BEFORE
THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

APPLICATION FOR A GENERATION LICENSE FOR WIND POWER GENERATION FACILITY

PURSUANT TO ENABLING PROVISIONS OF NEPRA ACT 1997 READ WITH ENABLING PROVISIONS OF RULES MADE THEREUNDER , LICENSING (APPLICATION & MODIFICATION PROCEDURE) REGULATIONS AND LICENSING (GENERATION) RULES 2000 &
THE FEDERAL GOVERNMENT'S
'POLICY OF RENEWABLE ENERGY FOR POWER GENERATION 2006'

ON BEHALF OF

GUL AHMED ELECTRIC LIMITED

FOR NEPRA'S GRANT OF GENERATION LICENSE FOR
GUL AHMED ELECTRIC LIMITED

FOR A POWER PROJECT OF 50 MW (THE **PROJECT**)

AT

JHIMPIR, DISTRICT THATTA, PROVINCE OF SINDH, PAKISTAN

DATED: 05 APRIL 2017

GUL AHMED ELECTRIC LIMITED

BUSINESS ADDRESS: 7TH FLOOR, AL-TIJARAH CENTRE, 32-1-A, BLOCK 6, P.E.C.H.S,
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Gul Ahmed Electric Ltd. Karachi

GUL AHMED ELECTRIC LIMITED

7th Floor, Al-Tijarah Centre, 32-1-A, Block 6, P.E.C.H.S. Main Shahra-e-Faisal Road, Karachi-75400 – Pakistan
Phone +92 21 34540270-73 Ext. 112 Fax +92 21 34540274 Email: info@gulahmedelectric.com

Ref: C-NEPRA-L17-00039 Date: 05 April, 2017

THE REGISTRAR,
NATIONAL ELECTRICAL POWER REGULATORY AUTHORITY,
NEPRA Tower, Attaturk Avenue (East)
G-5/1,
Islamabad

SUBJECT: **APPLICATION FOR GRANT OF GENERATION LICENSE TO GUL AHMED ELECTRIC LIMITED FOR ITS 50MW WIND POWER GENERATION PROJECT TO BE LOCATED AT JHIMPIR, DISTRICT THATTA, PROVINCE OF SINDH**

Dear Sir,

1. Pursuant to Rule 3 of the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, GUL AHMED ELECTRIC LIMITED hereby submits for NEPRA's kind consideration and approval, the Generation License Application (together with the information and annexures attached thereto).

2. The Generation License Application (including its annexures) are submitted in triplicate, together with:

   (a) A Pay Order No. 0159.3239490 dated 04 April 2017 of Meezan Bank amounting to PKR 296,208/- (Pakistani Rupees Two hundred and Ninety-six Thousand, Two Hundred and Eight Only) drawn in favour of NEPRA, as the application fee for the Generation License Application (as communicated to us by NEPRA);

   (b) Extract of Board Resolution of Gul Ahmed Electric Limited; and

   (c) Statement of Authorized Representative of Gul Ahmed Electric Limited, Mr. Ubaid Amanullah.

3. In light of the submissions set out in the Generation License Application and the information attached to the same, NEPRA is kindly requested to process the Generation License Application at the earliest, thereby enabling Gul Ahmed Electric Limited to proceed further with the development of the project.

Respectfully submitted for and on behalf of:
GUL AHMED ELECTRIC LIMITED

....

MR. UBAID AMANULLAH
(AUTHORIZED REPRESENTATIVE)

Gul Ahmed Electric Ltd. Karachi

GUL AHMED ELECTRIC LIMITED

7th Floor, Al-Tijarah Centre, 32-1-A, Block 6, P.E.C.H.S. Main Shahra-e-Faisal Road, Karachi-75400 – Pakistan
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EXTRACT OF THE CIRCULAR RESOLUTION PASSED BY THE BOARD OF DIRECTORS OF GUL AHMED ELECTRIC LIMITED ON 29 MARCH 2017

The following Resolutions were passed by the Board of Directors of Gul Ahmed Electric Limited through Circulation on 29 March 2017:

> **RESOLVED THAT** the Company do file an application to the National Electric Power Regulatory Authority for seeking a generation license for the 50 MW wind power project to be constructed at Jhimpir, pursuant to and under Sections 7(2)(a) and 15 of the NEPRA Act read with other enabling provisions of the NEPRA Act, the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations 1999, National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, and in accordance with the Policy for Development of Renewable Energy for Power Generation 2006.
>
> **FURTHER RESOLVED THAT** Mr. Iqbal Alimohamed, the Chief Executive Officer of the Company, Mr. Ubaid Amanullah, the Executive Director of the Company, Mr. Amin Bhimani, the Chief Financial Officer of the Company, Mr. Yousuf Aziz, Company Secretary, and Mr. Suleman Modi, Attorney, be and each of them are hereby authorized to singly do, execute, transact and perform for and on behalf and in the name of the Company all such acts deeds and things as may be necessary or required or desirable to be done or executed by the Company for or in connection with or in relation to the application to the National Electric Power Regulatory Authority for seeking a generation license under the NEPRA Act and without limiting the generality of the foregoing and in connection therewith to do any or all of the following acts deeds and things, namely, to file, withdraw or re-file applications, swear affidavits, review documents and information, make correspondence, letters, submissions, claims, objections of all kinds and to file or submit them before the National Electric Power Regulatory Authority, either themselves or through an authorized person or attorney, and to appear and represent the Company before the National Electric Power Regulatory Authority or any other regulatory authority or body and to accept the terms and conditions on which a Generation License is granted by the National Electric Power Regulatory Authority.

CERTIFICATION

CERTIFIED, that, the above resolution was duly passed by the Board of Directors of Gul Ahmed Electric Limited through Circulation, on 29 March, 2017.

FURTHER CERTIFIED, that the said resolution has not been rescinded and is in operation and that this is a true copy thereof.

Gul Ahmed Electric Ltd. Karachi

Iqbal Alimohamed
Chief Executive Officer
Gul Ahmed Electric Limited

1. BACKGROUND TO GENERATION LICENSE APPLICATION

1.1 PROCESS OF ISSUANCE OF LETTER OF INTENT LEADING TO GENERATION LICENSE APPLICATION

1.1.1 Issuance of "Letter of Intent"

GUL AHMED ELECTRIC LIMITED (a company duly organized and existing under the laws of Pakistan, with its office located at 7th Floor, Al-tijarah Centre, 32-1-A, Block 6, P.E.C.H.S, Main Sharae Faisal, Karachi) (the **Project Company**), was incorporated on 23 December 2015 to develop, own and operate an approximately 50 MW wind power project in Jhimpir, Thatta (**Project**) pursuant to a LETTER OF INTENT dated July 10, 2015 issued by the Energy Department Government of Sindh (**EDGOS**) vide its letter No. DAE/Wind/78/2015/23 (the **LOI**), which LOI was issued by the EDGOS to the parent company of the Project Company, i.e. Gul Ahmed Energy Limited. Subsequent to incorporation of the Project Company, the EDGOS has recognized that the Project Company will undertake the Project pursuant to the LOI, as evidenced by EDGOS' letter dated 09 February 2015. Further, the EDGOS has vide its letter No. DAE/Wind/84/2015/32 dated February 21, 2017 has granted the Project Company an extension in the validity period of the LOI up to 11 November 2017.

1.1.2 Submission of the Feasibility Study

Pursuant to the relevant provisions of the Policy for Development of Renewable Energy for Power Generation 2006 (the **RE Policy 2006**) and the LOI, the Project Company completed the detailed technical feasibility study (the **Project Feasibility Study**) for the Project. The Project Company submitted the same to the Panel of Experts, EDGOS. The Project Feasibility Study was prepared by Renewable Resources (Private) Limited who are the technical consultants for the Project. A copy of Project Feasibility Study is attached hereto as ANNEXURE A for NEPRA's perusal.

1.1.3 Submission of Initial Environmental Examination.

The technical consultants completed the initial environmental examination for the Project (the **Initial Environmental Examination**) and the Project Company submitted the same to the Sindh Environmental Protection Agency (the **SEPA**) on **10 February 2016**.

After careful review and analysis of the Initial Environmental Examination, the SEPA accorded its approval for the Project through its decision (Ref: **EPA/2016/02/12/IEE/06**) dated **08 April 2016**(the **IEE Approval Decision**). A copy of the IEE Approval Decision is attached hereto as ANNEXURE B for NEPRA's perusal.

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1.1.4 Grid Interconnection Studies

Grid Interconnection Study was carried out by National Transmission and Despatch Company (**NTDC**). The NTDC has also vide letter No.8802/GM/GSC/NTDC dated December 01, 2016 accorded its approval of the Grid Study and issued the Power Evacuation Certificate to the Project Company. A copy of the Grid Interconnection Study and a copy of the Power Evacuation Certificate/Approval of the Grid Study is attached hereto as ANNEXURE M for NEPRA's perusal.

1.1.5 Location of Project & Lease of Land

The Project site is located in Jhimpir, District Thatta, Karachi; a city of the southern province Sindh. The aerial distance between the Project site and Karachi is about 90 km and the road distance of site from Port Qasim is 145 km. The distance between Project site and the coastal line of Arabian Sea is approximately 80 km. The size of the whole wind farm is 370 acres. The north latitude of the site is 25° 0.871'N and the east longitude is 67° 42.682'E. The altitude of the site is 127m~177m above sea level. The monsoon from the Indian Ocean, which is stable in its direction and high in quality brings rich wind energy resource to the site. The Project Company has already been allotted land required for the Project from the Government of Sindh (the **GoS**) for a period of thirty (30) years through Land Allotment Letter Reference: No.01-65-2015/SO-VI/06 dated 14 January 2016. A copy of the Land Allotment letter as well as letters addressed to the Government of Sindh from the Project Sponsor and letters addressed to the Land Utilization Department from Government of Sindh requesting them to change the name from the Project Sponsor to the Project Company are attached hereto as ANNEXURE C for NEPRA's perusal.

1.1.6 Brief Technical Synopsis of the Project

The Project shall have an installed capacity of 50 MW with 20 wind turbine generators (WTG) of 2.5 MW each. There shall be a substation of 132 KV, which shall dispatch electricity to the CPPA-G through a grid station in Jhimpir. Please refer to **ANNEXURE M** for the Grid Interconnection Study carried out by NTDC.

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1.1.7 **Tariff**

Gul Ahmed Electric Limited had applied to the EDGOS for its recommendation to NEPRA for the award of upfront tariff to the Project and subsequently received the said letter on May 18, 2016. A copy of the Recommendation Letter from EDGOS to NEPRA for the award of upfront tariff to the Project is attached as ANNEXURE Q for NEPRA's perusal. Upon issuance of the Generation License and award of the upfront tariff, the Project Company would execute the Energy Purchase Agreement with the power purchaser and aims to achieve financial close for the Project within 12 months of granting of the Tariff. The expected commercial operations date of the Project is to be within 15 months of Financial Close.

1.1.8 **Request for grant of a generation license**

Based on the matters provided in Sections 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6 and 1.1.7 above whereby the Project Company, on its part, has undertaken and completed all activities required for procurement of approvals of the relevant matters from various stakeholders, it is submitted that the requirements of the regulatory process for applying to NEPRA for grant of a generation license to the Project Company are complete.

1.2 SUBMISSION

1.2.1 Under the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of) 1997 (the **NEPRA Act**) and the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, the National Electric Power Regulatory Authority (**NEPRA**) is responsible for and has the authority to, *inter alia*, grant licenses for the generation of electric power and other terms and conditions for the supply of electricity through generation.

1.2.2 **PURSUANT TO** Sections 7(2)(a) and 15 of the NEPRA Act read with other enabling provisions of the NEPRA Act, the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations 1999, National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, **AND** in accordance with the RE Policy 2006: **GUL AHMED ELECTRIC LIMITED HEREBY SUBMITS,** for NEPRA's kind and gracious consideration, the application for the grant of a generation license along with supporting documents (the **Generation License Application**) for its 50 MW power generation facility to be located at Jhimpir, District Thatta, Sindh, Pakistan.

1.2.3 Given the advance stage of the Project, NEPRA is kindly requested to process this Generation License request at the earliest, thereby enabling the Project Company to proceed further with the development process.

1.2.4 This Generation License Application is submitted in triplicate.

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1.2.5 The generation license fee, payable by the Project Company, in respect of this Generation License Application is also enclosed in the form of Pay Order No. 0159.3239490 for an amount of PKR 296,208/- (Pakistani Rupees two hundred and ninety-six thousand, two hundred and eight Only) dated **04 April 2017** drawn in favor of NEPRA.

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2. APPLICANT – GUL AHMED ELECTRIC LIMITED

2.1 The Project Company, being the applicant under this Generation License Application, is a public limited company (unlisted) incorporated under the laws of Pakistan and has been specifically established to undertake power generation business and activities in Pakistan.

2.2 The Project Company (following grant of a generation license and approval of the Project Company's reference generation tariff by NEPRA) proposes to design, engineer, construct, insure, commission, operate and maintain the Project constituting of a 50 MW power generation facility (the **Facility**) to be located at Jhimpir, District Thatta, Province of Sindh, Pakistan (the **Site**).

2.3 For the purposes of designing, engineering, procuring, constructing, installing, testing, completing, commissioning, operation and maintenance of the Project, the Project Company has finalized the contract with HydroChina Corporation. The profile of HydroChina Corporation is attached herewith as ANNEXURE D.

2.4 The following supporting documents relating to the Project Company are attached herewith as follows:

DOCUMENTS	**ANNEXURE**
Shareholding Pattern	ANNEXURE E
Certified True Copy of SECP Certified Memorandum and Articles of Association	ANNEXURE F
Certified True Copy of SECP Certified Certificate of Incorporation	ANNEXURE G

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3. FACILITY UTILIZATION

3.1 ELECTRICITY DEMAND & WIND CORRIDOR

3.1.1 Pakistan is a developing economy having a constant growth in industrialization coupled with a constantly rising demand for electricity. The non-availability of natural resources for expansion of the power sector has widened the gap between demand and supply, which has resulted in excessive and frequent load shedding. The shortfall in supply could be the major cause for stunned growth in the industrial sector in Pakistan. The total installed capacity of Pakistan as on June 30, 2014 was 24,375 MW; of which 16,366 MW (67.14%) was thermal, 7,116 MW (29.19%) was hydroelectric, 787 MW (3.23%) was nuclear and 106 MW (0.43%) was wind. At present, a total of 309 MW of wind power projects are in their operations phase.

3.1.2 The demand for electricity has continued to increase by out pacing the growth rate of the economy. The shortfall at times crosses 6,000MW and this is the time when urban areas have 8-12 hours of load shedding and small cities/rural areas have 18 hours of load shedding. The industry, having its self- generation on gas, has a suspended supply of gas for 2-3 days a week during winters. As mentioned above, Pakistan's major electricity sources at present are thermal and hydro generation, meeting approximately 96% of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil, high-speed diesel and gas. While the fuels are produced domestically, demand for them already outstrips supply by a considerable amount. Oil imports are already a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves. Therefore, securing alternative fuels and the technical management should be strengthened to solve these problems and wind power can play a very important role in overcoming Pakistan's growing energy crisis.

3.1.3 The wind power program in Pakistan was initiated around ten (10) years ago by installation of wind measuring stations in the coastal areas of Sindh, Pakistan. The energy potential of 346,000 MW in the country is estimated by National Renewable Energy Laboratory, USA and only the Gharo – Keti Bander – Hyderabad wind corridor (the **Wind Corridor**) has a potential of 50,000 MW of wind power generation. If harnessed adequately, wind energy alone would eradicate energy shortages in the country. The Government of Pakistan is currently looking to build wind farms in the Wind Corridor, some of which are regions where electricity supply through the national grid has been a challenge.

3.1.4 The Government of Pakistan has clearly articulated its support for the development of renewable energies. Due to the fact that the use of wind energy is actually the most economical renewable energy production technique, the focus is on supporting the development of wind farms through wind based independent power producers (the **Wind IPPs**).

3.1.5 In light of compliance by the Project Company of all requirements under the RE Policy 2006 for eligibility of an application for a generation license and following grant of a generation license and approval of Project Company's reference generation tariff, in each case, by NEPRA, the Project Company will

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finance, design, engineer, procure, construct, install, test, complete, commission, insure, operate and maintain the Project at Site.

3.1.6 The proposed Project has the advantage of being located in the Wind Corridor and thus will, following its completion, contribute towards relieving the shortage of electric power in the country.

3.1.7 Based on a thorough analysis of the national electricity generation structure and in light of technical parameters, it is anticipated that the Project shall operate as one of the most competitive independent power producers in Pakistan.

3.2 POWER OFF-TAKE

3.2.1 Following commercial operation date of the Project, the electricity generated will be sold to the Central Power Purchasing Agency (Guarantee) Limited (the **Power Purchaser**) pursuant to an energy purchase agreement (the **EPA**), which in turn will distribute and modulate the electricity generated by the Project Company.

3.2.2 The EPA will be finalized and executed by and between the Project Company and the Power Purchaser following NEPRA's approval of the Project Company's twenty five (25) years reference generation tariff, the grant of a generation license to the Project Company and the issuance by the AEDB of the Letter of Support.

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4. THE SPONSOR

4.1 AN INTRODUCTION

Gul Ahmed Energy Limited (The Project Sponsor) is the Sponsor of the Project Company with 100% shareholding in the Project Company. The Project Company is the second wind power project being set up by the Project Sponsor, the first being a 50 MW wind power project Gul Ahmed Wind Power Limited (GAWPL). Brief profile of the Project Sponsor is given below:

Gul Ahmed Energy Limited

Gul Ahmed Energy Limited (GAEL) is a 136 MW RFO private power plant at Korangi Industrial Area of Karachi on a BOO basis. GAEL is owned by the Gul Ahmed Energy Group (56.84%), Toyota Tsusho Corporation (18.63%), Tomen Power Singapore (12.77%), Habib Bank A.G. Zurich (10.84%) and Wartsila (0.92%).

GAEL achieved COD in November 1997 and has successfully completed over 19 years of operation and has also timely paid off its entire debt on time.

Gul Ahmed Energy Group

Gul Ahmed Energy Group has been engaged in a diversified portfolio of businesses including trade, manufacturing, banking, industries, and investments since 1948 with Iqbal Alimohamed being largely involved in power and energy businesses of the group.

The Gul Ahmed Energy Group consists of about 50 individuals having a collective shareholding of 56.8% in GAEL.

The Gul Ahmed Energy Group intends to continue its growth initiatives in the power sector; it has created a special purpose company: Gul Ahmed Wind Power Limited (GAWPL) for developing a 50 MW wind generation farm in Jhimpir, which is already in the operations phase and achieved COD in 4th Quarter of 2016. In case of GAWPL, IFC and PROPARCO are the Lead Foreign Lenders while United Bank Limited is the Lead Local Lender while IFC also holds 9.9% Equity in GAWPL.

Apart from GAWPL and the Project Company, the Gul Ahmed Energy Group is also involved in the development of Gul Ahmed Solar Power Limited (50 MW Solar Project).

Toyota Tsusho Corporation (TTC) and Tomen Power Singapore (a wholly owned subsidiary of TTC):

Established in 1948, Toyota Tsusho Corporation is the sole general trading company in the Toyota Group. As part of the expansion plan in non-automotive businesses, Toyota Tsusho acquired Tomen trading company in 2006. Toyota Tsusho's business spans a wide range of fields including metals, machinery &

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electronics, automotive, food, consumer products and energy. The total assets of Toyota Tsusho Corp stood at US$39 billion, as of March 2014.

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5. RESOURCES

5.1 SENIOR MANAGEMENT & PERSONNEL

5.1.1 The Project Company has access to and has engaged the highly qualified personnel of its Sponsor, in addition to top ranking consultants, for the development of the Project. The Project Company is presently under the process of appointing various personnel and details of the same will be provided upon finalization of the terms and conditions of their appointment.

5.1.2 In addition, the curriculum vitae of the following individuals currently engaged by the Project Company are attached herewith at ANNEXURE H:

	NAME OF INDIVIDUALS	POSITION	ANNEXURE
1.	MR. IQBAL ALIMOHAMED	Chief Executive	H
2.	MR. UBAID AMANULLAH	Executive Director	H
3.	MR. MUHAMMAD AMIN BHIMANI	Chief Financial Officer	H

5.2 THE EPC CONTRACTOR

5.2.1 In addition to recruitment of its own management, staff and personnel for the purposes of the Project, the Project Company has selected HYDROCHINA CORPORATION as the EPC Contractor for the Project.

5.3 TECHNICAL ADVISORS AND OWNER'S ENGINEERS

5.3.1 The Project Company has appointed RENEWABLE RESOURCES (PRIVATE) LIMITED (PAKISTAN) as technical advisors and 'Owner's Engineers' in respect of the Project.

5.4 FINANCIAL ADVISORS

5.4.1 The Project Company has appointed BRIDGE FACTOR PRIVATE LIMITED as its financial advisor in respect of the Project. Bridge Factor has advised a number of power projects, including majority of the wind power projects in Pakistan

5.5 LEGAL ADVISOR

5.5.1 HaidermotaBNR has been selected by the Project Company to provide legal support on all legal aspects of the Project including Project documentation, regulation and financing matters.

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6. CAPITAL BUDGET

6.1 The estimated total Project cost (the **Total Project Cost**), expressed in United States Dollars, has been calculated after thorough analysis, evaluation and understanding of the dynamics that affect the development and operation of a wind farm. The Total Project Cost comes to approximately US$ 90,000,000 (United States Dollars Ninety Million).

6.2 The capital structure of the Project is proposed as follows:

	USD
DEBT	72,000,000
EQUITY	18,000,000
TOTAL PROJECT COST	90,000,000

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7. FINANCIAL PLAN

The Total Project Cost of US$ 90,000,000 (United States Dollars Ninety Million is to be financed in a debt to equity ratio of 80:20, which is in accordance with the RE Policy 2006.

7.1 DEBT

7.1.1 With regards to debt financing for the Project, the Project Company is currently undergoing discussions with a consortium of leading Foreign Development Finance Institutions (DFIs) and local banks led by International Finance Corporation (the **Mandated Lead Arrangers**). The Mandated Lead Arrangers have provided soft commitments for an amount of up to USD 72,000,000 for the Project at competitive terms - a matter that signifies the confidence and keen interest of the lenders in the Project. A copy of the Mandate Letters by the International Finance Corporation, Asian Development Bank and the local banks are attached hereto as ANNEXURE I for NEPRA's perusal.

7.2 EQUITY

7.2.1 Based on the Debt to Equity ratio of 80:20, the equity required to be injected by the Sponsors (the **Equity**), amounts to USD 18,000,000. The Sponsor has already committed the equity in respect of the Project and such arrangements have been agreed with the Mandated Lead Arrangers.

7.2.2 The financial strength and net worth of Gul Ahmed Energy Limited (being the primary sponsor of the Project Company) is illustrated by the Financial Statements attached as ANNEXURE J. The Cash Balance certificate of the Project Company is also included in ANNEXURE J.

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8. THE PROJECT & THE FACILITY

8.1 PROJECT BACKGROUND

8.1.1 Since the issuance of the LOI, the Project Company conducted various studies to assess the feasibility of the Project. These studies *inter alia* included the wind resource assessment, geo technical investigation, digital topographic map, initial environmental examination and grid interconnection study. The complete feasibility study was submitted by the Project Company to EDGOS.

8.1.2 In order to select EPC and O&M contractors for the Project, the Project Company carried out a bidding process by circulating RFPs to the EPC contractors for awarding the turnkey EPC contracts for the development of the Project and following submitted the bids:

- Descon Engineering Limited;
- Nordex Germany;
- Huadong Engineering Corporation Limited;
- Vestas Asia Pacific Wind Technology Pte Ltd;
- General Electric
- China Shipbuilding Industry Corporation
- HydroChina Corporation

8.1.3 After an extensive technical, financial and commercial evaluation process, the Project Company selected "**HydroChina Corporation**" as Engineering, Procurement & Construction (EPC) Contractor with **Goldwind GW 121-2.5** Wind Turbines.

8.2 PROJECT COMMENCEMENT AND COMPLETION SCHEDULE

Activities	Project Company
Submission of proposal, review and approval EDGOS	✓
Issuance of LOI	✓
Allocation of Land (Received Land Coordinates)	✓
Installation of Wind Masts	✓
All Technical Wind Related Studies	✓
Request for Proposal (RFP) to be sent to EPC contractors	✓
Selection of EPC & O&M Contractor	✓
Grid Interconnection Study by NTDC	✓
Mandate Letter by the Lead Arranger	July 2017
Indicative Term Sheet with Lead Advisor & Arranger	June 2017
Land Lease Execution	April 2017
Submission of Tariff Petition to NEPRA (Upfront Tariff)	July 2017
Signing of EPC & O&M Contract	June 2017

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Submission of Performance Guarantee & Issuance of LOS	December 2017
Execution of Concession Documents	October 2017
Execution of Financing Documents	November 2017
Achievement of Financial Close	July 2018
Achievement of Commercial Operations Date	December 2019

8.3 PROJECT SITE

8.3.1 The site proposed for the implementation of the Project has been selected by considering:

- Location in the wind corridor;
- Wind conditions at the Site;
- Topographic conditions;
- Site accessibility; and
- Location of the grid with reference to the Site for interconnection. The Site is located within the wind corridor identified by EDGOS.

8.3.2 The Site is located in Jhimpir, District Thatta, Sindh, which is one of the most promising areas where wind power projects can be viably installed. The Project's wind farm site is located 145 km from Port Qasim Karachi in the East direction with easy road access. Nooriabad Industrial Estate (situated on the M9 motorway connecting Karachi and Hyderabad) is 09 Km from the Wind Farm.

8.3.3 Land Description of the Project Site:

Total Land Area: 370 Acres

	Geodetic Coordinates	
Point No.	**Latitude (N)**	**Longitude (E)**
Boundary 1	25° 2.603'N	67° 40.730'E
Boundary 2	25° 2.662'N	67° 40.794'E
Boundary 3	24° 58.912'N	67° 44.876'E
Boundary 4	24° 58.852'N	67° 44.818'E

8.3.4 The Project site is exposed to very strong south westerly winds; wind data analysis of the area suggests that, 80% wind blows from the south west direction. The terrain of the area is flat with small change in altitude. The proposed site lies under roughness class 1.5 as there is low vegetation. The site is easily accessible through metallic roads. The ground is hard and rocky; the subsurface soil also includes clay and silt.

8.3.5 The proposed wind farms lies on a flat inland area with hard and rocky ground conditions. The site would be categorized as inland wind development as opposed to offshore/coastal wind project development (which is more difficult to develop due to tides and soft subsoil clay). The general terrain at the site can be described as simple and flat terrain. Internal access roads are the roads

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connecting the single wind turbine locations with each other and the external access roads and grid station would be constructed during the civil works of the wind farm.

8.3.6 The proposed site area lies in an arid zone with very little annual precipitation. The result is that there is hardly any natural vegetation in the area. Some hard tree species are visible scattered far and wide in the area. The area is rocky with some rock outcrops towards the Super Highway. There are small rock outcrops and hillocks left over by the wind and flash flood erosions in the middle of the project land. The terrain at the site and surrounding area is generally flat with elevations varying between 127m to 177m.

8.3.7 The proposed site is located about 145 km from Port Qasim Karachi. Karachi borders on the Arabian Sea and the weather belongs to tropical monsoon climate. Rainfall is scarce with about 200 mm for a whole year and most of this is concentrated in July and August. The temperature in winter from November to February is temperate, but it is hot with high temperature in summer from April to August as the highest temperature has reached 44.02 Celcius.

8.4 INFORMATION REGARDING INFRASTRUCTURE, ROADS, RAIL, STAFF COLONY, AMENITIES ETC.

8.4.1 The Project Company is located in Jhimpir Sindh within the same wind corridor as many other wind power projects. The Bin Qasim Port, which is the point of delivery of equipment for the Project, is located towards the Southwest of the Project.

8.4.2 In order to make transportation to the Site, a detailed Transportation and Site Access Study has been carried out by the technical consultants (refer to Annex 2 of Annexure A (Feasibility Study).

8.4.3 As per the study, access to Project Site has been planned from Port Qasim using National Highway and Super Highway, whereby two different routes leading to the Site have been studied with respect to the track quality, elevations, waterways, nearby surroundings, and overall suitability. Both routes are viable options and will serve as backup for each other during the construction period.

8.4.4 The study has elaborated few critical points that need to be addressed during the construction of the roads at the Site in order to make a suitable connection of the Site with the recommended routes and allow movement of heavy vehicles, hardware and execution of civil works.

8.4.5 Under the turnkey EPC Contract, the EPC Contractor shall be responsible for the construction of roads at the Project Site and also for the access road. The EPC Contractor is also responsible for setting up clean, safe and secure staff colony within the Project Site, which will be used by the EPC and O&M

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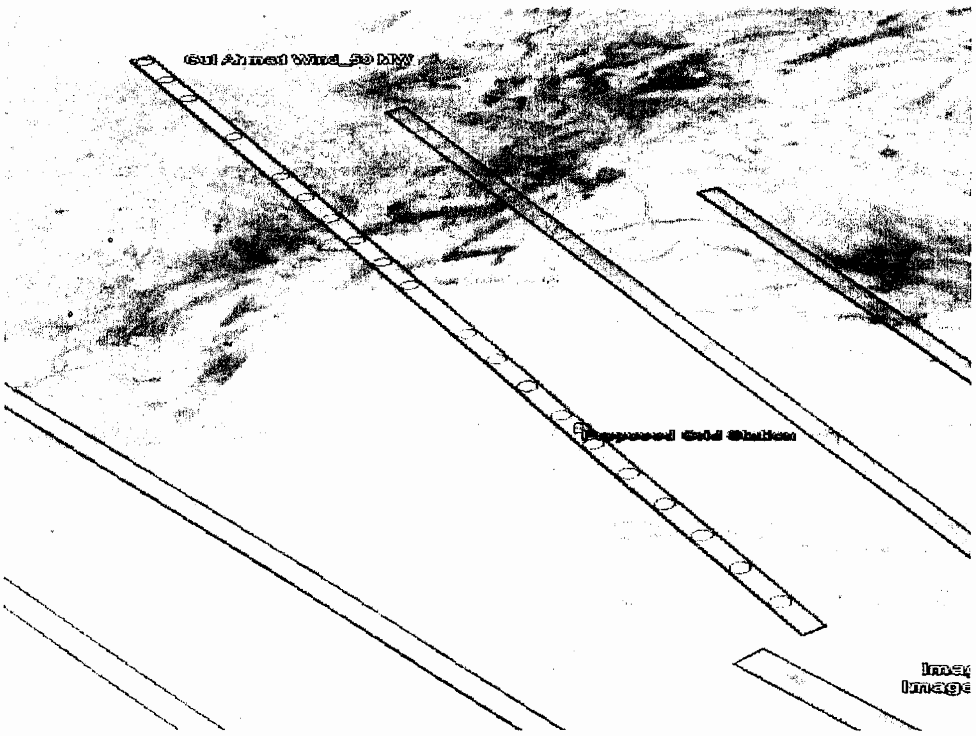
Contractor's team during the construction and operation period of the Project. The Project team's staff will also be resident here.

8.4.6 Furthermore, the procurement of utilities for the staff colony and construction activities will be the responsibility of the Contractor under the EPC and O&M Contracts to be signed by the Project Company. During construction, electricity will be provided by generators and water will be transported via bowsers. Septic tanks will be constructed for all waste disposal. Disposal of waste shall be the responsibility of the EPC Contractor.

8.4.7 With regards to the telecommunication, the wire based land line network is currently available in nearby towns that can be requested for the Project Site (if required), whereas all major mobile operators already have coverage on the Site area. The Project Site will have a microwave antenna for dedicated high speed data and voice communications.

8.5 WIND FARMS LAYOUT AT PROJECT SITE

8.5.1 The wind farms site is in long and narrow in shape, the topography is relatively flat and the elevation above sea level is approximately 127-177m. There is little vegetation at the wind farm site. Wind Turbines will have a 90m hub height. See figure below for the sketch map for the WTG towers location setting parameters for the project. The tentative micrositing is given in figure below.



8.6 TOPOGRAPHICAL AND GEOLOGICAL CONDITIONS AT PROJECT SITE

8.6.1 Topographical conditions:

The Site is on a plain area at an elevation of 127-177m, which is generally flat, but a bit higher on the west and lower on the east. The landform at wind farm sites is mainly of pediment and the vegetation there is less developed.

8.6.2 Geological conditions:

The planned wind farm sites are covered mainly by marine alluvium of Holocene and recent weathered deposit, and underlain mainly by Tertiary limestone. The bedrock in the site is generally outcropped. As the WTG is a high-rise structure, it has a high gravity center and should sustain high loads, large horizontal wind force and overturning moments. WTGs are designed to withstand these forces.

8.6.3 Hydrology:

According to the regional hydrological data available, the Project site is in a dry area, where the water table is deeply underground, and the surface water and water in the shallow surface layers is weakly to slightly corrosive to the concrete and is corrosive to the rebars in the concrete which has been immerged in water for a long-time or alternatively in wet and dry conditions. Corrosion prevention measures will be adopted in the design and implementation of the wind farm.

8.7 SITE ACCESSIBILITY

8.7.1 The major track from Karachi to Nooriabad is via the Karachi-Hyderabad Motorway, and another access to the Project site is through Jhimpir. When travelling via the Karachi-Hyderabad Motorway, the access from Nooriabad to the site is a single track, which turns toward the site.

However, the terrain is flat and long and heavy vehicles can easily navigate through this road. There are number of neighboring wind farms in the surrounding area of Jhimpir. There is no requirement to establish roads or tracks for movement of traffic. The total distance from Karachi to the site is approximately 130 km. The detailed route is given in figure below.

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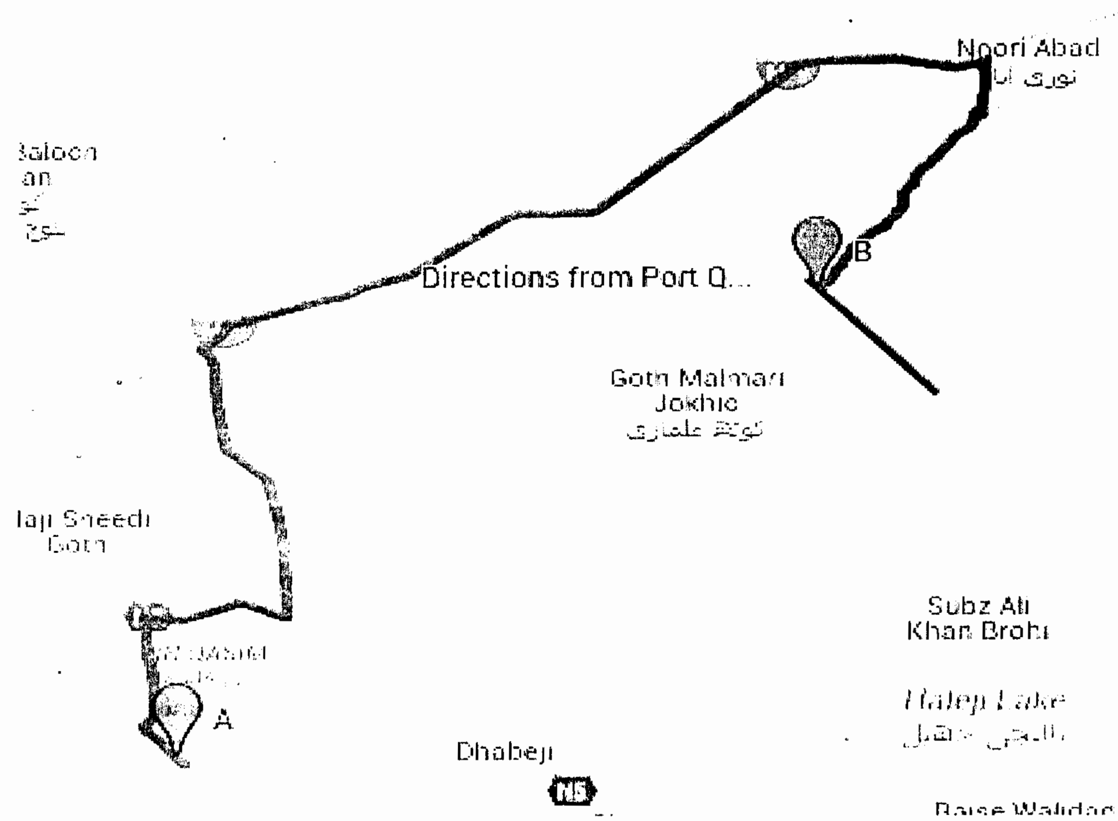

8.8 TELECOMMUNICATION AT PROJECT SITE

8.8.1 Close to the site, there is wire based telecommunication available in Jhimpir. Cellular phone suppliers, Warid Telecom Ltd, and Pakistan Telecommunication Mobile Ltd (Ufone) are offering services at the site. GPRS services are also available in the region.

8.8.2 For the SCADA system of the wind farm, a wire based telecommunication infrastructure has to be installed. Land line network will be arranged from Jhimpir once civil work starts at the site.

8.9 AVAILABILITY OF SEMI-SKILLED AND SKILLED LABOR

8.9.1 There is a dearth of wind project specific skilled labor in the area, however unskilled and semi-skilled labor is available in the area and the Project will be a source of employment for these individuals.

8.10 TRAINING AND DEVELOPMENT OF STAFF

8.10.1 The Operations & Management (O&M) of the Project shall be managed by the EPC Contractor for initial 2 years post-COD as Warranty Period O&M under the EPC Contract. The O&M for years 3 – 8 shall be carried out by the same contractor under the O&M Contract. Throughout the O&M period, the

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Contractor shall be responsible for On Job Training (OJT) of the local team, which shall remain part of the O&M and gradually take over after completion of O&M tenure.

8.10.2 The EPC and O&M Contracts shall mention in detail the training requirements for the operation of the wind farm and the Project Company's personnel. As per the Contracts, the Contractors shall be required to provide details of how training will be carried out, including the number of days of training outside Pakistan, and the number of people who will be trained under their offer. The Contractor will ensure that the personnel working on the wind farm during the construction and the operation period are correctly trained and qualified for the roles that they are performing and that a record of their training is maintained.

8.10.3 The Contractors shall be required to provide special emphasis to the Health & Safety (H&S) aspects of the Project construction and operations, for which specific training will be provided by the Contractors to all of the operations and maintenance personnel, including the regulatory requirements for the use of any special safety equipment required for the undertaking of such functions. Such training will be in addition to any other training provided and will continue, for each individual, until each said individual can be certified by the Contractors as having attended the full H&S training, thus gaining sufficient appreciation of the H&S requirements to operate the Project.

8.10.4 Although the content of training modules will be finalized between the Contractors and the Project Company prior to COD, some specific training needs that will be covered include the following:

a) Procedures for operation and maintenance of the wind farm and its associated equipment.
b) Awareness and application of safe systems of work and responsibilities of all staff involved in operations and maintenance duties.
c) Fire control and prevention (including equipment maintenance and management and 'emergency plan').
d) First-aid provision (including 'emergency plan').
e) Working at heights (including 'emergency plan').
f) Working on, at or near rotating plant.
g) Working on, at or near high and low voltage AC and DC apparatus (HV & LV) and the differences between live, not live and dead circuits.
h) Working on, at or near energized systems (such as pressure vessels, accumulators, springs, gearing, torque arms, unearthed electrical systems and dampers).
i) Working on, at or near hazardous substances (oils, chemicals, insulators and gases).
j) Confined space works and requirements therein.

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8.10.5 The Contractors shall provide or procure the provision of these training needs for all O&M personnel in order that the O&M services may be performed in accordance with the Project Agreements and Prudent Industry Practices.

8.11 PROJECT SITE SECURITY

8.11.1 The Project Company has plans to use the infrastructure at Jhimpir in the most efficient manner to provide seamless security at offices, accommodation and site.

8.12 SAFETY PLANS & EMERGENCY PLANS

8.12.1 The Project has carried out a comprehensive environmental study to assess the impact of the Project on the environment. The Study titled "Initial Environment Examination" (IEE) has already been approved by Sindh Environmental Protection Agency (SEPA) on 08 April 2016. As per the study, the Project has no significant hazardous impact on the environment. However, the study has addressed minor adjustments that shall be required during the construction phase in order to ensure the safety of the environment and Project personnel. The study also details an environment management plan, which will be enforced by the project team and the EPC contractor. The recommendations of the IEE have further been enforced upon by SEPA in its approval of the IEE. As per the EPC Contract to be signed by the Project Company, the EPC Contractor will be responsible for adhering to the recommendations of the IEE during the construction phase in order to comply with the SEPA approval. A copy of the IEE has shall be provided to the EPC Contractor as part of the EPC Contract.

8.12.2 In addition, the EPC Contractor shall be required under the EPC Contract to comply with all applicable safety regulations according to the laws of Pakistan and take care for safety of all personnel entitled to be on the Site. The EPC Contractor shall use reasonable efforts to keep the Site clear of unnecessary obstruction. Furthermore, the EPC Contractor shall be responsible for provision of, lighting, guarding and watching of the facility during construction of the Project. The EPC Contract shall also require the EPC Contractor to provide temporary roadways, footways, guards and fences during construction for the use and protection of the public and of owners and occupiers of adjacent land

8.12.3 Similarly the O&M Contractor shall be required under the O&M Contract to provide security in accordance with prudent industry practices. The O&M Contractor shall comply with reasonable health and safety requirements established from time to time by the legal and regulatory authorities. The O&M Contract shall also require the O&M Contractor to take all reasonable precautions to protect the Complex, Project Company and O&M Contractor's Personnel, sub- contractors, public and the environment

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8.12.4 With regards to the health and safety of the personnel during the construction and operation of the Project, the guideline of "safety first, (accident) prevention foremost" will be practiced. Comprehensive management and supervision will be applied to all staff members and the whole operation process, in order to ensure safe operation of the equipment and personal safety of workers.

8.12.5 A safety and health supervision department will be established on the wind farm, which is to be in charge of the education, training and management of safety and health related issues after the project is put into operation. There will be safety personnel in the production section, and a part- time worker for the routine safety and health work

8.12.6 The systems of patrol inspection, operation guardianship, maintenance and over-haul will be established for the daily maintenance of production equipment, instruments and apparatus. The safety and health supervision department will provide sound meter and other appropriate inspection equipment, as well as necessary public education service for production safety.

8.12.7 A comprehensive safety system will be established during the preparation phase, and carefully implemented during the construction and operation process. The systems of work sheet, operation sheet, shift relief, patrol inspection, operation guardianship, maintenance and over- haul will be strictly implemented. The Safety Regulation of the wind farm will also be seriously observed to preclude accidents such as fall, fire, or electric shock.

8.13 GRID CONNECTIVITY

8.13.1 The Project would be connected by a double circuit of 132kV looping in-out with a sub cluster also connecting nearby WPPs to Jhimpir-2 132/220 kV Grid.

8.14 ANNUAL ENERGY PRODUCTION

8.14.1 The Annual Energy Production of 153.3 GWh. The tables below show key details relating to power generation from the Project.

Installed Gross ISO Capacity of Project	50 MW
Annual Energy Generation	153.3 GWh
Capacity Factor	35.0 %

8.15 WTG TECHNOLOGY & EPC BIDDING PROCESS

8.15.1 The Project Company, in order to get the right companies involved in the procurement and construction of the project conducted a bidding process. The Consultants of the Project Company developed prequalification criteria for this purpose, which included the following:

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- Machines should be available in hot climate version.
- Should not be in litigation over completion liability issues in the region.
- Should have been viable financial entity for at least last three years.
- Should have successfully completed works of similar sizes in last three years.
- Suitable population of the proposed machine installed and working..

8.15.2 Based on the pre-qualification attributes set aside by the Project Company's Technical Management and its follow up with the EPC vendors, the RFPs were sent out to vendors fulfilling the criteria.

8.15.3 The Project Company received interest from various international WTG suppliers and EPC contractors. After considerable effort and receipt of proposals from many suppliers, the Project Company took this input as a starting point and started negotiations with the vendors for EPC proposals.

8.15.4 Based on its thorough due diligence and following an intense negotiations process with the various suppliers and contractors, the Project Company has shortlisted "**HydroChina Corporation**" and "**Goldwind WTG GW 121-2.5**"as the technology for its Project with a fixed price and fixed Commercial Operations Date.

8.16 GOLDWIND– THE WTG MANUFACTURER

8.16.1 Goldwind is an international, multi-faceted wind power company based in Beijing, China and has now expanded across six continents, preserving blue skies and white clouds for producing clean energy for future generations around the globe

8.16.2 With strong international research and development capabilities and an extensive experience of more than 27 years in wind farm development, Goldwind has become a global leader in manufacturing wind turbine generators (WTGs) and providing comprehensive wind power solutions. Goldwind's current product portfolio includes turbines with rated capacities of 1.5 MW to 2.5 MW. Additionally, Goldwind offers support services that cover everything from development assistance to operations and maintenance

8.16.3 Goldwind is the largest WTG manufacturer with more than 31 Gigawatts of installed capacity and more than 22, 000 installed WTG units worldwide. The 2.5 MW platform selected for the project has more than 1698 installed units in the world.

8.16.4 Today, Goldwind continues to lead the global wind industry with mature manufacturing capabilities and innovative product lines.

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8.16.5 The specifications of 2.5 MW GW 121-2.5 turbine are as follows:

(i).	Wind Turbine Type, Make & Model	GW 121-2.5
(ii).	Installed Capacity of Wind Farm (MW)	50 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	20 x 2.5 MW
(iv).	Number of blades	3
(v).	Rotor diameter	121 m
(vi).	Hub Height	90 m
(vii).	Generator Voltage	690 V
(viii).	Cut-in wind speed	3 m/s
(ix).	Cut-out wind speed	22 m/s
(x).	Extreme wind speed	52.5 m/s

8.16.6 The energy data of the wind farm is given below.

-1	Total Installed/Gross ISO Capacity (MW)	50 MW
-2	Total Annual Full Load Hours	3066
-3	Average Wind Turbine Generator(WTG) Availability	97%
-4	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	173.74
-5	Array & Miscellaneous Losses (GWh)	12.58
-6	Availability Losses (GWh)	4.72
-7	Balance of Plant Losses (GWh)	3.14
-8	Annual Energy Generation (20 year equivalent Net AEP) GWh	153.3
-9	Net Capacity Factor	35.00%

8.17 EPC CONTRACTOR

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8.17.1 The details of the EPC Contractor selected for the Project are attached as ANNEXURE D.

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CONCLUSION

In light of the submissions, the relevant financial analysis and information contained in this Generation License Application, along with the Annexures attached hereto, this Generation License Application is submitted for NEPRA's kind consideration and grant of the Generation License to the Project Company.

Respectfully submitted for and on behalf of:
GUL AHMED ELECTRIC LIMITED

Gul Ahmed Electric Ltd. Karachi

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MR. UBAID AMANULLAH
AUTHORIZED REPRESENTATIVE OF
GUL AHMED ELECTRIC LIMITED

SCHEDULE-I

The Location, Size (i.e. Capacity in MW), Type of Technology, Interconnection Arrangements, Technical Limits, Technical/Functional Specifications and other details specific to the Generation Facilities of the Licensee are described in this Schedule.

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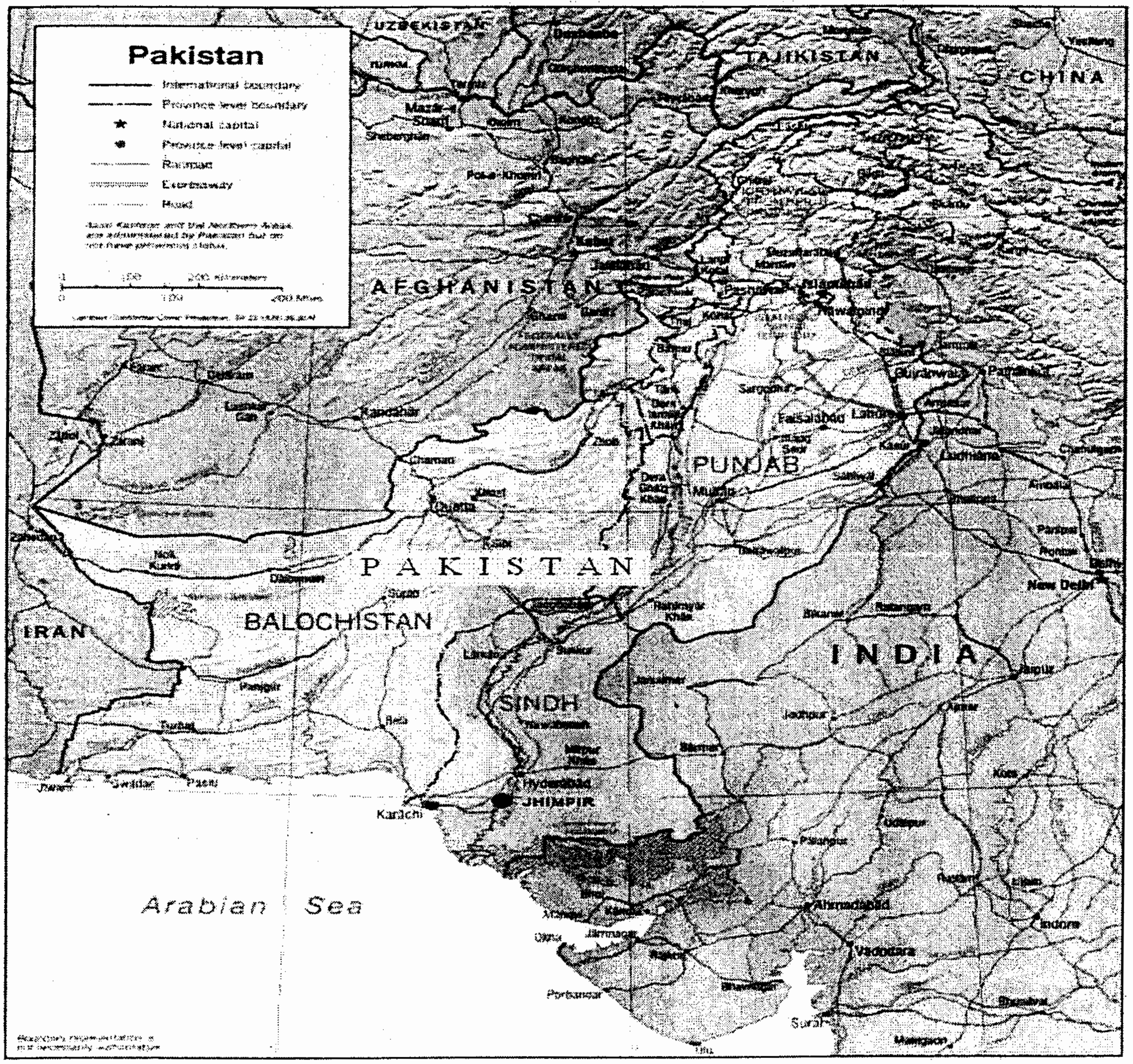
Actual drawings pertaining to Wind Farm Location Map, Wind Farm Lay Out, Wind Farm Micro-Sitting, Single Line Diagram (Electrical System of the Wind Farm).

Location of Generation Facility/ Wind Farm

The Project site is located near the Village Jhimpir, District Thatta, Karachi; a city of the southern province Sindh. The aerial distance between the Project site and Karachi is about 90 km and the road distance of site from Port Qasim is 145 km. The distance between Project site and the coastal line of Arabian Sea is approximately 80 km. The size of the whole wind farm is 370 acres. The north latitude of the site is 25° 0.871'N and the east longitude is 67° 42.682'E. The altitude of the site is 127m~174m above sea level. The geographical location of the project is shown in figure below.



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The Project Site has flat terrain with sparse vegetation, consisting of small shrubby bushes. The map is given in Figure below:

Project Size

The Project shall have an installed capacity of approx. 50 MW rated power. The number of WTGs are 20 with capacity of 2.5 MW each.

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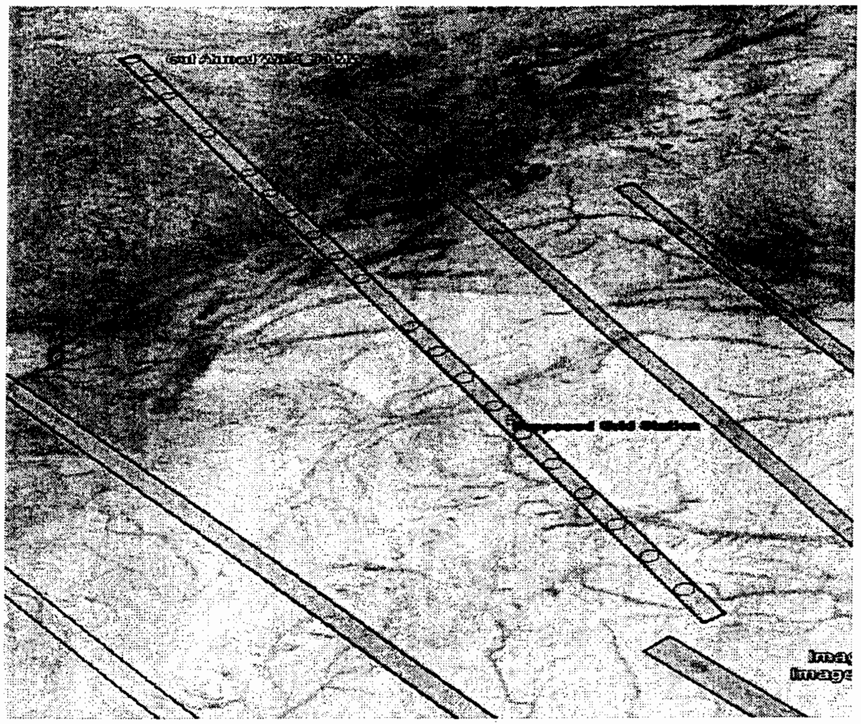
Layout of Generation Facility/ Wind Farm

The general layout along with neighboring Wind Farms of 50 MW GEL is shown in figure below.



Land Coordinates of Generation Facility/Wind Farm

Location: Jhimpir – Sindh, Pakistan

The Site coordinates are given in Table below.

Total Land Area: 370 Acres		
	Geodetic Coordinates	
Point No.	Latitude (N)	Longitude (E)
Boundary 1	25° 2.603'N	67° 40.730'E
Boundary 2	25° 2.662'N	67° 40.794'E
Boundary 3	24° 58.912'N	67° 44.876'E
Boundary 4	24° 58.852'N	67° 44.818'E

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Electrical System Single Line Diagram of Generation Facility/Wind Farm

The project will install 20 WTGs (Goldwind G121-2.5). There shall be four (04) WTG collector group.

