Shafi Energy

Shafi Energy (Pvt) Ltd.

A Shafi Group Company

15th November, 2018

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

Subject: Submission of Application for grant of Generation License for Shafi Energy Private Limited for 50 MW Wind Power Project (SEPL) at Jhimpir Area, Thatta, Sindh

I, Zahid Haleem Shaikh, being the duly authorized representative of SHAFI ENERGY (PRIVATE) LIMITED (a company incorporated under the laws of Pakistan with its registered office located at Shafi House, 35-A/3 opposite Beach Luxury Hotel, Karachi) hereby, pursuant to Rule 3 of the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, apply to the National Electric Power Regulatory Authority (NEPRA) for the grant of the Generation License to SHAFI ENERGY (PRIVATE) LIMITED.

I certify that the documents in support attached with this application are prepared and submitted in conformity with the provisions of the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, and I undertake to abide by the terms and provisions of the same. I further undertake and confirm that the information provided in the attached documents in support is true and correct to the best of my knowledge and belief.

The Generation License (including its Annexures) is submitted in triplicate together with:

a. The Bank Draft No. PO.0101.4965633 dated 15.11.2018, amounting to PKR 326,272 (Pakistani Rupees Three Hundred Twenty Six Thousand, Two Hundred and Seventy Two only) drawn on Meezan Bank as requisite for fee for Generation License.
b. Board Resolution of Shafi Energy Private Limited.
c. Affidavit of authorized representative.

Respectfully submitted for and on behalf of:
SHAFI ENERGY (PRIVATE) LIMITED

SHAFI ENERGY (PVT) LIMITED
Head Office Karachi

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Zahid Haleem Shaikh
Executive Director

Registered Office: Shafi House, 35-A/3, Lalazar, Opp. Beach Luxury Hotel, P.O. Box 4524, Karachi-74000, Pakistan.
Phone : (92-21) 35610696-8-9 Fax : (92-21) 35610701 E.mail: info@shafienergy.com
Website: www.shafienergy.com

Shafi Energy (Pvt) Ltd.

A Shafi Group Company

Shafi Energy

EXTRACT OF THE MINUTES OF THE MEETING OF THE BOARD OF DIRECTORS OF THE COMPANY HELD ON 12th November, 2018

"**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 and to enter into any subsequent modifications, and in relation to the foregoing, enter into and execute all requjred documents, make all filings and pay all applicable fees, in each case, of any nature whatsoever, as required."

"**FURTHER RESOLVED THAT** in respect of filing of application for Generation License (including any subsequent modifications) for submission to National Electric Power Regulatory Authority, **Zahid Haleem Shaikh** (Executive Director) be empowered and authorized for and on behalf of the Company to:

i. review, execute, submit, and deliver the application for Generation License (including any subsequent modifications) and any related documentation required by National Electric Power Regulatory Authority for the determination of the application for generation license, including any contact, documents, power of attorney, affidavits, statements, letters, forms, applications, deeds, guarantees, undertakings, approvals, memoranda, amendments, letters, communications, notices, certificates, requests, statements and any other instruments of any nature whatsoever;

ii. represent the Company in all negotiations, representations, presentations, hearings, conferences and /or meetings of any nature whatsoever with any entity (including, but in no manner limited to National Electric Power Regulatory Authority, any private parties, companies, partnerships, individuals, governmental and/or semi-governmental authorities and agencies, ministries, boards, departments, regulatory authorities and/or any other entity if any nature whatsoever);

iii. sign and execute the necessary documentation, pay the necessary fees, appear before the National Electric Power Regulatory Authority as needed, and do all acts necessary for completion and processing of the application for Generation License including any modifications;

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iv. appoint or nominate any one or more officers of the Company or any other person or persons, singly or jointly, in his discretion to communicate with, make presentations to and attend the National Electric Power Regulatory Authority hearings;

v. do all such acts, matters and things as may be necessary for carrying out the purposes aforesaid and giving full effect to the above resolutions/resolution.

"**AND FURTHER RESOLVED THAT Zahid Haleem Shaikh (Executive Director)**, be and are hereby authorized to delegate all or any of the above powers in respect of the forgoing to any other officials of the Company as deemed appropriate.

IN WITNESS THEREOF, I hereunder set my hands as such Company Secretary and affixed the corporate seal of said company.

Ejaz ur Rehman

[Company Secretary]

PROSPECTUS

ENERGY (PVT) LIMITED Head Office Karachi

PROSPECTUS

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

BRIEF INTRODUCTION OF THE APPLICANT

Shafi Energy (Private) Limited ("SEPL") is a SPV sponsored by the Shafi Gluco Chem (Pvt.) Limited, Shafi Texcel Limited and Muhammad Shafi Tanneries (Pvt.) Limited, for the development of a 50 MW wind power project. The Sponsor has a valid LOI from the Energy Department Government of Sindh ("EDGOS") in this regard and has been provided land coordinates for approximately 412 acres in Deh Kohistan, Tapo Jungshahi Taluka, District Thatta by the Government of Sindh (GOS).

The current status of the Project is as follows:

- A high-powered professional team to assist in the implementation of the Project is being put in place. Bridge Factor have been appointed as Transaction Advisors, whereas a consortium of Lahmeyer International and Renewable Resources (RE2) have been selected as Employer's Engineer and ME Consult as technical advisors to the Sponsors.
- All major technical studies have already been completed which include Topographic Survey, Geotechnical Study/Soil Survey, Transportation Study and Initial Environment Examination.
- The Sponsors have engaged Power Planners International ("PPI") to conduct the Grid Interconnection Study, which has been approved by the NTDC.
- The IEE has been approved by the Sindh Environment Protection Agency ("SEPA") and a NOC has been issued to the Project in this regard.

Brief Sponsor Profile

SEPL is sponsored by Shafi Gluco Chem (Pvt.) Limited Shafi Texcel Limited & Muhammad Shafi Tanneries (Pvt.) Limited, are the Sponsors of Shafi Energy Private Limited.

Shafi Group

Shafi Group was formed in 1940 by the (late) Mian Muhammad Shafi, along with his elders sons, Mian Muhammad Siddiq and Mian Abdul Hafeez, founded the group in 1940, as a trading house in hides and skins. The Group is today one of the premier houses in leather, textile, garments, dairy farming and rice processing.

Shafi Group of companies includes eight manufacturing units, including four tanneries which produce all various types of leathers, one leather garment unit, one footwear unit, one textile unit, one glucose and rice syrup production unit, one unit producing specialty leather chemical and also a company involved in dairy farming. The total turnover of the group is approximately US$ 100 million, a very major part of which is for export. The Group's international agent network spans over twelve countries in three continents with major markets being Germany, France, Italy, China, other Far Eastern, European and South and North American Countries.

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Karachi

SALIENT FEATURES OF THE FACILITY

- Plant Details – 50 MW.
- Project Name – Shafi Energy Private Limited.
- Project Location – Deh Kohistan 7/4, Tapo Jungshahi Taluka, District Thatta, Sindh, Pakistan.
- Technology – 25 x Gamesa WTG G114-2.0, electrical equipment, together with ancillary equipment and other goods and machinery.
- Proposed Capacity / Annual Capacity Factor – 50 MW / 38%
- Dispatch / Power Purchaser – CPPA-G
- Total Project Cost – approximately US$ million 75.07.
- Debt to Equity Ratio – 80/20
- No. of Units and Turbines – 25 x Gamesa WTG G114-2.0

PROPOSED INVESTMENT

The Total Project Cost of approximately US$ million 75.07 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

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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1. BACKGROUND TO GENERATION LICENSE APPLICATION

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

Issuance of "Letter of Intent"

SHAFI ENERGY (PRIVATE) LIMITED (a company duly organized and existing under the laws of Pakistan, with its office located at Shafi House, 35 A/3, Lalazar, M.T Khan Road Karachi) (the Project Company), was issued a LETTER OF INTENT (the LOI) by the Energy Department Government of Sindh (EDGOS) on 2nd March 2016 vide its letter No. DAE/Wind/102/2016, to develop and establish an approximately 50 MW wind farm project to be located at Deh Kohistan 7/4, Tapo Jungshahi Taluka, District Thatta, Sindh, Pakistan (Project). The validity of the LOI was later extended up-to February 20, 2019.

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.

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) in December 2016.

After careful review and analysis of the Initial Environmental Examination, the SEPA accorded its approval for the Project through its decision (Ref: 2017/01/09/IEE/109) dated 25th January 2017 (the IEE Approval Decision). A copy of the IEE Approval Decision is attached hereto as **ANNEXURE B** for NEPRA's perusal.

Grid Interconnection Studies

Grid Interconnection Study was carried out by Power Planners International. The National Transmission and Despatch Company (NTDC) has vide letter no. GMPP/CEMP/TRP-380/3122-26 dated 01-06-2017 accorded its approval of the Grid Study. A copy of the Grid Interconnection Study, a copy of the approval of the Grid Study and a copy of the Power Evacuation Certificate is attached hereto as **ANNEXURE C** for NEPRA's perusal.

Location of Project & Lease of Land

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The Project site is located in Deh Kohistan 7/4, Tapo Jungshahi Taluka, District Thatta, Sindh, Pakistan; a city of the southern province Sindh. The aerial distance between the Project site and Karachi is about 166 km and the road distance of site from Port Qasim is 120 km. The size of the whole wind farm is 412 acres. The altitude of the site is 33 m~87 m 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. A copy of the Land Allotment letter is attached hereto as **ANNEXURE D** for NEPRA's perusal.

Brief Technical Synopsis of the Project

The Project shall have an installed capacity of 50 MW with Siemens-Gamesa wind turbine generators (WTG) of 2.0 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 C** for the Grid Interconnection Study carried out by Power Planners International.

Request for grant of a generation license

Based on the matters provided 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.

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2 APPLICANT – SHAFI ENERGY PVT LIMITED

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

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 Deh Kohistan 7/4, Tapo Jungshahi Taluka, District Thatta, Sindh, Pakistan (the Site).

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 E**.

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

DOCUMENTS	ANNEXURE
Certified True Copy of SECP Certified Memorandum and Articles of Association	ANNEXURE G
Certified True Copy of SECP Certified Certificate of Incorporation	ANNEXURE H

SHAFI ENERGY (PVT) LIMITED

3 FACILITY UTILIZATION

3.1 ELECTRICITY DEMAND & WIND CORRIDOR

Pakistan currently has around 28.4 GW of installed capacity for electricity generation. Conventional thermal plants (oil, natural gas, coal) account for 62.87% of Pakistan's capacity, with hydroelectricity making up 27.17%, Renewable Energy (Wind, Solar & Bagasse) 5.59% and Nuclear 4.36%.

Pakistan is moving ahead towards solving its energy crises. A major contributor to this solution is the injection of electricity through base load power plants i.e. LNG and Coal based generation. However, Pakistan still needs to generate electricity to meet future ever increasing demand due to expected increase in GDP growth rate and suppressed demand factor. Base load plants are generating electricity through imported fuels which increases the burden on the foreign exchange reserves. Therefore, it is imperative for Pakistan to look for indigenous/cheap energy resources for sustainable growth through self-reliance.

Moreover, there should be considerable portion of renewable energy in the overall energy mix of the country to optimize the basket price. Pakistan has been facing severe power shortage for the last few years and inclusion of renewable energy in the electrical power system is the optimum solution. Renewable energy is the cheapest form of energy with no environmental impacts. Pakistan has abundant renewable resources, which should be utilized to provide affordable electric energy to its people.

To ensure a sustainable energy future for Pakistan, it is necessary that the energy sector be accorded a high priority. It is considered that wind power generation could become a significant contributor to Pakistan's electricity supply in the near future. The development of wind generation projects supports the environmental objectives of the Government of Pakistan by:

a) reducing dependence on fossil fuels for thermal power generation;
b) increasing diversity in Pakistan's electricity generation mix;
c) reducing greenhouse gas emissions through avoidance of thermal power generation; and
d) helping in reduction of the exorbitant trade deficit.

Pakistan has a huge wind potential which can be effectively and efficiently utilized for the economical generation of Power. The coastal belt of Pakistan is blessed with a wind corridor that is 60 km wide (Gharo -Kati Bandar) and 180 km long (up to Hyderabad). This corridor has potential of 50,000 MW of electricity generation through wind energy that is ready to be exploited. Currently 15 wind energy projects having a combined capacity of 785 MW are operational and 9 wind energy projects having a combined capacity of 445.8 MW are at different stages of construction.

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4 THE SPONSOR

4.1 AN INTRODUCTION

Shafi Gluco Chem (Pvt.) Limited, Muhammad Shafi Tanneries (Pvt.) Limited and Shafi Texcel Limited--are the Sponsors for the Project (the "Project Sponsor"). Brief Profile of the Project Sponsors is given below:

4.2 Shafi Group

Shafi Group was formed in 1940 by the (late) Mian Muhammad Shafi, along with his elders sons, Mian Muhammad Siddiq and Mian Abdul Hafeez, founded the group in 1940, as a trading house in hides and skins. The Group is today one of the premier houses in leather, textile, garments, dairy farming and rice processing.

Shafi Group of companies includes eight manufacturing units, including four tanneries which produce all various types of leathers, one leather garment unit, one footwear unit, one textile unit, one glucose and rice syrup production unit, one unit producing specialty leather chemical and also a company involved in dairy farming. The total turnover of the group is approximately US$ 100 million, a very major part of which is for export. The Group's international agent network spans over twelve countries in three continents with major markets being Germany, France, Italy, China, other Far Eastern, European and South and North American Countries.

4.2.1 Muhammad Shafi Tanneries (Pvt.) Limited

Muhammad Shafi Tanneries (Pvt.) Ltd. (MST), Karachi, the flag-bearer company of the group, is pioneer in production of kid leather for shoe industries and is one of the best known kid tanneries in the world. It started production and export in 1959 and now "MST" is the most prestigious and widely known trademark from Pakistan and is synonymous with the best in quality of leather and reliability in business.

MST's annual production capacity is over 22 million sq. ft. and annual turnover of over US$ 356 million. MST produces a wide range of leathers for shoe uppers and linings in various finishes/executions. It is not only the fashion trends, but also making innovations of its own in kid and goatskin leathers for shoes. Its innovative leathers are regularly chosen by Lineapelle, Bologna as well as by the ARS magazine, Italy for "FASHION TREND SECTION". MST has practically won all the Best Export Performance Trophy awards right from the inception of the award by the Federation of Pakistan Chambers of Commerce and Industry. MST displays its leather in Linea pelle, Bologna, Italy as well as in Asia-Pacific Leather Fair, Hong Kong.

4.2.2 Shafi Gluco - Chem (Pvt.) Limited

Established in 2003, Shafi Gluco – Chem (Pvt.) Limited (ISO 22000 Certification by UKAS in July 2011) is the most highly equipped, state of the art 'Starch Sweeteners' production facility in Pakistan. Shafi Gluco Chem (Pvt.) Limited, to assure the highest quality and service for its customers, has also appointed T.S.S. Team Starch Sweeteners (Germany), a consultancy firm, for guidance, innovation and technical advancements to prepare itself for the global market.

It is involved in the production of Liquid Glucose, Glucose Powder, Rice Protein & Concentrates, Organic Rice, and Rice Flour. Shafi Gluco-Chem has an annual production capacity of 22,000 tons and annual turnover of US$ 20 million.

4.2.3 Shafi Texcel Limited

Shafi Texcel Limited has a success story of over one decade; from modest start in 2014 from a weaving unit it has turned into a vertically integrated textile unit by adding yarn dyeing production in 2009 and a fabric finishing unit in 2014. Over the last 10 years, Shafi Texcel has been recognized as the leading value added fabric producer from Pakistan.

It offers woven fabrics for various end users mostly in cotton and blends with Polyester, Viscose, Lycra and other Fibers. The production weaving capacity is 1.5 million meter of fabric per month along with a capacity of 7 tons per day of yarn dyeing and 2 million meters per month of finishing.

Since its inception, Shafi Texcel has become a leading producer of yarn dyed fabrics in Pakistan. Shafi Texcel is positioned to provide customers with a vertically integrated solution to source yarn dyed fabrics. The product development team carries out extensive research to keep updated on new market trends and to stay one step ahead of the competition. Shafi Texcel constantly work hard to translate its novel and creative ideas into attractive products.

4.2.4 Sponsors' Energy Experience

Shafi Group has had experience in procurement, installation, commissioning, and operations and maintenance of over 9MW of captive power generation capacity for its group companies' manufacturing facilities. The captive power plants are based on thermal technology (gas turbine combined cycle) with their primary fuel being natural gas and diesel. The group has operated the captive power plants for the past 15 years.

4.2.5 Sponsor Companies' Consolidated Financials

Shafi Group of Companies	**2015**	**2016**
Key Financials	**PKR (000)**	**PKR (000)**
Annual Turnover	7,112,940	6,520,727
Total Assets	7,144,308	7,717,265
Net Assets	4,203,075	5,204,229

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5 RESOURCES

5.1 SENIOR MANAGEMENT & PERSONNEL

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.

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

	NAME OF INDIVIDUALS	POSITION	EXPERIENCE	ANNEXURE
1.	Mr. Mohammad Naseem	Managing Director Muhammad Shafi Tanneries (Pvt) Ltd.	More than 45 years	ANNEXURE I
2.	Mr. Zahid Haleem Shaikh	Executive Director Shafi Energy Pvt Ltd	More than 16 years	ANNEXURE I

In addition, experienced technical personnel are associated with the Project, the curriculum vitae are attached at **Annexure I.**

5.2 THE EPC CONTRACTOR

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

The Project Company has appointed RENEWABLE RESOURCES (PRIVATE) LIMITED (PAKISTAN) as technical advisors of the Project.

5.4 FINANCIAL ADVISORS

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

6 CAPITAL BUDGET

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$ 75.07.

