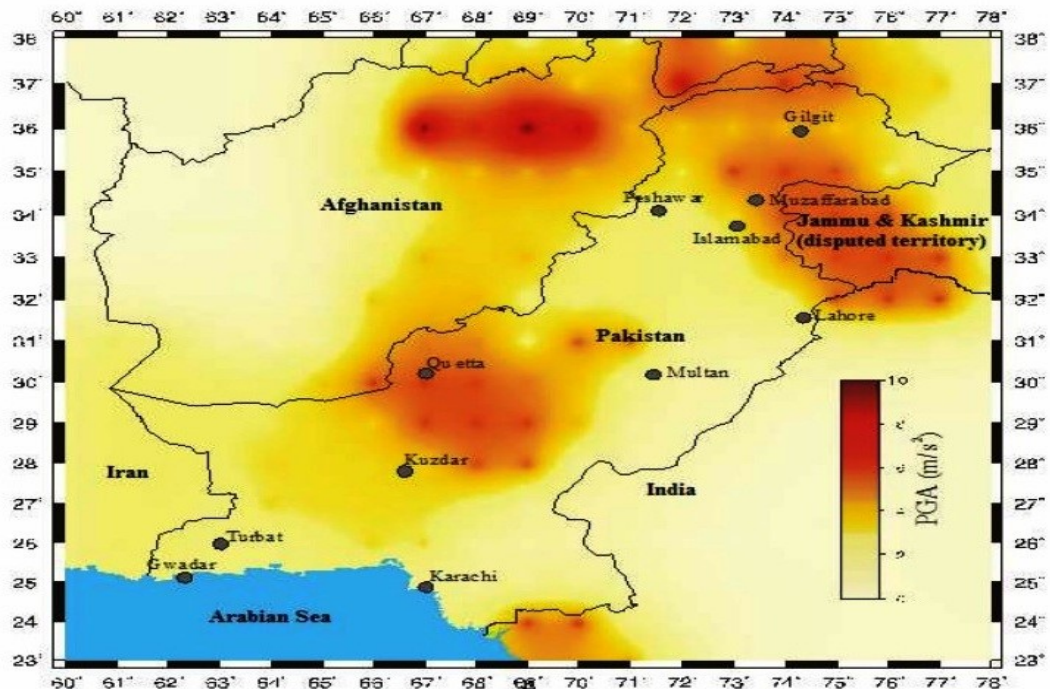


Figure.6: Seismic Hazard for Pakistan in terms of Peak Ground Acceleration (PGA)<sup>6</sup>

<sup>5</sup> Map data source(s): PMD, GSP, Pakistan Engineering Council – Prepared by Al Hasan Systems Private Ltd.

<sup>6</sup> PMD Seismic Monitoring and Early Tsunami Warning Centre - <http://seismic.pmd.gov.pk/seismicnew/map2.html>

#### 4.4 Meteorology and Climate

The coastal part of Karachi is largely influenced by the subtropical monsoon regime. The weather during the inter-monsoon periods is uncertain and short spells of dust storms, dry weather, or a humid cool breeze may prevail for short durations.

**Table 4.1: Seasonal Characteristics of the Climate of Karachi**

Season	Temperature	Rainfall	Wind
Summer (Mid-March to Mid-June)	The summer is hot with temperature increasing from 26.2 °C in March, rising up to 40 °C in June.	There are less frequent rain showers in summer with no more than 1 or 2 rainy days in summer. Average total amount of rain in summer is around 10 mm	The wind speed in summer is variable. It is around 2.5 m/s in March and rises up to 18 m/s in April and drops to 4 m/s for the rest of the season. The direction mostly remains blowing from West
Monsoon (Mid-June to mid-September)	The temperature in monsoon remains high but relatively lower than summer and oscillates around 32°C.	Almost 80 % of the yearly rain occurs in the monsoon with July and August being the wettest month.	The wind direction in the monsoon is mostly blowing from East.
Post-Monsoon Summer (Mid-September to November)	The average temperature post monsoon drops and average min temperature may reach 12 °C in November.	The post-monsoon period remains mostly dry and rainfall in November is around 1.8 mm.	The wind speed in September is around 3.7 m/s and drops to 1.4 m/s in November.
Winter (December to mid-March)	The winter is mild with January being the coolest month where average minimum temperature falls to 6 °C.	Like the other seasons, except monsoon, there is little occasional rainfall. The rainfall in winter	The wind speed in the winter season increases from 1.4 m/s in December to 2.6 m/s in March. The wind direction for most part winter season is blowing from NE and changes its



**Table 4.1: Seasonal Characteristics of the Climate of Karachi**

Season	Temperature	Rainfall	Wind
		is less than 50 mm.	course to blowing from West in early March

#### i. Temperature

The air temperature in Karachi Division and its coastal areas are generally moderate throughout the year due to presence of sea. Climate data generated by the meteorological station at Karachi Airport represents climatic conditions for the region. The mean monthly maximum and minimum temperatures, recorded during the last 21 years in Karachi to describe the weather conditions are shown in Table 4.2(a) and 4.2(b) respectively.

**Table 4.2(a): Mean Monthly Maximum Temperatures (°C) in Karachi**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	27.2	29.6	33.1	34.6	35.1	34.9	32.2	32.3	33.1	36.0	33.5	30.4	32.7
2002	27.0	28.2	33.3	35.4	35.6	35.1	32.2	31.6	31.4	36.5	32.7	28.1	32.3
2003	27.6	28.5	32.4	36.6	35.7	34.9	34.1	32.6	32.5	37.0	32.2	28.3	32.7
2004	26.6	29.9	36.2	35.4	36.8	35.6	33.8	32.7	32.8	33.7	33.1	29.4	33.0
2005	24.9	26.3	31.5	35.3	35.4	36.0	33.2	32.2	34.2	35.2	33.1	28.4	32.1
2006	26.0	31.3	31.8	34.0	34.6	35.3	33.8	31.0	34.2	35.0	33.4	26.3	32.2
2007	26.9	29.4	31.4	37.7	36.0	36.4	N/A	N/A	N/A	N/A	N/A	N/A	33.0
2008	24.4	26.9	34.3	34.4	33.9	35.1	33.5	31.9	34.7	35.5	32.5	27.2	32.0
2009	26.2	29.8	33.0	36.0	36.8	35.7	34.5	33.0	32.8	35.9	33.0	28.6	32.9
2010	27.5	29.2	34	35.7	36.5	34.7	34.6	33.2	34.5	35.9	32.7	28	33.0
2011	26.9	28.5	33.2	35.8	35.3	35.3	34.2	32.8	32.9	N/A	N/A	N/A	N/A
2012	25.7	26.9	31.7	35.1	35.5	34.6	33.2	32.7	33.2	35.0	32.7	28.2	32.0
2013	26.7	28.0	33.3	34.0	35.1	36.5	33.8	32.1	33.0	35.7	32.3	28.3	32.4
2014	25.5	28.0	31.7	35.1	35.9	36.5	34.0	33.7	33.8	36.3	32.9	28.7	32.7
2015	26.3	28.9	31.5	35.9	36.0	37.7	34.1	32.3	34.6	35.8	33.0	28.6	32.9



<b>2016</b>	27.8	30.3	33.3	34.7	35.7	36.1	33.6	33.0	32.9	34.0	33.3	31.0	33.0
<b>2017</b>	25.4	30.2	32.8	35.5	36.2	36.3	33.1	33.8	33.4	36.6	32.3	28.2	32.8
<b>2018</b>	28.5	30.4	34.4	36.2	38.7	35.4	33.8	31.9	32.6	36.8	33.8	28.2	33.4
<b>2019</b>	26.3	26.8	31.3	35.4	36.0	37.2	34.7	32.5	35.7	35.8	31.5	27.1	32.5
<b>2020</b>	24.3	30.1	31.2	36.2	36.6	37.3	36.7	34.6	35.0	36.2	31.4	28.1	33.1
<b>2021</b>	26.6	31.3	34.6	37.3	37.5	36.1	34.5	32.6	36.3	34.8	34.0	27.6	33.6

*Source: Pakistan Meteorological Department*

**Table 4.2(b): Mean Monthly Minimum Temperatures (°C) in Karachi**

<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Annual</b>
<b>2001</b>	11.5	14.9	19.6	23.8	28.1	29.0	27.1	26.5	25.9	24.4	18.6	15.8	22.1
<b>2002</b>	12.8	13.8	19.5	23.9	27.0	28.2	29.6	25.6	24.8	22.5	17.7	14.9	21.7
<b>2003</b>	12.7	16.9	19.8	24.2	26.5	28.2	23.6	27.0	25.3	20.9	15.2	12.0	21.0
<b>2004</b>	12.9	14.5	19.1	24.8	27.3	28.8	27.5	26.3	25.3	22.4	18.0	15.4	21.9
<b>2005</b>	12.3	11.3	20.3	23.0	26.4	28.3	27.2	26.6	26.6	22.9	18.9	13.0	21.4
<b>2006</b>	11.7	18.1	19.6	24.5	27.5	28.5	28.3	26.3	26.8	25.7	19.4	14.0	22.5
<b>2007</b>	13.0	17.3	19.7	24.7	27.6	28.6	N/A	N/A	N/A	N/A	N/A	N/A	21.8
<b>2008</b>	10.1	11.1	19.6	24.0	27.3	29.1	27.9	26.8	26.6	23.8	17.6	14.9	21.6
<b>2009</b>	14.7	16.5	20.8	23.8	27.6	28.7	28.1	27.5	26.5	22.6	17.0	13.9	22.3
<b>2010</b>	12.2	14.7	21.3	25.1	28	28.2	28.3	27.2	25.8	23.9	17.4	11.1	21.9
<b>2011</b>	11	14.5	19.7	23.1	27.1	28.8	27.8	28.6	26.5	N/A	N/A	N/A	N/A
<b>2012</b>	11.2	11.9	19.1	24.5	27.2	28.0	27.9	26.9	26.4	22.7	18.6	14.2	21.5
<b>2013</b>	11.6	15.1	19.2	24.2	27.1	29.3	28.0	26.6	25.5	25.4	18.1	13.0	21.9
<b>2014</b>	9.9	13.1	18.9	24.4	27.0	29.2	28.3	27.1	26.8	23.3	19.5	13.1	21.7
<b>2015</b>	12.6	16.4	19.2	25.7	27.7	29.8	28.4	26.9	26.3	24.9	18.6	12.6	22.4
<b>2016</b>	14.8	14.9	21.7	24.6	27.9	27.9	28.1	27.1	26.4	24.0	17.1	15.5	22.5





<b>Table 4.2(b): Mean Monthly Minimum Temperatures (°C) in Karachi</b>													
<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Annual</b>
<b>2017</b>	12.5	18.2	20.3	24.4	27.8	29.2	27.7	27.0	26.2	23.5	16.8	13.0	22.2
<b>2018</b>	12.9	15.8	20.9	25.3	27.7	28.8	28.1	26.3	25.5	23.0	19.3	13.1	22.2
<b>2019</b>	13.3	15.3	19.0	24.0	26.6	28.9	28.1	26.8	27.2	24.0	19.4	13.7	22.2
<b>2020</b>	10.8	15.3	19.1	24.7	27.7	29.7	29.4	28.1	27.3	22.7	16.0	12.5	21.9
<b>2021</b>	9.2	15.0	21.6	25.1	28.9	29.6	28.5	27.4	28.0	23.1	17.6	13.9	22.3

*Source: Pakistan Meteorological Department*

## ii. Precipitation

The main source of precipitation is rainfall which is received mostly in the months of July to September during SW Monsoon winds. It is very erratic as some years are very dry and there is no rain.

<b>Table 4.3: Monthly Amount of Precipitation (mm) at Karachi Airport</b>													
<b>Year</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Annual</b>
2001	0	0	0	0	0	10.6	73.6	16.2	N/A	0	0	0	100.4
2002	0	2.4	0	0	0	N/A	N/A	52.2	N/A	0	0.5	0.4	55.5
2003	6.4	21.8	0	0	0	16.3	270.4	9.8	N/A	0	0.2	0	324.9
2004	13.7	0	0	0	0	N/A	3	5.6	N/A	39.3	0	4.3	65.9
2005	6.6	12.8	N/A	0	0	N/A	N/A	0.3	54.9	0	0	17.1	91.7
2006	N/A	0	N/A	0	0	0	66.2	148.6	21.9	0	3.1	61.3	301.1
2007	0	13.2	33.4	0	0	110.2	N/A	N/A	N/A	N/A	N/A	N/A	156.8
2008	8	Trace	1.1	0	0	0	54	37.5	Trace	0	0	21	121.6
2009	3	Trace	0	Trace	0	2.6	159.9	44	68.9	0	0	1.5	279.9
2012	0.2	0	0	0	0	Trace	Trace	8.1	121	0	0	22.8	152.1
2013	Trace	20	2.8	30	0	Trace	5.5	105.4	4	1.2	0	0	168.9
2014	Trace	0	12.4	0	1.3	Trace	1.1	9.9	1.4	0	4.6	0	30.7
2015	0.3	2.1	2.8	0	0	Trace	46.6	1.4	Trace	0	0	0	53.2



2016	3.1	0	Trace	0	0	65.8	1.9	96.9	Trace	0	0	0	167.7
2017	41.5	Trace	0	0	0	58.8	33.3	65.6	26.4	0	0	6.6	232.2
2018	Trace	Trace	0	0	0	Trace	Trace	0.8	Trace	0	0	Trace	0.8
2019	39.4	Trace	2.2	0	0	1.6	66.3	204	51.7	1.2	Trace	Trace	367.3
2020	Trace	2.6	0.5	0	0	Trace	101.2	366.8	Trace	0	3.1	0	474.2
2021	0	0	0	0	0	Trace	45.4	Trace	88.3	17.2	0	16.9	167.8

Source: Pakistan Meteorological Department

The wet years have been found to follow a 3-year cycle during the first 9 years of the 3rd Millennium. The year 2010 was among the wettest years since Karachi City had witnessed more than 5 spells of 50 mm each during the month of July, three major spells of 60 to 100 mm in August and two spells of 25 and 10 mm each in the month of September. In July and August 2011 again, there was heavy rainfall all over Sindh. Hyderabad received about 74 to 103 mm rain in 24 hours and the same amount poured in Karachi and the villages in its outskirts. Among the other July 2020 was considered to be the wettest month among the others and the total annual rainfall records in 2020 higher than other past 19 years. The torrential rains resulted in flooding of several villages in Karachi District.

**Inundation due to Heavy Rainfall Events:** Highest rainfall events have occurred in July 1994: 256.3mm, July 2003: 270.4mm and August 2006: 77mm in 3 hours. According to observations recorded for the year 2007, August 10 and 11 were witnesses to unusually high rainfall of 107 mm in 24 hours compared with the normal of about 60 mm for August. The wettest August ever experienced by the city was in 1979, when over 262mm of rainfall was recorded. The record for the maximum rainfall within 24 hours in the eighth month was 166mm of rain on August 7, 1979. The heavy rainfall was not unusual since it was caused by the general monsoon system that travels from across Rajasthan and lays over Sindh. The monsoon weather system did not move towards Baluchistan but the penetration of moist currents from Sindh brought scattered to heavy rain in southern Baluchistan, particularly along its coastal regions. Major inundation and land submergence was noticed in Karachi in July 2003 and August 2006. On both occasions, precipitation pattern and intensity was almost similar. The downpour on both occasions was a cloud burst. For estimating the impact of inundation on the six corridors, the maximum intensity of Rainfall of 18th August 2006 at 77mm in about 3 hours i.e. 25.7mm/hour will be considered critical and adopted for making estimates on land submergence.

### iii. Wind Speed & Direction

The wind direction and speed between the summer and winter monsoon seasons are rather unsettled and large variations are noted both with respect to speed and direction. The Tables 4.4 and 4.5 show the wind speed and direction respectively.



**Table 4.4: Wind Speed (m/s) at 12:00UTS**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	2.6	3.4	4.3	5.6	7.5	8.1	6.8	7.3	5.5	3.7	2.0	2.4	4.9
2002	3.6	3.9	4.0	6.5	8.5	8.2	9.8	7.3	7.7	3.3	2.9	3.2	5.7
2003	4.0	5.0	5.4	5.2	7.7	8.8	6.7	7.1	6.0	3.2	3.1	3.0	5.4
2004	3.4	3.7	4.0	6.0	8.0	9.0	10.0	9.5	7.3	3.8	1.0	2.5	5.7
2005	3.6	4.2	4.8	5.1	7.1	7.5	9.0	6.9	6.4	3.9	2.0	1.5	5.2
2006	2.0	3.0	3.0	6.2	8.0	7.7	8.3	6.2	4.7	4.2	2.2	3.0	4.9
2007	2.0	3.7	4.0	4.0	6.0	6.3	N/A	N/A	N/A	N/A	N/A	N/A	4.3
2008	4.3	7.6	8.2	10.5	12.6	7.6	11.0	9.3	8.7	6.6	5.1	3.9	7.9
2009	7.0	7.2	7.9	9.3	9.8	9.7	9.5	9.3	9.1	6.1	5.0	3.9	7.8
2012	5.8	6.6	9.3	9.8	12.3	12.8	13.1	11.2	8.4	7.1	5.7	5.8	9.0
2013	5.2	6.9	9.0	10.3	11.5	10.8	12.0	11.2	10.3	7.7	5.1	4.5	8.7
2014	5.9	8.9	8.6	11.5	12.4	13.4	12.8	11.6	11.7	8.3	6.0	4.5	9.6
2015	6.9	10.3	10.1	11.5	12.8	12.3	13.7	12.3	10.5	8.7	5.6	5.8	10.0
2016	7.5	8.7	4.8	1.1	13.0	11.7	11.8	10.5	12.1	9.2	5.5	5.2	8.4
2017	7.0	8.0	10.8	12.1	12.8	11.5	12.1	10.3	8.7	8.5	5.4	7.4	6.9
2018	6.3	7.0	9.5	10.2	10.8	11.1	12.3	12.4	12.2	8.7	6.1	6.8	9.4
2019	6.7	8.9	10.2	11.7	12.1	11.7	13.7	9.1	8.5	8.0	6.9	7.4	9.6
2020	9.0	9.4	9.0	10.5	13.3	10.9	10.1	8.9	9.4	7.3	6.2	5.5	9.1
2021	6.1	7.6	9.7	8.5	11.7	12.7	12.6	11.1	8.8	8.1	6.7	6.6	9.2

*Source: Pakistan Meteorological Department*



Table 4.5: Wind Direction at 12:00UTS												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	S54W	S43W	S42W	S45W	S46W	S45W	N52W	S59W	S44W	N56W	S45W	S06W
2002	S67W	S52W	S51W	S55W	S51W	S42W	S54W	S45W	S48W	S56W	N54W	S41W
2003	S60W	N50W	S45W	S48W	S45W	S68W	S60W	S47W	S43W	S54W	S50W	S27W
2004	N27E	S46W	S53W	S49W	S52W	S54W	S54W	S62W	S56W	S47W	S45W	N86E
2005	N63E	S51W	S50W	S52W	S63W	S48W	S54W	S49W	S87W	S54W	S52W	N23W
2006	S48W	S62W	S50W	S57W	S64W	S60W	S67W	S78W	S51W	S53W	S49W	N79E
2007	S30W	S62W	S47W	S55W	S58W	S47W	S41W	S55W	S60W	S48W	S48W	N45E
2008	N45E	S47W	S54W	S51W	S52W	S39W	S50W	S52W	S46W	S39W	S38W	N
2009	N45E	S45W	S41W	S58W	S46W	S46W	S56W	S49W	S56W	S42W	S39W	S45E
2012	S3E	N56E	S62W	S46W	S61W	S51W	S66W	S51W	S53W	S41W	S41W	N9W
2013	N39W	S54W	S56W	S54W	S61W	S40W	S53W	S52W	S55W	S47W	S17W	N50W
2014	S72E	S54W	S43W	S46W	S46W	S45W	S54W	S48W	S85W	S45W	S49W	S45E
2015	S72E	S54W	S43W	S48W	S50W	S40W	S54W	S55W	S50W	S41W	S	S58W
2016	S43W	S36W	S48W	S54W	S54W	S45W	S48W	S36W	S51W	S45W	S43W	S36W
2017	S83E	S56W	S51W	S45W	S45W	S44W	S66W	S57W	S48W	S51W	S59W	N45E
2018	S54W	S43W	S42W	S45W	S46W	S45W	N52W	S59W	S44W	N56W	S45W	S06W
2019	S67W	S52W	S51W	S55W	S51W	S42W	S54W	S45W	S48W	S56W	N54W	S41W
2020	N31E	S12W	S52W	S55W	S49W	S44W	S47W	S55W	S47W	S38W	S4E	N35E
2021	S21W	S38W	S44W	S42W	S52W	S53W	S55W	S48W	S40W	S41W	S22E	S40E
Source: Pakistan Meteorological Department												





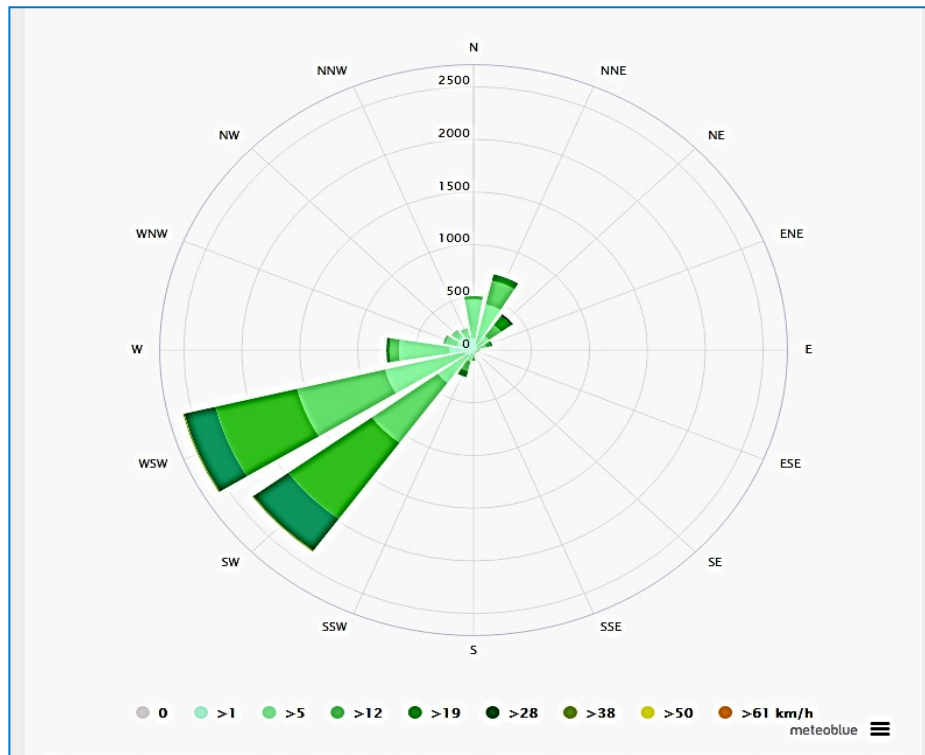


Figure 4.3: Wind rose for Karachi shows<sup>7</sup>

#### iv. Humidity

The relative humidity typically ranges from 25% (dry) to 70% (humid) over the course of a year, rarely dropping below 20% (very dry) and reaching as high as 90% (very humid).

Table 4.6: Mean Monthly Relative Humidity (Mean) at 1200 UTC (%)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	25.0	27.0	35.0	47.0	57.0	61.0	64.0	61.0	60.0	36.0	36.0	31.0	45.0
2015	38.0	41.0	37.0	45.0	60.0	56.0	69.0	67.0	56.0	47.0	28.0	31.0	47.9
2016	46.0	25.0	41.0	47.0	60.0	60.0	68.0	70.0	63.0	57.0	34.0	38.0	50.8
2017	38.0	25.0	36.0	44.0	59.0	62.0	70.0	67.0	63.0	44.0	29.0	20.0	46.4
2018	36.0	37.0	33.0	45.0	46.0	65.0	65.0	68.0	63.0	40.0	32.0	30.0	46.7
2019	40.4	33.9	36.6	48.0	55.6	58.8	64.8	72.6	67.6	41.1	34.6	29.7	48.6
2020	29.9	28.1	34.2	44.4	57.1	56.8	65.0	74.8	62.4	38.1	32.9	29.1	46.1
2021	31.3	34.1	41.2	43.3	54.3	60.3	67.5	64.5	63.0	46.5	27.6	38.7	47.7

Source: Pakistan Meteorological Department

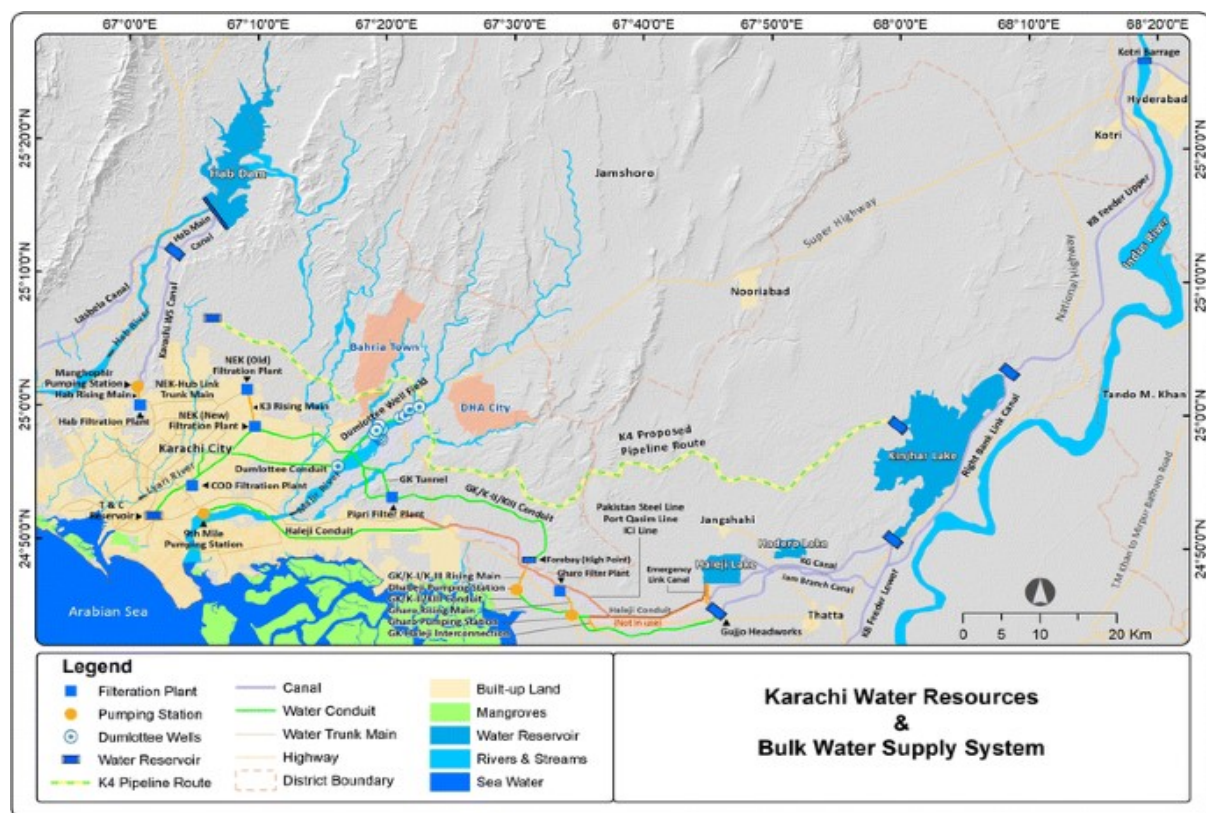
1.1- <sup>7</sup> Source: [https://www.meteoblue.com/en/weather/forecast/modelclimate/karachi\\_pakistan\\_1174872](https://www.meteoblue.com/en/weather/forecast/modelclimate/karachi_pakistan_1174872)

## 4.5 Hydrology

### Surface Water Resources

According to Karachi Water and Sewerage Board (KWSB), there are two sources of water supply in Karachi, i) River Indus supplied 1,200 cusecs daily equal to 645 MGD; and ii) Hub dam supplies about 50 MGD.

The Hub dam supply is rain fed so it fluctuates between about 30 – 15 MGD. By realizing the growing demand of water in Karachi city, the KW&SB is expending water supply system with an additional 650 MGD, known as K-IV water supply project, which will supply additional water from the Indus River through Kinjhar Lake by a different route of approximately 130-km length. The main components of the project include canals, two-phase pumping, three urban water storage reservoirs, and links with existing networks.



**Figure 4.10: Water Resources in Karachi**

(Source: Ihsanullah, 2009<sup>8</sup>)

The World Bank is providing support to Karachi for the improvement of water and sewerage services and the governance through water supply and sewerage improvement project. The proponent of the project is the ‘Karachi Water and Sewerage Board (KWSB)’.

The Project is divided into three implementation phases and every phase shall consists of three components as given below:

<sup>8</sup> Ihsanullah (2009) Evaluation and prospects of scientific management of water resources in Karachi city: A GIS perspective. Department of Geography, University of Karachi, Karachi, Karachi

**Component-1: Reforms** This component of project comprises of those activities which will support to reform the KWSB institution for better service delivery in the Karachi city.

**Component-2: Securing Sustainable Water Supply and Sanitation** The water supply and sewerage system improvement will be carried out under this component. Various activities will be carried out for the maintenance of the existing and the installation of new water supply and sewerage infrastructure.

**Component-3: Project Management and Studies** Under this component, various feasibility studies and tender documents of water / wastewater projects will be prepared for the current and the next phase of the Project.<sup>9</sup>

#### Groundwater Resources

Groundwater resources in this division are limited. The aquifers close to the coastal belt are mostly saline and unusable for domestic purposes. The aquifers near the Hub River bed are well developed and are source of water for agriculture and other domestic purposes. Generally, the aquifers in Karachi are estimated to lie at depth of 50m to 100m.

**Groundwater Recharge Characteristics/Sea water Intrusion:** Presently, coastal Karachi is known to have five sources of recharge to its groundwater reserves.

- i. Rainfall,
- ii. Indus River water supply
- iii. Hub-River & Hub Lake water supply
- iv. Polluted Lyari and Malir rivers/ contributory channels draining mixtures of domestic industrial and agricultural wastewater, composed of pre-said three sources
- v. Seawater.