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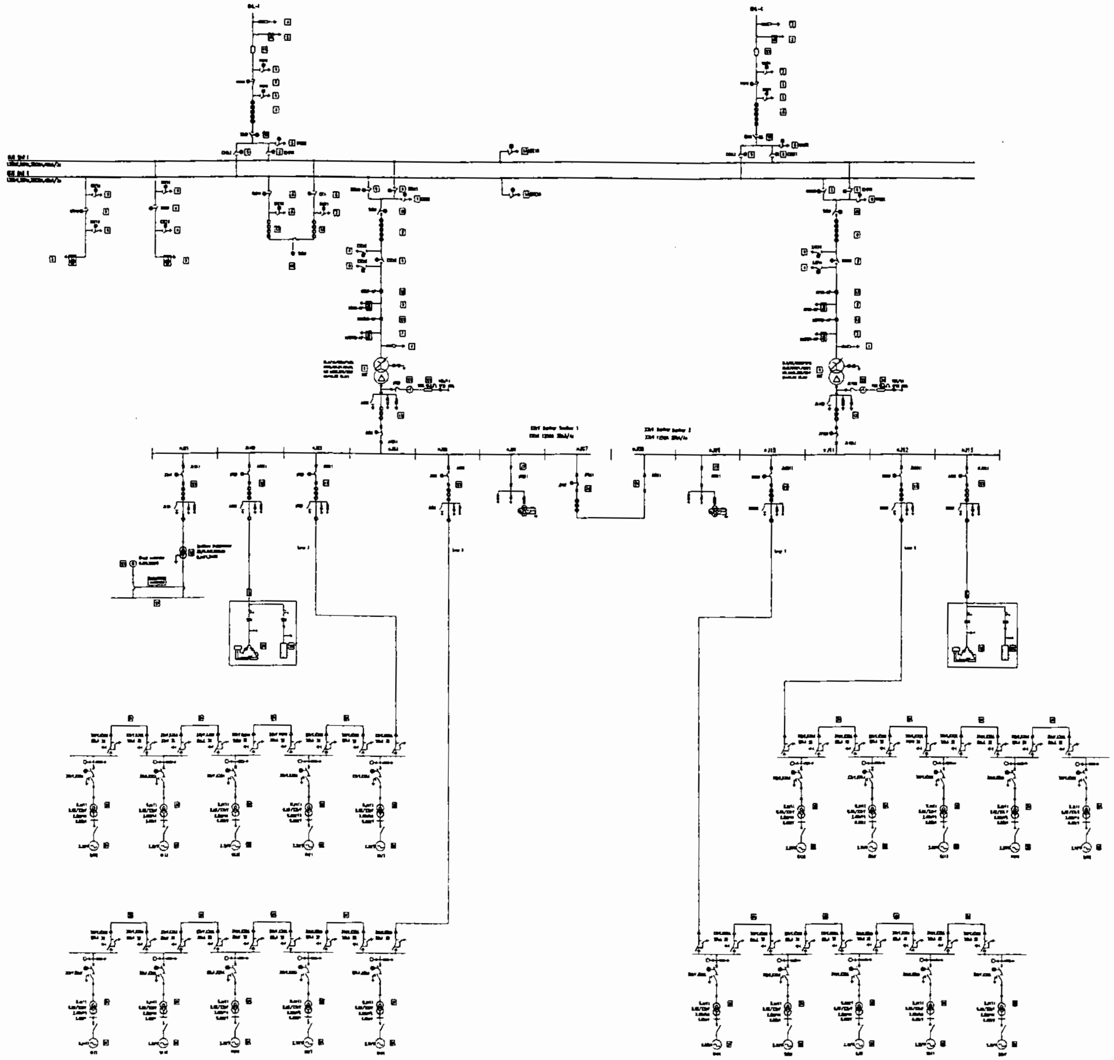

主要电气设备表
List of Main Electrical Equipment

序号 S/N	名称 Description	型号规格 Model & Specification
	132kV 设备 132kV Equipment	
1	主变 Main Transformer	31.5/40/50MVA ONAN/ONAF1/ONAF2 * Main transformer can be operating at 53MVA for 8 hours 132±8X1.25%/33kV Uk=10.5% YNd11 Neutral Point Current Transformer: 400/200/1A 5P20,30VA
2	132kV电容式电压互感器 132kV Capacitor Voltage Transformer	$\frac{132}{\sqrt{3}}/\frac{0.11}{\sqrt{3}}/\frac{0.11}{\sqrt{3}}$ kV 0.2/3P 75/200
3	132kV电压互感器 132kV Voltage Transformer	$\frac{132}{\sqrt{3}}/\frac{0.11}{\sqrt{3}}/\frac{0.11}{\sqrt{3}}$/0.11kV 0.2/3P/3P 15/100/50VA
4	132kV氧化锌避雷器 132kV Surge Arrester	120kV 293kV 10kA
5	145kV隔离开关 145kV Disconnector	145kV 2000A 40kA/3s
6	145kV接地开关 145kV Earthing Switch	145kV 2000A
7	132kV电压互感器 132kV Voltage Transformer	$\frac{132}{\sqrt{3}}/\frac{0.11}{\sqrt{3}}$ kV 0.2 50VA
8	132kV 电流互感器 132kV Current Transformer	132kV 1600:800:400/1A 0.2FS5/0.2FS5 15/15VA 1600:800:400/1A 5P20/5P20/5P20 30/30/30VA
9	132kV 电流互感器 132kV Current Transformer	132kV 800:300/1A 0.2FS5/0.2FS5 15/15VA 800:300/1A 5P20/5P20/5P20 30/30/30VA
10	145kV 断路器 145kV Circuit Breaker	145kV 4000A 40kA/4s
11	阻波器 Line Trap	145kV 2000A 40kA/3s
12	132kV 电流互感器 132kV Current Transformer	132kV 400:200/1A 0.2FS5 15VA
13	132kV 电流互感器 132kV Current Transformer	132kV 1600:800:400/1A 0.2FS5/5P20/5P20/5P20 15/30/30/30VA
14	145kV接地开关 145kV Earthing Switch	145kV 2000A
	33kV 设备 33kV Equipment	
15	40.5kV [illegible] 40.5kV VCB	1250A 25kA/4s 1600:800:400/1A 0.2S/5P20/5P20 15VA/30VA/30VA
16	40.5kV [illegible] 40.5kV VCB	1250A 25kA/4s 1600:800:400/1A 0.2S/5P20/5P20 15VA/30VA/30VA
17	40.5kV [illegible] 40.5kV PT	[illegible]
18	40.5kV [illegible] 40.5kV VCB	1250A 25kA/4s 50/1A 0.2S/5P20/5P20 15VA/30VA/30VA
19	40.5kV [illegible] 40.5kV VCB	1250A 25kA/4s 400:200/1A 0.2S/5P20/5P20 15VA/30VA/30VA
20	40.5kV [illegible] 40.5kV SF6 CB	1250A 25kA/4s 400:200/1A 0.2S/5P20/5P20 15VA/30VA/30VA
21	40.5kV [illegible] 40.5kV VCB	1250A
22	33kV [illegible] 33kV Auxiliary Transformer	250kVA 33±2X2.5%/0.4kV D yn11
23	33kV [illegible] 33kV Earthing Transformer	400kVA 33kV ZN [illegible] 40.5kV 350A 25kA 4s
24	33kV [illegible] 33kV Earthing Resistance	200A 95.3Ω 33kV 10s
25	33kV [illegible] 33kV Capacitor Unit of Reactive Compensation System	10Mvar 33kV
26	33kV [illegible] 33kV Impedance-controlled Reactor of Reactive Compensation Device	10Mvar 33kV
	0.4kV 设备 0.4kV Equipment	
27	0.4kV [illegible] 0.4kV LV power distribution Cabinet	0.4kV
28	0.4kV [illegible] 0.4kV Diesel generator	0.4kV 200kW
	[illegible] Wind farm equipments outside the substation	
29	风机机组 WTGs	2.5MW 690V
30	风机箱式变电站 WTG Transformer	RMU-33kV 33kV 630A 20kA 3S Transformer-33kV 33kV 2750kVA 33±2X2.5%/0.69kV Uk=8.5% D yn11 Circuit Breaker 690V 2500A
31	[illegible] 33kV Cable	XLPE-33kV

华东勘测设计研究院有限公司
HUADONG ENGINEERING CORPORATION LIMITED

工程设计资质证书编号:综合甲级 A133000751
DESIGN CERTIFICATE: Integrated Class-A NO.A133000751

发证单位:住房和城乡建设部
CERTIFICATED BY: MOHURD

核准 APPROVED		Gul Ahmed Wind Farm 工程 PROJECT	Bid 设计 DESIGN	Primary Circuit 部分 SECTION
核定 VERIFIED			
审查 EXAMINED			
校核 CHECKED		Single Line Diagram	
设计制图 DESIGNED & DRAWN			
日期 DATE		比例 SCALE	图号 DRAWING NO.

0 20 40 60 80 100mm

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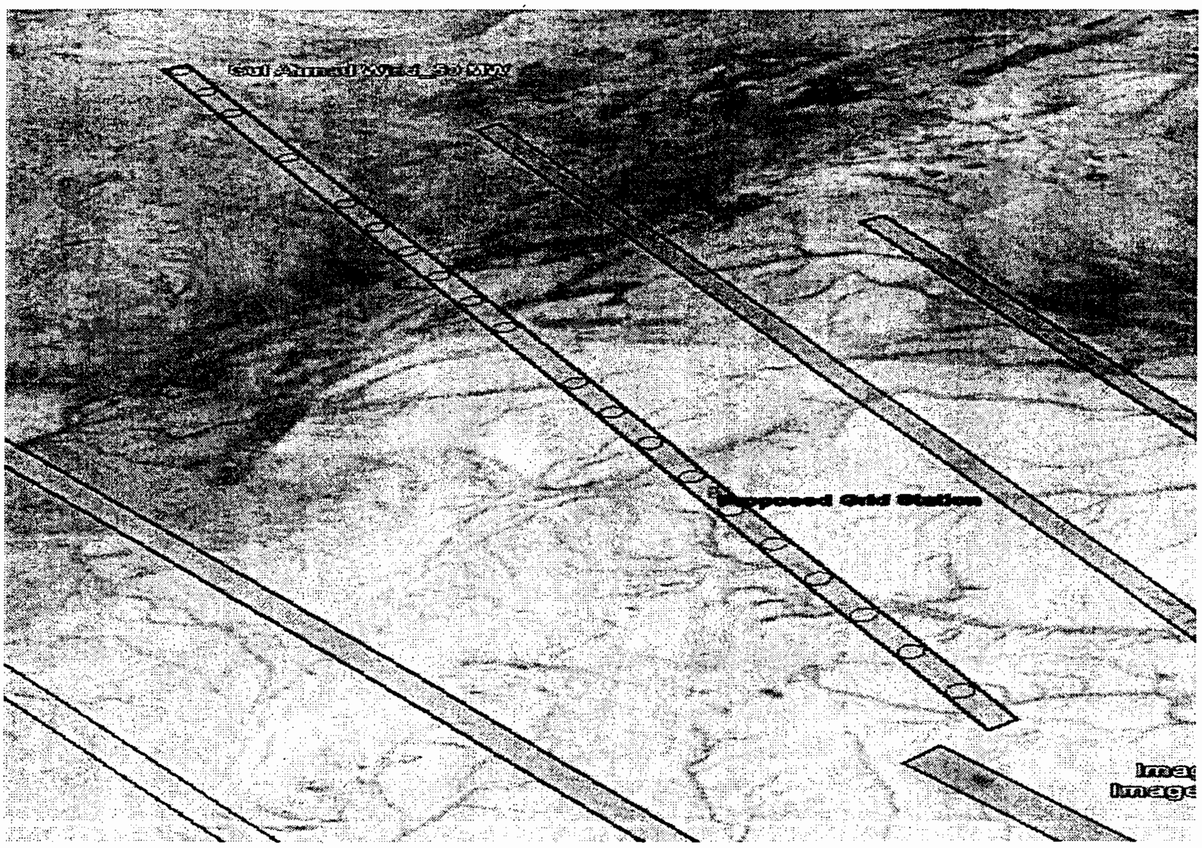
Micro-Sitting of Generation Facility/Wind Farm

The micrositing of Wind Farm with 20 WTGs is given in figure below.



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The coordinates are WTGs are given in table below.

Coordinates (UTM z42 WGS84)		
Turbine No.	Easting [m]	Northing [m]
GEL_GW01	366830	2770402
GEL_GW02	367125	2770098
GEL_GW03	367421	2769794
GEL_GW04	368012	2769187
GEL_GW05	368604	2768579
GEL_GW06	368900	2768275
GEL_GW07	369195	2767971
GEL_GW08	369491	2767667
GEL_GW09	369787	2767363
GEL_GW10	370082	2767060
GEL_GW11	370674	2766452
GEL_GW12	370969	2766148
GEL_GW13	371265	2765844
GEL_GW14	371561	2765540
GEL_GW15	371857	2765236
GEL_GW16	372152	2764933
GEL_GW17	372448	2764629
GEL_GW18	372744	2764325
GEL_GW19	373039	2764021
GEL_GW20	373335	2763717

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Interconnection Arrangement for Dispersal of Power from the Generation Facility/Wind Power Plant of GEL

The power generated from the Generation Facility/Wind Power Plant/Wind Farm of GEL shall be dispersed to the National Grid through the load center of HESCO.

(2). The proposed Interconnection Arrangement /Transmission Facilities for dispersal of power will consist of the following:-

i) A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.

ii) 220 kV double circuit (D/C) transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro- KDA-33 D/C transmission line at Jhimpir-2.

iii) 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir New (Jhimpir-1)- Gharo New D/C transmission line at Jhimpir-2.

iv) 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Gul Ahmad Electric WPP with Jhimpir-2. In this scheme, the interconnection of Gul Ahmed WPP includes 132 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out from Gul Ahmad Electric WPP on the 132kV single circuit from Cacho WPP to Jhimpir-2.

Any change in the above mentioned Interconnection Arrangement /Transmission Facilities duly agreed by GEL, NTDC and HESCO shall be communicated to the Authority in due course of time.

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Schematic Diagram for Interconnection Arrangement/Transmission Facilities for Dispersal of Power from GEL

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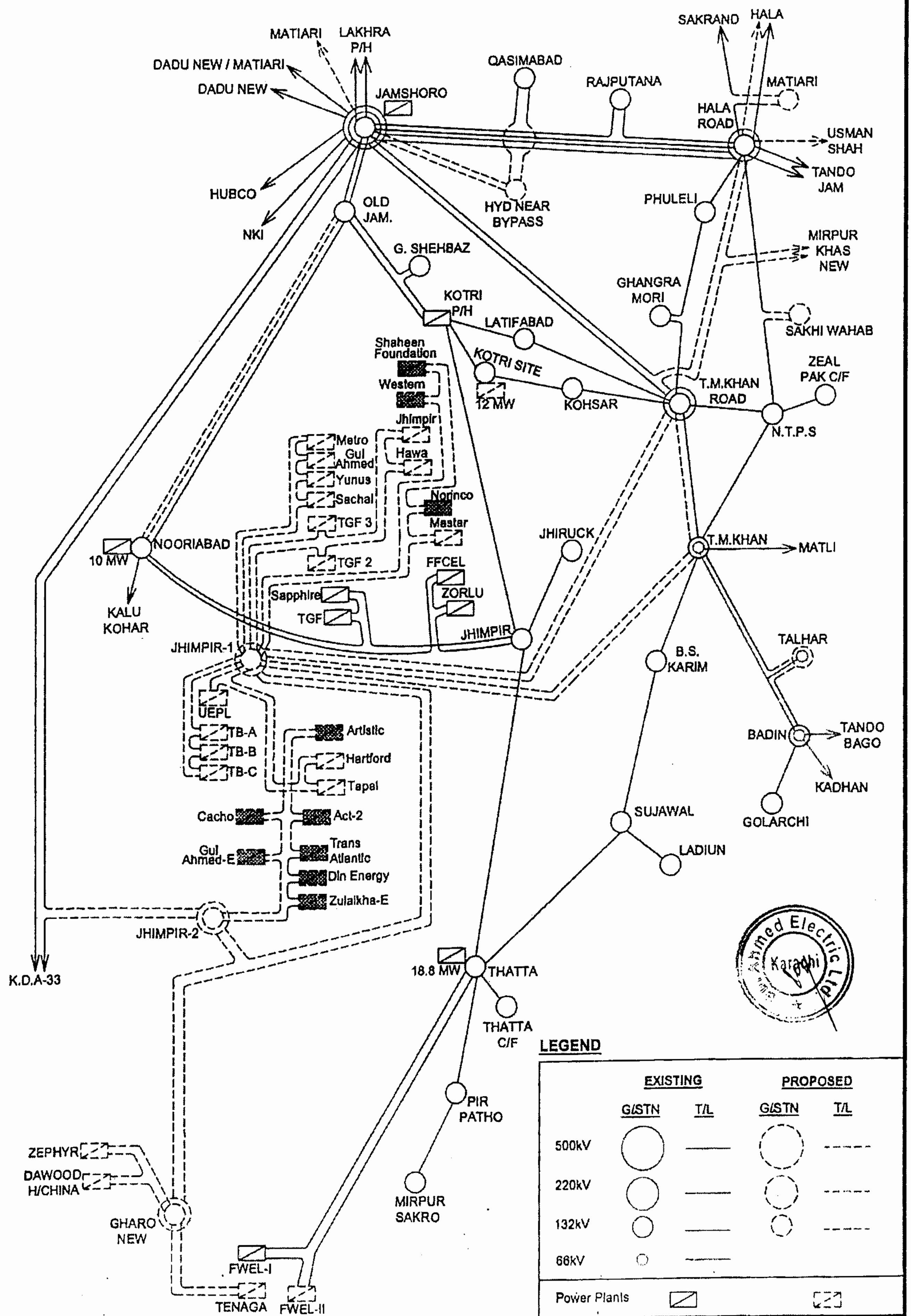
Figure #1: Proposed Interconnection Scheme For Power Evacuation of Gul Ahmed-E Wind Power Project



Detail of Generation Facility/Power Plant/ Wind Farm

(A). General Information

(i).	Name of Applicant/Company	Gul Ahmed Electric limited (GEL)
(ii)	Registered Office	36-F, Block 6, P.E.C.H.S, Karachi - 75400
(iii).	Business Office	Address: 7th floor, Al-Tijarah Centre, 32-1-A, Block 6, P.E.C.H.S., Main Shara-e-Faisal, Karachi. Ph: 92 21 34540270-73
(iv).	Plant Location	Jhimpir, District Thatta, Sindh
(v).	Type of Generation Facility	Wind Power

(B). Wind Farm Capacity & Configuration

(i).	Wind Turbine Type, Make & Model	Goldwind GW121-2.5 MW
(ii).	Installed Capacity of Wind Farm (MW)	50 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (kW)	20 x 2500 kW

(C). Wind Turbine Details

a.	**Rotor**	
(i).	Rated Power	2.5 MW
(ii).	Number of Blades	3 Each
(iii).	Rotor Speed	7~15.2 rpm
(iv).	Rotor Diameter	121 m
(v).	Swept Area	11595 m^2

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(vi).	Power Regulation	Variable speed and variable pitch
(vii).	Rated power at	9.3 m/s(static, air density = 1.225 kg/m³)
(viii).	Cut-in Wind Speed	3.0 m/s
(ix).	Cut-out Wind Speed	22 m/s
(x).	Survival Wind Speed	37.5m/s (10mins average) 52.5m/s (3 seconds average)
(xi).	Hub Height	90 m
(xii).	Pitch Regulation	Independent Electrical Pitch control system, belt transmission, one for each blade.
b.	**Blades**	
(i).	Number of Blades	3 Each
(ii).	Blade Length	59.5 m
(iii).	Material	Glass Fiber reinforced resin
(iv).	Weight	14200kg (per piece)
c.	**Generator**	
(i).	Power	2500 KW
(ii).	Voltage	690 V
(iii).	Type	PMDD Synchronous Generator
(iv).	Speed	Range:7-15.5rpm; Speed at rated power:13.5 rpm
(v).	Enclosure Class	IP 54
(vi).	Coupling	No coupling
(vii).	Efficiency	92.7%
(viii).	Weight	55400 Kg
(ix).	Power Factor	±0.95 (Leading to Lagging)
d.	**Yaw System**	
(i).	Yaw Bearing	Fixed system : outer slew bearing ring

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		Rotating system :inner ring of the slew bearing
(ii).	Brake	7 pairs of braking pads Fixed system : static brake disc Rotating system :hydraulic brakes
(iii).	Yaw Drive	4 induction drive motors
(iv).	Speed	0.316 degrees/Sec
e.	**Control System**	
(i).	Type	Microprocessor Controlled, DFÜ (SCADA)
(ii).	Grid Connection	Full power converter automatically synchronization
(iii).	Scope of Monitoring	Central monitoring and remote monitoring system
(iv).	Recording	The SCADA system is integrated into the turbine through the main controller. Normal operation, safety protection, fault inspection and handling, operation parameters setting and data recording
f.	**Brake**	
(i).	Design	3 Aerodynamic brakes for each blade
(ii).	Operational Brake	Aerodynamic brake
(iii).	Secondary Brake	Hydraulic brake (only for maintenance)
g.	**Tower**	
(i).	Type	4 section tubular steel tower
(ii).	Hub Heights	90m

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(D). Other Details

(i).	Project Commissioning Date (Anticipated)	December 2019
(ii).	Expected Life of the Project from Commercial Operation Date (COD)	25 Years

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Power Curve of Goldwind GW121-2.5MW Wind Turbine Generator

The tabular and graphical values of Power curve are shown below:

Wind Speed (m/s)	Power (kW)
3	63
3.5	113
4	188
4.5	279
5	384
5.5	513
6	666
6.5	876
7	1114
7.5	1365
8	1640
8.5	1904
9	2181
9.5	2428
10	2494
10.5	2520
11	2530
11.5	2538
12	2545
12.5	2550
13	2550
13.5	2550
14	2550
14.5	2550
15	2550
15.5	2550
16	2550
16.5	2550
17	2550
17.5	2550
18	2550
18.5	2550
19	2550
19.5	2550
20	2550
20.5	2550
21	2550
21.5	2550
22	2550

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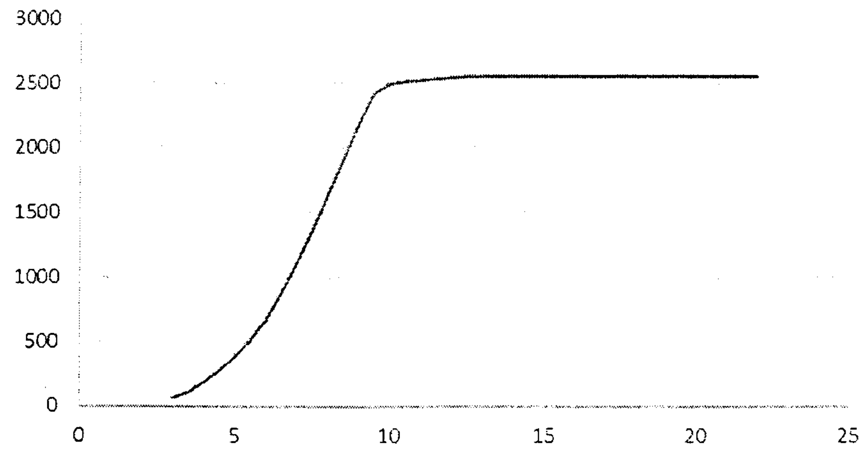
Power Curve GW 121-2.5



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ANNEXURE – A
FEASIBILITY STUDY

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FEASIBILITY STUDY REPORT FOR 50 MW WIND POWER PROJECT IN JHIMPIR, SINDH PAKISTAN

Feb, 2016

PROJECT COMPANY

Gul Ahmed Electric Limited

PROJECT CONSULTANT

Renewable Resources (Pvt.) Ltd

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APPROVAL SHEET

TITLE	:	Feasibility Study Report for 50 MW Wind Power Project in Jhimpir-Sindh, Pakistan
DOCUMENT NUMBER	:	RE2-141-170-003 Issue: 03
CLASSIFICATION	:	CONTROLLED

SYNOPSIS

This document is a feasibility study report of 50MW Wind Power Project sponsored by Gul Ahmed Energy Ltd. It contains the wind resource assessment, hardware specifications, energy yield estimates, electrical interface, civil works design and project cost. It also includes environmental impact assessment, soil investigations, site topography, grid interconnection studies and project management information. This report is prepared by Renewable Resources (Pvt.) Ltd, Pakistan.

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Company Secretary

APPROVED BY :

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LIST OF TABLES

LIST OF ABBREVIATIONS

AC	Alternate Current
AEDB	Alternative Energy Development Board
C.R	Core Recovery
CDM	Clean Development Mechanism
CFCs	Chlorofluoro Carbons
CH_4	Methane
Cm	Centimeter
CNG	Compressed Natural Gas
CO_2	Carbon dioxide
CoP	Conference of the Parties
CPPA	Central Power Purchasing Agency
DC	Direct Current
DISCOs	Distribution Companies
EE	Energy Efficiency
EMP	Environment Management Plan
EPA	Energy Purchase Agreement
EPC	Engineering Procurement Construction
EU	European Union
GENCOs	Generation Companies

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GHG	Green House Gas
GIS	Geographic Information System
GoP	Government of Pakistan
GoS	Government of Sindh
GPS	Global Positioning System
GW	Gold Wind
HESCO	Hyderabad Electric Supply Corporation
DAE	Department of Alternate Energy, Sindh
Hz	Hertz
IEE	Initial Environmental Examination
IPPs	Independent Power Producers
JI	Joint Implementation
Km	Kilometer
kV	Kilovolt
KW	Kilowatt
LOI	Letter of Intent
LOS	Letter of Support
m^2	Meter square
m^3/h	Meter cube per hour
MVA	Million Volt-Ampere
MW	Megawatt

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N_2O	Nitrous Oxide
NEPRA	National Electricity Power Regulatory Authority
NOCs	No Objection Certificates
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
O & M	Operation & Maintenance
OECD	Organization for Economic Cooperation and Development
OHL	Overhead Lines
PCM	Pulse Code Modulation
QC	Quality Control
RE	Renewable Energy
RE2	Renewable Resources (Pvt.) Ltd
RQD	Rock Quality Designation
SF_6	Sulfur Hexafluoride
SPT	Standard Penetration Test
WAPDA	Water And Power Development Authority
WTG	Wind Turbine Generator

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ACKNOWLEDGEMENTS

The management of Gul Ahmed Electric Ltd is thankful to Ministry of Water and Power and the dedicated team of Department of Alternate Energy (DAE) Sindh for generous support at all stages of project development and looks forward for their continued support.

The management of Gul Ahmed Electric Ltd also recognizes the kind cooperation of concerned Government departments (NEPRA, NTDC, and HESCO).

DISCLAIMERS

This report is prepared for the benefit of Gul Ahmed Electric Ltd (GEL) (the "Client"), and may not be relied upon or disclosed to any other person for any purpose, other than as stated below, without the Client's prior written consent in each specific case. The information contained in this report is intended to be used by the Client for such other purpose as may be necessary for the development and implementation of the Project.

COPY RIGHT NOTICE

COMPANY's CONTACT INFORMATION

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CONSULTANT's CONTACT INFORMATION

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DOCUMENT INFORMATION

Purpose and Scope:

The purpose of this report is to provide information required for the relevant agencies to make informed decision regarding the implementation and execution of this project.

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Company Secretary

DATE : February, 16

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1.1 PROJECT OVERVIEW AND SITE

The wind farm Project is located in Jhimpir, which is located approximately 130 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 370 acres of land, which is leased by GoS. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site. The Jhimpir wind corridor is identified as potential area for the development of wind power projects. The overview of the project site is shown in *Figure 1*.

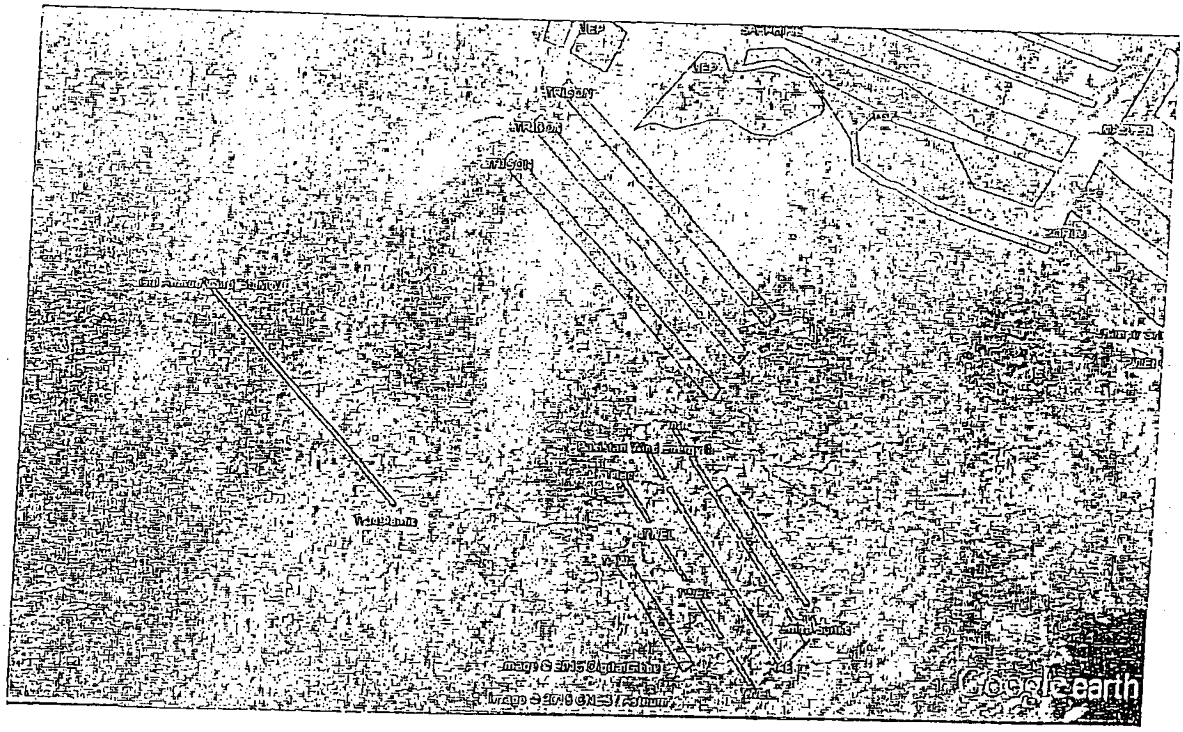

Figure 1: GEL Site overview

The terrain is flat at the Project Site with little vegetation, savanna being the mostly observed. There are some very small and scattered pieces of agricultural lands. The area has mostly dry climate. The satellite map of Project Site is shown in *Figure 2*.

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1 EXECUTIVE SUMMARY

Located on the western stretch of the South Asian Continent, The Islamic Republic of Pakistan is largely under the influence of tropical desert climate. The thermal depression of South Asia and the monsoon winds shape up Pakistan's southern coastal areas and northern mountain areas into a land rich in wind energy resources. The costal wind-energy-rich areas normally refer to Southern Sindh and the vast plateau to the east and the northeast of Karachi city. The relative shortage of conventional energy resources in Pakistan uncertainties in the fuel prices worldwide spurred the Pakistan Government to find alternative sources, including wind power.

Government of Sindh has formulated a policy to encourage the participation of private sector in the development and application of renewable energies. A Government organization called Department of Alternate Energy, Sindh (DAE, Sindh) has been established to facilitate the implementation of renewable energy projects.

At present, six (06) wind power projects of capacity approx. 50 MW each are in operation. A total of eight projects (six of 50 MW each, one of 99 MW and one of 30 MW) have achieved financial close and entered construction.

Gul Ahmed Electric Limited (GEL) is an SPV formed for developing 50MW Wind Power Project. GEL is a subsidiary of Gul Ahmed Energy Limited (GAEL).

Gul Ahmed Electric Ltd (GEL) is owned by Gul Ahmed Group, which also have other projects of in construction phase. The group now plans to install a Wind Power Project of 50 MW installed capacity and plans to accept the upfront tariff .In this regard, GAEL has an LOI for 50 MW from Government of Sindh (GOS).

Gul Ahmed Electric Limited has land available having area of approximately 370 Acres. In order to identify the land for the wind farm within the same area, preliminary site assessment has been carried out. This document is the complete feasibility study of the project including but not limited to soil investigations, topographic studies, wind resource assessment; energy yield estimates, environmental impact assessment, electrical and grid interconnection studies.

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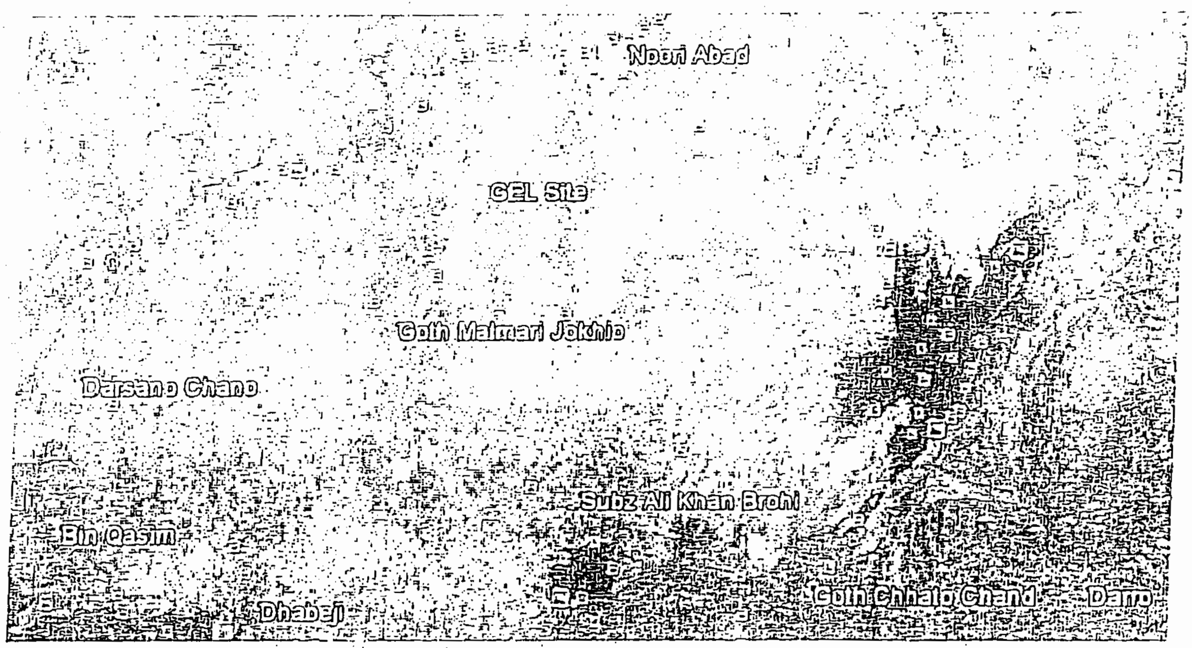

Figure 2: Satellite map of the Site

Further details of Site are given in Section 07 and Site Transportation and Access Study is attached as Annex II.

1.1.1 Project Size

The Project shall have an installed capacity of 50 MW, having area of 370 Acres.

1.1.2 Project Status and Calendar

The project calendar is given below:

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Table 1: Project Planned Milestones

Activity / Milestone	2015	2016				2017				2018	
	4th QTR	1st QRT	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR
Time consumed in Land arrangement and Grid Data.											
Preparation of Feasibility											
Submission of Feasibility Study											
Approval of Feasibility Study											
Generation License											
Upfront Tariff											
Signing of EPA											
Signing of IA											
Financial Close											
Project Construction											
Start of Operations											

The project construction shall take 14 months from the date of planning till the COD.

Table 2: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Engineering and Mobilization														
Construction of Temporary Establishment														
Civil Works of WTGs and Substation														
Construction of Substation														
Supply of WTGs and Towers														
Cables and Interconnection														
Erection and Installation														
Testing and Commissioning of EBOP														
Testing and Commissioning of WTGs														
EPA Tests and Reliability Run Test														

It is to be that noted that the Project construction schedule is based on 50 MW project size and is aimed by deploying parallel works. It has been assumed in this way due to NEPRA's persistence approach for having fix construction period regardless of the project capacity. Still, it is deemed appropriate to take longer construction period, which will be discussed with NEPRA at the tariff stage.

1.1.3 Wind Resource Assessment (WRA)

A separate study has been carried out for the WRA including complete analysis of wind data and long term correlation.

1.1.4 Energy Yield Estimates

The energy yield estimates have been generated including development of wind farm layouts, determination of energy yields and uncertainty assessments.

1.1.5 Geological Conditions

The information related to geological conditions is given in Section 11. The detailed Geotechnical Investigation Report is attached as Annex V.

There were 10 bore holes with average depth of 20 meters.

The Sub-surface conditions disclosed by this investigation show a highly fissured chalky limestone with cavities in all borehole locations. The top soil is composed of alluvium material and its thickness ranges from 0.70 – 3.0 m. The rocky formation displays a significant degree of fracturing which has weakened it.

The Site does not require special consideration for buried works. In general, it is a practice to provide dense, low permeability concrete to prevent degradation due to chemical attack. As such the use of Ordinary Portland Cement is recommended.

Ground water was not encountered in all boreholes up to the end of each boring.

1.1.6 Design of Civil Works

Information related to the civil works is given in Section 12.

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1.1.7 Design of Electrical Works

Information related to the electrical works is given in Section 13.

The Project has an installed capacity of 50 MW, using wind turbine generators (WTG), each with a capacity in the range of 1.5 – 3.3 MW. A substation consisting of step up transformer and other BOP equipment will connect the farm to the 132 kV power lines. Each WTG in the wind power station will have a capacity in the range of 1.5 – 3.3 MW, with an output voltage of 0.62 - 0.69 kV. The power from the turbine will be stepped up to Medium voltage (MV) through a generator step up transformer which will be housed in a separate compartment in close proximity to the wind turbine tower. Power from all the WTGs in the plant will be delivered to the substation, and onwards to the grid via the step up Power transformers and HV switchgear, built within the boundaries of the wind power plant. The switchgear gantries will be the point of metering and connection to the 132 kV power lines.

Grid interconnection point and required reactive power compensation, if any, for the project shall be as per the findings of the grid interconnection study.

Please refer to the Grid Interconnection Study attached as Annex VI.

1.1.8 Construction Management

Information related to the construction management is given in Section 14.

1.1.9 O & M Management

During the Warranty Period O&M (first 2 years), the responsibility of O&M shall be with the EPC Contractor. However, that responsibility shall be captured through a separate agreement. Therefore, three contracts: (1) the EPC Contract with the selected EPC contractor, (2) the 2 year O&M Contract with the EPC Contractor, (3) 8 year O&M Contract with the WTG supplier. In parallel, there shall be a mechanism to sign off a WTG supply Agreement with the WTG supplier and reset of the works as turnkey with the EPC Contractor. This shall be followed by having a Direct Agreement among WTG

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supplier, EPC Contractor, Sponsor and Lenders. Again, the 2 year O&M shall be with the EPC Contractor and 8 year O&M Contract with the WTG supplier.

The production area includes facilities such as generators, transformers, and the substation. There shall be buildings for protection and control, telecommunication, DC power supply and for administrative purposes.

1.1.10 Environmental Management

Information related to the environmental management works is given in Section 15.

A separate environment study has been carried out. The Initial Environment Examination (IEE) report is attached as Annex VII.

There are no significant hazards. The minor adjustments required during construction phase have been addressed and mitigation plan provided. A data collection survey was also done that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, shadow forecasting, flora and fauna, land- use pattern, and socioeconomic conditions.

1.1.11 Health and Safety

During the construction and operation of the Project, the guideline of "safety first, (accident) prevention foremost" will be practiced. Comprehensive management and supervision will be applied to all staff members and the whole operation process, in order to ensure safe operation of the equipment and personal safety of workers.

A comprehensive safety system will be established during the preparation phase, and carefully implemented during the construction process. The systems of work sheet, operation sheet, shift relief, patrol inspection, operation guardianship, maintenance and over-haul will be strictly implemented. The Safety Regulation of the wind farm will also be carefully observed to avoid accidents.

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1.1.12 CDM Aspect

The Project is a power generation project with renewable resource and zero emission. When put into operation, the project can provide power supply to the southern Pakistan power grid, which currently is mainly relying on fossil fuel. Therefore, it can help to reduce the greenhouse gas emission from coal or oil-fired power generation. It can deliver good environmental and social benefits. It is also consistent with the spirit of the Kyoto Protocol and qualified for the application of CDM projects.

The Project Company intends to develop a CDM project according to the provisions of the prevailing Policy.

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1.2 LIST OF ANNEXURE

ANNEX – I: Pakistan Energy Profile and Global Wind Energy Stats

ANNEX – II: Transportation and Access Study Report

ANNEX – III: Wind Resource Assessment Report

ANNEX – IV: Energy Yield Estimates Report

ANNEX – V: Geo Technical Investigation Report

ANNEX – VI: Electrical Grid Interconnection Study Report

ANNEX – VII: Initial Environmental Examination (IEE) Report

ANNEX – VIII: Technology Details of WTGs.

Presently, the Project plans to opt for upcoming upfront tariff. Therefore Annex III and Annex IV, being not required for an upfront tariff, are not submitted for approval at present. If for any reason, the Project is not able to opt for the upfront tariff, then the cost plus option will be opted and the wind studies will be submitted to relevant departments.

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1.3 PROJECT TEAM

1.3.1 Gul Ahmed Electric Limited (GEL)

Gul Ahmed Electric Limited (GEL) is subsidiary of Gul Ahmed Energy Limited. Gul Ahmed Energy Limited is backed by Gul Ahmed Group which is one of Pakistan's leading business groups with a much diversified portfolio of businesses and investments. The group has been in existence since 1948. Since then, the group has entered into several successful business ventures, with interest in Finance, Energy, Beverages, and Real Estate and last but not the least textile, the Group's main forte. The Group is involved in the manufacturing of cotton yarns, grey and finished cloth and textile made ups. The wind project is also owned and developed by Infraco Asia Indus which is owned by Infraco Asia, Infraco Asia is a part of the Infraco Group, which is a donor funded infrastructure development company, funded by the Private Infrastructure Development Group (PIDG), members of which include the development agencies of Austria, Ireland, Netherlands, Sweden, Switzerland, UK, KfW and the World Bank Group including International Finance Corporation. InfraCo Asia was established in 2010. International Finance Corporation (World Bank group) is also a minority shareholder in the Wind Project.

1.3.2 Renewable Resources (Pvt.) Ltd – Project Consultant

www.renewableresources.com.pk

Renewable Resources (RE2) is the professional technical advisor for the Project. RE2 is a consulting company specialized in Renewable Energy (RE), Energy Efficiency (EE) and Environment (Env) Projects. The company is owned by group of professionals who have been intimately involved in the renewable energy program of Pakistan, and have a fundamental understanding of issues relating to power project development, which include but are not limited to feasibility studies, regulatory approvals, concession and security documents, and applicable policies.

RE2 is capable of conducting full feasibility package featuring power production estimates, grid interconnection and tariff model. RE2 also has the expertise to deal with all technical aspects regarding the legal documents of power projects. The professional team of RE2 is well acquainted with the policies, regulations, methodologies and standards of RE power Projects and its work output meets international standards. RE2 is presently a consultant for various power Projects in Pakistan sponsored by local and international investors, with international banks.

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1.3.3 Power Planners International- Electrical and Grid Studies (PPI)

PPI is a limited company registered in England and Wales and has a team of highly skilled and experienced professionals. Power Planners is also registered with Saudi Electricity Company (SEC), with Pakistan Engineering Council and Alternative Energy Development Board, Pakistan. It is a renowned company in power sector in the field of power system analysis and planning especially in the areas of grid interconnection studies of renewable energy resources such as wind, solar, small Hydel etc. PPI comprises of enterprising group of professionals to provide consultancy services for:

- Feasibility studies of new power plants of any nature; Hydel, Thermal, Wind-Farms and other renewable energy sources, and their interconnections with the main electrical grid.
- Feasibility Studies for cross-border or cross-country interconnections of electrical grids for power exchange.
- Analytical studies for electric utilities, Independent Power Producers (IPPs), Independent System Operators (ISOs) and industries, that are planning to add new facilities or seek solutions to problems in their existing systems to enhance power quantity and quality to their customers.
- Preparation of engineering, design and specifications for new power projects.
- Training and developing the human resource in technical skills for power planning and expansion of energy sources. PPI's engineers possess highly specialized skills, vast and profound experience, and expertise of the advanced and latest state-of-the art software prevailing in the contemporary power systems industry.

The team at PPI comprises of engineers having a work experience of 10 to 30 years with utilities and consultant companies in Pakistan and Middle East in the fields of transmission planning, power system analysis, load forecasting and generation planning for systems of wide range of operating voltages.

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2 COUNTRY AND INDUSTRY OVERVIEW

The detailed stats and situation of energy in Pakistan, specific information and prospects of wind and international trends in wind power sector is given in Annex I.

At this juncture, we are encountering the worst electricity crises of the history of Pakistan resulting in extended load shedding to an extent which virtually suspends social life. The situation has further forced Government of Pakistan to again take decisions like early market shutdown, power cutoff to industry, and two holidays per week thus affecting all business activities.

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. Oil import is a significant burden on the national exchequer. Import of gas could be seen as a viable option to overcome the depleting domestic reserves, but gas import has significant issues, mainly the need for substantial capital investment in infrastructure, security difficulties and physical terrain concerns. Moreover, it would still be an imported product.

Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro or other renewable sources, such as wind / solar power. These options will assist in reducing Pakistan's reliance on imported oil, and consequent vulnerability to changes in global oil prices which will in turn have a positive effect on the current trade deficit and inflating import bill.

Looking at how the country's future electricity needs might be met, wind has the potential of being a strong contributor in future because of being an indigenous resource and available in huge quantities in the country.

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3 REGULATORY REGIME

Power sector Pakistan has a ministry overlooking the electricity business in the country and a regulatory authority, independent of the ministry, to control the business practices in the market. There are a number of stakeholders involved in the cycle:

- Ministry of Water and Power
- National Electricity Power Regulatory Authority (NEPRA)
- National Transmission and Dispatch Company (NTDC)
- Central Power Purchase Agency Guarantee Ltd. (CPPA-GL)
- Department of Alternate Energy, Sindh (DAE-GoS)

3.1 MINISTRY OF WATER AND POWER

The federal Ministry of Water and Power is the GoPs executive arm for all issues relating to electricity generation, transmission and distribution, pricing, regulation, and consumption. It exercises these functions through its various line agencies as well as relevant autonomous bodies. It also serves to coordinate and plan the nation's power sector, formulate policy and specific incentives, and liaise with provincial governments on all related issues.

3.2 ALTERNATIVE ENERGY DEVELOPMENT BOARD

Pakistan, like other developing countries of the region, is facing a serious challenge of energy deficit. Renewable Energy (RE) resources can play an important role in bridging this deficit. More importantly, RE can also play an important role in rural electrification. Realizing the importance of RE, the Government of Pakistan created the Alternative Energy Development Board (AEDB) in May 2003 to act as the central national body on the subject of Renewable Energy. The main objective of this Organization is to facilitate, promote and encourage development of Renewable Energy in Pakistan with a mission to introduce Alternative/Renewable Energy at an accelerated rate to achieve 10 percent share of RE in the energy mix of the country.

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The current initiative is directed towards creating a market-based environment that is conducive to private sector investment and participation. The AEDB provides a one-window point of operations for investors in the alternate energy sector. This is done in order to reduce the timeframe required for the completion of these projects, which are deemed essential to meet Pakistan's short term and long-term energy requirements.

3.3 NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

NEPRA has been created to introduce transparent and judicious economic regulation, based on sound commercial principles, in the electric power sector of Pakistan. NEPRA regulates the electric power sector to promote a competitive structure for the industry and to ensure the coordinated, reliable and adequate supply of electric power in the future. By law, NEPRA is mandated to ensure that the interests of the investor and the customer are protected through judicious decisions based on transparent commercial principles.

NEPRA remains to be the same platform for federal as well as provincial projects.

3.4 NATIONAL TRANSMISSION AND DISPATCH COMPANY (NTDC)

NTDC shall be the power purchaser. National Transmission & Dispatch Company (NTDC) Limited was incorporated on 3rd August 1998 and commenced commercial operation on 1st March 1999. It was organized to take over all the properties, rights and assets obligations and liabilities of 220kV and 500kV Grid Stations and Transmission Lines/Network owned by Pakistan Water and Power Development Authority (WAPDA). The NTDC operates and maintains nine 500kV Grid Stations, 4,160km of 500kV transmission line and 4,000km of 220kV transmission line in Pakistan.

For low voltage power such as 11 kV, the autonomous distribution companies (commonly called as DISCOS) are the power purchasers. Functionally, DISCOS fall at a step lower than NTDC and are looking after low voltage assets.

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3.5 Department of Alternate Energy Govt. of Sindh (DAE GoS)

Energy Department, Government of Sindh is to solve matters relating to development, generation, supply and distribution of hydro and thermal power. It also determines of rates of supply to consumers in bulk and otherwise and may prescribe tariffs within the province except where entrusted to WAPDA. Energy Department is also responsible for perspective planning, policy formulation, processing of power projects and enactment of legislation with regard to thermal and hydro power generation and distribution.

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4 CARBON CREDITS

The Kyoto Protocol to the United Nations Framework Convention on Climate Change will strengthen the international response to climate change. Adopted by consensus at the third session of the Conference of the Parties (COP) in December 1997, it contains legally binding emissions targets for Annex I (industrialized) countries. By arresting and reversing the upward trend in greenhouse gas emissions that started in these countries 150 years ago, the Protocol promises to move the international community one step closer to achieving the Convention's ultimate objective of preventing dangerous anthropogenic [man-made] interference with the climate system.

The developed countries are to reduce their collective emissions of six key greenhouse gases by at least 5%. This group target will be achieved through cuts of 8% by Switzerland, most Central and East European states, and the European Union (the EU will meet its group target by distributing different rates among its member states); 7% by the US; and 6% by Canada, Hungary, Japan, and Poland. Russia, New Zealand, and Ukraine are to stabilize their emissions, while Norway may increase emissions by up to 1%, Australia by up to 8%, and Iceland 10%. The six gases are to be combined in a "basket", with reductions in individual gases translated into "CO2 equivalents" that are then added up to produce a single figure.

Each country's emissions target must be achieved by the period 2008 - 2012. It will be calculated as an average over the five years. "Demonstrable progress" must be made by 2005. Cuts in the three most important gases carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) will be measured against a base year of 1990 (with exceptions for some countries with economies in transition). Cuts in three long-lived industrial gases – hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), and sulfur hexafluoride (SF_6) - can be measured against either a 1990 or 1995 baseline. A major group of industrial gases, chlorofluorocarbons, or CFCs, are dealt with under the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.

Actual emission reductions will be much larger than 5%. Compared to emissions levels projected for the year 2000, the richest industrialized countries (OECD members) will need to reduce their collective output by about 10%. This is because many of these countries will not succeed in meeting their earlier non-binding aim of returning emissions to 1990 levels by the year 2000, and their emissions have in fact risen since 1990. While the countries with economies in transition have experienced falling emissions since 1990, this trend is now reversing. Therefore, for the developed countries as a whole, the 5% Protocol target represents an actual cut of around 20% when compared to the emissions levels that are projected for 2010 if no emissions-control measures are adopted.

The Kyoto Protocol provides that nations can redeem a part of their climate protection commitments by implementing projects aimed at reducing emissions in other countries. These projects are primarily to be carried out by the private sector.

These investment projects can financially benefit from generating additional emissions reductions as compared to a business as usual case.

4.1 EMISSION REDUCTION MECHANISMS

There are three methods in Kyoto Protocol which permits the acquisition of emissions credits by means of project-based investment abroad.

4.1.1 Emissions Trading

Emission trading or Carbon Trading involves trading carbon emission credits within nations. Allowances are created, thereby making emissions a commodity that can be traded between industries etc. The Kyoto Protocol says that it is ok to trade in emissions, but that it should not be the major means to achieve one's commitments. Some European countries and corporations have started implementing such programs to get a head start and to see how well it will work.

4.1.2 Clean Development Mechanism (CDM)

Clean Development Mechanism (CDM) allows richer countries to offset their CO_2 emission against the emissions prevented when technology that cuts down on greenhouse gas emissions is deployed in poor countries.

4.1.3 Joint Implementation (JI)

Joint Implementation (also known as Activities Implemented Jointly) is where developed countries invest in emission-reducing activities in other industrialized countries, and gaining reduction units as a result.

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4.2 ROLE OF CDM IN GEL PROJECT

The Project is a power generation project with renewable resource and zero emission. When put into operation, the project can provide power supply to the southern Pakistan power grid, which currently is mainly relying on fossil fuel. Therefore, it can help to reduce the greenhouse gas emission from coal or oil-fired power generation. It can deliver good environmental and social benefits. It is also consistent with the spirit of the Kyoto Protocol and qualified for the application of CDM projects. If the project is approved and registered as a CDM project, CERs can provide extra financial resource for the project. It will provide favorable conditions for the project financing, improve competitiveness of the project, and reduce investment risk during the project implementation process. The CDM benefits in the Project (if incurred) shall be availed according to the provision in the Policy.

5 WIND INDUSTRY IN PAKISTAN

5.1 CURRENT STATUS OF WIND IPPs IN PAKISTAN

The wind energy sector of Pakistan has matured in the last few years. The major impediments delaying the development of wind power projects have been removed. Wind data of almost 10 years is available for two locations, i.e. Gharo and Jhimpir. All the stakeholders are now at the same frequency and are fully motivated to facilitate the development of wind power in the country.

Initially very few suppliers wanted to work in new markets like Pakistan. But now most of the suppliers are keen for the Pakistani market. One factor might be continuous maturity of Pakistani market. Presently, GE, Nordex, Vestas and Goldwind are all active in the market.

5.1.1 Letters of Intent (LOI)

The total number of LOIs issued by AEDB and DAE GoS for various projects till date is in the range of 100.

5.1.2 Land Allocation by AEDB / GOS

AEDB and DAE Sindh has got approx. 31,000 acres of land from GOS and further allocated land to twenty six (26) wind IPPs.

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5.1.3 Projects at Advanced Stages

Total of six (06) different projects with capacity of more than 300 MW have achieved their CODs. Following projects have started their commercial operations:

Table 3: Wind Projects with CODs

No.	Company	Capacity (MW)	COD
1	FFC Energy Ltd	49.5	1st Quarter 2013
2	Zorlu Energy	56.4	2nd Quarter 2013
3	Foundation Wind Energy I	50.0	1st Quarter 2015
4	Foundation Wind Energy II	50.0	4th Quarter 2014
5	Three Gorges First Wind Farm Pakistan (Pvt) Ltd	49.5	4th Quarter 2014
6	Sapphire Wind Energy Ltd	52.8	4th Quarter 2015.