The capital structure of the Project is proposed as follows:

	USD MILLION
DEBT	60.06
EQUITY	15.01
TOTAL PROJECT COST	75.07

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7 FINANCIAL PLAN

The Total Project Cost of approximately US$ 75.07 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

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. The Lenders have provided soft commitments for an amount of up to USD million 60.06 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 Lender's Letter of Intent by Meezan Bank Limited are attached hereto as **ANNEXURE J** for NEPRA's perusal.

7.2 EQUITY

Based on the Debt to Equity ratio of 80/20, the equity required to be injected by the Sponsors (the Equity), amounts to USD million 15.01. The Sponsors have already committed the equity in respect of the Project and such arrangements have been agreed with the Mandated Lead Arrangers.

The financial strength and net worth of Sponsors is illustrated by the Financial Statements in **ANNEXURE K**. The Cash Balance certificates of the Project Sponsors are also included in **ANNEXURE K**.

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8 THE PROJECT & THE FACILITY

8.1 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	✓
Selection of EPC & O&M Contractor	✓
Grid Interconnection Study by NTDC	✓
Lender's LOI for financing	✓
Land Lease Execution	August 8, 2016
Submission of Performance Guarantee & Issuance of LOS	06 months after tariff is made available
Execution of Concession Documents	05 months after tariff is made available
Execution of Financing Documents	05 months after tariff is made available
Construction period	18 months after achieving Financial Close

8.2 PROJECT SITE

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.

The Site is located in Deh Kohistan 7/4, Tapo Jungshahi Taluka, District Thatta, Sindh, Pakistan, which is one of the most promising areas where wind power projects can be viably installed. 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.

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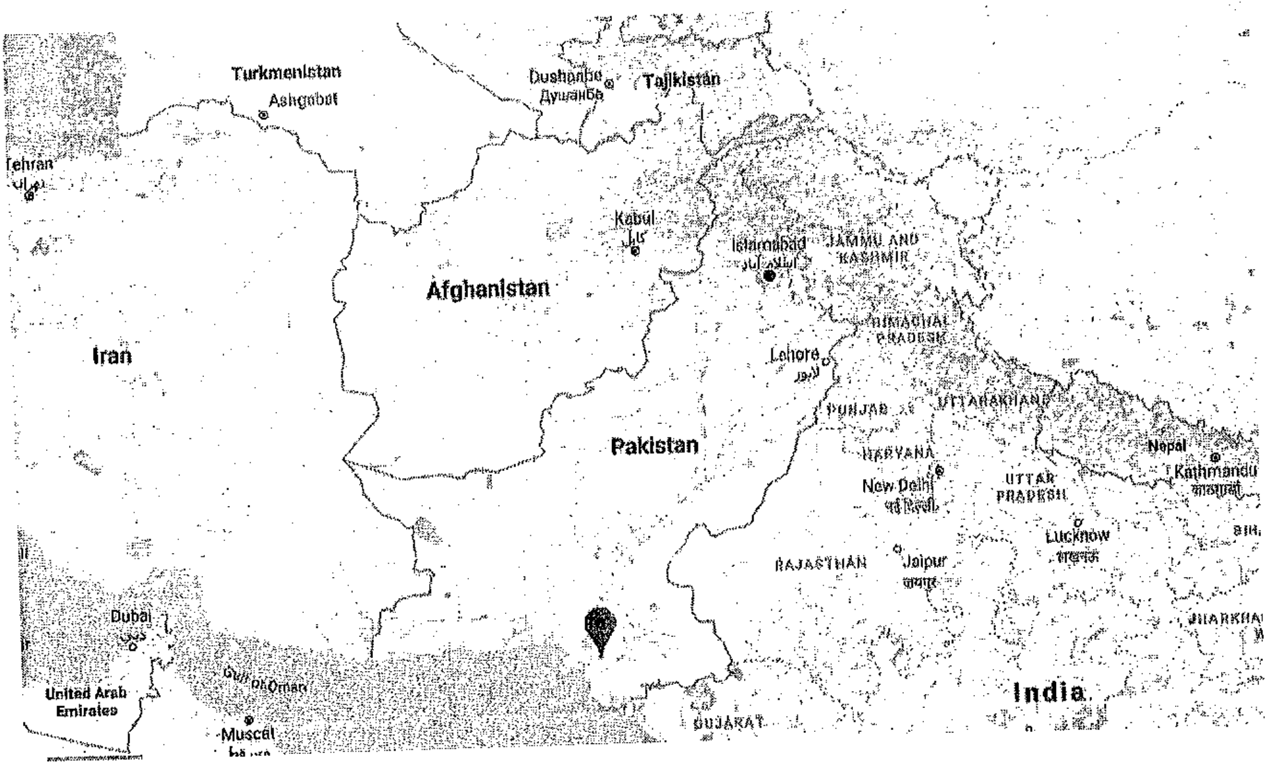
There are number of neighboring wind farms in the surrounding area of Jhimpir. There is no requirement to establish roads or tracks for movement of traffic. The total distance from Karachi port to the site is approximately 120 km.

The Project location is shown below:



Coordinates of the Project site are tabulated below:

Total Land Area: 412 Acres		
	Geodetic Coordinates	
Point No.	Latitude (N)	Longitude (E)
1	24°54'57.57"N	67°38'12.12"E
2	24°54'53.50"N	67°38'9.27"E
3	24°53'23.04"N	67°41'1.16"E
4	24°53'27.73"N	67°41'2.61"E
5	24°54'0,30"N	67°41'23.71"E
6	24°53'55.47"N	67°41'22.17"E
7	24°53'0.91"N	67°43'15.68"E
8	24°52'57.30"N	67°43'11.80"E
9	24°52'29.42"N	67°42'55.05"E
10	24°52'24.49"N	67°42'53.78"E
11	24°52'51.52"N	67°42'12.33"E
12	24°52'47.22"N	67°42'9.79"E

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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.

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 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.

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 34m to 87m.

The proposed site is located about 146 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 may reach upto 45 Celcius.

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

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.

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

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.

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.

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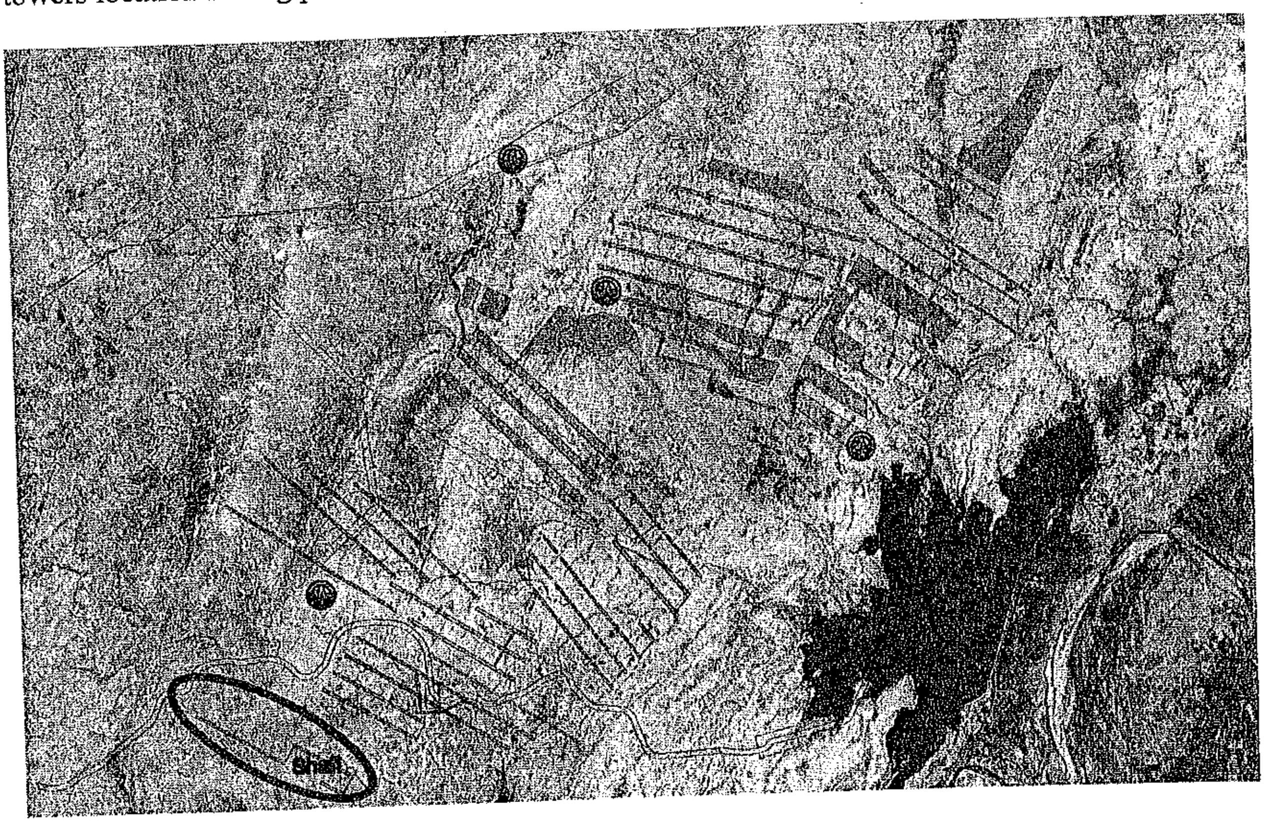
Under the turnkey EPC Contract, the EPC Contractor shall be responsible for the construction of roads at the Project Site and also for the access road. The EPC Contractor is also responsible for setting up clean, safe and secure staff colony within the Project Site, which will be used by the EPC and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

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.

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.

8.4 WIND FARMS LAYOUT AT PROJECT SITE

The wind farms site is in long and narrow in shape, the topography is relatively flat and the elevation above sea level is approximately 34m – 87m. There is little vegetation at the wind farm site. Wind Turbines will have 93m hub height. See figure below for the sketch map for the WTG towers location setting parameters for the project.



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Karachi

The tentative micrositing is given in table below:

Total Land Area: 412 Acres		
Coordinates (UTM z42, WGS84)		
WTG Label	Easting	Northing
Shafi_G01	2756050	362666
Shafi_G02	2755848	363009
Shafi_G03	2755645	363353
Shafi_G04	2755443	363696
Shafi_G05	2755240	364039
Shafi_G06	2755037	364382
Shafi_G07	2754835	364726
Shafi_G08	2754632	365069
Shafi_G09	2754429	365412
Shafi_G10	2754227	365755
Shafi_G11	2754024	366098
Shafi_G12	2753821	366442
Shafi_G13	2753619	366785
Shafi_G14	2754225	368040
Shafi_G15	2754022	368383
Shafi_G16	2753818	368725
Shafi_G17	2753614	369068
Shafi_G18	2753411	369410
Shafi_G19	2753207	369753
Shafi_G20	2753003	370096
Shafi_G21	2752800	370438
Shafi_G22	2752311	369023
Shafi_G23	2752110	369367
Shafi_G24	2751908	369710
Shafi_G25	2751706	370054

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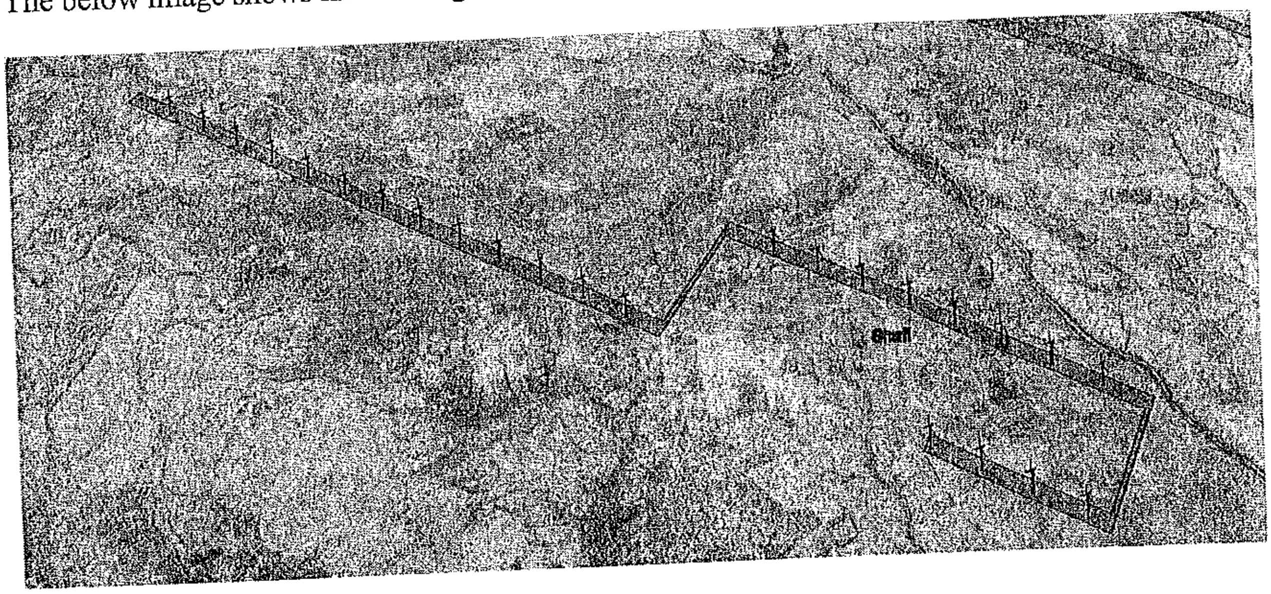
The below image shows micrositing of WTGs



8.5 TOPOGRAPHICAL AND GEOLOGICAL CONDITIONS AT PROJECT SITE

8.5.1 Topographical conditions:

The Site is on a plain area at an elevation of 34m - 87m, 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.

8.5.2 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.

8.5.3 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.

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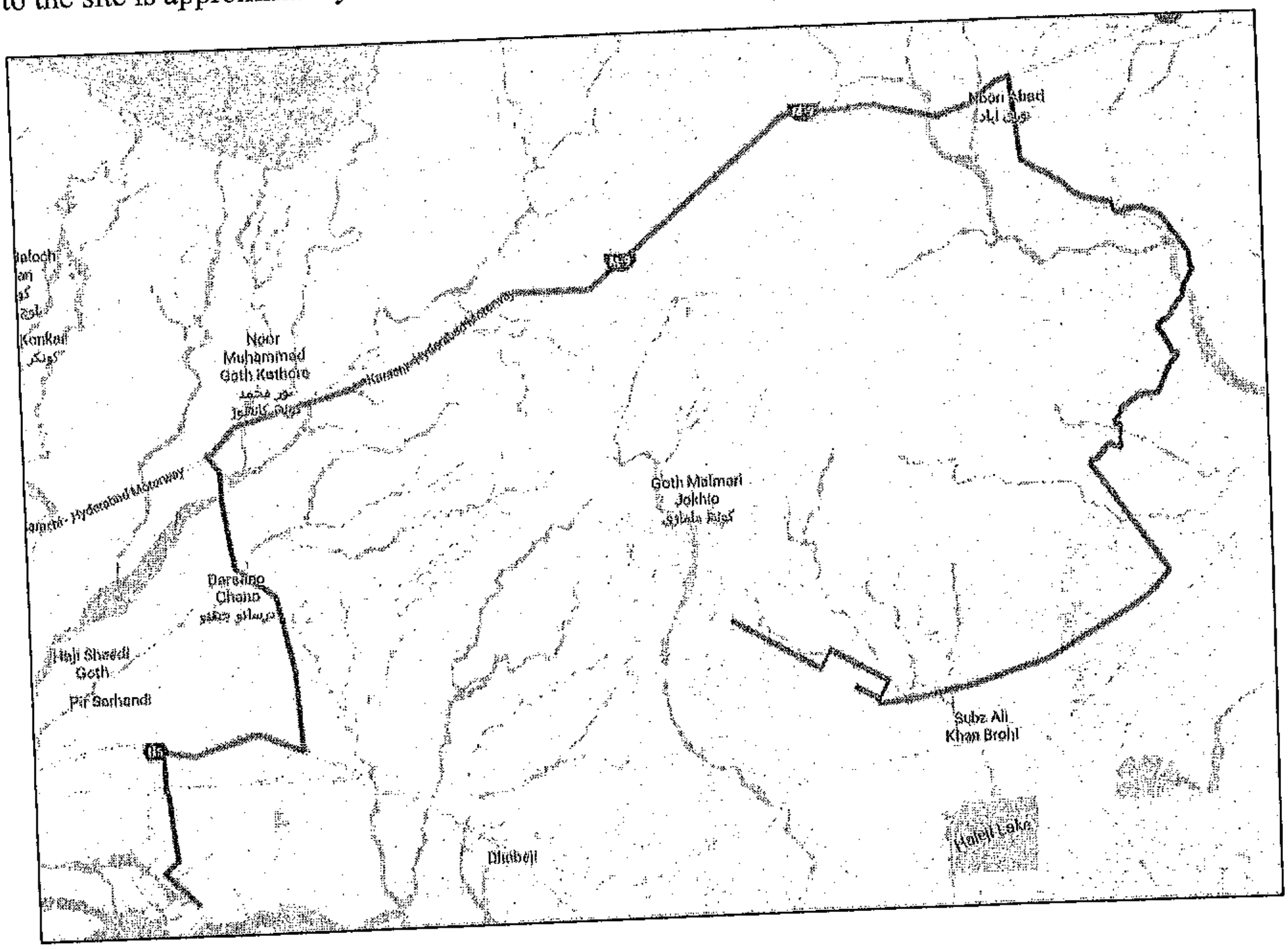
8.6 SITE ACCESSIBILITY

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 149 km. The route is given in Figure below.



8.7 TELECOMMUNICATION AT PROJECT SITE

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.

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.

8.8 AVAILABILITY OF SEMI-SKILLED AND SKILLED LABOR

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.

8.9 O&M, TRAINING AND DEVELOPMENT OF STAFF

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 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.

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.

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.

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).

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Head Office
Karachi

i) Working on, at or near hazardous substances (oils, chemicals, insulators and gases).
j) Confined space works and requirements therein.

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.

8.10 PROJECT SITE SECURITY

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. Similarly the O&M Contractor shall be required under the O&M Contract to provide security in accordance with prudent industry practices.