The possibilities of major contribution to groundwater recharge of shallow/phreatic aquifer directly by local rainfall seems very small, due to very poor frequency of rainfall events and rainfall intensities in the Karachi and high evaporation rates. The long-term (15 years annual record) mean monthly average precipitation for Karachi is between 0-15 mm during the months of January to June, 23 - 91 mm during the months of July to September, and 0-7 mm during the months of October to December. The remaining four sources play a significant role in recharge of the shallow aquifer-system and deep groundwater system (confined aquifer) in coastal Karachi. Unpolluted seawater of Karachi coast is characterized by a  $\delta$  18O value of  $\sim +1$  ‰ VSMOW and a chloride content of  $\sim 23000$  ppm. Both the Lyari River and Malir River waters, as well as the Indus River water and the Hub Lake water, have extremely very low aqueous contents of chloride and sulfate ions as compared to seawater. The average mean value of  $\delta$  18O in polluted river waters is  $\sim 5$  ‰ V-SMOW and in shallow groundwater is  $-5.9$  ‰ V-SMOW. The relatively deeper ground waters representing confined aquifer have a mean  $\delta$  18O value of  $-4.3$  ‰ VSMOW and excessively high values of aqueous chloride and sulfate.

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<sup>9</sup> <https://www.kwsb.gos.pk/wp-content/uploads/2020/07/DRAFT-EMF-FOR-KWSSIP.pdf>



## Water Supply and Demand

Recent studies suggest that population will grow by 30 per cent from 2017 to 2030 in Karachi. This will translate in an increased water demand which will in turn put pressure on the already scarce water resources. The Water supply provided by Karachi Water and Sewerage Board (KWSB) is approximately 665 MGD against a demand of 820-1200 MGD resulting in a shortfall of 155-535 MGD. Unfortunately, an estimated 35 per cent (232 MGD) of the supplied water is lost during transmission thus decreasing the water availability to a mere 433 MGD<sup>10</sup>.

The water supplied to Karachi fails to meet the water demand of the city. Therefore, the use of groundwater has increased for certain domestic and industrial purposes within the city. The available groundwater resources are mostly saline in nature as the city is located near coastal belt and excessive extraction of groundwater has resulted in seawater intrusion into the available water aquifers located in the areas near the sea<sup>11</sup>.

The table below shows water supply and demand gap till the year 2017.

<b>Table 4.9: Water Supply and Demand Gap till the Year 2017</b>				
<b>Year</b>	<b>Population (Million)</b>	<b>Demand (MGD)</b>	<b>Supply (MGD)</b>	<b>Gap (MGD)</b>
<b>1998</b>	11.3	567	410	157
<b>2017</b>	14.9	820	650	170
<b>Source: WWF (2019)<sup>10</sup></b>				

In January 2018, the Supreme Court appointed Honorable Justice Amir Hani Muslim, a retired Supreme Court judge, the new head of the water commission with a mandate to ‘implement’ the recommendations of the previous commission that the apex court had formed in December 2016 in response to my constitutional petition. The commission turned into a forum of first choice for many water-starved people, whether living in Tharparker’s deserts or Karachi’s posh localities. Treatment of sewage, a much-neglected issue, saw a revival under the commission. Thus, Sewage Treatment Plant-III (77MGD) was restored in June 2018. STP-I (100MGD) would start by end of 2019. STP-IV (180MGD) should also operate by December 2020. Five industrial effluent treatment plants are scheduled to be built in the SITE, Trans-Lyari, F.B, Landhi and Superhighway areas.

<b>Table 4.10 Present Water Supply Capacity</b>			
<b>Supplied from</b>		<b>Rated Capacity</b>	<b>Actual Supply</b>
Gharo Filtration Plant		20 MGD	30 MGD
Pipri Filtration Plant	with Filtration	100 MGD	102 MGD
	without Filtration	-	32 MGD
Dumlottee Conduit (without	from Wells	20 MGD	0 MGD

<sup>10</sup> WWF. (2019). Situational Analysis of Water Resources in Karachi.

[https://d2ouvy59p0dg6k.cloudfront.net/downloads/report\\_situational\\_analysis\\_of\\_water\\_resources\\_of\\_karachi.pdf](https://d2ouvy59p0dg6k.cloudfront.net/downloads/report_situational_analysis_of_water_resources_of_karachi.pdf)

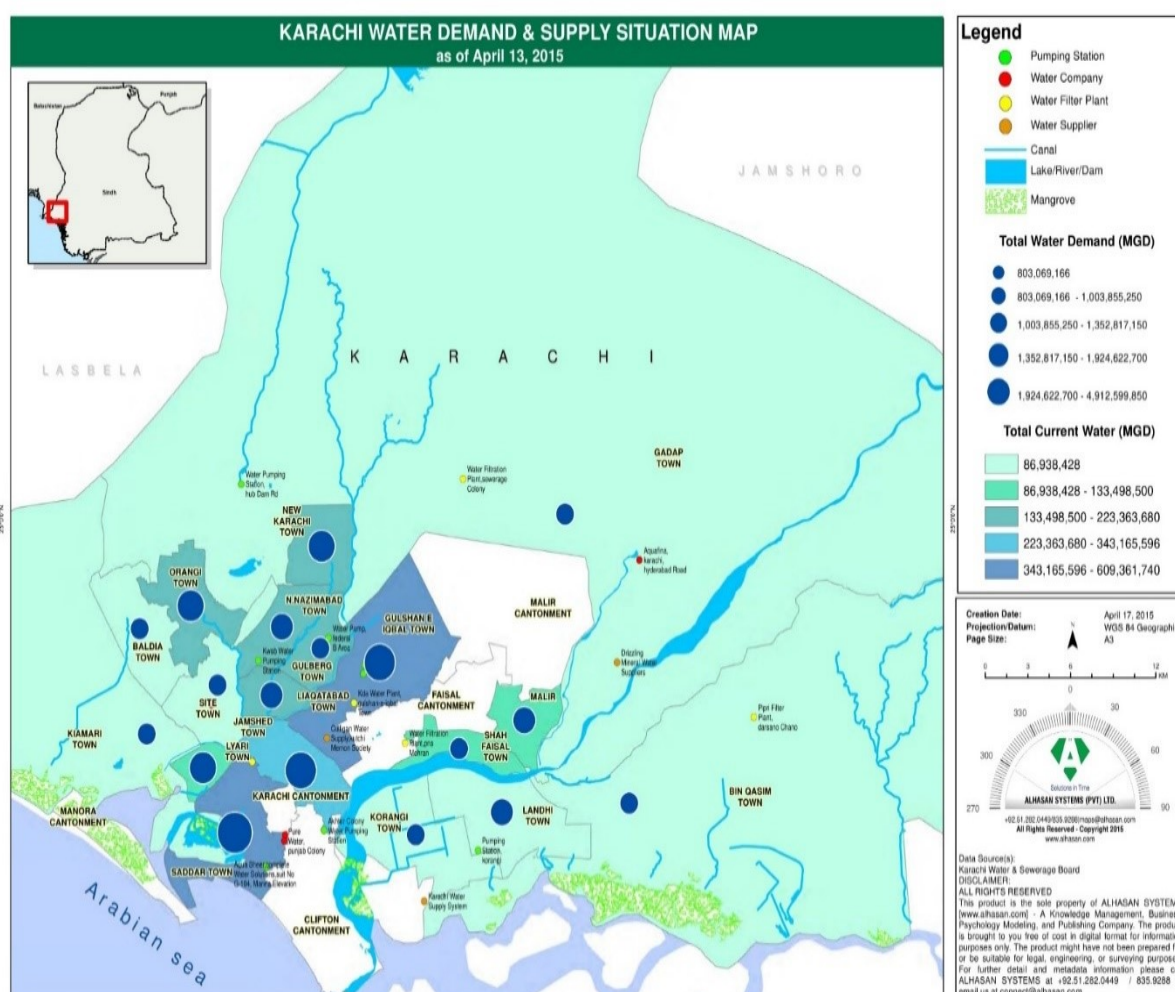
<sup>11</sup> Khattak, M. I., & Khattak, M. I. (2013). Ground water analysis of Karachi with reference to adverse effect on human health and its comparison with other cities of Pakistan. *Journal of Environmental Science and Water Resources*, 2(11), 410-418.





**Table 4.10 Present Water Supply Capacity**

Supplied from		Rated Capacity	Actual Supply
Filtration)	from GK/K-III Systems	-	17 MGD
NEK Old Filtration Plant		25 MGD	5 MGD
NEK New Filtration Plant		100 MGD	100 MGD
COD Filtration Plant	with Filtration	115 MGD	104 MGD
	without Filtration	-	48 MGD
Hub Filtration Plant		80 MGD	80 MGD
Supply without Filtration (from K-III System)		100 MGD	95 MGD
Supply without Filtration (from GK System)		-	17 MGD
Total		560 MGD	630 MGD



**Figure 4.11: Karachi Monthly Water Demand (Source: KW&SB)**

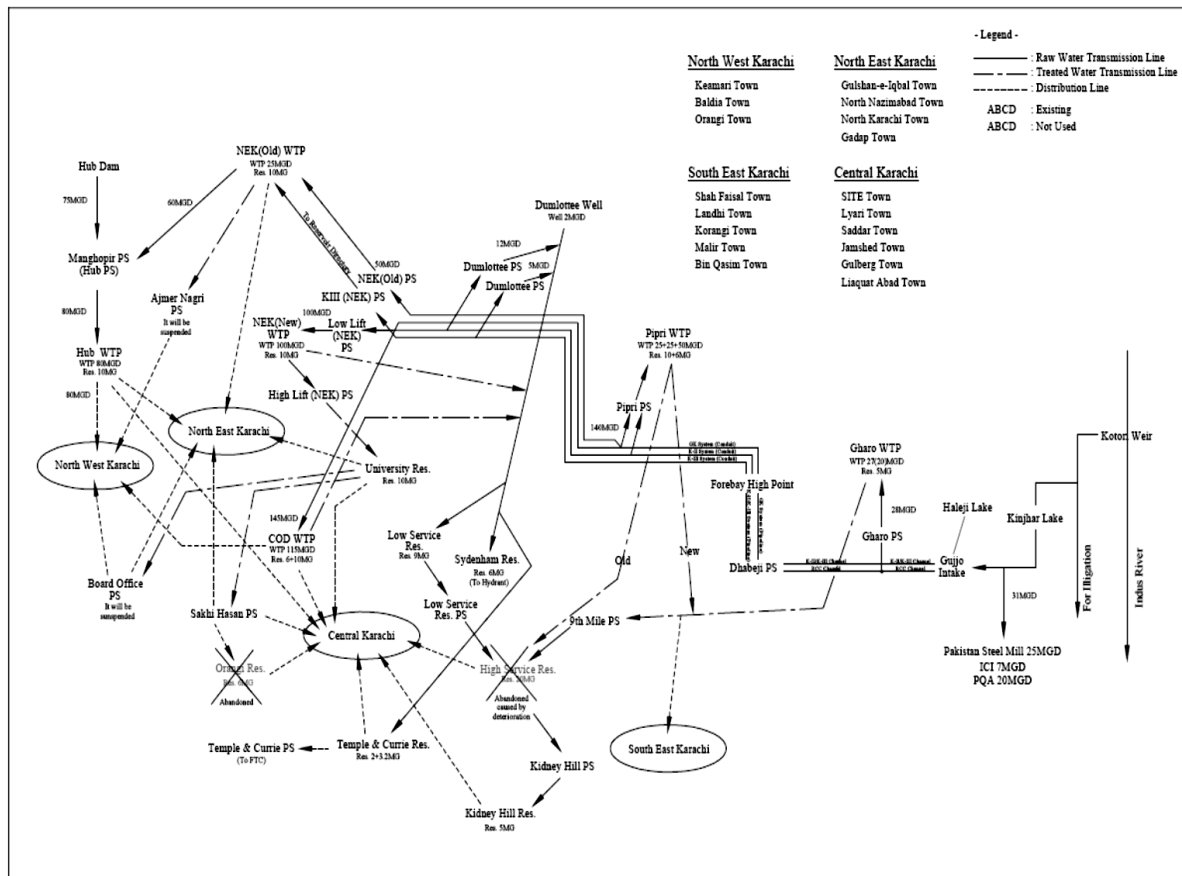


Figure 4.12: Water Transmission System

**The Sewerage System:** The existing sewerage catchment area which covers 18 towns in Karachi city is divided into three districts, namely: respective catchment area of T.P-1, T.P-2 and T.P-3. KW&SB formulated the Master Plan of the water supply and sewerage system in cooperation with JICA in 2008. However, most of the projects for rehabilitation and augmentation proposed in the Master Plan study, etc. have not been carried out due to financial constraint of KW&SB. Due its negligence to maintain and operationalize the treatment plants, not only municipal effluent but industrial effluent also is directly going into sea destroying marine life.

In January 2018, the Supreme Court appointed Honorable Justice Amir Hani Muslim, a retired Supreme Court judge, the new head of the water commission with a mandate to ‘implement’ the recommendations of the previous commission that the apex court had formed in December 2016 in response to my constitutional petition. The commission turned into a forum of first choice for many water-starved people, whether living in Tharparker’s deserts or Karachi’s posh localities. Treatment of sewage, a much-neglected issue, saw a revival under the commission. Thus, Sewage Treatment Plant-III (77MGD) was restored in June 2018. STP-I (100MGD) would start by end of 2019. STP-IV (180MGD) should also operate by December 2020. Five industrial effluent treatment plants are scheduled to be built in the SITE, Trans-Lyari, F.B, Landhi and Superhighway areas.

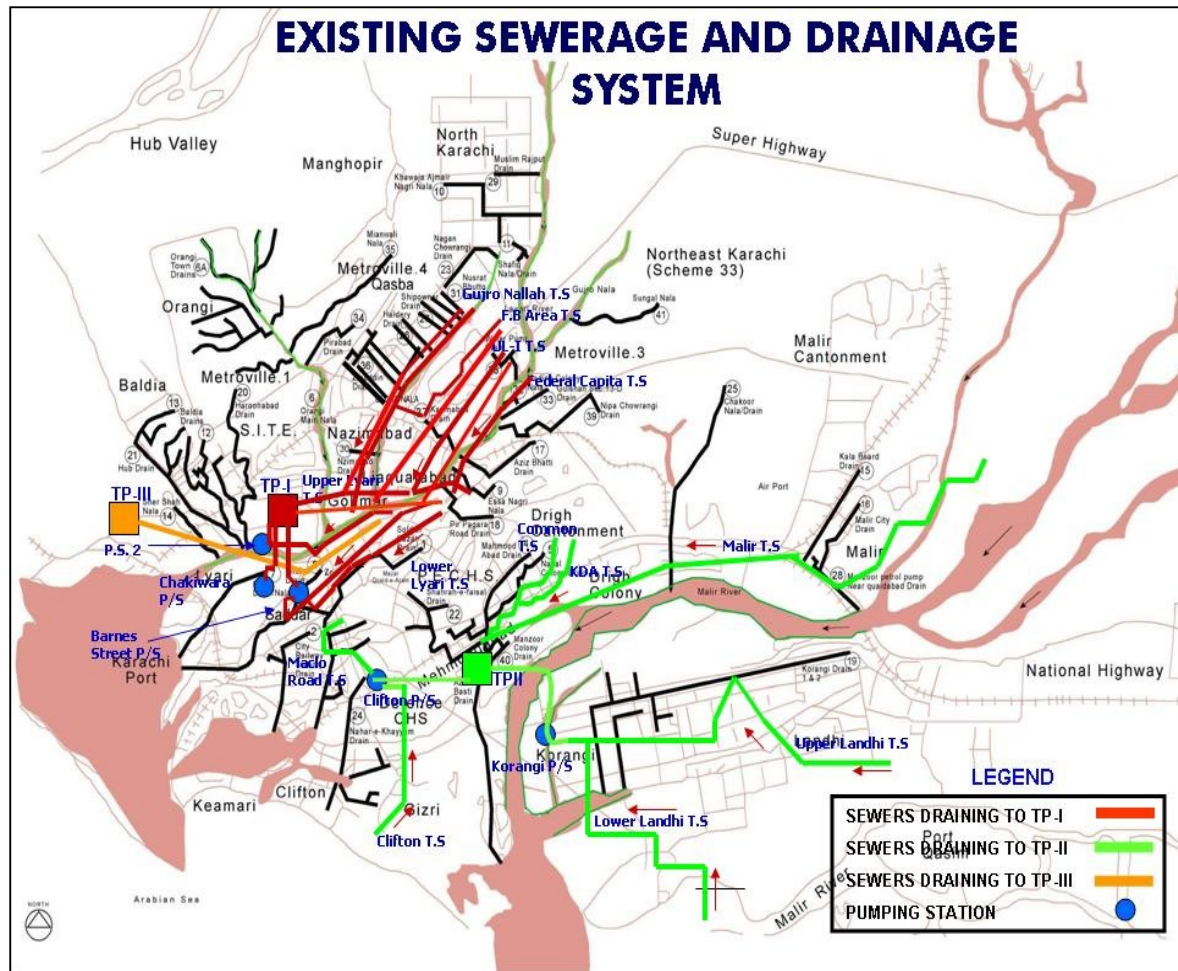


Figure 4.13: Existing Sewerage System of Karachi

## Water Quality

Two drinking water samples were taken from the project area and were tested for water quality parameters. Results are shown below;

ANALYTICAL TEST REPORT (Sample-1)							
S. NO.	PARAMETERS	STANDARDS	STANDARD	LDL	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.31	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.46	APHA-2020 B/C
5	Turbidity	< 5	< 5	0.01	NTU	0.33	APHA-2130 B



6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	925	Hach 8160
7	Total Hardness as CaCO <sub>3</sub>	< 500	180	0.1	mg/L	310	EDTA Titration.Hach-8213
8	Fluoride (as F <sup>-</sup> )	≤ 1.5	≤ 1.5	0.01	mg/L	0.5	USEPA 340.1
9	Chloride (as Cl <sup>-</sup> )	< 250	< 250	0.1	mg/L	280*	Hach 8206
10	Nitrate (NO <sub>3</sub> )	≤ 50	≤ 50	0.01	mg/L	0.37	Hach -8039
11	Nitrite (NO <sub>2</sub> )	≤ 3	≤ 3	0.001	mg/L	0.031	Hach - 8153
12	Cyanide (as CN <sup>-</sup> ) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.021	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082
25	Zinc	5.0	3.0	0.01	mg/L	0.043	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.03	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
<b>MICROBIOLOGICAL ANALYSIS REPORT</b>							
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>250*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>100*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>80*	APHA-SM9221F





ANALYTICAL TEST REPORT (Sample-2)							
S. NO.	PARAMETERS	STANDARDS	STANDARD	LD L	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.60	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.41	APHA-2020 B/C
5	Turbidity	< 5	< 5	0.01	NTU	0.31	APHA-2130 B
6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	902	Hach 8160
7	Total Hardness as CaCO <sub>3</sub>	< 500	180	0.1	mg/L	299	EDTA Titration.Hach-8213
8	Fluoride (as F <sup>-</sup> )	≤ 1.5	≤ 1.5	0.01	mg/L	0.42	USEPA 340.1
9	Chloride (as Cl <sup>-</sup> )	< 250	< 250	0.1	mg/L	253*	Hach 8206
10	Nitrate (NO <sub>3</sub> )	≤ 50	≤ 50	0.01	mg/L	0.34	Hach -8039
11	Nitrite (NO <sub>2</sub> )	≤ 3	≤ 3	0.001	mg/L	0.027	Hach - 8153
12	Cyanide (as CN <sup>-</sup> ) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.032	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082

Test Results reveal presence of coliforms in water samples.



25	Zinc	5.0	3.0	0.01	mg/L	0.041	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.02	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
<b>MICROBIOLOGICAL ANALYSIS REPORT</b>							
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>200*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>90*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>80*	APHA-SM9221F



#### 4.6 Ambient Air Quality and Noise Quality

An Ambient Air monitoring study and Noise monitoring were conducted in the microenvironment of the proposed project site.

Results of ambient air and noise monitoring conducted in the microenvironment of the study area are following:

Ambient air monitoring (location A)						
Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m <sup>3</sup>	08 Hours	0.09	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m <sup>3</sup>	08 Hours	15.6	40.0	NA	Chemiluminescence



<b>Nitrogen Dioxide (NO<sub>2</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>13.6</b>	<b>80.0</b>	<b>200</b>	
<b>Sulphur Dioxide (SO<sub>2</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>20.9</b>	<b>120.0</b>	<b>20</b>	<b>Ultraviolet Fluorescence Method</b>
<b>Ozone (O<sub>3</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>01 Hour</b>	<b>16.2</b>	<b>130.0</b>	<b>100</b>	<b>Non Dispersive UV Absorption Method</b>
<b>Particulate Matter (PM<sub>10</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>99.2</b>	<b>150.0</b>	<b>50</b>	<b>β Ray Absorption Method</b>
<b>Particular Matter (PM<sub>2.5</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>20.5</b>	<b>75.0</b>	<b>25</b>	
<b>Total Suspended Particles (TSP)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>279.1</b>	<b>500.0</b>	<b>NA</b>	
<b>Lead</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>ND</b>	<b>1.5</b>	<b>NA</b>	<b>ASS Method</b>

<b>Ambient air monitoring (location B)</b>						
<b>Parameter</b>	<b>Unit</b>	<b>Monitoring Duration</b>	<b>Average Obtained Concentration</b>	<b>SEQS</b>	<b>IFC Limits</b>	<b>Methodology</b>
<b>Carbon Monoxide (CO)</b>	<b>mg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>0.24</b>	<b>5.0</b>	<b>NA</b>	<b>Non Dispersive Intra Red (NDIR)</b>
<b>Nitrogen oxide (NO)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>13.0</b>	<b>40.0</b>	<b>NA</b>	<b>Chemiluminescence</b>
<b>Nitrogen Dioxide (NO<sub>2</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>20.9</b>	<b>80.0</b>	<b>200</b>	
<b>Sulphur Dioxide (SO<sub>2</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>25.6</b>	<b>120.0</b>	<b>20</b>	<b>Ultraviolet Fluorescence Method</b>
<b>Ozone (O<sub>3</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>01 Hour</b>	<b>16.2</b>	<b>130.0</b>	<b>100</b>	<b>Non Dispersive UV Absorption Method</b>
<b>Particulate Matter (PM<sub>10</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>96.8</b>	<b>150.0</b>	<b>50</b>	<b>β Ray Absorption Method</b>
<b>Particular Matter (PM<sub>2.5</sub>)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>23.7</b>	<b>75.0</b>	<b>25</b>	
<b>Total Suspended Particles (TSP)</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>231</b>	<b>500.0</b>	<b>NA</b>	
<b>Lead</b>	<b>µg/m<sup>3</sup></b>	<b>08 Hours</b>	<b>ND</b>	<b>1.5</b>	<b>NA</b>	<b>ASS Method</b>



Ambient air monitoring (location C)						
Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.36	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	18.9	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	20.8	80.0	200	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	27.3	120.0	20	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	18.4	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	97.2	150.0	50	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	21.3	75.0	25	
Total Suspended Particles (TSP)	µg/m3	08 Hours	263.0	500.0	NA	
Lead	µg/m3	08 Hours	ND	1.5	NA	ASS Method

NOISE LEVEL TEST REPORT						
S.N O.	LOCATION/SOURCE	Noise Level Readings				
		Minimum	Maximum	Average	SEQS	WHO
1	Point -1 25°02'02.07"N 66°59'40.41"E	52.1	55.9	54.0	Limits: *65dB(A) )	Limits: *70dB(A)
2	Point -2 25°01'37.52"N 66°58'48.15"E	50.6	56.2	53.4		
3	Point -3 25°01'27.32"N 67°00'07.89"E	53.0	57.0	55.0		
4	Point -4 25°01'23.08"N 66°59'31.27"E	51.6	56.8	54.2		
5	Point -5 25°01'56.62"N 66°58'54.05"E	52.0	57.4	54.7		







#### 4.7 Solar Resource

The district receives abundant sunshine round the year and has good solar PV power potential. World bank group's Energy Sector Management Assistance Program (ESMAP) has developed solar maps for countries including Pakistan. Solar's maps have been developed for Direct Normal Irradiation (DNI), Global Horizontal Irradiation (GHI) and Photovoltaic Power Potential. Maps have been depicted below;



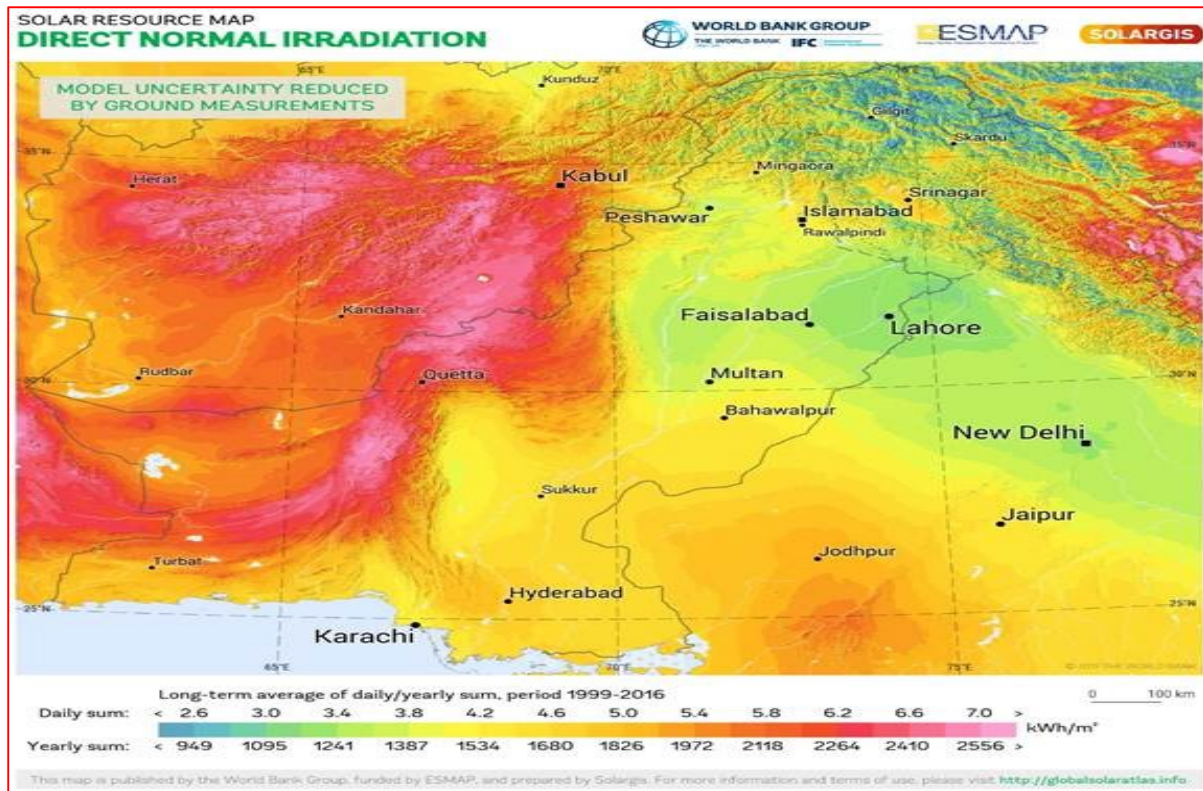


Figure 4.3: Solar Resource Map – Direct Normal Irradiation – Pakistan

DNI value for the Karachi solar power plant site is approx. 1534 kWh/m<sup>2</sup>/year.

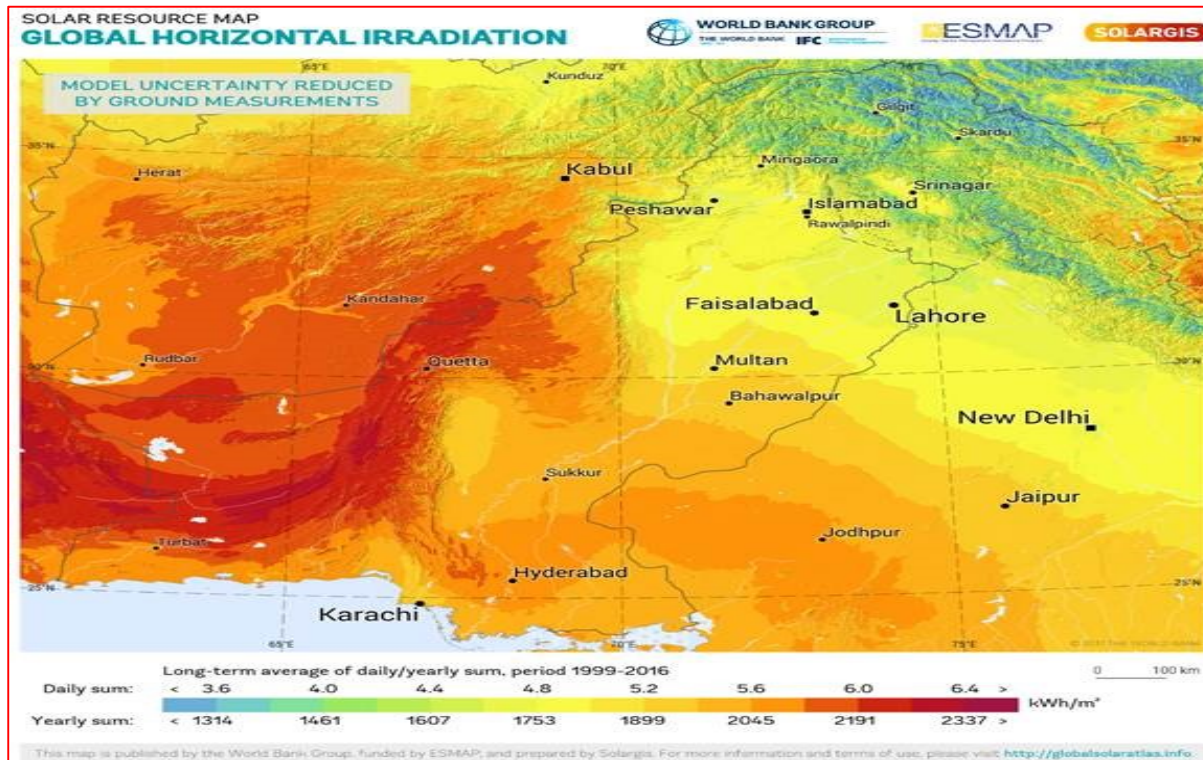


Figure 4.4: Solar Resource Map – Global Horizontal Irradiation – Pakistan

GHI value for Karachi solar power plant site is approx. 1899 kWh/m<sup>2</sup>/year.