Following projects have achieved financial close during 2014-15 and are currently under construction:

Table 4: Wind Projects in Construction Phase

No.	Company	Capacity (MW)
1	Yunus Energy Ltd	50.0
2	Metro Power Company Ltd	50.0
3	Gul Ahmed Wind Power Ltd	50.0
4	UEP Wind (Pvt) Ltd	99.0
5	Master Wind Energy Ltd	52.8
6	Tapal Wind (Pvt) Ltd	30.0
7	HydroChina Dawood	49.5
8	Tenega Genarsi	49.5

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5.1.4 Projects at Advanced Development Stages

Following projects have reached the Generation License / Tariff stage:

Table 5: Projects at advanced Development Stages

No	Company	Capacity (MW)
1	HAWA Energy (Pvt) Ltd	49.3
2	Jhimpir Power Ltd	49.3
3	Hartford Energy (Pvt) Ltd	49.3
4	Tricon Boston 1	49.3
5	Tricon Boston 2	49.3
6	Tricon Boston 3	49.3
7	Three Gorges Second Wind Farm Ltd	49.5
8	Three Gorges Third Wind Farm Ltd	49.5
9	Western Energy Ltd	49.5

5.1.5 Projects at Initial Development Stages

During 2015, various projects have got their LOIs and lands from GOS. The approvals of land have arrived in most cases and final allotment letters are awaiting consent of Chief Minister, Sindh. All these projects are currently at different stages of feasibility study and EPC bidding. These include:

Table 6: Projects at Initial Development Stages

No	Company	Capacity (MW)
1	Master Green Energy Ltd	100.0
2	Metro Wind Power Ltd	60.0
3	Gul Ahmed Electric Ltd	50.0
4	ACT2 Wind (Pvt) Ltd	50.0
5	Artistic Wind Power (Pvt) Ltd	50.0
6	Uni Energy Ltd	50.0
7	Din Group	50.0
8	Liberty Group	50.0
9	Naveena Group	50.0

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5.2 TARIFF REGIME IN PAKISTAN

5.2.1 Negotiated Tariff for Wind IPPs

The initial regime was of a negotiated tariff, which is still applicable. The Project Company justifies all expenses and financial position to NEPRA through a petition. The NEPRA in return determines the project tariff on a "cost plus" basis. The Project Company is allowed 17% IRR on the equity. There are four projects so far at cost plus tariff and all are currently in operation phase.

5.2.2 Upfront Tariff for Wind IPPs

NEPRA has announced a few upfront tariffs from time to time during past. The wind risk lies with the project company for upfront tariff. In lieu of it, the project companies can create cost efficiencies and draw maximum benefits from this "take and pay" basis. The indexations such as LIBOR / KIBOR, US$ and inflation are available.

The current upfront tariff allows full payment till an annual capacity factor of 35% is achieved. Afterwards, the tariff decreases to 75% from 35% till 36%. Then the tariff starts rising reaching 80% from 36% till 37%. Thereafter, the tariff regains its 100% value. This scheme is to intensify the high efficiency WTGs.

Most of the projects now prefer upfront tariff. GEL wants to opt for the upfront tariff.

6 PROJECT IN TERMS OF POLICY FRAMEWORK

6.1 LETTER OF INTENT (LOI)

First step was to obtain Letter of Intent from DAE, GoS which was accomplished in July 15. This letter entitled the Project Company to start working on wind power project at official level and get support from DAE GoS and other government departments in the preparation of feasibility study and acquisition of land for the project. The feasibility is being submitted before expiration of LOI but after the dead line given in the LOI for the feasibility.

6.2 ACQUISITION OF LAND

The land has been allocated from Government of Sindh in terms of legal formalities.

6.3 FEASIBILITY STUDY

The feasibility study of the Project is being finalized in this document.

6.4 GENERATION LICENSE

Rights to produce and sell electricity in Pakistan are granted by NEPRA through "Generation License". Project Company will file an application to NEPRA for Generation License which authorizes a company to produce and sell electricity in the country.

6.5 TARIFF DETERMINATION

A separate application shall be prepared for approval of upfront tariff.

6.6 LETTER OF SUPPORT (LOS)

Once the tariff is approved, the Project Company is required to move for arrangement of financing. DAE GoS will issue a Letter of Support for the Project Company giving government guarantees until EPA and IA are fully effective to ensure sponsors and lender of the full government support. A bank guarantee of US$ 2,500 / MW shall be required to be submitted by the Project Company before issuance of LOS.

6.7 ENERGY PURCHASE AGREEMENT (EPA)

Agreement between the Power Purchaser and the Project Company is called Energy Purchase Agreement (EPA). This agreement lists terms and conditions for the sale and purchase of electricity between the two companies. As soon as the feasibility study is submitted and upfront tariff is filed, the Project Company shall enter into the discussions of EPA.

6.8 IMPLEMENTATION AGREEMENT (IA)

The Implementation Agreement (IA) provides security to the sponsors and lenders against the performance of the power purchases through guarantees from Government of Pakistan. Its discussions shall start alongside the EPA.

6.9 FINANCIAL CLOSE

Upon approval of feasibility study, grant of generation license, determination of tariff and the signing of project documents (EPA and IA); the Project Company shall move forward to complete the financial close. However, the discussions with lenders have already been started.

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7 PROJECT SITE

7.1 WIND CORRIDOR OF PAKISTAN

Pakistan has 1046 km long coastal line with very encouraging wind regime. According to a study carried out by NREL and the wind masts installed in the Gharo and Keti Bandar wind corridor, the average wind speed in the region is 7.4 m/s making a regional potential of more than 50,000 MW. Wind Map of Pakistan by NREL is shown in *Figure 3*.

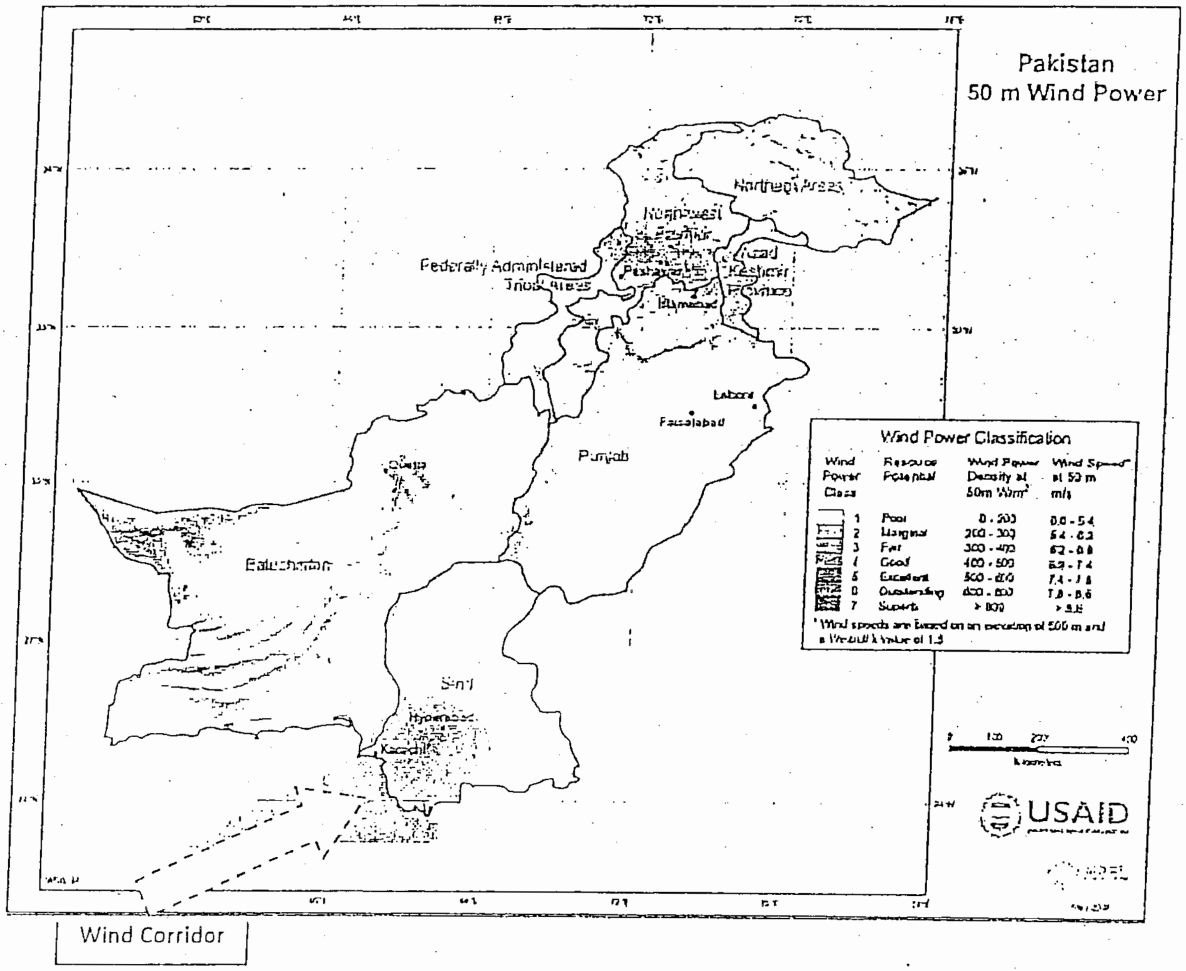

Figure 3: Wind Map of Pakistan by NREL

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Based on the wind potential, Government of Pakistan initiated the wind power projects and facilitated land to the potential investors. The lands were allocated in Gharo, Bhambore and Jhimpir, where different wind power developers have taken the land. Later, GOS started facilitating the developers with land as well. GEL is acquiring land in the Jhimpir directly from GOS.

An overview of project sites allocated in Jhimpir region is shown in *Figure 4*:

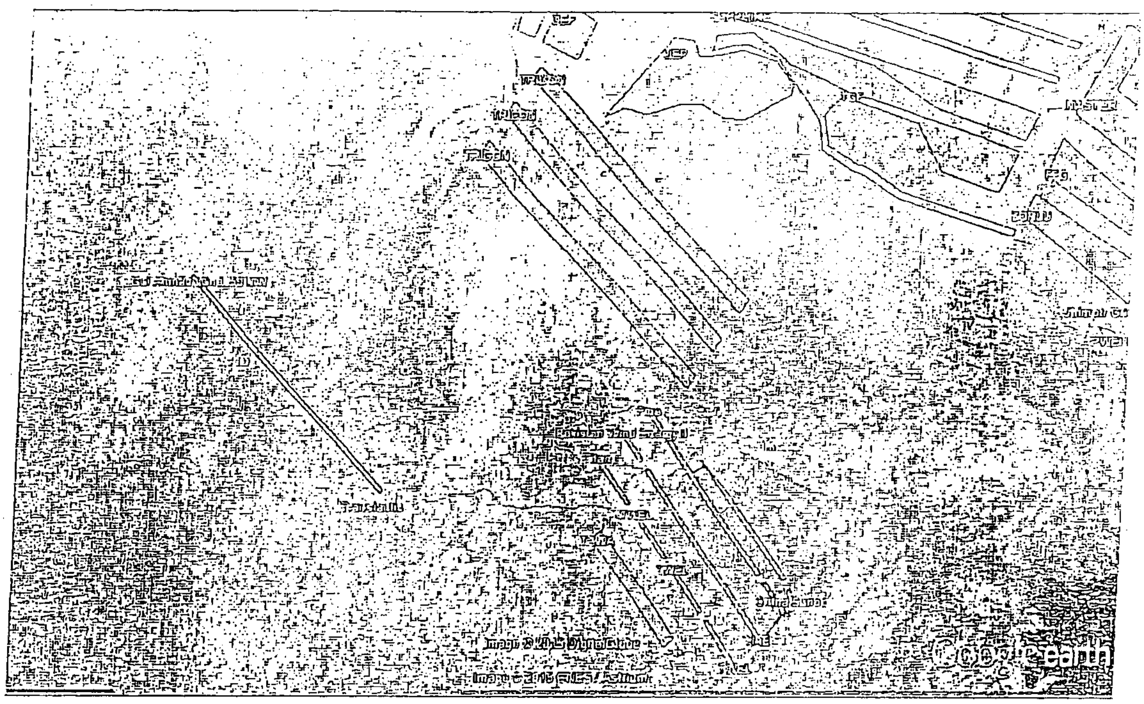

Figure 4: Overview of GEL Site

7.2 SITE DETAILS

The site is located in Jhimpir Sindh which is towards the North East of Karachi as shown in *Figure 4*. In the same region, where other wind farms are also there, the tentative micrositing is shown in *Figure 5*.

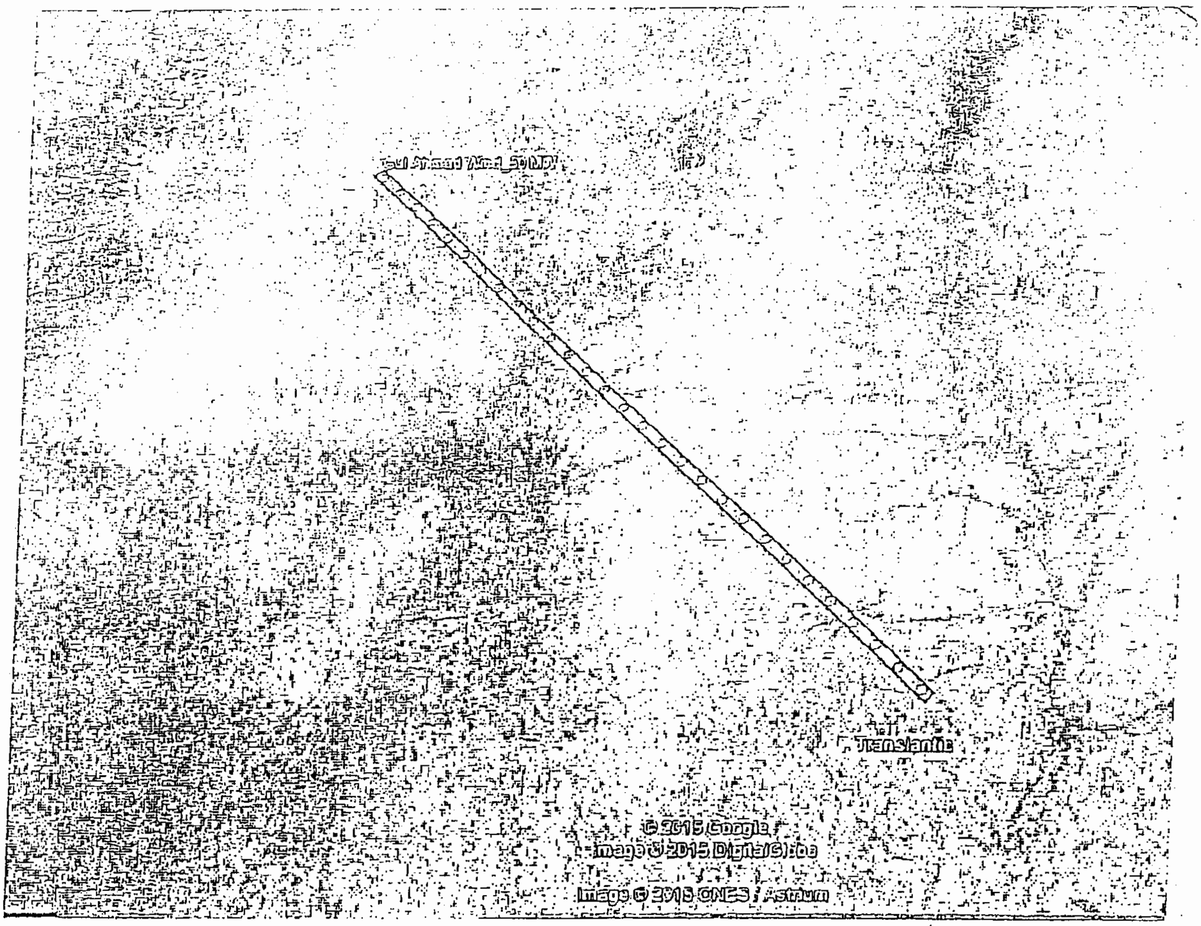

Figure 5: GEL Micrositing

The electrical network within the vicinity of the site of the plant comprises of LV (11 kV) and HV (132 kV and 220 kV) lines.

Hyderabad Electrical Supply Company 132/11 kV grid station is DISCO in Jhimpir. Nearest Grid is New Jhimpir Grid. The distance of the grid station from the Project site is approximately seventeen (17) kilometers.

A separate electrical and grid interconnection study will be conducted for the project including Power Quality, Load Flow, Short Circuit and Power Evacuation.

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The site is nearly flat with surrounding having same characteristics. View of GEL Site is given in *Figure 6*.

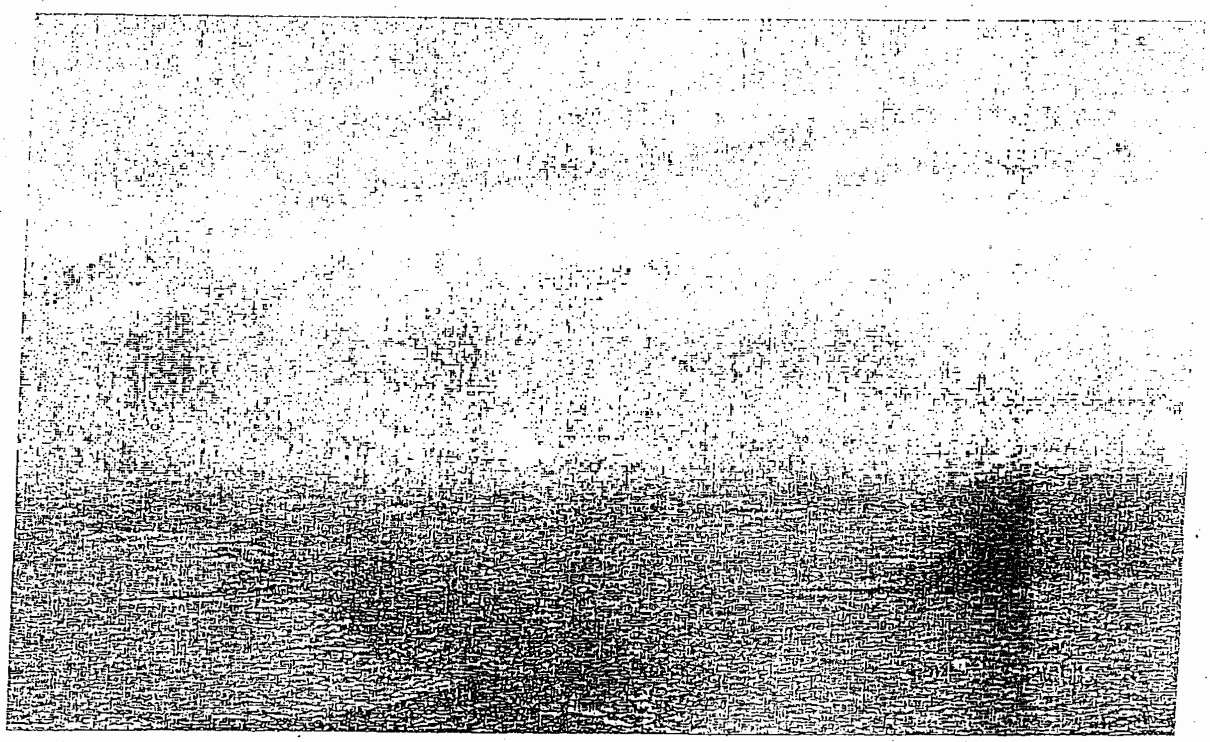

Figure 6: View of Project Site

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7.3 TRANSPORTATION AND ACCESS NETWORK

A Transportation and Access Study has been carried out and is attached as Annex II.

The major track from Karachi to Nooriabad is via the Karachi-Hyderabad Motorway, and another access to the Project site is through Jhimpir. When travelling via the Karachi-Hyderabad Motorway, the access from Nooriabad to the site is a single track, which turns toward the site. However, the terrain is flat and long and heavy vehicles can easily navigate through this road. There are number of neighboring wind farms in the surrounding area of Jhimpir. There is no requirement to establish roads or tracks for movement of traffic. The total distance from Karachi to the site is approximately 130 km.

The satellite overview of the track from Karachi to the Project site through Karachi-Hyderabad Motorway is shown in *Figure-7*.

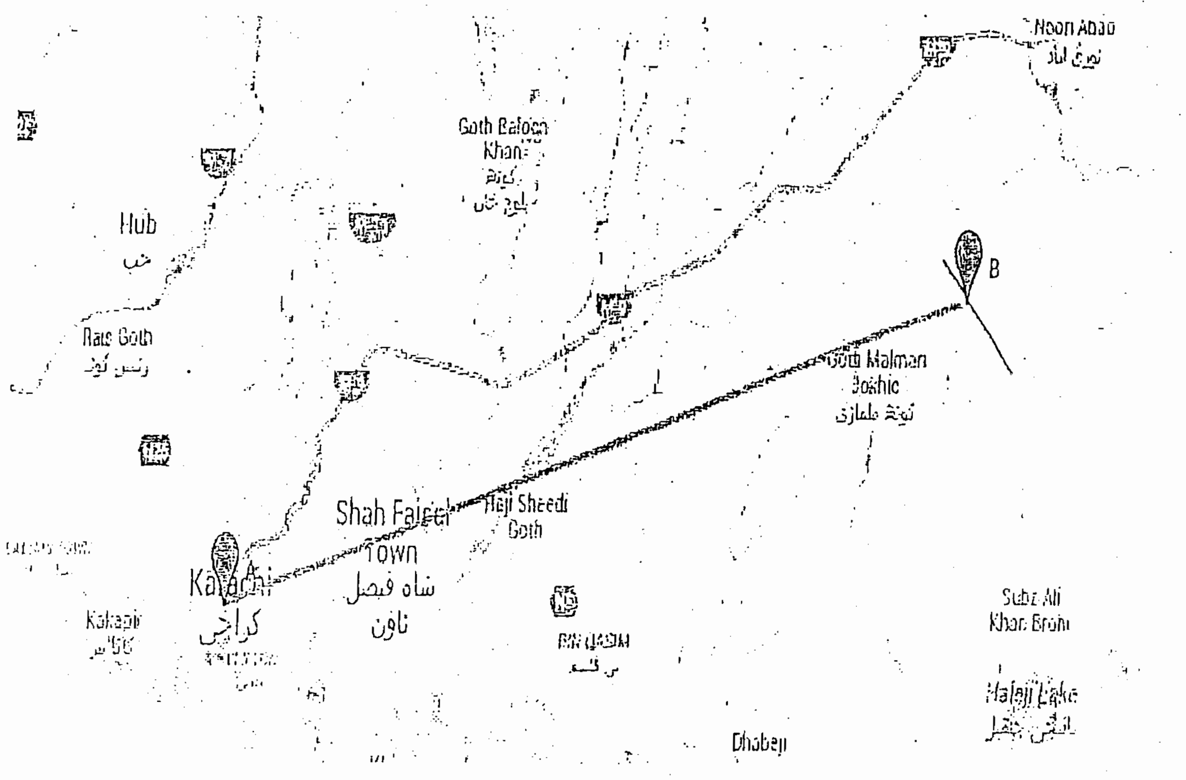

Figure 7: Access to the Site

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The major track from Karachi to site is two-way road. The Port Qasim is the one of the major port of Pakistan and is the point of delivery of equipment for the proposed wind power project. It is located towards South-West of the site as shown in *Figure-8*.

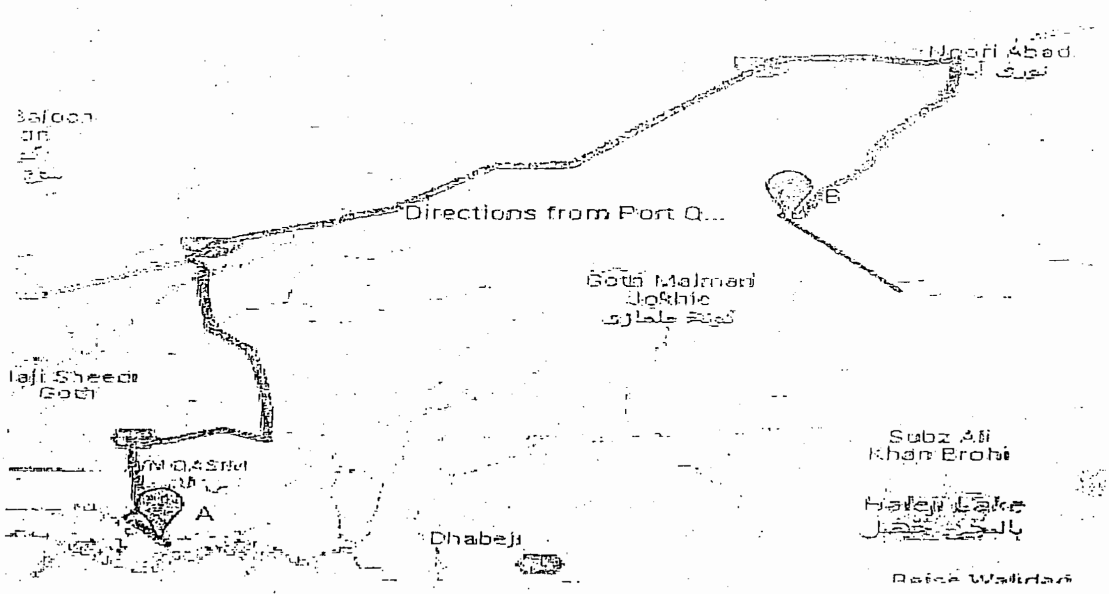

Figure 8: Detailed Access to the Site

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7.4 CLIMATIC CONDITIONS

The climate of southern parts of the Sindh province is characterized by fluctuating temperatures and sparse rainfall. The summers are hot and humid with average temperature ranging between 33 °C to 40°C. The temperature in summers may reach up to 50°C. The winters are pleasant with average temperature in the range of 15 °C to 25 °C. The months of July and August generally observe the annual monsoon rainfalls. The climate information of Karachi, which lies near to the site, is shown in table below:

Table 7: Maximum & Minimum Temperatures in Jhimpir Region[1]

S.No.	Month	Mean (°C)	Median (°C)	Min (°C)	Max (°C)	Std Dev (°C)
1	Jan	20.6	20	10.3	34.5	5.7
2	Feb	22.9	22.3	12.9	33.3	4.8
3	Mar	26.7	25.9	14.7	42.6	5
4	Apr	29.8	28.9	20.4	41.9	4.8
5	May	31.6	30.2	25.2	42.8	4.3
6	Jun	31.1	30.3	25.9	38.2	2.8
7	Jul	29.4	28.7	25.7	35.8	2.2
8	Aug	28.5	27.8	24.7	34.6	2.1
9	Sep	28.6	27.8	23.6	38.5	3.5
10	Oct	28.9	28.4	21.6	38.5	4
11	Nov.	25.8	25	17.9	35.9	4.4
12	Dec	21.8	21.6	9.9	34.8	5.7

Table 8: Average Precipitation and Rainfall Days in Jhimpir Region[2]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14mm	6mm	7mm	6mm	5mm	12mm	21mm	50mm	13mm	3mm	0mm	16mm
2	1	0	1	0	1	3	4	1	0	0	1

[1] Long term Temperature Data from nearby met mast

[2] Metrological Department of Pakistan

7.5 TELECOMMUNICATION

The wire based land line telecommunication is not available at the site. Some mobile phone suppliers including Warid, Ufone and Zong have coverage on the site area.

7.6 EARTHQUAKES

According to the seismic zoning map of Pakistan, the Jhimpuir region falls in ZONE II-B with moderate to severe damage area probability. This has been separately covered in the Geo Technical Study and the Environmental Impact Assessment.

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8 WIND RESOURCE ASSESSMENT AND ENERGY YIELD ESTIMATES

The detailed wind resource assessment report and energy yield estimates have been prepared as Annex III and Annex IV of this document respectively. At present, those studies are not being submitted with this feasibility study to DAE GoS because the Project plans to opt for the upfront tariff determination by NEPRA.

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9 SELECTION OF WTG AND EPC CONTRACTOR

GEL is currently working on the selection of following WTG suppliers and EPC Contractors. The details of EPC Contractors and WTGs offered by them are as follows:

Table 9: EPC bidders

EPC Contractor	Turbines offering	Capacity of Turbine
DESCON	• General Electric GE 1.7-103 • Gold Wind GW 121-2.5	• 1.7 MW • 2.5 MW
Power China	• General Electric GE 1.7-103 • General Electric GE 2.75 • Gold Wind GW 121-2.5 • Gamesa G114-2.0 • Gamesa G114-2.5	• 1.7 MW • 2.75 MW • 2.5 MW • 2.0 MW • 2.5 MW
Nordex	• Nordex N131-3000	• 3.0 MW
Vestas	• Vestas V126-3.3	• 3.3 MW

Turnkey EPC proposals have been invited through a bidding process, which will be evaluated on merit and then initial meetings shall take place with all bidders. Following this, detailed negotiations will be done with the two better prospective options to make a final selection.

The main aspects to select the WTG and EPC Contractor are as follows:

a) The quality of WTG and Type Certification according to site suitability
b) The quality and certifications of EBOP equipment
c) The ultimate energy yield potential at P90 for the Project
d) The total EPC cost and resultant tariff / IRR
e) Technical guarantees, warrantees and obligations
f) Time for Completion
g) The commercial and legal terms of the EPC package

At the moment, the entire feasibility is based on all WTGs mentioned in this section. The Project plans to make a final selection of the WTG and EPC Contractor by the time the stage for Generation License and Tariff of the Project will reach.

The specifications of WTG under consideration are attached as Annex VIII.

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10 GEOLOGICAL CONDITIONS

In order to collect detailed regional geological information, GEL hired professional services of Soil Met (Pvt) Ltd: a Pakistani local prospecting agency to conduct field exploration drilling often (10) bore holes on the Site during December, 2015. The average drilling depth is 15 m. The complete Geotechnical Investigation Report is report is attached as Annex-IV.

10.1. OBJECTIVES OF GEOTECHNICAL STUDIES

- To execute 10 boreholes, at the site of each proposed turbine location, 20 m (avg.) in depth.
- To execute field and laboratory geotechnical testing.
- To investigate the surface and sub-surface soil condition, to evaluate foundation design parameters.
- To provide shallow and deep foundation recommendations.

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10.2 GEOLOGY OF KARACHI REGION AND SURROUNDINGS

Geologically Karachi trough is located on the southern extension of the Kirther folded structures. It carries marine terrigenous and calcareous terrigenous Oligocene and Neogene sediments. Geological structure map of Karachi is shown in figure above.

The folds in the Palaeogene and Mesozoic sediments are overlain by the Oligocene-Neogene sediments of Karachi embayment.

The Karachi trough is delineated by the north-trending severely deformed mountain ranges namely Mor Range, Pab Range and Belaophiolite/mélange zone to the west. It is surrounded by Kirther Range to the north and to the east, and by the Indus delta and the Arabian Sea Creeks to the south-east and south. In the south, the Karachi structural embayment opens to the Arabian Sea. The trough is somewhat an asymmetrical Synclinorium.

The eastern limb of this trough is wider and comparatively greater than the western limb. The prominent strikes of the folds of the trough are sub-meridional north-south changing into southwestern direction in the south. The trough may be sub-divided into three principal regions named below:

- Northern Relatively Uplifted Region
- Southern Sub Merged Region
- Western Monocline

The tectonic map of Pakistan, Geological and Sub Surface details of Jhimpir are shown in *Figure 9 & Figure 10:*

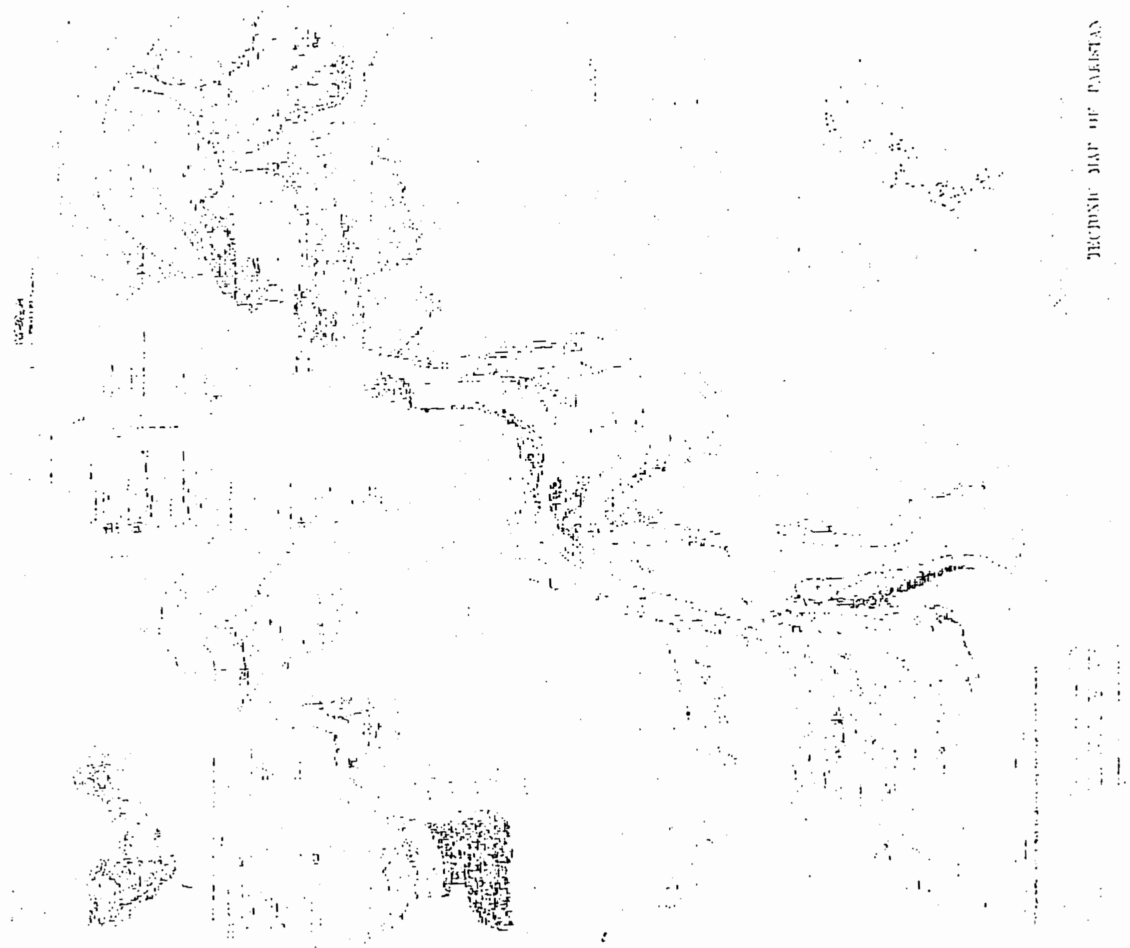

Figure 9: Tectonic Map of Pakistan

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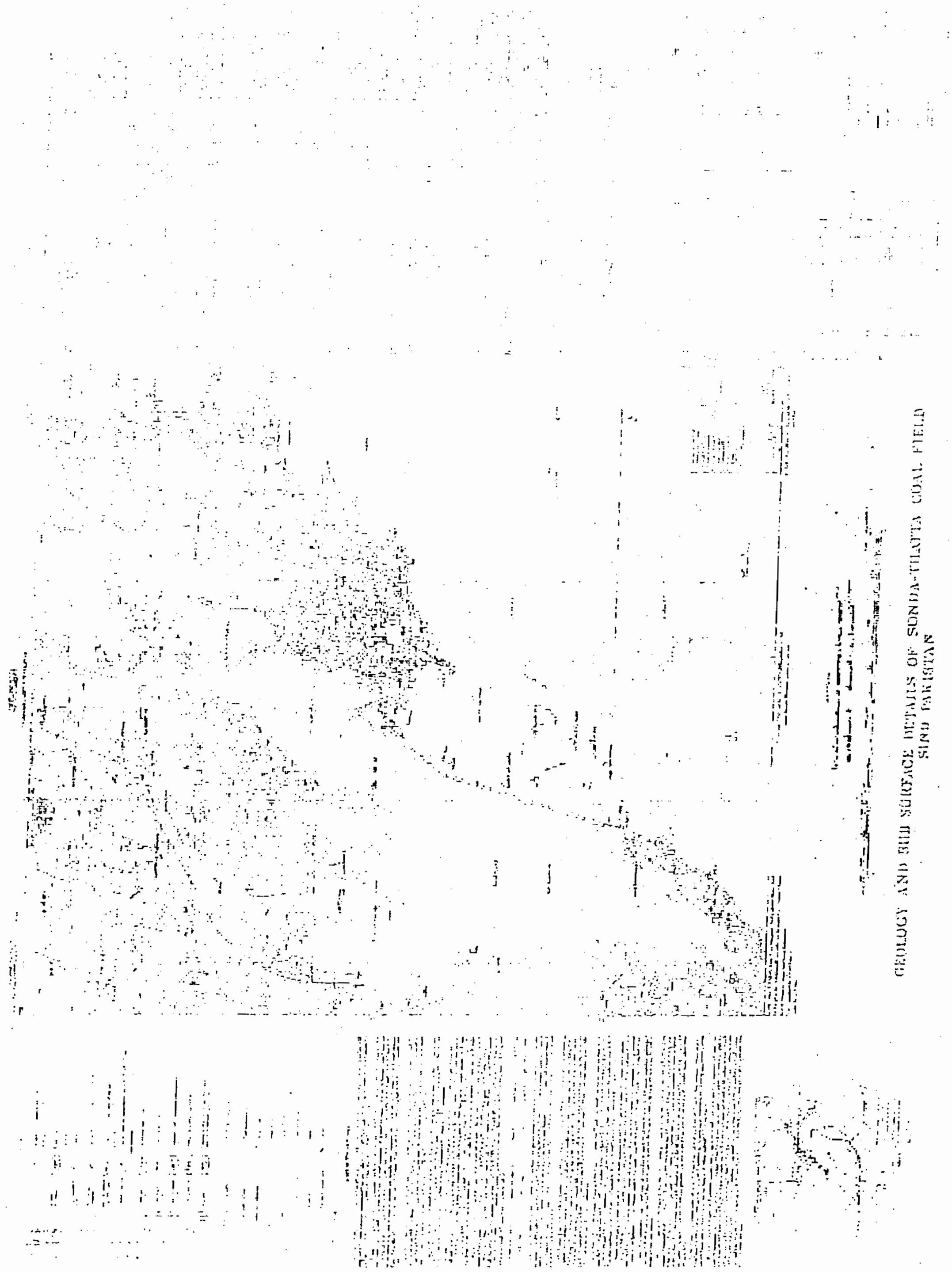

Figure 10: Geological and Sub Surface details of Jhimpir

10.3 SEISMOLOGY OF KARACHI REGION

The region is surrounded by some active fault lines; namely Pab Fault, Ornach Nal Fault and Runn of Kuch Fault. The history of earthquakes in Karachi is given in table below:

Table 10: Earthquake Records around Karachi

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	24.70	66.00	0	4.50	——	Karachi
1965	25.03	66.76	40	4.50	——	Karachi
1966	25.00	68.00	——	5.00	VI-VII	Jhimpir
1968	24.61	66.42	19	4.10	——	Karachi
1970	25.28	66.65	33	4.90	V	Karachi
1971	25.00	68.00	——	4.50	V	Jhimpir
1972	25.35	66.71	33	4.50	V	Karachi
1973	25.00	68.00	——	5.00	VI	Jhimpir
1973	25.48	66.33	57	4.90	V	Karachi
1975	25.50	66.80	——	4.50	V	Gadani
1975	25.22	66.59	33	4.70	V	Karachi
1976	24.96	70.38	14	4.70	V	Karachi
1984	25.86	66.41	33	5.00	VI	Karachi
1985	24.90	67.39	33	5.00	VI	Karachi
1986	25.34	66.60	33	4.60	V	Karachi
1992	25.25	67.76	33	3.60	IV	Karachi
1996	25.06	66.76	33	——	——	Karachi
1998	25.69	66.46	33	4.40	V	Karachi
1998	24.85	66.35	33	4.50	V	Karachi

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The seismic parameters of Karachi region are in table below along with map in *Figure 11*:

Table 11: Seismic Parameters of Karachi

Seismic Parameters	Value
UBC Zone	2B
Max Peak Ground Acceleration	16% - 20% of 'g' ($g = 9.8 m/s^2$)
Seismic Hazard	Upper Moderate
Magnitude (Richter Scale)	5.5 to 6.5
Intensity (MM Scale)	VI – VII

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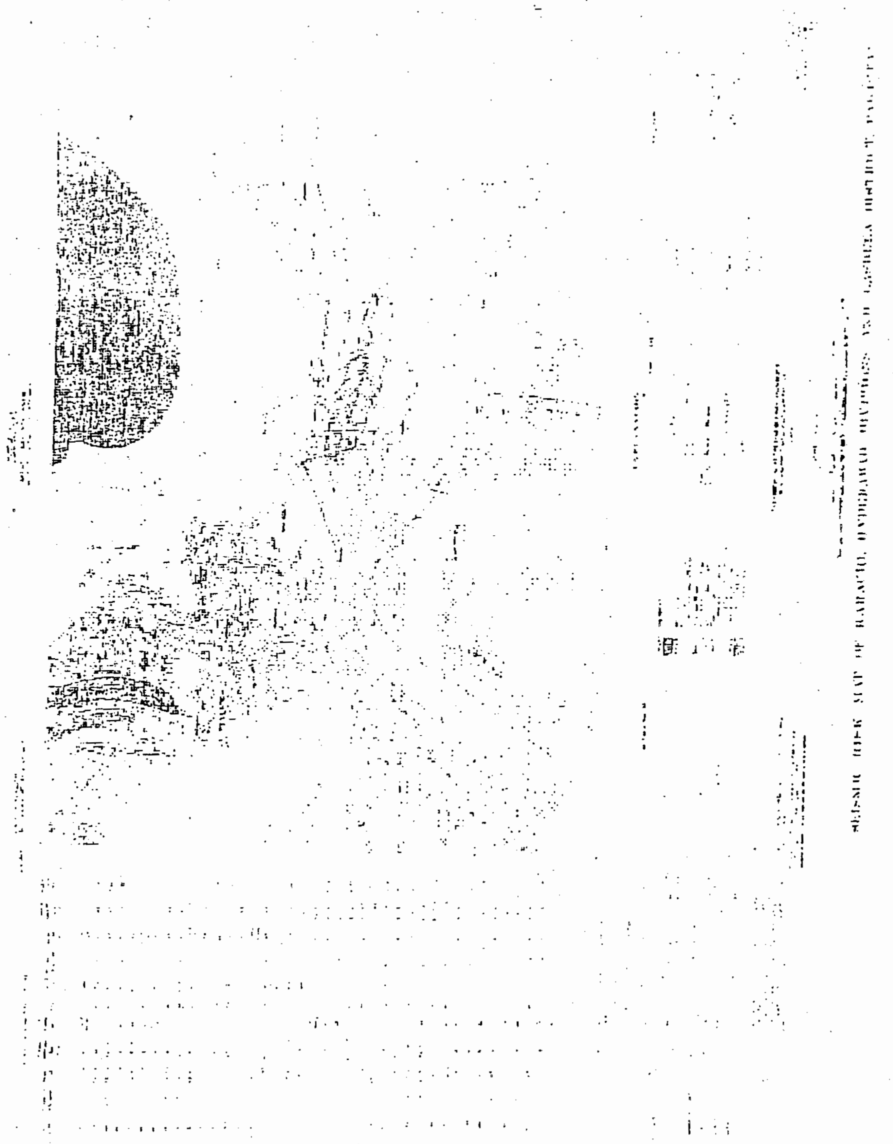

Figure 11: Seismic Map of Pakistan

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10.4 FIELD WORK

10.4.1 Borehole Drilling

The drilling and sampling work has been performed using the standards, procedures and equipment's recommended for engineering site investigation. All borings were advanced through soil between sampling intervals by rotary wash methods, using rotary drilling machines of hydraulic feed. These machines are most suitable to the site conditions with all accessories for extending the bore to required depths, taking samples and performing the necessary onsite tests. Minimum drilling fluid consisting of water bentonite slurry was used for flushing out the cutting to provide a positive head and to maintain stability of the drilled hole. The boreholes were also stabilized using casing with a nominal diameter of 130mm. A drag bit was used to advance the boring. Observations during drilling such as change of strata, texture, color and drilling difficulties were noted.

The soil layers encountered in the borehole were visually classified and were later upgraded as per laboratory test results. Few samples were obtained from split spoon sampler after performing standard penetration test (SPT). A number of core samples were preserved. The samples were cleaned, labeled and put in especially made core-boxes for onward transmission to the laboratory for testing. Special care was taken during handling and transportation of samples.

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10.4.2 Rock Core Drilling

Rock core drilling relates to the procedure in which underlying rock is investigated by coring so as to obtain samples for classification, to determine the quality of rock, and to check for possible detrimental properties such as cracks, fissures and weathering or other deterioration that could affect the strength of the formation. To obtain rock core samples, NX diameter core barrels with special bits were used. Under rotary action, the core bit advances into the rock. A circulating supply of water was provided in the cutting edge to help flush rock cuttings and dissipate heat. "Core Runs" were made to drill the hole in segments. At the completion of a core run, the barrel and rock sample were brought to the surface, the depth of recovery was properly recorded for further evaluation in the laboratory. Based on the length of the rock core recovered from each run, core recovery (C.R.) and rock quality designation (RQD) were calculated for a general evaluation of rock quality encountered. Suitable core samples were preserved for shear strength characteristics.

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10.4.3 Location of Boreholes

Table 12: Location of Boreholes during Geo Technical Investigations (UTM zone 42R)

S. No.	Latitude	Longitude
B1	25° 2'33.93"	67°40'50.91"
B2	25° 2'16.20"	67°41'9.94"
B3	25° 1'58.26"	67°41'29.89"
B4	25° 1'13.33"	67°42'18.67"
B5	25° 0'45.98"	67°42'47.45"
B6	25° 0'20.22"	67°43'16.03"
B7	24°59'58.64"	67°43'38.91"
B8	24°59'39.02"	67°44'0.39"
B9	24°59'11.31"	67°44'30.03"
B10	24°58'55.19"	67°44'47.73"

10.4.4 List of Field and Lab Tests

Geotechnical laboratory testing was carried out on retrieved disturbed soil samples. The following are the relevant tests carried out on selected samples as required for determining the subsurface conditions and correlating with the information obtained from field testing and sampling:

- Grain Size Analysis
- Liquid and Plastic limits
- Natural Moisture Contents
- Density
- Specific Gravity
- Direct Shear Test
- Unconfined Compressive Strength of Rocks
- Chemical Test

10.5 CONCLUSIONS OF GEOTECHNICAL STUDIES

A Geotechnical Investigation for GEL 50MW Wind Power Project Jhimpir, Sindh was carried out in Dec, 2015. The Scope of work included drilling of eight (10) boreholes up to 20 meters depth. Soil and rock samples were also collected during the field investigation. Laboratory testing of soil and rock samples has been carried out in Geo Tech lab and includes natural moisture content, specific gravity, water absorption, density, unconfined compressive strength etc.
Chemical characteristics of soil and rock samples have also been assessed through determination of total dissolved solids, sulphate content, chloride content and pH.

Keeping in view, the results from field, and laboratory tests and the expected loads being transferred to the founding stratum, allowable bearing pressures for shallow foundations at certain depth. Exposure to chloride and sulphate salts is '*negligible*' for soil; therefore, *Ordinary Portland Cement (OPC)* should be used for underground concreting.

11 CIVIL ENGINEERING DESIGN

The civil engineering design mainly includes following structures:

- Foundation of WTG Towers
- Foundation of substation and grid interconnection apparatus, i.e. transformer, switchgear.
- Construction of permanent buildings (residence and offices) of O&M staff.
- Construction of building for Protection and Control, Telecommunication and DC Power Supply.

The design activity of the civil works shall be carried out as part of the EPC contract during early phase of construction. However, the geo technical risk shall lie under contractor's responsibility as per the terms of the EPC Contract.

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12 ELECTRICAL ENGINEERING DESIGN

The basic electrical design of the wind farm is discussed in this chapter. The overall electrical system has been designed considering the data from HESCO/NTDC and requirements of the grid code addendum for wind energy approved by NEPRA.As part of the grid interconnection study (attached as Annex V), complete modeling of the wind farm has been performed. Load Flow Studies, Short Circuit Analysis, and Transient Stability Analysis along with the Power Quality Analysis have also been performed on the existing and future planned HESCO/NTDC network as part of the report.

The dispatch voltage shall be 132 kV. There will be two-stage step voltage, one step up to MV level at the each WTG level through individual GSUs, and the other at the substation. The MV level shall be either 22 kV or 33 kV.

The Wind Farm shall have two 132 kV outgoing lines to keep the N-1 grid connectivity criteria. The termination point of the lines on two remote ends have been identified, which will be firmed up during the construction phase by NTDC considering the network scenario at that time. The protection and telecommunication scheme will be accordingly finalized at that time.

The Wind Farm shall be divided into collector groups, each having approx five (05) WTGs. Every WTG shall be equipped with own step-up transformer and shall be connected with the successive WTG by means of Ring Main Units (RMU) and vacuum breaker in configuration in/out. The connection of the RMUs to the main MV Switchgear shall be achieved by under-ground XLPE insulated single core aluminum conductor.

The MV Switch gear shall have two bus sections with bus-sectionalizer device, each feeding half of the WTG groups. It will also feed auxiliary transformer and capacitor bank to meet the power factor requirements of the national grid code (0.95 lagging).

The 132 kV substation shall consist of two bus sections of a single bus bar with a sectionalizer and two breaker bays to connect main transformers with the 132 kV double circuit overhead lines (OHL). The Main Transformers shall meet the N-1 grid code criteria and thus may be two (02) in number (50 MVA each). The instrumentation transformers (CTs, VTs, CVTs) for all purposes shall be sized according to requirement.

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The 132 kV OHLs from the Wind farm substation to the 132 kV to far end connection points (whether adjacent grid stations or neighboring project substations) are out of the scope of the contractor and shall be installed and connected by NTDC.

The manufacturers of the HV/MV switchgear, main power transformer and other protection equipment shall beof reputable manufacturers confirming to the requirements to be spelled in detail in the EPC Contract and in the EPA. Further, the detailed electrical design will be subject to approval of both GEL and NTDC as per the requirements of EPC Contract and EPA respectively.

In this regard, the concept mentioned in this section serves as guidelines and firm design will be prepared during construction phase, which may be somewhat different from predicted here.

13 CONSTRUCTION MANAGEMENT

Like all wind power projects in Pakistan, the structure of EPC contract is on a "turnkey" basis. Everything shall be managed from one platform (one window) of the EPC contractor. The partners of EPC contractor shall be underneath that platform through "subcontracting" or "joint and several arrangements". In this way, the role of GEL shall become to supervise and monitor everything.

GEL personnel will supervise construction activities right from the beginning. The team of GEL will monitor construction schedule, owner's engineers and the EPC contractor to complete the project within given time frame and in-line with HSE guidelines.

GEL requires careful management of construction. To achieve this, GEL will prepare a Construction Management Master Plan taking into account all relevant aspects. The master plan shall be regularly reviewed, updated and shared with all project stakeholders.

Construction Management Plan depends on the nature of work, likelihood of disruptions, impact on local amenity, dangers or risks involved and any other relevant issue required to be addressed under the planning permit.

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The project construction shall take 18 months from the date of planning till the COD. The activity structure and timelines are given in table below:

Table 13: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Engineering and Mobilization														
Construction of Temporary Establishment														
Civil Works of WTGs and Substation														
Construction of Substation														
Supply of WTGs and Towers														
Cables and Interconnection														
Erection and Installation														
Testing and Commissioning of EBOP														
Testing and Commissioning of WTGs														
EPA Tests and Reliability Run Test														

14 Initial Environment Examination (IEE)

The Initial Environment Examination (IEE) has been carried out as per Pakistan Environmental Protection Act, 1997 according to the requirements of Environmental Protection Agency, Government of Sindh and is already submitted. The report is attached as Annex VII.

A data collection survey that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, shadow forecasting, flora and fauna, land use pattern, and socioeconomic conditions was undertaken, based on available secondary information or data collected in the field. Primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. Secondary data was collected for land, ecology, climate, and socioeconomic factors.

According to the study conducted, prime benefit of the Project will be the replacement of conventional power generation with renewable energy. Wind energy will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

Impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed power project. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes. Since proposed land is covered with shrubs, thus there is no need for removal of any significant vegetation for the construction of the wind power Project.

The proposed Project will have number of positive impacts and negligible negative impacts to the existing environment as follows:

- Significant improvement in the economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.

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- There is negligible removal of trees for the Project, which is the main positive impact to the proposed Project area.

- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration are the short term negative impacts due to proposed Project with mitigations being properly taken care.

Proper GRM will have to be implemented by GEL to overcome public inconvenience during the proposed Project activities.

Based on the environmental and social assessment and surveys conducted for the Project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions are being made in the Project to cover the environmental mitigation and monitoring requirements, and their associated costs. Adequate provisions are being made by GEL to cover the environmental mitigation and monitoring requirements, and their associated costs.

An environment and social analysis has been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. The impact analysis, found that due to careful consideration of environmental and social aspects during route and site selection by GEL, no major adverse impacts are expected. There is no adverse impact on the migration of habitat, any natural existing land resources and effect in the regular life of people.

The environment and social impact associated with the Project is limited to the extent of construction phase and can be mitigated through a set of recommended measures and adequate provision for environment and social impacts which cover monitoring, measuring and mitigation.

Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor will be carefully selected after undergoing an options assessment. This enabled the right of way alignment to bypass villages and important water supplies and resources. The main Project impacts are associated with clearing of shrub vegetation, waste management and excavation and movement of soils.

From this perspective, the Project is expected to have a less "environmental footprint". No endangered or protected species of flora or fauna are reported near Project sites.

Stakeholder from Government sector and Non-Government sector has also appreciated the project activities, raised concerns related to social and environment area which shall be addressed through effective planning and management.

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. The potential cumulative and residual impacts of the Project as a whole indicate the Project classifies as a category "B", in accordance with ADB's Safeguards Policy Statement2009. The Project is not considered highly sensitive or complex. Mitigation measures related to Construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed Project has limited adverse environmental and social impact which can be mitigated following the EMP& shall be pollution free Renewable source of Power generation with low Environmental foot prints.

In the view of all above, it is concluded that development of 50 MW wind power project of Gul Ahmed Electric Ltd will have no adverse environmental impact and the project can be regarded as Environmental Friendly Green Project.

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15 CONCLUSIONS OF FEASIBILITY STUDY

The detailed feasibility of the Project has been conducted which covers all aspects required for developing the Project.

The wind climate observed on the Site indicates good annual average wind speed. Thus the annual energy estimates are also good and it is feasible to develop the Project based on General Electric GE 1.7-103 (1.7 MW), Gold Wind 121-2.5 (2.5 MW), General Electric GE 2.75 (2.75 MW), Gamesa G114-2.0 (2.0 MW), Gamesa G114-2.5 (2.5 MW), Nordex N131-3000 (3.0 MW), Vestas V126-3.3 (3.3 MW) turbines. The Project IRR as currently being assessed is suitable.

The Project Site is feasible for the wind farm with easy access for the transportation of equipment. The climatic conditions at the Project Site are moderate and there is no significant impact of seismic hazards foreseen in the area. The telecommunication and transportation facilities are adequate.

The Project shall not have negative environmental impact during life cycle. Instead, the Project will bring positive development and improve the socio-economic conditions of the area through generation of employment opportunities and contribute in environmental sustainability of the area.