8.11 SAFETY PLANS & EMERGENCY PLANS

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

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

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.

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

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.

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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.

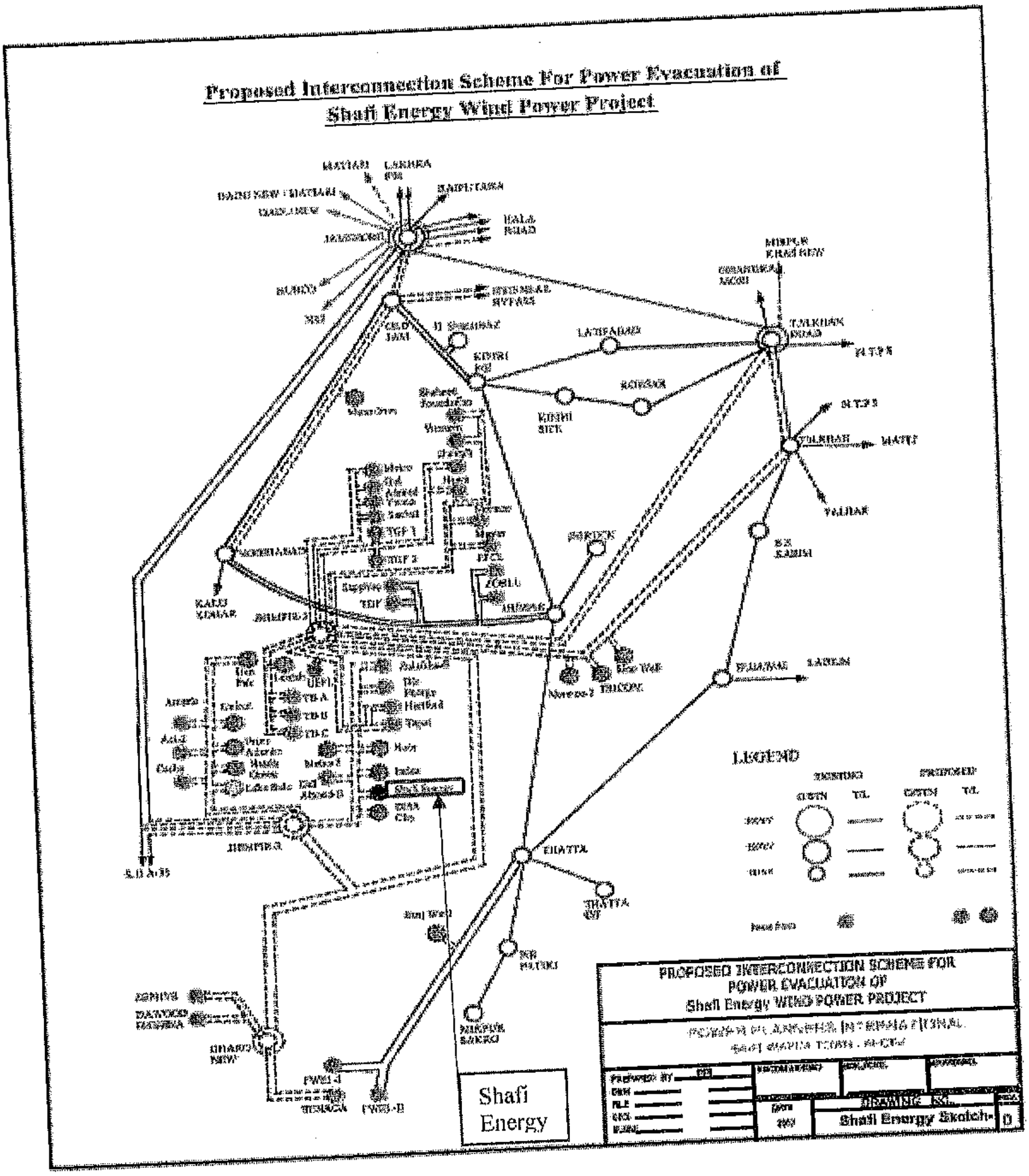
8.12 GRID CONNECTIVITY

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.

		Document
	System Studies	Grid Interconnection Study
1	Load Flow	Grid Interconnection Study
2	Short Circuit	Grid Interconnection Study
3	Stability and Reliability	

The Grid Interconnection Study is attached as **Annexure C**.

The proposed interconnection scheme for the evacuation of power from the project is shown below.



8.13 ANNUAL ENERGY PRODUCTION

The Annual Energy Production shall be 166.44 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	166.44 GWh
Capacity Factor	38 %

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Head Office
Karachi

8.14 EXPECTED LIFE OF THE GENERATION FACILITY

The Generation Facility has an expected life of 25 years.

8.15 GAMESA– THE WTG

With 20 years' experience, Gamesa is a global leader in the design, manufacture, installation and maintenance of wind turbines, with over 28,800 MW installed in 43 countries across five continents. Operation & Maintenance (O&M) is one of the key activities upon which Gamesa bases its development, having 70% of its fleet under an Operation & Maintenance contract thanks to an expansion of this activity in over 30 countries.

In April 2017 Siemens merged its wind power business with Gamesa. Siemens Wind Power and Gamesa now form a world-leading wind power provider in the name of "Siemens Gamesa Renewable Energy", with an unrivalled global presence with over 75 GW installed globally in more than 90 countries. The two companies complement one another almost perfectly and boast a unique product portfolio.

The Project comprises of 25 Gamesa G114-2.0 MW CIIA Wind Turbines at 80m hub height. The output of the farm will be 50 MW with capacity factor of 38%. The Project construction timeline will be 18 months after issuance of Notice to Proceed (NTP).

The Plant characteristics are as follows:

(i).	Wind Turbine Type, Make & Model	Gamesa G114-2.0
(ii).	Installed Capacity of Wind Farm (MW)	50 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (kW)	25 x 2.0 MW
(iv).	Number of blades	3
(v).	Rotor diameter	114 m
(vi).	Hub Height	93m
(vii).	Generator Voltage	690 V
(viii).	Cut-in wind speed	3 m/s
(ix).	Cut-out wind speed	25 m/s
(x).	Extreme wind speed (3 second average)	59.5 m/s

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	3328.80 hours
3	Average Wind Turbine Generator(WTG) Availability	98%
4	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	185.518
5	Array & Miscellaneous Losses (GWh)	10.72969

SHAFI ENERGY (PVT) LIMITED Head Office Karachi

6	Availability Losses (GWh)	3.71036
7	Balance of Plant Losses (GWh)	4.63795
8	Annual Energy Generation (25 year equivalent Net AEP) GWh	166.44
9	Net Capacity Factor	38%

8.16 EPC CONTRACTOR

HYDROCHINA CORPORATION, is part of Power China group one of the largest groups in China with total revenue of approx. US$ 50 billion and total assets of over US$ 77 billion. Power China perform more than 1900 Projects in 116 countries.

The company provides technical services in the field of hydropower, water resources development and wind power development in China, including planning of river basins, reconnaissance, design, consultancy, construction supervision, appraisal, evaluation, safety appraisal, check and acceptance, construction, project management and EPC contracting for hydropower and new energy development, and development, investment, operation and management of hydropower and new energy projects as well. The company was founded in 2002 and is headquartered in Beijing, China.

In Pakistan HydroChina Corporation has already conducted EPC works since 2011 and has completed EPC contracts for 280 MWs and is executing EPC contracts for another 300 MWs.

The brief company profile of HydroChina Corporation is attached as **Annexure E.**

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9 CONCLUSION

In light of the submissions, the relevant 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:
SHAFI ENERGY (PRIVATE) LIMITED

SHAFI ENERGY (PVT) LIMITED
Head Office
Karachi

....
ZAHID HALEEM SHAIKH
EXECUTIVE DIRECTOR
AUTHORIZED REPRESENTATIVE OF
SHAFI ENERGY (PRIVATE) LIMITED

SHAFI ENERGY (PVT) LIMITED
Head Office
Karachi

NO. DAE/Wind/102/2016
GOVERNMENT OF SINDH
Directorate of Alternative Energy
ENERGY DEPARTMENT
Karachi, dated: October 26, 2017

Ph: 021- 99207148

Say No to Corruption

Mr.Muhammad Naseem Shafi,
Director, Shafi Energy (Pvt) Ltd.
Shafi House 35-A/3, Lalazar,
Opposite beach Luxury Hotel Karachi.
Ph: 021-35610696-9

SUBJECT: EXTENSION IN THE VALIDITY PERIOD OF LETTER OF INTENT (LOI NO.DAE/WIND/102/2016/59 DATED MARCH 2, 2016) ISSUED TO M/S SHAFI ENERGY (PVT.) LIMITED FOR THE DEVELOPMENT OF 50MW WIND POWER PROJECT

Reference is made to your request dated August 16, 2017 regarding subject matter.

2. Directorate of Alternative Energy, Energy Department, Govt. of Sindh is pleased to convey that the extension in the validity period of LOI No.DAE/Wind/102/2016/59 dated March 2, 2016 issued to M/s Shafi Energy (Pvt.) Limited for the development of 50MW Wind Power Project in Jhimpir wind corridor, Thatta Sindh, upto **February 20, 2019**.

3. All other terms and conditions of LOI No.DAE/Wind/102/2016/59 dated March 2, 2016 shall remain same.

(Engr. Mehfooz Ahmed Qazi)
Director Alternative Energy

Copy for information to:

i) Secretary, Land Utilization Department, Govt. of Sindh
ii) Registrar, NEPRA, Islamabad
iii) CEO, Alternative Energy Development Board (AEDB), Islamabad
iv) CEO, CPPA, Islamabad
v) GM Planning (Power), NTDC, Lahore
vi) PS to Secretary, Energy Department, Govt. of Sindh

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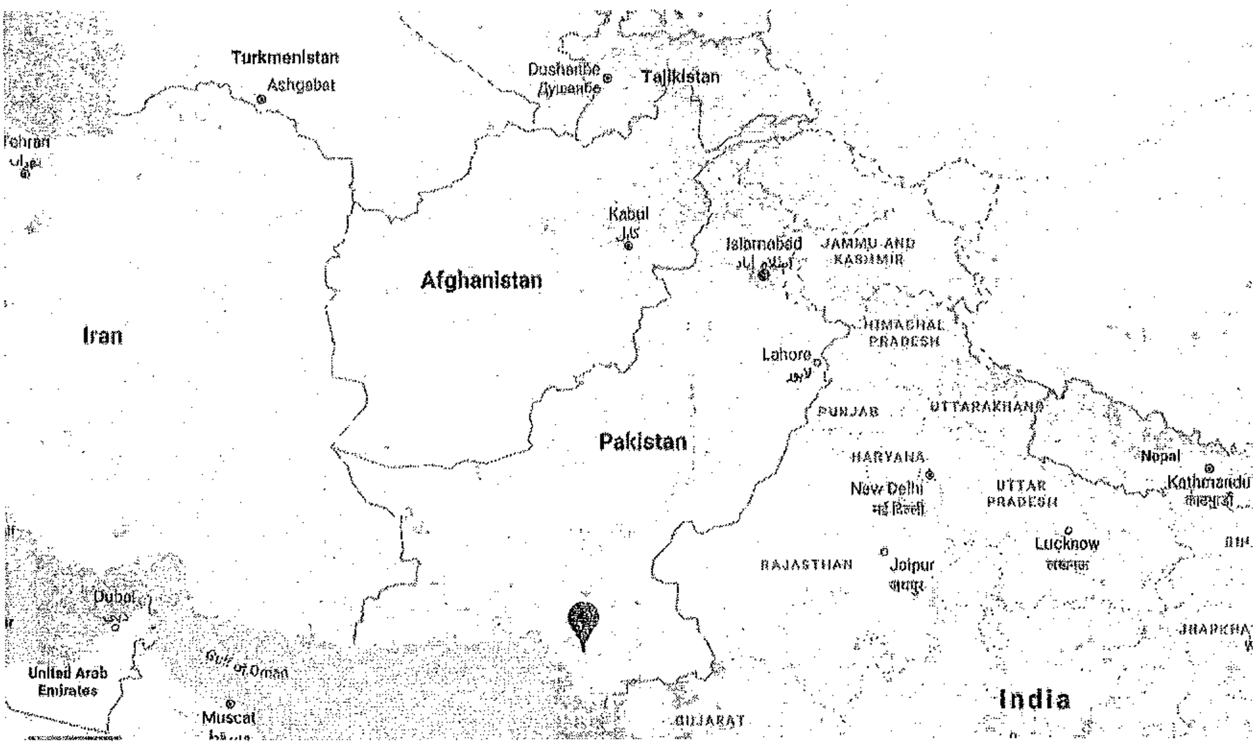
Head Office
Karachi

Schedule-I

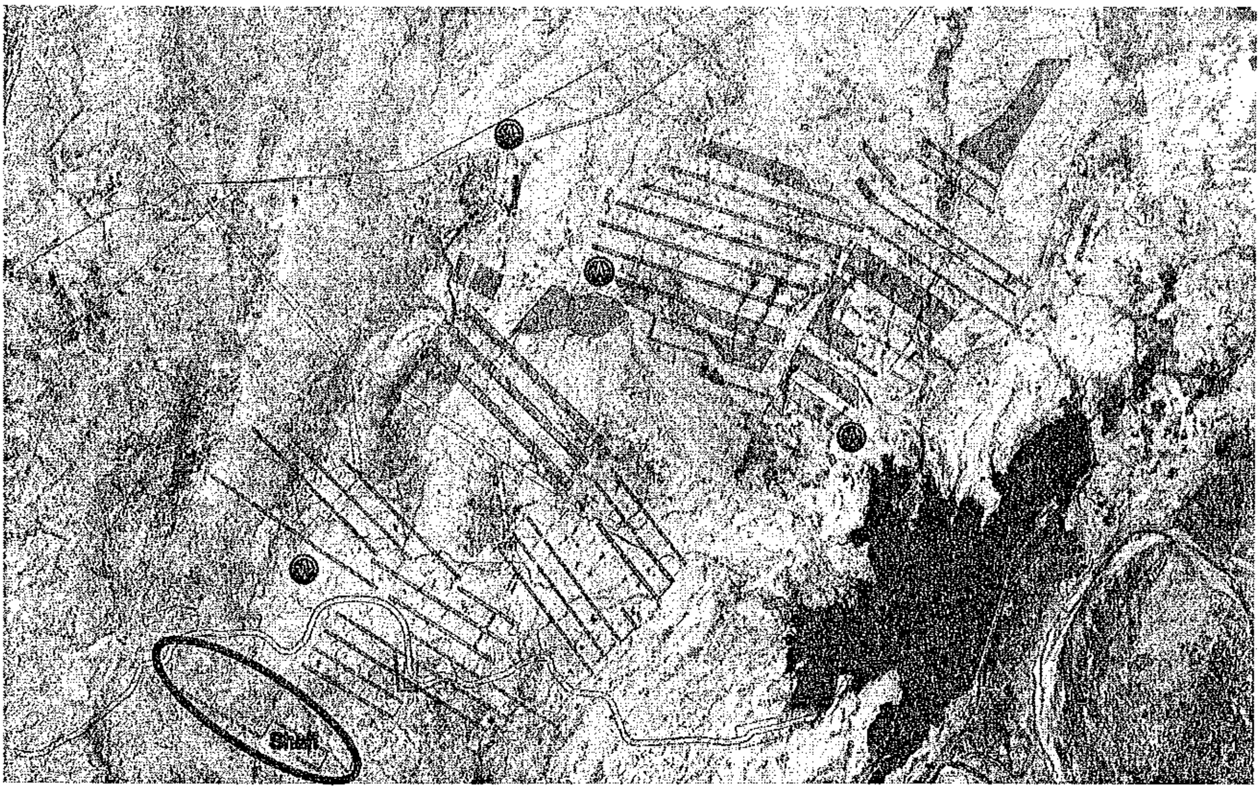
The Location, Size (i.e. Capacity in MW), Type of Technology, Interconnection Arrangements, Technical Limits, Technical / Functional Specifications and other details specific to the Generation Facilities of the Licensee are described in this Schedule.