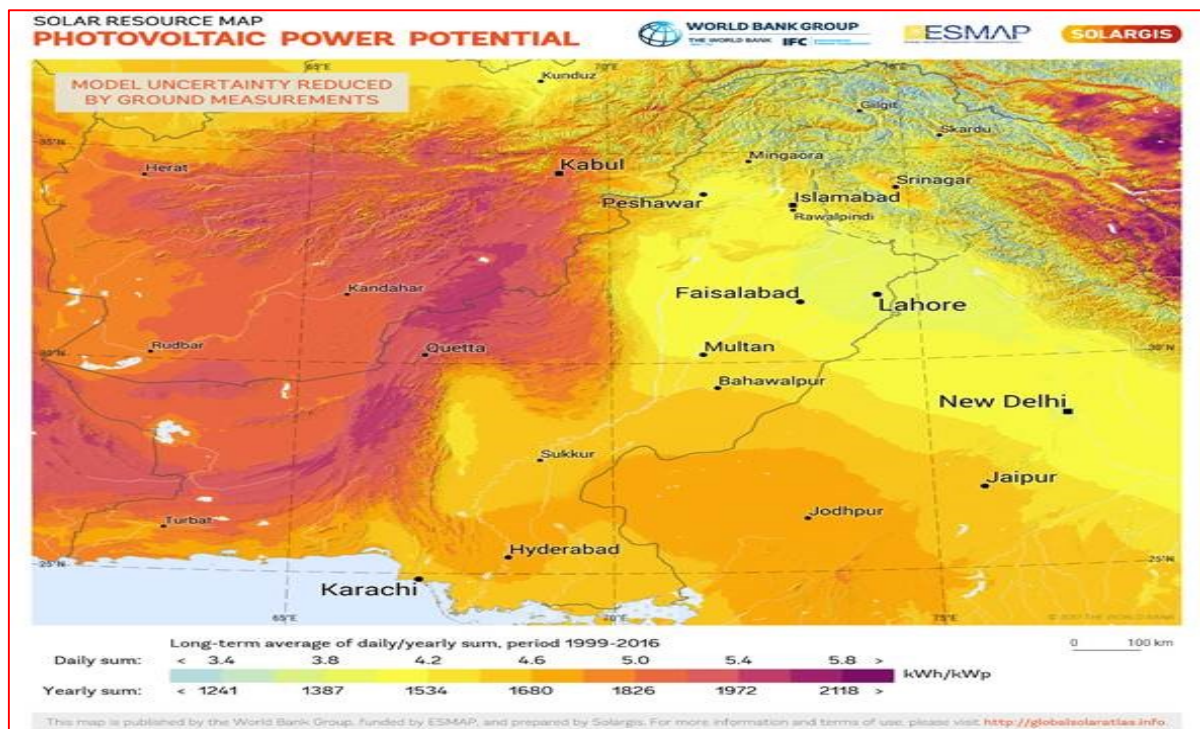


Figure 4.5: Solar Resource Map – PV Power Potential – Pakistan

Total PV Power Potential for Karachi solar power plant site is approx. 1680 kWh/kWp.

#### 4.8 Ecology

The ecology of microenvironment and macroenvironment of the project area has completely changed as a result of continuous emergence of urban conglomerates. Ecological risk of high order has been induced by land clearance and removal of natural vegetation from the plains during the urban sprawl to make room for industrialization and urbanization. This has degraded the physical environment as quantified in the above section & the biological environment in the sense that the entire macroenvironment has lost its biodiversity. During the survey, a smaller number of flora species was recorded in the project area such as;

1. Conocarpus spp.
2. Acacia Nilotica - (Sindhi Babur)
3. Capparis Decidua - (Kirar)
4. Ficus Religiosa - (Pepul)
5. Azadirachta Indica - (Neem)
6. Prosopis juliflora

Horticulturists and tree activists have declared Conocarpus as harmful as the eucalyptus trees planted in the past. Eucalyptus was planted in huge numbers across the city only to be cut down for its negative impact on the environment. The same mistake was repeated with Conocarpus. In response to the



growing concern against planting Conocarpus, district governments have put tremendous efforts in recent years towards plantation of Neem trees and other native species in the city.

## 4.9 Socio Economic Environment

### 4.9.1 Administration

Over the past several decades, Karachi has seen dramatic administrative changes. At the turn of the century, the Karachi Division that comprised of five districts was abolished and a new ‘City District Government of Karachi’ (CDGK) was established. The City District Karachi was divided into 18 Towns and 178 union councils. In July 2011, with the re-emergence of the Pakistan People’s Party (PPP), the, Sindh Government restored the 5 districts of Karachi Division and abolished the City District Government Karachi set-up. In November 2013, a new district, Korangi was formed by splitting District East. Furthermore, in September, 2020, the Government of Sindh approved establishment of Karachi’s seventh District, Keamari. District Keamari has been carved from the existing District West<sup>12</sup>. Presently, Karachi Division is comprised of District Central, District East, District Malir, District South, District Korangi, District West and District Keamari. There are also six military cantonments, which are administered by the Pakistan Army.

The proposed project is located in District West, Karachi. District west covers a total area of 169.2 sq.km while Manghopir covers an area of 149 sq.km. A total of 3 subdivisions falls under District West Karachi which include Manghopir sub-division, Mominabad sub-division, and Orangi sub-division. District west is managed by the District Municipal Corporation West and is headed by the Chairman, DMC West.

• Covered Area of District & Sub-Division	
• District West	• Manghopir Sub-Division
• 169 Sq. km	• 149 Sq. km

Prior to the splitting of District West, which was the biggest district of Karachi had the total area of district is 630 sq.km. On the other hand, the newly established District West excluding District Keamari is only 169 sq.km area with the Manghopir Sub-Division covering the majority of the area of District West. It is mentioned here that data regarding population and area of the newly established district has been according to the data available on the internet.

### Population

District west is an industrial and commercial district enjoying diverse land use occupations. The main occupation of the people is business and trade. The other major portion of the population consists of labour class including skilled and unskilled labour. There are large numbers of people involved in the fishing industry and transportation business. The remaining small portion of the population are employed in government departments and private companies.

• Demographic Change in District West and Manghopir Sub-Division (1998-2017)		
• 1998 Census Population	• 2017 Census Population	• %Change (1998-2017)

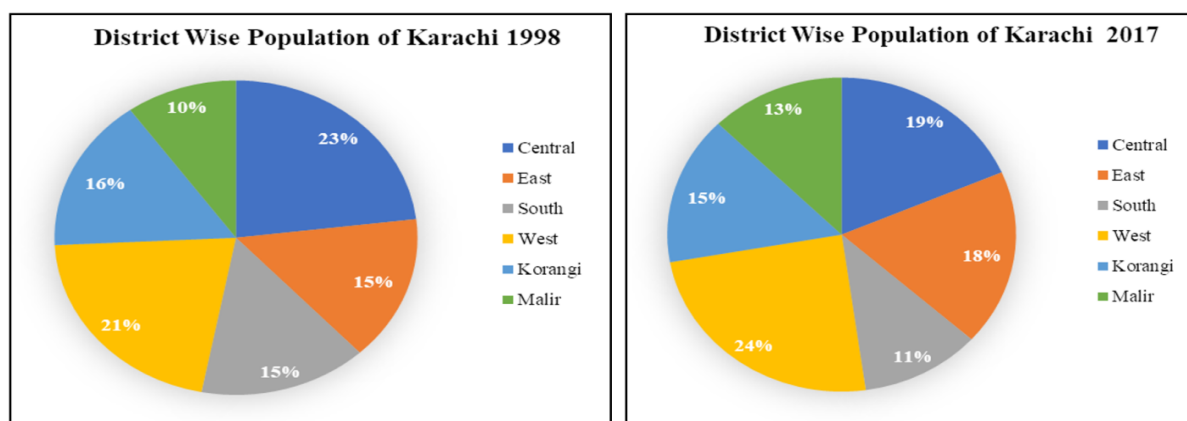
<sup>12</sup>Notification No.08/KEAMARI DISTT/2020/Rev.I(II)719 dated 4.9.2020





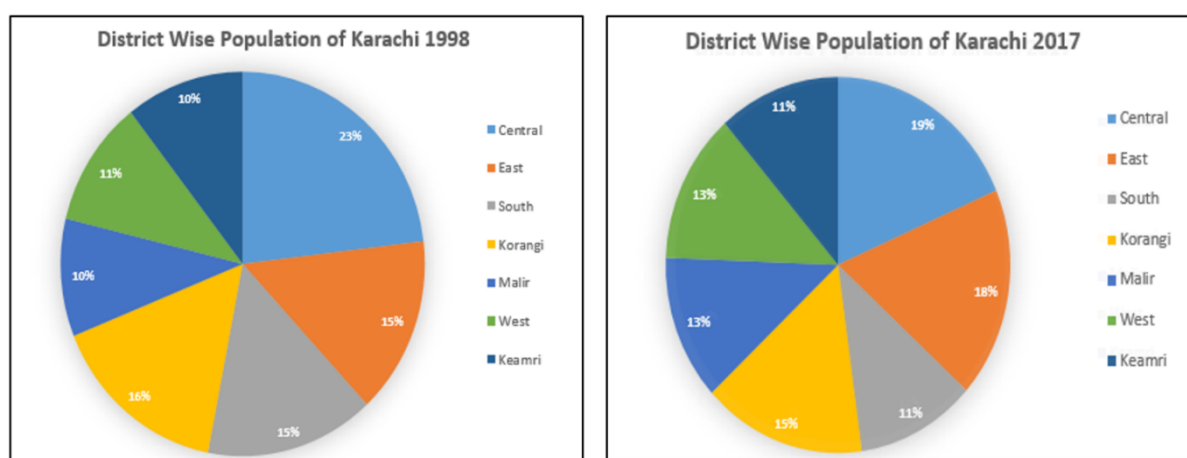
District West		
1,052,046	2,080,893	98
Mangohpir Sub-Division		
118,267	713,753	507
Source: Pakistan Bureau of Statistics 2017 (PBS)		

The total population of District West was 1,052,046 in the 1998 census which increased to 2,080,893 in the 2017 census showing an increase of 98%. The total population of the Manghopir sub-division was 118,267 according to the 1998 census which increased to 713,753 in the 2017 census showing an increase of 507%. The new district Kemari is divided out from the District West in 2020. The rising population has come out in about two decades, largely due to massive immigration of low-income communities from the other provinces of the country. Another reason for the dramatic population surge could be the launch of numerous low-income housing schemes in the periphery of the city.



#### District wise Population according to the 1998 and 2017 Census

According to the 1998 census, District West was the second most densely populated District of Karachi comprising 21% of the entire population before it was not divided. According to the census of 2017 District West was remained the most populated District of Karachi comprising 24% of the population. But below pie-chart shows about equal population of District Malir and West after splitting of West District in 2020.



#### 4.9.2 Transportation

The impact of the transport crisis on people's lives is enormous. Travelling in environmentally degraded conditions for long hours results in physical and mental health problems. This affects family and social life and limits people's choice of livelihoods (especially for women) since they wish to work in areas that they can easily access through the existing transport system. Increasingly, transport availability and quality is also determining where they would like to live.

The Hub River Road, a 4-5-kilometre long which connects Sindh to Baluchistan is busiest and important road. It has heavy traffic which also links to Karachi- Hyderabad Motor way through Northern Bypass Road. The existing road infrastructure serves the localized traffic of the densely populated areas along both sides, traffic of local industries, the recreational traffic to the beaches, the heavy traffic between the port/ SITE area and the Hawks Bay truck stand, and the defence / logistic needs of Pakistan Air force and Naval establishments at Mauripur and Manora. The situation becomes even worse during the rainy season or on holidays and it takes a long time to cross this section due to the rush of light vehicles and mini business of the picnickers.

#### 4.9.3 Economy

District West's industries contribute in the economy of the Karachi as well. There are number of textiles, steel, heavy machinery and chemicals industries in the area namely chemical Coating Centre, Captain P.Q Chemical industries. There are some famous marble industries are Basheer-ud-din Marble Industry and All Karachi Marble association. There are also Textile and Metal industries that are Jawed Metal Industry, Matrix Industries, Al Hafeez Textile Industries Unit-1 and Bliss Textile Industry. Plastic industries are also present in this district that are Mehran Plastic Industries and Sarhad Plastic Industries.

#### 4.9.4 Education Facilities

The education facilities available in the District West are not commensurate with the number population. A large number of schools, colleges, technical colleges have been opened up in the district by the government as well as by private organization. Hamdard University (Madinat-ul-Hikmat) founded by the late Hakeem Muhammad Saeed is promoting knowledge in the field of Medicine, Computer Science and Business Administration is one of the leading institute in the district. The below statistics show that District West has second higher numbers of schools, the enrollment of the students and sufficient numbers of teachers than other districts of the Karachi division. The number of schools, enrollment and teachers shows here active involvement of the residents of the District West in the education sector.

District wise Number of Schools, Enrollment and Staff in Karachi (2016-17)										
District	No. of Schools				Enrollment			Teacher		
	Boys	Girls	Mixed	Total	Boys	Girls	Total	Male	Female	Total
<b>Central</b>	117	141	348	606	44,822	58,510	103,332	1,803	4,996	6,799
<b>East</b>	51	64	163	278	23,022	29,106	52,128	870	2,271	3,141
<b>South</b>	70	87	173	330	26,122	35,824	61,946	1,079	2,496	3,575
<b>West</b>	128	101	340	569	38,562	45,454	84,016	1,443	1,909	3,352



<b>Malir</b>	136	113	414	663	34,548	32,333	66,881	1,540	1,148	2,688
<b>Korangi</b>	97	94	220	411	35,192	46,918	82,110	1,025	3,082	4,107
<b>Source: Sindh Education Management Information System (SEMIS) Census 2016 – 2017</b>										

Facilities available in the schools are presented in the table below. It illustrates that advance facilities in schools of District West have improved their standard in educating its residents on a certain level. Apart from the Government-run education institutions, dozens of private schools are also functioning in the district.

<b>District-wise Basic and Advance Facilities in Schools of Karachi</b>							
<b>Districts</b>	<b>Schools</b>	<b>Electricity</b>	<b>Washroom</b>	<b>Drinking Water</b>	<b>Boundary Wall</b>	<b>Lab</b>	<b>Library</b>
<b>Central</b>	607	447	484	507	529	121	56
<b>East</b>	264	223	241	219	238	59	25
<b>South</b>	482	383	426	356	432	49	49
<b>West</b>	363	232	301	256	340	82	27
<b>Korangi</b>	550	397	431	391	509	46	37
<b>Malir</b>	591	240	398	302	479	56	21
<b>Source: SEMIS Census 2016 – 2017</b>							

#### 4.9.5 Public Health Facilities

Like other cities which have innovative and modern healthcare facilities, Karachi is equipped with the best hospitals in Pakistan. These hospitals are possessed by top-notch doctors, surgeons, and health specialists who provide the most authentic and reliable diagnosis and treatment to the patients who come from all corners of the country. The public health facilities in Karachi are highly centralized in a few locations and cannot cater to a large part of the population. The below mentioned public health facilities data is not updated in the government records thus subject to some shortcomings. Though health facilities available in District West Karachi include public, private and welfare hospitals need to be increased.

The following table shows the number of health practitioners and paramedical personnel in Karachi.

<b>District-wise Government Medical and Paramedical Personnel in Karachi 2017</b>											
<b>District</b>	<b>Doctors</b>	<b>Nurses</b>	<b>L.H. V</b>	<b>Dispensers/Dressers</b>	<b>X-Ray Technicians</b>	<b>Lab Technicians</b>	<b>O.T Technicians</b>	<b>X-Ray Assistants</b>	<b>Lab. Assistants</b>	<b>O.T. Assistants</b>	<b>Midwives</b>
Central	579	207	15	82	12	17	25	0	3	12	26
South	324	115	4	51	14	23	33	0	8	8	2

East	245	18	22	26	4	0	3	0	4	1	6
West	356	83	19	67	12	14	22	5	12	15	19
Malir	234	25	14	53	9	4	6	0	10	5	18
Korangi	252	90	38	-	-	-	-	0	8	8	25
Source: Directorate General of Health Services, Hyderabad											

The following table shows the number of health practitioners and paramedical personnel in Karachi.

District-wise Government Health Facilities with Bed Capacity in Karachi 2017														
District	Hospital		Hospital Beds		Dispensaries		R.H Centers		T.B. Centre		B.H. Units		M.C.H.C.	
	Teaching	Civil, Specialized	Teaching	Civil, Specialized	No.	Beds	No.	Beds	No.	Beds	No.	Beds	No.	Beds
Central	-	-	3150	-	5	-	-	-	8	-	2	-	3	6
South	2	4	-	960	5	-	-	-	10	5	-	-	-	-
East	-	-	361	-	5	-	-	-	5	97	4	-	4	-
West	1	1	-	248	14	15	4	20	8	-	7	14	5	6
Malir	-	1	-	48	7	-	2	8	4	-	14	22	6	-
Korangi	-	7	-	724	8	-	-	-	7	-	8	16	4	41
Source: BOS, Government of Sindh (Development Statistics of Sindh, 2017)														

However, there are several dispensaries, maternity homes and child welfare centres and hospitals in the district which cater to the medical emergencies of the people of different localities. Namely Valika Hospital on Manghopir Road. Qatar Hospital in Orangi, Murshid Hospital and Naval Hospital in Mauripur, Ziauddin Hospital, KPT Hospital, Korean Hospital, Al-Khidmat Hospital, Arain General Hospital, Patni General Hospital, Metro Lion's Hospital, Hazrat Hassan Hospital, Rasheeda Memorial Hospital, Al-Mujeeb Welfare Hospital etc.

#### 4.9.6 Micro environment

The microenvironment of the project will be discussed as per the left and right portions of the site;

##### Left Portion of the Site

- This portion of the site consists of mostly hilly terrain with small portions of flat terrain.





- Limited commercial activity comprising of hill cutting was witnessed.
- Small depressions, possibly formed due to movement of heavy vehicles, had formed in the area, where rainwater had accumulated over time and was serving as grounds for grazing of livestock.
- Due to the recent rains in the area, the area had also witnessed the growth of rain fed vegetation, attracting animals for grazing.

#### Right Portion of the Site

- This portion of the site also consists mostly of hilly terrain with small portions of flat terrain.
- Limited agricultural activity was found within the boundaries of the site as well as few farmers associated with the fields residing in the area.
- The area showed some signs of work had been done by excavators that had carved into the hills.
- Due to the recent rains in the area, the area had also witnessed the growth of rain fed vegetation, attracting animals for grazing.

## Chapter 5 IMPACTS AND MITIGATION

This Chapter assesses the potential environmental and social impacts of the proposed project on environment and community. Also provided in the Chapter are the project-specific mitigation measures to minimize if not eliminating the potentially negative impacts, in order to ensure that the proposed interventions do not cause environmental and social impacts beyond the acceptable levels.

### 5.1 Environmental Safeguards Processing Steps

Implementation of the mitigation measures will require the following steps closely linking with activity planning, design and implementation steps.

- Step 1: Screening of Projects for impacts
- Step 2: Inclusion of Environmental Specifications and Environmental and Social Management Plan in Contractor(s) bidding documents
- Step 3: Compliance and Monitoring

### 5.2 Screening of Impacts

Project activities proposed for the subproject will undergo initial screening through a number of filters that include screening environmental and social impacts. Subprojects with any significant, long-term or medium term, irreversible environmental and social negative impacts will be avoided to the extent possible. A rapid assessment checklist for screening of impacts of Solar project and filled as per the environmental survey conducted for the subproject area.

#### Environmental & Social screening checklist

S. No	Issues	Yes	No	Don't Know	Remarks
1	Does the subproject require land acquisition?				The project will be developed on the land of GoS. Land acquisition is not required.
2	Will the project negatively impact livelihoods				The project activities will confine within the project area which is at present vacant and barren. The project will not negatively impact livelihoods rather, generation of employment is envisaged.
3	Is the project located on land with contested ownership?				No land ownership issues are with the project site.
4	Is the project located in an area with security problems				Project area does not represent substantial security threats.
5	Is the projected located on land reclaimed from floods				project site is not located on land reclaimed from floods.
6	Is the subproject located in a designated protected area?				The subproject is not located within any designated natural reserve.



S. No	Issues	Yes	No	Don't Know	Remarks
7	Is the subproject located in an area which would create a barrier for the movement of conservation-worthy wildlife or livestock?				No such barrier for the movement of wildlife or livestock is envisaged.
8	Is the project located close to groundwater sources, surface water bodies, water courses or wetlands?				No surface water body or wetland lies within 500m radius of project site.
9	Is the project located in an area with designated cultural properties such as archaeological, historical and/or religious sites?				No designated cultural properties exist in the project area.
10	Is the project located in an area from where people have been displaced?				Project site is vacant and barren.
11	Is the project located in a densely populated area?				project is located in sparsely polluted area.
12	Is the project located on prime agricultural land?				Project is not located on prime agriculture land.
13	Is the project located in an area of tourist importance?				Not known or established tourist sites exist in the subproject area nor any tourist activity was observed during surveys.
14	Is the subproject located far from accessible roads?		✓		The project is located off Northern Bypass (M10)

### 5.3 Assessment of Potential Impacts and Generic Mitigation

The positive and potentially negative impacts are assessed in detail in the subsections below for Solar PV project. The specific mitigation measures for sub-project impacts have also been provided hereunder.

#### 5.3.1 Positive Socio-economic and Environmental Impacts of project

Most of the project's environmental and social impacts will be beneficial, including for example generation of clean electricity, saving of carbon footprint of energy generation, generation of employment for locals etc. The beneficial impacts of the Solar PV subproject are described briefly hereunder:



- Clean electricity generation by avoiding use of fossil fuels, thereby putting effort towards climate change mitigation and adaptation.
- Savings of CO<sub>2</sub> emissions over the lifetime of the project.
- Generation of short term and long-term direct employment for locals. Estimated workforce for the construction phase will be 100-150 and operational phase will be around 20-30. It is envisaged that the about three-quarter of the workforce during construction phase will be required for unskilled jobs/work. Locals will be preferred for the workforce, expected to be about two-third of the unskilled workforce. For the operational phase, requirement of local unskilled labor is not expected to be more than half of the workforce. Possession of valid National Identity Card will be required to ensure hiring of locals among the workforce.
- Adding cleaner electricity to National grid to reduce the gap between demand and supply, particularly relevant for peak demand.
- Reduction of chronic power shortages.
- Indirect employment generation for the associated businesses such as suppliers & manufacturers of solar panels, inverters, transformers and maintenance service providers is also envisaged from the proposed project.
- The airshed of the area will remain unpolluted as no air emissions are associated with Solar energy generation.

The project area is underdeveloped, as indicated in the socioeconomic profile and lacks reliable supply of water and electricity. It is therefore recommended that community development in the project area being made part of the project developer's scope.

### 5.3.2 Impacts and Mitigation Measures

The impacts associated with these activities are impacts of dust emissions, water/groundwater contamination, soil contamination, solid waste management, noise pollution, wastewater disposal, traffic management, occupational and community risks with regards to health and safety.

### 5.3.3 Project Pre-Construction/Design Phase

Following is a description of impacts on each environmental and social component along with specific mitigation measures;

#### 5.3.3.1 Impact on Ecology

The project site does not lie in a protected area, Ramsar site, reserved forest, wildlife sanctuary or game reserve. No endangered faunal specie could be found during surveys or reported at the subproject site. The project site does not have any significant flora of concern. Therefore, no significant impacts are envisaged on the flora during the project construction and operation phase. Natural drainage pattern exists at the project site.

#### *Mitigation Measures:*

- Onsite activities will be so planned that the natural drainage pattern is not disturbed.
- Rainwater drainage system will be connected with natural drainage so as not to alter the site natural drainage pattern.





### 5.3.3.2 Impact on Cultural/Archaeological Sites

No cultural and archaeological sites are located within 500m of the project site.

#### *Mitigation Measures:*

No mitigation measures are required as there is no impact.

### 5.3.3.3 Land Acquisition and Encroachments

The project is located on land leased by GoS therefore no land acquisition is involved.

#### *Mitigation Measures:*

No mitigation measures are required as there is no impact.

### 5.3.4 Construction Impacts

Project activities will involve earthworks for construction and installation of panels and associated electrical equipment and substation. Following are the potential impacts of the subproject activities;

#### 5.3.4.1 Social Impacts

Social concerns and conflicts during the construction project activities may arise if all the primary and secondary stakeholders are not adequately informed, consented and taken into confidence about the project or its schedule of operations, before the commencement of project activities.

- If the proposed construction site is not appropriately cordoned off to restrain outsiders from entering the site, issues of trespassing and safety issues of trespassers may arise, over to the safety and security of the site personnel and equipment.
- Quarrels between commuters due to increased traffic flow may arise if traffic management is not in place.
- Nuisance to nearby communities is envisaged due to increased heavy traffic and movement of construction equipment and dust and noise emissions.

#### *Mitigation Measures*

- Extensive consultation with stakeholders will be carried out and their feedback; concerns and input will be taken into account in the project planning and execution.
- It will be ensured that the construction site is appropriately cordoned off with hard barricade.
- Traffic management will be ensured taking in consideration the nearby community, their access and movement and privacy and optimal access routes to the site from M10.

#### 5.3.4.2 Air Quality Deterioration

The use of construction machinery operated on diesel can generate exhaust emissions including SO<sub>2</sub>, NO<sub>x</sub>, Smoke and Particulate Matter (PM). Site clearance, leveling, minor excavation for solar panels installation and substation foundations and other earthworks will generate dust emissions. Another possible cause of air deterioration is handling and transportation of cement, mortar, concrete, other dusty materials, and handling and storage of aggregates in concrete plants. However, these impacts will be temporary and localized to the construction phase in subproject area.

#### *Mitigation Measures*



Different options are available to control dust and exhaust pollution. They are listed below:

- The exposure of construction workers to dust should be minimized by provision of dust masks and mandating the workers to wear them.

➤ **Dust Reduction Measures**

- Water should be sprinkled daily to wet all the expose surfaces.
- Use of water suppression for control of loose materials on paved or unpaved internal road surfaces. Oil and oil by-products is not a recommended method to control dust<sup>13</sup>.
- Truck loads should be covered with tarpaulin.
- Construction site including soil and material piles at the site should be adequately barricaded to avoid material escape, generation of dust.
- Ready-mix can be used in the stages of the project wherever and whenever required and deemed appropriate.
- Careful handling and working under moist conditions and monsoon season will be avoided as much as possible.

➤ **Exhaust emission reduction measures**

- Construction machinery, vehicles should be properly tuned and kept in good working condition, minimizing exhaust and vehicular emissions. It should be ensured that exhausts from these equipment and vehicles comply with relevant SEQS.
- Excessive engine idling should be discouraged and machinery causing excessive pollution (i.e., visible clouds of smoke) should be banned from site.
- Open burning of solid wastes, whether hazardous or nonhazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively<sup>14</sup>.

### 5.3.4.3 Noise

During the construction works, noise will be generated from the operation of machinery, project-related vehicular and material transport. These activities may cause discomfort to nearby communities and populace. Following table shows the noise levels of different construction equipment that will be used during construction phase of subproject.

Table 5.1: Typical noise levels of construction equipment (noise level in dB (A) at 15 m)			
Clearing		Structure Construction	
Bulldozer	80	Crane	75-77
Front end loader	72-84	Welding generator	71-82
Jack hammer	81-98	Concrete mixer	74-88
Crane with ball	75-87	Concrete pump	81-84
		Concrete vibrator	76
<b>Excavation and Earth Moving</b>		Air compressor	74-87
Bulldozer	80	Pneumatic tools	81-98

<sup>13</sup> WBG EHS Guidelines

<sup>14</sup> WBG EHS Guidelines



**Table 5.1: Typical noise levels of construction equipment (noise level in dB (A) at 15 m)**

Clearing		Structure Construction	
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
Grading and Compaction		Landscaping and clean-up	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
Paving		Front and end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94
<i>Source: U.S. Environmental Protection Agency, Noise from Construction Equipment and Operations. Building Equipment and Home Appliance. NJID. December 31, 1971</i>			

Figure 6.5 shows the locations around the subproject area that will be affected from noise during construction activity.

#### *Mitigation Measures*

Different options are available to control noise pollution. They are listed below:

##### ➤ **Noise Containment Measures**

- PVC Laminated Polyester Fireproof Mesh Sheet can be used with hard barricade to reduce the noise levels and check the noise levels outside the barricade periodically for different type of construction activities through a hand-held noise meter.
- High noise activities should cease between 22:00 and 06:00 hrs.

##### ➤ **Noise Reduction Measures**

- Equipment and vehicle noise can be reduced at source by regular maintenance & repair of construction machinery and equipment.
- Mufflers or silencers should be mandatory to be equipped by all project-related vehicles.

#### **5.3.4.4 Surface and Ground Water Quality**

The potential spills from construction equipment fuel, electrical equipment such as switch gears and transformers, construction vehicles during construction may unlikely result in contamination of groundwater under normal conditions. However, in conditions like post-monsoon season when groundwater table rise, contamination can occur. Also, inadequate storage at construction site and disposal to nearby areas of waste material will result in contamination of land, nuisance to the nearby community. Estimation water consumption from construction and labor camps will be 16000-24000 gallons per day.

No surface water body exists within 500m of project site; therefore, no contamination is envisaged.



### *Mitigation Measures*

- It will be ensured that the wastes generated from construction activities should be stored in a proper interim location onsite which should be adequately barricaded and covered to avoid ingress of storm water.
- Excavation material /civil works related solid waste should be reused or disposed to the approved disposal site.
- Porta cabins will be provided for worker residence as well as for shelter for labor during construction and provision of water. Septic tank with soakage pit will be constructed for wastewater disposal.
- During construction phase, water tankers will be used.

#### **5.3.4.5 Waste Management**

Typical solid waste generated during construction include waste concrete, empty cement bags, excavated soil, rejected or malfunctioned solar panels etc. The solid waste has the potential to cause negative impact on the surroundings if not properly managed and disposed of. It is likely to block nearby drainage channels that can ultimately cause localized flooding during the monsoon and nuisance to the communities.

Poor waste management practices would result in short term negative impact on the aesthetics of the surrounding. It can also impact air quality.

### *Mitigation Measures*

- All hazardous waste such as oil-waste will be handled and disposed through incineration via EPA certified hazardous waste contractor hired by CC.
- Recycling of solid waste will be carried out as far as possible and practical like cement bags, empty drums, discarded bricks etc.
- Rejected or malfunctioned solar panels will be sent back to the distributor/equipment manufacturer as no PV end-of-life treatment/recycling or disposal facility exist in the country as of today and the panels should not be disposed of without disbanding and untreated in the landfills/dumpsites.
- No wastes should be dumped indiscriminately at any location outside the site boundary/designated disposal site.
- Training should be provided to working personnel for identification, segregation, and management of waste.
- The site-specific waste management plan will be developed by CC.