All WTGs considered in the study are equally good for the Project. The negotiations of EPC contract and the price shall play a vital role in final selection.

The Project Site is conveniently located close to the Grid of HESCO and NTDC. However, the remaining Grid Interconnection study will tell which Grid to be selected for the connection.

From here onwards, the Project may enter into getting licenses and permits and into negotiation of security documents. The next steps after approval of feasibility study would be to apply for Generation License and Tariff, and to begin negotiations for EPA and IA. The Project may also enter into discussions with lenders at some stage.

It is expected that the Project will achieve financial close by 1st quarter of year 2017 and construction will be completed by 2nd quarter of year 2018. It is anticipated that the Project of GEL would be a valuable addition to the National Grid for generating electricity and contribute to overcome the current energy crises of the Pakistan.

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ANNEXURE – M
GRID INTERCONNECTION STUDY & POWER EVACUATION CERTIFICATE

Gul Ahmed Electric Ltd.
Karachi

NATIONAL TRANSMISSION & DESPATCH COMPANY LTD

GENERAL MANAGER (GSC)

No. 8802 /GM/GSC/NTDC Date: 01/12/2016

CERTIFICATE

Subject: APPROVAL OF SYSTEM STUDIES OF 50 MW OF M/S GUL AHMED ELECTRIC LIMITED WIND POWER PROJECT.

NTDC hereby accords its approval in respect of system studies submitted by M/s Gul Ahmed Electric Limited in respect of 50 MW Wind Power Project at Jhimpir Sindh. NTDC further certifies that the power to be generated by M/s Gul Ahmed Electric Limited will be evacuated by July, 2019 and the power injected through the above mentioned project will not have any adverse affect on the National Grid as required under the Grid Code.

Signature:

Name: WAJAHAT SAEED RANA

Designation: General Manager (GSC)
413-WAPDA House, Lahore.

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NATIONAL TRANSMISSION & DESPATCH CO. LTD

General Manager Planning Power, NTDCL

No. GMPP/CEMP/TRP- 380/2409-13 Dated: 03-06-2016

General Manager (CPPA-G) Ltd.
229-WAPDA House
Lahore.
Fax #: 042-99201179

Subject: **Grid Interconnection Study Report of 50 MW Wind Power Project (WPP) at Jhimpir Sponsored by M/s Gul Ahmed Electric Limited**

Ref: M/s Gul Ahmed Electric Limited letter no. A-CPPA-L16-00022 dated 26-04-2016.

Enclosed please find herewith the grid interconnection study report of 50 MW WPP by M/s Gul Ahmed Electric Limited. The subject interconnection study report has been prepared only to propose interconnection scheme for power evacuation from Gul Ahmed Electric WPP in integration with other WPPs in its vicinity which is self-contained in this regard.

The matters relating to execution of the proposed interconnection scheme and induction of the subject WPP will be dealt with by CPPA-G, NTDCL and other formations.

DA/As Above

3/6/16
(Maqsood Ahmed Qureshi)
General Manager Planning (Power)

CC:

- Managing Director (NTDC), 414-WAPDA House, Lahore for information.
- Chief Executive Officer (CPPA-G) Ltd., 6th Floor, Shaheed-e-Millat Secretariat, Jinnah Avenue, Blue Area, Islamabad.
- General Manager Services Division (NTDCL) 414-WAPDA House, Lahore for information.
- Executive Officer, M/s Gul Ahmed Electric Limited, 7th Floor, Al-Tijarah Centre, 32-1-A, Block 6, P.E.C.H.S. Main Shahra-e-Faisal Road, Karachi-75400, along with a copy of the subject interconnection study report.

- *Master File (MP)*

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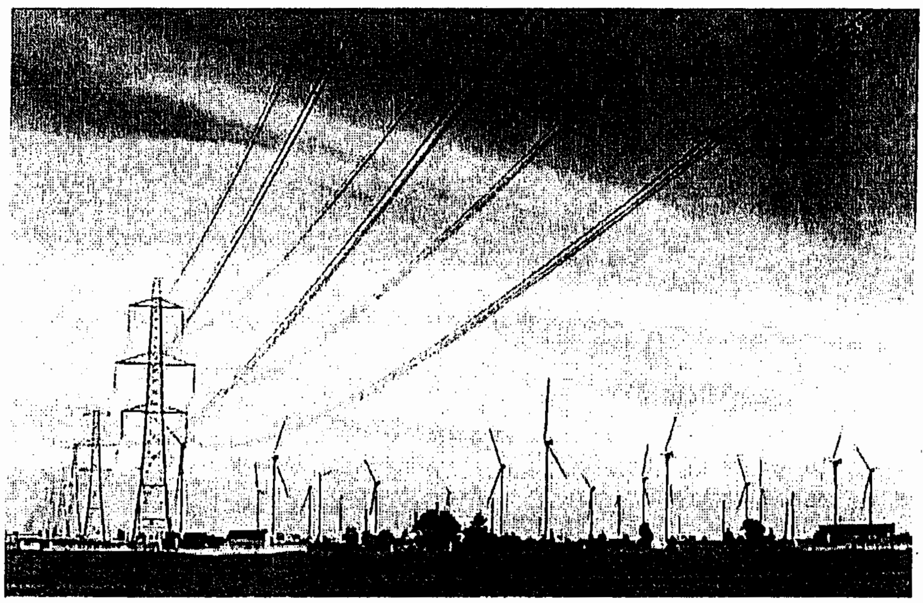
National Transmission and Despatch Company Limited (NTDCL)

Grid Interconnection Study for Evacuation of Power from 50 MW Gul Ahmed Wind Power Project to the National Grid



Planning (Power) Department
4th Floor, PIA Tower, Egerton Road, Lahore.

May 2016

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Executive Summary

1. Ministry of Water and Power in association with AEDB, Energy Department, Government of Sindh, in April 2016, decided to allocate the 500 MW wind power capacity vacated by M/s NBT Wind Power Pakistan-II & III to the 10 Wind Power Projects (WPPs) of approx. 50 MW each at Jhimpir, district Thatta, Sindh. The 10 WPPs comprise of ACT-2, Gul Ahmad Electric, Shaheen Foundation, Din Energy, Zulaikha Energy, Artistic, Harvey (Cacho), Norinco, Western Energy and Trans Atlantic. These 10 WPPs are in addition to the already planned/under construction WPPs in Jhimpir and Gharo clusters. Afterwards, the list of the selected 10 WPPs was communicated to CPPA-G and NTDCL for information and further action at their ends.

2. The sponsor of Gul Ahmad Electric WPP, i.e., M/s Gul Ahmed Electric Limited, has engaged Planning Power department of NTDCL to carry out interconnection studies and to propose interconnection scheme for its power evacuation to the National Grid.

3. The project sponsor of Gul Ahmad Electric WPP, as per requirements of NTDCL Planning Power, provided the project site location/coordinates, and other necessary technical data/information of Gul Ahmad Electric WPP, i.e., No., generation capacity, voltage, p.f. & type of WTGs, collector group configuration, gross & net output capacity of the plant, No. & rating of transformers, switchyard voltage levels, single line diagram & equipment rating etc.

4. As per information provided by the project sponsor Gul Ahmad Electric WPP comprises of 20 No. WTGs and each WTG is of Goldwind make, Type-4 with 2.5 MW gross capacity. The total gross generation capacity of Gul Ahmad Electric WPP is 50MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 47.7 MW.

5. This is the interconnection study report which has been prepared only to propose interconnection scheme for power evacuation from Gul Ahmad Electric WPP in integration with other WPPs in its vicinity. In this report, he results of

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load flow, short circuit, transient stability and power quality studies have been presented with the proposed interconnection scheme for evacuation of power from Gul Ahmad Electric WPP to the National Grid In the light of NEPRA Grid Code.

6. Considering the capacity, locations, existing/planned system network in the area, the following integrated interconnection scheme of the 7 WPPs lying in southern part of Jhimpir including Artistic, Gul Ahmad Electric, Din Energy, Zulaikha Energy, Artistic, Cacho and Trans Atlantic, has been proposed for their reliable power evacuation to the grid:

   i) A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.

   ii) 220 kV double circuit (D/C) transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.

   iii) 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir New (Jhimpir-1) – Gharo New D/C transmission line at Jhimpir-2.

   iv) 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Gul Ahmad Electric WPP with Jhimpir-2. In this scheme, the interconnection of Gul Ahmed WPP includes 132 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out from Gul Ahmad Electric WPP on the 132kV single circuit from Cacho WPP to Jhimpir-2.

7. The integrated scheme for the remaining 3 WPPs lying in northern part of Jhimpir including Shaheen Foundation, Norinco, and Western Energy, has been proposed with power evacuation from the under-construction Jhimpir-1 220/132kV grid station, through network reinforcement.

8. The above proposed interconnection scheme is expected to be completed in Dec. 2019. It is added that the expected timeline of the proposed

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interconnection scheme may be extended depending on variation in completion of the related activities, i.e., preparation and approval of PC-1, funding arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.

9. Detailed load flow studies have been carried out for various operating scenarios with maximum dispatch from all the existing/under-construction/planned WPPs in Jhimpir and Gharo clusters to evaluate the adequacy of the above proposed interconnection schemes of the 10 WPPs including Gul Ahmad Electric WPP for their reliable power evacuation to the grid.

10. The proposed interconnection scheme for Gul Ahmed WPP has been found adequate after performing the load flow studies to assess the steady state system performance under normal and N-1 contingency conditions. The voltage profile, line loading, frequency and active/reactive power flow etc. from the Gul Ahmed WPP and on the grid are within the NEPRA Grid Code criteria. It has been found on the basis of the study results that the power from Gul Ahmad Electric WPP can be dispersed to the National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints.

11. The short circuit studies have been carried out with proposed interconnection of Gul Ahmed WPP to compute the maximum three phase and single phase short circuit levels at the switchyard of Gul Ahmad Electric WPP and other substations in its vicinity. The minimum three phase and single phase short circuit levels have also been carried out at the 132 kV switchyard of Gul Ahmad Electric WPP for various number of WTGs in operation and reduced generation in its vicinity. It is found that the induction of Gul Ahmad Electric WPP with the proposed interconnection scheme has no adverse impact on the existing and proposed substations in its vicinity.

12. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Gul Ahmad Electric WPP are 9.42 kA and 6.26 kA respectively in the year 2021-22 but these are expected to rise due to future grid system

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expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Gul Ahmad Electric WPP.

13. Transient stability analysis has been carried out for Gul Ahmad Electric WPP with the proposed interconnection scheme. The stability of Gul Ahmad Electric WPP and the power system has been checked with application of different disturbances on the wind farm and at the substations in its vicinity. It has been found that Gul Ahmad Electric WPP and the power system remain stable with no adverse effects after subjected to faults as per Grid Code requirement.

14. The LVRT requirements for Gul Ahmad Electric WPP have been tested against contingency conditions of 100ms (5 cycles) under normal clearing time and 180ms (9 cycles) for delayed fault clearing. The stability simulations have proved that Gul Ahmad Electric WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

15. The impact of induction of Gul Ahmad Electric WPP on power quality has also been analyzed. The study results indicate that the power quality indices including flicker and voltage unbalance, remain within the permissible limits as mentioned in the IEC and other international standards. It is clearly mentioned that it is the responsibility of developer of Gul Ahmad Electric WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

16. It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of Gul Ahmad Electric WPP will be required to follow/implement the requirements/recommendations given in the revised Grid Code, after its approval from NEPRA and make necessary additions/modifications in the equipment/substation of Gul Ahmad Electric WPP, if any, in this regard.

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17. It is concluded on the basis of the results of the detailed system studies that the proposed interconnection scheme has no transmission system constraints in power evacuation from Gul Ahmad Electric WPP to the National Grid.

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1 Introduction

There is huge potential of wind power at Jhimpir, Gharo and in their surrounding areas in Southern Part of Pakistan. At present, about 308 MW of Wind Power Projects (WPPs) in operation, whereas, some WPPs are in testing/commission phase and many other WPPs are at different stages of implementation. In 2013, a PC-1 was prepared to propose evacuation scheme of 1756 MW of WPPs, located at Jhimpir, Gharo and near Jamshoro, to the National Grid. Out this wind capacity, a total of 500 MW WPPs located near Jamshoro was planned to be inducted by two companies, i.e., 250 MW each by M/s NBT Wind Power Pakistan-II (Pvt.) Ltd. and NBT Wind Power Pakistan-III (Pvt.) Ltd. The LOIs of these two WPPs were cancelled later due to non-achievement of the required milestones.

Ministry of Water and Power in association with AEDB, Energy Department, Government of Sindh, in April 2016, decided to allocate the 500 MW wind power capacity vacated by M/s NBT Wind Power Pakistan-II & III to the 10 Wind Power Projects (WPPs) of approx. 50 MW each at Jhimpir, district Thatta, Sindh.

The 10 WPPs comprise of ACT-2, Gul Ahmad Electric, Shaheen Foundation, Din Energy, Zulaikha Energy, Artistic, Harvey (Cacho), Norinco, Western Energy and Trans Atlantic. These ten WPPs are in addition to the already planned/under construction WPPs in Jhimpir and Gharo clusters. Afterwards, the list of the 10 WPPs was communicated to NTDCL through CPPA-G Ltd. for their information and further action at their ends.

The sponsor of Gul Ahmed WPP, i.e., M/s Gul Ahmed Electric Limited, has engaged NTDCL to carry out interconnection studies and to propose interconnection scheme for its power evacuation to the National Grid.

The site location/coordinates and other necessary technical data/information of the Gul Ahmed WPP, i.e., number, generation capacity, voltage, p.f. & type of WTGs; collector group configuration; gross & net output capacity of the plant; number &

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rating of transformers; single line diagram; switchyard voltage levels & equipment rating etc., have been provided by its sponsor and is attached in Appendix-1.

As per information provided by the project sponsor Gul Ahmad Electric WPP comprises of 20 No. WTGs and each WTG is of Goldwind make, Type-4 with 2.5MW gross capacity. The total gross generation capacity of Gul Ahmed Electric WPP is 50MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 47.7 MW.

This is the interconnection study report which has been prepared only to propose interconnection scheme for power evacuation from Gul Ahmed Electric WPP in integration with other WPPs in its vicinity. In this report, he results of load flow, short circuit, transient stability and power quality studies have been presented with the proposed interconnection scheme for evacuation of power from Gul Ahmed Electric WPP to the National Grid in the light of NEPRA Grid Code.

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2 Technical Data of Gul Ahmed Electric WPP

The project sponsor has provided the location/site coordinates, micro-siting arrangements of WTGs, proposed sketch of the WPP and detailed technical data/parameters of WTG and switchyard equipment etc. for Gul Ahmed Electric WPP which is attached in Appendix-1. The salient parameters of Gul Ahmed Electric WPP are given as under:

a) **WTG Generator Data:**

- Number of WTGs = 20
- Manufacturer/Model = Goldwind, GW 121-2.5
- Gross capacity = 2.5 MW
- Type = 4
- Voltage = 0.69 kV
- Power factor = 0.95 (Lagging/Leading)

b) **WTG Arrangement in Wind Farm**

- No. of collector groups = 4
- No. of WTGs in one collector group = 5 WTGs
- Length of each collector group with the switchyard = 3 km

c) **Total Wind Farm Capacity:**

- Total gross capacity= 50 MW
- EBOP Losses = 1.5 MW
- Auxiliary Consumption = 0.8 MW
- Total net output capacity that will flow to the Grid = 47.7 MW

d) **Generator Step-up Transformer Data:**

- No. of step-up transformers = 20
- Voltage ratio = 0.69/33 kV
- MVA rating = 2.65 MVA
- Percentage Impedance = 6.5%

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e) **Proposed Switchyard of Wind Power Project:**

- High Voltage (HV) Level = 132 kV
- Medium Voltage (MV) Level = 33 kV
- Bus Bar Scheme = Double bus single breaker
- Bus Bar capacity = 2000 Amp
- Power (HV/MV) transformer:
  - No. of transformers = 2
  - Voltage ratio = 132/33 kV
  - MVA rating = 31.5/40/50 MVA
  - Percentage Impedance = 10-12%
- Switchgear data, single line diagram and layout of switchyard attached in Appendix-1.

f) **Proposed Reactive Power Compensation**

2x10 MVAR Capacitor bank or SVC (to be decided in detailed design stage)

The other technical data/information about switchyard equipment is attached in Appendix-1.

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3 Study Objectives, Assumptions and Criteria

3.1 Study Objectives

The objectives of the interconnection study are given as under:

- To propose the transmission scheme for reliable dispersal of power from Gul Ahmed Electric WPP to the National Grid under normal and N-1 contingency conditions.
- To evaluate adequacy of the proposed interconnection scheme and to assess the impact of Gul Ahmed Electric WPP on the grid system and vice versa through load flow, short circuit, transient stability studies and power quality analyses.

3.2 Study Assumptions

The system studies are based on the following assumptions:

- Latest load forecast.
- Latest generation expansion plan.
- Latest transmission expansion plans of NTDC and DISCOs, especially HESCO.
- Export of power from NTDC to K-Electric is assumed as 650 MW.
- Interconnected transmission system has been assumed, however, split bus has been assumed at 132 kV bus bars of Hala Road and T.M. Khan Road 220/132 kV substations as per system requirements.
- The existing, under-construction and already planned WPPs at Jhimpir and Gharo clusters with their interconnection arrangements. The under-construction 220/132 kV substations, i.e., Jhimpir New (Jhimpir-1) and Gharo New, with their allied transmission lines are assumed to be commissioned.
- As per information provided by project sponsor, the total gross & net capacity of Gul Ahmed Electric WPP have been assumed as 50 MW & 47.7 MW

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respectively. The modeling of Gul Ahmed Electric WPP in PSS/E software has been made as under:

- There are a total number of 20 WTGs and four collector groups in the wind farm with each WTG having gross capacity of 2.5 MW and generating power at 0.69 kV which has been stepped up to 33 kV through 2.65 MVA transformer.
- The four collector groups comprising of 5 WTGs each have been modeled separately with equivalent gross capacity of 5 x 2.5=12.5 MW and equivalent 0.69/33 kV transformers.
- Each of the four collector groups have been connected through individual 33 kV cables with 33 kV bus bar of the 132/33 kV substation.
- The switched capacitor has been assumed at 33 kV bus bar.
- At 132/22 kV substation, 2 No. 132/33 kV transformers have been modeled separately. The percentage impedance of 132/33 kV transformer has been assumed as 12% each.

- Other WPPs in the vicinity of Gul Ahmed Electric WPP have also been modeled according to their own WTG capacities and collector group configuration.
- This interconnection study report is based on the information supplied by M/s Gul Ahmed Electric Limited and NTDCL is not responsible for the study results on account of any deficiency and/or inaccuracy of the supplied information.

3.3 Study Criteria

The interconnection studies have been carried out keeping in view of the following system operating criteria/limits in accordance with NEPRA Grid Code:

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Voltage Limits	±5% under normal and ±10% under contingency conditions. However, voltages at some generation buses and some substations may be kept upto +8% under normal operating conditions as per network configuration and/or system requirements.
Transmission Line Loading Limits	80% under normal and 100% under N-1 contingency conditions.
Transformer Loading Limits	80% under normal and 110% under N-1 contingency conditions.
Frequency Limits	49.8 – 50.2 Hz under normal condition and 49.4 – 50.5 Hz under N-1 condition.
Stability Criteria	System stability must be maintained after subjected to the following disturbances • 3-phase fault at bus bar cleared in 5-cycles/ 100 ms (normal clearing condition) and tripping of the associated circuit. • 3-phase fault at bus bar cleared in 9 cycles/180 ms (delayed clearing or stuck breaker condition) and tripping of the associated circuit.
Low Voltage Ride Through (LVRT) Requirements	• A wind power plant must withstand a voltage dip down to 30% of retained voltage for a duration of at least 100 ms for a normal clearing case, and at least 180 ms in the case of stuck breaker contingency event. • The wind power plant shall manage active power restoration, after the voltage recovery, at a rate of at least 20% of nominal output power per second, subject to availability of adequate wind speed at site.

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4 Proposed Interconnection Scheme

The following integrated interconnection scheme has been proposed for 7 WPPs lying in south of Jhimpir including Artistic, Gul Ahmad Electric, Din Energy, Zulaikha Energy, Artistic, Cacho and Trans Atlantic, keeping in view their generation capacities, the location, the existing/planned system network in its vicinity, for reliable dispersal of power from 50 MW Gul Ahmed Electric WPP to the National Grid:

- A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
- 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.
- 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir New (Jhimpir-1) – Gharo New D/C transmission line at Jhimpir-2.
- 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Gul Ahmed Electric WPP with Jhimpir-2. In this scheme, the interconnection of Gul Ahmed WPP includes 132kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out from Gul Ahmed Electric WPP on the 132 kV 132kV single circuit from Cacho WPP to Jhimpir-2.

It is intimated that lengths of the above mentioned lines are approximate and will be finalized after route survey.

The geographical diagram showing above proposed interconnection scheme for power dispersal of Gul Ahmed Electric WPP is attached as Figure #1 (Appendix-2). The google earth diagram indicating the locations/layout of the WPPs in Jhimpir area including Gul Ahmed Electric WPP is also attached in Appendix-2.

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5 Load Flow Studies

The detailed load flow studies have been carried out with the proposed interconnection scheme for various operating scenarios with maximum dispatch from all the existing/under-construction/planned WPPs in Jhimpir and Gharo clusters to evaluate the adequacy of the proposed interconnection scheme for Gul Ahmed Electric WPP for its reliable power evacuation to the National Grid. In this regard, peak load system scenarios for the years 2019 and 2021 have been simulated to evaluate the adequacy of the proposed interconnection scheme and performance of Gul Ahmed Electric WPP on the system under normal and N-1 contingency conditions. In addition, the load flow studies have also been carried out for off-peak load scenario in 2019 to analyze the impact of the Gul Ahmed Electric WPP on the system.

It is to be noted that all the load flow study Exhibits referred in the following sections are attached in Appendix-3. The results of the load flow studies for dispersal of power from Gul Ahmed Electric WPP to the National Grid are described as under:

5.1 Peak Load 2019 Scenario

Load flow study for the peak load scenario in 2019 under normal system condition has been carried out with net output of 47.7 MW from Gul Ahmed Electric WPP and is attached as Exhibit #1.0 & 1.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Gul Ahmed Electric WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Artistic WPP – Cacho WPP 132 kV S/C	32.7

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Transmission Line/Transformers	Power Flow (MW)
Zulaikha Energy WPP – Jhimpir-2 132 kV S/C	203.8
Jhimpir-1 – Jhimpir-2 220 kV S/C	167.1
Gharo New – Jhimpir-2 220 kV S/C	118.1
Jhimpir-2 – Jamshoro 220 kV S/C	237.6
Jhimpir-2 – KDA-33 220 KV S/C	377.3
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504.0
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

The active and reactive power flows from Gul Ahmed Electric WPP and other WPPs in its vicinity remain within limits.

a. N-1 Contingency Analysis

The load flow analysis has also been carried out for N-1 contingency conditions during peak load scenario of 2019. The results of contingency studies are attached as Exhibit #1.1 to 1.11 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
1.1	Gul Ahmed Electric WPP – Cacho WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
1.2	Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C out	-do-
1.3	1x50 MVA, 132/33 kV transformer at Gul Ahmed Electric WPP out	-do-

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Exhibit #	Contingency Conditions	Remarks
1.4	One collector group (5 WTGs) at Gul Ahmed Electric WPP out	-do-
1.5	Zulaikha Energy WPP – Jhimpir-2 132 kV S/C out	-do-
1.6	1x250 MVA, 220/132 kV transformer at Jhimpir-2 out	-do-
1.7	Jhimpir-2 – Jhimpir-1 220 kV S/C out	-do-
1.8	Jhimpir-2 – Gharo New 220 kV S/C out	-do-
1.9	Jhimpir-2 – Jamshoro 220 kV S/C out	-do-
1.10	Jhimpir-2 – KDA-33 220 kV S/C out	-do-
1.11	Jhimpir-1 – T.M. Khan Road 220 kV S/C out	-do-

b. Comments on Normal and N-1 Contingency Analysis

As per load flow study result, the power flows on transmission lines and transformers at/in the vicinity of Gul Ahmed Electric WPP are well within their capacities. In general, the study depicts that the voltage profile of the system and at the switchyard of Gul Ahmed Electric WPP is within limits and there would be no transmission system constraints in the flow of power from Gul Ahmed Electric WPP to the system under normal and N-1 contingency conditions.

5.2 Off-peak Load 2019 Scenario

Load flow study for the off-peak load scenario in 2019 under normal system condition has been carried out with net output of 47.7 MW from Gul Ahmed Electric WPP and is attached as Exhibit #2.0 & 2.0A. As per load flow study, the power

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flows on the transmission lines/transformers at/around Gul Ahmed Electric WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Artistic WPP – Cacho WPP 132 kV S/C	32.7
Zulaikha Energy WPP – Jhimpir-2 132 kV S/C	203.8
Jhimpir-1 – Jhimpir-2 220 kV S/C	183.9
Gharo New – Jhimpir-2 220 kV S/C	122.0
Jhimpir-2 – Jamshoro 220 kV S/C	251.4
Jhimpir-2 – KDA-33 220 kV S/C	383.9
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504.8
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

It is evident from the above table that the power flows on the 132 kV interconnection circuits of 7 WPPs including Gul Ahmed Electric WPP remain the same, however, the power flows on the 220 kV circuits and on other part of the system has varied mainly due to lower demand during off-peak load condition in 2019. The active and reactive power flows from Gul Ahmed Electric WPP and other WPPs in its vicinity remain within limits.

a. **N-1 Contingency Analysis**

The load flow analysis has also been carried out for N-1 contingency conditions during off-peak load scenario in 2019. The results of contingency studies are attached as Exhibit #2.1 to 2.11 and are summarized as under:

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Exhibit #	Contingency Conditions	Remarks
2.1	Gul Ahmed Electric WPP – Cacho WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
2.2	Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C out	-do-
2.3	1x50 MVA, 132/33 kV transformer at Gul Ahmed Electric WPP out	-do-
2.4	One collector group (5 WTGs) at Gul Ahmed Electric WPP out	-do-
2.5	Zulaikha Energy WPP – Jhimpir-2 132 kV S/C out	-do-
2.6	1x250 MVA, 220/132 kV transformer at Jhimpir-2 out	-do-
2.7	Jhimpir-2 – Jhimpir-1 220 kV S/C out	-do-
2.8	Jhimpir-2 – Gharo New 220 kV S/C out	-do-
2.9	Jhimpir-2 – Jamshoro 220 kV S/C out	-do-
2.10	Jhimpir-2 – KDA-33 220 kV S/C out	-do-
2.11	Jhimpir-1 – T.M. Khan Road 220kV S/C out	-do-

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b. Comments on Normal and N-1 Contingency Analysis

As per load flow study result, the power flows on transmission lines and transformers in the vicinity of Gul Ahmed Electric WPP are well within their capacities. In general, the study depicts that the voltage profile of the system is within limits and there would be no transmission system constraints in the flow of power from Gul Ahmed Electric WPP to the system under normal and N-1 contingency conditions.

5.3 Peak Load 2021 Scenario

Load flow study for the peak load scenario in 2021 under normal system condition has been carried out with net output of 47.7 MW from Gul Ahmed Electric WPP and is attached as Exhibit #3.0 & 3.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Gul Ahmed Electric WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Artistic WPP – Cacho WPP 132 kV S/C	32.7
Zulaikha Energy WPP – Jhimpir-2 132 kV S/C	203.8
Jhimpir-1 – Jhimpir-2 220 kV S/C	111.4
Gharo New – Jhimpir-2 220 kV S/C	105.3
Jhimpir-2 – Jamshoro 220 kV S/C	247.4
Jhimpir-2 – KDA-33 220 kV S/C	299.4
Jhimpir-1 – T.M.Khan Road 220 kV D/C	533.4
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

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The active and reactive power flows from Gul Ahmed Electric WPP and other WPPs in its vicinity remain within limits.

a. N-1 Contingency Analysis

The load flow studies have also been carried out for N-1 contingency analysis during peak load scenario of 2021 in the vicinity of Gul Ahmed Electric WPP. The results of contingency studies are attached as Exhibit #3.1 to 3.11 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
3.1	Gul Ahmed Electric WPP – Cacho WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
3.2	Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C out	-do-
3.3	1x50 MVA, 132/33 kV transformer at Gul Ahmed Electric WPP out	-do-
3.4	One collector group (5 WTGs) at Gul Ahmed Electric WPP out	-do-
3.5	Zulaikha Energy WPP – Jhimpir-2 132kV S/C out	-do-
3.6	1x250 MVA, 220/132 kV transformer at Jhimpir-2 out	-do-
3.7	Jhimpir-2 – Jhimpir-1 220 kV S/C out	-do-
3.8	Jhimpir-2 – Gharo New 220 kV S/C out	-do-

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Exhibit #	Contingency Conditions	Remarks
3.9	Jhimpir-2 – Jamshoro 220 kV S/C out	-do-
3.10	Jhimpir-2 – KDA-33 220 kV S/C out	-do-
3.11	Jhimpir-1 – TM.Khan Road 220 kV S/C out	-do-

b. Comments on Normal and N-1 Contingency Analysis

As per load flow study results, the power flows on transmission lines and transformers in the vicinity of Gul Ahmed Electric WPP are well within their capacities. In general, the study depicts that the voltage profile of the system is within limits and there would be no transmission system constraints in the flow of power from Gul Ahmed Electric WPP to the system under normal and N-1 contingency conditions.

5.4 Conclusions of Load Flow Analysis

The proposed interconnection scheme for evacuation of power from 50 MW Gul Ahmed Electric WPP to the National Grid has been found reliable in various operating scenarios under normal and N-1 contingency conditions with no transmission system constraints.

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6 Short Circuit Studies

The short circuit studies have been carried out with proposed Interconnection scheme of Gul Ahmed Electric WPP to compute the maximum three phase and single phase short circuit levels at the switchyard of Gul Ahmed Electric WPP and other substations in its vicinity. The studies have been carried out with all the existing and planned generation in operation and with interconnected transmission system. The minimum three phase and single phase short circuit levels have also been carried out at the 132 kV switchyard of Gul Ahmed Electric WPP for various number of WTGs in operation and reduced generation in its vicinity.

6.1 Methodology and Assumptions

The methodology of IEC 909 has been applied in short circuit analysis for which provision is available in the PSS/E software used for these studies. The maximum and minimum short circuit currents have been calculated with the following assumptions under IEC 909 standard:

- Set tap ratios to unity
- Set line charging to zero
- Set shunt to zero in positive sequence
- The voltage magnitude at bus bars set equal to 1.10 p.u for maximum short circuit analysis and 0.9 p.u for minimum short circuit analysis.

In the short circuit analysis, the parameters of generator and step-up transformer for Gul Ahmed Electric WPP, have been assumed as per information provided by its sponsor, attached in Appendix-1. The results of maximum and minimum short circuit studies with necessary details are presented in Appendix-4.

6.2 Short Circuit Study Results

The short circuit studies have been carried out with proposed Interconnection scheme and by using the above parameters for generator and step-up transformer to compute the maximum three phase and single phase short circuit levels at the 132 kV switchyard of Gul Ahmed Electric WPP and other substations in its vicinity.

The studies have been carried out for the year 2021-22 with all the existing and planned generation in operation and with interconnected transmission system except 132 kV split buses at 220/132 kV substations of Hala Road and T.M. Khan Road. The results of maximum short circuit studies for the year 2021-22 are summarized as under:

Maximum Short Circuit Levels

Name of Faulted Bus Bars	Maximum Short Circuit Levels	
	Three Phase (kA)	Single Phase (kA)
Gul Ahmed Electric WPP 132 kV	9.42	6.26
Cacho WPP 132 kV	7.58	4.85
Artistic WPP 132 kV	7.19	4.58
Jhimpir-2 220 kV	18.96	11.47
Jhimpir-2 132 kV	15.48	12.01
Jhimpir-1 220 kV	19.89	11.66
Jhimpir-1 132 kV	27.59	13.56

The minimum three phase and single phase short circuit levels have also been computed for system scenario of 2019 at the 132 kV switchyard of Gul Ahmed Electric WPP with all WTGs and one WTG in operation; and with reduced generation in operation in its vicinity. The minimum short circuit levels at the 132 kV switchyard of Gul Ahmed Electric WPP are tabulated as under:

Minimum Short Circuit Levels at Gul Ahmed Electric 132 kV Bus

WTGs in Operation at Gul Ahmed Electric WPP	Minimum Short Circuit Levels	
	Three Phase (kA)	Single Phase (kA)
All WTGs	7.83	4.89
One WTG	7.69	4.80

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6.3 Conclusions of Short Circuit Analysis

It is evident from the short circuit analysis that the induction of Gul Ahmed Electric WPP has no adverse impact on the existing and proposed substations in its vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Gul Ahmed Electric WPP are 9.42 kA and 6.26 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Gul Ahmed Electric WPP.

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7. Transient Stability Studies

Transient stability studies have been carried out with the proposed interconnection scheme to evaluate the dynamic response of generators and the power system after occurrences of faults. The transient stability simulations are used to check in time domain whether the generators at and in the vicinity of Gul Ahmed Electric WPP as well as the power system remain stable after subjected to severe disturbances as per Grid Code requirement.

7.1 Study Methodology

The dynamic simulation model of the entire network has been developed in the PSS/E software. The dynamic model parameters of WTG Type-4 used for Gul Ahmed Electric WPP, in the studies are attached in Appendix-5. On the other hand, the dynamic models/parameters of generators, exciters and governors of all the other power plants, already available in Planning (Power) NTDCL, have been used in the studies.

Two worst types of disturbances have been simulated to assess the stability of the Gul Ahmed Electric WPP and the power system as per NEPRA grid code criteria which are given as under:

- 3-phase fault at bus bar cleared in 5-cycles (100 ms) and tripping of the associated circuit.
- 3-phase fault at bus bar cleared in 9 cycles (180 ms) (delayed clearing or stuck breaker condition) and tripping of the associated circuit.

The simulations have been run in the time domain in the following sequence:

- Running simulation for initial one second for pre-fault steady state condition.
- Fault application at 1.0 second and running the simulation upto 1.1 second for 5 cycle fault (up to 1.18 second for 9 cycle fault).
- Fault clearance at 1.1 second for 5 cycle fault (1.18 second for 9 cycle fault) and tripping of the associated circuit.

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- Running simulation up to 10 seconds after fault clearance.

The following generator and network parameters are monitored in the simulations and have been presented in the report through the following stability plots for each type of disturbance:

i. Bus frequency and voltage
ii. WTG (speed, active and reactive power output, LVACR Sensor voltage)
iii. Line power flows, i.e., P (MW) & Q (MVAR)
iv. Conventional thermal generator rotor angle

In order to interpret the stability plots, the bus numbers assigned to the bus bars and the voltage levels, are given as under:

Bus Number	Bus Name / Voltage
81111	Gul Ahmed-E /132 kV
811111	Gul Ahmed-E MV/ 33kV
811116, 811117 811118, 811119	Gul Ahmed-E LV/ 0.69 kV
81112	Cacho / 132 kV
8111	Jhimpir-2 / 132 kV
811	Jhimpir-2 / 220kV
9429	Jhimpir-1 / 220kV
800	Jamshoro / 220 kV
900	KDA-33 / 220 kV
530	M.Garh / 220 kV
90	Hub / 500 kV

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7.2 Transient Stability Analysis Results

The transient stability analysis for Gul Ahmed Electric WPP with the proposed interconnection scheme has been carried out for peak load 2019 scenario. The stability of the Gul Ahmed Electric WPP and the power system has been tested with application of different disturbances on the wind farm and at the substations in its vicinity. The plotted results of the stability simulations are attached in Appendix-6 and described as under:

(i) For Normal Clearing Time (100 ms)

The transient stability studies for faults with normal clearing time of 100 ms corresponding to 5 cycles, have been carried out. The details of the faults & the associated outages, monitored variables, respective exhibits and stability behavior of Gul Ahmed Electric WPP & other generators as well as the power system are mentioned and presented in the following table:

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
1	Gul Ahmed Electric WPP 132 kV Bus	Gul Ahmed Electric WPP – Cacho WPP 132 kV S/C	1.1	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			1.2	Bus Voltage	
			1.3	WTG collector group Output (P&Q)	
			1.4	LVACR	
			1.5	Line Power Flow (P & Q)	
			1.6	Rotor Angle	
2	Gul Ahmed Electric WPP 132 kV Bus	Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	1.7	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			1.8	Bus Voltage	
			1.9	WTG collector group Output (P&Q)	

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Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			1.10	LVACR	
			1.11	Line Power Flow (P & Q)	
			1.12	Rotor Angle	
3	Gul Ahmed Electric WPP 132 kV Bus	One 132/33kV T/F at Gul Ahmed Electric 132 kV out	1.13	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			1.14	Bus Voltage	
			1.15	WTG collector group Output (P&Q)	
			1.16	LVACR	
			1.17	Line Power Flow (P & Q)	
			1.18	Rotor Angle	
4	Gul Ahmed Electric WPP 33 kV MV Bus	One Collector Group comprising of 5 WTGs at Gul Ahmed Electric WPP	1.19	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			1.20	Bus Voltage	
			1.21	WTG collector group Output (P&Q)	
			1.22	LVACR	
			1.23	Line Power Flow (P & Q)	
			1.24	Rotor Angle	
5	Jhimpir-2 220 kV Bus	Jhimpir-2 - Jhimpir-1 220 kV S/C	1.25	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			1.26	Bus Voltage	
			1.27	Line Power Flow (P & Q)	
			1.28	Rotor Angle	
			1.29	WTG collector group Output (P&Q)	
6	Jhimpir-2	Jhimpir-2 - Gharo New	1.30	Bus Frequency	Gul Ahmed

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Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
	220 kV Bus	220 kV S/C	1.31	Bus Voltage	Electric WPP and NTDCL system remain stable.
			1.32	Line Power Flow (P & Q)	
			1.33	Rotor Angle	
			1.34	WTG collector group Output (P&Q)	
7	Jhimpir-2 220 kV Bus	Jhimpir-2 - Jamshoro 220 kV S/C	1.35	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable
			1.36	Bus Voltage	
			1.37	Line Power Flow (P & Q)	
			1.38	Rotor Angle	
			1.39	WTG collector group Output (P&Q)	
8	Jhimpir-2 220 kV Bus	Jhimpir-2 - KDA-33 220 kV S/C	1.40	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable
			1.41	Bus Voltage	
			1.42	Line Power Flow (P & Q)	
			1.43	Rotor Angle	
			1.44	WTG collector group Output (P&Q)	
9	Jhimpir-1 220 kV Bus	Jhimpir-1 – T.M. Khan Road 220 kV S/C	1.45	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable
			1.46	Bus Voltage	
			1.47	Line Power Flow (P & Q)	
			1.48	Rotor Angle	
			1.49	WTG collector group Output (P&Q)	

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It is evident from the above stability Exhibits that Gul Ahmed Electric WPP meets LVRT requirements as mentioned in the NEPRA Grid Code Addendum for WPPs.

(ii) For Delayed Clearing Time (180 ms)

The transient stability studies for faults with delayed clearing time of 180 ms corresponding to 9-cycle fault (stuck breaker condition) have been carried out. The details of the faults & the associated outages, monitored variables, respective exhibits and stability behavior of Gul Ahmed Electric WPP & other generators as well as the power system are mentioned and presented in the following table:

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
1	Gul Ahmed Electric WPP 132 kV Bus	Gul Ahmed Electric WPP – Cacho WPP 132 kV S/C	2.1	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			2.2	Bus Voltage	
			2.3	WTG collector group Output (P&Q)	
			2.4	LVACR	
			2.5	Line Power Flow (P & Q)	
			2.6	Rotor Angle	
2	Gul Ahmed Electric WPP 132 kV Bus	Gul Ahmed Electric WPP- Jhimpir-2 132 kV S/C	2.7	Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			2.8	Bus Frequency	
			2.9	WTG collector group Output (P&Q)	
			2.10	LVACR	
			2.11	Line Power Flow (P & Q)	
			2.12	Rotor Angle	
3	Gul Ahmed Electric WPP 132 kV Bus	One 132/33kV T/F at Gul Ahmed Electric 132 kV out	2.13	Bus Frequency	Gul Ahmed Electric WPP and NTDCL
			2.14	Bus Voltage	

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Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			2.15	WTG collector group Output (P&Q)	system remain stable.
			2.16	LVACR	
			2.17	Line Power Flow (P & Q)	
			2.18	Rotor Angle	
4	Gul Ahmed Electric WPP 33 kV MV Bus	One Collector Group comprising of 5 WTGs at Gul Ahmed Electric WPP	2.19	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			2.20	Bus Voltage	
			2.21	WTG collector group Output (P&Q)	
			2.22	LVACR	
			2.23	Line Power Flow (P & Q)	
			2.24	Rotor Angle	
5	Jhimpir-2 220 kV Bus	Jhimpir-2 - KDA-33 220 kV S/C	2.25	Bus Frequency	Gul Ahmed Electric WPP and NTDCL system remain stable.
			2.26	Bus Voltage	
			2.27	Line Power Flow (P & Q)	
			2.28	Rotor Angle	
			2.29	WTG collector group Output (P&Q)	

It is evident from the above stability Exhibits that Gul Ahmed Electric WPP meets LVRT requirements as mentioned in the NEPRA Grid Code Addendum for WPPs.

7.3 Conclusions of Transient Stability Analysis

The results of transient stability analysis indicate that the Gul Ahmed Electric WPP & other generators in its vicinity and the power system remain stable with no adverse effects after subjected to severe disturbances either on Gul Ahmed Electric WPP or

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at the other substations in its vicinity. The stability simulations also prove that Gul Ahmed Electric WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

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8 Power Quality Analysis

The power quality analysis is very important for a wind power plant that may cause flicker and distortions in the power supply. These issues become more significant for weak power systems having low short circuit strength. Therefore, power quality analysis including flicker and voltage unbalance, has been carried out with the proposed interconnection scheme of 50 MW Gul Ahmed Electric WPP for the worst case scenario of minimum system short circuit levels in 2019.

8.1 Flicker

IEC61400-21 standard have been used for the calculation of flicker levels for steady-state continuous operation. The probability of 99th percentile flicker emission from a single inverter during continuous operation for short time $P_{st\Sigma}$ and long time flicker level $P_{lt\Sigma}$ are assumed same and calculated by the following formula:

$$P_{st\Sigma} = P_{lt\Sigma} = \frac{1}{S_k} \cdot \sqrt{\sum_{i=1}^{N_{wt}} (c_i(\psi_k, \upsilon_a) . S_{n,i})^2} \qquad \text{(A)}$$

Where

S_n is the rated apparent power of the WTG

S_k is the short-circuit apparent power at PCC

N_{wt} is the number of WTGs connected to the PCC

The value of c (φ_k) may not be greater than 1, therefore for the present analysis, the value of 1 for the worst case has been assumed. PCC is the point of common coupling which is 132 kV bus of the switchyard of 50 MW Gul Ahmed Electric WPP.

For the minimum short circuit case, the system network in the vicinity of 50 MW Gul Ahmed Electric WPP has been modeled with minimum generation in operation. The short circuit calculations have been done at 0.9 p.u. voltage. The values used in the calculation of flicker are as below:

S_n = 2.632 MVA

N_{WT} = 20

S_k = 1790.67 MVA

Using the above data in Equation (A), we get

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$P_{st\Sigma} = P_{lt\Sigma} = 0.006573 = 0.66\ \%$

Whereas, the acceptable value in IEC Standard is less than 4%. Therefore, the flicker level is far less than the maximum permissible limit which implies that the inverters at 50 MW Gul Ahmed Electric WPP would not cause any flicker problem during steady state operation even in the weakest system conditions.

8.2 Voltage Unbalance

(i) Voltage Step-Change

The voltage step-change occurs when only a single WTG is energized. The value of voltage change depends on the impedance of the network from the connection point to Point of Common Coupling (PCC). The PCC is 132 kV bus of Gul Ahmed Electric WPP. The Voltage step-change should be less than or equal to 3% and this condition is evaluated by using the following formula:

$$\Delta V = \sum Swka\ \left[\left(\frac{1}{Ske}\right) - \left(\frac{1}{Skss}\right)\right] \leq 3\% \qquad \text{(B)}$$

Where

S_{wka} is the MVA rating of the inverter

S_{ke} is the Short Circuit MVA at connection point

S_{kss} is the Short circuit MVA at PCC

The values used in the calculation of voltage step-change are as below:

S_{wka} = 2.632 MVA

S_{ke} = 420.18 MVA

S_{kss} = 1758.53 MVA

Using the above data in Equation (B), we get

$\Delta V = 0.004767 = 0.48\ \%$

The voltage step-change is less than the maximum permissible limit of 3% which implies that the WTG would not cause any voltage step-change problem.

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(ii) Voltage Fluctuation

The voltage fluctuation has been calculated assuming only one WTG in operation, using the following equation and it is found to be within permissible limits.

$$Volatge\ Fluctuation = \sqrt{\sum\left(\frac{Pwka}{Ske}\right)^2} \quad \leq 1/25 \ \text{or} \ 4\% \qquad \text{(C)}$$

Where

P_{wka} is the MW rating of WTG

S_{ke} is the Short Circuit MVA at connection point

The values used in the calculation of voltage fluctuation are as below:

P_{wka} = 2.5 MW

S_{ke} = 420.18 MVA

Using the above data in Equation (C), we get

Voltage Fluctuation = 0.00595 = 0.59%

The value of voltage fluctuation is less than the maximum permissible limit of 4% which implies that the WTG would not cause any voltage step-change problem.

8.3 Conclusions of Power Quality Analysis

The important power quality indices like flicker and voltage unbalance have been computed with Gul Ahmed Electric WPP and compared with limits given in IEC and other international standards. The study results indicate that the levels of flicker and voltage unbalance are within permissible limits, with the interconnection of subject WPP.

It is added that it is the responsibility of developer of the Gul Ahmed Electric WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

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9 Overall Conclusions and Recommendations

i) On the basis of detailed interconnection studies, the following integrated interconnection scheme of the 7 WPPs lying in southern part of Jhimpir including Gul Ahmed Eectric WPP, has been found reliable for power evacuation to the National grid:

- A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
- 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.
- 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.
- 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Gul Ahmed Electric WPP with Jhimpir-2. In this scheme, the interconnection of Gul Ahmed Electric WPP includes 132 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out from Gul Ahmed Electric WPP on the 132 kV single circuit from Cacho WPP to Jhimpir-2.

ii) The above proposed interconnection scheme is expected to be completed in Dec. 2019. It is added that the expected timeline of the proposed interconnection scheme may be extended depending on variation in completion of the related activities, i.e., preparation and approval of PC-1, funding arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.

iii) The results of detailed load flow studies for various operating scenarios indicate that the power from Gul Ahmed Electric WPP can be dispersed to the National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints. The voltage profile, line

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loading, frequency and active/reactive power flow etc. from Gul Ahmed Electric WPP and on the grid are within the NEPRA Grid Code criteria.

iv) The bus bar rating and normal rated current for switchgear equipment in the 132 kV switchyard of Gul Ahmed Electric WPP are recommended as 2500 Amperes.

v) The results of short circuit studies indicate that Gul Ahmed Electric WPP and its surrounding WPPs have no adverse impact on the existing and proposed substations in their vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Gul Ahmed Electric WPP are 9.42 kA and 6.26 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Gul Ahmed Electric WPP.

vi) The results of transient stability analysis indicate that Gul Ahmed Electric WPP & other power plants in its vicinity and the power system remain stable with no adverse effects after subjected to severe disturbances either on Gul Ahmed Electric WPP or at the other substations in its vicinity. The stability simulations also proved that Gul Ahmed Electric WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

vii) The important power quality indices like flicker and voltage unbalance have been computed with Gul Ahmed Electric WPP. The study results indicate that the levels of flicker and voltage unbalance are within permissible limits as mentioned in the IEC and other international standards, with the proposed interconnection of Gul Ahmed Electric WPP. It is clearly mentioned that it will be the responsibility of developer of the Gul Ahmed Electric WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

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viii) It is concluded on the basis of the results of the detailed system studies that the proposed interconnection scheme has no transmission system constraints in power evacuation from Gul Ahmed Electric WPP to the National Grid.

ix) It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of Gul Ahmed Electric WPP will be required to follow/implement the requirements/recommendations given in the revised Grid Code, after its approval from NEPRA and make necessary additions/modifications in the equipment/substation of Gul Ahmed Electric WPP, if any, in this regard.

x) In view of the huge wind potential at Jhimpir & in its surrounding areas, the power system network around Gul Ahmed Electric WPP will be developed in future. Therefore, there may be possibility of modification in the interconnection arrangement of Gul Ahmed Electric WPP in future, if needed necessary as per system requirements.

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ANNEXURE – N
PLANT CHARACTERISTICS

[PLANT CHARACTERISTICS; Generation Voltage, Frequency, Power Factor, Automatic Generation Control, Ramping Rate, Alternative Fuel, Auxiliary Consumption, Time Required To Synchronize The Grid]

S. No.		
1	Generation Voltage	690 V
2	Frequency	50 Hz
3	Power Factor	0.95 leading - lagging
4	Automatic Generation Control	Pitch controlled
5	Ramping rate	As per grid code
6	Alternative Fuel	NA
7	Aux. consumption	800 kW
8	Time required to synchronize to the grid	As per grid code

Gul Ahmed Electric Ltd.
Karachi

ANNEXURE – O
INFORMATION REGARDING CONTROL, METERING, INSTRUMENTATION & PROTECTION

S. No.		
1	Metering	0.2S for revenue metering
2	Protection	Line distance/differential relay with overcurrent/earth fault backup protection
3	Instrumentation	5P20 for protection application

Gul Ahmed Electric Ltd. Karachi

ANNEXURE – P
PROSPECTUS

Gul Ahmed Electric Ltd. Karachi

PROSPECTUS

All stakeholders interested / effected persons and the general public are notified that the authority has admitted the application of Gul Ahmed Electric Limited (Project Company) for consideration of grant of generation license to finance, design, engineer, procure, construct, install, test, complete and commission a 50 MW wind power generation facility to be located at Jhampir, District Thatta, Sindh. All stakeholders interested/ effected persons and the general public are invited to submit their comments for/or against the grant of license. The comments should be submitted to the registered office of National Electric Power Regulatory Authority within a period of 14 days from the date of this publication.

Brief of prospectus including salient features of the Project Company is as under.

BRIEF INTRODUCTION OF THE APPLICANT

The Project Company is a public limited company (unlisted) incorporated in Pakistan and registered under the Companies Ordinance, 1984. The Project Company has been specifically established to undertake wind power generation business and activities in Pakistan. The business office of the Project Company is 7th Floor, Al-tijarah Centre, 32-1-A, Block 6, P.E.C.H.S, Main Sharae Faisal, Karachi, Pakistan.

Brief Sponsor Profile

Gul Ahmed Energy Limited (The Project Sponsor) is the Sponsor of the Project Company with 100% shareholding in the Project Company. The Project Company is the second wind power project being set up by the Project Sponsor, the first being a 50 MW wind power project Gul Ahmed Wind Power Limited (GAWPL). Brief profile of the Project Sponsor is given below:

Gul Ahmed Energy Limited

Gul Ahmed Energy Limited (GAEL) is a 136 MW RFO private power plant at Korangi Industrial Area of Karachi on a BOO basis. GAEL is owned by the Gul Ahmed Energy Group (56.84%), Toyota Tsusho Corporation (18.63%), Tomen Power Singapore (12.77%), Habib Bank A.G. Zurich (10.84%) and Wartsila (0.92%).

GAEL achieved COD in November 1997 and has successfully completed over 19 years of operation and has also timely paid off its entire debt on time.

Gul Ahmed Energy Group

Gul Ahmed Energy Group has been engaged in a diversified portfolio of businesses including trade, manufacturing, banking, industries, and investments since 1948 with Iqbal Alimohamed being largely involved in power and energy businesses of the group.

The Gul Ahmed Energy Group consists of about 50 individuals having a collective shareholding of 56.8% in GAEL.

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The Gul Ahmed Energy Group intends to continue its growth initiatives in the power sector; it has created a special purpose company: Gul Ahmed Wind Power Limited (GAWPL) for developing a 50 MW wind generation farm in Jhimpir, which is already in the operations phase and achieved COD in the 4th Quarter of 2016. In case of GAWPL, IFC and PROPARCO are the Lead Foreign Lenders while United Bank Limited is the Lead Local Lender while IFC also holds 9.9% Equity in GAWPL.

Apart from GAWPL and the Project Company, the Gul Ahmed Energy Group is also involved in the development of Gul Ahmed Solar Power Limited (50 MW Solar Project).

SALIENT FEATURES OF THE FACILITY

Plant Details – 50 MW.

Project Name – Gul Ahmed Electric Limited.

Project Location – Jhimpir, District Thatta, Sindh, Pakistan.

Technology – 20 x Goldwind WTG GW 121-2.5, electrical equipment, together with ancillary equipment and other goods and machinery.

Proposed Capacity / Annual Capacity Factor – 50 MW / 35%

Dispatch / Power Purchaser – CPPA-G

Total Project Cost – US$ 90,000,000 (United States Dollars Ninety Million)

Debt to Equity Ratio – 80:20

No. of Units and Turbines – 20 x Goldwind WTG GW 121-2.5

PROPOSED INVESTMENT

The Total Project Cost of US$ 90,000,000 (United States Dollars Ninety Million) is to be financed in a debt to equity ratio of 80:20, which is in accordance with the RE Policy 2006.

SOCIAL AND ENVIRONMENTAL IMPACT

The proposed Project will not have any negative social or environmental impact. Project Company has also obtained approval of Initial Environmental Examination (IEE) from Environmental Protection Agency, Government of Sindh

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The proposed Project has the advantage of being located in the Wind Corridor and thus will, following its completion, contribute towards relieving the shortage of electric power in the country.

Based on a thorough analysis of the national electricity generation structure and in light of technical parameters, it is anticipated that the Project shall operate as one of the most competitive independent power producers in Pakistan.

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ANNEXURE – Q
RECOMMENDATION LETTER FROM EDGOS TO NEPRA FOR THE AWARD OF UPFRONT TARIFF

Gul Ahmed Electric Ltd. Karachi

Ph: 021-99206449

NO. DAE/Wind/84/2015
GOVERNMENT OF SINDH
Directorate of Alternative Energy
ENERGY DEPARTMENT
Karachi, dated May 18, 2016

SAY NO TO CORRUPTION

The Registrar,
National Electric Power Regulatory Authority
NEPRA Tower Attaturk Avenue (East),
Sector G-5/1,
Islamabad.

Subject: RECOMMENDATION LETTER FOR AWARD OF UPFRONT TARIFF.

Reference is made to the letter received from M/S Gul Ahmed Electric Limited dated May 13, 2016. Wherein the project company has requested Directorate of Alternative Energy, Energy Department Government of Sindh for issuance of recommendation letter in favour of the 50 MW wind power project M/S Gul Ahmed Electric Limited for award of upfront tariff.