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), May be added

Location of Generation Facility/ Wind Farm



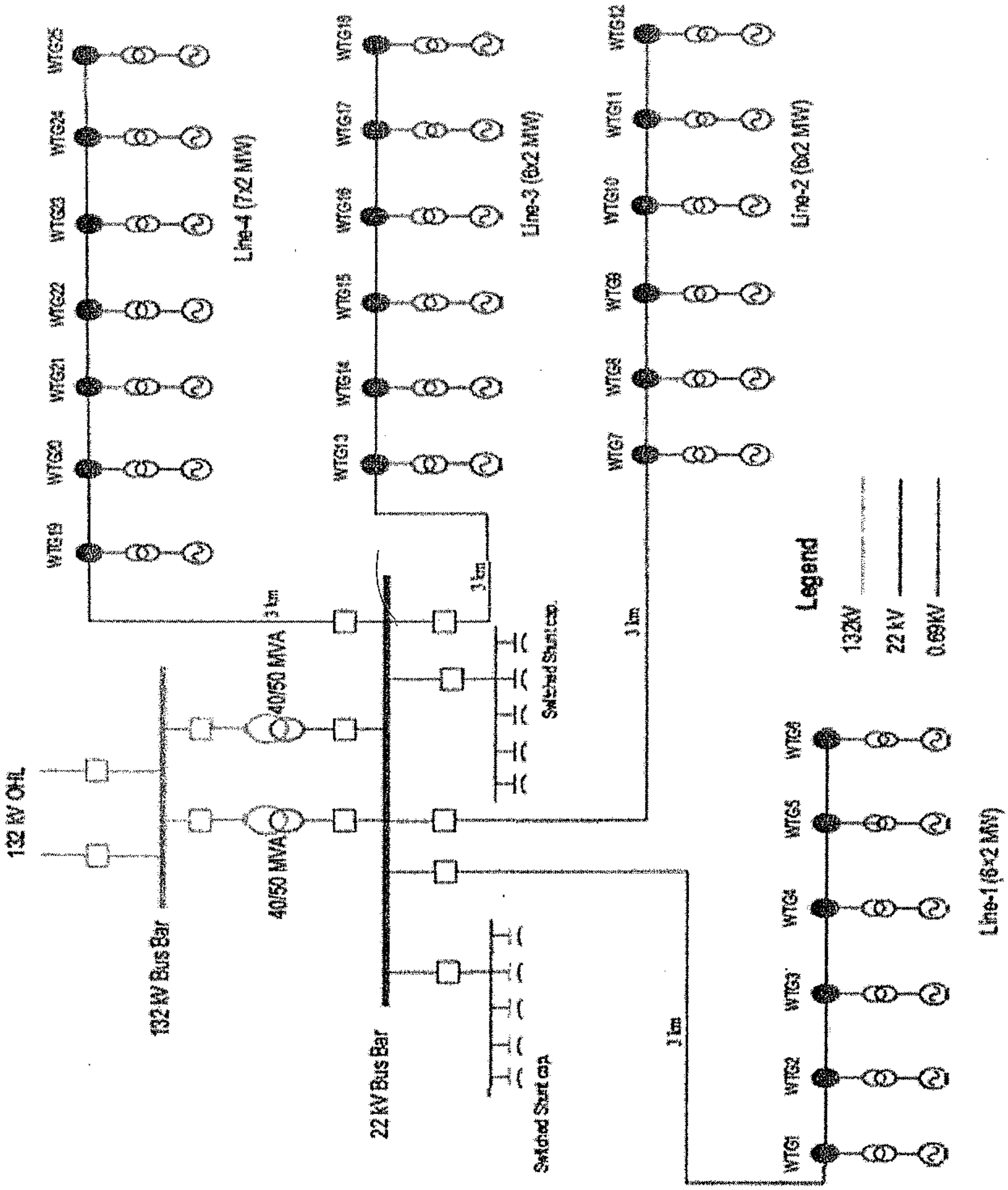
Layout of Generation Facility/ Wind Farm



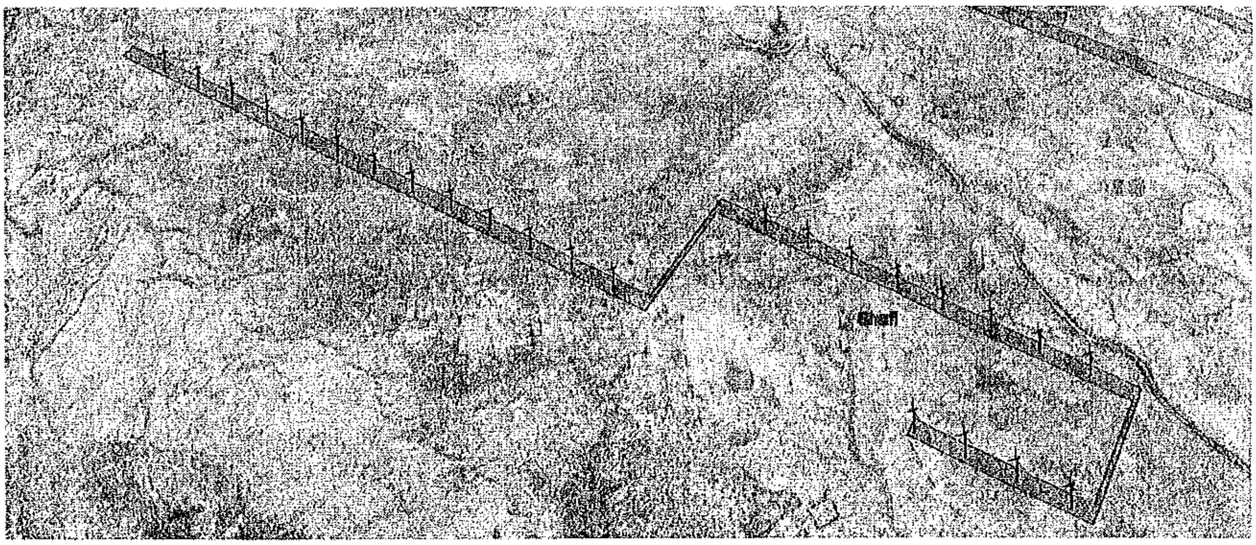
Land Coordinates of Generation Facility/ Wind Farm

Total Land Area: 412 Acres		
Geodetic Coordinates		
Point No.	**Latitude (N)**	**Longitude (E)**
1	24°54'57.57"N	67°38'12.12"E
2	24°54'53.50"N	67°38'9.27"E
3	24°53'23.04"N	67°41'1.16"E
4	24°53'27.73"N	67°41'2.61"E
5	24°54'0.30"N	67°41'23.71"E
6	24°53'55.47"N	67°41'22.17"E
7	24°53'0.91"N	67°43'15.68"E
8	24°52'57.30"N	67°43'11.80"E
9	24°52'29.42"N	67°42'55.05"E
10	24°52'24.49"N	67°42'53.78"E
11	24°52'51.52"N	67°42'12.33"E
12	24°52'47.22"N	67°42'9.79"E

Electrical System Single Line Diagram of Generation Facility/Wind Farm



Micro-Sitting of Generation Facility/ Wind Farm



Total Land Area: 412 Acres		
Coordinates (UTM z42, WGS84)		
WTG Label	Easting	Northing
Shafi_G01	2756050	362666
Shafi_G02	2755848	363009
Shafi_G03	2755645	363353
Shafi_G04	2755443	363696
Shafi_G05	2755240	364039
Shafi_G06	2755037	364382
Shafi_G07	2754835	364726
Shafi_G08	2754632	365069
Shafi_G09	2754429	365412
Shafi_G10	2754227	365755
Shafi_G11	2754024	366098
Shafi_G12	2753821	366442
Shafi_G13	2753619	366785
Shafi_G14	2754225	368040
Shafi_G15	2754022	368383
Shafi_G16	2753818	368725
Shafi_G17	2753614	369068
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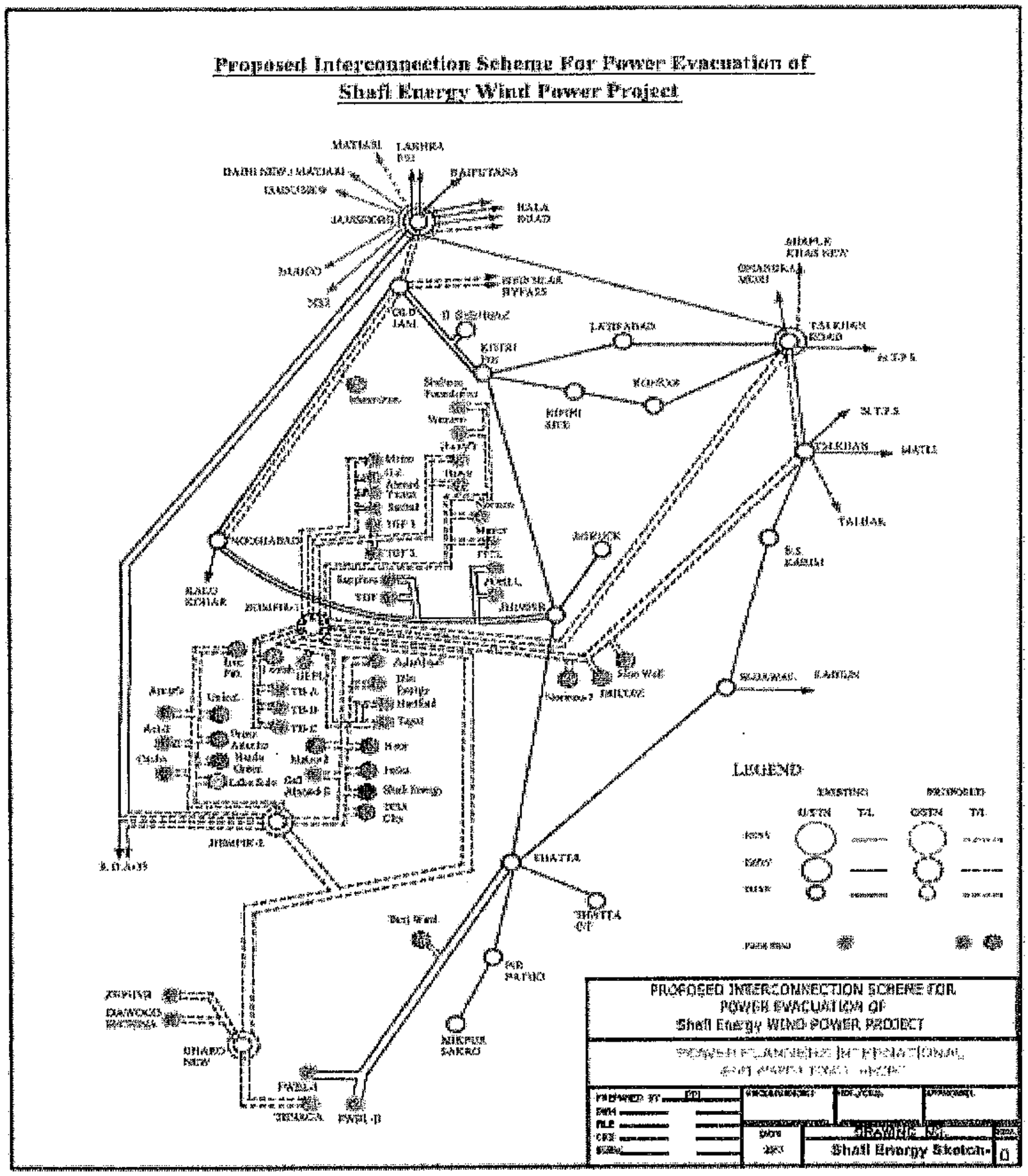
Shafi_G20	2753003	370096
Shafi_G21	2752800	370438

Shafi_G22	2752311	369023
Shafi_G23	2752110	369367
Shafi_G24	2751908	369710
Shafi_G25	2751706	370054

Interconnection Arrangement/Transmission Facilities for Dispersal of Power from the Generation Facility/Power Plant/Wind Farm of Shafi Energy Private Ltd (SEPL)

Schematic Diagram for Interconnection Arrangement/Transmission facilities for Dispersal of Power from SEPL



Detail of Generation Facility/Power Plant/ Wind Farm

(A) General Information

1	Name of Applicant	Shafi Energy Private Limited
2	Registered / Business Office	Shafi House, 35 A/3, Lalazar, M.T Khan Road Karachi
3	Plant Location	Deh Kohistan, Tapo Jungshahi Taluka, District Thatta
4	Type of Generation Facility	Wind Power

(B) Wind Farm Capacity & Configuration

1	Wind Turbine Type, Make & Model	SIEMENS-GAMESA G114-2.0
2	Installed Capacity of Wind Farm (MW)	50 MW
3	Number of Wind Turbine Units/Size of each unit (KW)	25 x 2000KW

(C) Wind Turbine details

	a) Rotor	
1	Number of blades	3
2	Rotor diameter	114
3	Swept Area	10,207 m^2
4	Power regulation	Combination of blade pitch angle adjustment, and generator/ convertor torque control
5	Cut-in wind Speed	3 m/s
6	Cut-out wind Speed	25 m/s
7	Survival Wind Speed	59.5 m/s (max 3 sec)
8	Pitch Regulation	Electric motor drives a ring gear mounted to the inner race of the blade pitch bearing.
	b) Blades	
1	Blade length	56 m
2	Material	Composite material reinforced with fiber glass through resin infusion technology
	c) Generator	
1	Power	2040 kVA
2	Voltage	690 V
3	Type	Doubly fed with coil rotor and slip rings
4	Enclosure class	IP-54 – IP-21 ring body
5	Power factor	0.95
	d) Yaw System	
1	Yaw bearing	PETP
2	Brake	Active Yaw
3	Yaw drive	Motor drive

4	Speed	0.42 degree/s controlling speed
	e) Control System	
1	Type	Automatically or manually controlled
2	Scope of monitoring	Remote monitoring of different parameters e.g. Temperature sensors, pitch, speed, generator torque, Wind speed and direction.
3	Recording	Production data, event lists, long and short-term trends
	f) Brake	
1	Design	Mechanical brakes
2	Operational brake	Aerodynamic brakes achieved by feathering blades
3	Secondary brake	Mechanical brakes on high speed shafts
	g) Tower	
1	Type	Conical Barrel Tube
2	Hub height	93 m
	h) Other details	
1	Project commissioning date (anticipated)	June 2021 (anticipated)
2	Expected life of the project from COD	25 years

Power Curve of GAMESA G114-2.0 Wind Turbine Generator (WTG)

Power Curve	
GAMESA G114-2.0	
Air Density: 1.15 kg/m3	
Wind Speed @ Hub Height (m/s)	Power (kW)
3	29
4	135
5	319
6	581
7	943
8	1408
9	1789
10	1951
11	1991
12	2000
13	2000
14	2000
15	2000
16	2000
17	2000
18	2000
19	2000
20	2000
21	2000
22	1906
23	1681
24	1455
25	1230

Schedule-II

The Total Installed/Gross ISO Capacity (MW), Total Annual Full Load Hours, Average Wind Turbine Generator (WTG) Availability, Total Gross Generation of the Generation Facility/Wind Farm (in GWh), Array & Miscellaneous Losses (GWh), Availability Losses (GWh), Balance of Plant Losses (GWh) and Annual Energy Generation (GWh) of the Generation Facility /Wind Farm of Licensee is given in this Schedule

Schedule – II

1	Total installed Gross ISO Capacity of the Generation Facility / Wind Farm (MW/GWh)	50 MW
2	Total Annual Full Load Hours	3328.80 hours
3	Average Wind Turbine Generator (WTG) availability	98%
4	Total Gross Generation of the Generation Facility/Wind Farm in (GWh)	185.518
5	Array & Miscellaneous Losses GWh	10.72969
6	Availability Losses GWh	3.71036
7	Balance of Plant Losses GWh	4.63795
8	Annual Energy Generation (20 yrs equivalent Net AEP) GWh	166.44
9	Net Capacity Factor	38%

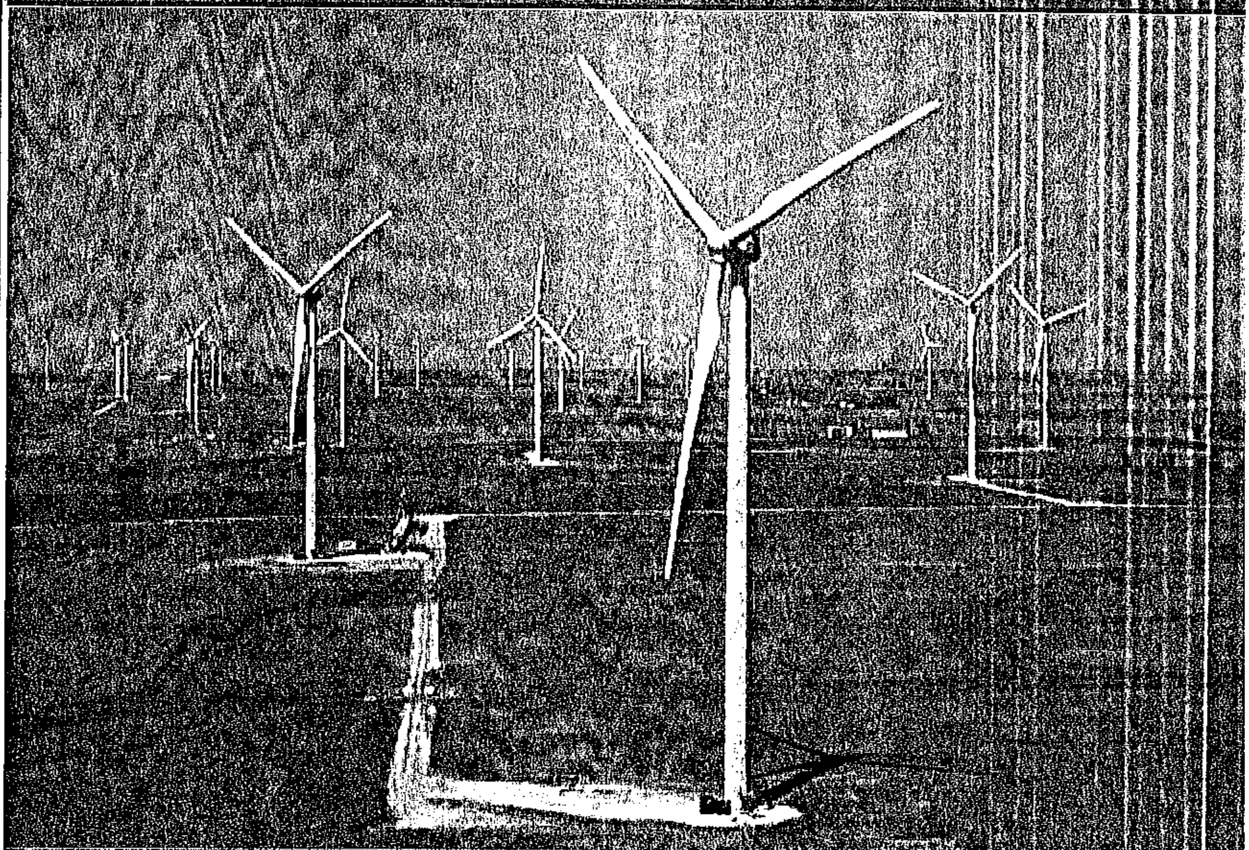
Note: All above figures are indicative as provided by the Licensee. The Net energy available to NTDC for dispatch will be determined through procedures contained in the Energy Purchase Agreement.