### *Waste Segregation*

All hazardous waste if found shall be segregated from nonhazardous wastes at the point of generation of waste. During construction phase, suitable containers with following color coding shall be kept to collect and segregate common wastes at all facilities:

Waste material	Color code
Concrete/ Campsite Debris	Blue
Metal	Green





Plastic	White
Oily Rags	Black
Used Oil	Red
Rubbish/Trash	Yellow

### Recycling

Recycling and reuse minimize the quantity of waste requiring disposal. Some of the wastes can be reused within the construction site while others can only be recycled (Table 6.2). There is a great recycling potential for few of these wastes in the recycling market. Waste shall be sold to the third-party contractors/ companies, who have proper recycling facilities.

CC will suggest/recommend recycling of the paper, glass, plastic wastes in their respective processing units. Iron/steel waste would be sent to re-rolling mills.

**Table 5.2: Waste management options (different categories)**

S#	Waste Type	Category	Disposal Options
1.	Septic Tank Sludge	Non-hazardous	Disposed in Landfill site.
2.	Excavation Material	Non-hazardous	Reuse for backfill
3.	Construction debris including Scrap	Non-hazardous	Recycle, reuse or sell to third party contractor.
4.	Metals	Non-hazardous	Store cuttings in designated area for reuse. Remove surplus materials and use them at other sites, where feasible.
5.	Concrete	Non-hazardous	Store unused concrete blocks for later reuse. Recycle, reuse or sell to third party contractor.
6.	Bricks	Non-hazardous	Reuse for footings and broken bricks.
7.	Plastic and vinyl	Non-hazardous	Recycle, reuse or sell to third party contractor.
8.	Corrugated Cardboard	Non-hazardous	Recycle, reuse or sell to third party contractor.
9.	Woods	Non-hazardous	Recycle
10.	Empty Drums and Containers	Non-hazardous	Disposed them off through recycler.
11.	Oil waste (fuel oil, transformer oil, switchgear oil)	Hazardous	Handled and disposed through incineration via EPA certified waste contractor hired by CC.
12.	PV modules	Hazardous	Extract recyclable content and then disposal in landfill site approved by authorities.
13.	Sanitary Wastewater	Non-hazardous	Treat wastewater in septic tanks before disposal.
14.	Trash	Non-hazardous	1. Segregate glass, metal, plastic from trash. 2. Recycle all recyclable items. 3. Designed landfill.

The Waste Tracking Form, attached below shall be used to record this information by CC, while waste is being dispatched outside construction site. It is the responsibility of respective EPA certified waste contractor to assign a suitable person to sign off the record of waste tracking before the waste is dispatched outside.



### WASTE TRACKING FORM

<b>Location of Generation:</b>	
<b>Reporting Team:</b>	
<b>Submitted by (Name):</b>	
<b>Submitted on (Date):</b>	
<b>Waste</b>	<b>Disposal Location</b>
Excavation Material	
Concrete	
Bricks	
Metal	
Card board	
Wires	
Drums and Containers (Empty)	
Oil Contaminated Soil	
Sanitary Wastewater	
Sludge	
General Trash	

**Checked and Signed:** \_\_\_\_\_ **Dated:** \_\_\_\_\_

#### 5.3.4.6 Soil Contamination

Soil at the construction site can get contaminated from either spill, due to stagnant water or degradation due to activities in the microenvironment of the site.

#### *Mitigation Measures*

- Fuel oils, Transformer oils and lubricants for construction machinery will be stored in covered diked areas, underlain with HDPE membrane.
- Washing and maintenance of vehicles will be restricted onsite and contractor is mandated to get entry of well-maintained and cleaned machinery.
- Regular inspections will be carried out to detect leakages in construction vehicles and equipment.
- Appropriate implements such as shovels, plastic bags and absorbent materials will be made available near fuel and oil storage areas for removal of oil and contaminated soil.

#### 5.3.4.7 Traffic Management

Project site is located off M10 Highway. The project site is not frequented with vehicular traffic. Therefore, traffic disruption is not envisaged. However, adequate vehicular traffic management will be undertaken to avoid nuisance to nearby communities.



### *Mitigation Measures*

- Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid nuisance to nearby villages and congestion at the connecting point to M10 Highway.
- Appropriate Sign postings may be installed to alert populace of all potential hazards including limited access to construction sites.
- Movement of construction material to the project sites should be planned in a way that it will not hamper major transport activity in the micro and macro environment. The transfer of material should not be done during late hours.

#### **5.3.4.8 Impacts on Flora**

The project site does not have any significant flora. Therefore, no significant impacts are envisaged on the flora during the project construction and operation phase.

### *Mitigation Measures*

- No mitigation measures will be required.

#### **5.3.4.9 Impacts on Local Resources**

During project execution, supplies of equipment, material, etc. will be required. As the project area is under developed and has limited commercial activities, supplies are likely to be sourced from population centers such as Hub and Karachi. These centers are far well-developed than the project area and have substantially more commercial and industrial activities and resources. Additionally, supplies for the project will mainly be required during construction phase, which has the limited time period of several months. Therefore, residual adverse impacts of project supplies on local resources are not likely.

#### **5.3.4.10 Labor Issues**

- The construction works involving earthworks, excavation, erecting structures, etc. poses an inherent risk of injury to labor from accidents.
- Poor housekeeping practices may lead to stagnant water as breeding grounds for insect vectors (causing malaria etc.).
- Hazards from handling equipment, ergonomic stress, lifting heavy materials etc. may cause injury to the labor.
- Electrical equipment and substation pose electrocution hazard.

### *Mitigation Measures*

Site-specific labor health and safety hazards are also critical to identify based on job safety analysis or comprehensive hazard or risk assessment. Health and safety management planning should include the adoption of a systematic and structured approach for prevention and control of physical, electrical, chemical, and biological health and safety hazards. Use of PPE should be made mandatory. Only trained and experienced crane, forklift, etc. operators should be hired. CC shall ensure that Job Hazard Analysis (JHA) is performed prior to commencing jobs. It shall also be ensured that the JHA is reviewed after the following:



- Whenever work is stopped
- Every time work conditions or the job scope changes
- Persons working the job shall review and acknowledge the JHA by their signature

#### **5.3.4.11 Crane and Lifting Operations**

For all Crane & Lifting Operations CC shall ensure full compliance with standard operating procedures. CC shall develop a site-specific pre-lift checklist which includes the following at minimum:

- Crane rigging capacity adequately for load
- Condition of slings
- Rigging condition adequate for load
- Area of swing or travel unobstructed
- Multiple crane use
- Power line approach distance maintained
- Stability and footing
- Taglines and spotters
- Illumination and weather
- Signal operator
- Job hazard analysis and other permits

All lifting and rigging activities shall be supervised and conducted by a competent person or team, CC shall maintain a lifting gear registry for all lifting gear on-site inclusive of a listing of all lifting gear, copies of equipment certificates (manufacturer, safe working load, serial number) and the inspection/recertification frequency.

#### **5.3.4.12 Forklifts and Non-Road Vehicles**

CC should ensure forklift and non-road vehicles are fit for purpose and operated according to manufacturer's requirements. Only competent operators are permitted to operate forklifts and non-road vehicles.

At minimum, all forklifts and non-road vehicles shall be equipped with following equipment:

- Seat belts
- Horn
- Emergency Brake
- Wheel chock
- Labeled Controls
- Fire Extinguishers
- First Aid Kit
- Back-up Alarm





#### **5.3.4.13 Scaffolding**

CC is responsible to establish periodic inspection, certification and recertification program for scaffold works. Only qualified worker is authorized to erect, inspect and certify scaffold. All scaffolds should have a guardrail system on each open side, up to the access point. It should be equipped with toe boards having suitable access ladder.

#### **5.3.4.14 Over-exertion**

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries at construction site.

##### *Mitigation Measures*

Recommendations for their prevention and control include:

- Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two-person lifts are necessary.
- Work site layout will be planned to minimize the need for manual transfer of heavy loads.
- Tools will be selected and work stations would be designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations.
- Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes.

#### **5.3.4.15 Slips and Falls**

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction site.

##### *Mitigation Measures*

Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Good house-keeping practices, such as the sorting and placing loose construction materials in established areas, would be implemented.
- Excessive waste debris and liquid spills will be cleaned up regularly.
- Electrical cords and ropes will be located in common areas and marked corridors.
- Slip retardant footwear will be used.

#### **5.3.4.16 Struck by Objects**

Construction activities of the project may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.



### *Mitigation Measures*

Techniques for the prevention and control of these hazards include:

- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap.
- Temporary fall protection measures in scaffolds and out edges of elevated work surfaces would be used, such as hand rails and toe boards to prevent materials from being dislodged.
- Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be wore.

#### **5.3.4.17 Moving Machinery**

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise.

Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

### *Mitigation Measures*

Techniques for the prevention and control of these impacts include:

- The location of vehicle traffic, machine operation, walking areas, and controlling vehicle traffic will be planned and segregated through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
- The visibility of personnel will be ensured through the use of high visibility vests when working in or walking through heavy equipment operating areas as well as training of workers to verify eye contact with equipment operators before approaching the operating vehicle.
- Inspected and well-maintained lifting devices will be used that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

#### **5.3.4.18 Electrocuting Hazard**

Subproject involves generation of electricity and its evacuation through substation and therefore poses electrocution hazard to the workers. An electrical hazard can be defined as a serious workplace hazard that exposes workers to any of the following:

- Burns
- Electrocution
- Shock
- Arc flash or arc blast
- Fire
- Explosions

List of potential electrical hazard at site is as follows;



- Improper grounding
- Exposed electrical parts
- Inadequate wiring
- Damaged insulation
- Overload circuits
- Damaged tools and equipment

*Mitigation Measures*

- Use of ground-fault circuit interrupters
- Periodic inspection of extension cords and portable tools
- Use power tools and equipment as designed
- Proper lockout/tagout procedures will be followed
- Safety signs for electrical hazard will be placed
- Ensuring proper guarding of electrical equipment and facilities

**5.3.4.19 Other Site Hazards**

Construction of site may pose a risk of exposure to dust, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms.

*Mitigation Measures*

- Only authorized personal should be allowed at the construction site
- Identify and minimize, so far as reasonably practicable, the causes of potential hazards to workers, including communicable diseases and vector borne diseases;
- Avoid stagnation of water and initiate drainage/cleanup of stagnant water;
- Provide for the provision of appropriately stocked first-aid equipment at work sites;
- Provide for appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate outerwear, boots and gloves; safety helmets;
- Provide training for workers for the use of PPE;
- WB Group's Environment, Health and Safety (EHS) Guidelines will be implemented;
- No bonded and child labor will be permitted at site;
- Major labor laws will be followed e.g., Minimum Wage, Hours of work, Overtime Payment.
- Also, laborers will be trained on appropriate interaction with local people;
- Include procedures for documenting and reporting accidents, diseases, and incidents; and
- All safety precautions will be taken to address safety hazards for the nearby community. These precautions may include safety/warning signage, safety barrier around the construction site.
- Lighting provided for labor during night time work should be adequate.
- CC will include appropriate clauses to protect environment and public health. The EMP will be included in the bidding document;



Summary of Recommended Personal Protective Equipment According to Hazard		
Objective	Workplace Hazards	Suggested PPE
Eye and face protection	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation.	Safety Glasses with side-shields, protective shades, etc.
Head protection	Falling objects, inadequate height clearance, and overhead power cords.	Plastic Helmets with top and side impact protection.
Hearing protection	Noise, ultra-sound.	Hearing protectors (ear plugs or ear muffs).
Foot protection	Falling or rolling objects, pointed objects. Corrosive or hot liquids.	Safety shoes and boots for protection against moving & falling objects, liquids and chemicals.
Hand protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures.	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
Respiratory protection	Dust, fogs, fumes, mists, gases, smokes, vapors.	Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available.
	Oxygen deficiency	Portable or supplied air (fixed lines). On-site rescue equipment.
Body/leg protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration.	Insulating clothing, body suits, aprons etc. of appropriate materials.
Source: IFC Environmental, Health, and Safety General Guidelines		

### COVID-19 Prevention

Prevention measures are listed below;

- Assess the hazards to which the workers may be exposed; evaluate the risk of exposure; and select, implement, and ensure workers use controls to prevent exposure.
- Conducting a job hazard analysis can help to determine whether work activities require close contact (within 6 feet) between workers, visitors, or other members of the public.
- When a job hazard analysis identifies activities with higher exposure risks, and those activities are not essential, consider delaying them until they can be performed safely.
- Use closed doors and walls, whenever feasible, as physical barriers to separate workers from any individuals experiencing signs and/or symptoms consistent with COVID-19.
- Use administrative controls, when feasible, to reduce or eliminate the risk of exposure.
- Training for employees on the spread of the disease in the geographic areas in which they work.

- Screening calls when scheduling indoor construction work to assess potential exposures and circumstances in the work environment, before worker entry.
- Appropriate cleaning practices (i.e., washing hands frequently with soap and water for at least 20 seconds, or, if soap and water are not immediately available, using alcohol-based hand sanitizer that contains at least 60% alcohol and rubbing hands until they are dry; sanitizing all surfaces workers will touch).
- The proper way to cover coughs and sneezes following Ministry of Health and WHO recommendations (i.e., sneezing or coughing into a tissue or into the upper sleeve).
- Alternatives to shaking hands upon entry, and the importance of workers not touching their own faces (mouth, nose, eyes).
- Wearing masks over their noses and mouths to prevent them from spreading the virus.
- The need to continue using other normal control measures, including PPE, necessary to protect workers from other job hazards associated with construction activities.
- To the extent possible, screen all visitors on all construction sites in advance of their arrival on the job site for signs and symptoms of COVID-19.
- Adopt staggered work schedules, e.g., provide alternating workdays or extra shifts, to reduce the total number of employees on a job site at any given time and to ensure physical distancing.
- Keep in-person meetings (including toolbox talks and safety meetings) as short as possible, limit the number of workers in attendance, and use social distancing practices.
- Ensure clean toilet and handwashing facilities. Clean and disinfect portable job site toilets regularly. Fill hand sanitizer dispensers regularly. Disinfect frequently touched items (i.e., door pulls and toilet seats) regularly.

### 5.3.5 Project Operation Impacts

Solar PV technology is a clean energy generation technology which does not produce air emissions, effluent generation and noise during operations. However, some potential impacts during project operations are discussed below and mitigation measures have been given where required.

#### 5.3.5.1 Wastewater

Wastewater during the operation phase will mainly comprise of sewage and residual water from cleaning of solar PV panels. Both are wastewater streams are considered non-hazardous and its potential negative impacts will be mitigated as follows;

##### *Mitigation Measures*

- Adequate separate drainage lines will be provided for the flow of sewage and residual water from panel cleaning.
- Sewage water will be discharged through multi-chamber Septic Tank connected with soakage pit. Alternatively, sewage water can be collected in a concrete-line pit and can be remove on periodic basis through waste contractor for off-site disposal.
- Wastewater from solar panels cleaning can be collected in settling pit and be reused to the extent feasible or it can also be used for dust suppression on exposed surfaces, which will reduce the water requirement for the project during operations. Alternatively, the residual water can be disposed through Septic Tank connected with soakage pit.





- If RO plant is used for groundwater desalination, RO reject will be collected in the concrete-lined evaporation pond and will not be discharged outside the project boundary. Mineral residues after evaporation can be disposed offsite through waste contractor or can be sold if commercially viable. An alternative would be to bore a rejection well and RO brine may be injected deep underground.

#### **5.3.5.2 Solid Waste Disposal**

During operations, solid waste will comprise of broken/disused electrical and electronic equipment such as PV panels, batteries, inverters, transformers; food waste, sewage sludge, etc. PV panels and batteries contain certain number of heavy metals such as Mercury and Cadmium which are considered toxic for environment. Waste will be segregated before disposal.

##### *Mitigation Measures*

- Several components of the solar panels can be recycled such as glass, plastic and aluminum can be recycled. However, at present, no such facility exists in the country. Disposal of broken and dysfunctional panels to landfills/dumpsites is also not recommended due to the potential of soil and groundwater contamination due to constituents of solar cells. Therefore, the disused panels will be returned to the supplier/manufacturer.
- Disused dry batteries will be returned to the supplier/manufacturer for possible recycling.
- Other electrical equipment as transformers and inverters will be returned to the suppliers/manufacturers.
- No hazardous waste such as food, packaging, sewage sludge etc. will be disposed through waste contractor.

#### **5.3.5.3 Community Health and Safety**

Potential impacts on the community during the operations are minimal as the solar PV plant does not have air emissions, noise generation and effluent discharge, however electrocution hazard remains.

##### *Mitigation Measures*

- Entry/exit gate(s) of the site will be clearly marked.
- Entrance in the site will only be allowed to the authorize personnel and to the visitors after registration at entrance.
- Site will properly be barricaded through wall/fence of adequate height to minimize chances of trespassing, thereby avoiding the incidents such as electrocution.
- Electrical hazard signs and posters will be adequately marked on the outer face of the barricading wall/fence to alert the passerby.
- Unskilled staff for operational phase will mainly be sourced from the area to avoid any community conflict due to influx of outsiders.

#### **5.3.5.4 Occupational Health and Safety**

There will be significantly lower requirement of onsite staff than construction phase to ensure the smooth plant operations after commissioning. Electrocution will be the main hazard for the onsite workers during operations.

##### *Mitigation Measures*



- Electrical equipment will adequately be grounded for workers safety.
- Electrocution hazard signs will be displayed, particularly for the PV panel area and substation.
- Staff will be required to wear necessary PPE once they are out of their campsite for routine inspection, surveillance and/or monitoring.
- Maintenance at the site will be duly be authorized and be carried out with necessary safety precautions such use of PPE, adequate grounding, etc.

#### **5.3.5.5 Impacts due to spill and leakage of transformer oil, liquid dielectric**

Potential impact for spills and leakage of dielectric includes soil and groundwater contamination if the equipment is mounted on soft surface and fire hazard as the liquid dielectric is usually flammable.

##### *Mitigation Measures*

- Transformers and associated equipment with liquid dielectric will be concrete footing with adequate drain and collection pit in case of spill to avoid soil contamination and ingress into soil.
- Leakages will be prevented through periodic maintenance.
- Spilled oil and dielectric will be disposed through incineration by waste contractor.

#### **5.3.5.6 Visual Impacts**

Project site is the part of vast expanse of barren land. Ground-mounted PV panels will raise only couple of meters from ground so the project is unlikely to cause major visual obstruction for the general landscape.

##### *Mitigation Measures*

- Visual impact of the solar plant will be minimized through adequate landscaping at site.

#### **5.3.5.7 Impact of Sulfur Hexafluoride (SF6) Leak**

SF6 is a non-toxic and non-flammable but a potent greenhouse gas. It is used as gas-dielectric in electrical equipment such as switchgear. Leakage of SF6 in large quantities pose the risk of suffocation in confined and unventilated spaces. Risk of leakage is low with modern robust electrical equipment.

##### *Mitigation Measures*

- SF6 carrying equipment must not be dropped or rolled and must be protected from overheating.
- Leakage detection devices can be installed in the substation area. Handheld detectors can also be used.
- Gas mask is also recommended for the authorize personnel for operation and maintenance to avoid risk of asphyxiation from accidental release of gas in large quantities.

#### **5.3.5.8 Impacts of Electromagnetic Fields (EMF)**

As with the other electrical and electronic equipment, Solar PV systems produce Electromagnetic Fields which is the function of electric field and magnetic field. Studies<sup>1516</sup> have shown the EMF values from

<sup>15</sup> <https://pubmed.ncbi.nlm.nih.gov/26023811/>

<sup>16</sup> <https://nccleantech.ncsu.edu/wp-content/uploads/2019/10/Health-and-Safety-Impacts-of-Solar-Photovoltaics-PV.pdf>



PV systems are well below the guideline limits by ICNIRP<sup>17</sup>, therefore it will not have negative health impacts for project staff and nearby communities.

### 5.3.5.9 Flooding

Project area due to minor undulations, would be prone to floods during heavy precipitation events.

#### *Mitigation Measures*

- Improvements in forecasts and warnings
- Sustainable and long-term mitigation policies
- Automated Local Emergency Response in Real Time (ALERT) systems will be developed.

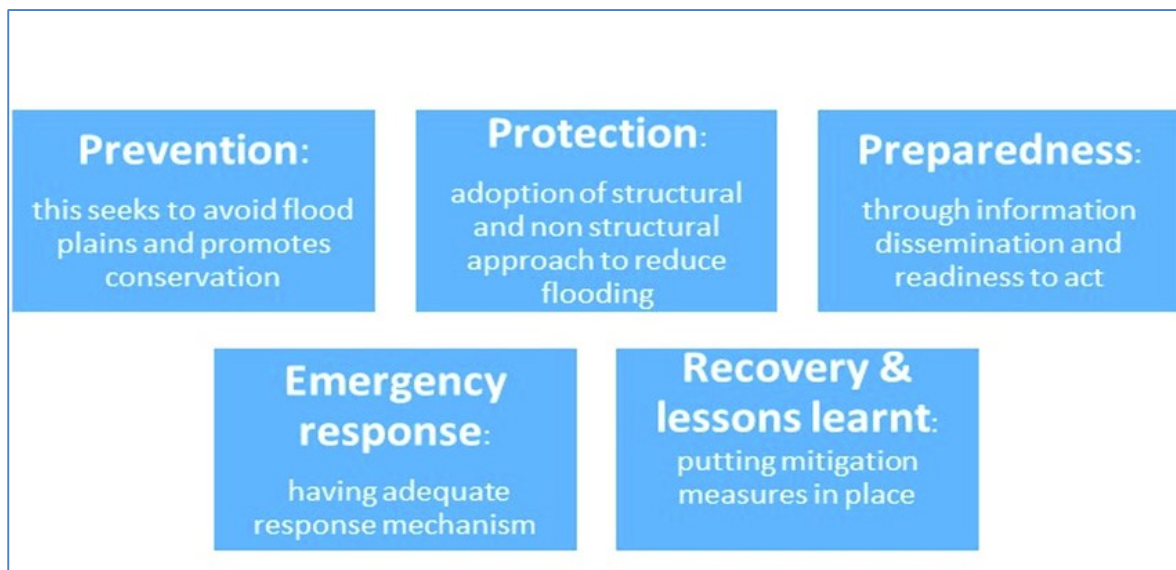


Figure 5.1: Flash Flooding Risk Management Plan<sup>18</sup>

<sup>17</sup> ICNIRP Guidelines. Retrived from <https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf>

<sup>18</sup> EU-Directives-2007-EU-flood-Risk-Management-Plan

## Chapter 6 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

### 6.1 Introduction

#### 6.1.1 General

This section discusses the implementation and management of mitigation measures that are required for proposed project that includes progressive report and techniques to assure that all necessary environmental protection measures are carried out in the future as planned and to reduce residual impact to acceptable levels and achieve the expected outcomes of the project. The Environmental Management and Monitoring Plan (EMMP) are based on the type, extent and duration of the identified environmental impacts. The EMMP has been prepared following the regulatory requirements and guidelines.

Environmental management and monitoring are mandatory activity to be undertaken by the project developer over the entire project cycle showing its commitment towards meeting environmental regulations/standards as well as maintaining health and safety standards.

The environmental management and monitoring programs are implemented from the very early stages of planning and execution phases of the project. In fact, the authorization of the project is the point of initiation of environmental management plan. The monitoring data, observations recorded and test results / analyses are vital and formulate legal documents to be kept in safe custody and may be provided to competent authority as and when required in accordance to Sindh Environmental Protection Act 2014.

EMMP is a dynamic and a live document that is under constant review having periodic revisions and may be updated as required. Any amendments in the procedures, information is notified to the concerned personnel after the approval from the competent authority for subsequent implementation. It also highlights the responsible personnel to work for the implementation of this EMMP.

The Sindh Solar Energy Project (SSEP) will be responsible for implementing the EMMP and ensuring that all personnel management are informed about the EMMP and the requirement to implement the procedures it contains. The EMMP is intended as a quick reference for Project personnel and regulators to monitor compliance

#### 6.1.2 Objectives of EMMP

The EMMP will serve as a principal execution module of the project that would not only mitigate adverse environmental impacts during the designing, construction, operational and maintenance phase of the project but also ensures that environmental standards and good housekeeping is maintained. Continuous environmental monitoring is exercised to ensure that preventive measures are in place and are effective; to sustain environmental integrity. Some of the key objectives of the EMP are to:

- Outline mitigation measures recommended in the IEE and define the responsibility and implementation of these measures;
- To outline functions and responsibilities of personnel;
- To state and implement standards and guidelines which are required under environmental legislations particular in context to the project,



- Facilitates the implementation of the mitigation measures by providing the technical details of each project impact, and proposing implementation schedule of the proposed mitigation measures;
- Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented; and
- Identify training requirements at various levels and provide a plan for the implementation of training sessions

It is important that the recommendations and mitigation measures are carried out according to the spirit of the environmental assessment process and in line with the guidelines. The EMMP are presented in Table 6.1 and 6.2. Screening of potential environmental and social impacts has played a vital role in reconfirming typical mitigation measures and in identifying any different approaches based on the feasibility and detailed design assumptions and any alternatives available at this stage.

### 6.1.3 Legislation and Guidelines

Legislation and guidelines pertaining to this project have been discussed at length in chapter 3 of this IEE study. It shall ensure that the project activities during designing, construction and operation phases of the project would follow the relevant environmental legislations and guidelines. The staff of the proponent and contractor should also be aware of these laws.

## 6.2 Structure of EMP

The environmental management plan is divided into the following core components:

- Organizational Structure and Roles and responsibilities;
- Implementation of Environmental Management Plan
- Mitigation matrix for each project phase;
- Monitoring plan for the project;
- Worker's Health and Safety Plan
- Waste management plan
- Equipment Maintenance
- Emergency Response Plan
- Site Restoration
- Change Management Plan

## 6.3 Institutional Framework for the Implementation of EMMP

This Framework illustrates the roles & responsibilities required for the implementation of EMMP. Environmental management during construction of proposed project would be performed by CC in supervision of the SSEP. In O&M phase, the implementation of EMMP would be the responsibility of SSEP and the same will ensure that all activities during each phase will be in compliance with the EMMP and SEQS.

### ***SSEP***

SSEP would perform the following roles and responsibilities:

- Will be responsible for the successful execution of the project;
- Ensure that the project complies with regulatory requirements;





- Ensure that EMMP is followed and staff is properly trained;
- Keep in place emergency and rescue plans for safety of staff and general public;
- Improve the coordination and exchange of information between management, employees and contractors etc.;
- Ensure the health and safety of employees;

## CC

Some roles and responsibilities of Construction Contractor are as under:

- Ensure that the project activities are undertaken in an environment friendly manner and EMMP is implemented;
- Evaluate compliance with SEQS, national and international guidelines for environmental protection;

### 6.4 Environmental Mitigation and Monitoring Plan

The Mitigation and Monitoring Plan has been tabulated in tables 6.1, 6.2 and 6.3. The plan will be used as a management and monitoring tool for implementation of the mitigation measures. The matrix lists down the following.

- Environmental Impacts for various project phases;
- The mitigation measures recommended in the IEE;
- The person/organization directly responsible for adhering to or executing the required mitigation measures;
- The parameters which will be monitored to ensure compliance with the mitigation measures; and
- The timing at which the mitigation or monitoring has to be carried out.
- The person/organization responsible to execute monitoring plan.

It is highlighted that although responsibilities for executing and monitoring mitigation measures have been delegated to different persons/organizations, SSEP holds the primary and overall responsibility for ensuring full implementation of the EMP.

### 6.5 Environmental Training

An environmental training program will be prepared to address the need of contractor's site staff and build their capacity to effectively implement project-specific EMMP. HSE officer (Contractor) will coordinate with contractors to organize training for their staff and to help them establish system /infrastructure for future sustainability. In addition to the training arranged and imparted by the HSE officer (Contractor) for complete project team, the contractor will also plan small training sessions for workers involved in specific jobs. Cost of trainings and mitigation measures will be deemed included in contract cost. Environmental Training Plan is provided in Table 6.3.

### 6.6 Emergency Response Plan

Emergency procedures will be prepared to include all events which have the tendency to create an emergency situation at the solar power plant. It is advisable that emergency procedures are prepared in conjunction with the emergency services such as fire brigade.



The procedures will be readily available to all personnel involved, regularly practiced and checked periodically that they are up to date. Employees likely to be affected will be provided with the knowledge of the actions required to minimize the adverse effects.

The emergency procedures will consider:

- the properties of the raw materials and excipients, solvents used;
- concerns associated with the exposure to the product
- the quantities involved;
- the plant components may cause electric shock hazard

### 6.6.1 Contingency Planning – Incidents and Emergencies

#### A. Fire Contingency Plan

Because flammable / combustible materials, and electrical appliances are present at the site, fire is an ever-present hazard. All personnel and subcontractors are not trained professional fire-fighters. Therefore, if there is any doubt that a fire cannot be quickly contained and extinguished, personnel will notify the Site supervisor and vacate the area. The site supervisor will immediately notify the local Fire Department.

The following procedures will be followed to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be kept away from where flammable materials are handled or stored.
- “No Smoking” signs will be posted at visible areas where flammable materials are present.
- Fire extinguishers will be placed in all areas where a fire hazard may exist.
- Before workers begin operations in an area, the area supervisor will give instruction on exit procedures and assembly points. Exit routes will be displayed through signage in work areas and exit points will be clearly marked.

The following procedures will be implemented in the event of a fire:

- Anyone who sees a fire will notify the supervisor who will then contact the Site Superintendent and the HSE Officer. The HSE Officer will activate the emergency alarm and contact the local Fire Department.
- When the emergency siren sounds, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will comprise of pairs of workers (buddy system) who join each other immediately after hearing the fire alarm and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count.
- When a small fire has been extinguished by a worker, the site superintendent and the Health and Safety Officer will be notified.

#### i. Responsibilities of Fire Safety Officer (Contractor)

The Fire Safety Officer will supervise and perform firefighting activities.

- Responsible for Head Count in the assembly area.



- Conduct Fire drills for the employees and reports the outcomes, suggestions and action plan of such drills.
- Responsible for maintenance and documentation of all fire extinguishers.
- Develop and regularly review building fire exit plans.
- Inspect and test new and existing fire protection systems, fire detection systems and fire safety equipment to ensure that they are operating optimally.
- Action by Staff Detecting the fire or smoke

If any person smells a burning odor or hear any one shouting “Fire, Fire” or sees the fire/smoke, he/she will immediately inform the telephone operator and will:

- Give his/ her name
- Location of Fire
- Type of Fire

Receptionist (Telephone Operator) will

- immediately inform Administration Manager, during and after working hours.
- call security in-charge
- call fire safety officer (contractor).
- call Police and City Government only if told by Security in-charge or fire officer.