2. The Directorate of Alternative Energy, Energy Department Government of Sindh hereby confirms that M/S Gul Ahmed Electric Limited is holding a valid LOI for its 50 MW wind power project in Jhampir, Thatta and recommends M/S Gul Ahmed Electric Limited for grant/award of upfront tariff.

3. The EPC contractor and Wind Turbine Generator (WTG) supplier of M/S Gul Ahmed Electric Limited have certified that they will provide brand new WTGs for the 50MW wind power project of M/S Gul Ahmed Electric Limited. They have also certified that the WTGs and its related equipment will be reliable, efficient and of highest international standards with proven technology. The copy of certificates in this regard is attached as **Annex-A & B.**

4. Through documents provided, Directorate of Alternative Energy, Energy Department Government of Sindh has noted that the wind turbines proposed by M/S Gul Ahmed Electric Limited for its 50 MW projects are internationally certified as per IEC standards. The turbines have not been imported yet; the sponsor has informed that they will import new turbines of acceptable quality. Physical inspection is the responsibility of power purchaser.

5. This letter is issued upon the request of M/S Gul Ahmed Electric Limited, processing for award of upfront tariff and generation license. Please feel free to contact for any query in this regard.

Encl: As above

(Engr. Mehfooz A. Qazi)
Director (Alternative Energy)

Copy for information:

- Mr. Ubaid Amanullah, Executive Director, M/S Gul Ahmed Electric Ltd.
- PS to Secretary, Energy Department, Govt. of Sindh.

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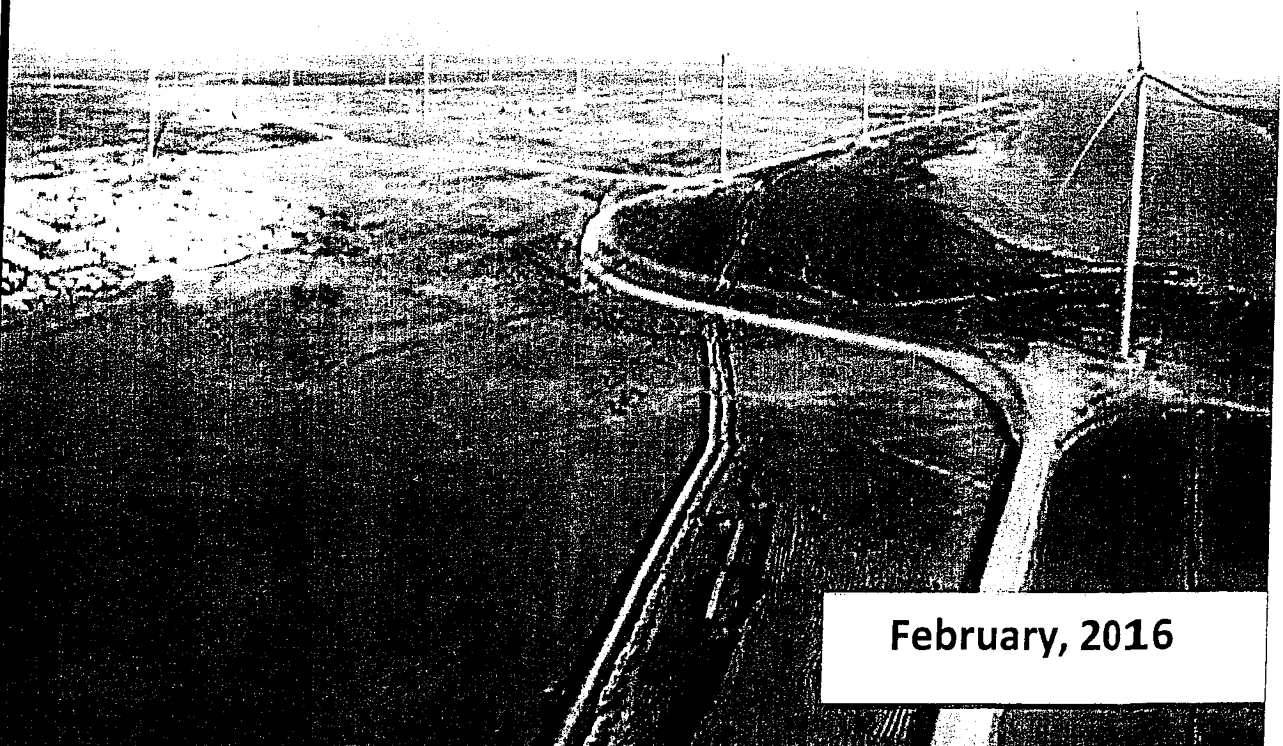
GUL AHMED ELECTRIC LIMITED

GENERATION LICENSE APPLICATION

Gul Ahmed Electric Ltd Karachi

ORIGINAL

INITIAL ENVIRONMENTAL EXAMINATION (IEE) OF 50 MW WIND POWER PROJECT IN JHIMPIR, SINDH PAKISTAN



February, 2016

PROJECTCOMPANY

Gul Ahmed Electric Limited

PROJECT CONSULTANTS

Renewable Resources (Pvt.) Ltd

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Disclaimer Notice

This report has been prepared for the benefit of (GEL) Gul Ahmed Electric Limited (the "Client"), and may not be relied upon or disclosed to any other person for any purpose, other than as stated below, without the Client's prior written consent in each specific case. The information contained in this report is intended for purposes of seeking an approval from the Environment Protection Agency in accordance with the requirements of the Pakistan Environment Protection Act, 1997, and may be used by the Client for such other purpose as may be necessary for the development and implementation of the Project.

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Prepared in February, 2016

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APPROVAL SHEET

TITLE : Initial Environmental Examination (IEE) of 50 MW Wind Power Project in Jhampir Sindh Pakistan

DOCUMENT NUMBER : RE2/131/170/001 Issue: 01

CLASSIFICATION : **UN CLASSIFIED**

SYNOPSIS : This document is a report on Initial Environmental Examination (IEE) of 50 MW Wind Power Project in Jhimpir Sindh, Pakistan. Project is owned by Gul Ahmed Energy Limited (GAEL). The report is Prepared by Renewable Resources (Pvt.) Ltd.

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DATE : February, 2016

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LIST OF TABLES

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AEDB	Alternative Energy Development Board
CBD	Convention on Biological Diversity
CITES	Convention on Trade of Endangered Species
CLs	Core Labor Standards
Db	Decibel
DMC	Developing Member Countries
EIA	Environmental Impact Assessment
EHS	Environment Health and Safety
EMP	Environment Management Plan
ESMC	Environmental and Social Management Cell
EPA	Energy Purchase Agreement
EMMP	Environment Monitoring and Management Plan
GAD	Gender and Development
GHG	Greenhouse Gas Emissions
GRM	Grievance Redressal Mechanism
IEE	Initial Environmental Examination
IFC	International Finance Corporation
JICA	Japan International Cooperation Agency
Km	Kilometers
LAA	Land Acquisition Act
LOS	Law of Seas
MEA	Multilateral Environmental Agreements
MW	Mega Watt

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MWh	Mega Watt Hour
NCS	National Conservation Strategy
NEP	National Environmental Policy
NEQS	National Environmental Quality Standards
NGO	Non-Government Organization
Nox	Nitrate Oxides
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
O & M	Operation and Maintenance
OPIC	Overseas Private Investment Corporation
PEPA	Pakistan Environment Protection Act
POPs	Persistent Organic Pollutants
Pak-EPA	Pakistan Environment Protection Agency
PV	Photo Voltaic
RE2	Renewable Resources (Pvt.) Ltd
SCR	Social Complaint Register
SHEE	Safety Health Environment and Energy
Sox	Sulfur Oxides
WWF	World Wildlife Foundation

EXECUTIVE SUMMARY

Introduction

This document is an *Initial Environmental Examination* IEE of a *50 MW Wind Power Project* (Project) being developed by Gul Ahmed Electric Limited (GEL) in Jhimpir, Sindh Pakistan.

The sponsor of the Project is Gul Ahmed Energy Limited (GAEL).

GUL Ahmed Electric Limited is developing a 50MW wind farm located in Jhimpir, District Thatta.

Gul Ahmed Electric Limited (GEL) is an SPV formed for developing 50MW Wind Power Project. GEL is a wholly owned subsidiary of Gul Ahmed Energy Limited (GAEL).

Gul Ahmed Energy is interested to setup a Wind Power Project of 50 MW Capacity in Jhimpir, Sindh, Pakistan.

Consultant

Renewable Resources is the Project consultant engaged for Project development including the Initial Environmental examination (IEE) of the Project.

The contact details of consultant are given below;

Renewable Resources (Pvt.) Ltd	
Islamabad Office	No.7, Street No.48, F-7/4, Islamabad – Pakistan Tel: 0092 51 8358591 Fax: 0092 51 8358592
Karachi Office	86/I Khayaban-e-Behria, Phase V, Karachi – Pakistan Tel: 0092 21 35347122 Fax: 0092 21 35347123
Website	www.renewableresources.com.pk
Contact Person	Irfan Afzal Mirza, CEO
Email	irfanmirza@renewableresources.com.pk

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Project Sponsors

The Project Sponsors are the Ltd liability company incorporated under the laws of Pakistan, called Gul Ahmed Energy Limited (GAEL). Contact details are as follows;

Gul Ahmed Energy Limited	
Address	Address: 7th floor, Al-Tijarah Centre, 32-1-A, Block 6, P.E.C.H.S., Main Shara-e-Faisal, Karachi. Ph: 92 21 34540270-73 Fax:+92 21 34540274 Email: newprojects.team@gaenergy.com
Contact Persons	Mr. Ubaid Amanullah Email: ubaid.amanullah@gaenergy.com Mr. Danish Iqbal Email: danish.iqbal@gaenergy.com

Study Methodology

The study was conducted using standard methodology prescribed by national and international agencies to facilitate the review of identified environmental issues. This entailed an understanding and description of the environment within the activities which will occur or potentially have influence on the social and biological environment. The IEE study was conducted in four phases.

- Phase-I involved the definition and categorization of the Project components, collection of baseline data and information of the defined Project area through physical survey and consultation with the local inhabitants near the Project area.
- Phase-II involved the laboratory analysis of the different environmental parameters which includes (Ambient Air Monitoring, Ambient Noise, and Water quality analysis of the project area.
- Phase-III involved assessment of potential impact assessment of the pre-construction, construction, operation and Decommission phase of the Project.
- Phase-IV involved the mitigation measures, formulation and monitoring of an Environmental Management Plan (EMP) to minimize the environmental impacts of the Project during construction and operation phase.

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The approach of IEE study includes the following steps:

- Describing the Project and details of Project Proponents
- Review of applicable Statutory Requirements and compliances
- Establishing environmental baseline conditions through survey and consultation with the local stakeholders
- Scoping the issues and establishing the boundaries of the assessment
- Review of Project Alternatives
- Assessing the potential environmental effects of the Project, including residual and cumulative effects
- Identifying potential mitigation measures to eliminate or minimize the potential adverse environmental impacts
- Environmental Management & Monitoring Plan and follow-up programs

Statutory Requirements

The report fulfills the following regulatory requirements:

- Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000 with reference to Pakistan Environmental Protection Act, 1997,
- Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014 with reference to Sindh Environmental Protection Act, 2014
- Performance Standards of IFC and World Bank group

The details of the statutory requirements and compliances of this IEE report to the national and international regulations or guidelines are explained in **Section 2** of this report.

Project Overview

The wind farm Project of 50 MW of Gul Ahmed Electric Limited is located in Jhimpir, District Thatta Sindh. The land has been leased by the Government of Sindh by Gul Ahmed Electric Limited. The Karachi Hyderabad Motorway (Super Highway) is connecting road to the site. The total land area of the Project is 370 acres.

Subject to finalization of the EPCC, the Project will install 29 units of General Electric turbine generators (WTGs), each with rated output of 1.7MW. However, the exact configuration will be determined upon finalisation of the EPC. The other options of wind turbine generators (WTGs)

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are also available like, Nordex N117 wind turbine generators (WTGs) rated output of 3.0MW total 16 WTGs, Vestas V126 wind turbine generators (WTGs) rated output of 3.3 MW total 15 WTGs, G.E 1.7 wind turbine generators (WTGs) rated output of total 29 WTGs.

Further details about the Project and its location are given in Section3 of this report.

Description of Environment

A data collection survey was undertaken that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, shadow forecasting, flora and fauna, land use pattern, and socio-economic conditions, based on available secondary information or data collected in the field. Primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. Secondary data was collected for land, climate, and socioeconomic factors.

The physical survey of the site was conducted by Mr. Umair Ali Khilji of Renewable Resources Pvt. Limited. The environmental and social baseline conditions observed in the Project area are presented in **Section 4** of this report.

Impact Assessment and Mitigation

A detailed analysis of Project alternatives are discussed in **Section 5.** During the IEE, the Project potential social and environmental impacts were identified. Each identified environmental and social impact was then characterized with respect to its nature, reversibility, geographical extent, consequence-severity and likelihood. Based upon this characterization, the impacts were then assessed to be of high, medium or low significance. The IEE has recommended appropriate mitigation measures to address the potential environmental and socio-economic impacts. The details of impact assessment and mitigation measures are provided in **Section 6,** which is further supplemented by the Environmental Management Plan (EMP) provided in **Section-8** of this report.

Stakeholder Consultation

Stakeholder consultation was carried out as part of IEE study. The details of the consultation are documented in **Section-8** of the report.

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Finding and Recommendations

- Wind Power Project is a green energy Project and, therefore, there is no major long lasting social or environment impact foreseen.
- Air quality of the area may be slightly disturbed only during construction phase of the Project.
- The Project Area does not fall under any sensitive, protected area.
- No threatened / Near-Threatened species of wildlife was recorded in the Project Area.
- There are three settlements near the project area; only two are permanent settlements and other one were seasonal/temporary settlement. These settlements are outside from the project land area at distance of 3-11 Kilometers therefore no disturbance to the inhabitants is foreseen.
- Regarding bird mortality due to collision, it is found that birds landing area is around 25 km away from the wind farm and the migratory birds are not seen in the wind farm area and there are minimal to zero chance of bird collision from these wind turbines.
- Noise impacts will be less than 70 DB (A) which is within the range as per National Environmental Quality Standards (NEQs) of Pakistan.
- The environmental disturbance normally associated with construction activities will be minimized through an Environment Management Plan (EMP), implementation of which will continue during Project operation and which includes monitoring arrangements.
- The Project will bring a positive development in the area and improve the socio-economic conditions through generation of employment opportunities and opening of avenues for the development of this area. Power project constructed and then operated in the area will cause development of good infrastructure, which will be benefited by the local population.
- At least, one year bird monitoring is recommended to compile substantive data about the impacts of wind power plants on the birds and other important wildlife of the area.
- The Project will also help promote renewable energy in Pakistan and will contribute positively by meeting the energy supply demand of the country.
- This IEE study concludes that the proposed Wind project will not lead to significant adverse environmental and social impacts of such nature or magnitude that would require a more detailed report in the form of an EIA. Additionally careful implementation of the EMP will ensure that environmental impacts are managed and minimized and the project proponent meets all statutory requirements.

The project has been discussed with local people, government officials and NGO (like Wildlife department, Forest department, SEPA, WWF and IUCN). The consultations elicited general support for the project. There were no serious environmental issues raised or matters that the Consultant had overlooked. The main concerns expressed were to ensure that local people got employment on the project and that measures were in place to avoid excessive noise or dust and bird mortality.

In the view of all above, 50 MW wind power Project of Gul Ahmed Electric Limited can be regarded as **Environmental Friendly Green Project**. The details of IEE findings and recommendations are discussed in **Section-9** of this report.

The following Annexures are attached with the report in order to support the results and findings of the report.

Annexure-I: Environmental Management and Monitoring Plan
Annexure-II: EMP Implementation Cost Estimates
Annexure-III: Pakistan Environmental Protection Agency Act 1997 and (Review of IEE and EIA) Regulations, 2000
Annexure-IV: Sindh Environmental Protection Agency Act 2014 and (Review of IEE and EIA) Regulations, 2014
Annexure-V: Pakistan National Environmental Quality Standards
Annexure-VI: IFC HSE Guidelines for Wind Energy Sector
Annexure-VII: Laboratory Analysis Reports of Ambient Air Quality, Noise and Drinking Water Quality
Annexure-VIII: List of Flora and Fauna Recorded in Project Area
Annexure-IX: Snapshots of Biological Environment
Annexure-X: Social Survey Forms
Annexure –XI: Snapshots of Community Consultation
Annexure –XII: Snapshots of Stakeholders Consultation

SECTION 1

INTRODUCTION AND PURPOSE OF STUDY

1 INTRODUCTION AND PURPOSE OF STUDY

1.1 PROJECT PROPONENT

The sponsor of the Project is Gul Ahmed Energy Limited.

Gul Ahmed Electric Limited (GEL) is an SPV formed for developing 50MW Wind Power Project. GEL is a wholly owned subsidiary of Gul Ahmed Energy Limited (GAEL).

Gul Ahmed Electric is interested to setup a Wind Power Project of 50 MW Capacity in Jhimpir, Sindh, Pakistan.

Renewable Resources (Pvt.) Limited (RE2) is the consultant to develop the Project of Gul Ahmed Electric Limited.

Gul Ahmed Electric Limited has land available having area of approximately 370 Acres. In order to identify the land for the wind farm within the same area, preliminary site assessment has been carried out.

1.2 THE PROFESSIONAL ADVISORS

Renewable Resources (Pvt.) Ltd is the professional technical advisor for the Project. Renewable Resources is a consulting company specialized in Renewable Energy (RE), Energy Efficiency (EE) and Environment (Env) Projects. The company is owned by group of professionals who have been intimately involved in the renewable energy program of Pakistan, and have a fundamental understanding of issues relating to power project development, which include but are not Ltd to feasibility studies, regulatory approvals, concession and security documents, and applicable policies.

RE2 is capable of conducting full feasibility package featuring power production estimates, grid interconnection and tariff model. RE2 also has the expertise to deal with all technical aspects

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regarding the legal documents of power projects. The professional team of RE2 is well acquainted with the policies, regulations, methodologies and standards of RE power Projects and its work output meets international standards. RE2 is presently a consultant for various power Projects in Pakistan sponsored by local and international investors, with international banks.

RE2 has gained significant experience in conducting Environmental and Social Impact Assessments (ESIA) and Initial Environmental Examinations (IEE) of renewable energy projects in accordance with national and international laws and standards. These studies cover all baseline environmental conditions and anticipated environmental impacts of projects and provide comprehensive Environmental Management Plans.

To date, RE2 has conducted twenty (20) environmental studies of renewable energy projects, which have all been approved by the relevant Environmental Protection Agencies.

1.3 PROJECT BACKGROUND & JUSTIFICATION

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. While both are produced domestically, demand already outstrips domestic supply by a considerable margin. Oil import is a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves. Electricity mix of Pakistan (2013-2014) is presented in the figure below:

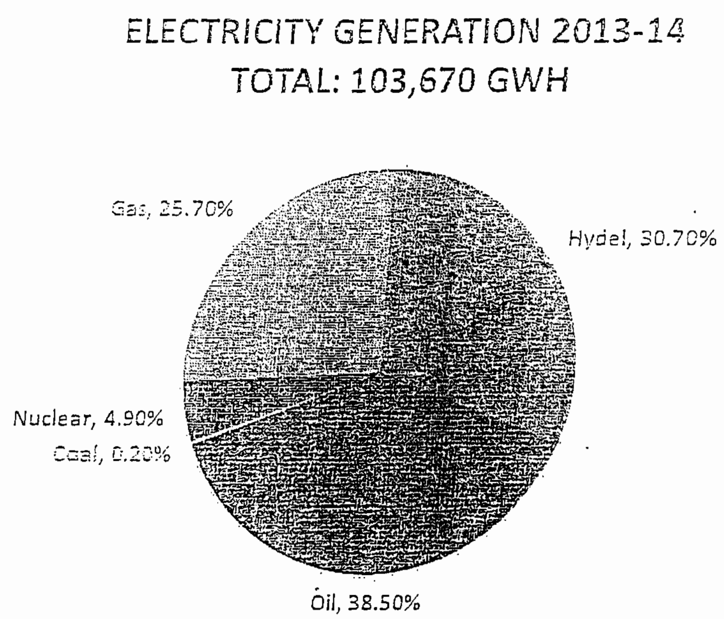

Figure 1.1: Electricity Mix of Pakistan by Source[1]

[1] Energy Year Book of Pakistan 2011

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Import of gas could be seen as a viable option to overcome the depleting domestic reserves. However, gas import has significant challenges, such as the need for substantial capital investment in infrastructure, security difficulties and physical terrain concerns. Moreover, it would increase Pakistan's reliance on imported fuels with associated foreign exchange burdens. This must be considered in the context of rising costs for gas and oil-based fuels as a result of uncertainty over future supply.

Alternatives to further fuel imports for electricity generation are the production of domestic coal, generation from hydro-electric power, or other renewable sources, such as wind and solar power. These options will assist in reducing Pakistan's reliance on imported oil and protect against resulting vulnerability to changes in global oil prices, which will in turn also have a positive effect on the current trade deficit and inflating import bill.

As with gas, securing future supplies of domestic coal and hydro-electric power would require significant spending on infrastructure. While Pakistan has domestic reserves of coal, it currently makes up a very small proportion of the country's total power generation. This is due, in part, to the fact that most of the reserves are located in the remote Thar Desert region. Exploiting the coal reserves would require significant upfront investment in local infrastructure (including provision of water supplies), development of mines, housing and related infrastructure, and investment in transmission lines, as a pre-requisite to any power plant development. Hydro-electric power already supplies almost 30% of the domestic electricity that is generated, and numerous sites for future investment exist. However, due to their locations, this would also require significant investment in transmission and other infrastructure. Moreover, there are various political issues relating to the development of hydro-electric and coal generation power plants, which remain to be resolved.

In light of the prevailing circumstances, wind generation appears to be a viable and environmentally friendly alternative for meeting Pakistan's urgent electricity demands. The development of wind generation projects could reduce dependence on oil-based thermal power generation, increase diversity in Pakistan's electricity generation mix, and reduce greenhouse gas (GHG) emissions, all of which will contribute towards projecting a positive image of Pakistan within the international community. Also the per kWh tariff for wind power projects are now comparatively lower than that of furnace oil projects, particularly the Rental Power Projects, which were previously inducted to meet the urgent needs of electricity shortfalls.

1.4 PROSPECTS OF WIND ENERGY IN PAKISTAN

Pakistan has considerable potential for wind energy in the coastal belt of its southern provinces Sindh and Balochistan, as well as in the central desert areas of Punjab and Northern Sindh. This potential source of renewable energy has however, not been properly realized thus far. According to a study conducted by NREL, and data collected from the wind masts installed in the Gharo and Keti Bandar wind corridor, the average wind speed in this wind corridor is 7.4 m/s making a regional potential of more than 50,000 MW. The Wind Map of Pakistan as comprised by NREL is shown in Figure 1.2 below.

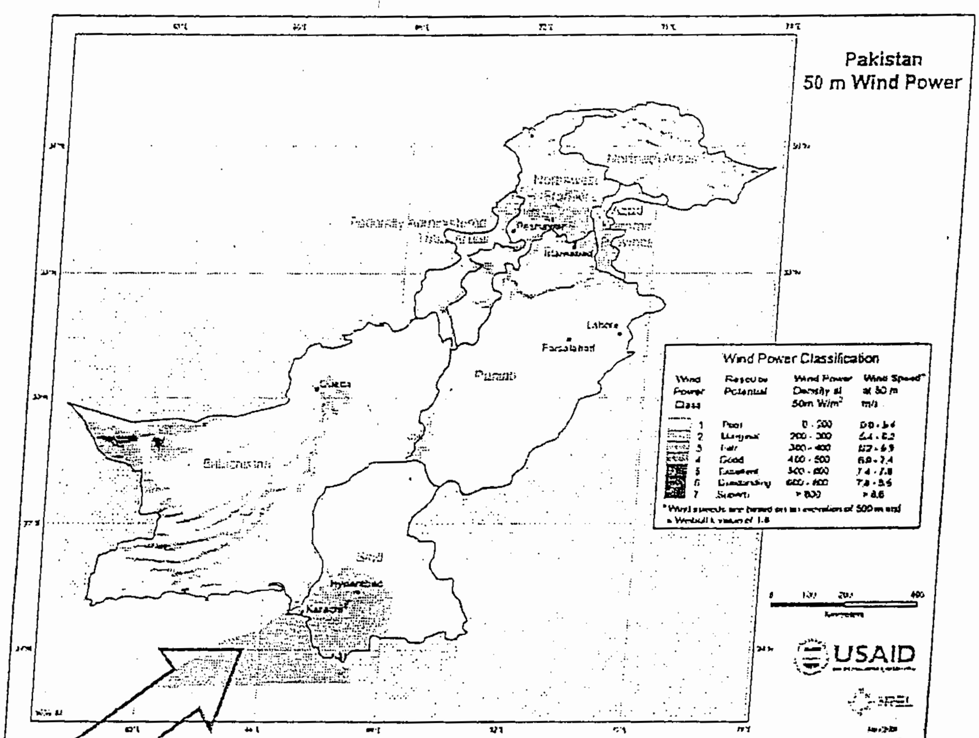

Figure 1.2: Wind Map of Pakistan by NREL

The Government of Pakistan (GOP) is diversifying its energy mix on a fast track basis to ensure Energy Security, Sustainable Development, Social Equity and Environmental Protection. Given its overall economics, wind energy is envisaged as an important ingredient of Pakistan's future energy mix.

Keeping in view the anticipated future energy needs and the significant potential for renewable energy, the GOP has set a target of at least 5% of the total national power generation capacity to be generated through renewable energy technologies, especially through wind energy by the year 2030.

1.5 PROJECT OVERVIEW & OBJECTIVES

The Wind Farm Project is located in Jhimpir, which is approximately 130km from Karachi, Pakistan's commercial hub and main coastal/port city.The Project site consists of 370 acres of land, which has been leased by the Government of Sindh. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site.

Subject to finalization of the EPCC, the Project presently contempiates installing a total of 29 wind turbine generators (WTGs), each with rated output of 1.7 MW. The other options are also available as mentioned in the table given below.

The brief overview of Project is summarized in **Table 1.1** below.

Table 1-1: Project at a Glance

S. No	Particulars	Description
1	Project Site	Jhimpir, Province of Sindh, Pakistan
2	Project Capacity	50MW
3	Turbines to be installed	G.E. 1.7 MW – Total 29 WTG Gamesa G114 - 2.0 MW – Total 25 WTGs G.W 121 – 2.5 MW – Total 20 WTGs Vestas V126 -3.3 MW – Total 15 WTG Nordex N117 3.0 MW – Total 16 WTG
4	Annual Expected Electricity to be supplied to the Grid	G.E 1.7 MW= 531,209MWh/a
5	Estimated Project Cost	**107.5 million US $**

The Project is being developed with the following objectives:

i. Contribute to meeting the electricity supply deficit in south west of Pakistan in particular; and country in general;

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ii. Provide electricity to stimulate and support the expansion of local industry and service businesses;

iii. By using indigenous renewable resources of power generation, avoid depletion of natural resources for future generation and environmental stability;

iv. Create employment during construction and operations and provide opportunities for developing ecotourism;

v. Improve microeconomic efficiency of the power sector by reducing fossil fuel usage;

vi. Reduce greenhouse gas emissions from power generation and contribute to negligible emission, effluent, and solid waste intensity of power generation in the system;

vii. Conserve natural resources including land, forests, minerals, water, and ecosystems; and

viii. Improve local physical infrastructure such as access roads and transmission network in the Project area.

1.6 NEED AND OBJECTIVES OF IEE STUDY

Pakistan Environmental Protection Act 1997 (PEPA 1997) requires the proponents of every development project in the country to submit either an Initial Environmental Examination or Environmental Impact Assessment to the concerned environmental protection agency.

Sindh Environment Protection Agency Act 2014 (SEPA 2014)

Sindh Assembly has passed the Sindh Environmental Protection Act 2014; Environmental protection became the provincial subject; SEPA have developed Act, regulations and sectorial guidelines to develop its own Act and regulation and guidelines.

The IEE/EIA Regulations 2000 issued under PEPA 1997 and IEE /EIA regulations issued under SEPA Act 2014

Both guidelines provide separate lists for the projects requiring IEE or EIA. This Initial Environmental Examination (IEE) report has been prepared in accordance with the provisions in the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000. According to these regulations, an IEE is required for projects falling in any category listed in

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Schedule-I of the regulations, and an EIA is required for projects listed in Schedule-II of the regulations.

1.7 BASIS PROJECT CATEGORIZATION OF EIA STUDY

Section 12 of Pakistan Environmental Protection Act 1997 and other regulatory documents such as Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations 2000 requires that every new development project in Pakistan has to be preceded by an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the magnitude of the project and severity of impacts anticipated at the time of commissioning of the project.

PEPA (Review of IEE/EIA) Regulations 2000 categorize projects into two separate schedules depending on whether a project requires an IEE (Schedule-I) or an EIA (Schedule-II). The Regulations also require that all projects located in environmentally sensitive areas need submission of an EIA.

Section 17 of Sindh Environment Protection Agency 2014 and Sindh Environmental Protection Agency (Review of IEE/EIA) Regulations 2014 requires wind project to conduct the IEE under schedule I,

Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulation, 2014, the list of projects requiring an EIA includes wind energy projects if it falls under any sensitive, protected area. It defines "Environmental Sensitive Areas" as the area which falls under sensitive sites like protected areas, or the sites which may have crucial and growing importance. The Project Area does not fall under the said category accordingly IEE report has been prepared.

Accordingly an IEE Study has been conducted, and the same will be submitted to seek approval prior to project initiation.

This report conforms to the requirements of the IEE report addressed in IFC and World Bank group performance standards.

In the context of the scope of the Project, the IEE report has addressed the following objectives, where applicable:

- Category of the Project consistent with Pakistan Environmental Protection Act, 1997, Sind Environment Protection Act 2014 and IFC's and World Bank group performance standards.
- Highlight baseline environmental and social conditions of the Project area along with identification of environmentally sensitive area and concerned stakeholders like Government officials and different NGOs.
- Relevant host country laws, regulations, applicable treaties and agreements
- Protection of human health, cultural properties and biodiversity including endangered species and sensitive ecosystems.
- Major hazards; occupational health and safety; fire prevention and life safety
- Socio-economic impacts; land use: land acquisition; involuntary resettlement
- Impacts on indigenous peoples and communities, if applicable
- Cumulative impacts of existing, proposed, and anticipated future projects
- Efficient production, delivery, and use of energy
- Pollution prevention and waste minimization, pollution controls (liquid effluent and air emissions), and solid and chemical waste management.

1.8 Scope of IEE Study

This IEE study is focused at developing the environmental profile of the project area so as to evaluate the existing physical, biological and socioeconomic aspects leading to respective impacts due to construction and operations at the Wind Farm.

The main purpose of the IEE study is to ensure that:

- Any major adverse impact on the environment (physical, ecological and social) during different phases of projects viz. siting, design, construction and operation are identified.
- Adverse impacts are appropriately addressed and adequate mitigation measures are incorporated in the siting, design, construction and operation phases of project.

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Socioeconomic aspects are identified, and mitigation measure has been suggested.

- Alternatives to achieve the objectives are analyzed.
- Environmental Management Plan (EMP) for sustainable development and operation of the project is developed for implementation and monitoring of the project activities.

The present IEE report has identified the significant environmental aspects and screened the potential aspects to ensure that the likely impacts due to proposed activities during construction, installation of masts and WTGs and operation of the proposed project, and the residual impact on adoption of mitigation measures have been critically assessed with respect to compliance with the Pakistan Environmental Protection Act 1997, Sindh Environment Protection Act 2014 and World Bank, IFC.

1.9 Methodology for Initial Environmental Examination Study

The environmental assessment (examination and evaluation) is primarily based on simple comparative evaluation approach. Initially the baseline or the profile of the project area is developed by site surveys, collecting data, records and information on physical, ecological /biological as well as socioeconomic environment. The data are compiled then projected or modeled for different phases of projects, i.e. design, construction, and operations. The likely changes in the critical environmental aspects or significant changes in the ambient environmental parameters are identified. Identification, assessment and evaluation of significant impact either in qualitative or quantitative terms is carried out for which appropriate mitigation measures are proposed.

Project Team of environmentalists and sociologists held consultation based on the detailed contents of the Project with main stakeholders. Environmental and social considerations being an essential component of the implementation phase of this project, the following points were underscored for implementing the IEE recommendations:

Identifying the need, if any, for involuntary resettlement and for land acquisition and to prepare an appropriate Involuntary Resettlement Program.

Reducing the impact on the living environment during the construction period, selecting appropriate construction methods and construction schedule.

Accordingly the IEE study has:

- Conducted public consultation at the early stage
- Held stakeholders meetings during the study.
- Understood in detail the concerns of Persons resident in the villages that are outside the Gul Ahmed land area.
- In consideration of:
- Agreement between GoS and Gul Ahmed Energy Limited, allowing Gul Ahmed Electric Limited land for installation of Wind Power Generation will require no payment for land acquisition,
- Consultation Meetings with the residents of one village located within the GEL project boundary and one on the outside of the land area, have confirmed the issue that establishment of the Wind Farm on GAEL land will not require land acquisition or involuntary resettlement, and insignificant impact on the ecology and living environment, It is implicit that there would be no need for involuntary resettlement or acquisition of land.
- This IEE report presents the existing environmental scenario and the results from the assessment and evaluation of the environmental aspects emerging during the installation and operation phases of wind turbines. Following screening of potential environmental aspects, the assessed and evaluated impacts requiring necessary mitigation measures are suggested in the report. The report also includes the Environmental Management and Monitoring Program that will be implemented during siting, construction operation phases and decommission phase.

The methodology specifically adopted for conducting the IEE of The Project may be summarized as follows

1.9.1 Scoping

The key activities of this phase include:

Project Data Compilation: A generic description of the proposed activities relevant to environmental assessment was compiled with the help of the proponent.

Published Literature Review: Secondary data on weather, soil, water resources, wildlife, and vegetation were reviewed and compiled.

Legislative Review: Information on relevant legislation, regulations, guidelines, and standards was reviewed and compiled.

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Identification of Potential Impacts: The information collected in the previous steps was reviewed and potential environmental issues identified.

Baseline Data Collection:

Primary Data Primary data for Environmental Monitoring including Ambient Air, Ambient noise, ground water and surface water was developed through EPA Certified Laboratory, in addition to that Birdlife and wildlife survey was also conducted during this study and previous studies conducted by the Project team. A field visit was conducted to verify and collect primary data on the site alternatives. A questionnaire was developed and views of local inhabitants were taken about the wind power Project.

Secondary Data reasonable data of baseline information on the Project area was available from existing literature and other studies conducted close to the Project area have also been referred in this study.

1.9.2 Impact Assessment

The environmental, socioeconomic, and Project information collected was used to assess the potential impact of the proposed activities. The issues studied included potential Project impact on:

- Geomorphology
- Groundwater and surface water quality,
- Ambient air quality and ambient noise levels
- Ecology of area, including flora and fauna especially with reference of migratory and local birds
- Local communities
- Noise impact
- Shadow impact

Wherever possible and applicable, the discussion covers the following aspects:

- The present baseline conditions
- The potential change in environmental parameters likely to be effected by Project related activities
- The identification of potential impacts
- The evaluation of the likelihood and significance of potential impacts
- The definition of mitigation measures to reduce impacts to as low as practicable

- The prediction of any residual impacts, including all long-term and short-term, direct and indirect, beneficial and adverse impacts
- The monitoring of residual impacts

1.9.3 Documentation

This report documenting the IEE process and results is prepared in accordance with the relevant guidelines set by the Pakistan Environment Protection Agency (Pak-EPA) in general and Sindh Environmental Protection agency in specific.

1.10 METHOD FOR EVALUATING IMPACT

The description of baseline conditions represents the basis for evaluating the Project's impact. The description and evaluation of the environmental impact, and proposals for measures to be taken to mitigate and compensate for any determined environmental impact during construction and operation phase, are presented in the Environment Management Plan (EMP) (Annexure-I).In the interest of transparent presentation and evaluation, tabulated evaluation procedures have been applied. The severity of a particular environmental impact together with its general trends (i.e. negative or positive) is described on the basis of a point system. The evaluation scale applied is as follows:

◇◇◇	=High
◇◇	=Medium
◇	=Low
○	=No Impact
☆	=Locally Favorable
☆☆	=Regionally Favorable

Both national and international standards, such as those of the World Bank and WHO, are used as a basis for this judgment. According to these standards, impacts are evaluated as follows;

High	International and national standards are exceeded
Medium	Between international and national standards
Low	International and national standards are met

SECTION 2

LEGASLATIVE REQUIREMENTS

2 LEGISLATIVE REQUIREMENTS

This chapter describes the relevant: (i) national and international policies; (ii) legal and administrative framework; and (iii) institutional setup, in respect of the environmental and social assessment of the proposed Project.

2.1 NATIONAL ENVIRONMENTAL LAWS

There are several laws in Pakistan which contain provisions relating to the protection of the environment. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new phenomenon. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context specific. The laws relevant to development projects are briefly reviewed below.

2.2 POLICY GUIDELINES

2.2.1 National Conservation strategy

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan (GOP) on national environmental issues. The Strategy approved by the Federal Cabinet in March 1992 was also recognized by International Financial Institutions, principally the World Bank. The NCS had identified 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage. It had also recommended immediate attention to the stated core areas in order to preserve the environment of Pakistan.

A mid-term review of the NCS in 2000 concluded that achievements under the NCS were primarily awareness raising and institutional building rather than meaningful improvement of the environment and natural resources and that the NCS was neither designed nor adequately focused as a national sustainable development strategy (GoP, November 2002). Thus the need

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for a more focused National Environmental Action Plan (NEAP) was formulated and approved by the Pakistan Environmental Protection Council in 2001 to practically improve the national environment with emphasis on poverty reduction, and economic as well as sustainable development.

NEAP now constitutes the national environmental agenda and its core objective is to initiate actions that would safeguard public health, promote sustainable livelihoods and enhance the quality of life of the people of Pakistan.

The GOP and United Nations Development Programme (UNDP) have jointly initiated an umbrella support programme called the NEAP-Support Programme that was signed in October 2001 and implemented in 2002. The development objective supported by NEAP-Support Programme is environmental sustainability and poverty reduction in the context of economic growth. The objectives of new policy has total 171 guidelines on sectorial and cross sectorial issues. The objectives of new policy include assurance of sustainable development and safeguard of natural wealth of country. The following are the approved Sectorial Guidelines:

- Water Supply and Management
- Air Quality and Noise
- Waste Management
- Forestry
- Biodiversity and Protected Areas
- Climate Change and Ozone Depletion
- Energy Efficiency and Renewable
- Agriculture and Livestock
- Multilateral Environmental Agreements
- Biodiversity Action Plan

The key to protection of the biological heritage of Pakistan lies in the involvement of local people and in the support provided by competent institutions for conservation and sustainable use. The Government of Pakistan has recognized the importance of these measures in the preparation of National Conservation Strategy and in becoming a signatory to, and ratifying, the Convention on Biological Diversity (CBD) in 1994. Developing the Biodiversity Action Plan for Pakistan, 2000 has been the most significant direct steps towards addressing the biodiversity loss.

2.2.2 The Biodiversity Action Plan

The Biodiversity Action Plan (BAP), which has been designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve biodiversity in the country.

The BAP recognizes that an EIA is used as a tool at a project level to identify environmental effects of a proposed project and to plan for reducing adverse effects. The BAP further stipulates that an EIA needs to be initiated at an early stage of project development and that public participation in the review of potential effects is important.

2.3 ENVIRONMENT INSTITUTIONS AND ADMINISTRATION

The Constitution of Pakistan distributes the legislative powers between the federal and the provincial governments through Federal and Concurrent Lists. The Federal list depicts the areas and subjects on which the Federal government has exclusive powers. The Concurrent list contains areas and subjects on which both Federal and Provincial governments can enact laws.

The Ministry of Climate Change, Local Government and Rural Development are responsible for environmental issues at the federal level. The NCS unit within the Ministry ensures implementation of the National Conservation Strategy.

The Pakistan Environment Protection Agency is the federal body responsible for administering the provisions of the Pakistan Environment Protection Act. It is responsible for ensuring compliance with the NEQs, developing monitoring and evaluation systems and initiating legislation when necessary.

The provincial Environment Protection Agencies, i.e. the Environment Protection Department in Sindh, are responsible for environmental planning and development and approval of Initial Environmental Examination (IEE) and Environmental Impact Assessments (EIA) of new Projects at the provincial level.

2.4 LAWS, REGULATIONS, AND GUIDELINES

The Pakistan Environment Protection Act, 1997, is the basic law that empowers the Government of Pakistan to develop policies and guidelines for the protection of the country's natural environment. A brief description of the laws is given below.

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2.5 PAKISTAN ENVIRONMENTAL PROTECTION ACT, 1997

The PEPA, 1997, is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a broad range of issues and extends to air, water, soil, marine, and noise pollution, as well as to the handling of hazardous wastes.

The key features of the law that have a direct bearing on the proposed Project relate to the requirements for an initial environmental examination (IEE) and EIA for development Projects. Section 12(1) requires that: "No proponent of a Project shall commence construction or operation unless he has filed with the Federal Agency an initial environmental examination or, where the Project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Federal Agency approval in respect thereof." Pak-EPA has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies. As the proposed Project will be located near Karachi, it falls under the jurisdiction of the EPA Sindh.

2.6 SINDH ENVIRONMENTAL PROTECTION ACT, 2014

The Sindh Environmental Protection Act, 2014 (SEPA) is the basic legislative tool empowering the provincial government to frame regulations for the protection, conservation, rehabilitation and improvement of the environment. The SEPA 2014 is broadly applicable to air, water, soil, hazardous waste, marine and noise pollution. Penalties have been prescribed for those contravening the provisions of the Act. The powers of the provincial Environmental Protection Agencies (EPAs) were also considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint. Sindh Environmental Protection Act, 2014 (SEPA) attached as Annexure IV.

- 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.
- Under section 17 of SEPA, "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 Agency approval in respect thereof. "

- SEPA shall review the IEE & EIA and accord approval subject to such terms and conditions as it may prescribe or require. The agency shall communicate within sixty days it approval or otherwise from the date IEE is filed failing which the IEE shall deemed to have been approved.

2.7 PAKISTAN ENVIRONMENT PROTECTION AGENCY REVIEW OF IEE AND EIA REGULATION, 2000

The Pakistan Environment Protection Agency Review of IEE and EIA Regulations provide the necessary details in respect of the preparation, submission, and review of the IEE and EIA. Categorization of Projects of IEE and EIA is one of the main components of the Regulations.

The following is a brief step-wise description of the approval process:

- A project is categorized as requiring an IEE or EIA using the two schedules attached to the Regulations.
- An EIA or IEE is conducted as per the requirements of the EPA guidelines.
- The EIA or IEE is submitted to the concerned EPA—provincial EPAs if the project is located in the provinces, or the Pak-EPA if it is located in Islamabad.
- A fee, depending on the cost of the project and the type of the report, is submitted along with the document.
- The submittal is also accompanied by an application in the format prescribed in Schedule IV of the Regulations.
- EPA conducts a preliminary scrutiny and replies within 10 days of the submittal of a report by:(a) confirming completeness;(b) asking for additional information, if needed; or (c) returning the report requiring additional studies, if necessary.
- EPA is required to make every effort to complete the IEE and EIA review process within 45 and 90 days, respectively, upon confirmation of completeness.
- If the EPAs accord their approval subject to certain conditions, then before commencing construction of the project, the proponent is required to submit an undertaking accepting the conditions as per mentioned in schedule vii.
- Before commencing operation of the project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the IEE.
- An Environment Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.
- The EPAs are required to issue confirmation of compliance within 15 days of the receipt of request and complete documentation.

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- The IEE approval is valid for three years from the date of accord.

A monitoring report is to be submitted to the EPA after completion of construction, followed by annual monitoring reports during operation.

Complete guidelines of Preparation of EIA/IEE along with details of other concerned laws and regulations outlined in the Pakistan Environment Protection Act 1997 are provided in Annexure- III for reference

2.8 SINDH ENVIRONMENT PROTECTION AGENCY REVIEW OF IEE AND EIA REGULATION, 2014

The SEPA review of IEE and EIA regulations, 2014 (the 'regulations'), prepared ~~by the~~ SEPA under the powers conferred by section of Sindh Environmental Protection Act, 2014provide the necessary details on the preparation, submission and review of the IEE, EIA and environmental checklist of the project.

These regulations classify projects on the basis of expected degree of severity of environmental impacts and list them in three separate schedules. Schedule-I lists projects that may not have significant environmental impacts and require an IEE. Schedule-II lists projects of potentially significant environmental impacts requiring preparation of an EIA. Schedule-III list projects of screening and requiring preparation of environmental checklist. The Regulations also require under the schedule-II Clause-A6: Wind energy projects if falls under any sensitive, protected area and under the Clause-J: that all projects located in environmentally sensitive areas require preparation of an EIA. SEPA (Review of IEE /EIA regulations) 2014 has been provided in the report . The Project Area does not fall under the protected area; accordingly IEE report has been prepared. Wind Projects, transmission lines less than 11KV and grid station falls in Schedule I - lists of projects requiring an IEE while the wind energy projects if fall under any sensitive, protected areas and transmission lines (11KV and above) and distribution projects fall in Schedule II - lists of projects require an EIA.

Complete guidelines of Preparation of EIA/IEE along with details of other concerned laws and regulations outlined in the Sindh Environment Protection Act are provided in Annexure- IV for reference

2.9 SECTORAL GUIDELINES FOR ENVIRONMENTAL REPORTS-WIND POWER PROJECTS

The wind power sectorial guidelines form part of a package of regulations and guidelines, to be read in conjunction with the overall EIA /IEE guidelines package. These guidelines have been prepared by the Federal EPA in collaboration with other key stakeholders, which include: the provincial EPAs; the Federal and Provincial Planning Development Divisions; NGOs; representatives of chambers of commerce and industry; and other consultants.

These guidelines consist of comprehensive guidelines and procedures for the environmental assessment of wind power projects in Pakistan. It is emphasized that the various guidelines should be read as a package; reliance on the sectorial guidelines alone is inadequate.

2.10 POLICY FOR DEVELOPMENT OF POWER GENERATION PROJECTS, 2006

The Alternative Energy Development Board was established as an autonomous body attached to the Cabinet Division on 12th May 2003.The AEDB was established to act as a central agency for the development, promotion, and facilitation of renewable energy technologies; the formulation of plans and policies; and the development of a technological base for manufacturing of renewable energy equipment in Pakistan. In February 2006, the administrative control of the AEDB was shifted from the Cabinet Division to the Ministry of Water & Power. The AEDB has developed the national policy for promoting renewable energy sources in the medium and long term, which is known as the Policy for Development of Renewable Energy for Power Generation, 2006 (Power Policy). AEDB is also responsible for procuring land leases from the Revenue department for wind farm projects.

The current Project is developed under provisions of the Policy for Development of Renewable Energy for Power Generation, 2006.

2.11 PROJECT DEVELOPMENT IN TERMS OF POLICY FRAMEWORK

The following paragraphs describe the progress of the Project in terms of the Power Policy:

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2.11.1 Letter Of Intent (LOI)

The first step for the development of a project pursuant to the Policy is to register with the GoS and obtain a Letter of Intent. The sponsors of the Project successfully filed their application and obtained their LOI from the Government of Sindh on July 06th, 2015, after depositing their bank guarantee. The LOI is the official mandate for the Project Company to commence working on the Project, with the support of the GoS and other government departments. The LOI heralds the commencement of activities leading to the preparation of a feasibility study and acquisition of land for the Project.

2.11.2 Acquisition of Land

The land is being allocated by the Government of Sindh in the Jhimpir area. Land measures 370 acres of area.

2.11.3 Submission of Feasibility Study

The Project Company is required to submit a detailed feasibility study, including Technical Feasibility, Electrical Grid Studies, and Environmental Studies, to the GoS for their approval.

2.11.4 Generation License

In order to produce and sell electricity in Pakistan, a project is required to obtain a "Generation License" from the regulator, NEPRA. The Project Company is therefore required to make an application to NEPRA for its Generation License.

An application for the generation license along with necessary documents will be submitted to NEPRA after submission of Feasibility Study to Government of Sindh.

2.11.5 Tariff Determination

A separate application will be submitted by the Project Company to NEPRA for approval of its power tariff. This application will be submitted simultaneously with the application of Generation License.

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2.11.6 Letter of Support (LOS)

Once the tariff has been approved, the Project Company can engage with its lenders to finalize its financing terms and conditions. At this stage, GoS will issue a Letter of Support to the Project Company as soon as the Project Company submits a bank guarantee in respect of its obligation to achieve Financial Close. The amount of the Bank Guarantee is calculated at US$2,500 per MW.

The Letter of Support provides the Project Company with a continued mandate to develop the Project, and provides certain assurances of support from governmental entities and departments. The Letter of Support remains valid until the effectiveness of the EPA and IA.

2.11.7 Energy Purchase Agreement (EPA)

The agreement between the Power Purchaser and the Project Company is called the Energy Purchase Agreement (EPA). This agreement lists terms and conditions for the sale and purchase of electricity between the two parties. Discussions relating to the EPA normally commence as soon as the feasibility study is submitted and the tariff petition is filed with NEPRA.

2.11.8 Implementation Agreement (IA)

The Implementation Agreement (IA) is an agreement between the Project Company and the GOP, where in the GOP mandates the Project Company to develop the power project, and provides certain assurances and concessions to the Project, its lenders, shareholders and contractors. Importantly, the IA provides certain guarantees in respect of the performance of the power purchaser. The IA also assures the project of compensation in case of any termination resulting from a default or force majeure. These discussions normally commence alongside the EPA.

2.11.9 Financial Close

Upon approval of feasibility study, grant of generation license, approval of tariff, and the signing of Project documents (EPA and IA); the Project Company shall move forward to financial close.

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2.12 NATIONAL AND INTERNATIONAL ENVIRONMENTAL STANDARDS

2.12.1 National Environmental Quality Standards

The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and were last revised in 2010. The NEQS specify the standards for industrial and municipal effluents, gaseous emissions, ambient air requirements, vehicular emissions, noise levels and water quality standards.

The National Environmental Quality Standards (NEQS) specify the following standards:

- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources
- Maximum permissible limits for motor vehicle exhaust and noise
- For power plants operating on oil and coal:
  - Maximum allowable emission of sulfur dioxide
  - Maximum allowable increment in concentration of sulfur dioxide in ambient air
  - Maximum allowable concentration of nitrogen oxides in ambient air
  - Maximum allowable emission of nitrogen oxide for steam generators as function of heat input
  - Maximum allowable concentration of effluent pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment and sea (three separate set of numbers)

Selected NEQS for liquid effluents discharged to inland waters, gaseous emission from industrial sources, emissions from motor vehicles, noise, ambient air quality and water quality standards are provided in Annexure-V

2.12.2 National Environmental Policy, 2005

The National Environmental Policy (NEP) was approved by the Pakistan Environmental Protection Council in its 10th meeting in 27th December 2004 under the chairmanship of the Prime Minister of Pakistan and there after approved by the Cabinet on 29th June 2005. NEP is the primary policy of the Government of Pakistan that addresses the environmental issues of the country

The broad Goal of NEP is, "{to protect, conserve and restore Pakistan's} environment in order to improve the quality of life of the citizens through sustainable development." The NEP identifies the following set of sectorial and cross-sectorial guidelines to achieve its Goal of sustainable development.

a. Sectorial Guidelines:

Water and sanitation; air quality and noise; waste management; forestry; biodiversity and protected areas; climate change and ozone depletion; energy efficiency and renewable; agriculture and livestock; and multilateral environmental agreements.

b. Cross Sectorial Guidelines

Poverty; population; gender; health; trade and environment; environment and local governance; and natural disaster management. The NEP suggests the following policy instruments to overcome the environmental problems throughout the country:

- Integration of environment into development planning
- Legislation and regulatory framework
- Capacity development
- Economic and market based instrument
- Public awareness and education
- Public private civil society partnership

Even though NEP is a policy document that does not apply to the Project directly, development projects, such as wind power generation projects, are not expected to negatively impact the environmental issues identified by NEP. In any event, mitigation measures would be adopted to minimize or avoid any negative impact. Furthermore, renewable sources of energy, such as wind power projects, provide an environmentally positive means for increasing power production and development.

2.12.3 Land Acquisition Act, 1984

The Land Acquisition Act (LAA) of 1894, amended from time to time, has been the de-fact o policy governing land acquisition and compensation in the country. The LAA is the most commonly used law for acquisition of land and other properties for development projects. It comprises of 55 sections pertaining to area notifications and surveys, acquisition, compensation and apportionment awards and dispute resolution, penalties and exemptions.

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For the proposed Project, the proponents have leased land from the Government of Sindh and no settlement or structure exists at the site. The LAA is therefore not applicable to the acquisition of land for the proposed Project.

2.12.4 Telegraph Act, 1985

This law was enacted to define the authority and responsibility of the Telegraph authority. The law covers, among other activities, installation and maintenance of telegraph lines and posts (poles). The Act defines the mechanism to determine and make payment of compensation associated with the installation of these lines and posts.

Under this Act, the land required for the poles is not acquired (or purchased) from the owner, nor the title of the land transferred. Compensation is paid to the owner for any structure, crop or tree that exists on the land; cost of the land is not paid to the owner.

2.12.5 The Sindh Wildlife Protection Ordinance, 1972

The Sindh Wildlife Protection Ordinance, 1972 empowers the government to declare certain areas reserved for the protection of wildlife and control activities within these areas. It also provides protection to endangered species of wildlife. As no Project activities are planned in declared protected areas, provision of this law is not applicable to the proposed Project

2.12.6 The Sindh Fisheries Ordinance, 1972

The Sindh Fisheries Ordinance, 1980 regulates fishing in public waters, including the coastal areas of Sindh. It empowers the Government of Sindh to issue licenses for fishing in public waters, place restrictions on the type of equipment that can be used for fishing, restrict fishing in certain areas or of certain species of fish, regulate the onshore trade of fish catch, and regulate the fish processing industry. Article 8 of the Ordinance prohibits the discharge of wastewater to public waters without the consent of the Director Fisheries.

As no activities are planned for this Project which can breach this Ordinance, provision of this law is not applicable to the proposed Project.

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2.12.7 The Forest Act 1927

The Forest Act, 1927 empowers the government to declare certain areas as reserved forest areas. As no reserved forest exists in the vicinity of the proposed Project, the provisions of this law are not applicable to the proposed Project.

2.12.8 Canal and Drainage Act, 1873

The Canal and Drainage Act (1873) prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage. This Act will be applicable to the construction and O&M works to be carried out during the proposed Project.

2.12.9 The Antiquities Act, 1975& the Sindh Cultural Heritage (Preservation) Act, 1994

The Antiquities Act of 1975 ensures the protection of Pakistan's cultural resources. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance.