Annexure – A
Feasibility Study

SHAFI
Group of Companies

RENEWABLE RESOURCES

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



November, 2016

PROJECT COMPANY:

Shafi Energy (Pvt.) Ltd

PROJECT CONSULTANT:

Renewable Resources (Pvt.) Ltd

APPROVAL SHEET

TITLE	:	Feasibility Study Report for 50 MW Wind Power Project in Jhimpir-Sindh, Pakistan
DOCUMENT NUMBER	:	RE2-141-198-001 Issue: 01
CLASSIFICATION	:	**CONTROLLED**

SYNOPSIS

This document is a feasibility study report of the 50 MW Wind Power Project being developed by Shafi Energy (Pvt.) Ltd. It contains the hardware specifications, energy yield estimates, electrical interface, civil works design and the project cost. It also includes the Initial Environment Examination, soil investigations, site topography, grid interconnection studies and the project management information. This report has been prepared by Renewable Resources (Pvt.) Ltd, Pakistan.

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Irfan Afzal Mirza
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Renewable Resources (Pvt.) Ltd
irfanmirza@renewableresources.com.pk

DATE : November, 2016.

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LIST OF FIGURES

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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
CMA	Certified Management Accountant
CNG	Compressed Natural Gas
CO_2	Carbon dioxide
CoP	Conference of the Parties
CPPA	Central Power Purchasing Agency
DAE, ED-GoS	Directorate of Alternative Energy, Energy Department, Government of Sindh
DC	Direct Current
DISCOs	Distribution Companies
EE	Energy Efficiency
EMP	Environment Management Plan
EPA	Energy Purchase Agreement
EPC	Engineering, Procurement and Construction
EU	European Union

GDP	Gross Domestic Product
GENCOs	Generation Companies
GHG	Green House Gas
GIS	Geographic Information System
GoP	Government of Pakistan
GPS	Global Positioning System
GW	Gold Wind
HAWT	Horizontal Axis Wind Turbine
HESCO	Hyderabad Electric Supply Corporation
Hz	Hertz
IEE	Initial Environmental Examination
IPPs	Independent Power Producers
JI	Joint Implementation
KANUPP	Karachi Atomic Nuclear Power Plant
KESC	Karachi Electric Supply Company
km	Kilometer
kV	Kilovolt
kW	Kilowatt
LNG	Liquefied Natural Gas
LOI	Letter of Intent
LPG	Liquefied Petroleum Gas
LOS	Letter of Support
LUC	Local Control Unit
m^2	Meter square
m^3/h	Meter cube per hour
MTDF	Medium Term Development Framework

MVA	Million Volt-Ampere
MW	Megawatt
N_2O	Nitrous Oxide
NAPWD	Northern Areas Public Works Department
NCS	National Conservation Strategy
NEPRA	National Electricity Power Regulatory Authority
NEQS	National Environmental Quality Standards
NOCs	No Objection Certificates
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
O & M	Operation & Management
OECD	Organization for Economic Cooperation and Development
OHL	Overhead Lines
OLTC	On-Load Tap Changer
PAEC	Pakistan Atomic Energy Commission
PCM	Pulse Code Modulation
PEPA	Pakistan Environment Protection Act
PLC	Programmable Logic Control
PMD	Pakistan Meteorological Department
PPIB	Private Power Infrastructure Board
PVC	Poly Vinyl Carbonate
QC	Quality Control
R & D	Research and Development
RE	Renewable Energy
RE2	Renewable Resources (Pvt.) Ltd

RQD	Rock Quality Designation
SF_6	Sulfur Hexafluoride
SPT	Standard Penetration Test
UPS	Uninterruptible Power Supply
USA	United States of America
VAWT	Vertical Axis Wind Turbine
WAPDA	Water and Power Development Authority
WMO	World Meteorological Organization
WTG	Wind Turbine Generator

ACKNOWLEDGEMENTS

The management of Shafi Energy (Pvt.) Ltd is thankful to the Ministry of Water and Power and the dedicated team of Directorate of Alternative Energy (DAE, Energy Department) Govt. of Sindh for generous support at all stages of project development and looks forward to their continued support in the future.

The management of Shafi Energy (Pvt.) Ltd also looks forward to the cooperation of Government of Sindh and other Government departments (NEPRA, NTDC, HESCO) which is being extended to the Project.

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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 an informed decision regarding the implementation and execution of this project.

1 EXECUTIVE SUMMARY

Located on the western stretch of the South Asian Continent, The Islamic Republic of Pakistan is largely under the influence of a 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 some 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 and the hiking of 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 the Directorate of Alternative Energy, Energy Department, Govt. of Sindh (DAE, ED, Sindh) has been established to facilitate the implementation of renewable energy projects.

At present, twelve (12) wind power projects of approx. 50 MW capacity each are in operation.

Shafi Group of Companies (the Sponsors) are pursuing for development of a 50 MW wind power project to assist Pakistan for overcoming its current energy crises. The Sponsors have a valid LOI from Energy Department, Government of Sindh ("EDGOS") and have been allotted 412 acres of land in Jhimpir for which the GOS has already issued a land allotment letter.

Shafi Group of companies includes eight manufacturing units, including four tanneries which produce all various types of leathers, one leather garment unit, one footwear unit, one textile unit, one glucose and rice syrup production unit, one unit producing specialty leather chemical and also a company involved in dairy farming. The total turnover of the group is Approximately US$ 100 million, a very major part of which is for export. Major markets are Germany, France, Italy, China, other Far Eastern, European and South and North American Countries.

Shafi Energy Pvt Ltd is interested in setting up a Wind Power Project of 50 MW capacity in Jhimpir, Sindh, Pakistan.

Renewable Resources (Pvt) Limited (RE2) is the consultant for Shafi Energy (Pvt.) Ltd for developing this project.

1.1 PROJECT OVERVIEW AND SITE

The wind farm Project is located in Jhimpir, which is located approximately 120 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 412 acres of land, which has been 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 overview of the project site is shown in ***Figure 1***.

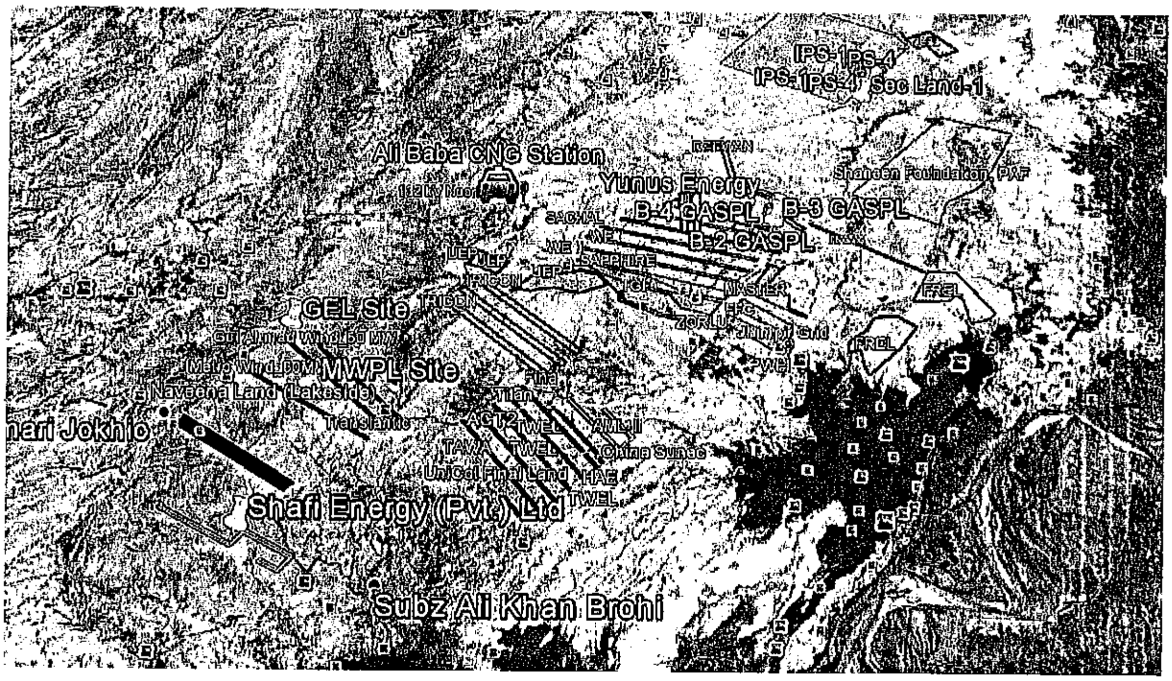


Figure 1: Shafi Energy (Pvt.) Ltd Site overview

The Project Site has flat terrain with sparse vegetation, consisting of small shrubby bushes.

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

1.1.1 Project Size

The Project site consists of 412 acres of land and the Project shall have an installed capacity of 50 MW

1.1.2 Project Status and Calendar

The project calendar is given on the next page:

Table 1-1: Project Planned Milestones

Activity / Milestone	2016	2017				2018				2019	
	4th QTR	1st QTR	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											

Table 1-2: <u>Project Construction Scheduling</u>

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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																		

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

1.1.6 Design of Civil Works

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

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, planned through wind turbine generators (WTG) with capacity in the range of 1.5 – 3.3 MW each and an output voltage of 0.62 - 0.69 kV. A substation consisting of step up transformer and other BOP equipment will connect the farm to the 132 kV power lines. 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 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

The O&M shall be managed by the O&M Contractor for initial 2 years of Warranty Period followed by a complete Full Service Agreement till end of five years of operations. The local team shall remain part of the O&M and shall gradually take over after having On Job Trainings (OJT).

O&M management will be established with the principle of requiring "few on-duty staff". After entering the electrical equipment and machinery to their stable operation mode, the wind turbine and associated apparatus shall be managed with "no on-call staff and few on-guard staff".

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 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.

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.

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 minimize accidents.

1.1.12 CDM Aspect

The Project is a power generation project using a renewable resource with zero emissions. 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 substantial 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.

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

Presently, the Project plans to opt for upfront tariff. Therefore, Annex III and Annex IV, being not required for an upfront tariff, are not being submitted for approval. 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.

1.3 PROJECT TEAM

1.3.1 Shafi Energy Pvt Ltd

Shafi Group of companies includes eight manufacturing units, including four tanneries which produce all various types of leathers, one leather garment unit, one footwear unit, one textile unit, one glucose and rice syrup production unit, one unit producing specialty leather chemical and also a company involved in dairy farming. The total turnover of the group is Approximately US$ 100 million, a very major part of which is for export. Major markets are Germany, France, Italy, China, other Far Eastern, European and South and North American Countries.

Muhammad Shafi Tanneries (Pvt.) Ltd. (MST), Karachi, the flag-bearer company of the group, is pioneer in production of kid leather for shoe industries and is one of the best known kid tanneries in the world. It started production and export in 1959 and now "MST" is the most prestigious and widely known trademark from Pakistan and is synonymous with the best in quality of leather and reliability in business.

MST produces a wide range of leathers for shoe uppers and linings in various finishes/executions. It is not only the fashion trends, but also making innovations of its own in kid and goatskin leathers for shoes. Its innovative leathers are regularly chosen by Lineapelle, Bologna as well as by the ARS magazine, Italy for "FASHION TREND SECTION". MST has practically won all the Best Export Performance Trophy awards right from the inception of the award by the Federation of Pakistan Chambers of Commerce and Industry. MST displays its leather in Linea pelle, Bologna, Italy as well as in Asia-Pacific Leather Fair, Hong Kong.

The Sponsors have a valid LOI from Energy Department Government of Sindh ("EDGOS") and has been allotted 412 acres of land in Jhimpir for which the GOS has already issued a land allotment letter.

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.

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.

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.

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 (MoWP)
- National Electricity Power Regulatory Authority (NEPRA)
- National Transmission and Dispatch Company (NTDC)
- Central Power Purchase Agency Guarantee Ltd. (CPPA-GL)
- Directorate of Alternative Energy, Energy Department, Govt. Sindh.

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 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.

3.3 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.

3.4 CENTRAL POWER PURCHASE AGENCY GUARANTEE LIMITED (CPPA-GL)

CPPA-GL is an agency to purchase power from Wind power plants on behalf of NTDC. CPPA-GL acts as a one window for all affairs related to NTDC for the Project including signing of the Energy Purchase Agreement (EPA), establishment of Operating Committee (OC), development of Operating Procedures (OP), appointment of Independent Engineer (IE) and testing of the Project leading to declaration of commercial operations. CPPA-GL also handles payments to the Project against sale of electricity and all sort of Non Project Missed Volume (NPMV) under the EPA.

3.5 Directorate of Alternative Energy, Energy Department, Govt. of Sindh (DAE, ED, GOS)

The Directorate of Alternative Energy, Energy Department, Govt. of Sindh is responsible for harnessing the alternative/renewable energy resources, addressed the relevant issues/matters at provincial level, facilitates local and foreign investors and donors for promotion and implementation of alternative energy/renewable energy projects, plan and implement project through public funding, foreign grants, loans etc. and design alternative energy policy for province and review it from time to time.

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.

4.2 ROLE OF CDM IN THE SHAFI ENERGY (PVT.) LTD 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 significant 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 been 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 come to new market like Pakistan. But now most of the suppliers are keen for the Pakistani market. One factor could be the Pakistani market getting matured. Now GE, Nordex, Vestas, Gamesa and Goldwind are all active in the market.

5.1.1 Letter of Intent (LOI)

The total number of LOIs issued by AEDB and DAE, Energy Department, Govt. of Sindh for various projects till date are in the range of 100.

5.1.2 Land Allocation by AEDB / GOS

AEDB and DAE, Energy Department, GoS have got approx. 31,000 acres of land from GOS and further allocated land to Wind IPPs.

5.1.3 Projects at Advanced Stages

Total of twelve (12) Wind Power projects with capacity around 600 MW have achieved their CODs. Following projects have started their commercial operations:

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
7	Yunus Energy (Pvt.) Ltd	50	4th Quarter 2016.
8	Gul Ahmed Wind Power Ltd.	50	4th Quarter 2016.
9	Master Wind Energy Ltd	50	4th Quarter 2016.
10	Tenaga Generasi Ltd	50	4th Quarter 2016.
11	Metro Wind Power Ltd	50	4th Quarter 2016
12	Tapal Wind (Pvt.) Ltd	30	4th Quarter 2016.

Following projects have achieved financial close during 2015-16 and are currently under construction:

No.	Company	Capacity (MW)
1	UEP Wind (Pvt) Ltd	99.0
2	HydroChina Dawood Power (Pvt.) Ltd.	49.5
3	Hawa Energy (Pvt.) Ltd	49.3
4	Jhimpir Power (Pvt.) Ltd	50

5.1.4 Projects at Advanced Development Stages

Following projects have reached the stage of EPA/IA:

No.	Company	Capacity (MW)
1	Hartford Energy (Pvt) Ltd	49.3
2	Tricon Boston 1	49.3
3	Tricon Boston 2	49.3
4	Tricon Boston 3	49.3
5	Three Gorges Second Wind Farm Ltd	49.5
6	Three Gorges Third Wind Farm Ltd	49.5

5.1.5 Projects at Initial Development Stages

During 2015-16, various projects got their LOIs and lands from DAE, Energy Department, GoS. The approvals of land have been done. All these projects are currently at different stages of feasibility study and EPC bidding. Some of these include:

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 Energy Limited	50.0
8	Zulaikha Energy (Pvt) Ltd	50.0
9	Lake Side Energy (Pvt) Ltd	50.0
10	Shafi Energy (Pvt.) Ltd	50.0

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% capacity factor is achieved. Then the tariff starts rising, reaching 80% from 36% till 37% capacity factor is achieved. Thereafter, the tariff regains its 100% value. This scheme is to intensify the high efficiency WTGs.

Most of the projects now prefer upfront tariff. Shafi Energy (Pvt.) Ltd will also be opting 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, Energy Department, GoS, which was accomplished on 23rd February, 2016. This letter entitled the Project Company to start working on wind power project at official level and get support from DAE, Energy Department, 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 and in accordance with the timeline mentioned.

6.2 ACQUISITION OF LAND

The land has been acquired by the project company from the 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, Energy Department, GoS will issue tripartite 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.

7 PROJECT SITE

7.1 WIND CORRIDOR OF PAKISTAN

Pakistan has a 1046 km long coastal line with a 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.***

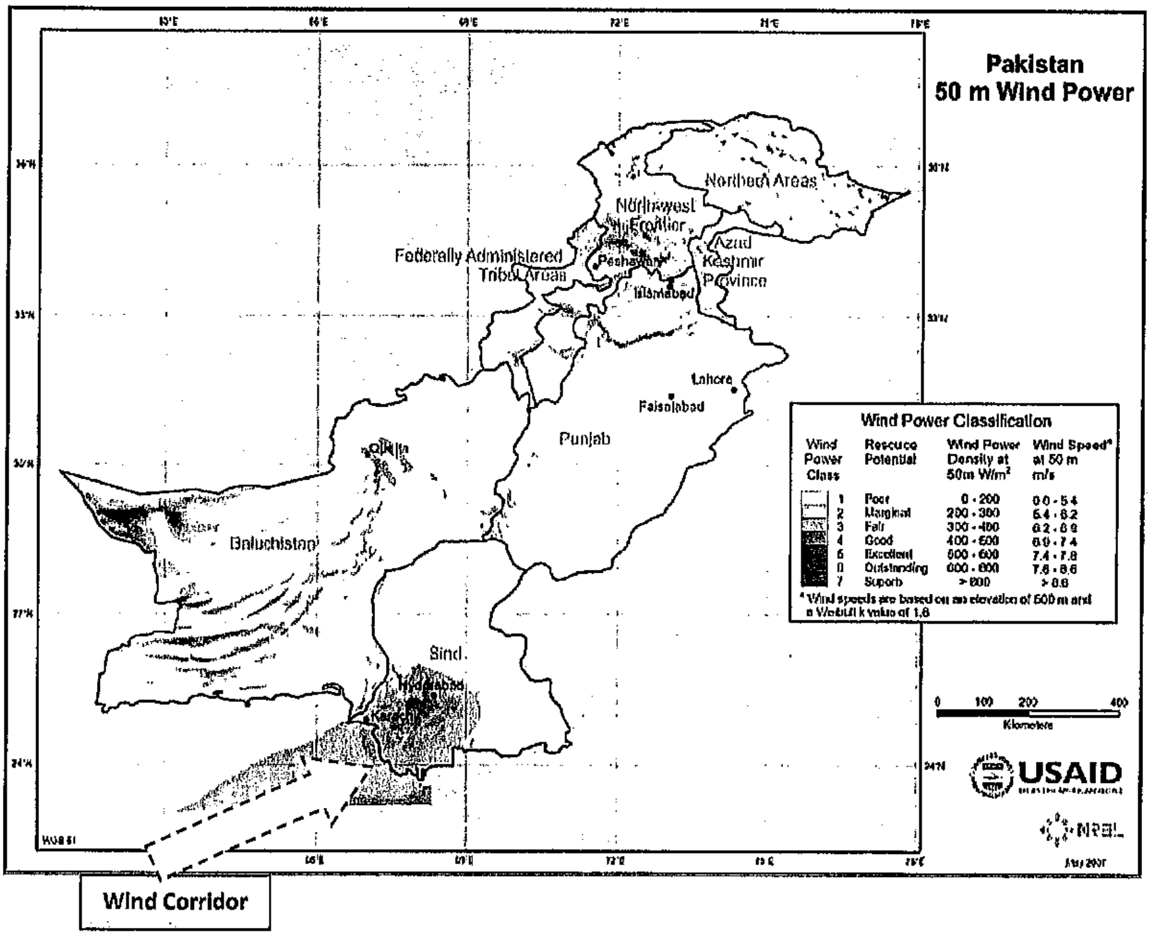


Figure 2: Wind Map of Pakistan by NREL

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. The Sponsors have a valid LOI from Energy Department Government of Sindh ("EDGOS") and has been allotted 412 acres of land in Jhimpir for which the GOS has already issued a land allotment letter.