Staff on duty will restrict fire by closing doors and windows of affected area, if possible and turn electrical mains to OFF position. If the fire is contained and small, rush towards the nearest fire extinguisher and try to extinguish the fire.

## **B. Evacuation Procedures**

In the event of on-site evacuation of personnel is necessary, the following actions will be taken:

- The emergency signal will be activated (one single long blast on the air horn).
- No further entry of visitors or contractors will be permitted.
- Shut off all machinery if safe to do so.
- All on-site personnel, visitors, and contractors will assemble at the entrance of the site for a head count and await further instruction from the Site Superintendent.
- All persons will be accounted for by their immediate crew leaders (e.g., area supervisor). Crew leaders will determine the safest exits for employees and will choose an alternate exit if the first choice is inaccessible.
- During exit, the crew leader will try to keep the group together. Immediately upon exit, the crew leader will account for all employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the Site Superintendent.

## **C. Evacuation Responsibility**

The decision will be made by the Emergency Rescue team which includes Fire Safety Officer (contractor) & Site In-charge and will be communicated to the Project Manager.



Emergency rescue team will inform the Project Manager and decide if partial or full evacuation is required. Also liaise to mitigate the situation and return the area to normal as soon as possible.

The emergency response team members involved are as follows:

**i. Actions by Site Incharge (Contractor)**

- Manager Administration and the Security officer in co-ordination with specific area in-charge will arrange for evacuation.
- If the fire goes beyond the control of management, the local Fire brigade to be summoned in consultation with Manager Administration.
- He will conduct root cause analysis and log the same on the prescribed incident report form.
- Security in charge will inform Manager Administration as soon as fire is confirmed by him personally.
- Call Fire Department immediately.
- Advise telephone operator to inform all head of departments/in-charges.

**ii. Senior Management/Administration**

- Should reach the place of fire as soon as the news is confirmed.
- Manager Administration will inform all areas of the Grid Station operations if needed.
- Media Handling
- A debriefing session at the end of the disaster.

**iii. House Keeping**

- Open all windows and doors for ventilation.
- Remove obstacles on the way to the fire exit.

### 6.6.2 Fire Detection & Warning

Portable Fire extinguishers will be used in buildings and as protection during "Hot Work" activities throughout the site. As construction progresses and systems are commissioned within specific buildings, personnel will be informed of the different alarm sounds.

Following types of fire extinguishers are generally used:

- ABC (Dry Chemical): Red or Orange in color. All-purpose dry chemical may be used on any type of fire
- CO2: Red in color, Big Black horn on hose. Good for Oil, Grease & Electrical fires.
- Water: Completely red with no color band. Suitable for paper, textiles, wood, most plastics & rubber.

Large office accommodation will be protected by the use of hard-wired smoke detection devices with battery backup.

A suitable means of raising the alarm, in the event of a fire or other emergency at the facility, will be established. The alarm system will be appropriate to ensure all personnel can be notified immediately



of any emergency situation and evacuation, or other actions required. The alarm system will be tested on a regular basis.

### **6.6.3 Fire Fighting Equipment**

The following firefighting equipment will be maintained in good order in the facility:

- Fire Extinguishers of adequate size and Type
- Sand buckets
- Rescue gear (includes stretchers, turnout gear, fire rescue gloves, emergency light, fire boots, fire hoods, etc.)
- Equipment will be maintained and tested to ensure serviceability in the event of a fire.
- Tests will be conducted monthly.

The facility fire suppression system will be prioritized and made serviceable as soon as practical during construction.

### **6.6.4 Fire Drills**

The Fire Safety Coordinator/ Officer will ensure that monthly drills are carried out that ensure all personnel are familiar with the evacuation procedure and their respective muster points.

Simulated fire emergencies will be carried out to ensure the readiness and competency of the fire brigade to fight a major fire. During the drill, equipment will be tested. In the event any equipment should fail it will be immediately replaced.

Review of brigade competency will be determined during the drills. Brigade members will be retrained if any evidence of in-competency exists.

## **6.7 Waste Management Plan**

The waste management plan will be prepared and implemented by the construction contractor for the proposed solar PV project in order to ensure timely collection, handling and disposal of the waste generated during the construction phase. Waste management at the power plant would:

- reduce risk exposure to a minimum,
- protect employees,
- bring the organization into compliance with EPA's requirement



**Table 6.1: Environmental Mitigation and Monitoring Plan during Pre-Construction/Design Stage**

S#	Environmental Effect	Potential Significance	Pre-Construction Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
1.	Compliance with provincial and national environmental regulations	Medium	<ul style="list-style-type: none"> <li>✓ This EMMP to be made part of the bidding/tender documents.</li> <li>✓ The bid documents shall note that Pakistani laws and regulations relating to the environment will be followed during the construction phase.</li> </ul>	CC	Tender documents		SSEP
2.	Impact on ecology	Medium	<ul style="list-style-type: none"> <li>✓ Onsite activities will be so planned that the natural drainage pattern is not disturbed.</li> <li>✓ Rainwater drainage system will be connected with natural drainage so as not to alter the site natural drainage pattern.</li> </ul>	CC	Visual impact and count of floral/faunal species at project site	Once pre-construction	SSEP
3.	Impact on Cultural/archaeological sites	Low	<ul style="list-style-type: none"> <li>✓ No mitigation measures required as no such sites are located at project site and within 1km of project.</li> </ul>	-	-	-	-
4.	Land Acquisition and Encroachments	Medium	<ul style="list-style-type: none"> <li>✓ The project is located on land of GoS. No land acquisition is involved.</li> </ul>	CC	Land documents and land survey	Pre-construction	SSEP



**Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
1.	Social Impacts	Medium	<ul style="list-style-type: none"> <li>✓ Extensive consultation with stakeholders will be carried out and their feedback; concerns and input will be taken into account in the project planning and execution.</li> <li>✓ It will be ensured that the construction site is appropriately cordoned off with hard barricade.</li> <li>✓ Traffic management will be ensured taking in consideration the nearby community, their access and movement and privacy and optimal access routes to the site from M10.</li> </ul>	CC	Visual observations, feedbacks from project personnel and community	As required keeping in view site conditions	SSEP
2.	Air Quality deterioration due to dust and exhaust emissions	Medium	<ul style="list-style-type: none"> <li>✓ The exposure of construction workers to dust should be minimized by provision of dust masks and mandating the workers to wear them.</li> <li>✓ Truck loads should be covered with tarpaulin.</li> <li>✓ Construction site including soil and material piles at the site should be barricaded to avoid material escape, generation of dust.</li> <li>✓ Ready-mix can be used in the stages of the project wherever and whenever required and deemed appropriate.</li> <li>✓ Construction operations should be carefully planned and scheduled.</li> <li>✓ Careful handling and working under moist conditions and monsoon season will be avoided as much as possible.</li> <li>✓ Construction machinery, vehicles should be properly tuned and kept in good working condition, minimizing exhaust and vehicular emissions. It should be ensured that exhausts from these equipment and vehicles comply with relevant SEQS.</li> </ul>	CC	<p>Ambient Air Quality parameters (SPM, NO, NO<sub>2</sub>, SO<sub>2</sub>, PM<sub>10</sub>, CO, PM<sub>2.5</sub>, O<sub>3</sub>, Lead) – Mobile air quality Van will be used.</p> <p>Vehicular Emissions for Construction Vehicles and equipment exhaust (Smoke, CO, NO<sub>x</sub>, SO<sub>x</sub>, PM, Noise) – Exhaust</p>	Quarterly	SSEP



**Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			<ul style="list-style-type: none"> <li>✓ Excessive engine idling should be discouraged and machinery causing excessive pollution (i.e. visible clouds of smoke) should be banned from sites.</li> <li>✓ Open burning of solid wastes, whether hazardous or nonhazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively.</li> <li>✓ Use of water suppression for control of loose materials on exposed surfaces. Oil and oil by-products are not a recommended method to control dust.</li> <li>✓ Water should be sprinkled daily or whenever there is dust problem on all exposed surfaces to suppress emission of dust.</li> </ul>		<p>analyzers will be used.</p> <p>Monitoring conducted as per SEQS.</p>		
3.	Noise	Medium	<ul style="list-style-type: none"> <li>✓ PVC Laminated Polyester Fireproof Mesh Sheet can be used with hard barricade to reduce the noise levels and check the noise levels outside the barricade periodically for different type of construction activities through a hand-held noise meter.</li> <li>✓ High noise activities should cease between 22:00 and 06:00 hrs.</li> <li>✓ Equipment and vehicle noise can be reduced at source by regular maintenance &amp; repair of construction machinery and equipment.</li> <li>✓ Mufflers or silencers should be mandatory to be equipped by all project-related vehicles.</li> </ul>	CC	Noise monitoring at project site	Monthly	SSEP
4.	Surface and groundwater quality	Medium	<ul style="list-style-type: none"> <li>✓ It will be ensured that the wastes generated from construction activities should be stored in a proper interim location onsite which should be</li> </ul>	CC	Water sampling at project site if groundwater is used	Monthly	SSEP



**Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			adequately barricaded and covered to avoid ingress of storm water. ✓ Excavation material /civil works related solid waste should be reused or disposed to the approved disposal site. ✓ Porta cabins will be provided for worker temporary residence as well as for shelter for labor during construction and provision of water. Septic tank with soakage pit will be constructed for wastewater disposal.				
5.	Waste Management	Medium	<ul style="list-style-type: none"> <li>✓ All hazardous waste such as oil-waste will be handled and disposed through incineration via EPA certified hazardous waste contractor hired by CC.</li> <li>✓ Recycling of solid waste will be carried out as far as possible and practical like cement bags, empty drums, discarded bricks etc.</li> <li>✓ No wastes should be dumped indiscriminately at any location outside the site boundary/designated disposal site.</li> <li>✓ Training should be provided to working personnel for identification, segregation, and management of waste.</li> <li>✓ The site-specific waste management plan will be developed by CC.</li> </ul>	CC	Visual observation and waste disposal certificates	Daily/as required	SSEP
6.	Soil Contamination	Medium	<ul style="list-style-type: none"> <li>✓ Fuel oils, Transformer oils and lubricants for construction machinery will be stored in covered dyked areas, underlain with HDPE membrane.</li> <li>✓ Washing and maintenance of vehicles will be restricted onsite and contractor is mandated to</li> </ul>	CC	Visual observation and track record of disposal of contaminated media	As required	SSEP



**Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase**

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			<p>get entry of well-maintained and cleaned machinery.</p> <ul style="list-style-type: none"> <li>✓ Regular inspections will be carried out to detect leakages in construction vehicles and equipment.</li> <li>✓ Appropriate implements such as shovels, plastic bags and absorbent materials will be made available near fuel and oil storage areas for removal of oil and contaminated soil.</li> </ul>				
7.	Traffic management	Low	<ul style="list-style-type: none"> <li>✓ Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid nuisance to nearby villages and congestion at the connecting point to M10.</li> <li>✓ Appropriate sign postings, warning signs, diversion signs and barriers will be installed to alert public of all potential hazards including limited access to construction sites.</li> <li>✓ Movement of construction material to the project site should be planned in that way it will not hamper major transport activity in the micro and macro environment. The transfer of material should not be carried out during sleeping hours.</li> </ul>	CC	Flow of usual traffic	Daily/as required	SSEP
8.	Impacts on Flora	Low	<ul style="list-style-type: none"> <li>✓ Adequate greening of the site with local plant species will be carried out in accordance with the local climate and soil conditions.</li> </ul>	CC	Visual observations, records of plantation	As required	SSEP





<b>S#</b>	<b>Environmental Effect</b>	<b>Potential Significance</b>	<b>Mitigation Measure(s)</b>	<b>Mitigation Responsibility</b>	<b>Monitoring Parameters / Location</b>	<b>Monitoring Frequency</b>	<b>Monitoring Responsibility</b>
1.	Solid Waste (Electrical & Electronic equipment waste, food waste, general waste, sewage sludge)	Medium	<ul style="list-style-type: none"> <li>✓ Several components of the solar panels can be recycled such as glass, plastic and aluminum can be recycled. Other stuff will be disposed in an approved landfill/dumpsite.</li> <li>✓ Disused dry batteries will be returned to the supplier/manufacturer for possible recycling. Disposal through landfills is not recommended as the batteries may contain some quantity of heavy metals such as Mercury, Cadmium and Lead which are considered toxic for environment.</li> <li>✓ No hazardous waste such as food, packaging, sewage sludge etc. will be disposed through waste contractor.</li> </ul>	SSEP	Visual Monitoring onsite, waste record register and waste disposal certificates	Daily/as required	Third-party consultant
2.	Community Health and Safety	Medium	<ul style="list-style-type: none"> <li>✓ Entry/exit gate(s) of the site will be clearly marked.</li> <li>✓ Entrance in the site will only be allowed to the authorize personnel and to the visitors after registration at entrance.</li> <li>✓ Site will properly be barricaded through wall/fence of adequate height to minimize chances of trespassing, thereby avoiding the incidents such as electrocution.</li> <li>✓ Electrical hazard signs and posters will be adequately marked on the outer face of the barricading wall/fence to alert the passerby.</li> <li>✓ Unskilled staff for operational phase will mainly be sourced from the area to avoid any community conflict due to influx of outsiders.</li> </ul>	SSEP	Visual Monitoring and community feedback	Continuous/as required	Third-party consultant
3.	Occupational Health and Safety	Medium	<ul style="list-style-type: none"> <li>✓ Electrical equipment will adequately be grounded for workers safety.</li> </ul>	SSEP	Visual inspection at the project site, incident records	Daily/as required	Third-party consultant



Table 6.3: Environmental Mitigation and Monitoring Plan during operation phase							
S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			<ul style="list-style-type: none"> <li>✓Electrocution hazard signs will be displayed, particularly for the PV panel area and substation.</li> <li>✓Staff will be required to wear necessary PPE once they are out of their campsite for routine inspection, surveillance and/or monitoring.</li> <li>✓Maintenance at the site will be duly be authorized and be carried out with necessary safety precautions such use of PPE, adequate grounding, etc.</li> </ul>				
4.	Ground Water Quality deterioration and soil contamination due to leaks or spills from Transformer oil, liquid dielectric	Low	<ul style="list-style-type: none"> <li>✓Transformers and associated equipment with liquid dielectric will be concrete footing with adequate drain and collection pit in case of spill to avoid soil contamination and ingress into soil.</li> <li>✓Leakages will be prevented through periodic maintenance.</li> <li>✓Spilled oil and dielectric will be disposed through incineration by waste contractor.</li> </ul>	SSEP	Visual inspection, track record of disposal of contaminated media	As required	Third-party consultant
5.	Sulfur hexafluoride (SF6) leak	Low	<ul style="list-style-type: none"> <li>✓SF6 carrying equipment must not be dropped or rolled and must be protected from overheating.</li> <li>✓Leakage detection devices can be installed in the substation area. Handheld detectors can also be used.</li> <li>✓Gas mask is also recommended for the authorize personnel for operation and maintenance to avoid risk of asphyxiation from accidental release of gas in large quantities.</li> </ul>	SSEP	Not required as per SEQS	-	-



Table 6.4: Training Plan			
Staff	Responsibilities	Areas	Schedule
Project staff	Contractor/HSE Officer	<ul style="list-style-type: none"> <li>Findings of IEE</li> <li>Mitigation Measures</li> <li>EMP</li> <li>Waste disposal procedures</li> <li>Camp Operation</li> <li>Social and Cultural values of the Project areas</li> <li>Environmental sensitivity of the Project area</li> <li>Flora and Fauna of the area</li> <li>Emergency Response Plan</li> <li>Community Issues</li> </ul>	✓ Prior to start of Project activities
Drivers	Contractor/HSE Officer	<ul style="list-style-type: none"> <li>Road safety</li> <li>Road restrictions</li> <li>Defensive driving</li> </ul>	✓ Before and during construction activities
Camp/Site Staff	Safety Officer	<ul style="list-style-type: none"> <li>Waste Disposal</li> <li>Housekeeping</li> </ul>	✓ Before and during construction activities



Table 6.5: Estimated Cost of EMP Implementation		
Activity	Cost (PKR)	Remarks
Training Program	500,000	Refer table above
	Environmental Monitoring	
Ambient Air (construction)	$(40,000 \times 4) = 160,000$	Cost for 1-year monitoring at 1 location @Rs.40,000 per monitoring per location per quarter
Exhaust Emissions (construction)	$(1500 \times 6 \times 5 \times 4) = 180,000$	Cost for 1-year monitoring at 5 locations for 6 parameters @Rs.1500 per parameter
Noise (construction)	$(1000 \times 5 \times 12) = 60,000$	Cost for 1-year monitoring at 5 locations @Rs.1000 per location per month
Waste management (construction)	120,000	Estimated cost of 1-year monitoring
Soil contamination (construction)	120,000	Estimated cost of 1-year monitoring
Traffic Management (construction)	120,000	Estimated cost of 1-year monitoring
Ecology (construction)	120,000	Estimated cost of 1-year monitoring
Solid waste (operation)	120,000	Estimated cost of 1-year monitoring
Community and Occupational Health and Safety	240,000	Estimated cost of 1-year monitoring
Soil contamination (construction)	120,000	Estimated cost of 1-year monitoring
Cost of Mitigation (construction)	1,000,000	Initial estimates
Cost of Mitigation (construction)	500,000	Initial estimates
Reporting	500,000	Initial estimates
Sub total	4,460,000	-
Contingency (5%)	223,000	-
Grand total	4,083,000	-



## Chapter 7 CONCLUSION AND RECOMMENDATIONS

### 7.1 Conclusion

This Environmental Impact Assessment study was carried out to identify the environmental and socioeconomic impacts of the proposed “120MW Solar Power Plant in Deh Halkani and Deh Band Murad, District West, Karachi” project.

During the study, environmental and socioeconomic baseline information was collected from variety of sources including visit of project area, previous environmental reports and studies conducted in the area, published literature and field surveys. All this information was used to compose the profile of the physical, biological and socioeconomic environment of the area which is likely to be affected by the proposed project activities. Information for the project description was provided by the project’s developer.

On the basis of the established baseline and the proposed activities described as under project description, the potential environmental impacts were identified on the project area’s physical, biological and socioeconomic environments. In summary the potential impacts during the construction phase of the proposed project include the generation of dust and gaseous emissions, noise, construction waste, health and safety and socioeconomic effects. Similarly, the key environmental and social issues during the operation phase included those arising from liquid and solid waste disposal and electrocution hazard.

The IEE process finds that the impacts of the project activities at the design, construction and operation stages have been adequately addressed and mitigation measures have been duly proposed wherever needed. Adoption of mitigation measures will ensure the reduction of any possible impacts on the micro and macroenvironment as well as socio-economic conditions, to acceptable levels. The development of this project will be made compatible with the requirements of the Sindh Environmental Protection Act 2014, Sindh EPA (Environmental Assessment) Regulations 2021 and Sindh Environmental Quality Standards (SEQS); as well as other regulatory requirements of the Government of Sindh. The issues of environment, health & safety has been duly incorporated in the design, construction & operations phases of the project.

The SSEP shall remain cognizant of the social development of its project surrounding and will contribute to the uplift of the overall social and economic health of the communities around it. To help build a viable society, the SSEP shall facilitate the surrounding communities in conserving energy, environmental protection, health, education, skill development, poverty alleviation and other pertinent areas of social development.

On the basis of the findings of the IEE Study, it is possible to conclude that:

- Construction and Operation of Solar Power Plant, on adoption of the mitigation measures, have no broad scale significant adverse impacts on the physical as well as socio-economic composition of the microenvironment and macroenvironment of the project area;
- The likely impact of construction and operation of the grid station and transmission lines will be appropriately mitigated through proven technologies, careful planning and stringent monitoring practices;
- The project will assist in meeting the forecasted demand for energy;
- Employment opportunities will be generated for short to medium term;
- The proposed project; after commissioning will become an integral part of the microenvironment.





Mitigation will be assured by a robust plan of environmental monitoring conducted to ensure that all advised measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be informed to the developer for due implementation, and the resultant remedies being reported to the provincial EPA.

## 7.2 Recommendations

The study recommends and confirms that the project developer shall adopt all environmental management processes in full, as prescribed by the national and international laws and guidelines and given in the IEE document. Following essentials recommendations which are also the part of EMP as mitigation measures will be followed by project developer in letter and spirit:

- Communities in the project area shall be intimated prior to commencing project activities;
- For cutting of trees, compensatory plantation shall be provided at a ratio of 1:3;
- A Comprehensive Waste Management Plan for construction and operation phases should be developed;
- Wastes should be routinely collected from the designated area and disposed in an environmentally friendly manner;
- Protective measures against high noise intensity, soil erosion, traffic problem, land pollution and water contamination will be taken care of;
- Emergency response plan should be prepared and implemented during construction and operation phases;
- Preventive and protective measures including modification, substitution, or elimination of hazardous conditions, with particular attention to live power lines, working at height, EMF, high noise levels, and exposure to chemicals will be made; and
- The Project will thus respond to all aspects of sustainability: Economic, social and environmental and will thus be a sustainably viable project.
- The study therefore recommends that the IEE report should be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

## 7.3 References

- Geological Survey of Pakistan
- IFC General EHS Guidelines
- Pakistan Meteorological Department (PMD)
- Pakistan Bureau of Statistics. Census data 2017.
- PSLM-Survey 2014-15
- Solargis. Energy Sector Management Assistance Program. World Bank Group
- State of Industry Report 2020, NEPRA
- Study of Information Collection and Verification Survey for Renewable Energy Introduction and Grid Stabilization (2016)



# ANNEXURES

# **ANNEXURE – I**

## **Sindh Environmental Protection Act, 2014**



# **The Sindh Government Gazette**

**Published by Authority**

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**KARACHI THURSDAY MARCH 20, 2014**

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## **PART-IV**

**PROVINCIAL ASSEMBLY OF SINDH  
NOTIFICATION  
KARACHI, THE 20<sup>TH</sup> MARCH, 2014.**

**NO.PAS/Legis-B-06/2014-** The Sindh Environmental Protection Bill, 2014 having been passed by the Provincial Assembly of Sindh on 24<sup>th</sup> February, 2014 and assented to by the Governor of Sindh on 19<sup>th</sup> March, 2014 is hereby published as an Act of the Legislature of Sindh.

### **THE SINDH ENVIRONMENTAL PROTECTION ACT, 2014.**

**• SINDH ACT NO. VIII OF 2014.**

#### **AN ACT**

to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development.

**WHEREAS** it is expedient to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, and for matters connected therewith and incidental thereto;

**Preamble.**

#### **PART-I**

It is hereby enacted as follows:-

1. (1) This Act may be called the Sindh Environmental Protection Act, 2014.

**Short title and  
commencement.**

- (2) It extends to the whole of the Province of Sindh.
- (3) It shall come into force at once.

**Definitions.**

2. In this Act, unless there is anything repugnant in the subject or context—

- (i) "adverse environmental effect" means impairment of, or damage to, the environment and includes—
  - (a) impairment of, or damage to, human health and safety or to biodiversity or property;
  - (b) pollution; and
  - (c) any adverse environmental effect as may be specified in the rules or regulations made under this Act;
- (ii) "Agency" means the Sindh Environmental Protection Agency established under section 5 of this Act;
- (iii) "agricultural waste" means waste from farm and agricultural activities including poultry, cattle farming, animal husbandry residues from the use of fertilizers, pesticides and other farm chemicals and agricultural runoff;
- (iv) "air pollutant" means any substance that causes pollution of air and includes soot, smoke, dust particles, odor, light, electro-magnetic radiation, heat, fumes, combustion exhaust, exhaust gases, noxious gases, hazardous substances and radioactive substances;
- (v) "biodiversity" or "biological diversity" means the variability among living organisms from all sources, including inter-alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems;
- (vi) "biosafety" means the mechanism developing through policy and procedure to ensure human health and the environmentally safe application of biotechnology;
- (vii) "Council" means the Sindh Environmental Protection Council established under section 3 of this Act;
- (viii) "discharge" means spilling, leaking, pumping, depositing, seeping, releasing, flowing-out, pouring, emitting, emptying or dumping into the land, water or atmosphere;
- (ix) "ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit;



- (x) "effluent" means any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour;
- (xi) "emission standards" means the permissible standards established by the Agency for emission of air pollutants and noise and for discharge of effluent and waste;
- (xii) "environment" means-
  - (a) air, water, land and natural resources;
  - (b) all layers of the atmosphere;
  - (c) all organic and inorganic matters and living organisms;
  - (d) ecosystems and ecological relationships;
  - (e) buildings, structures, roads, facilities and works;
  - (f) all social and economic conditions affecting community life; and
  - (g) the inter-relationship between any of the factors in sub-clause (a) to (f) made under this Act;
- (xiii) "environmental aspect" means an organization's activities or services that can interact with the environment;
- (xiv) "environment audit" means a systemic scrutiny of environmental performance of an organization, factory, company or manufacturing and production unit regarding to its operations;
- (xv) "environmental impact assessment" means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigation and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed;
- (xvi) "Environmental Management Plan" means a site specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with the environmental legislation;
- (xvii) "Environmental Protection Order" means an order passed under Section 21 made under this Act.
- (xviii) "Environmental Protection Tribunal" means the Environmental Protection Tribunal constituted under section 25 of this Act;

- (xxix) "Environmental Review" means a quantitative and qualitative assessment of documents submitted by proponent, comments from public and Government agencies or organizations;
- (xx) "factory" means any premises in which industrial activity is being undertaken;
- (xxi) "genetically modified organism" means any organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology and which does not occur naturally through mating and or recombination and includes both living and non-living modified organisms;
- (xxii) "Government" means the Government of Sindh;
- (xxiii) "Government Agency" includes:-
- (a) A department, attached department or any other office of Government; and
  - (b) A development authority, local authority, company body corporate established or control by Government;
- (xxiv) "Court" means the Court of the Judicial Magistrate First Class;
- (xxv) "hazardous substance" means-
- (a) a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its chemical activity or toxic, explosive, flammable, corrosive, radioactive or other characteristics, causes, or is likely to cause, directly or in combination with other matters an adverse environmental effect; and
  - (b) any substance which may be prescribed as a hazardous substance;
- (xxvi) "hazardous waste" means waste which is or which contains a hazardous substance or which may be prescribed as hazardous waste, hospital waste, nuclear waste, obsolete pesticides and persistent organic pollutants;
- (xxvii) "hospital waste" means waste medical supplies and materials of all kinds, and waste blood, tissue, organs and other parts of the human and animal bodies, from hospitals, clinics, laboratories and veterinary facilities;



- (xxviii) "industrial activity" means any operation or process for manufacturing, making, formulating, synthesising, altering, repairing, ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal, or for mining, for oil and gas exploration and development, or for pumping water or sewage, or for generating, transforming or transmitting power or for any other industrial or commercial purposes;
- (xxix) "industrial waste" means waste resulting from an industrial activity;
- (xxx) "initial environmental examination" means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an adverse environmental effect for requiring preparation of an environmental impact assessment;
- (xxxi) "local authority" means any agency set up or designated by Government, by notification in the official Gazette, to be a local authority for the purposes of this Act;
- (xxxii) "local council" means a local council constituted or established under a law relating to local government;
- (xxxiii) "motor vehicle" means any mechanically propelled vehicle adapted for use upon land whether its power of propulsion is transmitted thereto from an external or internal source, and includes a chassis to which a body has not been attached, and a trailer, but does not include a vehicle running upon fixed rails;
- (xxxiv) "municipal waste" includes sewage, refuse, garbage, waste from abattoirs, sludge and human excreta and the like;
- (xxxv) "noise" means the intensity, duration and character of sounds from all sources, and includes vibration;
- (xxvi) "non degradable plastic products" means a plastic product which are made from the non-biodegradable substances;
- (xxxvii) "nuclear waste" means waste from any nuclear reactor or nuclear plant or other nuclear energy system, whether or not such waste is radioactive;

(xxxviii) "Oxo-biodegradable Plastic Products" means a plastic product made of a polymer by adding a pro-degrading additive containing a transition metal salt, except cobalt, which cause the plastic to degrade and bio-grade from oxidative and cell mediated phenomena either simultaneously or successfully;

(xxxix) "person" means any natural person or legal entity and includes an individual, firm, association, partnership, society, group, company, corporation, co-operative society, Government Agency, non-governmental organization, community-based organization, village organization, local council or local authority and, in the case of a vessel, the master or other person having for the time being the charge or control of the vessel;

(xl) "pollution" means the contamination of air, land or water by the discharge or emission of effluent or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiational, thermal or radiological or aesthetic

properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious, or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity.

(xli) "prescribed" means prescribed by rules made under this Act;

(xlii) "project" means any activity, plan, scheme, proposal or undertaking involving any change in the environment and includes-

(a) construction or use of buildings or other works;

(b) construction or use of roads or other transport systems;

(c) construction or operation of factories or other installations;

(d) mineral prospecting, mining, quarrying, stone-crushing, drilling and the like;

(e) any change of land use or water use; and

(f) alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations;

- (xlili) "proponent" means the person who proposes or intends to undertake a project;
- (xliv) "regulations" means regulations made under this Act;
- (xlv) "rules" means rules made under this Act;
- (xlvi) "sewage" means liquid or semi-solid wastes and sludge from sanitary conveniences, kitchens, laundries, washing and similar activities and from any sewerage system or sewage disposal works;
- (xlvii) "Schedule Plastic Products" means all types of flexible plastic packaging and disposable plastic products made of Polythene, Polypropylene, Polystyrene and Poly-ethylene Terephthalate (PET), used for food and non-food items, like shopping bags, garbage bags, snacks packs, water and milk packaging, shrink wraps, bubble pellet wraps, films, liners, woven or non-woven bags, mulch films;
- (xlviii) "Sindh Environmental Quality Standards" means standards established by the Agency under clause (e) of sub-section(1) of section 6 and approved by the Council under clause (c) of sub-section(1) of section 4 made under this Act;
- (xlix) "standards" means qualitative and quantitative standards for discharge of effluent and wastes and for emission of air pollutants and noise either for general applicability or for a particular area, or from a particular production process, or for a particular product, and includes the Sindh Environmental Quality Standards, emission standards and other standards established under this Act and the rules and regulations;
- (l) "strategic environmental assessment" mean an analysis of a proposed policy, legislation, plan or programme to determine whether the principles of sustainable development have been integrated therein and to identify its likely environmental effects and such components as require an initial environmental examination or environmental impact assessment;
- (li) "sustainable development" means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs;



- (lii) "trans-boundary environmental impacts" means environmental impact arising from beyond the boundaries or limits of Sindh province and causing any adverse environmental impact or pollution in the air, land, water and coaster water of Sindh province;
- (liii) "waste" means any substance or object which has been, is being or is intended to be, discarded or disposed-of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, nuclear waste, municipal waste, hospital waste, used polyethylene bags and residues from the incineration of all types of waste.
- (liv) "waters (coastal waters, internal waters, territorial waters and historical waters)" means such limits of the waters adjacent to the land territory as may be specified in the Territorial Waters and Maritime Zones Act, 1976 (LXXXII of 1976).