Under the Act, the Project proponents are obligated to ensure that no activity is undertaken within 61m (200 ft.) of a protected antiquity, and to report to the Department of Archaeology, Government of Pakistan any archaeological discovery made during the course of the Project. The Sindh Cultural Heritage (Preservation) Act, 1994, is the provincial law for the protection of cultural heritage. Its objectives are similar to those of the Antiquity Act, 1975. No antiquity protected under these two laws was identified in the vicinity of the proposed Project.

2.12.10 Factories Act, 1934

The clauses relevant to the proposed Project are those that address the health, safety and welfare of the workers, disposal of solid waste and effluents, and damage to private and public property. The Act also provides regulations for handling and disposing toxic and hazardous

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substances. The Pakistan Environmental Protection Act of 1997 (discussed above), supersedes parts of this Act pertaining to environment and environmental degradation.

2.12.11 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 year of age. The ECA states that no child shall be employed or permitted to work in any of the occupations 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 processes defined in the Act include carpet weaving, bidi (kind of a cigarette) making, cement manufacturing, textile, construction and others. Gul Ahmed Electric and its contractors will be bound by the ECA to prohibit any child labor at the Project sites or campsites.

2.12.12 Civil Aviation Rules, 1994

These rules apply to flight operations within Pakistan by aircrafts other than military aircrafts and, except where otherwise prescribed, to flight operations by air crafts registered, acquired or operating under these rules, wherever they may be. The rules with relevant significance to the power Project:

- No person shall erect any temporary or permanent structure, nor position a vehicle or other mobile object on or in the vicinity of an aerodrome (airport), that will be within the clearance area, or will protrude through an obstacle limitation surface, at that aerodrome.
- No person shall operate a light in the vicinity of an aerodrome which because of its glare is liable to dazzle pilots of aircraft taking off from or landing at that aerodrome; or which can be mistaken for an aeronautical ground light. If such a light is operated it shall be extinguished or satisfactorily screened immediately upon notice being given to the person or persons operating the light, by the Director-General or by the Manager or by a person authorized by him.
- No person or persons shall operate a radio station or electrical equipment in the vicinity of an aerodrome or of a radio aid to navigation serving an airway or an air route in Pakistan which is liable to cause interference with radio communications between

aircraft and an Air Traffic Services Unit, or which is liable to disturb the signal from a navigational radio aid.

- A captive balloon or a kite shall not be flown at a height above 200ft within 6kmofan aerodrome, and a free balloon shall not be flown at any place, except with the express permission of the Director-General and in compliance with the conditions attached to such permission
- An aircraft shall not be flown over congested areas of cities, towns, or settlements or over an open air assembly of persons, except by permission of the Director-General, unless it is at such height as will permit, in the event of an emergency, a landing to be made without undue hazard to persons on the ground, and except when it is taking off or landing, shall not be flown closer than500ft to any person, vessel, vehicle or structure.
- As there is no airport in close proximity to the Project area, it is highly unlikely that the aforementioned rules would apply to the Project's construction and operation activities. However, it is often recommended for projects to seek the relevant permission from Civil Aviation Authority for the installation of wind turbines. The blade tips of wind turbines will be marked in red to make the structure more visible from a distance to aircrafts.

2.12.13 Pakistan Penal Code, 1860

The Code deals with offences where public or private property or human lives area 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. Most of the environmental aspects of the Code have been superseded by the Pakistan Environmental Protection Act, 1997.

2.12.14 National Resettlement Policy / Ordinance

The Ministry of Environment, Local Government and Rural Development formulated a draft policy in 2004 on involuntary resettlement with technical assistance from ADB. The policy aims to compensate for the loss of income to those who suffer loss of communal property including common assets, productive assets, structures, other fixed assets, income and employment, loss of community networks and services, pasture, water rights, public infrastructure like mosques, shrines, schools and graveyards.

The government has also developed a document entitled "Project Implementation and Resettlement of the Affected Persons Ordinance, 2002", later referred to as the "Resettlement Ordinance", for enactment by provincial and local governments, after incorporating local requirements. The Ordinance, being a new law, shall be supplementary to the LAA as well as other laws of Pakistan, and wherever applicable under this policy. However, if necessary, appropriate amendments to the LAA 1894 will also be proposed to facilitate the application of the Resettlement Ordinance.

There has not been much progress on the enactment of the Resettlement Ordinance; hence this is not relevant for the proposed project.

2.12.15 Sindh Local Government Ordinances, 2001

These ordinances were issued under the devolution process and define the roles of the district governments. These ordinances also address the land use, conservation of natural vegetation, air, water and land pollution, disposal of solid waste and wastewater effluents, as well as matters relating to public health.

2.12.16 The IUCN Red List

Some animal species are already extinct in Pakistan, and many are internationally threatened. The 1996 IUCN Red List of Threatened Animals classifies 37 species and 14 sub-species of mammals that occur in Pakistan as internationally threatened or near-threatened.

The Red List is based on field data that is more than 10 to 15 years old and needs to be re-assessed. The country also provides critical habitat to 25 internationally threatened bird species and 10 internationally threatened reptiles.

According to the National Avian Research Centre in Abu Dhabi, with Houbara's birth rate of 5 per cent a year and if number of Houbara keeps decreasing at the same rate with more than 6,000 being bagged by hunting parties and more than 4000 smuggled out of country, the worst scenario are that the Houbara bustard would disappear as the species by 2015.

There are a number of organizations that were formed to protest the illegal hunting and preserve the wildlife. This includes National Council for Conservation of Wildlife (NCCW), established in 1974 and supported by the UN, which breaks into three groups: Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on

Wetland of International Importance Especially as Waterfowl Habitat (RAMSAR) and Convention on the Conservation of Migratory Species of Wild Animals (CMS).

2.12.17 Motor Vehicles Ordinance, 1965, and Rules, 1969

The Motor Vehicles Ordinance, 1965, was extended in 1978, to the whole of Pakistan. The ordinance deals with the powers of motor vehicle licensing authorities and empowers the Road Transport Corporation to regulate traffic rules, vehicle speed and weight limits, and vehicle use; to erect traffic signs; and to identify the specific duties of drivers in the case of accidents. It also describes the powers of police officers to check and penalize traffic offenders at the provincial level. At the same time, the ordinance also empowers the Regional Transport Authority to operate as a quasi-judicial body at the district level to monitor road transport, licensing requirements, and compensations for death or injury to passengers on public carriers.

2.12.18 Cutting of Trees (Prohibition) Act, 1975

This Act prohibits cutting or chopping of trees without permission of the Forest Department. During the site survey conducted by the team of environmentalist and socialist, there is no tree on the site. Hence this law is not relevant to the proposed project.

2.13 WORLD BANK GUIDELINES ON ENVIRONMENT

The principal World Bank publications that contain environmental guidelines are listed below.

- Environmental Assessment Operational Policy 4.01.Washington, DC, USA. World Bank 1999.Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross Sectorial Issues. World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991,Pollution Prevention and Abatement Handbook: Towards Cleaner Production, Environment Department, the World Bank, United Nations Industrial Development Organization and the United Nations Environment Program, 1998.Environmental Health and Safety (EHS) guidelines, International Finance Corporation (IFC) World Bank Group, 2007.
- The first two publications listed here provide general guidelines for the conduct of an IEE, and address the IEE practitioners themselves as well as project designers. While the Sourcebook in particular has been designed with Bank projects in mind, and is especially relevant for the impact assessment of large-scale infrastructure projects, contains a wealth of information which is useful to environmentalists and project proponents.

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- The Sourcebook identifies a number of areas of concern, which should be addressed during impact assessment. It sets out guidelines for the determination of impacts, provides a checklist of tools to identify possible biodiversity issues and suggests possible mitigation measures. Possible development project impacts on wild lands, wetlands, forests etc. are also identified and mitigation measures suggested. The Sourcebook also highlights concerns in social impact assessment, and emphasizes the need to incorporate socio-economic issues in IEE exercises.

The EHS guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background d and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during construction, operation, and decommissioning phase of project or facility.

The World Bank Guidelines for noise are provided in Table 2-1

Table 2-1 World bank Guidelines for Noise levels

No.	Receptor	Day (07:00-22:00)	Night (22:00-07:00)
1.	Residential & Institutional educational	55	45
2.	Industrial & Commercial	70	70

Source: Pollution Prevention and Abatement Handbook World Bank Group (1998)
Notes: Maximum allowable log equivalent (hourly measurements) in dB(A)

2.14 Equator Principles

The Equator Principles are a set of guidelines, promoted by the International Finance Corporation (IFC) that address the environmental and social issues associated with major development projects worldwide. They provide a common baseline and framework for the implementation of internal environmental and social procedures and standards for project financing activities across all industries.

Principle 1: Review and Categorization (of projects)
Principle 2: Social and Environmental Assessment
Principle 3: Applicable Social and Environmental Standards
Principle 4: Action Plan and Management System
Principle 5: Consultation and Disclosure

Principle 6: Grievance Mechanism
Principle 7: Independent Review
Principle 8: Covenants
Principle 9: Independent Monitoring and Reporting
Principle 10: EPFI Reporting

Review and categorization

An EPFI will categorize a project, based on the magnitude of the potential social or environmental impacts and risks of that project, in accordance with IFC classification criteria.

These categories are:

Category A: Projects with potential significant adverse social or environmental impacts that is diverse, irreversible or unprecedented.
Category B: Projects with limited adverse social or environmental impacts that is few. in number, generally site specific, largely reversible and readily addressed through mitigation measures.

Category C: Projects with minimal or no social or environmental impacts.
Wind Energy projects, by their nature; tend to fall into Categories B or C, being medium or low risk. Certain EPFIs as a matter of policy for example treat every wind turbine project as Category D: The Equator Principles apply to projects over 10 million US dollars. The Principles state that adopting financial institutions will provide loans directly to projects only under the following circumstances:
This IEE study has adequately addressed the Equator Principles applicable to risky projects as stated hereunder:

Principle 1 (Review and Categorization): The study has reviewed the National and International Laws and Guidelines on different environmental aspects and has categorized the Gul Ahmed Energy Limited Wind Power Project in Category C Low Hazard).

Principle 2 (Social and Environmental Assessment): The Study has been prepared to respond to the National and International requirements and to satisfactorily address the key environmental and social issues.

Principle 3 (Applicable Social and Environmental Standards): For the purpose of this IEE Study, primary data on the baseline environmental and social conditions have been generated wherever necessary to address the requirements of National laws and regulations; applicable

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International Treaties and Agreements; sustainable development and use of renewable natural resources; protection of human health, cultural properties, and biodiversity and other physical, ecological and socioeconomic issues required to be addressed under this Principle.

Principle 4 (Action Plan and Management System): Section-6 of this study screens the potential environmental impacts and proposes/provides Mitigation Measures to reduce the severity of impact. The study also includes the Environmental Monitoring and Management Plan.

Principle 5 (Consultation and Disclosure): Being a project of Category B, the public consultation is limited to the scoping sessions with stakeholders and an extensive socio economic survey of the villages/hamlets that are all outside the boundary of the Project area. The surveys and consultation meetings have established that no major resettlement or temporary relocation or acquisition of land is involved.

Principle 6 (Grievance Mechanism): This Principle will not apply since 'no' resettlement or temporary relocation or acquisition of land is involved.

Principle 7 (Independent Review): Being placed in Category C, an independent review is not required.
Principle 8 (Covenants): The IEE study has incorporated Covenants linked to compliance. Moreover, No Objection Certificates are issued to Proponents of Project under conditions of compliance with the Mitigation and Performance Monitoring Plan. Needless to say that if the proponent does not comply with the agreed terms, Sindh EPA is authorized to take corrective and even coercive action.

Principle 9 (Independent Monitoring and Reporting): This Principle will be not be applicable to the GEL Wind Power Project since it falls in category of projects requiring an IEE.

Principle 10 (EPFI Reporting): The concerned EPFI may safely commit to report publicly at least annually about its Equator Principles implementation processes and experience.

2.15 IFC Performance Standards on Social and Environmental Sustainability

International Finance Corporation (IFC) applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards are also applied to the projects in emerging markets. Together, the eight Performance Standards establish standards that the Proponent is to meet throughout the project.

The objectives of Performance standards are given below:

- To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment
- To promote improved social and environment performance of companies through the effective use of management systems.

Performance Standard-1: Social & Environmental Assessment and Management System

This Performance Standard seeks to:

- Identify and assess social and environment impacts in the project's area of influence;
- Avoid, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment;
- Ensure that affected communities are appropriately engaged on issues that could potentially affect them; and
- Promote improved social and environment performance of the project through the effective use of management systems.

Under this Standard, the project is required to establish and maintain a social and environmental management system appropriate to the nature and scale of the project and in accordance with the level of social and environmental risks and impacts. The management system is required to incorporate the following elements:

- Social and Environmental Assessment;
- Management program;
- Organizational capacity;
- Training;
- Community engagement;
- Monitoring; and
- Reporting

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This IEE study has been conducted to respond to requirements of national legislation and international Guidelines as well fulfills the above requirements of the IFC Performance Standards PS1.

Performance Standard-2: Labor and Working Conditions

This PS seeks to establish, maintain and improve the worker-management relationship; promote fair treatment, non-discrimination and equal opportunity for workers, and compliance with national labor and employment laws; protect the workforce by addressing child labor and forced labor issues; and promote safe and healthy working conditions, and to protect and promote the health of workers.

The Sponsors of proposed project and their contractors will be required to adhere to this PS, in particular with regard to compliance with national labor and employment laws; employment of child labor, and promoting safe and healthy working conditions, besides protecting and promoting the health of workers.

Performance Standard-3: Pollution Prevention and Abatement

The PS 3 seeks to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities, and to promote the reduction of emissions that contribute to climate change. The Standard requires the project to consider during its entire lifecycle ambient conditions and apply pollution prevention and control technologies and practices that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective.

PS 3 will be applicable to all stages of the Gul Ahmed Wind Power Project. Various aspects of pollution prevention and abatement of the proposed project are discussed separately in this report.

Performance Standard-4: Community Health, Safety and Security

The PS 4 seeks to avoid or minimize risks and impacts on the health and safety of local community during the project lifecycle from both routine and non-routine circumstances, and to ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security. The PS requires the project to evaluate the risks and impacts to the health and safety of the affected community during the design, construction, operation, and decommissioning of the project and establish preventive measures to address them in a manner commensurate with the identified risks and impacts.

The present assessment addresses the requirement of PS 4 for the proposed project, and has evaluated the impacts of sitting the project on health, safety and security of the community in the microenvironment as well as the macro-environment. The Environmental Management Plan also addresses company community aspects.

Performance Standard-5: Land Acquisition and Involuntary Resettlement

This PS aims to address the adverse impacts associated with land acquisition and involuntary resettlement caused by the project. The PS seeks to:

- Avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs.
- Mitigate adverse social and economic impacts from land acquisition or restrictions on affected person's use of land by: (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.
- Improve or at least restore the livelihoods and standards of living of displaced persons.
- Improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.

  The project site is the property of Gul Ahmed Energy Limited. Moreover there is no permanent settlement or hamlet within the designated area. Project Land has been leased by the Sindh Government to GEAL.

Performance Standard-6: Biodiversity Conservation and Sustainable Natural Resource Management

The PS 6 seeks to protect and conserve biodiversity, and promote sustainable management and use of natural resources through adoption of practices that integrate conservation needs and development priorities.

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The present environmental assessment addresses the potential impacts of the proposed project on the biodiversity. This IEE has recommended measures for the conservation of flora, fauna and other natural resources.

Performance Standard-7: Indigenous Peoples

The PS 7 seeks to address the impacts of the project on the indigenous people. Specifically, the objectives of the PS are to:

- Ensure that the development process fosters full respect for the dignity, human rights, aspirations, cultures and natural resource-based livelihoods of Indigenous Peoples.
- Avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not feasible, to minimize, mitigate, or compensate for such impacts, and to provide opportunities for development benefits, in a culturally appropriate manner.
- Establish and maintain an ongoing relationship with the Indigenous Peoples affected by a project throughout the life of the project.
- Foster good faith negotiation with and informed participation of Indigenous Peoples when projects are to be located on traditional or customary lands under use by the Indigenous Peoples.

- Respect and preserve the culture, knowledge and practices of Indigenous Peoples

No indigenous people - with a social and cultural identity distinct from the existing dominant society that makes them vulnerable to being disadvantaged in the development process of the proposed project are known to exist in and around the proposed site. No such people were found in the area during the present study either. Therefore, this PS is not applicable for the proposed project.

Performance Standard-8: Cultural Heritage objectives have been set in the IFC performance standards to achieve sustainable development.

The objectives of this PS-8 are to protect cultural heritage from the adverse impacts of project activities and support its preservation, and to promote the equitable sharing of benefits from the use of cultural heritage in project activities.

No sites of cultural heritage are known to exist at or in the immediate vicinity of the project location. There are also no indications of any old settlement in the area, nor is there any site covered under the listing of cultural heritage sites. This PS will therefore not be applicable to the Project.

2.16 IFC- Environmental, Health, and Safety Guidelines

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP).
For Wind Energy the EHS Guidelines for wind energy include information relevant to environmental, health, and safety aspects of onshore and offshore wind energy facilities.

Construction activities for wind energy projects typically include land clearing for site preparation and access routes; excavation, and filling; transportation of supply materials and fuels; construction of foundations involving excavations and placement of concrete; operating cranes for unloading and installation of equipment; and commissioning of new equipment. Decommissioning activities may include removal of project infrastructure and site rehabilitation.

Environmental issues associated with the construction and decommissioning activities may include, among others, noise and vibration, soil erosion, and threats to biodiversity, including habitat alteration and impacts to wildlife. Due to the typically remote location of wind energy conversion facilities, the transport of equipment and materials during construction and decommissioning may present logistical challenges.

Environmental issues specific to the operation of wind energy projects and facilities include the following:

- Visual impacts
- Noise
- Species mortality or injury and disturbance
- Light and illumination issues
- Habitat alteration
- Water quality
- Electric Power Transmission and Distribution

The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a substation located within an

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electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas.

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 and other emissions (e.g. from vehicle traffic, land clearing activities, and materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fuelling activities. Environmental issues during the construction phase of power transmission and distribution projects specific to this industry sector include the following:
- Terrestrial habitat alteration.
- Aquatic habitat alteration.
- Electric and magnetic fields.
- Hazardous materials

IFC Guidelines for Environment Health Safety specific to Wind Power Project are attached as Annexure VI

2.17 INSTITUTIONAL SETUP FOR ENVIRONMENTAL MANAGEMENT

The apex environmental body in the country is the Pakistan Environmental Protection Council (PEPC), which is presided by the Prime Minister (referred to as 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 EPAs were first established under the 1983 Environmental Protection Ordinance (PEPO, 1983); PEPA 1997further strengthened their powers. The EPAs have been empowered to receive and review the environmental assessment reports (IEEs and EIAs) of the proposed projects, and provide their approval (or otherwise).The proposed Project would be located in the Sindh Province, hence this IEE report will be sent to the Sindh-EPA for review.

2.18 OBLIGATION UNDER INTERNATIONAL TREATIES

Pakistan is signatory of several Multilateral Environmental Agreements (MEAs), including:

- Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal
- Convention on Biological Diversity (CBD)
- Convention on Wetlands (Ramsar)
- Convention on International Trade in Endangered Species (CITES)
- UN Framework Convention on Climate Change (UNFCCC)
- Kyoto Protocol
- Montreal Protocol on substances that deplete the ozone layer
- UN Convention to Combat Desertification
- Convention for the Prevention of Pollution from Ships (MARPOL)
- UN Convention on the Law of Seas (LOS)
- Stockholm Convention on Persistent Organic Pollutants (POPs)
- Cartina Protocol

These MEAs impose requirements and restrictions of varying degrees upon the member countries. However, the implementation mechanism for most of these MEAs is weak in Pakistan, and administrative/institutional setup is practically on existent. Although almost all of the above MEAs would apply to the Project in one way or the other, the ones which have direct relevance for the proposed Project include the Basel Convention, Montreal Protocol, Stockholm Convention, UNFCCC, and Kyoto Protocol.

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SECTION 3

DESCRIPTION OF PROJECT

3 DESCRIPTION OF PROJECT

3.1 PROJECT LOCATION

The wind farm Project is located in Jhimpir, which is located approximately 130 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 370 acres of land, which has been leased by the acquired by the project company. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site. The Jhimpir wind corridor is identified as potential area for the development of wind power projects. The layout of the project site is shown in Figure 3.1.

The Project site has very sparse vegetation consisting of small shrubby bushes and flat terrain area Location of the Project is shown in Figure 3.2.

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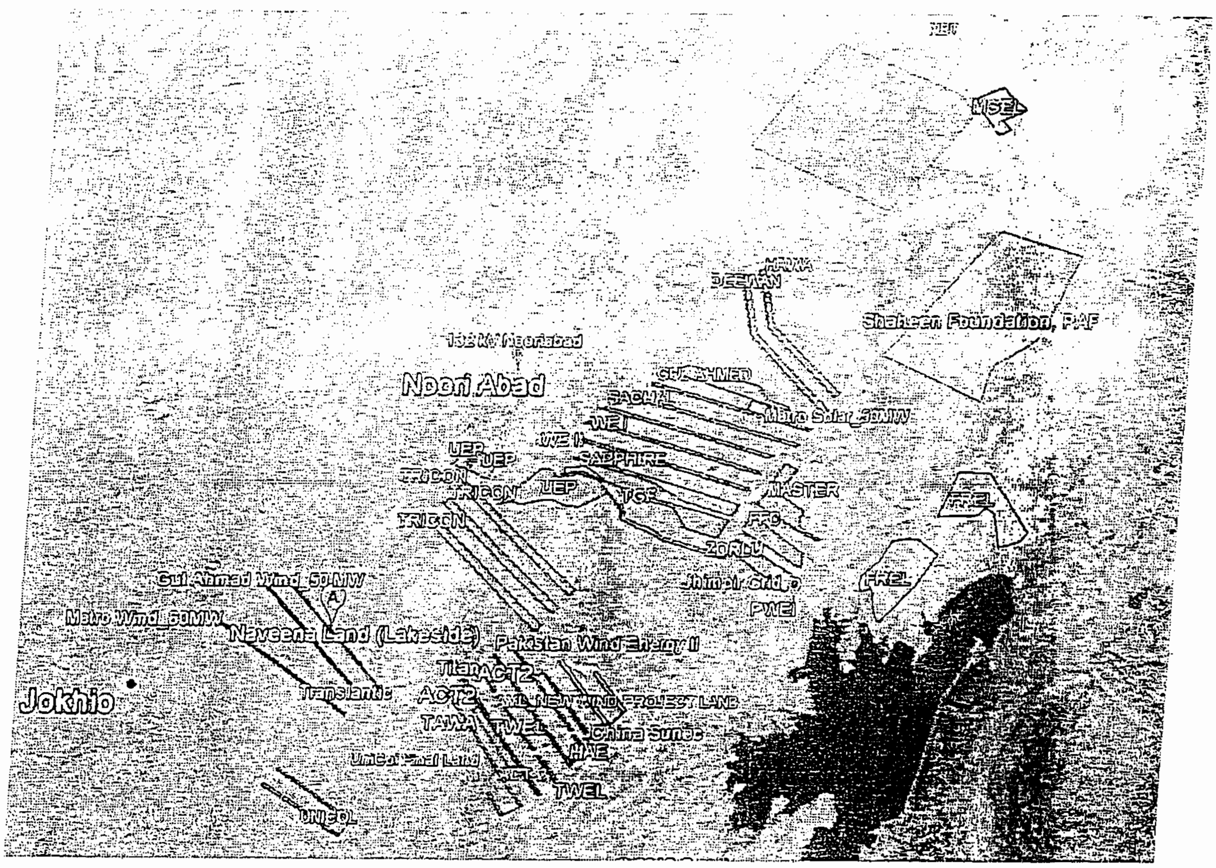

Figure 3.1: GA Project Site Layout

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	Project Sponsor: Gul Ahmed Energy Limited	Document Issue	01

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3.2 ROAD ACCESS

The Project site is easily accessible throughout the year.

The major track from Karachi to Nooriabad is via the Karachi-Hyderabad Motorway, and another access to the Project site is through Jhimpir. When travelling via the Karachi-Hyderabad Motorway, the access from Nooriabad to the site is a single track, which turns toward the site. However, the terrain is flat and long and heavy vehicles can easily navigate through this road. There are number of neighboring wind farms in the surrounding area of Jhimpir. There is no requirement to establish roads or tracks for movement of traffic. The total distance from Karachi to the site is approximately 130 km.

The satellite overview of the track from Karachi to the Project site through Karachi-Hyderabad Motorway is shown in Figure 3.3.

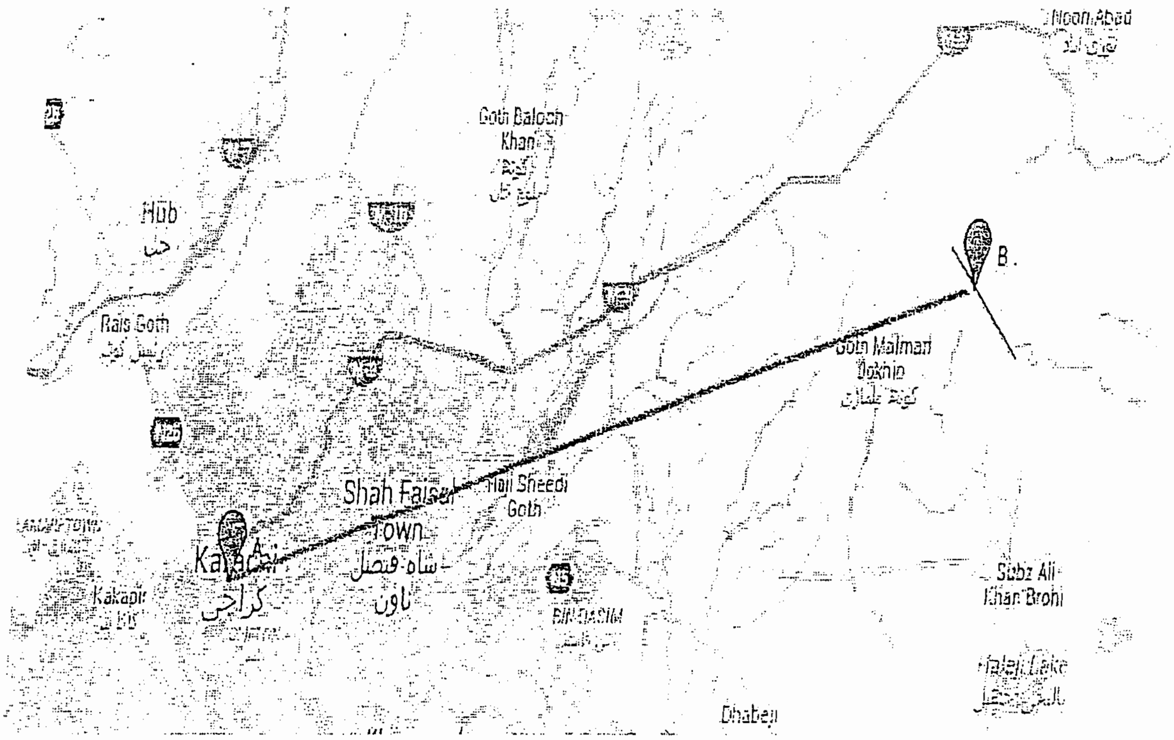

Figure 3.3: Ariel View of Complete Track (Through Karachi-Hyderabad Motorway)

Table 3-1: Land Coordinates

S. No.	Latitude	Longitude
1.	25° 2.602'N	67° 40.729'E
2.	24° 58.852'N	67° 44.819'E
3.	24° 58.910'N	67° 44.874'E
4.	25° 2.657'N	67° 40.794'E

The Project area is open and can be seen from images below in Figure 3.2;

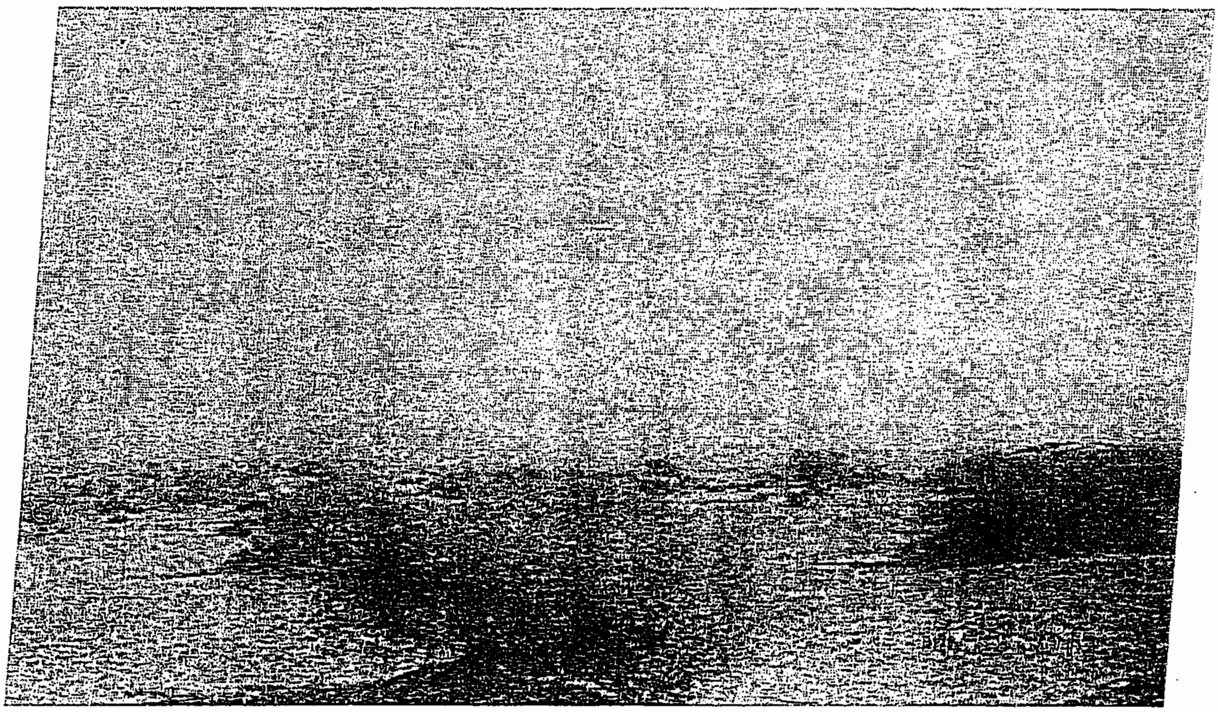

Figure 3.2: A View of Project Site

3.2 ROAD ACCESS

The Project site is easily accessible throughout the year.

The major track from Karachi to Nooriabad is via the Karachi-Hyderabad Motorway, and another access to the Project site is through Jhimpir. When travelling via the Karachi-Hyderabad Motorway, the access from Nooriabad to the site is a single track, which turns toward the site. However, the terrain is flat and long and heavy vehicles can easily navigate through this road. There are number of neighboring wind farms in the surrounding area of Jhimpir. There is no requirement to establish roads or tracks for movement of traffic. The total distance from Karachi to the site is approximately 130 km.

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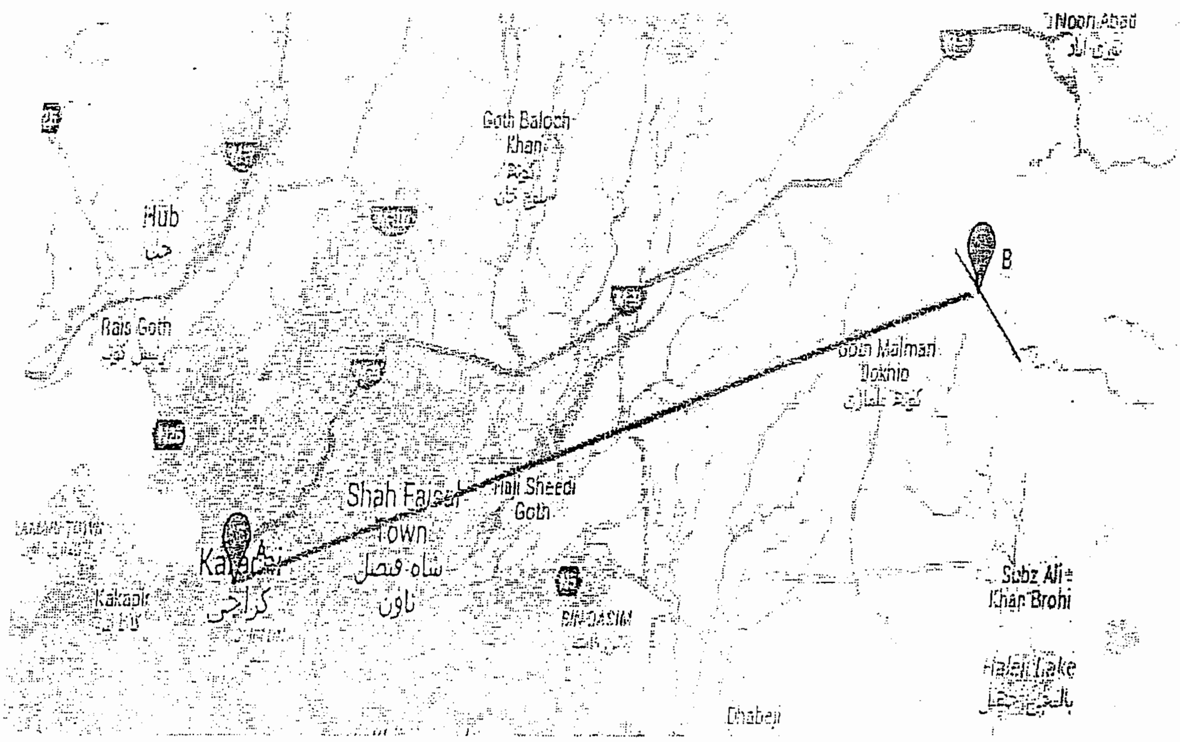

Figure 3.3: Ariel View of Complete Track (Through Karachi-Hyderabad Motorway)

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The major track from Karachi to site is two-way road. The Port Qasim is the one of the major port of Pakistan and is the point of delivery of equipment for the proposed wind power project. It is located towards east of the site as shown in Figure 3.4.

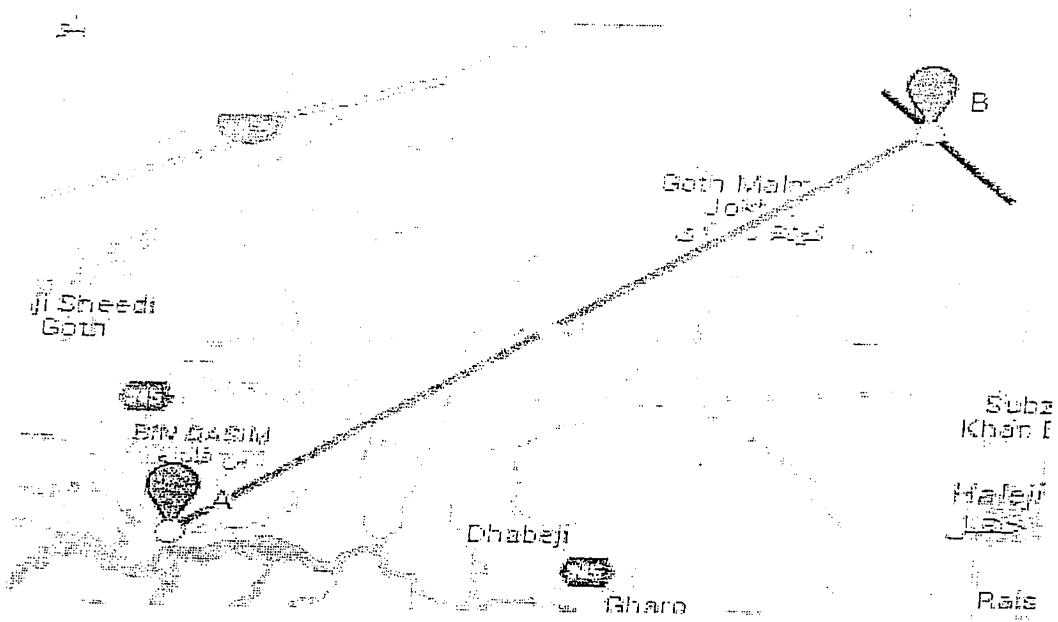

Figure 3.4: Orientation of Site from Port Qasim (Aerial View)

Aerial distance between the Port to the site is 44.8 km. Total track length between Port Qasim Karachi and site is approximately 104 km. Detail access to site is shown in Figure 3.5.

The track from Port to the Nooriabad Super Highway is good but site access Road that turns to the site needs minor development.

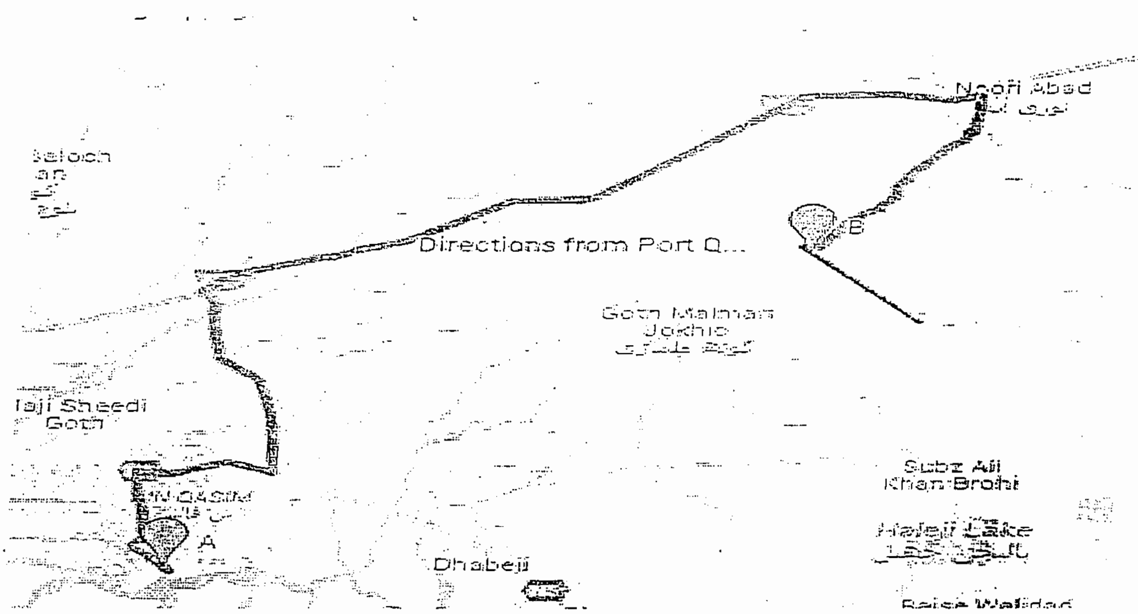

Figure 3.5: Detailed Access from Port Qasim to the Site

There is a number of neighboring wind farms under various stages of development in the Jhimpir region of various capacities ranging from 05 MW to 250 MW. The view of different tracks of land allocated to the wind farm project developers in Jhimpir is shown in Figure 3.6.

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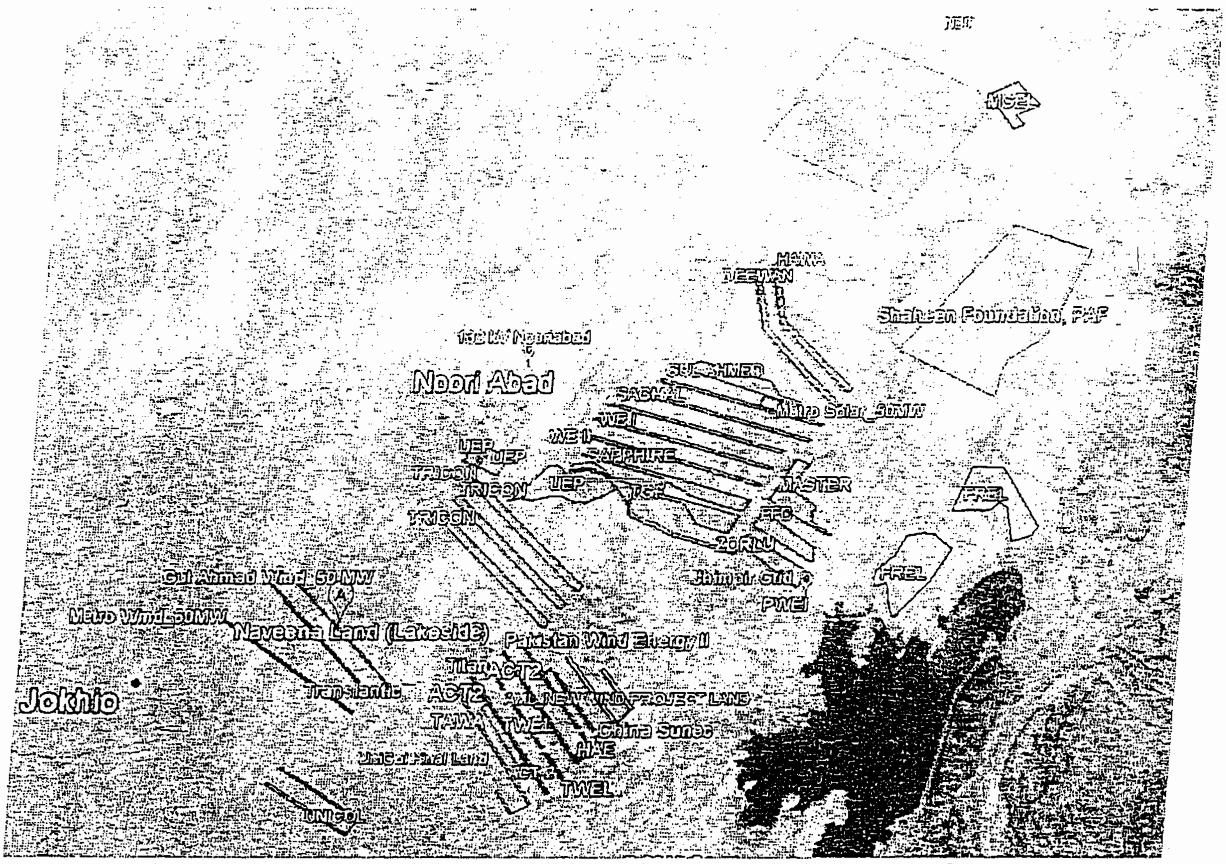

Figure 3.6: GA Site with Respect to Neighbouring Wind Farms in Jhimpir

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3.3 PROJECT SIZE AND COMPONENTS

The Project is of 50 MW capacities. Following WTGs will be installed:

- G.E 1.7 MW – Total 29 WTG
- Gamesa G114 - 2.0 MW – Total 25 WTGs
- G.W 121 – 2.5 MW – Total 20 WTGs
- Vestas V126 -3.3 MW – Total 15 WTG
- Nordex N117 3.0 MW – Total 16 WTG

The Project can be divided into four major phases:

- Pre-Construction Phase
- Construction Phase
- Operation and Maintenance Phase
- Decommissioning Phase

3.3.1 Preconstruction Phase

Pre-construction phase consists of:

- Land Procurement
- Soil and topographic Survey
- Installation of wind measuring mast
- Wind Resource Assessment and Micrositing
- Approvals from Government Departments (discussed in section 2.9)

3.3.2 Construction Phase

Construction Phase of the Project will be awarded to an EPC firm selected through a competitive bidding process. It is estimated that direct manpower required during the Construction phase will be approximately 500 persons, with unskilled jobs being offered mainly to local inhabitants, particularly during the Construction Phase.

Construction activities will be comprised mainly of:

- Construction of site roads and crane pads at each wind turbine site

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- Construction of turbine foundation and transformer pads
- Installation of electrical systems, underground and some overhead lines
- Assembly and erection of the wind turbines
- Construction and installation of substation
- Commissioning and Testing

All supplies both for construction and for the camp will be transported by trucks from Karachi. This will include all fuels and oils, drilling equipment, spare parts for construction machinery, and food supplies for construction camps.

3.3.3 Operation and Maintenance Phase

In order to maintain a high level of performance, a maximum staff of 10 persons per shift will be maintained for the wind farms, in addition to the security staff.

3.3.4 Decommissioning Phase

The Project's wind power generation systems, if operated prudently, should maintain certain residual value upon decommissioning, following the estimated 20 year life-cycle of the Project, as agreed in the EPA. Its continued performance would demand up-gradation rather than decommissioning of the plant. The tower and turbine may need replacement while the old ones may be sold as scrap to be appropriately disposed-off.

However, if the site is to be decommissioned prior to the designated plant life, it will be initiated by dismantling the turbines, supporting towers and substation, and transporting them out of the Project area. The activity will take approximately six (06) months and will require 400-500 truck- loads to transport the material. The turbine material and the tower will be sold as scrap, and concrete will be broken and moved to the landfill site. The stored fuel or oil will be transported out of the area for sale or disposal at a suitable landfill site. The site will be leveled to make it available for regular use.

3.4 PROJECT SCHEDULE

The Project is presently preparing its feasibility study, which is expected to be completed within the 4th Quarter of 2015. It is expected that the Tariff would be applied soon after completion of the feasibility study. This would be followed by the execution of the EPA, and thereafter the financial closing of the project by the 4th Quarter of 2016. The planned COD is the **1st** Quarter of 2018.

The EPC contract would be locked with tariff approval, which is expected to be available by January, 2016.

No.	Milestone	Anticipated Date
1	Submission of Feasibility Study	4th QTR of 2015
2	Tariff Application	1st QTR of 2016
3	EPC Contract Signing	1st QTR of 2016
4	Tariff Approval	1st QTR of 2016
5	EPA/IA	2nd QTR of 2016
6	Financial Close	4th QTR of 2016
7	Project COD	1st QTR of 2018

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3.5 LOCATION OF GRID

The Project is planned to be built in the Jhimpir region. The electrical network within the vicinity of the site of the plant comprises of LV (11 kV) and HV (132 kV and 220 kV) lines. For projects with installed capacity in excess of 10 MW, connection must be made with HV lines.

Hyderabad Electrical Supply Company 132/11 kV grid station is in Nooriabad. The distance of the grid station from the Project site is approximately ten (14.5) Kilometers.

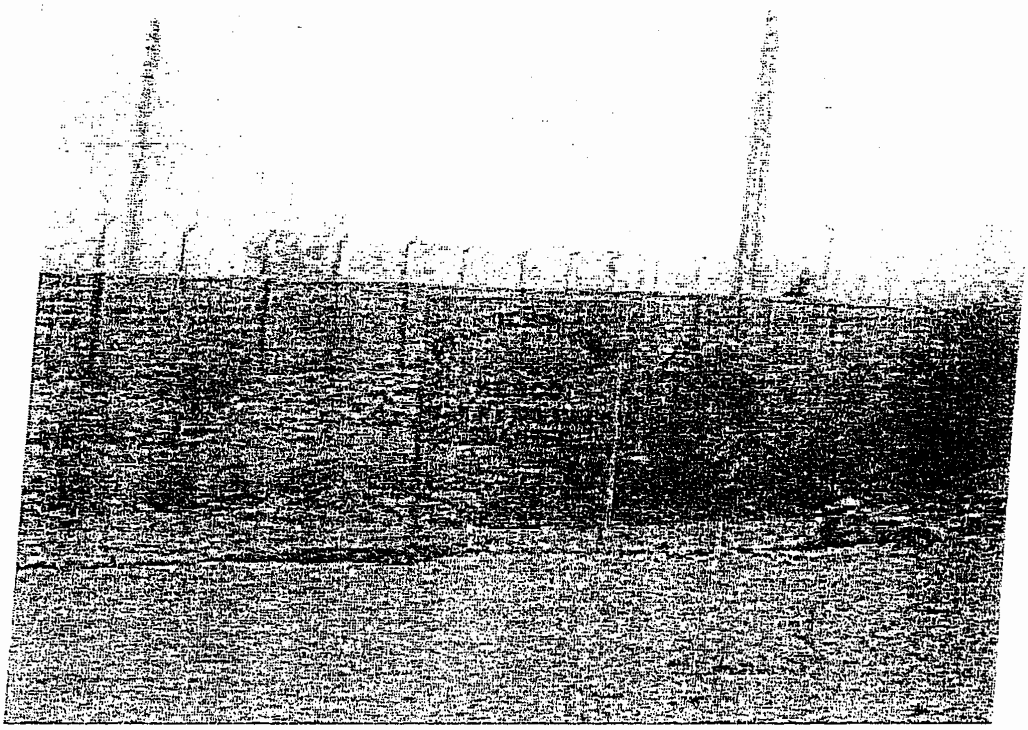

Figure 3.7: Nearest HESCO grid station

Another Grid Station of 220kV is under construction and will be available by end of 2016 as per the plans of NTDC.

3.6 WIND TURBINE DETAILS

Brief technical specification of wind turbine model is given in Table 3.2.

Table 3-2: Technical Specification s of Wind Turbine

Make	G.E
Rated Power	1.7
Hub Height	80 meters
No of Turbines	29

3.7 INFRASTRUCTURE DETAILS

Under the project following supporting infrastructure and facilities will also be constructed; their design details are still in planning stage;

- Administration Building
- Switch yard Building
- Dormitories Building
- Maintenance Building
- Internal Connecting roads
- Green belts

3.8 NET ENERGY YIELD AND CAPACITY FACTOR

The net energy yield and capacity factor of 50 MW wind farm is calculated and presented in Table 3.1.

Table 3-3: Annual Energy Production Estimates

Number of WTG	29
Approximate Net Energy Production [MWh/a] of G.E	531,209MWh/a
Capacity Factor [%] of G.E	35.0%

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SECTION 4

BASELINE ENVIRONMENTAL CONDITIONS

4 BASELINE ENVIRONMENTAL CONDITIONS

A data collection survey that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, flora and fauna, land use pattern, and socioeconomic conditions was undertaken, based on available secondary information or data collected in the field. Primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. Secondary data was collected for land, ecology, climate, and socioeconomic factors.

4.1 CLIMATIC CONDITIONS

The climate of the Project area can be broadly classified as arid, moderate, hot and humid. The mild winter is restricted to the November-February period. The summer extends from May to September, which overlaps the short spells of the main rainy season during July-August. The weather tends to be very humid during June, July, and September and is pleasant during March and April.

The climate of this area is characterized by fluctuating temperatures and sparse rainfall. The summer seasons are hot and humid with average temperatures ranging between 33ºC to 37ºC. The temperature in summer seasons may reach up to 45ºC. The winters are pleasant with average temperature in the range of 15ºC to 25ºC. The months of July and August generally observe the annual monsoon rainfalls. The meteorological stations of Badin and Hyderabad are located within the wind corridor. However, the meteorological data from Karachi station is also representative of the prevailing climatic conditions of coastal areas in the wind corridor. The climate information of Jhimpir is shown in Table 4.1.

The climatic conditions of Thatta and Badin districts may be taken as moderate as a whole. The climate is tempered by the cool sea breeze which blows for eight months of the year from March to October. During the monsoon season the sky is overcast but there is very little precipitation. The climate in summer is generally moist and humid. The cold weather in the districts start from the beginning of November when a sudden change from the moist sea breeze to the dry and cold north-east wind brings about as a natural consequence, an immediate fall in temperature. The data has been gathered or extracted through by using Meteonorm 7.1 and also the onsite monitoring during the laboratory analysis. The annual average of maximum and minimum temperatures of Jhimpir is given in Table 4.1 and presented in Figure 4.1.

Table 4-1: Average Maximum and Minimum Temperatures in Jhimpir Region (°C)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
24	28	33	38	41	40	37	35	36	36	31	26
12	15	19	23	26	28	27	26	25	23	19	14

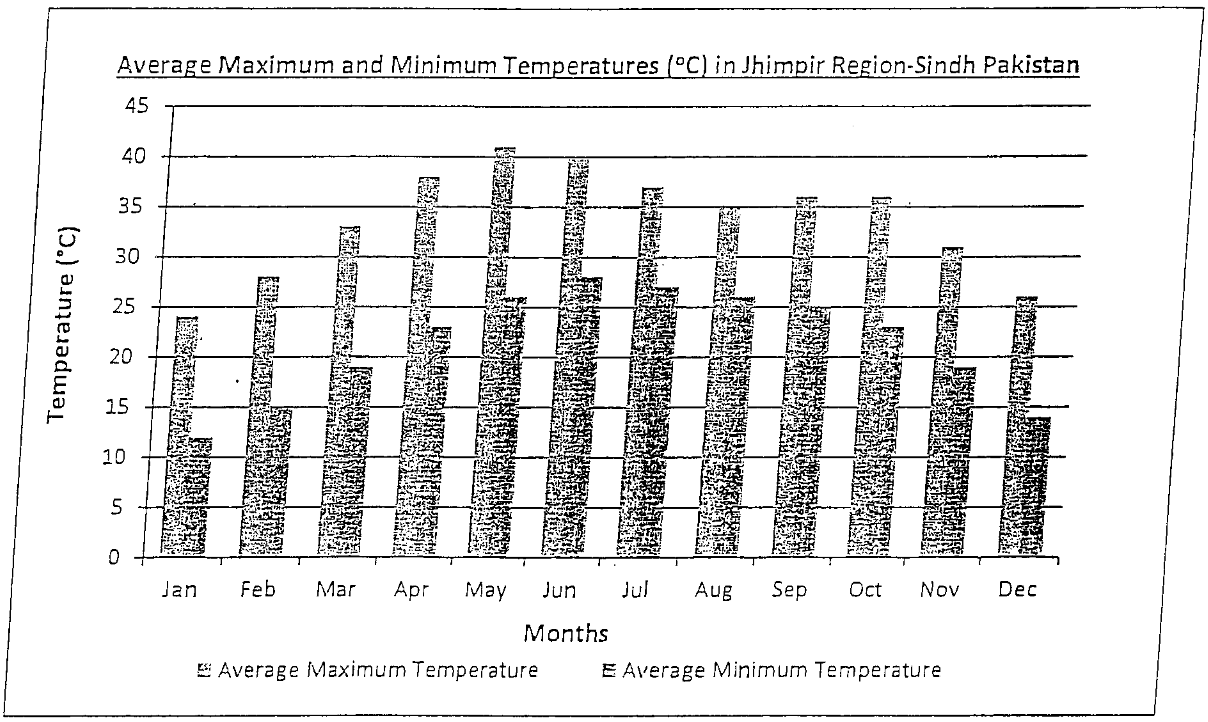

Figure 4.1: Graph of Average Maximum and Minimum Temerature (°C)

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The annual precipitation takes place mainly during summer. It is unevenly distributed. Average rainfall as per meteorological record is given in Table 4.2, most of which occurs in monsoon season, from April to September.

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Table 4-2: Average Precipitation and Rainfall Days in Jhimpir Region

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14mm	6mm	7mm	6mm	5mm	12mm	21mm	50mm	13mm	3mm	0mm	16mm
2	1	0	1	0	1	3	4	1	0	0	1

4.2 SURFACE AND GROUND WATER HYDROLOGY AND DRAINAGE

Major water reserve of the area is Keenjhar Lake, also known as Kalri Lake. The lake is located approximately 26 km from the Project site. It is 24 km long and 6 km wide and has an area of 14000 ha (35,583 acres). The lake is fed by the Kalri Bagar feeder canal from the North-West as well as by small seasonal streams entering into it from the North and the West. The feeder is also the conduit for the industrial wastes of Kotri town. Keenjhar is a wild life sanctuary and a Ramsar site. Keenjhar Lake which is shown in Figure 4.3.