An overview of the project site allocated in Jhimpir region is shown in *Figure 3*:

Figure 3: Overview of Shafi Energy (Pvt.) Ltd 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.*

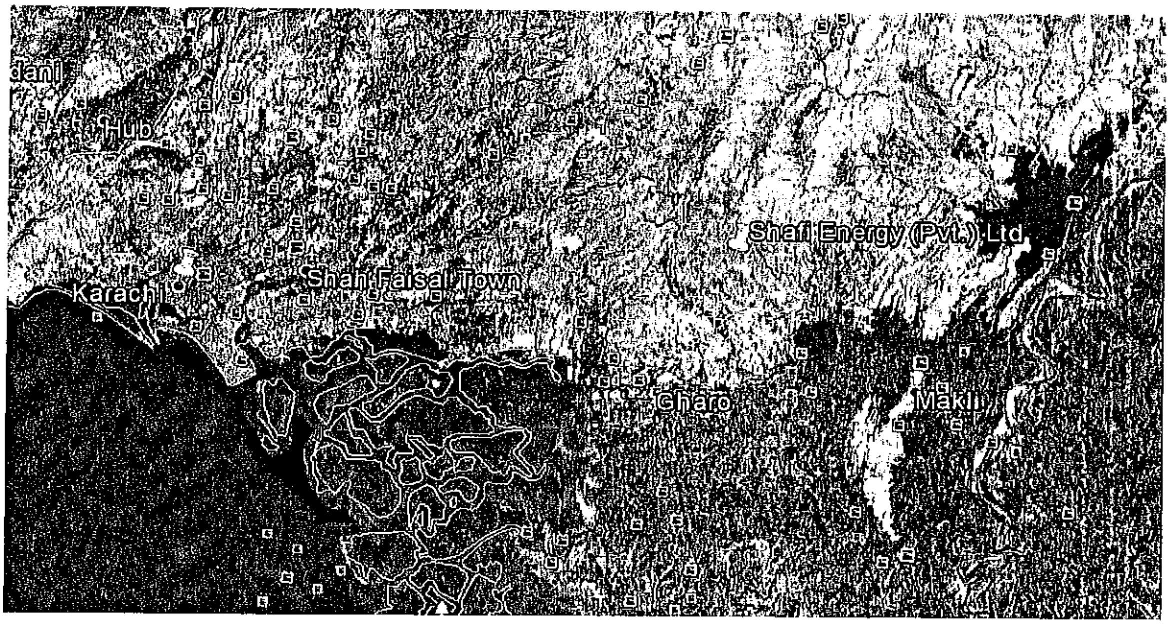


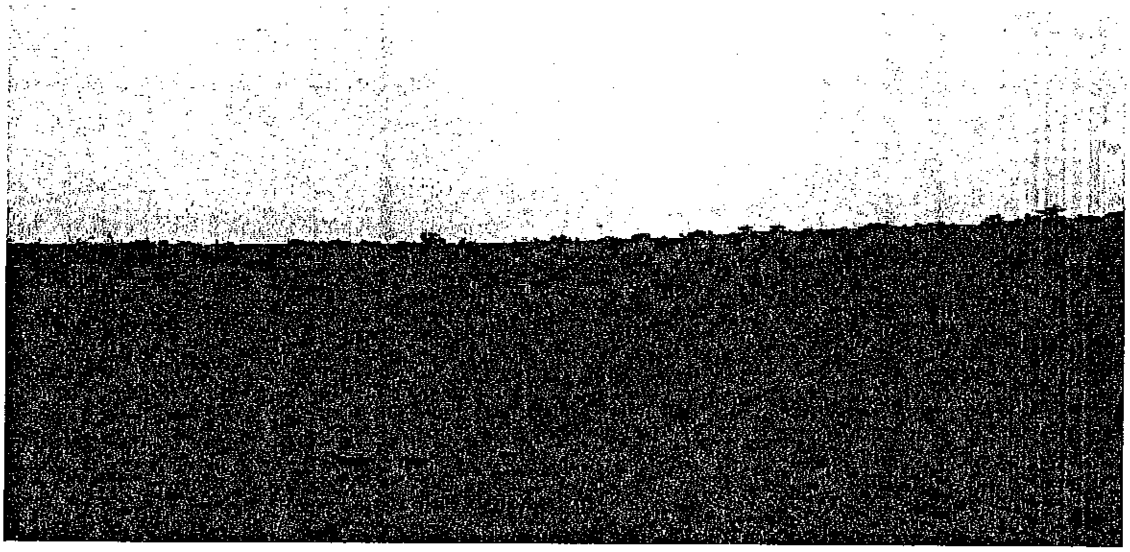
Figure 4: Shafi Energy Site Location

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.

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

The site is nearly flat with the surroundings having same characteristics. View of Shafi Energy (Pvt.) Ltd Site is given in ***Figure 5** below.*



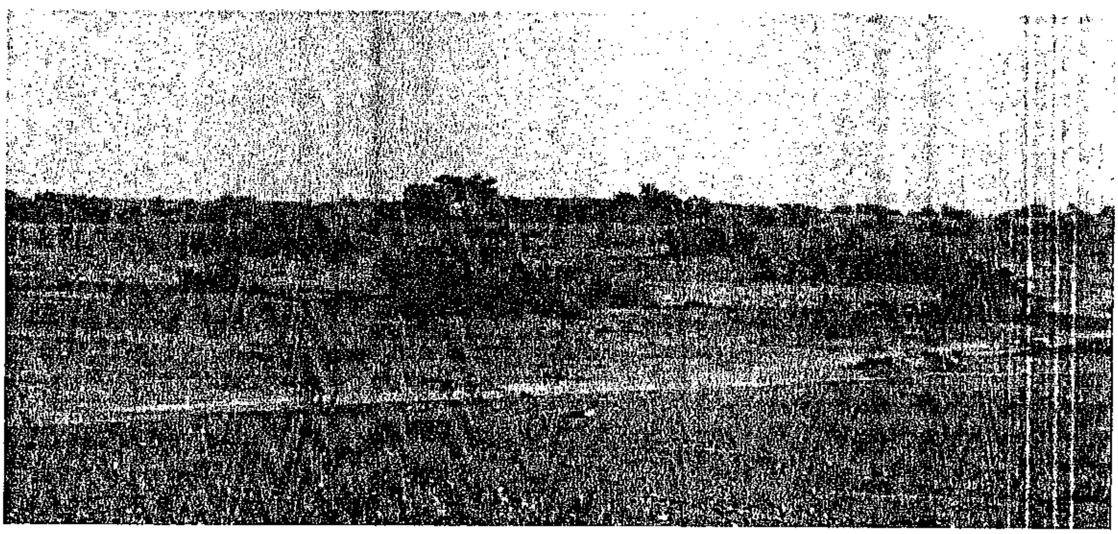


Figure 5: View of Project Site

7.3 TRANSPORTATION AND ACCESS NETWORK

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

The major section of track from Karachi to the site is via the National and Super high-way. The track is a multi-lane road. It has a flat terrain, and long and heavy vehicles can easily navigate through this road. However, access to the site is not suitable for heavy transport for a minor segment of the track, hence requires track maintenance from M-9 Super high-way turning point up until the Project site.

There are many neighboring wind farms in the surrounding area of Thatta. The site is located in Jhimpir, Sindh that is towards the East of Karachi and within the same corridor as many other wind power projects.
Track used and recommended is mainly includes M-9 super highway which is most suitable and is used by the majority of the ongoing projects for the transportation.
One of the biggest port of the Pakistan "Port Qasim" is 146 kilometers away from the proposed project site.
During the transportation, study of the proposed project site, some critical points were observed that EPC contractor should need to focus before starting the construction work at site.

The satellite overview of the track from Bin Qasim Port to the Project site through the National and Super Highway is shown in ***Figure-6***.

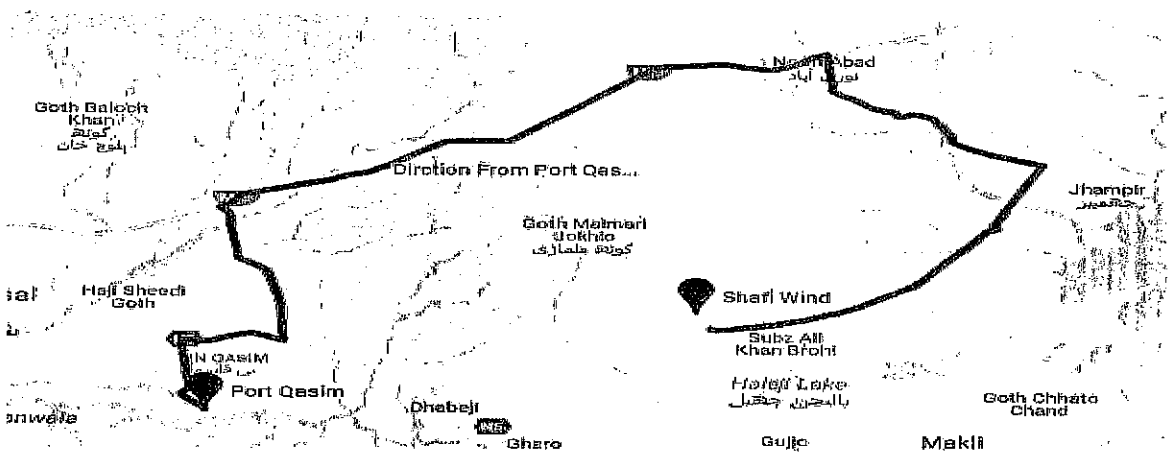


Figure 6: Access to the Site

Aerial distance between the Port and the site is 29.2 km. Total track length between Port Qasim Karachi and site is approximately 146 km. Detail access to site is shown in in Figure-7.

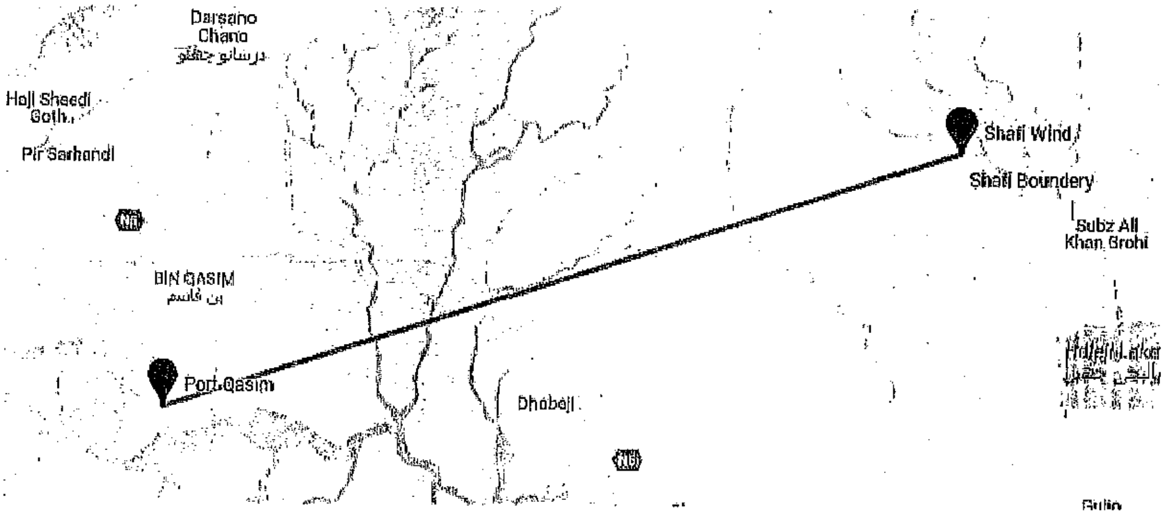


Figure 7: Orientation of Port Qasim from Site (Aerial View)

7.4 CLIMATIC CONDITIONS

The climate of the southern parts of Sindh 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 7-1: 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 7-2: 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] Meteorological Department of Pakistan
[2] Meteorological Department of Pakistan

7.5 TELECOMMUNICATION

PTCL telephone service is not available but mobile carriers have coverage on the site area.

7.6 EARTHQUAKES

According to the seismic zoning map of Pakistan, the Jhimpir 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.

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, these studies are not being submitted with this feasibility study to DAE, Energy Department, GoS as the Project plans to opt for the upfront tariff determined by NEPRA.

9 SELECTION OF WTG AND EPC CONTRACTOR

Shafi Energy (Pvt.) Ltd 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:

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 is reached.

10 GEOLOGICAL CONDITIONS

In order to collect detailed regional geological information, Shafi Energy (Pvt.) Ltd hired professional services of Soil Testing Services–Pakistan Alternative Engineering Services (Pvt.) Ltd: a Pakistani local prospecting agency to conduct field exploration and drilling of (05) bore holes on the Site during February, 2016. The average drilling depth is 25 m. The complete Geotechnical Investigation Report is report is attached as Annex-V.

10.1 OBJECTIVES OF GEOTECHNICAL STUDIES

- To execute 05 boreholes, at the site of each proposed turbine location, 25 m 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.

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 8 & Figure 9***:

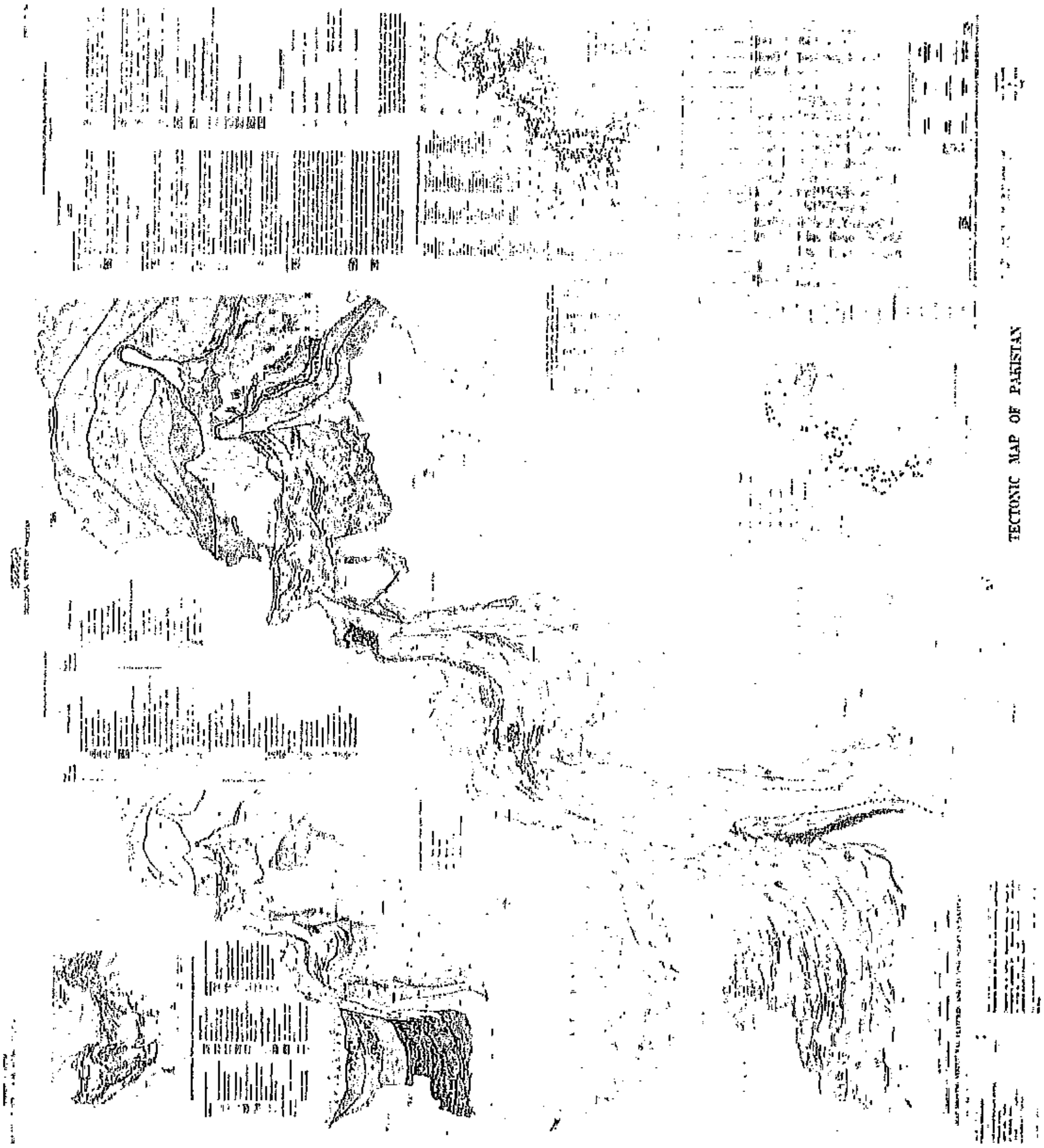


Figure 8: Tectonic Map of Pakistan

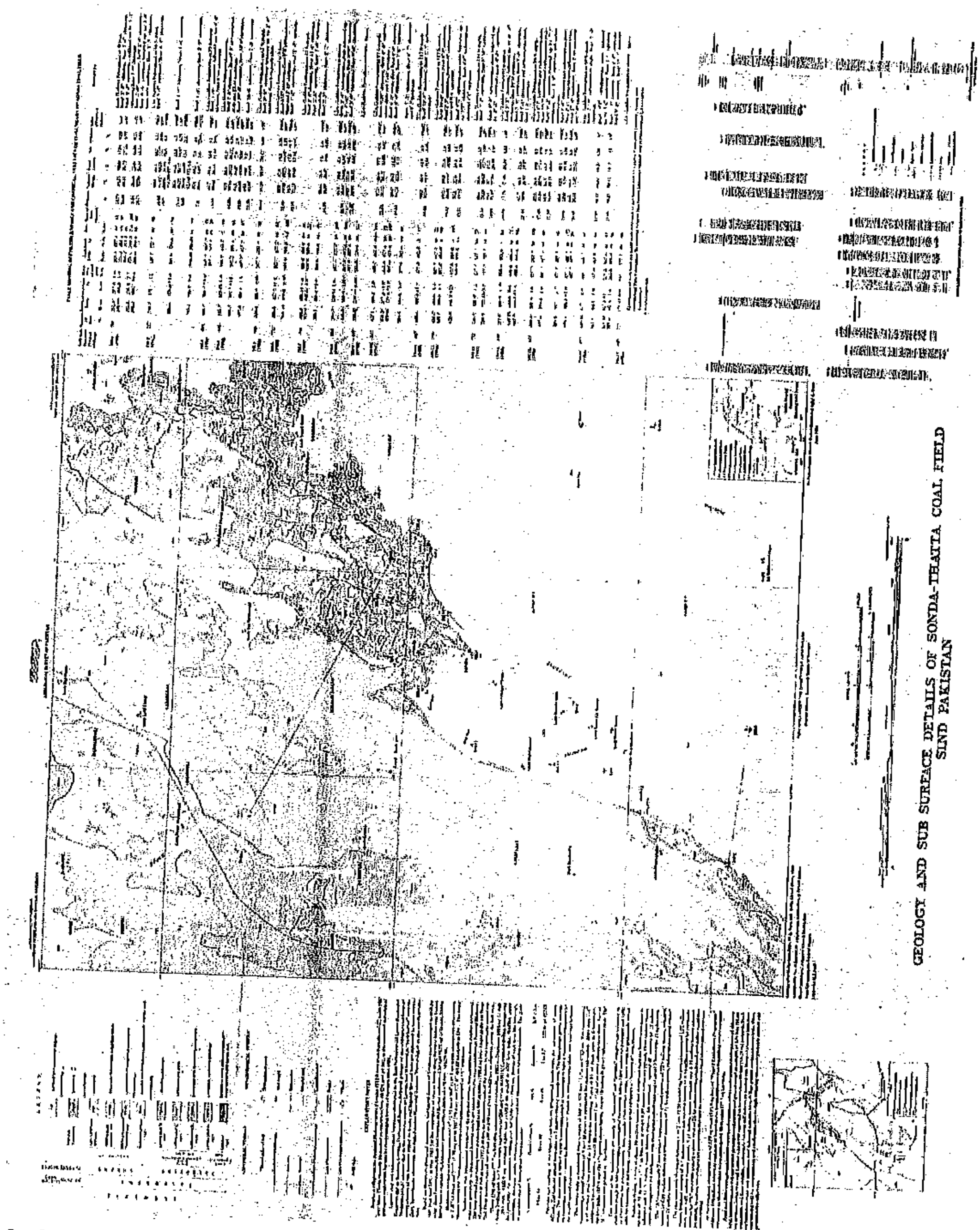


Figure 9: Geological and Sub Surface details of Jhimpir

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 10-1: Earthquake Records around Karachi

Year	Longitude	Latitude	Depth (km)	Richter Scale	Modified Mercalli Intensity	Location
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

The seismic parameters of Karachi region are given in the table below along with the map in ***Figure 10***:

Table 10-2: <u>Seismic Parameters of Karachi</u>

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

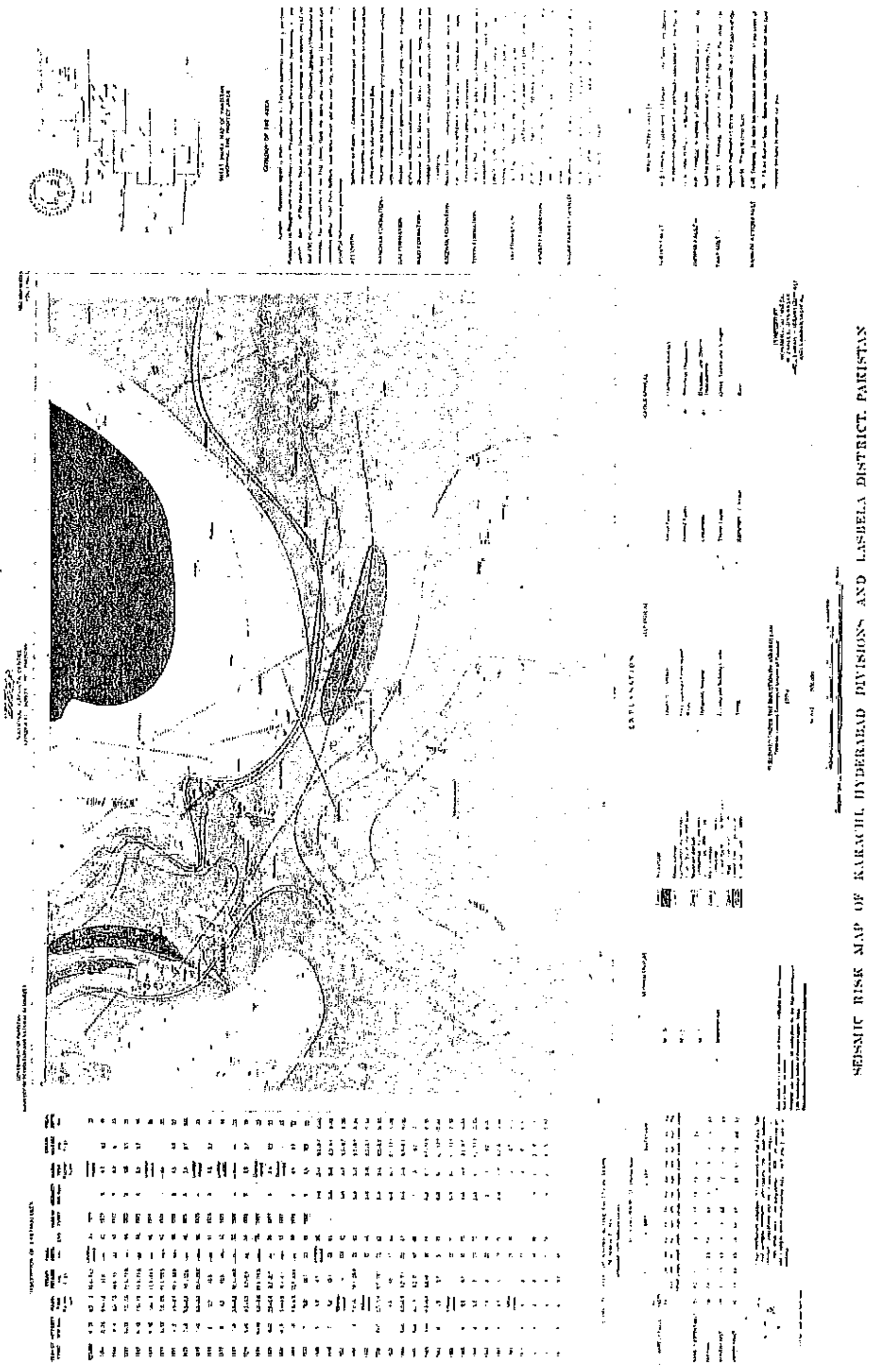


Figure 10: Seismic Map of Pakistan

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.

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.

10.4.3 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

The Geotechnical Investigation for Shafi Energy (Pvt.) Ltd Wind Power Project in Jhimpir, Sindh was carried out in Aug/Sep, 2016. Scope of work included drilling of (05) bore holes up to 25 meters depth. Soil and rock samples were also collected during the field investigation. Laboratory testing of the soil and rock samples has been carried out in STS lab which includes natural moisture content, specific gravity, water absorption, density, unconfined compressive strength etc. Chemical characteristics of the soil and ground water 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 depth of 1.5 meters. 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.

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.

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 VI**), 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 a two-stage step voltage, one step up to MV level at each WTG level through individual GSUs, and the other at the substation. The MV level shall be at 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 points of the lines on the 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-coupler 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 coupler 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 (31.5/40/50 MVA each). The instrumentation transformers (CTs, VTs and CVTs) for all purposes shall be sized according to requirement. 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 HV/MV switchgear, main power transformer and other protection equipment shall be of 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 Shafi Energy and NTDC as per the requirements of EPC Contract and EPA.

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 Shafi Energy (Pvt.) Ltd shall become to supervise and monitor everything.

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

Shafi Energy (Pvt.) Ltd requires careful management for construction. To achieve this, Shafi Energy (Pvt.) Ltd 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.

In order to manage all the above operations correctly, Shafi Energy (Pvt.) Ltd shall have a consultant as a "Construction Supervisor" who shall supervise the quality and progress of all contractors and give approvals of the milestones.

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 13-1: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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 the Pakistan Environmental Protection Act, 1997, according to the requirements of Environmental Protection Agency, Government of Sindh and has already been submitted. **The report is attached as Annex VII.**

A data collection survey, which 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 the available secondary information or through data collected in the field. The primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. The secondary data was collected for land, ecology, climate, and socioeconomic factors.

According to the study conducted, the 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.

The 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 and 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 a number of positive impacts and negligible negative impacts to the existing environment as follows:

- ❖ Significant improvement in economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.
- ❖ 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 Shafi Energy (Pvt.) Ltd to overcome the 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 by Shafi Energy (Pvt.) Ltd 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 Shafi Energy (Pvt.) Ltd, no major adverse impacts are expected. There is no adverse impact of migration on the habitat, any natural existing land resources and there is no effect on 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 of the 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 lesser "environmental footprint". No endangered or protected species of flora or fauna are reported near the project sites.

The stakeholder from the Government and Non-Government sector has also appreciated the project activities, raised concerns related to the social and environment areas 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. 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 impacts, which can be mitigated following the EMP & shall be pollution free Renewable source of Power generation with low Environmental foot prints.

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 that the project is classified as a category "B", in accordance with ADB's Safeguards Policy Statement 2009. The project is not considered highly sensitive or complex. The 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 and shall be a pollution free renewable source of power generation with small environmental foot prints.

In view of the aforementioned details, it is concluded that development of the 50 MW wind power project by Shafi Energy (Pvt.) Ltd will have no adverse environmental impact and the project can be regarded as an Environmental Friendly Green Project.

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 advantageous annual average wind speed. Thus the annual energy estimates are also favorable 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 IRR of the Project 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 its 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 worthy for the project. However, the negotiations of the EPC contract and price shall play a vital role in the final selection.

The project site is conveniently located close to the grid of HESCO and NTDC. However, the remaining Grid Interconnection study will tell exactly which grid is 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 the 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 4th quarter of year 2017 and construction will be completed by 2nd quarter of year 2019. It is anticipated that the Shafi Energy (Pvt.) Ltd Project would be a valuable addition to the National Grid for generating electricity and contributing to overcome the current energy crises of Pakistan.

Annexure – B
Environmental Study & Approval

Reference No: EPA/2017/01/09/IEE/109/

ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF SINDH

Plot # ST-2/1, Sector 23, KIA, Karachi-74900
Ph: 5065950, 5065598, 5065637
5065532, 5065946, 5065621
epasindh@cyber.net.pk
Facsimile: 5065940

Dated: 25th January, 2017

SUBJECT: DECISION ON INITIAL ENVIRONMENTAL EXAMINATION (IEE)

1.	**Name & Address of Proponent:**	Mr. Zahid Haleem Shaikh, Executive Director, Shafi Energy (Pvt) Limited Shafi House, 35-A, Lalazar, Opp Beach luxury Hotel, Karachi
2.	**Description of Project:**	Establishment of 50 MW Wind Power Project
3.	**Location of Project:**	Project site is located in Jhimpir about 80 km Northeast of Karachi.
4.	**Date of Filing of IEE:**	09-01-2017

5. After careful review and analysis of the Initial Environmental Examination (IEE) report, the Sindh Environmental Protection Agency (SEPA) accords its approval subject to the following conditions:

i) All mitigation measures recommended in IEE report should be complied with, for achieving negligible impacts on physical, biological, environmental and socio-economic resources of the area. Sindh Environmental Quality Standards (SEQS) shall be followed in letter and spirit.

ii) A complete code of Health, Safety and Environment (HSE) shall be developed which should include efficient parameters at specific work place. For this purpose HSE setup should be established and supervised by a designated HSE officer at the senior level with sufficient administrative and technical authority to perform the designated functions. Proponent will make sure that the operating instructions and emergency actions are made available to every worker/labor at the site.

iii) The proponent shall also appoint a reputable research institute or organization to conduct a detailed *cumulative* noise mapping/modeling study of the wind projects in the macroenvironment of project area and its impact on the **sensitive receptors**, if any and same will be submitted to SEPA.

iv) The proponent shall be under obligation to compensate for any significant adverse short term, long term and irreversible impact occurred due to windfarm operations. During the project execution, safe distances of the under mentioned environmental sensitivities will be maintained:

- 500m from communities, industries and main transport network
- 300m from community water well

Always Remember--- Reuse, Reduce & Recycle

- 500m from archaeological / cultural site / monument
- Distance will be measured from the tip blade of turbines or / and transmission power lines associated.
- Project activity will not be carried out within buffer zone of any projected area designated under Sindh wildlife protection act.

v) Employment should be provided to local people and assured for unskilled jobs. Skilled jobs shall be given to locals after providing them proper field training, where a minimum training is required. Local people should be informed and explained well in advance about the operation. Compensation should be provided to inhabitants in case of loss of agriculture land, crop property, etc., in accordance with the rates, that are agreed upon. All conflicting issues regarding compensation etc. should be settled in advance prior to the start of activity. Benefits to local people will be offered under Corporate Social Responsibility (CSR) policy, community development schemes will be decided in consultation with local communities and may be facilitated by involving district / local Government office.

vi) Local people should be provided with community welfare schemes i.e., draught relief programmes, educational programmes, and establishment of health units, veterinary/live stock care unit etc., which should benefit them and develop mutual trust. Sustainability of these facilities should be ensured.

vii) Campsites will be located at least one kilometer away from any settlement to avoid disturbance to the local people.

viii) No industrial or residential activity will be permitted on the land allocated for wind energy projects.

ix) The project area will be restored to its original nature to the possible extent. For the purpose, documentation (Photographs) will be kept in record.

x) The project shall be constructed in the prescribed time strictly as per schedule, which shall be submitted to this office at the start of construction activity.

xi) Compensation will be provided to the Inhabitants in case of loss of agriculture land, crop property, etc., in accordance with the rates, that are agreed upon.

xii) The proponent shall ensure facilitation to the EPA officer(s)/official(s) for the regular inspections to verify the compliance of the SEP Act, Rules and Regulations framed there under and the conditions contained in this approval.

xiii) The proponent shall appoint an Independent Monitoring Consultant (IMC) whose responsibility shall be to monitor the project activities. The IMC shall ensure that the activities at project site are undertaken in environment friendly manner and the mitigation measures are implemented as per the recommendations of IEE. The report shall include pollutants measurement and analysis reports along with photographic records showing therein the environmental conditions at site during

the construction and operation stages of project. The proponent shall be liable to submit monthly environmental monitoring reports to EPA Sindh.

6. This approval shall be treated cancelled if any of the conditions, mentioned in para-5 above is violated. In follow up of the cancellation of this approval prosecution under the provision of Sindh Environmental Protection Act, 2014 will be initiated against the proponent.
7. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any other law in force.
8. The IEE report is meant only for proposed activities described in IEE only. Proponent should submit separate approval required under regulations, along with site specific Environment Management Plan for any consequent and subsequent activity for approval of EPA, Sindh.