#### PART-II

#### THE SINDH ENVIRONMENTAL PROTECTION COUNCIL.

#### Establishment of the Sindh Environmental Protection Council.

3. (1) The Government of Sindh shall, by notification in the official Gazette, establish a Council to be known as the Sindh Environmental Protection Council consisting of-

- (i) Chief Minister or such other **Chairperson** person as the Chief Minister may nominate in this behalf.
- (ii) Minister-in-charge of the **Vice Chairperson** Environment Protection Department.
- (iii) Additional Chief Secretary, **Ex-officio Member** Planning and Development Department, Government of Sindh.
- (iv) Secretaries of the **Ex-officio Members** Environment, Finance, Public Health Engineering, Irrigation, Health, Agriculture, Local Government, Industries, Live Stock and Fisheries, Forest and Wildlife, Energy, Education, Departments of Government of Sindh and the divisional commissioners of Sindh.

- (v) Such other persons not exceeding twenty-five as Government may appoint from representatives of the Chambers of Commerce and Industry and industrial associations, representatives of the Chambers of Agriculture, the medical and legal professions, trade unions, non-governmental organizations concerned with the environment and sustainable development, and scientists, technical experts and educationists. **Non-official Members**
- (vi) Director General, Sindh Environment Protection Agency **Member / Secretary**
- (vii) **Two Members of the Provincial Assembly of Sindh amongst the eleven Members of the Standing Committee on Environment nominated by the Speaker**

2) The Members of the Council, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-appointment but shall not hold office for more than two terms.

(4) The Council shall frame its own Rules of Procedure.

(5) The Council shall hold meetings, as and when necessary, but not less than two meetings, shall be held in a year.

(6) The Council may constitute committees of its members and entrust them with such functions as it may deem fit, and the recommendations of the committees shall be submitted to the Council for approval.

(7) The Council, or any of its committees, may invite any technical expert or representative of any Government Agency or non-governmental organization or other person possessing specialized knowledge of any subject for assistance in performance of its functions.

**Functions and  
Powers of the  
Council.**

4. (1) The Council shall-
- (a) co-ordinate and supervise the enforcement of the provisions of this Act and other laws relating to the environment in the Province;
  - (b) approve comprehensive provincial environmental and sustainable development policies and ensure their implementation within the framework of a conservation strategy and sustainable development plan as may be approved by Government from time to time;
  - (c) approve the Sindh Environmental Quality Standards;
  - (d) provide guidelines for the protection and conservation of species, habitats, and biodiversity in general, and for the conservation of renewable and non-renewable resources;
  - (e) coordinate integration of the principles and concerns of sustainable development into socio-economic and development policies, plans and programmes at the provincial, district and local levels;
  - (f) consider the annual Sindh Environment report and give appropriate directions thereon and cause it to be laid before the Provincial Assembly;
  - (g) deal with inter-provincial and federal-provincial issues, and liaise and coordinate with other Provinces through appropriate inter-provincial forums regarding formulation and implementation of standards and policies relating to environmental matters with an inter-provincial impact;
  - (h) provide guidelines for biosafety and for the use of genetically modified organisms; and
  - (i) assist the Federal Government or Federal Agency in implementation and or administration of various provision of United Nation Convention on Laws on Seas, 1980 (UNCLOS) in coastal waters of the province;
- (2) The Council may, either itself or on the request of any person or organization, direct the Agency or any Government Agency to prepare, submit, promote or implement projects for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, and the sustainable development of resources or to undertake research in any specified aspect of environment.



## PART-III

## THE SINDH ENVIRONMENTAL PROTECTION AGENCY

5. (1) Government shall, by notification in the Official Gazette, establish the Sindh Environmental Protection Agency, to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made thereunder.

**Establishment  
of the Sindh  
Environmental  
Protection  
Agency.**

(2) The Agency shall be headed by a Director General who shall be appointed by Government on such terms and conditions as it may determine.

(3) The Agency shall have such administrative, technical and legal staff as Government may specify, to be appointed in accordance with such procedure as may be prescribed.

(4) The powers and functions of the Agency shall be exercised and performed by the Director General.

(5) The Director General may, by general or special order, delegate any of these powers and functions to staff appointed under sub-section (3).

(6) For assisting the Agency in the discharge of its functions Government shall establish Advisory Committees for various sectors and appoint as members thereof eminent representatives of the relevant sector, educational institutions, research institutes and non-governmental organizations.

6. (1) The Agency shall –

**Functions of the  
Agency.**

- (a) administer and implement the provisions of this Act and the rules and regulations;
- (b) prepare, in co-ordination with the appropriate Government Agency or local council and, in consultation with the concerned Advisory Committees where established, environmental policies for the approval of the Council;
- (c) take all necessary measures for the implementation of the environmental policies approved by the Council;
- (d) prepare and publish an annual Sindh Environment Report on the state of the environment in the province;
- (e) prepare or revise and establish the Sindh Environmental Quality Standards with approval of the Council.

Provided that before seeking approval of the Council, the Agency shall publish the proposed Sindh Environmental Quality Standards for public opinion in accordance with the prescribed procedure;

(f) ensure enforcement of the Sindh Environmental Quality Standards;

(g) where the quality of ambient air, water, land or noise so requires, the Agency may, by notification in the Official Gazette establish different standards for discharge or emission from different sources and for different areas and conditions as may be necessary:

Provided that where these standards are less stringent than the Sindh Environmental Quality Standards; prior approval of the Council shall be obtained;

(h) establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors;

(i) take measures to promote research and the development of science and technology which may contribute to the prevention of pollution, protection of the environment, and sustainable development;

(j) issue licences, approval for the consignment, handling, transport, treatment, disposal of, storage, handling or otherwise dealing with hazardous substances;

(k) certify laboratories as approved laboratories for conducting tests and analysis and one or more research institutes as environmental research institutes for conducting research and investigation for the purposes of this Act;

(l) identify the needs for and initiate legislation in various sectors of the environment;

(m) provide assistance to relevant Federal and Provincial Government Agencies in the management of environment accidents and natural and environmental disasters, including conduct of inquiry thereto;

(n) render advice and assistance in environmental matters including such information and data available with it as may be required for carrying out the purposes of this Act:

Provided that the disclosure of such information shall be subject to the restrictions specified in Part XI (Access to Information);



- (o) assist Government Agencies, local councils, local authorities and other persons to implement schemes for the proper disposal of wastes so as to ensure compliance with the Sindh Environmental Quality Standards;
  - (p) provide information and guidance to the public on environmental matters;
  - (q) recommend environmental courses, topics, literature and books for incorporation in the curricula and syllabi of educational institutions;
  - (r) promote public education and awareness of environmental issues through mass media and other means including seminars and workshops;
  - (s) establish and maintain mechanisms, including its own website, to disseminate information, subject to the provisions of this Act, regarding policies, plans and decisions of the Government, the Council and the Agency, relating to the environment;
  - (t) specify safeguards for the prevention of accidents and disasters which may cause pollution, collaborate with the concerned persons in the preparation of contingency plans for control of such accidents and disasters, and co-ordinate implementation of such plans;
  - (u) review and approve mitigation plans and give guidance and directions, where necessary, relating to clean up operations ordered under this Act;
  - (v) encourage the formation and working of non-governmental organizations, community organizations and village organizations to prevent and control pollution and promote sustainable development;
  - (w) take or cause to be taken all necessary measures for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution and promotion of sustainable development; and
  - (x) perform any function that the Council may assign to it.
- (2) The Agency may -
- (a) undertake inquiries or investigation into environmental issues, either of its own accord or upon complaint from any person or organization;
  - (b) request any person to furnish any information or data relevant to its functions;

- (c) initiate, with the approval of Government, requests for foreign assistance in support of the purposes of this Act and enter into arrangements with foreign agencies or organizations for the exchange of material or information and participate in international seminars or meetings;
- (d) recommend to Government and the Council the adoption of financial and fiscal programmes, schemes or measures for achieving environmental objectives and goals and the purposes of this Act, including -
  - (i) taxes, duties, cesses and other levies; and
  - (ii) incentives, prizes, awards, rewards, subsidies, tax exemptions, rebates and depreciation allowances;
- (e) establish and maintain laboratories to help in the performance of its functions under this Act and to conduct research in various aspects of the environment and provide or arrange necessary assistance for the establishment of similar laboratories in the private sector;
- (f) arrange, in accordance with such procedure as may be prescribed, financial assistance for projects designed to facilitate in discharge of its functions; and
- (g) acquire assistance of concerned authorities of district administration and other relevant agencies, departments and police assistance for enforcement of this Act.

**Powers of the Agency.**

7. Subject to the provisions of this Act, the Agency may-

- (a) lease, purchase, acquire, own, hold, improve, use or otherwise deal in and with any property both moveable and immovable;
- (b) sell, convey, mortgage, pledge, exchange or otherwise dispose of its property and assets;
- (c) fix and realize fees, rates and charges for rendering any service or providing any facility, information or data under this Act or its rules and regulations;
- (d) enter into contracts, execute instruments, incur liabilities and do all acts or things necessary for proper management and conduct of its business;
- (e) appoint, with the approval of Government and in accordance with such procedures as may be prescribed, such advisers, experts and consultants as it considers necessary for the efficient performance of its functions on such terms and conditions as it may deem fit;
- (f) summon and enforce the attendance of any person and require him to supply any information or document needed for the conduct of any enquiry or investigation into any environmental issue;



- (g) Director General may authorize any officer or official to enter and inspect or under a search warrant issued by Environmental Protection Tribunal or a Court, search at any time, any land, building, premises, vehicle or vessel or other place where or in which there are reasonable grounds to believe that an offence under this Act has been, or is being, or likely to be committed;
- (h) take samples of any materials, products, articles or substances or of the effluent, wastes or air pollutants being discharged or emitted or of air, water or land in the vicinity of the discharge or emission;
- (i) arrange for the testing and analysis of samples at a certified laboratory;
- (j) confiscate any article used in the commission of the offence where the offender is not known or cannot be found within a reasonable time:

Provided that the powers under clauses (f), (g), (h) (i), and (j) shall be exercised in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898) or the rules and regulations and under the direction of the Environmental Protection Tribunal or a Court; and

- (k) establish the Sindh Environmental Co-ordination Committee comprising the Director-General as its Chairman and such other persons as Government shall appoint as its members to exercise such powers and perform such functions as shall be delegated or assigned to it by Government for carrying out the purposes of this Act and for ensuring coordination among Government Agencies in implementation of environmental policies.

#### PART-IV

#### SINDH SUSTAINABLE DEVELOPMENT FUND

**Establishment  
of the Sindh  
Sustainable  
Development  
Fund.**

8. (1) There shall be established a Sindh Sustainable Development Fund.

(2) The Sindh Sustainable Development Fund shall be derived from the following sources, namely—

- (a) allocations and grants made or loans advanced by the Government of Sindh or by the Federal Government;
- (b) aid and assistance, grants, advances, donations and other non-obligatory funds received from foreign governments, national or international agencies, and non-governmental organizations; and

- (c) voluntary contributions from private, corporate, multinational organizations and other persons.
- (d) Any fees generated under the provision of this act including the fines imposed against contraventions including penalties.
- (3) The Sindh Sustainable Development Fund shall be utilized, in accordance with such procedures as may be prescribed for -
  - (a) providing financial assistance to projects designed for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, the sustainable development of resources and for research in any specified aspect of the environment; and
  - (b) any other purposes which, in the opinion of the Board, will help achieve environment objectives and the purposes of this Act.

**Management of  
the Sindh  
Sustainable  
Development  
Fund.**

9. (1) The Sindh Sustainable Development Fund shall be managed by a Board known as the Provincial Sustainable Development Fund Board consisting of—

- (i) Additional Chief Secretary, **Chairperson**  
Planning and Development  
Department, Government of  
Sindh,
- (ii) Such officers of Government, **Ex-officio Members**  
not exceeding five (05), as  
Government may appoint  
including Secretaries of the  
Environment, Finance,  
Industries and Local  
Government Departments,  
Government of Sindh.
- (iii) Such non-official persons, not **Non-official Members**  
exceeding five (05), as  
Government may appoint,  
including representatives of  
the Chambers of Commerce  
and Industry, non-  
governmental organizations  
and major donors.
- (iv) Director General, Sindh **Secretary/ Member**  
Environmental Protection  
Agency.

(2) The members of the Board, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.



(3) A non-official member of the Board, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-nomination, but shall not hold office for more than two terms.

(4) The Board shall frame its own rules of procedure with the approval of Government.

(5) In accordance with such procedures and such criteria as may be prescribed, the Board shall have the power to —

- (a) sanction financial assistance for eligible projects;
- (b) invest moneys held in the Sindh Sustainable Development Fund in such profit-bearing Government bonds, saving schemes and securities as it may deem suitable; and
- (c) take such measures and exercise such powers as may be necessary for utilization of the Sindh Sustainable Development Fund for the purposes specified in sub-section (3) of section 8.

(6) The Board shall constitute committees of its members to undertake regular monitoring of projects financed from the Sindh Sustainable Development Fund and to submit progress reports to the Board which shall publish an Annual Report incorporating its annual audited accounts and performance evaluation based on the progress reports.

10. (1) The Agency shall maintain proper accounts of the Sindh Sustainable Development Fund and other relevant records and prepare annual statement of accounts in such form as may be prescribed. **Accounts.**

(2) The accounts of the Sindh Sustainable Development Fund shall be audited annually by the Auditor General of Pakistan.

#### PART-V PROHIBITIONS AND ENFORCEMENT

11. (1) Subject to the provisions of this Act and the rules and regulations, no person shall discharge or emit or allow the discharge or emission of any effluent, waste, pollutant, noise or any other matter that may cause or likely to cause pollution or adverse environmental effects, as defined in section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards; or, where applicable, the standards established under Section 6(1)(g)(i); or direction issued under Section 17, 19, 20 and 21 of this Act; or any other direction issued, in general or particular, by the Agency. **Prohibition of certain discharges or emissions and compliance with standards.**



(2) All persons, in industrial or commercial or other operations, shall ensure compliance with the Environmental Quality Standards for ambient air, drinking water, noise or any other Standards established under section 6(1)(g)(i); shall maintain monitoring records for such compliances; shall make available these records to the authorized person for inspection; and shall report or communicate the record to the Agency as required under any directions issued, notified or required under any rules and regulations.

(3) Monitoring and analysis under sub-section (1) and (2), shall be acceptable only when carried out by the Environmental Laboratory certified by the Agency as prescribed in the rules.

**Prohibition of  
import of  
hazardous  
waste.**

12. No person shall import hazardous waste into Sindh province or its coastal, internal, territorial or historical waters, except acquiring prior approval of the Agency.

**Handling of  
hazardous  
substances.**

13. Subject to the provisions of this Act, no person shall import, generate, collect, consign, transport, treat, dispose of, store, handle or otherwise use or deal with any hazardous substance except-

(a) under a licence issued by the Agency; or

(b) in accordance with the provisions of any other law, rule, regulation or notification for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Government is a party.

**Prohibition of  
action adversely  
affecting  
Environment.**

14. (1) Subject to the provisions of this Act and the rules and regulations, no person shall cause any act, deed or any activity, including-

(a) recycling or reuse of hospital waste and infectious waste;

(b) disposal of solid and hazardous wastes at unauthorized places as prescribed;

(c) dumping of wastes or hazardous substances into coastal waters and inland water bodies;

(d) release of emissions or discharges from industrial or commercial operations as prescribed;

(e) recycling or reuse or recovery of hazardous wastes or industrial by-products in an unauthorized or non-prescribed manner or procedure; and

- (f) any activity which may cause adverse environmental affect due to trans boundary projects of Province of Sindh.

which lead to pollution or impairment of or damage to biodiversity, ecosystem, aesthetics or any damage to environment and natural resources as defined in section 2 (xxxvi) of this Act.

(2) No person shall generate, handle, transport, dispose of or handle the hospital waste and infections waste except in accordance with the Hospital Waste Management Rules and in such manner as may be prescribed.

(3) No person shall import, manufacture, stockpile, trade, supply, distribute or sell any scheduled plastic product which is non-degradable. The scheduled plastic products must be oxo-biodegradable and the pro-degradant used must be approved by the Agency or any other department or agency and in such manner as prescribed.

15. (1) Subject to the provisions of this Act, no person shall operate or manufacture a motor vehicle or class of vehicles from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Sindh Environmental Quality Standards or, where applicable, the standards established under sub-clause (i) of clause (g) of sub-section (1) of section 6.

**Regulation of motor vehicles.**

(2) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any motor vehicle or class of vehicles shall install such pollution control devices or other equipment or use such fuels or undergo such maintenance or testing as prescribed.

(3) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any manufacturer of motor vehicle or class of vehicles shall use such manufacturing standard or design or pollution control devices or other equipment or undergo such testing as may be prescribed.

(4) Where a direction has been issued by the Agency under sub-section (2) and (3) in respect of any motor vehicles or class of motor vehicles, no person shall operate or manufacture any such vehicle till such direction has been complied with.

16. (1) The monitoring, testing and analysis carried out in compliance or for the enforcement of any provisions of this Act

**Certified Environmental Laboratory.**

(2) The laboratory or organization having any facility for environmental monitoring, testing and analysis and intend to perform under sub-section (1) shall register with the Agency in accordance with the Environmental Laboratory Certification Rules as prescribed.



**Initial  
environmental  
examination and  
environmental  
impact  
assessment.**

**PART-VI  
ENVIRONMENTAL EXAMINATIONS AND ASSESSMENTS**

17. (1) No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof.

(2) The Agency shall –

(a) review the initial environmental examination and accord its approval, subject to such terms and conditions as it may prescribe, or require submission of an environmental impact assessment by the proponent; or

(b) review the environmental impact assessment and accord its approval subject to such terms and conditions as it may deem fit to impose or require that the environmental impact assessment be re-submitted after such modifications as may be stipulated or decline approval of the environmental impact assessment as being contrary to environmental objectives.

(3) Every review of an environment impact assessment shall be carried out with public participation and, subject to the provisions of this Act, after full disclosure of the particulars of the project.

(4) The Agency shall communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations:

(5) The provisions of sub-sections (1), (2), (3) and (4) shall apply to such categories of projects and in such manner as prescribed:

(6) The Agency shall maintain separate registers for initial environmental examination and environmental impact assessment projects, which shall contain brief particulars of each project and a summary of decisions taken thereon, and which shall be open for inspection to the public during office hours.

18. (1) All provincial government agencies, departments, authorities, local councils and local authorities responsible for formulating policies, legislation, plans and programmes to be implemented in Sindh province which may cause any environmental impact in the jurisdiction of the province shall, before submitting the same to the competent authority for approval, forward to the Sindh Environmental Protection Agency a strategic environment assessment containing —

Strategic  
environmental  
assessment.

- (a) description of the objectives and features of the proposed policy, legislation, plan or programme that are in consonance with the principles of sustainable development;
  - (b) assessment of the adverse environmental effects, if any, likely to be caused during implementation of the policy, legislation, plan or programme alongwith proposed preventive, mitigation and compensatory measures;
  - (c) analysis of possible alternatives; and
  - (d) identification of those components of the policy, legislation, plan or programme, if any, in respect of which specific environmental impact assessment need to be carried out in due course.
- (2) The Agency shall, in consultation with the concerned Government Agencies and Advisory Committees where established, review the strategic environment assessment, within sixty (60) days of its filing, and prepare a report containing its comments and recommendations in respect thereof which shall be forwarded to the initiating Government Agency, authority, local council or local authority and duly considered by it and the competent authority before approval or otherwise of the proposed policy, legislation, plan or programme.
- (3) The provisions of sub-sections (1), and (2) shall apply to such categories of policies, plans and programmes and in such manner as may be prescribed.

19. (1) The Agency shall carry out or arrange environmental monitoring of all projects in respect of which it has approved an initial environmental examination or environmental impact assessment to determine whether the actual environmental impact exceeds the level predicted in the assessment and whether the conditions of the approval are being complied with.

Environmental  
monitoring.

(2) For purposes of sub-section (1), the Agency may require the person in charge of a project to furnish such information as it may specify pertaining to the environmental impact of the project, including quantitative and qualitative analysis of -



**Environmental  
Audit and  
Review.**

- (a) discharge of effluents, wastes, emissions of air pollutants, noise and any other matter or action that may be found offensive under section 14 from the project on daily, weekly, monthly or annual basis;
- (b) ambient quality of the air, water, noise and soil before, during and after construction and during operation of the project.
- (3) On review of the data collected by it and information provided, the Agency may issue such directions to the person in charge as it may consider necessary to ensure compliance with the conditions of the approval.

20. (1) The Agency shall from time to time require the person in charge of a project to furnish, within such period as may be specified, an environmental audit or environmental review report or environmental management plan containing a comprehensive appraisal of the environmental aspects of the project.

(2) The report of a project prepared under sub-section (1) shall include -

- (a) analysis of the predicted qualitative and quantitative impact of the project as compared to the actual impact;
- (b) evaluation of the efficacy of the preventive, mitigation and compensatory measures taken with respect to the project; and
- (c) recommendations for further minimizing or mitigating the adverse environmental impact of the project.

(3) Based on its review of the environmental audit report, the Agency may, after giving the person in charge of the project an opportunity of being heard, direct that specified mitigation and compensatory measures be adopted within a specified time period and may also, where necessary, modify the approval granted by it under section 17.

**PART-VII  
ENVIRONMENTAL PROTECTION ORDER**

**Environmental  
Protection  
Order.**

21. (1) Where the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of any provision of this Act, the rules or regulations or of the conditions of a licence, or is likely to cause, or is causing or has caused an adverse environmental effect, the Agency may, after giving the person responsible for such



discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures as the Agency may consider necessary within such period as may be specified in the order.

(2) In particular and without prejudice to the generality of the foregoing power, such measures may include —

- (a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;
- (b) installation, replacement or alteration of any equipment or thing to eliminate, control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;
- (c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances;
- (d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Agency; and
- (e) impose a penalty as prescribed.

(3) Notwithstanding the provisions of sub-section (1), in an emergency situation where, for reasons to be recorded, the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of the provisions of this Act and that circumstances of the case warrant immediate action in the public interest, it may pass an ad-interim order of the nature described in sub-sections (1) and (2) by providing reasonable opportunity of hearing.

#### PART-VIII OFFENCES AND PENALTIES

22. (1) Whoever contravenes or fails to comply with the provisions of sections 11, 17, 18 and 21 or any order issued there under shall be punishable with a fine which may extend to five million rupees, to the damage caused to environment and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues:

**Penalties.**

Provided that if the contravention of the provisions of section 11 also constitutes a contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2).

(2) Whoever contravenes or fails to comply with the provisions of sections 13, 14, 15 and 16 or any rule or regulation or conditions of any license, any order or direction, issued by the Agency, shall be punished with a fine, and in case of continuing contravention or failure with an additional fine which may extend to ten thousand rupees for every day during which such contravention continues.

(3) Where an accused has been convicted of an offence under sub-sections (1) and (2), the Environmental Protection Tribunal and Court shall, as the case may be, in passing sentence, take into account the extent and duration of the contravention or failure constituting the offence and the attendant circumstances.

(4) Where an accused has been convicted of an offence under sub-sections (1) or (2), the Environmental Protection Tribunal or Court, as the case may be, shall endorse a copy of the order of conviction to the concerned trade or industrial association, if any, or the concerned Provincial Chamber of Commerce and Industry or the Federation of Pakistan Chambers of Commerce and Industry.

(5) Where a person convicted under sub-sections (1) and (2) had been previously convicted for any contravention of this Act and its rules or regulations, the Environmental Protection Tribunal, as the case may be, may, in addition to the punishment awarded thereunder-

- (a) sentence him to imprisonment for a term that may extend up to three years;
- (b) order the closure of the factory;
- (c) order confiscation of the facility, machinery and equipment, vehicle or substance, record, document or other object used or involved in contravention of the provisions of this Act;
- (d) order such person to restore the environment at his own cost, to conditions existing prior to the contravention or as close to such conditions as may be reasonable in the circumstances to the satisfaction of the Agency; and
- (e) order that compensation be paid to any person or persons for any loss, or damage to their health or property suffered by such contravention.

(6) The Director General or an officer generally or specially authorised by him in this behalf may, on the application of the accused, compound an offence under this Act with the permission of the Environmental Protection Tribunal or Court in accordance with such procedure as prescribed.



(7) Where the Director General is of the opinion that a person had contravened any provision of this Act, he may, subject to the rules, by notice in writing to that person require him to pay to the Agency a penalty in the amount set out in the notice for each day the contravention continues.

23. Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence has been committed with the consent or connivance of, or is attributed to any negligence on the part of, any director, partner, manager, secretary or other officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly:

**Offences by  
body corporate.**

Provided that in the case of a company as defined under the Companies Ordinance, 1984 (XLVII of 1984), only the Chief Executive as defined in the said Ordinance shall be liable under this section.

*Explanation.*— For the purposes of this Section, "body corporate" includes a firm, association of persons and a society registered under the Societies Registration Act, 1860 (XXI of 1860), or under the Co-operative Societies Act, 1925 (VII of 1925).

24. Where any contravention of this Act has been committed by any Government Agency, local authority or local council, and it is proved that such contravention has been committed with the consent or connivance of, or is attributable to any negligence on the part of, the Head or any other officer of Government Agency, local authority or local council, such Head or other officer shall also be deemed guilty of such contravention along with the Government Agency, local authority or local council and shall be liable to be proceeded against and punished accordingly.

**Offences by  
Government  
Agencies, local  
authorities or  
local councils.**

#### PART-IX

#### ENVIRONMENTAL PROTECTION TRIBUNALS AND COURTS

25. (1) Government may, by Notification in the Official Gazette, establish as many Environmental Protection Tribunals as it considers necessary and, where it establishes more than one Environmental Protection Tribunal, it shall specify territorial limits within which, or the class of cases in respect of which, each one of them shall exercise jurisdiction under this Act.

**Environmental  
Protection  
Tribunals.**

(2) An Environmental Protection Tribunal shall consist of a Chairperson who is, or has been, or is qualified for appointment as a Judge of the High Court to be appointed after consultation with the Chief Justice of the High Court and two members to be appointed by Government, of which at least one shall be a technical member nominated from amongst the officers of the Agency with suitable professional qualifications and experience in the environmental field.

(3) For every sitting of the Environmental Protection Tribunal, the presence of the Chairperson and not less than one Member shall be necessary.

(4) A decision of an Environmental Protection Tribunal shall be expressed in terms of the opinion of the majority of its members, including the Chairperson, or if the case has been decided by the Chairperson and only one of the members and there is a difference of opinion between them, the decision of the Environmental Protection Tribunal shall be expressed in terms of the opinion of the Chairperson.

(5) An Environmental Protection Tribunal shall not, merely by reason of a change in its composition, or the absence of any member from any sitting, be bound to recall and rehear any witness who has given evidence, and may act on the evidence already recorded by, or produced, before it.

(6) An Environmental Protection Tribunal may hold its sittings at such places within its territorial jurisdiction as the Chairperson may decide.

(7) No act or proceeding of an Environmental Protection Tribunal shall be invalid by reason only of the existence of a vacancy in, or defect in the constitution, of, the Environmental Protection Tribunal.

(8) The terms and conditions of service of the Chairperson and members of the Environmental Protection Tribunal shall be such as may be prescribed.

**Jurisdiction and powers of Environmental Protection Tribunals.**

26. (1) An Environmental Protection Tribunal shall exercise such powers and perform such functions as are, or may be, conferred upon or assigned to it by or under this Act or the rules and regulations.

(2) All contraventions punishable under sub-section (1) of section 22 shall exclusively be triable by an Environmental Protection Tribunal.

(3) An Environmental Protection Tribunal shall not take cognizance of any offence triable under sub-section (2) except on a complaint in writing by—

(a) the Agency or any Government Agency or Local Council; and

(b) any aggrieved person, who has given notice of not less than thirty days to the Agency, of the alleged contravention and of his intention to make a complaint to the Environmental Protection Tribunal.



(4) In exercise of its criminal jurisdiction, the Environmental Protection Tribunal shall have the same powers as are vested under the Code of Criminal Procedure, 1898 (Act V of 1898).

(5) In exercise of the appellate jurisdiction under section 27 the Environmental Protection Tribunal shall have the same powers and shall follow the same procedure as an appellate court in the Code of Civil Procedure, 1908 (Act V of 1908).

(6) In all matters with respect to which no procedure has been provided for in this Act, the Environmental Protection Tribunal shall follow the procedure laid down in the Code of Civil Procedure, 1908 (Act V of 1908).

(7) An Environmental Protection Tribunal may, on application filed by any officer duly authorised in this behalf by the Director General, issue bailable warrant for the arrest of any person against whom reasonable suspicion exists, of his having been involved in contravention punishable under sub-section (1) of section 22:

Provided that such warrant shall be applied for, issued and executed in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898):

Provided further that if the person arrested executes a bond with sufficient sureties in accordance with the endorsement on the warrant he shall be released from custody, failing which he shall be taken or sent without delay to the officer in-charge of the nearest jurisdiction police station.

(8) All proceedings before the Environmental Protection Tribunal shall be deemed to be judicial proceedings within the meaning of sections 193 and 228 of the Pakistan Penal Code (Act XLV of 1860), and the Environmental Protection Tribunal shall be deemed to be a court for the purpose of sections 480 and 482 of the Code of Criminal Procedure, 1898 (Act V of 1898).

(9) No court other than an Environmental Protection Tribunal shall have or exercise any jurisdiction with respect to any matter to which the jurisdiction of an Environmental Protection Tribunal extends under this Act and the rules and regulations.

(10) Where the Environmental Protection Tribunal is satisfied that a complaint made to it under sub-section (3) is false and vexatious to the knowledge of the complainant, it may, by an order, direct the complainant to pay to the person complained against such compensatory costs which may extend to one hundred thousand rupees.

**Appeals to the  
Environmental  
Protection  
Tribunal.**

27. (1) Any person aggrieved by any order or direction of the Agency under any provision of this Act or the rules or regulations may prefer an appeal with the Environmental Protection Tribunal within thirty days of the date of communication of the impugned order or direction to such person.

(2) An appeal to the Environmental Protection Tribunal shall be in such form, contain such particulars and be accompanied by such fees as prescribed.