Figure 4.2: Satellite View of Keenjhar/Kalri Lake near Project Site

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The only perennial water channel in the area is the KalriBaghar (KB) Upper Feeder which feeds Keenjhar Lake with Indus water from Kotri Barrage. The KB Feeder is approximately 20km away from the Jhimpir wind farm sites and lies on its eastern side. The KB feeder is about 61km long and its design discharge is about 258 cubic meters per second (cumecs). Kinjhar Lake is also being fed by hill torrents during floods from the western side. The catchment area of these hill torrents are about 1664 sqkm and have their outfall into the Kinjhar Lake. These hill torrents include RodhNai and LiariNai. BaranNai, which is the principal source of flood drops into the River Indus downstream of Kotri barrage.

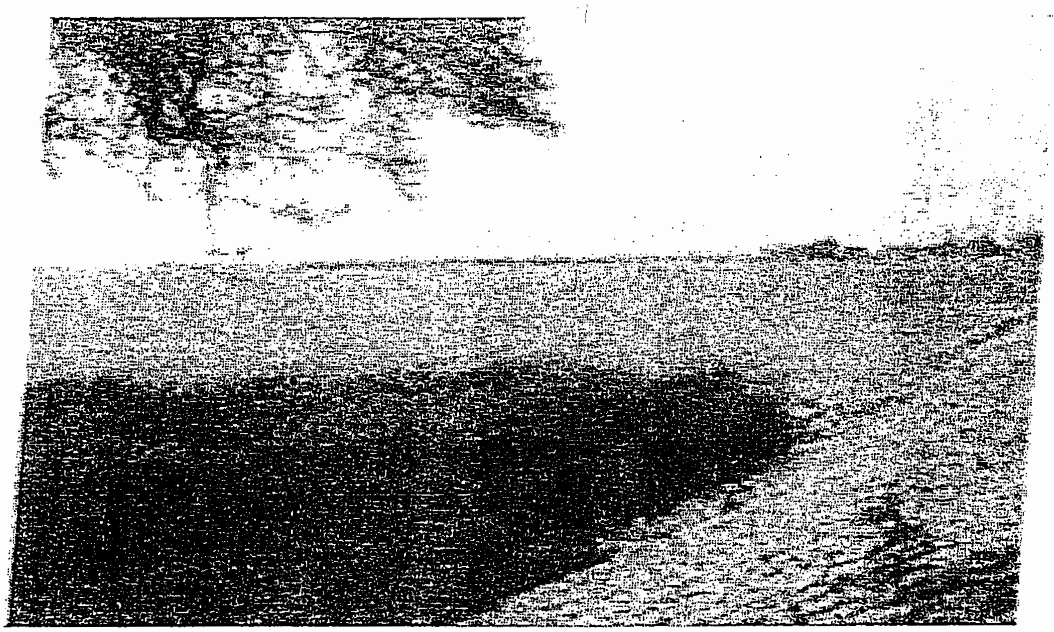

Figure 4.3: View of Kinjhar/Kalri Lake near Project Site

Kinjhar Lake is the main source of fresh water for drinking and irrigation for the areas downstream of Jhimpir including the city of Karachi. Kinjhar Lake is an artificial water storage reservoir located in District Thatta. It came into existence as a consequence of implementation of the Kotri Barrage canals Irrigation Project. This artificial reservoir has been formed out of natural depressions of Sonheri and Kinjhar Dhands. The gaps between the surrounding hills of the dhands were closed with the construction of earthen embankments having an average height of about 7.6m. Apart from KB Feeder, hill torrents and Kinjhar Lake there is no other source of surface water available in the area. The quantity of water in Kinjhar Lake is ample to fulfill the requirements of the downstream areas for irrigation and drinking purposes.

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Regular Surveys have not been carried out to assess the availability and quality of Ground water in the Province of Sindh. Various sources estimate that the volume is 3-5 MAF scattered in 28% of the geographical area of Sindh. This water is found mainly along the Indus water channels and in a few underground streams. In recent years, drought has caused excessive extraction of groundwater to make up for the lack of irrigation water. This, in turn, has resulted in rapid depletion of the groundwater and filling up of the underground freshwater channels and reservoirs with brackish water.

During social survey, it is learned that the availability of drinking water is the major problem of the area. The water of shallow wells present in the expansion areas contains higher values of TDS and mostly saline in nature therefore is not suitable for human consumption. The results are also attached in annexures VII.

The depth of water table is also depleting over the period. Due to increased number of private tube wells being installed in the location of sub project, the ground water is depleting. Recharge from surface /rain water is helping in reduction of depth of sub soil water table. During dry periods, the situation sometimes becomes quite serious.

The project activities will not disturb the water bodies located nearby. As there is no water discharges from the Wind turbines during operations and during construction wastewaters will not be disposed in any water body. However, water from domestic activities like Labor camps will be treated through septic tank / soaking pits.

The area is very poor in terms of the indicator in respect to piped water, which is available to only about 14% of the housing units. About 13% of rural households have hand pumps inside the housing units, while 16% use outside ponds for fetching water, and 6% of housing units use dug wells. The ground water level of the site is 115 meters.

The drainage system in the area is not developed. The booster pumping station for the water supply pipeline is established to supply water from Keenjhar Lake to Nooriabad Industrial State. Nooriabad Industrial state is located at a distance of approximately 10 km from Keenjhar Lake.

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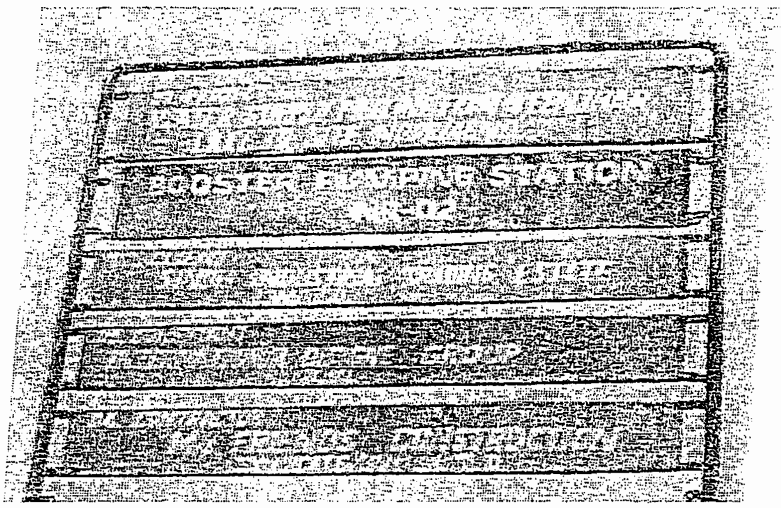

Figure 4.4: Booster Pumping Station from Kinjhar Lake to Nooriabad IndustriaL Estate

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4.3 AMBIENT AIR QUALITY

The area in and around the Project site is underdeveloped with no industrial development nearby, but the area is likely to develop into a modern city after development of wind power projects in the area. The primary sources of air pollution include traffic near Karachi Hyderabad Motorway. The impact of exhaust emissions from vehicular traffic operating on Highway N5 is limited to the microenvironment of the highway. No sources of anthropogenic sources of air pollution exist in the immediate vicinity of the site; therefore the ambient air of the area is likely to be free from the key pollutants such as carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO2) and particulate matter (PM). But in very minor quantities. In general, the air quality of the area is high with no significant air pollutants (PM). Ambient air quality recorded by the (SGS) EPA Certified Laboratory during this study. It may be seen that the average level of each parameter in ambient air is on lower side in comparison with National Environmental Quality Standards (NEQS). The results are attached in annexure VII.

4.4 NOISE QUALITY

There is no continuous source of noise emission within or around the proposed project wind farm site.

The Noise level recorded at the unpolluted site in ranges between 37.5 dB (A) and 45 dB (A) with the average at 44.0 dB (A), which is characteristic of wilderness and well within 75 dB (A) the level suggested by NEQS.

There is very minor human settlement near the Project area. Traffic near the Project site is consequently very low. Industrialization is also very low, thus baseline noise levels are low.

4.5 SEISMIC HAZARDS

According to the seismic zoning map of Pakistan, the Jhimpir region falls in **ZONE II-B** with moderate to severe damage area probability with G Factor of g=0.1-0.3, as shown in the map in Figure 4.5.Earthquake records indicate that this region has experienced several earthquake tremors in the past, as well as recently. The region has some major tectonic features, including the Runn Kutch-Karachi fault, Pab fault, Ornach-Nal fault, Surjan fault, and Jhimpir fault.

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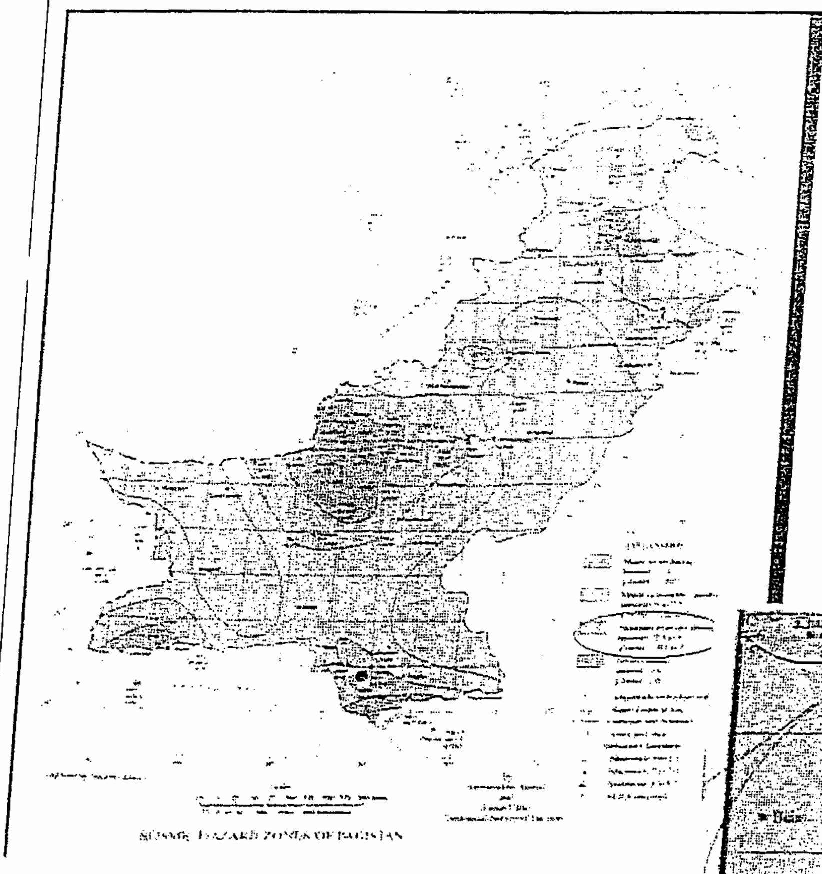

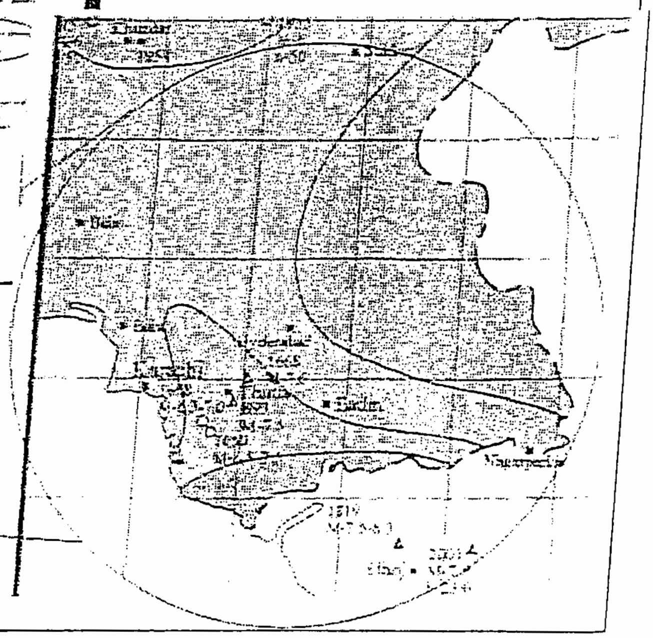

Figure 4.5: *Seismic Hazard Zones of Pakistan*

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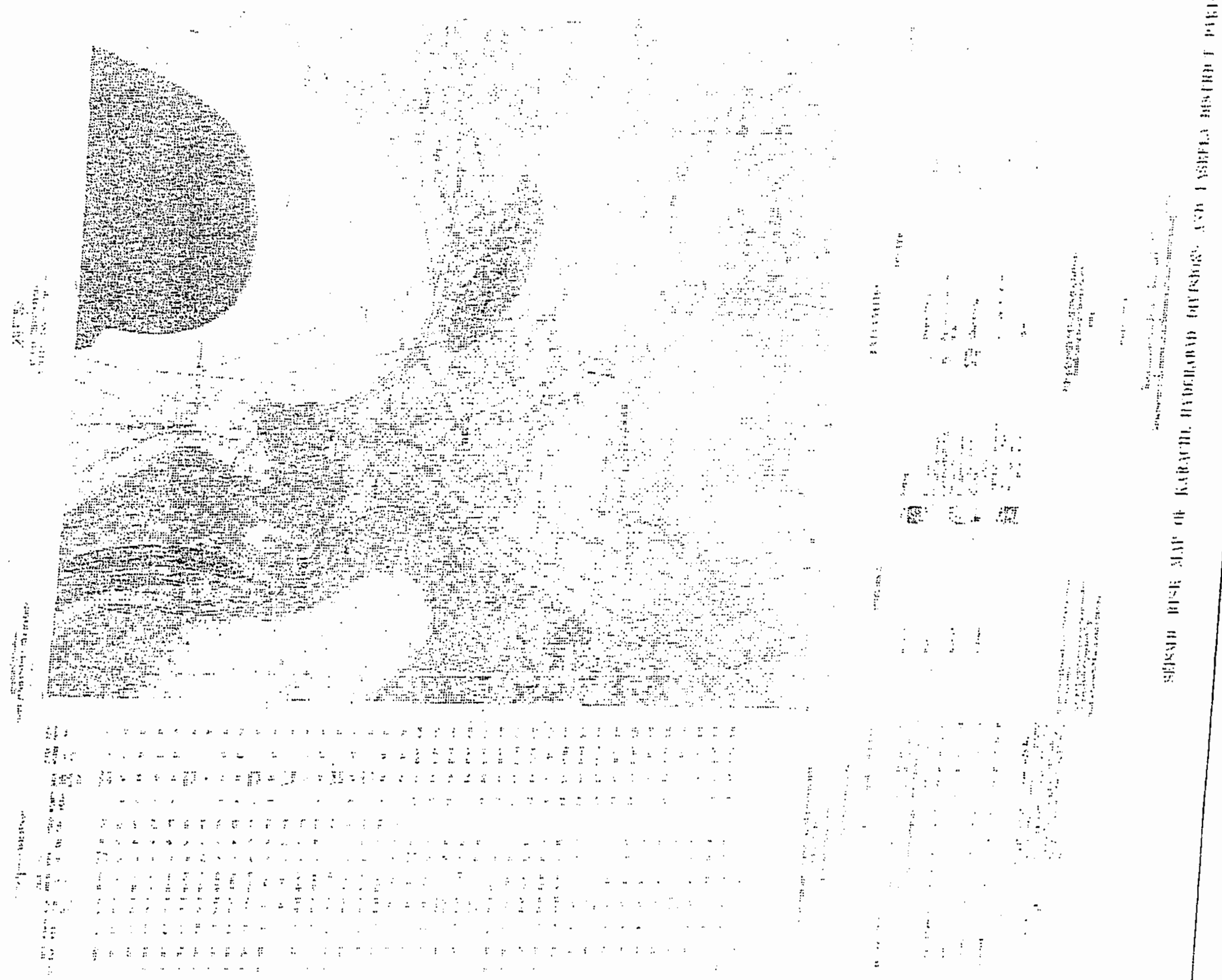

Figure 4.6: Seismic Map of Pakistan

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4.6 FLOODS

Sindh province has two sources of flooding. The Riverine flood is more predictable and allows ample time to react, whereas the torrential floods leave almost no time to respond. Torrential floods have lesser frequency and duration but very high intensity; therefore, impact is often severe. These floods normally occur in monsoon months of July and August when the catchment areas in Balochistan receive heavy rains. The Western boundary of Sindh is connected with Balochistan through the Khirthar hills.

In 2011, torrential floods devastated more than 11,000 villages in Kacha and the surrounding areas of Sindh, displacing more than 213,000 households from their villages along with 1,065,000 numbers of livestock. District Thatta was the worst affected in Sindh because it was the last district on the Indus River where the flood remained for around two months. Official data reveals that approximately one million people were directly hit in this district of the province.

According to the flood map of Pakistan, Sindh province falls under a moderate to heavy flooding zone.

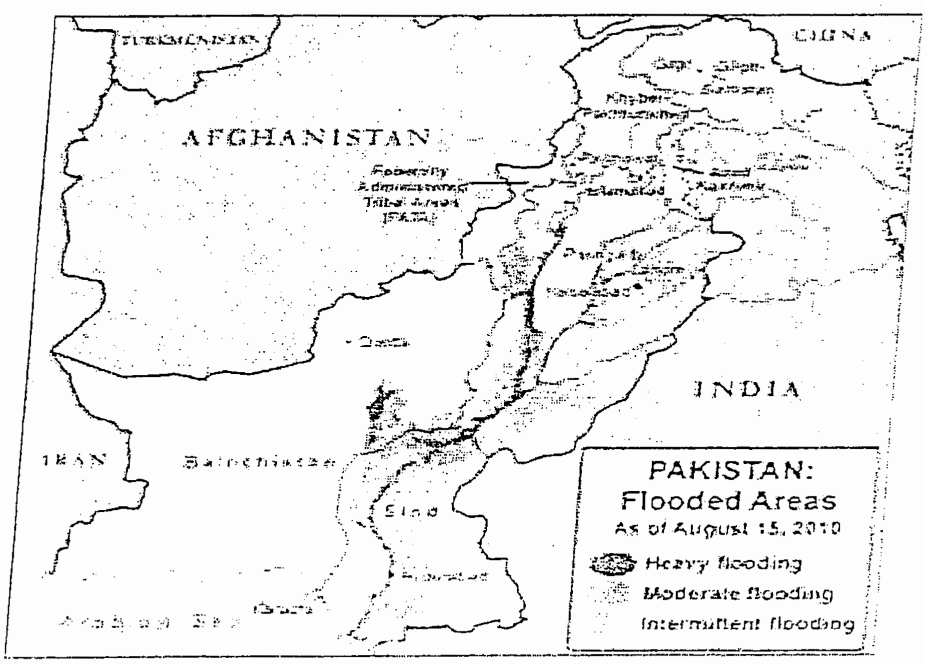

Figure 4.7: Flood Map of Pakistan

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4.7 GEOLOGICAL SETTINGS

The Project area has a wide range of soil types due to its diverse land forms, which include sandy, deltaic, alluvial, gravel, coastal, and mountainous.

The Prevailing geologic conditions in the region are the results of extensive sedimentation, coastal movements, and erosion over a long period of time in the geological ages. The geology of the region is closely related to the formation process of Himalayan Ranges. This has resulted in intense deformation with complex folding, high angel strike-slip faults, and crust thickening expressed in a series of thrust faults. The important tectonic changes which have had so much influence in the region are freely visible, particularly in the Indus plain. Ultimately, it is only by considering the geology on a broader regional scale, as well as in site specific detailed, that the effect can be appreciated.

The hilly region of western Sindh consists almost entirely of rocks belonging to the tertiary system of geological nomenclature. It is only along the Laki range and in its neighborhood that there is some exposure of rocks belonging to the next older system; the cretatious with the exceptions of some volcanic beds associated with these cretatious strata, all the rocks formation of western Sindh are the sedimentary origin. All of the more important hills messes consist of limestone. A vast majority of this limestone deposit is from the nummultic period and is largely built up of the accumulated shells of foraminifera; principally those belonging to the genus nummulties.

Table 4-3: Geologocal Formations covered in the Wind Corridor of Jhimpir

Geological Symbol	Description	Percentage (%) of Total Area
Q	Unconsolidated surface deposits of silt and gravel of recent period	32.57
Te	Eocene Sedimentary Rocks (Mostly Limestone) of Tertiary Ages	67.43

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4.8 SOIL CLASSIFICATION

The texture of soils in the wind corridor ranges from loamy saline, silty, and clayey in the coastal areas to gravely, mainly loamy, and clayey soils in the in land areas.

The loamy soils in the coastal areas are strongly saline (hence devoid of any agriculture), moderately alkaline (pH of 7.9 to 8.4) and strongly calcareous ($CaCO_3$ content greater than 15%). The soil in the inland areas, especially those areas covered under the lower Indus basin, consists mainly of loamy and clayey soils. These soils have little or no salinity (0 to 4dSm-1) and are moderately alkaline (pH of 7.9 to 8.4). The soils are generally non-saline, non-sodic except local saline patches in inter-dual valleys and some parts of the alluvial plain.

The soil of Jhimpir is classified as mainly loamy saline and part gravely. The soil is similar in nature to the soil of Gharo area. However the soils in some patches may be different with a slight salinity (between 4dSm-1 to 8dSm-1). This type of soil is usually neutral (with a pH of 6.6to 7.3), and moderately calcareous (with $CaCO_3$ content in the range of 3% to15%). Properties of soil in some patches of the wind farm may be different to the ones stated above with moderately alkaline (pH of 7.9 to 8.4), strongly calcareous (with $CaCO_3$ content of greater than 15%) with little or no salinity (between 0dSm-1 to 4dSm-1).This type of soil is usually neutral (with a pH of 6.6 to 7.3), and moderately calcareous (with $CaCO_3$ content in the range of 3% to 15%).

4.9 LAND USE CAPABILITY

The land area of the Project consists of a complex of agriculturally unproductive (rock) land and some poor grazing (gravely land) (Class VIII, VII). This area constitutes about 38.3% of the total wind farm area and is also incapable of agriculture as the soil underneath mainly consists of rock and gravel. The remaining portion (about 61.7%) of the land is a complex of poor torrent-watered crop land and poor (loamy) grazing land. Some part of this land is capable of agriculture being fed by torrent water whereas the remaining portion comprises of grazing area (capable of growing grass and shrubs).

Table 4-4: Land Use Capability Class in Jhimpir

Classification No	Soil (Class)	Capability	Percentage (%) of Total Area
7	IV, VII	Complex of poor torrent-watered cropland and poor (loamy) grazing land	61.68
10	VIII, VII	Agriculturally un-productive(rock) land and some poor grazing (gravely) land	38.32

The Project site consists of areas that have variable land use. The rocky and gravely soil formation devoid the major land area for any agricultural use. However the land area is also influenced by perennial grazing consisting of short grasses shrubs and scrubs. This area is dependent on residual moisture from torrent overflows. The major bushes found in the area include Devi, Chali, Damral, and Darathi (local names). No medicinal value is associated with these plant species found in the area.

4.10 SOCIO ECONOMIC FEATURES

4.10.1 Local Settlement Pattern and Population

Jhimpir, being in the administrative control of District Thatta, is unique in terms of population sensibility and characteristic. The total area of Thatta is 17,355 sq/km, the total population consists of 1,113,194 persons scattered in several *goths/paras*. Gender distribution shows a figure of 589,341 males and 523,853 females. The population density of Thatta is 64.1 per sq/ km, and the percentage of the total population residing in an urban area is 11.2 %. The average household size is approximately 5 persons. The average growth rate of the population has remained at 2.26% from 1981-98.

Table 4-5 List of Settlements and Population details

S.No	Name of Settlement/Goth	Coordinates	Distance from Project Site (km)	Population	Status /Type
1.	Kalo Khan Goth	25° 6.482'N 67° 44.766'E	9.89km	500-600	Permanent
2.	Rawal Pollari Goth	25° 6.684'N 67° 44.728'E	10km	400-500	Permanent
3.	Bilal Pollari Goth	25° 3.511'N 67°42.114'E	3km	150-200	Permanent

Average household size is 5; houses built in nearby villages are single room houses, made of mud and bushes; there are four settlements found in the proximity of the proposed project area nearest settlement are found at the distance of 3.0 kilometer. Kalo Khan Goth. Rawal Pollari Goth and Bilal Pollari Goth are the only permanent settlements and there are no seasonal /temporary settlements near the project site. The population of the settlements varies from 150 – 400+ inhabitants and houses from 50 – 60. Table shows the GPS coordinates of the settlements observed during the survey. During Micrositing study of the towers, due consideration will be given to avoid any disturbance to locals.

4.10.2 Health and Education Facilities

The health infrastructure in District Thatta is scant. Three out of the six coastal Talukas do not have any Rural Health Centre or any Veterinary Dispensary. A particular problem of access to health services is the scattered nature of the population. Thus, many people have no access to health services within a convenient location from their homes. Serious ailments have to be treated at Thatta, Hyderabad, or Karachi. Many of the diseases occurring in the area are water-borne and are due to lack of sanitation facilities. A basic health care center is present in the area with minimum facilities and staff.

Figure 4.8 A Basic Health Unit in Jhimpir

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The literacy rate in District Thatta was reported to be 22% in 1998. The male literacy rate was three times higher at 32% compared to the female literacy rate of only 11%.The literacy rate in urban areas was much higher at 46% compared to only about 19% in rural areas. A single primary school is located in the area.

Government primary school has been observed in the vicinity, which is not functional. The peoples of these goths are demanding the teachers as well as the middle schools. Private school is observed which is far and located at Bachal Jhakro Goth. The only primary school is presenet in the Kalo Khan Goth. There is dire need of high school and to make primary school functional.

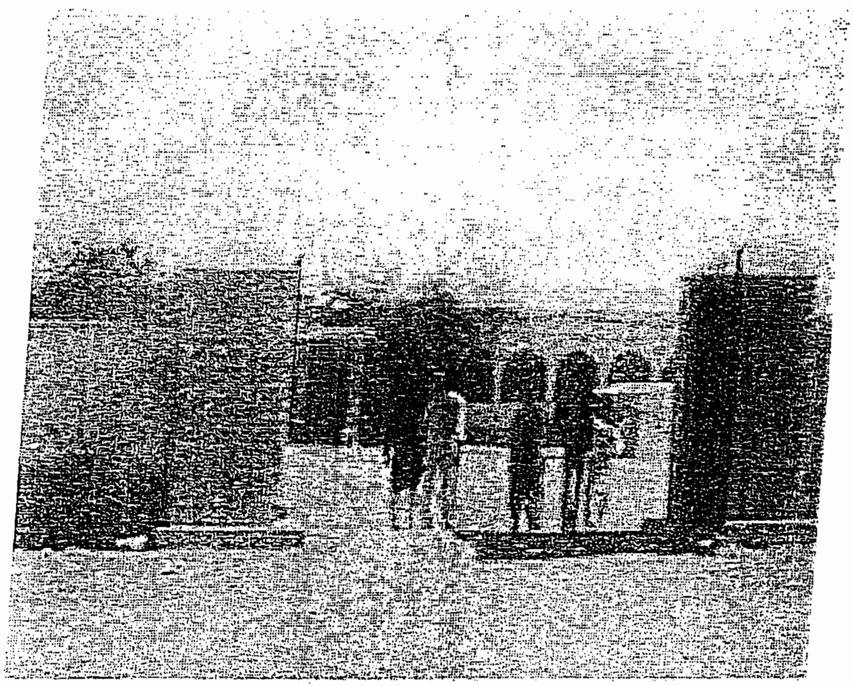

Figure 4.9: A View of School nearby Project Area

4.10.3 NGOs Working in the Area

Different national and international NGOs are working in District Thatta with the help of their local partners. Their scope of work ranges from relief operations in the coastal areas of Thatta to social welfare and livelihood improvement initiatives. Certain NGOs are working on CPI (Community Physical Infrastructure) projects, and others have found their way in providing microfinance to local communities through social collateral. A few of these NGOs are also

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working on awareness and advocacy. NGOs and institutions working in the area includes NRSP (National Rural Support Program), Aga Khan Planning and Building Services (AKPBS), PPAF (Pakistan Poverty Alleviation Fund), IUCN, WWF, and Pakistan Fisher Folk Forum.

4.10.4 Income Source

The area does not offer opportunities for employment and the population is primarily engaged as cheap unskilled labor force either in Nooriabad, Thatta, Hyderabad or Karachi. Skilled labor from this area mainly comprise of vehicle drivers, agriculture activities, Shepherd, welders, plumbers, and electricians. Government service is relatively rare; few locals are working in the Pakistan Steel Mill Dolomite Project and the Pakistan Railway Station in Jhimpir. During the social assessment visit it was observed that peoples are barely meeting their dietary needs. This in a way is exciting for the local population because the Gul Ahmed Energy project is expected to bring job opportunities and raise the living standard of locals.

4.10.5 Infrastructure and Industry

The district is linked by road with other districts. The National Highway from Karachi to Peshawar passes through Thatta for a length of approximately 200 km.

The main railway line from Karachi to Peshawar also connects the district. The nearest railway station is Jhimpir.

Electricity is only available in 21% for the rural housing units, while kerosene oil is still used in 77% of the rural dwellings. Firewood is used as the main cooking fuel in about 91% of rural households and 77% of urban households.

The district is also equipped with digital and non-digital telecommunication systems, besides postal service and telegraph service.

From an industrial point of view, The Thatta district has progressed considerably. There are about 30 industrial units established in the district.

Nearest industrial hub is Nooriabad at the distance of approximately 19 kilometers, Nooriabad has different type and size of industries; which includes Textile, Power, Cement, etc.

4.11 ECOLOGY

RE2 project team (Flora and fauna experts) done by Dr. Syed Ali Ghalib have conducted the field survey for the study following were the methodology.

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A. Methodology

Data in respect of fauna and flora were gathered both from primary and secondary sources. The sampling locations were randomly selected, ensuring that representative locations are sampled for each habitat and the maximum possible number of species belonging to each habitat is recorded.

Prior to the start of actual field work, there is a need to collect a sift of information to form a general overview on the wildlife populations on the site (and nearby areas) and their likely sensitivity.

This is largely a secondary data collection exercise during which information is sought and collected on:

(i) Mammals, birds, reptiles, amphibians and plants:

(ii) Habitats:

(iii) Designated / protected / sensitive sites in the vicinity of the proposed development

After having made a general overview of the likely animal populations on the site, their likely sensitivity and the proximity of the designated / protected sites forms the main objective of the field survey programme. This allows the selection of target / key species1 and their principal habitats in the Area.

Data in respect of fauna and flora were gathered from both primary and secondary sources. The sampling locations were randomly selected, ensuring that representative locations are sampled for each habitat and the maximum possible number of species belonging to each habitat is recorded.

Secondary data were collected through literature search including the studies conducted within and in the surroundings of the Project Area and information collected from the local communities and from the Sindh Wildlife Department.

The vegetation surveys were carried out by laying 20 x 20m quadrates within the study area. The plant communities were determined within the habitat.

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Field Surveys were undertaken in the project area to collect data about the fauna of the area. Standard direct and indirect methods were applied to record the occurrence, distribution and population of various animal species in the area, which included point count surveys, roadside or track counts, line transect method and tracks/signs counts.

Survey Methods

There are two main survey types involved in such studies.

Distribution and status surveys: These are meant to record the occurrence, distribution and population / seasonal status of the various species using the site as breeding, wintering or staging site.

Vantage Point Surveys: These surveys comprise a series of observations from a certain fixed chosen location to quantity the flight activities of the birds at a proposed development site, which provides data to estimate the collision risk of the birds (particularly the migratory ones) against the blades of the turbine.

The survey area must adequately cover the entire development area. This includes access tracks; borrow pits, nearby villages, forested area, water points, farmland, vegetative area and wastelands.

Habitat loss and displacement may affect animals out with the project site. Therefore, surveys are also made in the area extending at least 500m beyond the project area boundary on either side.

Snap shots of Biological Environment survey are attached as Annexure IX.

B. Principal Habitats

The Project Area is mostly a wasteland comprising of the following main habitats.

- Sandy Plain Area
- Rocky Plain Area
- Rocky Area
- Scrubland

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- Small patches of barani agriculture land
- Small villages
- Coal pits/mines

4.11.1 Flora

Flora survey conducted by Project team experts revealed that, during the fieldwork in the Project Area, 24 plant species belonging to 15 families were identified. Out of these, 17 species are perennial, 05 are annual and 02 are herbs. The quantitative analysis of the floral composition was made and four distinct plant communities were identified based on life forms of the identified species. The dominant vegetation includes Zizyphus nummularia, Prosopis cineraria, Capparis decidua and Acacia milotica. There is also ploughed Barani agriculture land and also some vegetated area. Sueda fruticosa is the key species of the site area.

Project Area has 20 plant species belonging to 14 families were identified sampled in the main locations within the project Area. Out of these, 13 species were perennial, 5 were annual and 02 were herbs the. The quantitative analysis of the floral composition was made and four distinct plant communities were identified based on life forms of the identified species. Summary of Floral composition found in project area is shown in table 4-6;

Table 4-6 Floral Composition found in Project Area

S. No	Life Form	Number
1	Trees	06 species
2	Shrubs	11 species
3	Herbs	06 species
4	Grasses	02 species

No endemic or rare plant species (expect commiphora wightii) was recorded during the survey.

The following Table provides the list of floral species observed in the three main habitats viz. Flat Plains, Streambeds and hillocks/ foothills in quadrates measuring 20 x 20 m and 2 x2 m.

4.11.2 Fauna

The wildlife in the area has been affected by colonization of the area, and many wild life species have either diminished or vanished. No threatened wildlife species has been reported from the Project Area. Faunal attributes recorded during the study period is given below in table 4-7

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Table 4-7 Faunal Attributes in the Project Area

Attributes	Numbers
Mammals	10 species
Birds	38 species
Reptiles	08 species
Plants	28 species

A. Mammals

During the present survey, 15 species were recorded. The area has very thin population of mammals. Only solitary individuals of big mammals such as Indian Jackal and Red Fox could be sighted. One den of Indian Crested Porcupine was located. The small mammals such as Five Striped Palm Squirrel, Indian and Desert Gerbils, House mouse were scarce. Desert Hedgehog, Desert Hare, Ratel and Indian Pangolin have been reported from the area.

B. Birds

28 species were recorded from the area (Table 4-7). The area supports Grey Partridges, Chestnut bellied and Lichtenstein Sand grouses, Pigeons, Doves, Bee-eaters, Mynahs Shrikes, Bulbuls, Indian Robin, Purple Sunbird, Black Drongo, Black Kite, House Sparrow, and House Crow. Indian Silver bill and Sind Jungle Sparrows area quite common near the villages or near the water points.

C. Reptiles

As regards the Reptiles, 08 species were recorded during the present survey (Table 4-7). Snakes such as Saw-scaled Viper, Indian Cobra, Indian Krait, Indian Sand Boa, Plain Racer have been reported from the area. Indian Desert Monitor was found to be scarce, while Indian Garden Lizard and Indian Spiny tailed Lizard were common in the area.

<u>*List of Flora and Fauna found in the Project area is attached as Annexure VIII*</u>

D. Protected Areas

There is no Wildlife Protected Area in the close vicinity of the site. Keenjhar Wildlife Sanctuary is more than 16.5 miles away from the site. No Protected / Reserve Forest or any Rangeland lies in the vicinity of the Project Area. Two Ramsar Sites are located within this wind corridor viz. Haleji Lake, and Keenjhar Lake.

4.12 NATURAL MINERAL RESOURCES

The area near the Project site is very rich in natural resources. Coal reserves of approximately 28 million tones covering an area of 350 sq.miles are present in the area of Jhimpir.

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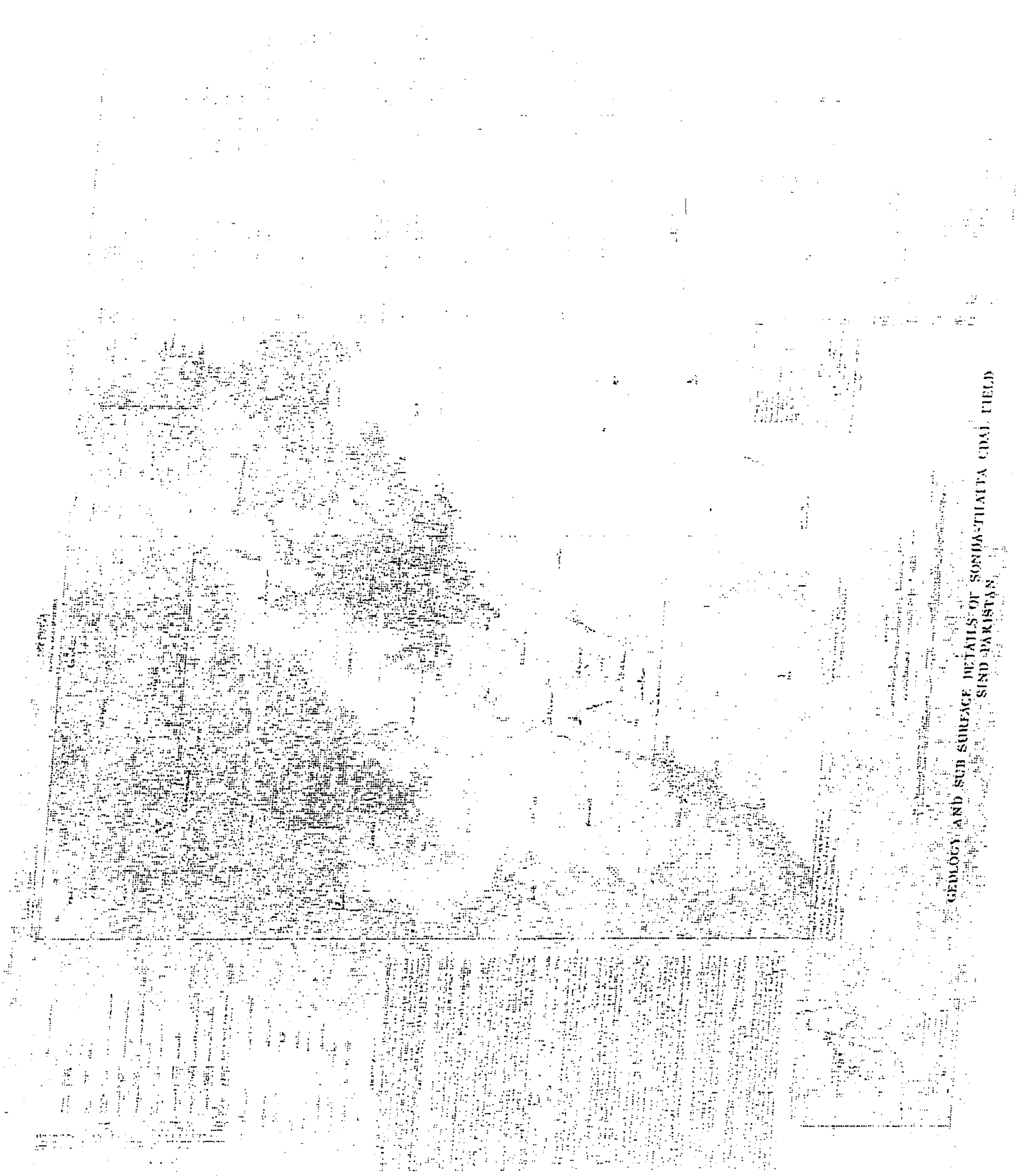

Figure 4.9: Geological and Sub Surface Details of Jhimpir

SECTION 5

ANALYSIS OF PROJECT ALTERNATIVES

5 ANALYSIS OF PROJECT ALTERNATIVES

Setting up of a wind power project involves selection of environmentally and techno economically suitable site, land characteristics, meteorology, infrastructure, grid availability, water availability, rail and road connectivity, accessibility and shading aspects etc. This chapter elaborates analysis of project alternatives, which can be considered in the project area.

5.1 WITH OR WITHOUT PROJECT

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. While both are produced domestically, demand already outstrips supply by a considerable amount. Oil import is a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves.

Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro-electric or other renewable sources, such as wind and solar power. These options will assist in reducing Pakistan's reliance on imported oil, and consequent vulnerability to changes in global oil prices which will in turn have a positive effect on the current trade deficit and inflating import bill. As with gas, securing future supplies of coal and hydro-electric power would rely on significant spending on infrastructure. Pakistan has domestic reserves of coal. However, coal currently makes up a very small proportion of total generation, largely the result of most of the reserves being located in one area, the Thar Desert. Exploiting the reserves would require huge and costly upfront investment in local infrastructure (including provision of water supplies), development of mines, housing and related infrastructure, and investment in transmission lines before power plant development could commence. Hydroelectric power already supplies almost 30% of electricity, and numerous sites for future investment exist, but due to their locations, this would also require significant investment in transmission to meet the expected power needs. Moreover, there are varying political stands on hydro-electric power options.

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Looking at how the country's future electricity needs might be met in a way that supports the environmental objectives of the Government of Pakistan; wind power generation has the potential of being a strong contributor. The development of wind power generation projects could reduce dependence on fuels for thermal power generation, increase diversity in Pakistan's electricity generation mix, and reduce greenhouse gas (GHG) emissions avoiding thermal power generation. The project will also add to the power generation from Renewable energy resources and help in meeting target of Government to achieve 5 % power generation from RE by 2015.

In view of the above, the "Without Project" option is not a preferred alternative.

5.2 ALTERNATIVE FUEL

The only viable generating options for energy production to meet the supply-demand gap in project region are fossil fuel energy. Pakistan is already facing huge short fall in fulfilling the coal requirement for already existing thermal power plant. The quality of coal is also low to medium in the region resulting in fly ash, carbon footprints and sulphur fume emission when it's burnt.

Coal power generation cause serious environmental threats including air pollution, coal dust, contamination of ground water, emissions of heavy metal pollutants which in turn can cause serious health issues.

So, it is imperative to look for alternatives to fossil fuel based power generation to achieve long term power solution of the country.

5.3 Location Alternative

The area where the project is located is the identified wind corridor of Jhimpir. The location of the project is selected on the base of suitable terrain and wind speed availability in the area.

Jhimpir Wind Corridor is also considered as most suitable land for wind power project other than Gharo. Also there are number of wind farms already in the development stage in this area. Therefore the infrastructure for the development of wind power generation in this area is already in development phase. The availability of land in this area is also a major reason for the selection of land in this area. As there are number for wind masts already installed in the area, therefore it's easier to use reference wind data of the neighbouring wind masts for the feasibility study which is more reliable and actual site based.

The major reasons for the selection of this site are;

- Adequate wind resource that allows for the operation of utility-scale wind turbines;
- Proximity and sufficient access to an adequate electric transmission/Grid;
- Contiguous areas of available land resource;
- Compatible land use;
- Limited sensitive ecological issues;
- Sufficient distance from major population centers; and
- Compliance with Provincial, and Federal laws and regulations.

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SECTION 6
POTENTIAL ENVIRONMENTALIMPACTS AND MITIGATION MEASURES

6 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 LAND USE

The total land allocated for the Project is 370 acres. At the Project site, there has been an absence of the following since the past few decades:

- Any agricultural activity on the land
- Any commercial activity on the land to support the livelihood of local residents nearby
- Any green field, wetland or protected area

There are three settlements/Goths near the project area, which are located 03 to 10 kilometers away from the project site and will not be affected due to construction and operation activities of the project.

Therefore, there is no threat to the existing land use or degradation, and there is no net impact on the land use.

Extent of displacement of existing land use or other environmental resources	◇ = Low Impact

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.2 AIR QUALITY

The Project involves power generation using wind energy—a clean source of energy (i.e., no fuels are used). Air pollution will increase during construction due to truck/vehicle traffic to the Project site, minor construction required to erect the WTG, earthwork, development of access roads, vehicle traffic on un-metaled road, etc. Also, the use of construction vehicles and equipment and idling of vehicles carrying construction raw materials will add to the emissions during the construction period.

However, the increase in air pollution is temporary. Also, the nearest major human habitat is approximately 03 km away from the project site. Thus, the impact of the construction activity on air pollution will be low and temporary. Construction emissions will be higher than emissions from Project operation activities, but still limited in volume. Emissions will be monitored and controlled through effective implementation of EMP.

Impact on Air Quality	◇ = Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.3 NOISE QUALITY

Project construction involves a variety of noise generating activities that include the use of grading, excavating/drilling/, concrete batching, tower erection, the construction of ancillary structures, concreting, material movement, site cleanup, etc.

Noise levels generated by construction equipment vary significantly depending on the type and condition of equipment, the operation method and schedule and the site of the activity.

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Construction activities at site are expected to produce noise levels in the range of 75–85 dB (A), with most works carried out during daytime.

The noise levels produced during construction will not have a significant impact on existing ambient noise levels at receiving sites, as noise generating activities are dispersed and most construction activities will occur during the day when higher noise levels are tolerated due to higher background noise levels. In addition, the constructions phase will be restricted to a few months, therefore the intermittent impact from construction noise is deemed to be negligible.

During Project operation, noise will be generated from rotor movement through the air, turbine operation, vehicle movements, and machinery operation around the site for maintenance and repair purposes. Blades moving through the air produce an aerodynamic noise. This noise is detectable when it is greater than the background noise, generally at wind speeds between the turbine cut-in wind speed (when the turbine starts to generate power) and up to 8-9 m/s (before the background noise starts to mask the noise from the blades and turbine). In addition, the operating turbine may produce a tonal noise.

The modern tubular towers contribute towards minimizing the noise emissions.

Impact on Noise Quality during Construction	◇ = Low
Impact on Noise Quality during Operation	◇ = Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

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6.4 NOISE FROM WIND TURBINES

No landscape is ever completely quiet. The modern tubular towers contribute toward minimizing the noise emissions. Birds and human activities emit sound, and at wind speeds around 4-7 m/s and up to the noise from the wind in leaves, shrubs, trees, masts etc. will gradually mask (drown out) any potential sound - from wind turbines. This makes it extremely difficult to measure sound from wind turbines accurately. At wind speeds around 8m/s and above, it generally becomes a quite abstruse issue to discuss sound emissions from modern wind turbines, since background noise will generally mask any turbine noise completely.

The sound power level from a single wind turbine is usually between 90 and 105 dB(A). This creates a sound pressure level of 50-60 dB (A) at a distance of 40 meters from the turbine, i.e. about the same level as conversational speech.

Figure 6.1 is released by GE, which shows the comparison of various common sounds with respect to the sound generated from Wind turbines. The research explains that a large wind turbine isn't very loud from an objective standpoint. According to this data, at a distance of 300 meters, a turbine will be somewhere between an air conditioner (50 decibels) and a refrigerator (40 decibels). At about 500 meters, the levels drop to about 38 decibels, which is well below the typical 40-45 decibels of background noise in a populated area.

Therefore, wind turbines are not any louder than what an average person is already used to.

The quality of wind farm noise is one factor. Researchers are looking at whether the low-frequency sound of blades has a different psycho-social impact than noise from highways or airports. It's very common that people living close to turbines call the sound "penetrating." Of course, different people handle the sound in different ways. Many residents are unfazed by turbines at close distances.

However, noise analysis have been done to make the baseline data which ranges between 36-44 dB (A), close noise monitoring will be performed during construction and operation phases to keep in permissible limits.

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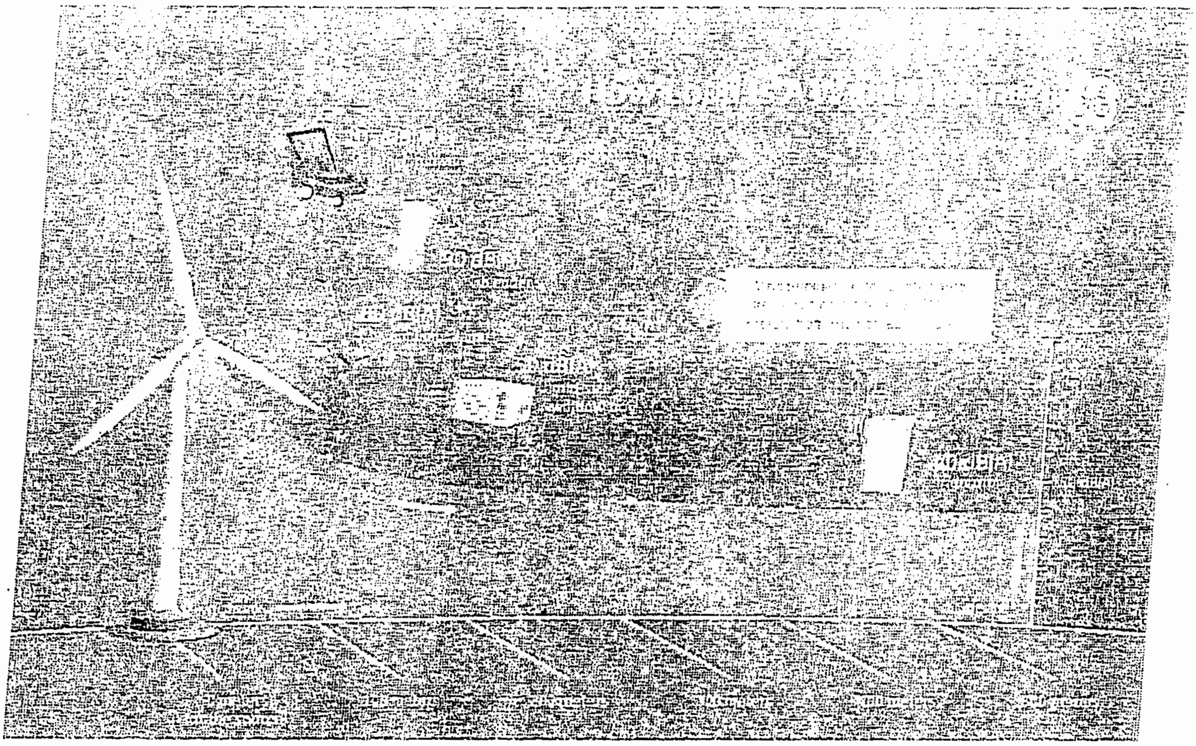

Figure 6.1: Noise Generating from Wind Turbine[2]

The Project will use modern wind turbine models, which have advanced technology that includes upwind rotors, tubular towers and sound proof nacelles to reduce mechanical noise. Noise from wind turbines varies with wind speed, but is generally comparable to the background sound in a typical household at 40 to 60 dB. The noise from wind turbines is usually measured in relation to ambient noise. If the wind is at higher speeds, the ambient noise level will be higher. Most new wind turbines will have noise levels at or close to ambient level. Distances of 100 feet are usually sufficient to keep noise levels below 60 dB, which has been suggested as a reasonable regulatory limit. Nearest communities are located at 3-6 kilometers.

[2] GE Global Research; National Institute of Deafness and Other Communication Disorders (NIDCD part of NIH)

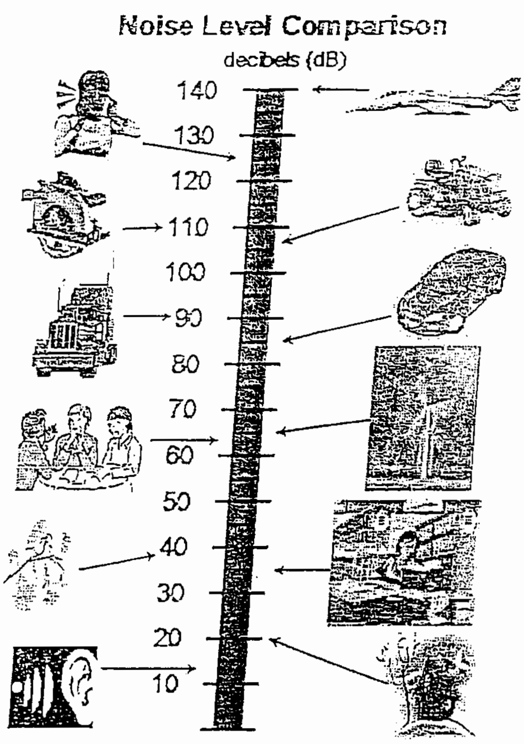

Figure 6.2: Noise Generating from Wind Turbine[3]

Impact of Noise Generated from Turbine	◇= Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

[3] GE Global Research; National Institute of Deafness and other Communication Disorders (NIDCD part of NIH)

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6.5 SHADOW FORECASTING

Wind turbines, like other tall structures, will cast a shadow on the neighboring area when the sun is visible. For a community living very close to the wind turbine, it may be annoying if the rotor blades chop the sunlight, causing a flickering (blinking) effect while the rotor is in motion.

The probability of when and for how long there may be a flicker effect may be predicted. It might not be known in advance whether there is wind, or what the wind direction is, but using astronomy and trigonometry a likely, or a "worst case" scenario can be predicted.

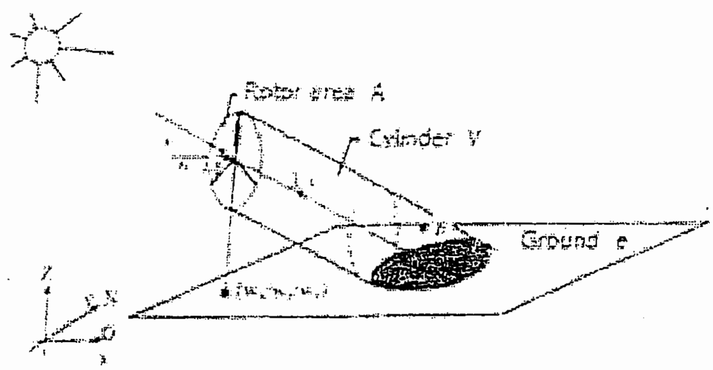

Figure 6.3: Shadow Flicker of Wind Turbine

In a study conducted by the Department of Energy and Climate Change, UK, the data of wind turbines of 18 countries were selected to study the shadow flicker impact. The study concluded that the so-called "shadow flicker" caused by wind turbines does not pose a significant risk to health of the nearby residents. There is no case reported about any significant impact of shadow flicker in any of the wind farms in the countries included in the study.[4]

[4] http://www.decc.gov.uk

At distances of greater than 1,000 feet between wind turbines and receptors, shadow flicker usually only occurs at sunrise or sunset when the cast shadows are sufficiently long. Moreover, in Pakistan, there is a common trend for people to build homes in shady areas.

Impact of Shadow flicker	◇= Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.6 WATER USE AND QUALITY

The volume of water used during Project construction and operation is low. i.e, approximately 1500 to2000 gallons per day water is required during construction of the project. Water required for plant civil works, will be sourced from ground water. During operation phase, approx. 100 gallons per day water is required. RO Plant will be installed to make water free from any contamination. Water is available and quantities required are negligible than requirement.

Once the wind farm is operational, water is only required for the domestic use of Project staff at the site.

Water Use & Quality	◇= Low

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◇◇◇	=High
◇◇	=Medium
◇	=Low
○	=No impact
☆	=Locally Favorable
☆☆	=Regionally Favorable

6.7 GROUNDWATER CONTAMINATION

Groundwater contamination can occur if chemicals or any other waste materials are not properly handled or are incorrectly disposed of and leach into the water table or if wastewater from plant activities is not properly disposed of.

All the waste material will be handled and disposed of in accordance with accepted safe practices, with no harmful substances released by the Project. Therefore, there will be no effect on surface water quality or ground water contamination.

Ground Water Contamination	○ = No Impact

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.8 Solid Waste Generation

Solid waste generated on site may spread over or create hazard for community and employees of the project.

Two type of solid waste will be generated during construction and operation phases; it is estimated that average 200kg/day domestic (non-hazardous waste) will be generated, which will be disposed at TMA identified waste disposal point at Jhimpir city.

All the hazardous waste material will be handled and disposed of through EPA certified waste disposal contractors (like, Petro waste, KMC). Therefore, there will be no effect on general sites condition and cleanliness of project boundaries.

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Solid Waste Generation	◯ = No Impact

◇◇◇	=High
◇◇	=Medium
◇	=Low
◯	=No Impact
☆	=Locally Favorable
☆☆	=Regionally Favorable

6.9 Wastewater Generation

Wastewater will be generated on site from domestic activities; and from construction activities; Wastewater from camp (Black water) will be stored in the septic tanks this must be transferred through tankers to the nearby located TMA disposal point (if hazardous wastewater is present). The effluent water will be transported to the evaporating pond that will be constructed temporarily within project premises. The effluent water will then be evaporated naturally. The protected fence and all other precautionary measures will be taken in place. It will be ensure that wastewater from site shall not enter into the water body.

Wastewater from construction activities must be stored in the settling tanks after settling of the particles it can be re-used for the sprinkling at the connecting roads for dust supersession.

Wastewater Generation	◇ = Low Impact

◇◇◇	=High
◇◇	=Medium
◇	=Low
◯	=No Impact
☆	=Locally Favorable
☆☆	=Regionally Favorable

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6.10 BIOLOGICAL ENVIRONMENT

6.10.1 Wetland and Wildlife Sanctuaries

Around 1967, an exploration sponsored by WWF—UK revealed that wildlife and wetlands resources in Pakistan were severely threatened and, in most areas, declining in condition. The expedition report prepared by Mountfort (1967) recommended that a range of wetland sites be declared Protected Areas. The Convention on Wetlands came into force for Pakistan on 23 November 1976. Pakistan presently has 19 sites designated as Wetlands of International Importance, with a surface area of 1,343,627 hectares.

The wetlands of Pakistan are shown in Figure 6.4.

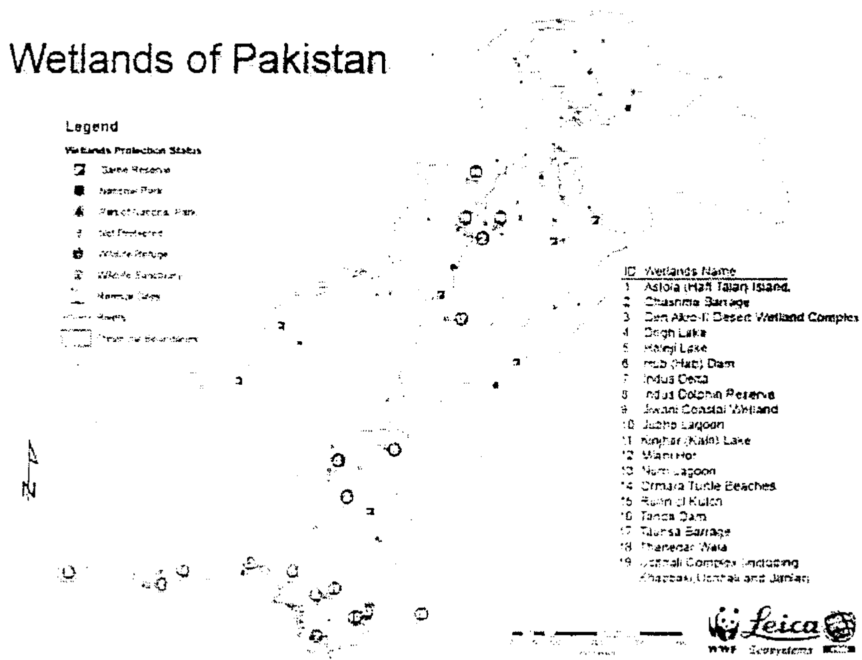

Figure 6.4: Wetlands of Pakistan[5]

[5] www.pakistanwetland.org

Document Title: Initial Environmental Examination (IEE) 50 MW Gul Ahmed Electric Limited of Wind Power Project in Jhimpir, Sindh Pakistan	Consultant Name: Renewable Resources (Pvt.) Ltd	Document No RE2/131/170/001	Date of Approval February,2016
	Project Sponsor: Gul Ahmed Energy Limited	Document Issue 01	

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Out of 19 Ramsar sites, 10 sites are located in the province of Sindh, which are shown in Figure 6.5.

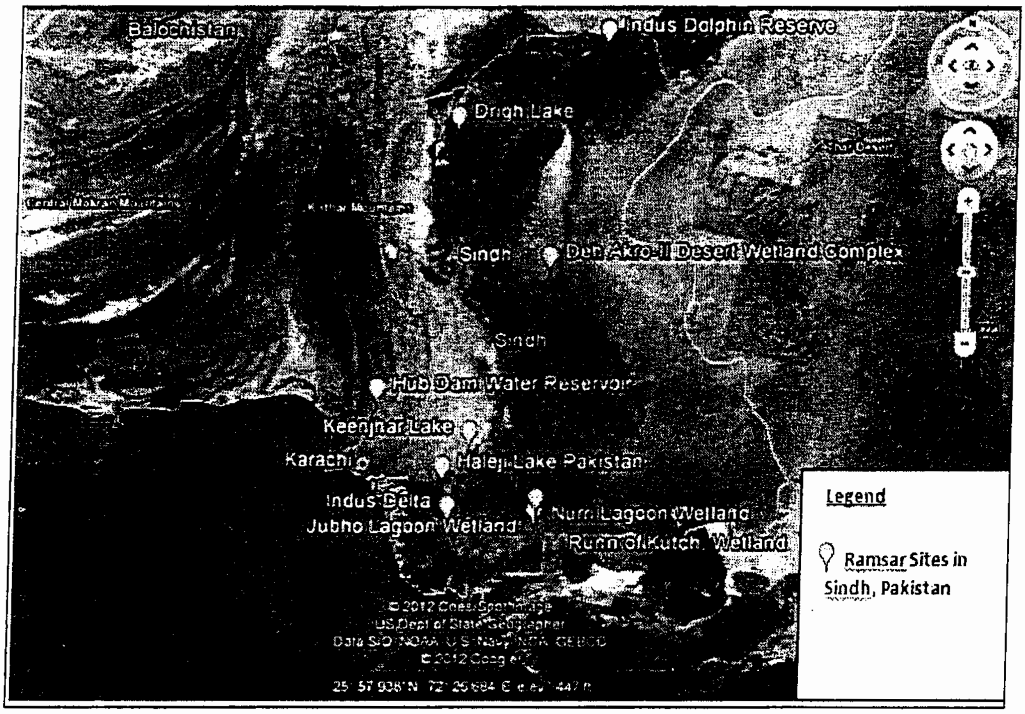

Figure 6.5: Wetland located in Sindh

Keenjhar Lake is the declared wildlife sanctuary, and the Ramsar site is located at a distance of 16 miles approximately from the Project site. It is the largest fresh water lake in Pakistan. It is an important source that provides drinking water to Thatta District and Karachi city. The area is favored as a habitat for winter migratory birds like ducks, geese, flamingos, cormorants, shorebirds, herons, egrets, ibises, terns, coots, and gulls. It has been observed that it is the breeding area of the night heron, cotton teal, purple moorehen, and pheasant tailed jacana. The natural vegetation of the surrounding area is tropical thorn forest. The lake is rich in fish and fauna, and supports the livelihood of about 50,000 local people. Main activities at this Ramsar site are commercial fishing, nature conservation, and public recreation.

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6.10.2 The Indus Flyway

Pakistan is one of the principal wintering grounds for water birds in South Asia. The lakes in the Indus Valley are major refuge for the migratory water birds which breed in Northern Eurasia. Pakistan forms part of their "Indus River Green Route". When the climate in their breeding grounds in Russia becomes too rigorous and the food gets scarce, then the birds leave the place and disperse to their winter resorts further south along the following distinct flyways.

1. Northern Europe Scandinavia-North Sea.
2. Central and Southern Europe-Black Sea-Mediterranean.
3. West Siberia-Caspian Sea-Nile.
4. Siberian-Kazakhstan-Pakistan/Central Asian Flyway.
5. East Siberia- Tibet-Ganges/ East Asian- Australian Flyway.
6. Far East- Kamchatka –China / Japan. West Pacific Flyway.
7. North East Siberia- Chokotka- California / Pacific Flyway.

Most of the sub-continent's visitors come through Pakistan route to India and Sri Lanka or Africa. Majority of winter visitors to the sub-continent enter via Indus Plain. Some come down the Indus River Valley and its far northern tributaries as well as the Chenab and Jhelum rivers further east. A very significant number enter from further west coming over the Peiwar Pass and following down the Kurram River. Some of these autumn migrants fan out eastwards into Northern India and thus avoid the Rajasthan Desert to the South, while other follow the Indus River down to the Indus Delta.[6]

[6] Roberts, T.J. 1991. The Birds of Pakistan. Volume 1. Oxford University Press, Karachi

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Table 6-1: Migratory and Local Birds of Keenjhar Lake[7]

List of Migratory Birds of Keenjhar Lake	List of Local Birds of Keenjhar Lake
White pelican	Marsh Harriers
Dalmatian pelican	Ospreys
Large cormorant	Cuckoos
Grey heron	Swifts
Large egret	Swallows
Black bittern	Pigeons
Yellow bittern	Doves
Spoonbill	Parrots
Flamingo	Sandgrouses
Pintail	Mynas
Common teal	Shrikes
Mallard	Larks
Gadwall	Grebes
Wigeon	Pelicans
Garganey	Carmorants
Shoveller	Flamingos
Common pochard	Herons and Bitterns
White eyed Pochard	Ibises and Spoonbills
Tufted duck	Ducks
Common coot	Morhens/Waterhens
Grey plover	Coots
Dunlin	Waders
Little stint	Gulls and Terns
Avocet	Babblers
Ruff	Sunbirds
Herring gull	Bushchats
Blackheaded gull	Bee-eaters
Whiskered tern	Drongos
	Crows
	Prinias
	Warblers
	Wagtails
	Sparrows
	Weaverbirds

[7] www.wwfpak.org

6.10.3 Birds/Avian Collision

Birds can be affected by wind farm development through loss of habitat, disturbance to their breeding and foraging areas, and by collisions caused by the rotating turbine blades. Pakistan receives a large number of migratory birds from Europe and Central Asian States every year. These birds spend the winter seasons in Pakistan and go back to their native habitats in the summer. The route of these birds take from Siberia to Pakistan is known as International Migratory Birds Route Number 4. It is also called the Green Route or Indus Flyway. Out of seven flyways of the world, the Indus Flyway is one of the busiest routes. Birds begin their journey in November. February is the peak time, and by March they start flying back.

At present there is no atlas available for bird migratory routes within Pakistan. However, extensive research has been done based on the literature available on bird migratory flyways and the wetlands map developed by Pakistan Wetland Organization. A map of Indus flyway also known as Green Route or Migratory Route No 4 is shown in Figure 6.6. The Indus flyway route is marked with arrows in red.

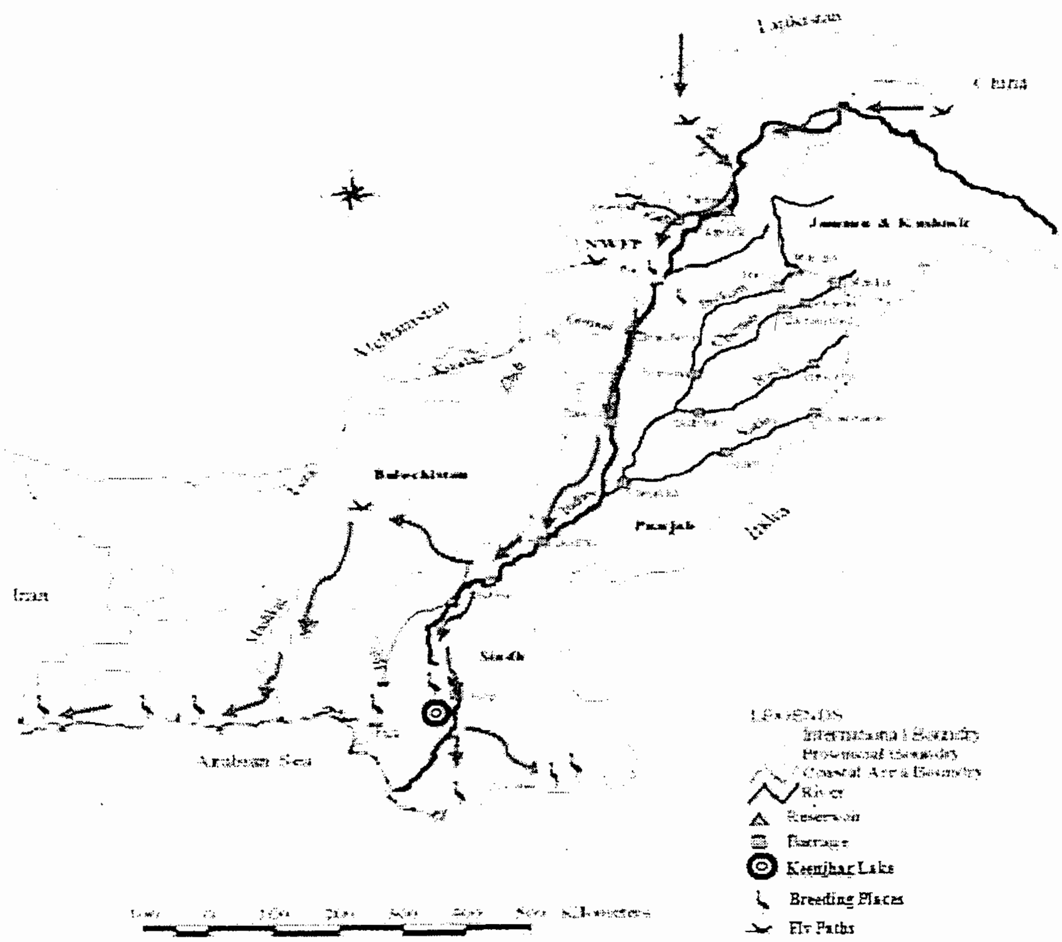

Figure 6.6: Indus Flyway for Migratory Birds/Green Route No.04

The main migrants to South during the winter season are the Water birds, Raptors, Houbara Bustard and the Passerines (Warblers, Pipits, Wagtails and Buntings).

The water birds migrate fairly large number in winter. They are very diverse group of species comprising mostly of Pelicans, Flamingo, Cormorants, Darter, Herons, Egrets, Bitterns, Storks, Ibises, Spoonbill, Ducks, Cranes, Water Cock, Rails, Crakes, Coot, Waders, Gulls and Terns.

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The wintering birds of Prey include: Eurasian Griffon, and Cinereous Vulture, Marsh Harrier, Montagu's Harrier, Common Buzzard, Long legged Buzzard, Booted Eagle, Greater Spotted Eagle, Steppe Eagle, Common Kestrel, Merlin and Eurasian Hobby.

A list of 236 species of birds is available, both resident and migratory, whose range of occurrence covers the most important wetland of the surrounding area of the Wind Farms in the Jhimpir Wind Corridor viz. Keenjhar Lake. The list is quite comprehensive and is based mainly on the experience gained during the water bird surveys undertaken during the last ten years. It gives an overall idea about the resident and migratory birds, many of which may be expected to be observed on their migration / local movement to and from the lake and the surrounding areas.

From the review of literature and interviews with local residents of the area, it was observed that migratory birds come and land on the Eastern side of the Keenjhar Lake, which is towards the river Indus. Whereas all the wind farm sites are located towards the West and Northwest direction of the Keenjhar Lake. The detailed view and description of the bird's living areas in Keenjhar Lake is described in Figure 6.7. It is found from the study that there is very little probability of bird hit from the wind farms as the Project is located approximately 26 km away from western side of Keenjhar Lake, and birds usually do not land and stay in the western part of Keenjhar Lake.

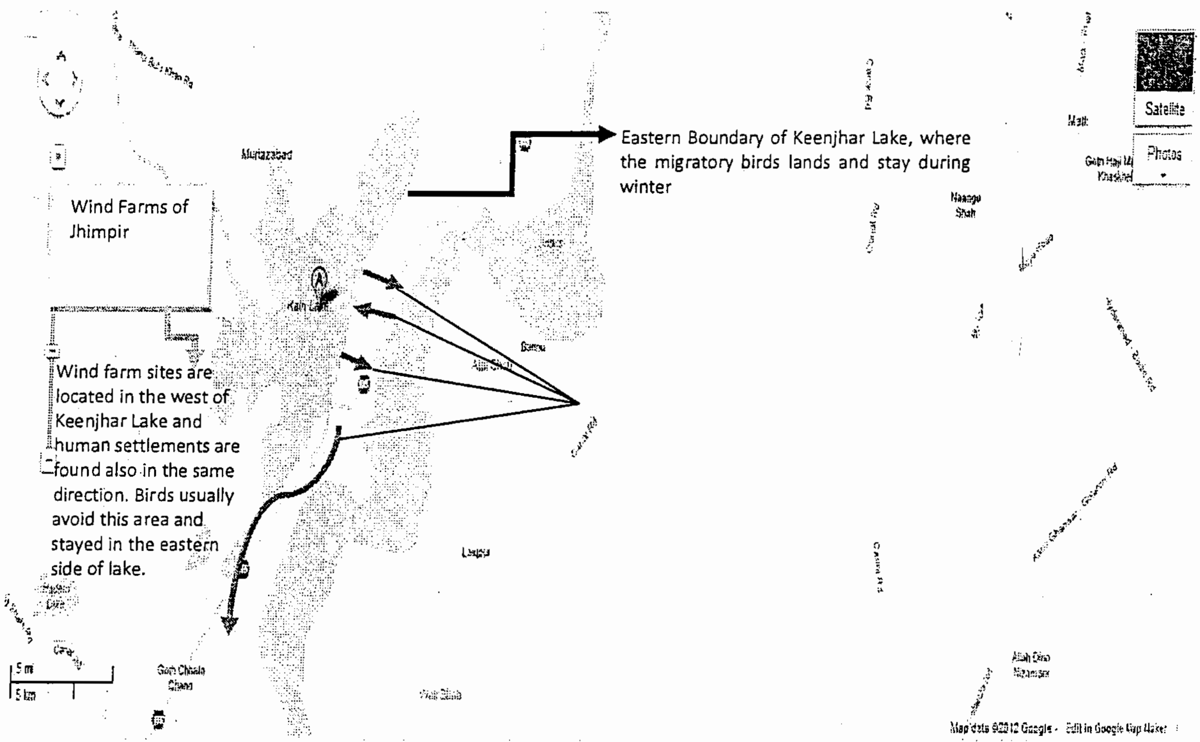

Figure 6.7: Birds Flying and Staying Patterns on Keenjhar Lake with Respect to Wind Farms

Compared to other causes of mortality among birds, the effect of wind power is relatively minor. Non-collision impacts on birds such as site avoidance and disruption of migratory behavior could also be significant. However, according to a survey conducted by WWF in 2009, the number of birds in and around Keenjhar Lake has reduced drastically in recent years. Furthermore, these birds have a tendency to fly at an altitude of 400 to 500 meters, thereby negating any chance of collision with wind towers at this specific Project site.

As a general rule, birds notice new structures and learn to avoid them in movements, thereby sustaining their ability to continue feeding and breeding in the location. Wind farm technology is new to Pakistan, but this technology has now been used in western and developed countries for over a decade. A study report (Sept. 2005) by the U.S Government Accountability Office (GAO) on the effects of wind energy development on wildlife determined that fewer birds fly into wind turbines than is generally thought.

Although several hundred utility-scale wind farms currently operate across the United States, such problems appear to be limited to two project areas, according to the report. In the context

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of other sources of avian mortality, it does not appear that wind power is responsible for a significant number of deaths, the report states in its conclusion[8].

The impact of wind energy development on bird populations came to prominence due to the high number of mortalities associated with one of the world's largest wind farm developments in California's Altamont Pass.[9]This wind farm had up to 5,600 wind turbines in operation and is located in a year-round, high activity, area for raptors. Additional factors included prey abundance; high-speed rotor blades; lattice tower structures, which provided horizontal cross-bars for perching; rapid blade movement; and the close proximity of turbines.

Another research cited by the European Wind Energy Association shows that the risk of bird deaths through collision with wind turbines is low. For example, it is estimated that 33,000 birds are killed annually by wind turbines operating in the U.S., an average of 2.2 fatalities for each of the 15,000 turbines.

In Spain, a study showed 0.13 dead birds per year per turbine. Furthermore, in the U.S., over 100 million birds are estimated to die each year from colliding with vehicles, buildings, power lines, and other structures, with wind power responsible for just 1 out of every 5,000 – 10,000 avian fatalities.

There seems no threatened or endangered bird species found at the site. Any development of the wind farm will have no impact on the existing bird life. Also, an emission-free power generation is clearly beneficial to all fauna.

However, due to the minimal expected impact of bird's collision with the wind turbines, the following mitigation measures are proposed:[10]

The wind towers to be erected minimum at a distance of 300 meters to avoid the avian collision and to give the birds a wider corridor for access in the Project area.

- Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds monitoring the birds during the migratory season be undertaken to record their distribution and migratory pattern and use of the area during the season.
- Hunting, feeding or harassment of wildlife is strictly prohibited during the entire course of construction and operation phases.

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8 http://www.gao.gov/new.items/d05906.pdf

9 American Wind Energy Association: Facts about Wind Energy & Birds, 5pp.-Internet Article

10 Ghalib, S.A., Khan, M.Z., Ahmed, S.M., Begum, A., Hussain, B. and Ahmed, W. 2014. Study of the Wildlife of Jhimpir Wind Corridor, district Thatta, Sindh and Development of Bird Monitoring Strategy in the Area. African Journal of Science and Research. 6(3) : 01-09.

- Food wastes not to be disposed of in the open. Food wastes collected in waste segregation unit is disposed of according to waste disposal procedure on a regular and strict basis.
- Night work during construction be prohibited, night travelling not is allowed unless absolutely necessary.
- Operation camp is located 500m away from perennial water bodies.
- Gul Ahmed Electric Ltd will work with the local WWF located in Thatta and remain involved in the conservation efforts of threatened species

Impact on Migratory Birds	◯ = No Impact
Impact on Local Birds	◇ = Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

◯ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.10.4 Flora and Vegetation

As there is no dense vegetation or forestation in the Project site area, there will be no damage to any kind of vegetation or forests. However, there will be a requirement for minimal vegetation clearing or deforestation during the Project. It is anticipated that once the Project is operational, new plants shall be re-planted in the empty spaces around wind turbines. Enough space will be allocated for green belts.

Impact on Flora and vegetation	○= No Impact

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.11 SOCIO ECONOMIC ENVIRONMENT

6.11.1 Archeological Sites

No archaeological sites are present near the Project site.

Archeological Sites	☆☆ = Regionally Favorable

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.11.2 Re-Settlement

Project is located on government land leased by the GoS to the Project sponsors. The settlements are located outside of project boundary which will not be affected, and no resettlements are required. However, any involuntary resettlements, if required, will be done as per IFC performance standard PS-5.

Resettlement	◇ = Low Impact

◇◇◇	=High
◇◇	=Medium
◇	=Low
○	=No Impact
☆	=Locally Favorable
☆☆	=Regionally Favorable

6.11.3 Visual Impact on Landscape

The addition of the Project to the local landscape will have a significant visual impact, as it would be the first such structure in Pakistan. In European countries, wind turbines are considered to give insignificant visual impact due to the fact that wind power technology is very common there and large numbers of wind turbines are installed. But as far as Pakistan is concerned, wind power is an emerging technology for local inhabitants, and it would give a noteworthy positive visual impact.

Visual Impact on Landscape	☆☆ Regionally Favorable

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.11.4 Aviation Hazard

No aviation hazard will be created by the Project as it is located 95km from the nearest airport at Karachi. In addition, the blades are marked with red bands to make the structure more visible.

Aviation Hazard	○ = No Impact

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.11.5 Traffic Management

The impact on traffic will be minimal and due to trucks carrying construction material and WTG components as well as vehicles to carry personnel. Traffic will need to be planned and managed effectively to avoid inconvenience for the local population and/or endanger public safety.

Traffic Management	◇ = Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.11.6 Labor Welfare and Safety

Large amounts of labor will be deployed during construction. The labor camps need to provide proper water supply and sanitation facilities (toilets with septic tanks). Otherwise insects may proliferate and lead to public health hazard. The safety aspects to be covered include proper handling of electrical devices, tools, equipment, and construction materials to prevent accidents to personnel. Local will be preferred for the unskilled jobs, to reduce potential of the spread of STI/STD disease. Overall impact will be low.

Labor Welfare & Safety	◇ = Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

6.11.7 Seismic Hazards

The damage zone classification of the region where the site is located is ZONE II-B (moderate to severe damage). The foundation design of the wind turbine generator (WTG) will take account of this seismic factor.

Seismic Hazards	◇ =Low

◇◇◇ =High

◇◇ =Medium

◇ =Low

○ =No Impact

☆ =Locally Favorable

☆☆ =Regionally Favorable

SECTION 7

PUBLIC CONSULTATION

7 PUBLIC CONSULTATION

This section provides the details of the consultation meetings held with stakeholders as part of the environmental and social soundness assessment process requiring information disclosure and sharing. For this purpose consultation meetings were held at the outset for the scoping process of IEE study, followed by a series of meetings at the proletarian level. Dr. Syed Ali Ghalib and our team member Mr. Farooq Ali Khan (RE2) has perform the consultations with different departments and officials. These stakeholders are the different government officials and NGOs like IUCN Pakistan, WWF department, Karachi (Senior Director, Mr. Rabnawaz), SEPA representative (Dr. Aashiq Hussain Langah), Sindh Wildlife department Hyderabad office (Mr. Ghulam Muhammad Gadani, GM), Sindh Forest department, Karachi (Divisional Forest officer), Archeological department, Karachi.

7.1 Objectives of Public Consultation

The overall objectives of the consultation process were as follows:

- To inform all interested people on the likely positive and negative effects of the wind power proposed project and encourage feedback from stakeholders on IEE findings, principally the impacts and proposed mitigation measures;
- To gain a consensus on the impacts identified, their importance and the relevance and effectiveness of the mitigation measures proposed;
- To provide confidence that all relevant issues and mitigation measures have been identified, agreement that the mitigation measures are adequate, and that nothing significant has been missed;
- To enable incorporation of stakeholder views and concerns in the IEE.

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7.2 Consultation Process

7.2.1 Scope

The social survey team conducted meetings and interviews with local communities. During these meetings a description of the project was given along with an overview of the projects likely social and environmental impact.

7.2.2 Community Consultation

Community consultations consisted of formal and informal meetings at Jhimpir residential area, and project vicinity. The consultation exercise was conducted in both Sindhi and Urdu languages. A non-technical oral description of the project was given providing an overview of all likely positive and negative impacts. Following which, an open discussion was held so that the participants could voice their concerns and opinions. All participants were encouraged to voice their concerns and opinions. Participants were also asked to suggest alternatives where they had particular concerns.

Feedback obtained from the stakeholders was documented, and all issues and suggestions raised were recorded in survey forms. Both social and environmental issues were raised.

The people interviewed (Table 7-2) had worries /concerns related to basic needs and generally agreed that most of the effects would be temporary only during construction. Some common concerns regarding the lack of educational facility, shortage of clean drinking water, lack of basic health unit, lack of waste disposal, lack of electricity, poor roads condition and minimal employment opportunities issues were raised. None of these issues related specifically to proposed wind power project but were general complaints. Most of the participants appreciated the project and said that it would boost the local employment opportunities, while some said that business and economic situation in the area will also improve.

A matrix of concerns by community members was prepared as given in Table 7-1. The register of attendance is provided as Table 7-2. A pictorial record of the meetings is included as **Annexure XI.**

Table 7-1: **Summary of Concerns Raised during Stakeholder Consultation**

Issues	Concerns raised by community	Remarks
Health Care Facilities	Healthcare centers particularly for women and children Schools	Basic health unit is available in the Jhimpir with very little facilities, A dispensary may be provided.
Employment	Provision of semi-skilled and unskilled jobs for local labor in the project construction period.	Unskilled jobs will be given to locals people where possible. Training will be provided.
Safety of Community	Comply with the traffic management rules.	Proper traffic management will be resorted to during the construction period.
Drinking water	Community member rated Safe drinking water at highest priority during our survey.	As part of the Social development program GEL shall provide the safe drinking water through RO filter plant to nearby communities
Educational Facility	Unavailability of Teachers, and School (Primary and Secondary) Vocational training	NGO working in social sector and proponent shall provide the required facilities for the local peoples.
Other issues	Black top link roads	Linking roads will be developed as part of the project component will benefit the local residents as well.

Table 7-2 **General Public Interviewed during Public Consultation at Jhimpir**

S.NO	NAME	OCCUPATION	LOCATION
1	Abdul Hakeem	Shop keeper	Goth kalo
2	Sohar Khan	Labour	Goth kalo
3	Ghulam Sarwar	Labour	Goth kalo
4	Mukhtiar	Driver	Goth kalo
5	Mohan Lal	Shop keeper	Goth kalo
6	Sultan	Unemployed	Goth Rawal Pollari
7	Allah Daad	Labour	Goth Rawal Pollari
8	Haq Nawaz	Driver	Goth Rawal Pollari
9	Lakhani	Unemployed	Goth Rawal Pollari
10	Rab Nawaz	Labour	Goth Billal Pollari

7.2.3 Government Agencies

Stakeholders including provincial government officials, international NGOs, and related stakeholders were consulted at their offices. All the stakeholders were given maximum project information and were shown a detailed map of the area. Their concerns and suggestions are reproduced below. Attendance lists of the stakeholders consulted in the proposed project was collated and reproduced in Table 7-3. Pictures of the meetings are provided in **Annexure- XII.**

a) Environmental Protection Agency (Karachi Head Office) (Director Technical EIA/IEE)

The Karachi head office of EPA is responsible for general environment protection in the project area. A meeting was held on January, 28, 2016 with the Mr. Aashiq Hussain Langah (Director EIA) and Mr. Waris Gabool (Deputy Director Technical). The project team provided information about the proposed project site with the help of the project area map and briefed about the salient features of the project and requested the officers that express their views /suggestion and concerns of the Department. Their views concerns / suggestions are re-produced as follows;

- The social survey conducted by the social expert must have Livelihood matrix, group discussion, Priorities of locals, pear wise ranking and questioner. Only questioner is not enough for social survey.
- Analyse Cumulative effect on community
- Attach the following documents with IEE report
- Land Lease Document
- Approvals from Energy Department
- NOC from DC (Deputy Commissioner) of the concern area
- LOI Copy
- Laboratory test for air, noise, surface and ground water must be attached with IEE report.
- Flora and Fauna survey report must be attached with IEE report.
- Drinking water availability shall be ensured by the proponent throughout the project period.
- Project activities will support the area at large, and activities will not cause any harm.
- Removal of vegetation may be avoided, as for as possible. Plantation programme may be developed in the Project Area taking care that invasive species may be avoided to be introduced.
- A certificate must be obtained from the sindh wildlife department to the effect that the proposed WPP area does not fall into the limits of any Protected Area notified by the Department.

b) Sindh Wild Life Department (Conservator)

A consultation meeting was held on February 02, 2016 with Mr. Ghulam Muhammad Gaddani Conservator Wildlife Department at his Karachi office along with his team. The project team provided information about the proposed project site with the help of the project area map and requested the officers to identify any protected wildlife sanctuary or other concerns of the Department. A set questionnaire was also filled. During the meeting the Conservator expressed his views regarding the project and overall appreciated project activities. Their views and concerns / suggestions are re-produced as follows;

- Mr. Ghulam Muhammad Gaddani along his team identified the Keenjhar Lake as the Wildlife sanctuary and Ramsar site as nearest protected area which is located approx. 26 kilometers and he briefed about its importance and patterns of the birds during the different seasons.
- He also proposed that to provide the basic facilitates to the communities like School, clean drinking water and sanitation etc.

c) **Sindh Forest Department (Karachi Office)**

A consultation meeting was held on January 26, 2016 with Divisional Forest Officer Mr. Shahzad Sadiq Gill, Range Forest Officer Mr. Tahir Latif, Range Forest Officer Mr. Raja Karim and Sub.Division Forest Officer Mr. Rab Dino Khatti at his Karachi office along with his team. The project team provided information about the proposed project site with the help of the project area map and requested the officers to identify any protected wildlife sanctuary or other concerns of the Department. During the meeting the forest officers expressed his views regarding the project and overall appreciated project activities. They do not have any issue / objection with the project in Jhimpir. As they know that this is the barren land and there is very rare vegetation or even no vegetation. Only the concern was, Euphorbia (Tree species) is very common in that area, so be careful with the removal. The Department has created some water conservation ponds in the area. These get filled with water during heavy rains and are used by the local people and the livestock for drinking purposes. These may be safeguarded during the Project activities.

7.2.4 Non-Governmental Organizations

A number of NGO's, other than the government sector were consulted for the proposed projects who are highly involved in protection of wildlife and nature conservation

a) **International Union for Conservation Nature IUCN**

A consultation meeting was held on January 28, 2016 with Mr. Muhammad Tahir Qureshi Senior Coastal Ecosystem Advisor and Mr. Kamran Ahmad Naqvi Urban Specialist Technical at IUCN Karachi Office. RE2 team provided information about the proposed project site with the help of the project area map and requested the experts to share their views or other concerns of the IUCN as expert. A set of questionnaire was also filled. During the meeting the Mr. Qureshi and Mr. Kamran expressed their reservation regarding the project. Their views and concerns / suggestions are re-produced as follows;

- Raised concern about mortality of birds and said that project is located near birds flying route.
- Raised concern about Noise pollution drives by wind turbines and it may affect local norms and modify the bird's habitats in that area. But i made him clear that the detail study for noise pollution has already been conducted and incorporated in our IEE report.

- Meanwhile, GE turbines noise and shadow affect has been described in detail in our study. It does not affect local norms and habitat modification.
- Employment opportunities shall be provided locals must be preferred in the unskilled jobs under social development program of proponent.
- Mr. Qureshi said that sustainable development shall be carried out.
- They also suggested that development should be sustainable.

b) WWF (World Wide Fund)

A consultation meeting was held on January 22, 2016 with Senior Director WWF-Pakistan Mr. Rab Nawaz and Technical Advisor WWF and Ex. DG Marine Fisheries department Mr. Mohammad Moazzam Khan. RE2 team provided information about the proposed project site with the help of the project area map and requested the experts to share their views / concerns /suggestions as the expert conservationist. Mr. Rab Nawaz and his team supported and appreciated the project activities; they do not have any objection / issue even they are well satisfied with the green energy project and the way the consultant (RE2) making consultation with all concern departments.

c) List of Public and NGO Sector Stakeholder Consulted

A number of stakeholders, other than the general public, who are likely benefitted be involved during the project execution phase, were also consulted (Table- 7-3)

Table 7-3 List of Public and NGO Sector Stakeholders

Name of Stakeholder Representative	Type of Stakeholder	Department / Occupation/ Designation
Mr. Aashiq Hussain Langah	Sindh EPA	Director (EIA)
Mr. Waris Gabool	Sindh EPA	Deputy Director Technical
Mr. Ghulam Muhammad Gadani	Sindh Wildlife Department	General Manager
Mr. Tahir Qureshi	IUCN	Senior Coastal Ecosystem Advisor
Mr. Kamran Ahmad Naqvi	IUCN	Urban Specialist
Muhammad Moazzam Khan	WWF	Ex. DG Marine Fisheries department
Mr. Rab Nawaz	WWF	Technical Advisor

Name of Stakeholder Representative	Type of Stakeholder	Department / Occupation/ Designation
Mr. Shahzad Sadiq Gill	Sindh Forest department	Divisional Forest Officer
Mr. Tahir Latif	Sindh Forest department	Range Forest Officer
Mr. Raja Karim	Sindh Forest department	Range Forest Officer
Mr. Rab Dino Khatti	Sindh Forest department	Sub. Division Forest Officer

Mitigation Measures:

The following mitigation measures have been suggested.

1. Disturbance to the habitat of the Indian spiny tailed Lizard be minimized / controlled.
2. As far as possible, the burrows / holes of the lizard are safeguarded against any developmental activity. The animals are specially protected during the construction phase.
3. Monitoring the birds during the migratory season be undertaken to record their distribution and migratory pattern and use of the area during the season.
4. Hunting, feeding or harassment of wildlife is strictly prohibited during the entire course of operation.
5. Vegetation clearing and land uptake during the operation be minimized.
6. Development of new access tracks during operations is minimized.
7. Routes involving minimum clearing of vegetation are selected.
8. Operation must avoid disturbing live bird nests and small mammal and reptile holes.
9. Food wastes not to be disposed off in the open. Food wastes collected in waste segregation units is disposed off according to waste disposal procedure on a regular and strict basis.
10. Night work during construction be prohibited, night traveling not be allowed unless absolutely necessary.

11. All mitigations related to minimizing noise are adhered to.
12. Construction work near areas which show small mammal and reptile populations should commence after a soft start up and be randomly monitored.
13. Vehicle speeds on access road be controlled to avoid incidental mortalities of reptiles. Any such incident is reported and vehicle speeds be randomly checked.
14. Movement of all project personnel is restricted to work areas.
15. Movement of project vehicles is restricted only to the project access road or to routes approved.
16. Operation camp is located 500m away from perennial water bodies.

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SECTION 8

ENVIRONMENT MANAGEMENT PLAN

8 ENVIRONMENT MANAGEMENT PLAN

8.1 PURPOSE AND OBJECTIVE OF EMP

The purpose of Environmental Management Plan (EMP) is to provide a summary of the predicted impacts associated, mitigating measures and monitoring actions so as to minimize potential negative impacts and enhance positive impacts from the Project. The EMP will provide a guide (almost checklist) for the main stakeholders, namely the owner, contractor and operator of the Wind Power Project, on what mitigating actions need to be taken and where and when they are needed. It will thus help to improve the likelihood that adverse impacts are mitigated, project benefits are showcased, and an environmentally beneficial standards of best practice is provided to all those involved. In particular, the EMP:

- Defines roles and responsibilities for those involved in the implementation of the EMP and identifies areas where these roles and responsibilities can be shared with other stakeholders
- Define the implementation mechanism for the mitigation measures identified during the present study.
- Provides concise instructions to project personnel and contractors regarding procedures for protecting the environment and minimizing environmental impact, making these legally binding through their inclusion in contract specifications
- Defines the requirements for communication, documentation, training, management and implementation of the mitigating measures; and,
- Specifies actions required to assess compliance with and effectiveness of the mitigation measures through compliance and effects monitoring mechanism, defined in the EMP's two action tables.

8.2 COMPONENT OF EMP

The EMP consists of the following:

- Institutional Arrangements
- Mitigation and Monitoring plan
- Grievance Redressing Mechanism
- Reports and Documentation
- Environmental and social trainings
- Public disclosure requirements
- Budgetary estimates for EMP implementation

All the components of EMP are discussed from Sections 8.3 to 8.9

8.3 INSTITUTIONAL ARRANGEMENT

8.3.1 PROJECT DEVELOPER

The Project Developer (i.e. GAEL) is the 'owner' of the project and as such is responsible for ensuring that the conditions of the environmental authorization issued in terms of Sindh Environmental Protection Act, 2014 (should the project receive such authorization) are fully satisfied, as well as ensuring that another necessary permits or licenses are obtained and complied with. It is expected that the Project Developer will appoint the contractor, and the consultant.

Gul Ahmed Electric Limited will establish an Environment & Social Management Cell (ESMC) at Corporate and site level, headed by a Project Director to be responsible for day-to-day implementation of the Project. Gul Ahmed Electric Limited is responsible for undertaking the Project in accordance with the Environmental Impact Assessment (EIA) and implementing the Environmental and Social Management Plan, which will be consistent with the standards set by IFC and World Bank Group.

The ESMC is responsible for coordinating and implementing all environmental and social activities. During Project implementation, the ESMC will be responsible for reflecting the occurrence of new and significant impacts resulting from Project activities and integrating sound mitigation measures into the EMP. The ESMC includes a safeguard specialist and

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supporting staff, together forming the Environmental and Social Unit, appointed by Gul Ahmed Energy to look after environmental, social and safety issues. The ESMC will be empowered to implement safeguard planning and monitor implementation.

The safeguard specialist provides guidance to the Project Manager and his staff to adopt environmental good practices while implementing the Project. The safeguard specialist is responsible for implementing safeguard issues associated with the Project through a site team composed of Gul Ahmed Electric Limited (GEL) site staff and the contractor's staff, to be assigned by the ESMC as necessary.

The duties of the Environmental and Social Unit of the ESMC at the corporate level are to:

- Monitor the implementation of mitigation measures during construction and operation phases of the Project.
- Prepare suitable environmental management reports at various sites.
- Advise and coordinate field unit activity towards effective environment management.
- Prepare environment health and safety manual for the operation of transmission lines/substations.
- Advise during Project planning/design and cells on environmental and social issues while route selection of the alignment at the planning/design stage to avoid negative environmental impact.
- Provide training and awareness on environmental and social issues related to power transmission Projects to the Project/contract staff.

The duties of the Environmental and Social Unit at the site level are to:

- Implement the environment policy guidelines and environmental best practices at the sites.
- Advise and coordinate the contractor(s) activity towards effective environment management.
- Implement environment and safety manual.

- Carry out environmental and social survey in conjunction with the Project planning cell while route selection of the alignment at the planning stage to avoid negative environmental impact.

- Make the contractor staff aware of environmental and social issues so that EMP could be managed effectively.

8.3.2 Supervision Consultant (RE)

The supervision consultant / Project Monitoring Consultant (PMC) (RE) has qualified environment health and safety staff on board to which will be responsible for overseeing the implementation of the EMP during the construction.

8.3.3 Lead Contractor

The contractor will be responsible for the following:

- Overall construction program, project delivery and quality control for the construction for the wind project.
- Overseeing compliance with the Health, Safety and Environmental Responsibilities specific to the project management related to project construction.
- Promoting total job safety and environmental awareness by employees, contractors and sub-contractors and stress to all employees and contractors and sub-contractors the importance that the project proponent attaches to safety and the environment.
- Ensuring that each subcontractor employ an Environmental Officer to monitor and report on the daily activities on-site during the construction period.
- Ensuring that safe, environmentally acceptable working methods and best practices are implemented and that sufficient plant and equipment is made available properly operated and maintained, to facilitate proper access and enable any operation to be carried out safely.
- Meeting on site with the Environmental Officer prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Ensuring that all appointed contractors and sub-contractors are aware of this
- Environmental Management Plan and their responsibilities in relation to the plan;
- Ensuring that all appointed contractors and sub-contractors repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained

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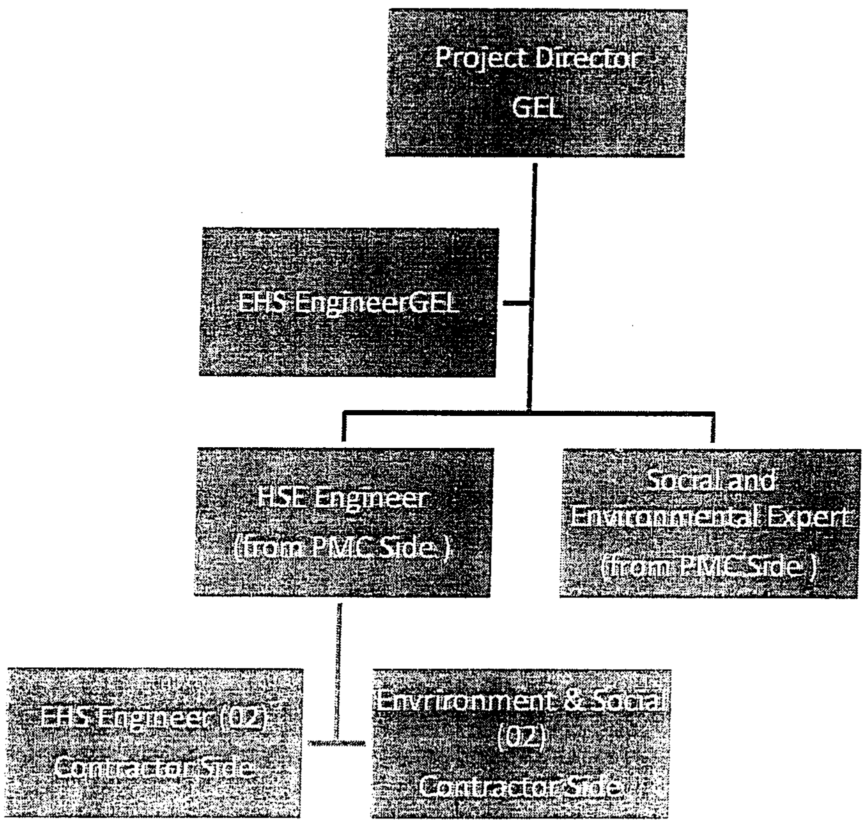
in the Environmental Management Plan, to the satisfaction of the Environmental Officer.
At the time of preparing this draft EMP, the appointment of a lead contractor has not been made and will depend on the project proceeding to the construction phase.

The Framework of Environment and Social Management Cell are shown in **Figure8.1** and Key responsibilities of ESMC are summarized in **Table7.1.**



Environment and Social Management Cell (ESMC)

8.4 MITIGATION & MONITORING PLAN

The mitigation plan is a key component of the EMP. It lists all the potential effects of each activity of the Project and their associated mitigation measures identified in the IEE.

For each Project activity, the following information is presented in the plan:

- A listing of the potential impact associated with that Project activity
- A comprehensive listing of mitigation measures (actions)
- The person(s) responsible for ensuring the full implementation of the action
- The person(s) responsible for monitoring the action
- The timing of the implementation of the action to ensure that the objectives of mitigation are fully met
- It should be emphasized that the mitigation measures will have to be translated into environmental as well as social requirements and specifications to be made part of the contracts for the construction activities, with legal binding.

The objective of the environmental and social monitoring during the various phases of the proposed Project will be as follows:

- Ensuring that the mitigation measures included in the IEE are being implemented completely
- Ensuring the effectiveness of the mitigation measures in minimizing the Project's impacts on social and environmental resources

To achieve these objectives, the Environmental Management and Monitoring Plan (EMMP) for construction and operation phase is given in Annexure-I.

8.5 GRIEVANCE REDRESSAL MECHANISM

Environmental and social grievances will be handled in accordance to the Project Grievance Redress Mechanism. Open and transparent dialogue will be maintained with Project affected persons as and when needed, in accordance with ADB safeguard policy requirements. The Grievance Redress Mechanism (GRM) for the Project provides an effective approach for complaints and resolution of issues made by the affected community in a reliable way. This mechanism will remain active throughout the life-cycle of the Project.

Gul Ahmed Electric Limited shall have a standard mechanism to:

i. inform the affected people (AP) about GRM and its functions;
ii. set the procedures and mechanisms adopted for making the complaints;
iii. support the complainants in communicating their grievance and attending the GRM meetings; and
iv. Implement compliance with a GRMs' decision, its monitoring and communication to the people.

Under the GRM, the ESMC will maintain the Social Complaint Register (SCR) at the sites to document all complaints received from the local communities or any other stakeholder. The information recorded in the Register will include the date of the complaint, particulars of the complainant, description of the grievance, actions to be taken, the person responsible to take the action, follow up requirements and the target date for the implementation of the mitigation measure. The register will also record the actual measures taken to mitigate these concerns.

As soon as a complaint is received, the ESMC will determine the remedial action. If required, consultations will also be undertaken with the contractor's site manager. Once the remedial action is decided, implementation responsibility as well as schedule will be determined.

The proposed remedial action will be documented in the SCR, with complete details (by whom and by when). The proposed remedial action will be shared with the complainant. Similarly, the actual action taken will also be documented in a register and shared with the complainant. The complainant's views on the remedial action taken will also be documented in the register.

The SCR will be reviewed during the fortnightly meetings at the site during the Project, and the action items discussed. The progress on the remedial actions will also be reviewed during the meetings.

8.6 REPORTS AND DOCUMENTATION

The ESMC will produce periodic reports based on the information collected. These will include reports for:

- Project initiation meetings with each contractor
- Non-compliances
- Effects monitoring
- Summary of SCR under GRM

The reports will also be made available for review, to the external monitoring teams, and to any other stakeholders who visit the site. In addition, the Social and Environmental Monitoring expert will prepare reports for each monitoring visit.

At the end of the Construction Phase, a final report will also be prepared.

8.7 ENVIRONMENTAL AND SOCIAL TRAININGS

Environmental and social trainings will help to ensure that the requirements of the EIA and EMP are clearly understood and followed by all Project personnel throughout the Project period. The primary responsibility for providing training to all Project personnel will be that of the ESMC.

The environmental and social training program will be finalized before the commencement of the Project, during the detailed design phase. The training will be provided to the GEL staff, the construction contractors, and other staff engaged for the Project. Training will cover all staff levels, ranging from the management and supervisory to the skilled and unskilled personnel. The scope of the trainings will cover general environmental awareness and the requirements of the EIA and the EMP, with special emphasis on sensitizing the Project staff to the environmental and social aspects of the area.

During the O&M phase of the Project, these trainings will continue to be conducted by ESMC for all relevant staff of the Company.

8.8 PUBLIC DISCLOSURE REQUIREMENTS

Gul Ahmed Electric Limited (GEL) will disclose this IEE and EMP to all the stakeholders before the commencement of the proposed Project. The EIA report will be made available to the stakeholders at the sites designated by the EPA, in accordance with the national legislation (PEPA 1997) and Sindh EPA Act 2014. In addition, the executive summary of the IEE will be translated into the local (Urdu / Sindhi) languages (if necessary), and made available to the affected communities (and also kept at the Project site). This will ensure that the local communities are aware of the Project, its key impacts, the mitigation measures and the implementation mechanism. In addition, the Executive Summary will be disclosed through the GEL official website.

8.9 COST ESTIMATES FOR EMP IMPLEMENTATION

The cost of implementation of the environmental safeguards includes both the direct cost of the mitigation measures and the costs of monitoring the execution of the EMP such as laboratory costs and monitoring visits, training costs, etc. Contractor cost to be included in the BOQ items, while Gul Ahmed Electric Ltd (GEL) cost shows the environmental monitoring / training cost that will be borne by the Gul Ahmed Electric Ltd through the EMSC. Detailed cost is shown in Annexure –II.

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SECTION 9

INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

9 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

The field studies were conducted for preliminary scoping, survey, and assessment activities and in order to coordinate the field survey and analysis.

A questionnaire was developed to assess the general concerns of the local residents of nearby villages in respect of this Project. Mr. Umair Ali Khilji of Renewable Resources Pvt. Ltd himself filled the questionnaires after directing the questions to the native people. Snapshots of consultative meetings are also attached in **Annexure-X.**

During the construction phase, residents of the local areas selected representatives, local councilors, and informal community leaders, including members of NGOs, will be asked to state their current perceptions of priorities for improvements to the urban environmental infrastructure in their areas and the likely impacts of the Project during construction and operation phases.

The stakeholder consultation is a continuous process, and should be maintained throughout the Project. The consultations carried out during the present IEE and reported in this Chapter are essentially a first step in this process.

During the present IEE, the stakeholder analysis was carried out to identify relevant stakeholders on the basis of their ability to influence the Project or their vulnerability to be negatively impacted from it. This approach ensured that no relevant groups were excluded from the consultations, and appropriate engagement strategies were developed for each stakeholder.

During the stakeholder consultations carried out in the communities near the proposed site, the participants were first provided the salient information about the proposed Project.

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Since the Project would not directly affect them, the villagers generally did not have any apprehension or reservation about the Project. On the contrary, they expected that the Project would bring employment and small business/trade opportunities for the local population.

SECTION 10

CONCLUSION AND RECOMMENDATION

10 FINDING AND RECOMMENDATION

Prime benefit of the Project will be the replacement of conventional power generation with renewable energy. Wind energy will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

Impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed power project. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes. Since proposed land is covered with shrubs, thus there is no need for removal of any significant vegetation for the construction of the wind power Project.

The proposed Project will have number of positive impacts and negligible negative impacts to the existing environment as follows:

- Significant improvement in the economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.
- The Project Area does not fall under any sensitive, protected area.
- No threatened / Near-Threatened species of wildlife was recorded in the Project Area.

- There is negligible removal of trees for the Project, which is the main positive impact to the proposed Project area.

- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration are the short term negative impacts due to proposed Project with mitigations being properly taken care.

Proper GRM will have to be implemented by Gul Ahmed Electric to overcome public inconvenience during the proposed Project activities.

Based on the environmental and social assessment and surveys conducted for the Project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions are being made in the Project to cover the environmental mitigation and monitoring requirements, and their associated costs. Adequate provisions are being made by Gul Ahmed Electric Ltd (GEL) to cover the environmental mitigation and monitoring requirements, and their associated costs.

An environment and social analysis has been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. The impact analysis, found that due to careful consideration of environmental and social aspects during route and site selection by Gul Ahmed Electric Ltd (GEL) no major adverse impacts are expected. There is no adverse impact on the migration of habitat, any natural existing land resources and effect in the regular life of people. At least, one year bird monitoring is recommended to compile substantive data about the impacts of wind power plants on the birds and other important wildlife of the area.

The environment and social impact associated with the Project is limited to the extent of construction phase and can be mitigated through a set of recommended measures and adequate provision for environment and social impacts which cover monitoring, measuring and mitigation.

Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor will be carefully selected after undergoing an options assessment. This enabled the right of way alignment to bypass villages and important water supplies and resources. The main Project impacts are associated with clearing of shrub vegetation, waste management and excavation and movement of soils.

From this perspective, the Project is expected to have a less "environmental footprint". No endangered or protected species of flora or fauna are reported near Project sites.

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The project has been discussed with local people, government officials and NGO. The consultations elicited general support for the project. There were no serious environmental issues raised or matters that the Consultant had overlooked. The main concerns expressed were to ensure that local people got employment on the project and that measures were in place to avoid excessive noise or dust and bird mortality.

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. Mitigation measures related to Construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed Project has Ltd adverse environmental and social impact which can be mitigated following the EMP & shall be pollution free Renewable source of Power generation with low Environmental foot prints.

This IEE study concludes that the proposed Wind project will not lead to significant adverse environmental and social impacts of such nature or magnitude that would require a more detailed report in the form of an EIA. Additionally careful implementation of the EMP will ensure that environmental impacts are managed and minimized and the project proponent meets all statutory requirements.