**Appeals from  
orders of the  
Environmental  
Protection  
Tribunal.**

28. (1) Any person aggrieved by any final order or by any sentence of the Environmental Protection Tribunal passed under this Act may, within thirty days of communication of such order or sentence, prefer an appeal to the High Court.

(2) An appeal under sub-section (1) shall lie before the High Court of Sindh.

**Jurisdiction of  
Judicial  
Magistrate.**

29. (1) Notwithstanding anything contained in the Code of Criminal Procedure, 1898 (Act V of 1898), or any other law for the time being in force, but subject to the provisions of this Act, all contraventions punishable under sub-section (2) of section 22 shall exclusively be triable by the Court of Judicial Magistrate of First Class having of First Class having jurisdiction.

(2) A Judicial Magistrate shall be competent to impose any punishment specified in sub-sections (2) and (4) of section 22.

(3) A Judicial Magistrate shall not take cognizance of an offence triable under sub-section (1) except on a complaint in writing by—

(a) the Agency; and

(b) any aggrieved person.

**Appeals from  
orders of the  
Judicial  
Magistrate.**

30. Any person aggrieved by any final order or sentence passed by a Judicial Magistrate under section 28 may, within thirty days from the date of the communication of such order or sentence, appeal to the Court of the District and Sessions Judge defined as Green Court under this Act, whose decision thereon shall be final.



**PART-X  
PUBLIC PARTICIPATION**

31.(1) The Agency shall cause relevant details of any proposed project regarding which an Environmental Impact Assessment has been received to be published, alongwith an invitation to the public to furnish their comments thereon within a specified period. **Public participation.**

(2) In accordance with such procedure as may be prescribed, the Agency shall hold public hearings to receive additional comments and hear oral submissions.

(3) All comments received under sub-sections (1) and (2) shall be duly considered by the Agency while reviewing the environmental impact assessment or strategic impact assessment, and decision or action taken thereon shall be communicated to the persons who have furnished the said comments.

**PART-XI  
GENERAL**

32. The Agency may, by notification in the official Gazette, make and amend the schedule. **Power to make and amend schedule.**

33. No suit, prosecution or other legal proceedings shall lie against Government, the Council, the Agency, the Director General of the Agency, members, officers, employees, experts, advisors, committees or consultants of the Agency or Environmental Protection Tribunal or Court or any other person for anything which is done or intended to be done in good faith under this Act or rules or regulations. **Indemnity**

34. Any dues recoverable by the Agency under this Act and rules or regulations shall be recoverable as arrears of land revenue. **Dues recoverable as arrears of land revenue.**

35. The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being in force. **Act to override other laws.**

36. The Sindh Environment Protection Agency may, by notification in the Official Gazette, make rules for carrying out the purposes not in consistence of this Act with the approval of Government. **Power to make rules.**

37. (1) For carrying out the purposes of this Act, the Agency may, by Notification in the Official Gazette and with the approval of Government, make regulations not inconsistent with the provisions of this Act or the rules. **Power to make regulations.**

(2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for —

- (a) submission of periodical reports, data or information by any Government Agency, local authority or local council in respect of environmental matters;
- (b) preparation of emergency contingency plans for coping with environmental hazards and pollution caused by accidents, natural disasters and calamities;
- (c) appointment of officers, advisors, experts, consultants and employees **as per prescribed rules**;
- (d) levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented;
- (e) monitoring and measurement of discharges and emissions;
- (f) categorization of projects to which, and the manner in which sections 17, 18 and 20 applies;
- (g) laying down of guidelines for preparation of initial environmental examination, environmental impact assessment and strategic environmental assessment, and development of procedures of their filing, reviews and approval.
- (h) laying down standard operating procedures for environmental sampling, examination of water, waste water, gaseous emissions, solid waste and noise;
- (i) providing procedures for handling hazardous substances; and
- (j) installation of devices in, use of fuels by, and maintenance and testing of motor vehicles for control of air and noise pollution.

**BY ORDER OF THE SPEAKER  
PROVINCIAL ASSEMBLY OF SINDH**

**G.M.UMAR FAROOQ  
SECRETARY  
PROVINCIAL ASSEMBLY OF SINDH**

**Karachi: Printed at the Sindh Government Press  
20-3-2014**



# **ANNEXURE – II**

## **Sindh EPA (Environmental Assessment) Regulations, 2021**



**GOVERNMENT OF SINDH  
SINDH ENVIRONMENTAL PROTECTION AGENCY**

Karachi dated the 03<sup>rd</sup> September, 2021

**NOTIFICATION**

**NO.EPA/TECH/739/2021:-** In exercise of the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, is pleased to make the following regulations, namely:-

**1. Short title and commencement**

- (1) These regulations may be called the Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021.
- (2) They shall come into force at once.

**2. Definitions. -**

- (1) In these regulations, unless there is anything repugnant in the subject or context
  - (a) “Act” means the Sindh Environmental Protection Act, 2014 (VIII of 2014);
  - (b) “Agency” means the Sindh Environmental Protection Agency as defined under section 2(ii);
  - (c) “Director General” means the Director General of the Agency;
  - (d) Environmental Checklist means rapid environmental assessment or environmental screening through a prescribed checklist in respect of projects having least/minimal impacts on the environment.
  - (e) "Firm" means the Environmental Consulting Firm registered by the Agency.
  - (f) “Environmentally sensitive area” means a location, large or small, that has significant environmental values that contribute to maintaining biological diversity and integrity, have intrinsic or attributed scientific, historical or cultural heritage value, or are important in providing amenity, harmony or sense of community, ecosystem as declared by Agency.
  - (g) “Protected area” means any area which safeguards the earths precious bio-diversity, protected areas of natural beauty and conservation of cultural significance as declared by relevant authority;
  - (h) “Schedule” means the Schedules provided in these regulations;

- (i) “Urban area” means an area within the limits of a town, municipality or city as determined by the Agency on the basis of population and environmental issues
  - (2) All other words and expressions used but not defined in these regulations shall have the same meaning as are assigned to them in the Act.
- 3. Projects requiring Environmental Checklist (EC)**

A proponent of a project falling in any category listed in Schedule-I shall file environmental checklist with the Agency and the provisions of section 17 shall apply to such projects.
- 4. Projects requiring an Initial Environmental Examination (IEE)**

A proponent of a project falling in any category listed in Schedule-II shall file an IEE with the Agency, and the provisions of section 17 shall apply to such projects.
- 5. Projects requiring an Environmental Impact Assessment (EIA)**

A proponent of a project falling in any category listed in Schedule-III shall file an EIA with the Agency, and the provisions of section 17 shall apply to such projects.
- 6. Projects not requiring an Environmental Assessment**
  - (1) A project not falling in any category listed in Schedules-I, II and III shall not be required to file an EC, IEE or EIA
  - (2) Notwithstanding anything contained in sub-regulation (1), the Agency may direct the proponent of a project, whether or not listed in Schedule I or II or III, to file an EC or IEE or EIA, for reasons to be recorded in such direction:

Provided that no such direction shall be issued without the recommendations in writing of the Advisory Committee constituted under regulations 21.
- 7. Preparation of environmental assessment report**
  - (1) The Agency may issue guidelines for preparation of an EC or IEE or EIA reports including guidelines of general applicability, and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to particular sector.
  - (2) The Agency may issue guidelines for preparation scope of an Environmental Management Plan(EMP) or Environmental Audit(EA).
  - (3) Where guidelines have been issued under sub-regulation (1) & (2), an EC, IEE or EIA or EMP or EA shall be prepared, to the extent practicable, in accordance therewith and the proponent shall justify any departure therefrom.
- 8. Review Fees**

The proponent shall pay, at the time of submission of an EC, IEE or EIA or EMP or BTS tower a non-refundable review fee to the Agency as prescribe in Schedule-IV.

## **9. Filing of report**

- (1) Two hard copies and two electronic copies for an EC or IEE or EIA report shall be filed with the Agency by the proponent. The Agency may require the proponent to submit additional copies, as and when required during the review process.
- (2) Every EC, IEE and EIA shall be accompanied by -
  - (a) an application, in the form prescribed in Schedule-V;
  - (b) Copy of receipt showing payment of review fee as prescribed in Schedule-IV

## **10. Preliminary Scrutiny**

- (1) Any report filed by the proponent or applicant shall be returned, if found incomplete in terms of Regulation 9.
- (2) Notwithstanding anything contained in sub-regulation (1) of regulation 12, the Agency may require the proponent to submit an additional information at any stage during the review process.

## **11. Public participation**

- (1) In the case in an EIA, the Agency shall issue a public notice to be published in widely circulated English or Urdu or Sindhi national newspaper and in a local newspaper of general circulation in the area affected by the project, mentioning the type of project, its exact location, the name and address of the proponent and the date, time and place of public hearing for inviting comments from primary stakeholders.
- (2) The date fixed under sub-regulation (1) shall not be earlier than ten days from the date of publication of the notice.
- (3) The Agency shall also ensure the circulation of the EIA, where necessary, to the concerned Government Agencies and solicit their comments thereon.
- (4) All comments received by the Agency from the public or any Government Agency shall be duly considered before issuance of decision.
- (5) The Agency may issue guidelines indicating the basic techniques and measures to be adopted to ensure effective public consultation, involvement and participation in EIA assessment.

## **12. Review process**

- (1) Notwithstanding anything contained in sub section (4) of Section 17, the Agency shall make every effort to conclude its review process of the EA, EMP or environmental checklist within fifteen days, of the IEE within thirty days, and of the EIA within sixty days after receiving of complete case.
- (2) In reviewing an EIA, the Agency shall consult such Committee of Experts be constituted for the purpose by the Director General, and may also solicit views of concerned Advisory Committee, if any, constituted by the Agency.



- (3) The Director General may, where considers it necessary, constitute a committee to inspect the site of the project and submit its report on such matters as may be specified.
- (4) In reviewing the IEE, the Director General may constitute a committee of the officers from within the Agency, on case to case basis, in view of the jurisdiction and location of the project for the purpose to extend final recommendation about the approval or rejection of the IEE.
- (5) The review of the IEE or EIA by the Agency shall be based on quantitative and qualitative assessment of the documents and data furnished by the proponent, comments from the public and Government Agencies received under regulation 12, and views of the committees mentioned in sub-regulations (2) and (3) above.
- (6) EMP, EA, EC shall be reviewed as per guidelines issued by SEPA

### **13. Decision**

- (1) The documentary evidence in the form of videos (soft copies) of public hearing shall be submitted by the proponent within three days after conclusion of public hearing to the Agency.
- (2) On completion of the review process, the decision of the Agency shall be communicated to the proponent in the form prescribed in Schedule-VI or in case of an IEE or EMP or environmental checklist or environmental audit in the form prescribed in Schedule-VII in case of an EIA.

### **14. Conditions of approval**

- (1) Every approval of an EC or IEE or EIA or EMP or EA shall, in addition to such conditions as may be imposed by the Agency, be subject to the condition that the project shall be designed, constructed or operated and mitigatory and other measures adopted, strictly in accordance with the EC or IEE or EIA or EMP or EA, unless any variations thereto have been specified in the approval by the Agency.
- (2) Where the Agency accords its approval subject to certain conditions, the proponent shall submit an undertaking to the Agency, before commencing operation of the project, in the form prescribed in Schedule-VIII that the conditions of approval, and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures have been duly complied with.

### **15. Validity period of Approval**

- (1) The approval accorded by the Agency under section 17 read with sub-regulation (2) of regulation 15 shall be valid, for commencement of construction, for a period of three years from the date of issue.
- (2) If construction is commenced during the initial three years validity period, the

validity of the approval shall stand extended for a further period of three year.

- (3) The proponent may apply to the Agency for extension in the validity periods mentioned in sub-regulations (1), (2), which may be granted by the Agency in its discretion for such period not exceeding three years at a time, if the conditions of the approval do not require significant change:

Provided that the Agency may require the proponent to submit a fresh IEE or EIA, if in its opinion changes in location, design, construction and operation of the project so warrant.

#### **16. Entry and inspection**

- (1) For the purpose of verification of any matter relating to the review or to the conditions of approval of an EC or IEE or EIA or EMP or EA list prior to, before or during and after commencement of construction or operation of a project, duly authorized staff of the Agency shall be entitled to enter and inspect the project site, factory building and plant and equipment installed therein.
- (2) The proponent shall ensure full cooperation of the project staff at site to facilitate the inspection, and shall provide such information as may be required by the Agency for this purpose and pursuant thereto.

#### **17. Cancellation of approval**

- (1) Notwithstanding anything contained in these regulations, if, at any time, on the basis of information or report received or inspection carried out, the Agency is of the opinion that the conditions of an approval have not been complied with, or that the information supplied by a proponent in the approved EC or IEE or EIA or EMP or EA list is incorrect, it shall issue notice to the proponent for show cause within two weeks of receipt thereof as to why the approval should not be cancelled.
- (2) In case no reply is received or if the reply is considered unsatisfactory, the Agency may, after giving the proponent an opportunity of being heard -
  - (i) require the proponent to take such measures and to comply with such conditions within such period as it may specify, failing which the approval shall stand cancelled; or
  - (ii) cancel the approval.
- (3) On cancellation of the approval, the proponent shall cease construction or operation of the project forthwith.
- (4) Any action taken under this regulation shall be without prejudice to any other action that may be taken against the proponent under the Act or rules or regulations or any other law for the time being in force.

**18. Registers of EC or IEE and EIA projects**

Separate Registers to be maintained by the Agency for EC or IEE and EIA projects shall be in the form prescribed in Schedule-IX.

**19. Environmentally sensitive areas**

- (1) The Agency may designate an area to be an environmentally sensitive area,
- (2) Notwithstanding anything contained in regulations 3 and 5, the proponent of a project situated in an environmentally sensitive area shall be required to file an EIA with the Agency.

**20. Environmental assessment guidelines**

- (1) The Agency may from time to time issue guidelines to assist proponents and other persons involved in the preparation of environmental assessment.
- (2) Where guidelines have been issued under sub-regulation (1), the projects shall be planned and prepared, to the extent practicable, in accordance therewith and any departure therefrom justified in the IEE/EIA pertaining to the project.

**21. Environmental Assessment Advisory Committee. -**

The agency may constitute one or more Committees for the purpose of rendering advice on implementation and enforcement of Section 17, which may include experts of relevant field, civil society, academia, environmental experts, representative of Administrative Department, legal expert and experts from natural resources.

**22. Repeal and Savings.**

(1) The Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2014, shall, on commencement of these regulations, stand repealed.

(2) All orders made, notification issued, actions taken under the repealed Regulations shall remain in force until amended, altered or repealed by the provisions of these regulations.

**DIRECTOR GENERAL  
SINDH ENVIRONMENTAL PROTECTION  
AGENCY**

## **SCHEDULE-I**

(See Regulation 3)

### **List of projects requiring Environmental Screening (through check list)**

- a. Subject to the compliance with concerned zoning laws:
  - i. Construction of residential and commercial buildings having total covered area from 60,000 sq.feet to 100,000 sq.feet
  - ii. Housing Schemes covering an area from 05 acres to 15 acres.
  - iii. Ware Houses for Non-Hazardous substances having total area from 1000 sq.yards to 5,000 sq.yards
  - iv. Warehouse for Fertilizers
  - v. Marriage Halls/Banquet/Restaurants/Baking facilities having total area more than 500 sq.yards
  - vi. Motor vehicle workshops/Service Stations having total area of more than 500 sq.yards.
- b. Construction/Reconstruction/Rehabilitation of roads in urban area from 500 meters to 01 kilometres and in rural area from 500 meters to 05 kilometres.
- c. Construction of Flyover, underpasses and bridges of length from 100 meters to 500 meters
- d. On-farm dams and fish farms
- e. Pulses mills
- f. Flour Mills
- g. Lining of existing minor canals and /or water courses.
- h. Canal cleaning
- i. Forest harvesting operations
- j. Rain harvesting projects
- k. Health care units of less than 50 beds
- l. BTS Tower
- m. Lime Kilns
- n. Ice factories and cold storage.
- o. Cotton oil mill
- p. Construction of LPG, CNG, LNG filling station and petrol pumps
- q. Carpet manufacturing units
- r. Rain harvesting projects
- s. Industrial Effluent Treatment Plant
- t. Sanitary Landfill site up to 500 tons/day



**Schedule-II**  
(See Regulation 4)

**List of projects requiring an Initial Environmental Examination**

**A. Agriculture, Livestock and Fisheries**

1. Poultry, livestock and fish farms
2. Warehousing for pesticides and pharmaceuticals
3. Projects involving packaging, formulation, cold storage and warehouse of agricultural, livestock and fish products.
4. Construction & Operation of Slaughter houses

**B. Energy**

1. Hydroelectric power generation up to 25 MW
2. Thermal power generation up to 100 MW
3. Coal fired power plants with capacity up to 50 MW
4. Transmission lines up to 132 KV, and grid stations
5. Waste-to-energy generation projects including bio-mass up to 25 MW
6. Construction of Coal Handling and storage facilities
7. Handling, Transportation & Storage of Biofuel Facility
8. Handling and storage of edible grains and seeds
9. All Renewable energy Projects (excluding Protected/Sensitive area under any law)

**C. Oil and Gas projects:**

1. Oil and gas 2D/3D Seismic survey and drilling activities (on and off shore)
2. Oil and gas extraction projects including exploration and production located outside the environmentally sensitive/protected areas
3. Oil & Gas transmission gathering, storage, separation & transportation system
4. Construction of CNG, LPG Petroleum and LNG bulk storage facility
5. Oil blending and recycling units

**D. Manufacturing and processing**

1. Ceramics and glass units
2. Food processing units
3. Pharmaceutical units.
4. Rice mills, ghee/oil mills, Cotton ginning
5. Man-made fibers and resin projects

6. Tanning and leather finishing projects
7. Manufacturing of apparel, textile garments units, including weaving, spinning, dyeing, bleaching and printing
8. Woodwork units manufacturing products
9. Steel re-rolling mills
10. Waste recycling plants
11. Battery manufacturing plant
12. Brick Kilns
13. Marble processing units
14. Stone Crushing units

**E. Mining and mineral processing**

1. Commercial extraction of sand, gravel, limestone, clay, Sulphur and other minerals not included in Schedule I.
2. Crushing, grinding and separation processes
3. Metal Smelting plant production capacity up to 20 tons/day

**F. Transport**

1. Construction of flyovers, underpasses and bridges having length more than 500 meters to 1000 meters in urban areas and more than 5km in rural areas
2. Bus terminals/ railway station/ metro stops and construction & operation of transport related terminals
3. Rehabilitation or rebuilding or reconstruction of existing roads more than one kilometers in urban areas and more than 5 km from rural areas

**G. Water management, dams, irrigation and flood protection**

1. Dams and reservoirs with storage volume of less than 25 million cubic meters of surface area less than 4 square kilometers
2. Irrigation systems and drainage system with the area of less than 15,000 hectors
3. Flood protection bunds

**H. Water supply and filtration**

Water supply schemes and filtration plants

**I. Waste disposal and wastewater treatment**

1. Solid and Non-hazardous waste with annual capacity up to 10,000 tonnes (excluding municipal landfill sites and commercial facilities) including Garbage Transfer station/composting plant

2. Wastewater treatment for sewerage treatment facility less than 100 mgd
3. Hospital waste disposal facilities including incineration units owned by Hospitals for own use excluding commercial facility.

**J. Urban development**

1. Housing schemes more than 15 acres to 50 acres
2. Residential, Commercial multistory High rise construction projects having covered area more than 100,000 sq.feet to 500,000 sq.feet.
3. Laboratories
4. Hospitals, health care unit of more than 50 beds
5. Construction of Educational and Academic institutions.

**K. Other projects**

Any other project for which filing of an IEE is required by the Agency under sub-regulation (2) of Regulation 6.

### **SCHEDULE III**

(See Regulation 5)

#### **List of projects requiring an EIA**

##### **A. Energy**

1. Hydroelectric power generation more than 50 MW
2. Thermal power generation more than 100 MW
3. Coal power projects more than 50 MW
4. Transmission lines above 132 KVA and distribution projects.
5. Nuclear power plants
6. Wind, Solar or renewable energy projects if falls under any environmental sensitive and protected area.

##### **B. Oil and Gas projects**

1. Oil Petroleum refineries.
2. LPG and LNG Terminals Projects
3. Coal Handling Terminals Projects

##### **C. Manufacturing and processing**

1. Cement plants
2. Chemical manufacturing industries
3. Fertilizer plants
4. Steel Mills
5. Sugar Mills and Distilleries
6. Establishment of Industrial estates & Export processing zones
7. Petrochemicals complex
8. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, printing and publishing, paints and dyes.

##### **D. Mining and mineral processing**

1. Mining and processing of coal, gold, copper, sulphur and precious stones
2. Mining and processing of major non-ferrous metals, iron and steel rolling
3. Metal Smelting plant production capacity more than 20 tons/day

##### **E. Transport**

1. Airports
2. Construction of highway, motor ways, major roads (Intercity roads) more than one km and above



3. Ports and harbor development
4. Mass transit projects
5. Railway works
6. Construction of Flyover, underpass and bridges having total length more than one km.

**F. Water management, dams, irrigation and flood protection**

1. Dams and reservoirs with storage volume of 25 million cubic meters and above having surface area of 4 square kilometers and above
2. Irrigation and drainage projects serving more than 15,000 hectares and above

**G. Water supply and filtration**

Public water supply schemes and **filtration** plants.

**H. Waste Disposal and treatment**

1. Facilities for handling, storage or disposal of hazardous or toxic wastes or radioactive waste (including landfill sites, incineration units, etc.)
2. Solid waste municipal landfill sites.
3. Combine Effluent Treatment Plant
4. Domestic wastewater treatment plant more than 100mgd

**I. Urban development and tourism**

1. Housing schemes above 50 acres
2. Residential, Commercial High rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 sq.feet
3. All Projects located in High Density Zones notified by Government and relevant land controlling organization, irrespective of their size.
4. Commercialization of major corridors/roads in urban centers
5. Large Scale public facilities
6. Large-scale tourism development projects

**J. Environmentally Sensitive Areas**

All projects situated in environmentally sensitive areas being identified by the Agency.

**K. Other projects**

1. Any other project for which filing of an EIA is required by the Agency under sub-regulation (2) of Regulation 5.
2. Any other project likely to cause an adverse environmental effect.

**Schedule-IV**  
**(See Regulation 8)**

<b>Project Cost (in million)</b>	<b>Review Fee</b>
<b>Up to 20</b>	<b>Rs.50,000</b>
<b>Above 20 up to 100</b>	<b>Rs. 100,000</b>
<b>Above 100 up to 200</b>	<b>Rs. 200,000</b>
<b>Above 200 up to 500</b>	<b>Rs. 400,000</b>
<b>Above 500</b>	<b>Rs. 600,000</b>
<b>Review fee for Environmental Checklist or EMP shall be Rs. 40,000/=</b>	
<b>Review fee for BTS Tower shall be 20,000/=</b>	

\*

**Note:**

The fee shall be payable into the “Sindh Sustainable Development Fund” account  
Details are as under:

**A/C Title:** Sindh Sustainable Development Fund

**Account Number:** 03084572626100

**Bank:** Sindh Bank

**Branch Code:** 0308-Korangi Industrial Area

**SCHEDULE V**  
[See Regulation 9(2)(a)]  
**Application Form**

1.	Name and address of Proponent		Phone: Email:	
2.	CNIC No. of proponent			
3.	Brief description of project			
4.	Location of project			
5.	Cost of the Project			
6.	Objectives of project			
7.	IEE/EIA attached?	IEE/EIA: Yes/No		
8.	Have alternative sites/options been considered/ reported in IEE/EIA?	Yes/No		
9.	Title document of the project			
10.	Existing land use		Land requirement	
11.	Is basic site data available, or has it been measured?	(only tick yes if the data is reported in the IEE/EIA)	Available	Measured
			Yes/No	Yes/No
		Meterology (including rainfall)	Yes/No	Yes/No
		Ambient air quality	Yes/No	Yes/No
12.	Have estimates of the following been reported, especially Quantitative Analysis?	Water balance	Estimated	Reported
		Solid waste disposal	Yes/No	Yes/No
		Liquid waste	Yes/No	Yes/No
13.	Source of power		Power requirement	
14.	Labour force (number)	Construction: Operation:		
15.	Environmental Consulting Firm			

Verification. I do solemnly affirm and declare that the information given above and contained in the attached EC/IEE/EIA is true and correct to the best of my knowledge and belief.

Date

Signature, name \_\_\_\_\_  
of proponent (with official  
stamp/seal)

**SCHEDULE VI**  
*[See Regulation 13(2)]*

**Decision on IEE/Environmental Check List**

1. Name and address of proponent \_\_\_\_\_
  2. Description of project \_\_\_\_\_
  3. Location of project \_\_\_\_\_
  4. Date of filing of IEE \_\_\_\_\_
  5. After careful review of the IEE, the Agency has decided –
    - (a) to accord its approval, subject to the following conditions:  
\_\_\_\_\_  
\_\_\_\_\_
    - or (b) that the proponent should submit an EIA of the project, for the following reasons –  
\_\_\_\_\_  
\_\_\_\_\_
- Dated \_\_\_\_\_

Tracking no. \_\_\_\_

Director-General  
Sindh Environmental Protection Agency  
(with official stamp/seal)



## **SCHEDULE VII**

*[See Regulation 13(2)]*

### **Decision on EIA**

1. Name and address of proponent \_\_\_\_\_
  2. Description of project \_\_\_\_\_  
\_\_\_\_\_
  3. Location of project \_\_\_\_\_
  4. Date of filing of EIA \_\_\_\_\_
  5. After careful review of the EIA, and all comments thereon, the Federation Agency has decided –
    - (a) to accord its approval, subject to the following conditions:  
\_\_\_\_\_  
\_\_\_\_\_
    - or (b) that the proponent should submit an EIA with the following modifications-  
\_\_\_\_\_
    - or (c) to reject the project, being contrary to environmental objectives, for the following reasons:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- Dated \_\_\_\_\_  
\_\_\_\_\_
- Tracking no.\_\_\_\_

Director-General  
Sindh Environmental Protection Agency  
(with official stamp/seal)

**SCHEDULE VIII**  
*[See Regulation 14(2)]*

**Undertaking**

I, (full name and address) as proponent for (name, description and location of project) do hereby solemnly affirm and declare that the conditions of approval and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures and other relevant matters have been duly complied with in the design and construction of the project.

Signature, name and

designation of proponent  
(with official stamp/seal)

Witnesses(full names and addresses)

\_\_\_\_\_  
\_\_\_\_\_

**SCHEDULE IX**  
(See Regulation 18)  
**Form of Registers for EC, IEE and EIA projects**

<u>S. No.</u>	<u>Description</u>	<u>Relevant Provisions</u>
1	2	3
1.	Tracking number	
2.	Category type (as per Schedules I or II)	
3.	Name of proponent	
4.	Name and designation of contact person	
5.	Name of consultant	
6.	Description of project	
7.	Location of project	
8.	Date of submission of IEE/EIA	
9.	Date of public hearing / technical presentation	
10.	Date of committee of experts for schedule-II projects	
11.	Approval granted (Yes/No)	
12.	Date of approval granted or refused	

# **ANNEXURE – III**

## **Sindh Environmental Quality Standards (SEQS)**





# The Sindh Government Gazette

Published by Authority

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**KARACHI THURSDAY JANUARY 28, 2016**

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## PART-I

GOVERNMENT OF SINDH  
SINDH ENVIRONMENT PROTECTION  
AGENCY

### NOTIFICATION

NO.EPA/TECH/739/2014:- In exercise of the powers conferred under clause (g) of sub-section (1) of section of 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the following standards:-

1. (1) These Standards may be called the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015.

(2) These Standards shall come into force at once.

2. In these Standards, unless there is anything repugnant in the subject or context --

(a) "Government" means the Government of Sindh;

(b) "Standards" means the Sindh Environmental Quality Standards.



**SINDH ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND  
LIQUID INDUSTRIAL EFFLUENTS (mg/l, UNLESS OTHERWISE DEFINED)**

S. No.	Parameter	Standards		
		Into Inland Waters 3	Into Sewage Treatment <sup>(5)</sup> 4	Into Sea <sup>(1)</sup> 5
1.	Temperature 40 <sup>0</sup> C or Temperature Increase *	≤3 <sup>0</sup> C	≤3 <sup>0</sup> C	≤3 <sup>0</sup> C
2.	pH value (H <sup>+</sup> )	6-9	6-9	6-9
3.	Biochemical Oxygen Demand (BOD) <sub>5</sub> at 20 <sup>0</sup> C <sup>(1)</sup>	80	250	80**
4.	Chemical Oxygen Demand(COD) <sup>(1)</sup> .. ..	150	400	400
5.	Total Suspended Solids (TSS) .. . . .	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500
7.	Oil and Grease	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3
9.	Chloride (as Cl <sup>-</sup> )	1000	1000	SC***
10.	Fluoride (as F <sup>-</sup> )	10	10	10
11.	Cyanide (as CN <sup>-</sup> ) total	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS) <sup>(2)</sup>	20	20	20
13.	Sulphate (SO <sub>4</sub> <sup>2-</sup> )	600	1000	SC***
14.	Sulphide (S <sup>2-</sup> )	1.0	1.0	1.0
15.	Ammonia (NH <sub>3</sub> )	40	40	40
16.	Pesticides <sup>(3)</sup>	0.15	0.15	0.15
17.	Cadmium <sup>(4)</sup> ..	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent) <sup>(4)</sup> ..	1.0	1.0	1.0
19.	Copper <sup>(4)</sup> .. ..	1.0	1.0	1.0
20.	Lead <sup>(4)</sup>	0.5	0.5	0.5
21.	Mercury <sup>(4)</sup>	0.01	0.01	0.01
22.	Selenium <sup>(4)</sup>	0.5	0.5	0.5
23.	Nickel <sup>(4)</sup> ..	1.0	1.0	1.0
24.	Silver <sup>(4)</sup>	1.0	1.0	1.0
25.	Total toxic metals .. . .	2.0	2.0	2.0
26.	Zinc .. . . .	5.0	5.0	5.0
27.	Arsenic <sup>(4)</sup>	1.0	1.0	1.0
28.	Barium <sup>(4)</sup>	1.5	1.5	1.5
29.	Iron .. . . .	8.0	8.0	8.0
30.	Manganese .. . .	1.5	1.5	1.5
31.	Boron <sup>(4)</sup>	6.0	6.0	6.0
32.	Chlorine .. . . .	1.0	1.0	1.0



**Explanations:**

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Sindh Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
  2. Methylene Blue Active Substances; assuming surfactant as biodegradable.
  3. Pesticides include herbicides, fungicides, and insecticides.
  4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.
  5. Applicable only when and where sewage treatment is operational and BOD<sub>5</sub>=80mg/l is achieved by the sewage treatment system.
  6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.
- \*. The effluent should not result in temperature increase of more than 3<sup>0</sup>C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.
- \*\* The value for industry is 200 mg/l
- \*\*\* Discharge concentration at or below sea concentration (SC).

- Note: 1. Dilution of liquid effluents to bring them to the STANDARDS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.
2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the STANDARDS limits".

**"SINDH ENVIRONMENTAL QUALITY STANDARDS FOR  
INDUSTRIAL GASEOUS EMISSION (mg/Nm<sup>3</sup>, UNLESS  
OTHERWISE DEFINED)."**

S. No.	Parameter	Source of Emission	Standards
1	2	3	4
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringleman Scale or equivalent smoke number
2.	Particulate matter	(a) Boilers and Furnaces	
	(1)	(i) Oil fired	300
		(ii) Coal fired	500
		(iii) Cement Kilns	300



		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500
3.	Hydrogen Chloride	Any	400
4.	Chlorine	Any	150
5.	Hydrogen Fluoride	Any	150
6.	Hydrogen Sulphide	Any	10
7.	Sulphur Oxides <sup>(2) (3)</sup>	Sulfuric acid/ Sulphonic acid plants	
		Other Plants except power Plants operating on oil and coal	1700
8.	Carbon Monoxide	Any	800
9.	Lead	Any	50
10.	Mercury	Any	10
11.	Cadmium	Any	20
12.	Arsenic	Any	20
13.	Copper	Any	50
14.	Antimony	Any	20
15.	Zinc	Any	200
16.	Oxides of Nitrogen	Nitric acid Manufacturing unit.	3000
	(3)	Other plants except power plants operating on oil or coal:	
		Gas fired	400
		Oil fired	600
		Coal fired	1200

**Explanations:-**

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 percent Sulphur content in fuel oil. Higher content of Sulphur will ease standards to be pro-rated.
3. In respect of emissions of Sulphur dioxide and Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to Standards specified above, comply with the following standards:-



**A. Sulphur Dioxide**

Sulphur Dioxide Background levels Micro-gram per cubic meter ( $\mu\text{g}/\text{m}^3$ ) Standards.

Background Air Quality (SO <sub>2</sub> Basis)	Annual Average	Max. 24-hours Interval	Criterion I Max. SO <sub>2</sub> Emission (Tons per Day Per Plant)	Criterion II Max. ground level increment to ambient (One year Average)
Unpolluted	<50	<200	500	50
Moderately Polluted*				
Low	50	200	500	50
High	100	400	100	10
Very Polluted**	>100	>400	100	10

\* For intermediate values between 50 and 100  $\mu\text{g}/\text{m}^3$  linear interpolations should be used.

\*\* No projects with Sulphur dioxide emissions will be recommended.

**B. Nitrogen Oxide**

Ambient air concentrations of Nitrogen oxides, expressed as NO<sub>x</sub> should not be exceed the following:-

Annual Arithmetic Mean  $100\mu\text{g}/\text{m}^3$   
(0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere should be maintained as follows:-

For fuel fired steam generators as Nanogram ( $10^0$ -gram) per joule of heat input:

Liquid fossil fuel	..	..	..	130
Solid fossil fuel..	..	..	..	300
Lignite fossil fuel	..	..	..	260

Note:-

Dilution of gaseous emissions to bring them to the STANDARDS limiting value is not permissible through excess air mixing blowing before emitting into the environment.



Sindh Environmental Quality Standards for Motor  
Vehicle Exhaust and Noise

(i) For in-use Vehicles				
S. No.	Parameter	Standards (maximum permissible limit)	Measuring Method	Applicability
1	2	3	4	5
1.	Smoke	40% or on the Ringleman Scale during engine acceleration mode	To be compared with Ringleman Chart at a distance of 6 meters or more.	Immediate effect
2	Carbon Monoxide	6 %	Under idling conditions: Non- dispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A)	Sound-meter at 7.5 meter from the source.	

For new Vehicles

**EMISSION STANDARDS FOR DIESEL VEHICLES****(a) For passenger Cars and Light Commercial Vehicles (g/Km)**

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8
Passenger Cars.	M I: with reference mass (RW).	Pak-II, IDI	1.0	0.7	0.08		All imported and local manufactured
	up to 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II DI	1.0	0.9	0.10	NEDC (ECE 15+ EUDCL)	Diesel vehicles with effect from 01-07-2012
Light Commercial Vehicles	NI-I (RW<1250 Kg)	Pak-II IDI	1.0	0.70	0.08		
		Pak-II DI	1.0	0.90	0.10		
	NI-II(1250kg< RW < 1700 Kg)	Pak-II IDI	1.25	1.0	0.12		
		Pak-II DI	1.25	1.3	0.14		
	NI-III(RW< 1700 Kg)	Pak-II IDI	1.50	1.2	0.17		
		Pak-II DI	1.50	1.6	0.20		



## Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the source
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## (b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Category/ Class	Tiers	CO	HC	NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8	9
Heavy Duty Diesel Engines	Turks and Buses	Pak-II	4.0	1.1	7.0	0.15	ECE-R-49	All Imported and local manufactured diesel vehicles with the effect 1-7-2012
Large goods Vehicles	N2(2000 and up	Pak-II	4.0	7.0	1.10	0.15	EDC	

## Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the Source
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## Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/ Class	Tier	Co	HC+ NOx	Measuring Method	Applicability
1	2	3	4	5	6	7
Passenger Cars.	M 1: with reference mass (RW). upto 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II	2.20	0.5	NEDC (ECE 15 + EUDCL)	All imported and new models * locally manufactured petrol vehicles with effect from 1 <sup>st</sup> July, 2009**



Light Commercial Vehicles	NI-I (RW<1250 kg) NI-II (1250kg> kg RW< 1700 Kg)	Pak-II	2.20	0.5	
		Pak-II	4.0	0.65	
		Pak-II	5.0	0.08	
	NI-III(RW> 1700 kg)				
Motor Rickshaws & Motor Cycles	2,4 strokes < 150 cc	Pak-II	5.5	1.5	ECER 40
	2,4 strokes > 150cc	Pak-II	5.5	1.3	

#### Parameter Standards (maximum permissible limit) Measuring method

Noise source                      85 db (A)                      Sound-meter at 7.5 meters from the

#### Explanations:

- DI: Direct Injection.  
 IDI: Indirect Injection.  
 EUDCL: Extra Urban Driving Cycle.  
 NEDC: New European Driving Cycle.  
 ECE: Urban Driving Cycle.  
 M: Vehicles designed and constructed for the carriage of passenger and comprising no more than eight seats in addition to the driver's seat.  
 N: Motor vehicles with at least four wheels designed and constructed for the carriage of goods.  
 \* New model means both model and engine type change.  
 \*\* The existing models of petrol driven vehicles locally manufactured will immediately switch over to Pak-II emission standards but no late than 30<sup>th</sup> June, 2012.



SINDH ENVIRONMENTAL QUALITY STANDARDS FOR AMBIENT AIR

Pollutants	Time-weight average	Concentration in Ambient Air	Method of measurement
Sulphur Dioxide(SO <sub>2</sub> )	Annual Average*	80 µg/m <sup>3</sup>	Ultraviolet Fluorescence method
Oxides of Nitrogen as (NO)	24 hours**	120 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
Oxides of Nitrogen as (NO <sub>2</sub> )	Annual Average*	40 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
O <sub>3</sub>	24 hours**	40 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
	Annual Average*	80 µg/m <sup>3</sup>	Gas Phase Chemiluminescence
Suspended Particulate Matters(SPM)	1 hour	130 µg/m <sup>3</sup>	Non dispersive UV absorption method
Respirable Particulate Matter	Annual Average*	360 µg/m <sup>3</sup>	High Volume Sampling (Average flow rate not less than 1 l in 3/minutes)
PM10	24 hours**	500 µg/m <sup>3</sup>	B Ray absorption method
Respirable Particulate Matter	Annual Average*	120 µg/m <sup>3</sup>	B Ray absorption method
PM2.5	24 hours**	150 µg/m <sup>3</sup>	B Ray absorption method
Lead Pb	Annual Average*	40 µg/m <sup>3</sup> ***	B Ray absorption method
	24 hours**	75 µg/m <sup>3</sup>	B Ray absorption method
Carbon Monoxide(CO)	Annual Average*	1 µg/m <sup>3</sup>	ASS Method after sampling using EPM 2000 or equivalent filter paper
	24 hours**	1.5 µg/m <sup>3</sup>	ASS Method after sampling using EPM 2000 or equivalent filter paper
	8 hours**	5 mg/m <sup>3</sup>	Non Dispersive Infra Red(NDIR) method
	1 hours**	10 mg/m <sup>3</sup>	Non Dispersive Infra Red(NDIR) method



\*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly and at uniform interval.

\*\* 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

\*\*\* Annual Average limit of  $40\mu\text{g}/\text{m}^3$  or background annual average concentration plus allowable allowance of  $9\mu\text{g}/\text{m}^3$ , whichever is lower.

### Sindh Standards for Drinking Water Quality

Properties / Parameters	Standard Values for Sindh	WHO Standards	Remarks
<b>Bacterial</b>			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample  In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Must not be detectable in any 100 ml sample  In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Most Asian countries also follow WHO standards
<b>Physical</b>			
Colour	$\leq 15$ TCU	$\leq 15$ TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non	Non	



	objectionable/Acceptable	objectionable/Acceptable
Turbidity	< 5 NTU	< 5 NTU
Total hardness as CaCO <sub>3</sub>	< 500 mg/l	---
TDS	< 1000	< 1000
pH	6.5 – 8.5	6.5 – 8.5
<b>Chemical</b>		
<i>Essential Inorganic</i>	<i>mg/Litre</i>	<i>mg/Litre</i>
Aluminium (Al) mg/l	≤ 0.2	0.2

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
<i>Toxic Inorganic</i>	<i>mg/Liter</i>	<i>mg/Litre</i>	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	
Nickel (Ni)	≤ 0.02	0.02	



Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Nitrate (NO <sub>3</sub> )	≤ 0.50	50	
Nitrite (NO <sub>2</sub> )	≤ 3 (P)	3	
Selenium (SE)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	---	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
<b>Organic</b>			
Pesticides mg/L		PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.***	Annex II
Phenolic compounds (as Phenols) mg/L		≤ 0.002	
Polynuclear aromatic hydrocarbons (as PAH g/L)		0.01 (By GC/MS method)	
<b>Radioactive</b>			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

\*\*\* PSQCA: Pakistan Standards Quality Control Authority

### Proviso:

The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The Arsenic concentrations in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centers are generally old and will take significant resources and time to get them replaced. In the recent past, Lead was completely phased out from petroleum



products to cut down Lead entering into environment. These steps will enable to achieve WHO guidelines for Arsenic, Lead, Cadmium and Zinc. However, for bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

### Sindh Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1 <sup>st</sup> Jan, 2015		Effective from 1 <sup>st</sup> January, 2015	
		Limit in dB(A) Leq *			
		Day Time	Night Time	Day Time	Night Time
1.	Residential Area (A)	65	50	55	45
2.	Commercial Area (B)	70	60	65	55
3.	Industrial Area (C)	80	75	75	65
4.	Silence Zone (D)	55	45	50	45

- Note: 1. Day time hours: 6:00 a.m to 10:00 p.m  
 2. Night time hours: 10:00 p.m to 6:00 a.m  
 3. Silence zone; Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts  
 4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.  
 \* dB(A) Leq; Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

### 3. Repeal and Savings.

- (1) The provisions of the Statutory Notification dated 10<sup>th</sup> August, 2000 and 18<sup>th</sup> October, 2010, issued by the Ministry of Environment, Government of Pakistan, to the extent of the Province of Sindh are hereby repealed.
- (2) All actions taken, proceedings initiated shall be deemed to have been taken and initiated validly under the the provisions of these Rules.

DIRECTOR GENERAL  
SINDH ENVIRONMENTAL PROTECTION  
AGENCY

# **ANNEXURE – IV**

## **Environmental Monitoring Reports**

Lab Report Ref. No.: QTS/SPP/22/5474-A

Reporting Date: 12/12/2022

Project Name: ESMP 175 MW Solar Power Plant Deh Halkani & Band Murad.

**SAMPLE DESCRIPTION**

Sample ID: Drinking water 01 (Deh Halkani & Band Murad)  
Sample Type: Grab Sample  
Sample Collected/Submitted by: QTS Representative  
Sampling Date: 03/12/2022  
Sample Receipt at QTS - Date: 03/12/2022

**ANALYTICAL TEST REPORT**

S. NO.	PARAMETERS	STANDARDS	STANDARD	LDL	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.31	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.46	APHA-2020 B/C
5	Turbidity	< 5	< 5	0.01	NTU	0.33	APHA-2130 B
6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	925	Hach 8160
7	Total Hardness as CaCO <sub>3</sub>	< 500	180	0.1	mg/L	310	EDTA Titration.Hach-8213
8	Fluoride (as F <sup>-</sup> )	≤ 1.5	≤ 1.5	0.01	mg/L	0.5	USEPA 340.1
9	Chloride (as Cl <sup>-</sup> )	< 250	< 250	0.1	mg/L	280*	Hach 8206
10	Nitrate (NO <sub>3</sub> )	≤ 50	≤ 50	0.01	mg/L	0.37	Hach -8039
11	Nitrite (NO <sub>2</sub> )	≤ 3	≤ 3	0.001	mg/L	0.031	Hach - 8153
12	Cyanide (as CN <sup>-</sup> ) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.021	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082
25	Zinc	5.0	3.0	0.01	mg/L	0.043	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.03	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
<b>MICROBIOLOGICAL ANALYSIS REPORT</b>							
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>250*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>100*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>80*	APHA-SM9221F

SSDWQ=Sindh Standard for Drinking Water Quality  
USEPA=United State Environmental Protection Agency method  
Hach USA, method  
BDL=Below Detection Limit  
NS= Not Specified

**Term & Condition:**

- This report is not valid for any negotiations.
- Report is valid for current batch(sample).
- The remaining portion of the sample will be discarded after 07 days unless otherwise instructed.
- This report is intended only for your guidance & not for legal purpose or for advertisement.

**Comments:**

\*Tested parameters are not within the SSDWQ and WHO Standards.

Sample Analyzed by: <u>Hareem Zehra</u>	Signature of Laboratory In charge:  Name : Ali Raza
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Lab Report Ref. No. : QTS/SPP/22/5474-B

Reporting Date: 12/12/2022

Project Name: ESMP 175 MW Solar Power Plant Deh Halkani &amp; Band Murad.

## SAMPLE DESCRIPTION

Sample ID: Drinking water 02(Deh Halkani & Band Murad)  
Sample Type: Grab Sample  
Sample Collected/Submitted by: QTS Representative  
Sampling Date: 03/12/2022  
Sample Receipt at QTS - Date: 03/12/2022

## ANALYTICAL TEST REPORT

S. NO.	PARAMETERS	STANDARDS	STANDARD	LDL	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.60	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.41	APHA-2020 B/C
5	Turbidity	< 5	< 5	0.01	NTU	0.31	APHA-2130 B
6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	902	Hach 8160
7	Total Hardness as CaCO <sub>3</sub>	< 500	180	0.1	mg/L	299	EDTA Titration.Hach-8213
8	Fluoride (as F <sup>-</sup> )	≤ 1.5	≤ 1.5	0.01	mg/L	0.42	USEPA 340.1
9	Chloride (as Cl <sup>-</sup> )	< 250	< 250	0.1	mg/L	253*	Hach 8206
10	Nitrate (NO <sub>3</sub> )	≤ 50	≤ 50	0.01	mg/L	0.34	Hach -8039
11	Nitrite (NO <sub>2</sub> )	≤ 3	≤ 3	0.001	mg/L	0.027	Hach - 8153
12	Cyanide (as CN <sup>-</sup> ) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.032	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082
25	Zinc	5.0	3.0	0.01	mg/L	0.041	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.02	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
MICROBIOLOGICAL ANALYSIS REPORT							
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>200*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>90*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>80*	APHA-SM9221F

SSDWQ=Sindh Standard for Drinking Water Quality  
USEPA=United State Environmental Protection Agency method  
Hach USA, method  
BDL=Below Detection Limit  
NS= Not Specified

## Term &amp; Condition:

- This report is not valid for any negotiations.
- Report is valid for current batch(sample).
- The remaining portion of the sample will be discarded after 07 days unless otherwise instructed.
- This report is intended only for your guidance & not for legal purpose or for advertisement.

## Comments:

\*Tested parameters are not within the SSDWQ and WHO Standards.

Sample Analyzed by: Hareem Zehra

Signature of Laboratory In charge:  
Name : Ali Raza




### Ambient Air Quality Test Report

<b>Project Name:</b>	<b>ESMP 175 MW Solar Power Plant Deh Halkani &amp; Band Murad.</b>	<b>Test Report No:</b>	<b>QTS/SPP/22/5475-A</b>
<b>Sample Description:</b>	<b>Ambient Air Quality Test</b>	<b>Sample Duration:</b>	<b>24hr's</b>
		<b>Location: A</b>	<b>25°01'58.50"N 66°58'59.99"E</b>

PARAMETERS								
Date	Time	NO (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SPM (µg/m <sup>3</sup> )	Lead (µg/m <sup>3</sup> )
02.12.2022	10:00	14.5	12.6	16.2	103	24	309	ND
	11:00	13.3	10.8	20.3	109	22	328	
	12:00	18.5	06.0	25.6	116	29	345	
	13:00	21.8	08.2	21.9	130	30	350	
	14:00	19.2	14.4	30.0	132	35	365	
	15:00	20.3	11.6	33.5	129	29	342	
	16:00	20.9	09.2	37.1	122	25	322	
	17:00	15.0	18.2	29.4	121	19	304	
	18:00	14.5	16.3	25.5	120	19	296	
	19:00	16.9	13.5	21.5	115	20	295	
	20:00	13.2	14.8	23.2	103	22	275	
	21:00	10.6	16.4	14.8	96	19	264	
	22:00	10.3	19.2	11.5	92	16	250	
	23:00	09.4	14.0	16.2	91	15	238	
03.12.2022	00:00	16.4	12.4	18.4	84	14	224	
	01:00	18.3	16.3	15.3	81	14	211	
	02:00	20.9	13.5	14.6	75	16	218	
	03:00	17.2	10.3	14.3	78	13	220	
	04:00	12.3	14.3	16.6	69	17	223	
	05:00	11.6	14.6	17.3	63	12	238	
	06:00	13.5	15.9	19.4	74	16	242	
	07:00	14.9	19.3	20.3	88	19	251	
	08:00	14.0	15.2	14.6	93	20	279	
	09:00	16.9	11.4	17.5	102	22	294	
MIN		9.4	6	11.5	63	12	211	
MAX		21.8	19.3	37.1	132	35	365	
AVG		15.6	13.6	20.9	99.2	20.5	279.1	
SEQS		40	80	120	150	75	500	1.5



### Ambient Air Quality Test Report

<b>Project Name:</b>	<b>ESMP 175 MW Solar Power Plant Deh Halkani &amp; Band Murad.</b>	<b>Test Report No:</b>	<b>QTS/SPP/22/5475-A</b>
		<b>Sample Duration:</b>	<b>24hr's</b>
<b>Sample Description:</b>	<b>Ambient Air Quality Test</b>	<b>Location: A</b>	<b>25°01'58.50"N 66°58'59.99"E</b>

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m <sup>3</sup>	08 Hours	0.09	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m <sup>3</sup>	08 Hours	15.6	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	13.6	80.0	200	
Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	20.9	120.0	20	Ultraviolet Fluorescence Method
Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	01 Hour	16.2	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM <sub>10</sub> )	µg/m <sup>3</sup>	08 Hours	99.2	150.0	50	β Ray Absorption Method
Particulate Matter (PM <sub>2.5</sub> )	µg/m <sup>3</sup>	08 Hours	20.5	75.0	25	
Total Suspended Particles (TSP)	µg/m <sup>3</sup>	08 Hours	279.1	500.0	NA	
Lead	µg/m <sup>3</sup>	08 Hours	ND	1.5	NA	ASS Method

\*SEQS= Sindh Environmental Quality Standards.

\*IFC= International Finance Corporation

(24 Hours Standard for all the parameters Except O<sub>3</sub> and CO),

µg/m<sup>3</sup>= Micrograms per Cubic Meter

mg/m<sup>3</sup>= Milligrams per Cubic Meter

ppm = Parts per million

ND= Not Detected

N/A=Not Available

#### Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQs

<b>Sample Analyzed By: Sajid Ali</b>	<b>Signature of Laboratory Incharge:</b> _____ <b>Name : Ali Raza</b>
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### Ambient Air Quality Test Report

Project Name:	ESMP 175 MW Solar Power Plant Deh Halkani & Band Murad.	Test Report No:	QTS/SPP/22/5475-B
		Sample Duration:	24hr's
Sample Description:	Ambient Air Quality Test	Location: B	25°01'58.50"N 66°58'59.99"E

PARAMETERS								
Date	Time	NO (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SPM (µg/m <sup>3</sup> )	Lead (µg/m <sup>3</sup> )
03.12.2022	10:00	16.5	20.6	26.2	93	32	249	ND
	11:00	12.3	15.8	30.3	94	39	248	
	12:00	12.5	16.0	35.6	102	37	255	
	13:00	12.8	18.2	31.9	112	31	250	
	14:00	10.2	24.4	30.0	118	29	255	
	15:00	10.3	28.6	30.5	120	20	262	
	16:00	10.9	29.2	37.1	135	21	271	
	17:00	14.0	28.2	36.4	131	18	274	
	18:00	12.5	22.3	29.5	110	16	266	
	19:00	10.9	23.5	22.5	105	20	255	
	20:00	13.2	24.8	23.2	103	18	245	
	21:00	11.6	19.4	24.8	100	19	244	
	22:00	10.3	16.2	29.5	92	20	240	
	23:00	08.4	14.0	26.2	90	27	218	
04.12.2022	00:00	10.4	17.4	28.4	81	20	204	
	01:00	11.3	20.3	24.3	79	19	191	
	02:00	12.9	16.5	18.6	75	16	188	
	03:00	17.2	15.3	15.3	68	14	190	
	04:00	12.3	21.3	19.6	69	18	193	
	05:00	18.6	24.6	14.3	76	25	198	
	06:00	20.5	16.9	18.4	80	23	201	
	07:00	14.9	19.3	20.3	88	29	211	
	08:00	12.0	25.2	19.6	98	24	219	
	09:00	13.9	23.3	22.5	95	29	224	
MIN		8.4	14	14.3	68	14	188	
MAX		20.5	29.2	37.1	135	39	274	
AVG		13.0	20.9	25.6	96.8	23.7	231.2	
SEQS		40	80	120	150	75	500	1.5

### Ambient Air Quality Test Report

<b>Project Name:</b>	<b>ESMP 175 MW Solar Power Plant Deh Halkani &amp; Band Murad.</b>	<b>Test Report No:</b>	<b>QTS/SPP/22/5475-B</b>
<b>Sample Description:</b>	<b>Ambient Air Quality Test</b>	<b>Sample Duration:</b>	<b>24hr's</b>
		<b>Location: B</b>	<b>25°01'58.50"N 66°58'59.99"E</b>

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m <sup>3</sup>	08 Hours	0.24	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m <sup>3</sup>	08 Hours	13.0	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	20.9	80.0	200	
Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	25.6	120.0	20	Ultraviolet Fluorescence Method
Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	01 Hour	16.2	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM <sub>10</sub> )	µg/m <sup>3</sup>	08 Hours	96.8	150.0	50	β Ray Absorption Method
Particulate Matter (PM <sub>2.5</sub> )	µg/m <sup>3</sup>	08 Hours	23.7	75.0	25	
Total Suspended Particles (TSP)	µg/m <sup>3</sup>	08 Hours	231	500.0	NA	
Lead	µg/m <sup>3</sup>	08 Hours	ND	1.5	NA	ASS Method

\*SEQS= Sindh Environmental Quality Standards.

\*IFC= International Finance Corporation

(24 Hours Standard for all the parameters Except O<sub>3</sub> and CO),

µg/m<sup>3</sup>= Micrograms per Cubic Meter

mg/m<sup>3</sup>= Milligrams per Cubic Meter

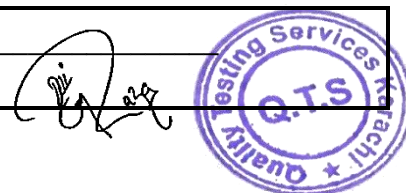
ppm = Parts per million

ND= Not Detected

#### Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQs

<b>Sample Analyzed By: Sajid Ali</b>	<b>Signature of Laboratory Incharge:</b> <b>Name : Ali Raza</b>
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### Ambient Air Quality Test Report

<b>Project Name:</b>	<b>ESMP 175 MW Solar Power Plant Deh Halkani &amp; Band Murad.</b>	<b>Test Report No:</b>	<b>QTS/SPP/22/5475-C</b>
<b>Sample Description:</b>	<b>Ambient Air Quality Test</b>	<b>Sample Duration:</b>	<b>24hr's</b>
		<b>Location: C</b>	<b>25°01'50.27"N 66°59'57.39"E</b>

#### PARAMETERS

Date	Time	NO (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	SPM (µg/m <sup>3</sup> )	Lead (µg/m <sup>3</sup> )
05.12.2022	10:00	26.5	16.2	36.4	122	22	345	ND
	11:00	22.8	19.4	40.6	124	19	338	
	12:00	22.5	28.0	31.2	132	22	315	
	13:00	19.8	28.9	19.9	136	21	320	
	14:00	20.2	34.1	20.4	138	18	355	
	15:00	18.4	38.0	28.0	120	24	312	
	16:00	14.9	31.4	27.4	115	31	291	
	17:00	15.0	27.0	30.6	112	26	284	
	18:00	22.5	19.0	39.5	104	26	278	
	19:00	20.9	13.5	42.0	95	30	261	
	20:00	23.2	14.8	26.2	103	27	255	
	21:00	21.6	09.4	21.8	80	22	249	
	22:00	16.3	11.9	19.4	82	17	230	
	23:00	12.6	10.7	16.9	70	15	227	
06.12.2022	00:00	13.0	15.4	22.4	61	14	216	
	01:00	12.8	22.0	34.8	69	18	201	
	02:00	16.0	26.5	28.6	74	22	196	
	03:00	22.8	21.3	19.3	78	24	192	
	04:00	22.4	11.4	21.0	60	19	198	
	05:00	16.6	14.6	24.6	71	15	208	
	06:00	14.5	19.8	20.4	84	13	216	
	07:00	16.9	22.0	21.4	91	20	241	
	08:00	19.0	20.4	26.6	108	21	269	
	09:00	23.4	18.9	32.0	105	26	294	
MIN		12.6	9.4	16.9	60	13	192	
MAX		26.5	38	42	138	31	355	
AVG		18.9	20.8	27.3	97.2	21.3	263	
SEQS		40	80	120	150	75	500	1.5



### Ambient Air Quality Test Report

<b>Project Name:</b>	<b>ESMP 175 MW Solar Power Plant Deh Halkani &amp; Band Murad.</b>	<b>Test Report No:</b>	<b>QTS/SPP/22/5475-C</b>
		<b>Sample Duration:</b>	<b>24hr's</b>
<b>Sample Description:</b>	<b>Ambient Air Quality Test</b>	<b>Location: C</b>	<b>25°01'50.27"N 66°59'57.39"E</b>

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m <sup>3</sup>	08 Hours	0.36	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m <sup>3</sup>	08 Hours	18.9	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	20.8	80.0	200	
Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	08 Hours	27.3	120.0	20	Ultraviolet Fluorescence Method
Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	01 Hour	18.4	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM <sub>10</sub> )	µg/m <sup>3</sup>	08 Hours	97.2	150.0	50	β Ray Absorption Method
Particular Matter (PM <sub>2.5</sub> )	µg/m <sup>3</sup>	08 Hours	21.3	75.0	25	
Total Suspended Particles (TSP)	µg/m <sup>3</sup>	08 Hours	263.0	500.0	NA	
Lead	µg/m <sup>3</sup>	08 Hours	ND	1.5	NA	ASS Method

\*SEQS= Sindh Environmental Quality Standards.

\*IFC= International Finance Corporation

(24 Hours Standard for all the parameters Except O<sub>3</sub> and CO),

µg/m<sup>3</sup>= Micrograms per Cubic Meter

mg/m<sup>3</sup>= Milligrams per Cubic Meter

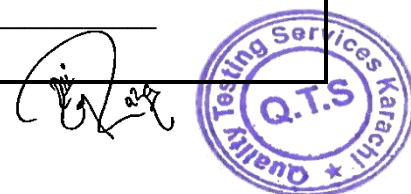
ppm = Parts per million

ND= Not Detected

#### Remarks:

The average concentration calculated for the 08 hours are well within guideline values set by SEQs

<b>Sample Analyzed By: Sajid Ali</b>	<b>Signature of Laboratory Incharge: _____</b> <b>Name : Ali Raza</b>
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Lab Report Ref. No. : EMC/QTS/SPP/22/ 5476

Reporting Date: 12/12/2022

Project Name: ESMP 175 MW Solar Power Plant Deh Halkani & Band Murad.

### SAMPLE DESCRIPTION

Sample ID: Noise Level Test  
 Sample Description: Ambient Noise  
 No. of samples: 05  
 Sample Collected/Submitted by: QTS representative  
 Sampling Date: 03/12/2022  
 Sample Receipt at QTS - Date: 03/12/2022

### NOISE LEVEL TEST REPORT

S.NO	LOCATION/SOURCE	Noise Level Readings				
		Minimum	Maximum	Average	SEQS	WHO
1	Point -1 25°02'02.07"N 66°59'40.41"E	52.1	55.9	54.0	Limits: *65dB(A)	Limits: *70dB(A)
2	Point -2 25°01'37.52"N 66°58'48.15"E	50.6	56.2	53.4		
3	Point -3 25°01'27.32"N 67°00'07.89"E	53.0	57.0	55.0		
4	Point -4 25°01'23.08"N 66°59'31.27"E	51.6	56.8	54.2		
5	Point -5 25°01'56.62"N 66°58'54.05"E	52.0	57.4	54.7		

SEQS = Sindh Environmental Quality Standards (Outside Noise Level)

dB (A) Leq=Time weighted average of the level of sound in decibel on scale which is relatable to human hearing.

**Term & Condition:**

- This report is not valid for any negotiations
- Report is valid for current batch(sample)
- This report is intended only for your guidance & not for legal purpose or for advertisement.

**Comments:**

The Noise Level from the sources is within acceptable level as describe in SEQs.

Sample Analyzed by: <u>Sajid Ali</u>	Signature of Laboratory In charge:  Name : <u>Ali Raza</u>
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