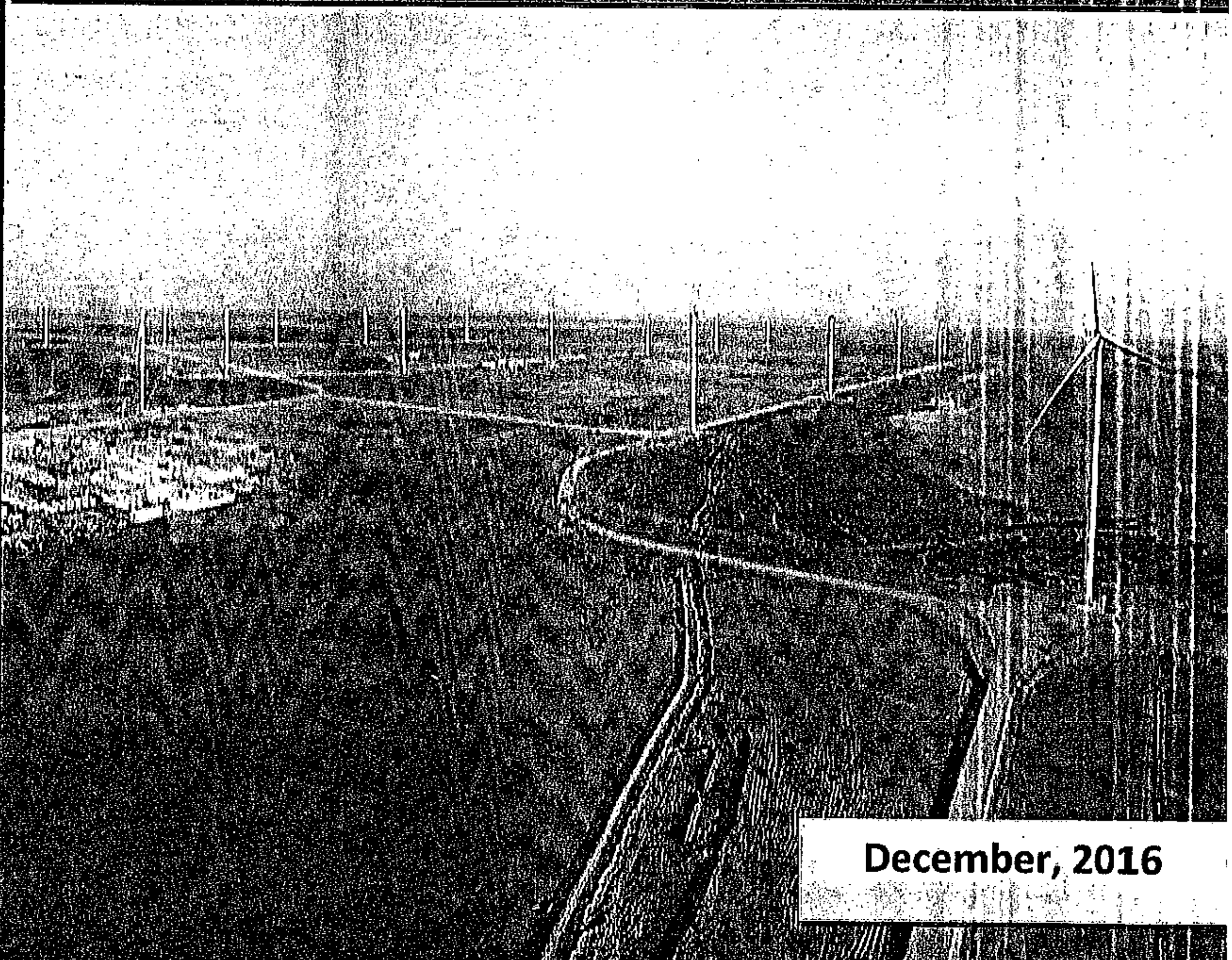
Muhammad Imran Sabir
Deputy Director (Technical)
For Director General

ORIGINAL

SHAFI
Group of Companies

RENEWABLE RESOURCES

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



December, 2016

PROJECTCOMPANY

Shafi Energy (Pvt.) Limited

PROJECT CONSULTANTS

Renewable Resources (Pvt.) Ltd

SHAFI
Group of Companies

RENEWABLE RESOURCES

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Prepared in December, 2016

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APPROVAL SHEET

TITLE	:	Initial Environmental Examination (IEE) of 50 MW Wind Power Project in Jhampir Sindh Pakistan
DOCUMENT NUMBER	:	RE2/131/198/001 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 Shafi Group of Companies. The report is Prepared by Renewable Resources (Pvt.) Ltd.

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DATE : December, 2016

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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

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
SEPL	Shafi Energy Private limited
SGC	Shafi Group of Companies

EXECUTIVE SUMMARY

Introduction

This document is an ***Initial Environmental Examination*** IEE of a ***50 MW Wind Power Project*** (Project) being developed by Shafi Energy (Pvt.) Limited (SEPL) in Jhimpir, Sindh Pakistan.

The sponsor of the Project is **Shafi Group of Companies (SGC)**.

Shafi Energy (Pvt.) Limited is developing a 50MW wind farm located in Jhimpir, District Thatta.

Shafi Energy (Pvt.) Limited (SEPL) is an SPV formed for developing 50MW Wind Power Project. SEPL is a wholly owned subsidiary of Shafi Group of Companies (SGC).

Shafi Energy (Pvt.) Limited 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.1002, 10th Floor, Green Tower Jinnah Avenue, 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

Project Sponsors

The Project Sponsors are the limited liability company incorporated under the laws of Pakistan, called Shafi Energy (Pvt.) Limited (SEPL). Contact details are as follows;

Shafi Group of Companies	
Address	Shafi House, 35-a/3, Opp. Beach Luxury Hotel, Lalazar, M.T Khan Road Karachi- 74000, Pakistan Tel: +92-21-35610696, 35610698 Fax: +92-21-35610701
Contact Persons	Mr. Umair Haleem Email: umair@shafi.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) and also conducted biological studies 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.

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 50 MW of Shafi Energy (Pvt.) Limited is located in Jhimpir, District Thatta Sindh. The land has been leased by the Government of Sindh to Shafi Group of Companies (the sponsors). The Karachi Hyderabad Motorway (Super Highway) is connecting road to the site. The total land area of the Project is 412 acres.

Subject to finalization of the EPC, the Project will install 25 units of Gamesa114 turbine generators (WTGs), each with rated output of 2.0MW.

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. Aamir Khalid 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.

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 eight settlements located near/inside the project area; only two are located inside the boundary of the project. All settlements are permanent settlements and no settlement were seasonal/temporary.
- Regarding bird mortality due to collision, it is found that birds landing area is around 27.5 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, 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 Shafi Energy (Pvt.) 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: ADB Safeguard policy statement 2009, OPIC-Environment and social policy statement & IFC HSE Guidelines for Wind Energy Sector
Annexure-VII: Laboratory Analysis Reports of Ambient Air Quality, Noise and Drinking Water Quality
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SECTION 1

INTRODUCTION AND PURPOSE OF STUDY

1 INTRODUCTION AND PURPOSE OF STUDY

1.1 PROJECT PROPONENT

The sponsor of the Project is Shafi Group of Companies.

Shafi Energy (Pvt.) Limited (SEPL) is an SPV formed for developing 50MW Wind Power Project. SEPL is a wholly owned subsidiary of Shafi Group of Companies (SGC).

Shafi Energy 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 Shafi Energy Pvt. Limited.

Shafi Energy (Pvt.) Limited has land available having area of approximately 412 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 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.

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:

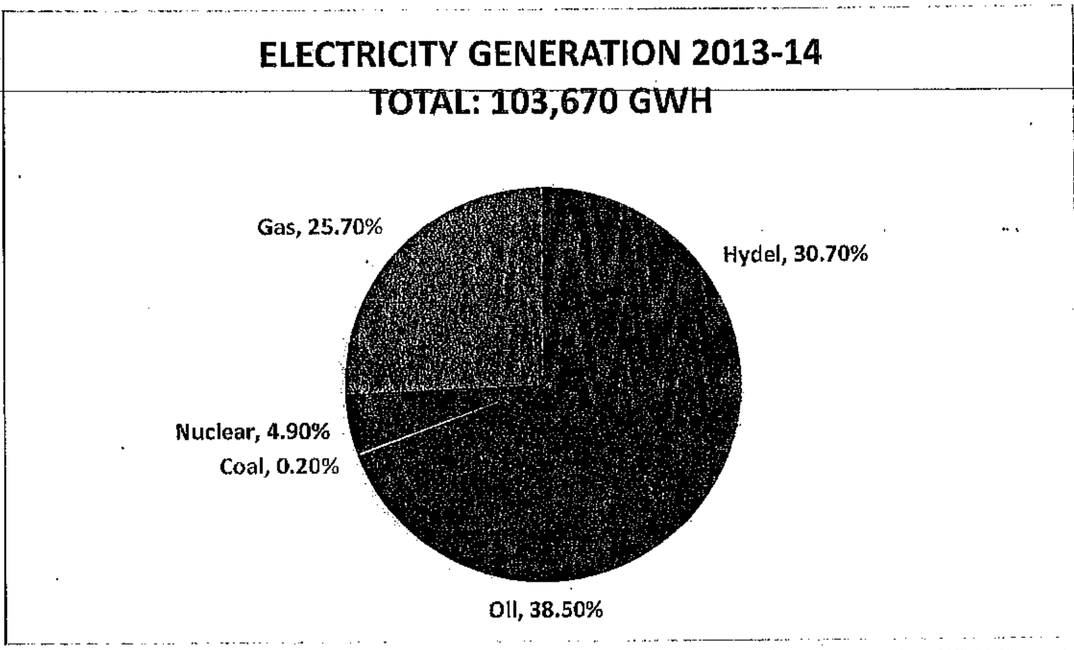

Figure 1.1: Electricity Mix of Pakistan by Source[1]

[1] Energy Year Book of Pakistan 2014

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.

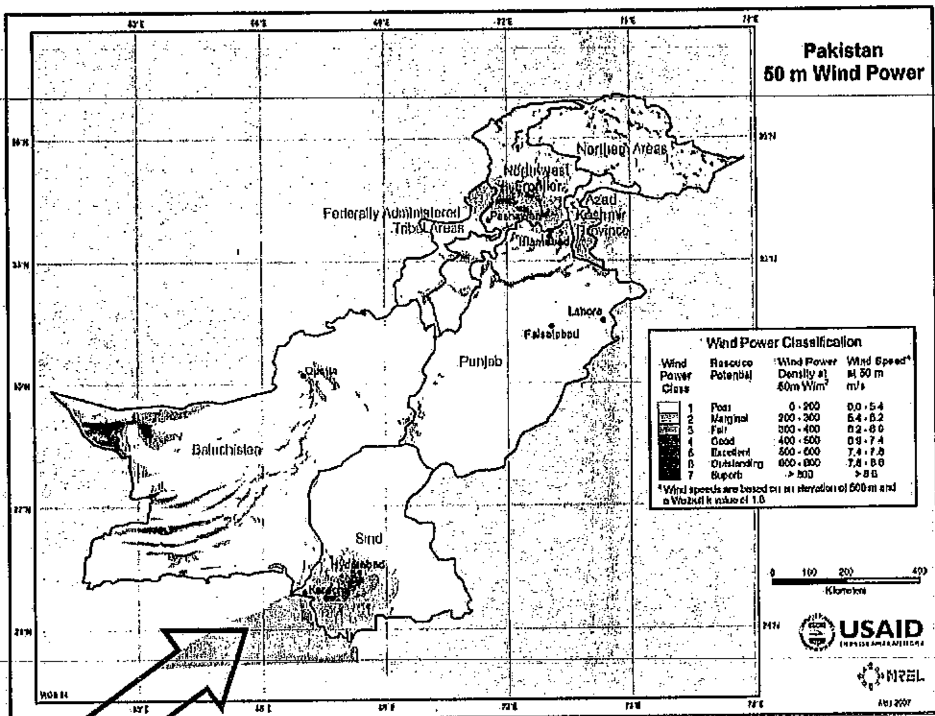

Figure 1.2: Wind Map of Pakistan by NREL

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 166km from Karachi, Pakistan's commercial hub and main coastal/port city.The Project site consists of 412 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 EPC, the Project presently contemplates installing a total of 25 wind turbine generators (WTGs) of Gamesa114, each with rated output of 2.0 MW.

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	Gamesa114 – 2.0 MW – Total 25 WTGs
4	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;

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 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.

The document has also been made to comply with the requirements of **ADB's safeguard policy statement, 2009** as well as local and national standards. To comply with other lender's requirement, the IEE report also addresses **IFC's and World Bank group performance standards** which will be met by the project.

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 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.

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 ADB, 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 Shafi Energy land area.
- In consideration of:
- Agreement between GoS and Shafi Group of Companies, allowing Shafi Energy (Pvt.) Limited land for installation of Wind Power Generation will require no payment for land acquisition,
- Consultation Meetings with the residents of village located within the SEPL project boundary and six on the outside of the land area, have confirmed the issue that

establishment of the Wind Farm on SEPL 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.

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 (SGS), in addition to that Birdlife and wildlife survey the team of Experts Mr. Dr. Syed Ali Ghalib and Mr. Razzaq 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 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 IEE 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 IEE 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;

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.

❖ 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.

<u>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</u>

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.

<u>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</u>

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:

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 February 23rd, 2016, 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 412 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.

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.

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.

For the proposed Project, the proponents have leased land from the Government of Sindh and there are temporary settlements or structure exists at the site. The LAA is therefore 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.

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 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. Shafi Energy 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 6km of an 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 Climate Change, 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 OPIC- ENVIRONMENTAL AND SOCIAL POLICY STATEMENT

This Environmental and Social Policy Statement ("Policy Statement") addresses OPIC's commitments regarding the environmental and social dimensions of sustainable development and provides Applicants notice of the general environmental and social requirements that OPIC applies in evaluating prospective Projects seeking OPIC support and monitoring on-going OPIC-supported Projects.

This Policy Statement implements applicable environmental and social requirements and procedures contained in U.S. law. Additionally, this Policy Statement reflects specific policy commitments that have been made by OPIC with respect to environmental and social policies and procedures. Finally, this Policy Statement adopts, as a standard for the environmental and social review process, the International Finance Corporation's ("IFC") Performance Standards on Social and Environmental Sustainability and Industry Sector Guidelines and any subsequent revisions to those standards.

2.13.1 Screening and Categorization

OPIC categorizes projects based on OPIC's preliminary assessment of (1) the potential environmental and social risks and impacts of a project in the absence of any required mitigation, (2) the Applicant's commitment and capacity to effectively manage the environmental and social risks and impacts, including the ability to implement any required mitigation and (3) the potential role of third parties in achievement of successful outcomes. OPIC categorizes all projects as Category A, B, C, or D based on environmental and social factors.

The wind energy projects fall in "Category C" as these are likely to have minimal adverse environmental or social impacts. In categorizing projects, OPIC considers direct, indirect, induced, regional, trans-boundary and cumulative environmental and social impacts. Risks are assessed at key stages in the project life cycle including pre-construction, construction, operations, decommissioning, and closure.

2.13.2 Applicant Role and Responsibilities

For Category C Projects, applicants are required to submit sufficient information necessary to confirm the absence of potential adverse environmental and social risks.

OPIC requires essential Environmental and Social Action Plan (ESAP) only for Category A and Category B Projects. ESAP is not necessarily required for Category C Projects.

2.13.3 Tailored Reviews

OPIC undertakes detailed, tailored environmental and social reviews for certain sectors and types of Projects in response to OPIC policies and practices and new OPIC products or initiatives, which are based on emerging trends in international best practices related to environmental and social safeguards.

The detailed OPIC Environmental and Social Policy Statement is attached as Annexure-VI.

2.14 ASIAN DEVELOPMENT BANK (ADB) POLICIES & STANDARDS

The following ADB policies and standards designed to manage social and environmental risks and impacts are considered:

- Safeguards Policy Statement
- Policy on Gender and Development

- Social Protection Strategy
- Public Communications Policy
- Core Labor Standards

2.14.1 2009 Safeguard Policy Statement

ADB operational policies include three basic safeguard policies mentioned below. This safeguard policy statement applies to all ADB-financed and/or ADB-administered sovereign and non-sovereign projects, and their components regardless of the source of financing, including investment projects funded by a loan; and/or a grant; and/or other means, such as equity and/or guarantees (hereafter broadly referred to as projects).

The Involuntary Resettlement Policy: Minimize, mitigate, and/or compensate for adverse project impacts, on the environment and affected people when avoidance is not possible.

Policy of Indigenous Peoples: Help borrowers/clients to strengthen their safeguard system and develop the capacity to manage environmental and social risks.

Environmental Policy: Avoid adverse impacts of projects on the environment and affected people where possible.

2.14.2 Policy on Gender and Development

The Asian Development Bank (ADB) first adopted the Policy on the role of Women in Development (WID) in 1985 and over the passage of time has progressed from WID to Gender and Development (GAD) approach that allows gender to be seen as a cross cutting issue influencing all social and economic processes.

ADB's Policy on GAD will adopt mainstreaming as a key strategy in promoting gender equity. The key elements of ADB's policy will include the following:

Gender sensitivity: to observe how ADB operations affect women and men, and to take into account women's needs and perspectives in planning its operations.

Gender analysis: to assess systematically the impact of a Project on men and women, and on the economic and social relationship between them

Gender planning: to formulate specific strategies that aim to bring about equal opportunities for men and women

Mainstreaming: to consider gender issues in all aspects of ADB operations, accompanied by efforts to encourage women's participation in the decision making process in development activities

Agenda setting: to assist Developing Member Country (DMC) governments in formulating strategies to reduce gender disparities and in developing plans and targets for women's and girl's education, health, legal rights, employment, and income-earning opportunities.

~~2.14.3 Social Protection Strategy~~

It is the set of policies and programs designed to reduce poverty and vulnerability by promoting efficient labor markets, diminishing people's exposure to risks and enhancing their capacity to protect themselves against hazards and interruption/loss of income. Social Protection consists of five major elements:

Labor Markets policies and programs designed to facilitate employment and promote efficient operation of labor markets;

Social Insurance programs to cushion the risks associated with the unemployment, health, disability, work injury, and old age;

Social Assistance and Welfare Service program for the most vulnerable groups with no other mean of adequate support;

Micro and Area Based Schemes to address vulnerability at the community level; and

Child Protection to ensure the healthy and productive development of future Asian workforce.

Social Protection System in Asia and Pacific Region

In considering the demand of social protection with Asian sub regions, it is important to identify the circumstances faced by their vulnerable groups. A common trait to all countries in the region is the need to address child and youth priorities, extend coverage to poorer communities, improve governance, and promote institutional development.

2.14.4 2005 Public Communications Policy

ADB's public communications policy provides a framework to enable ADB to communicate more effectively. The policy aims to enhance stakeholders trust in an ability to engage with ADB. The policy promotes:

- Awareness and understanding and results of ADB activities, policies, strategies, objectives and results;
- Sharing and exchange of development knowledge and lessons learned, so as to provide fresh and innovative perspectives and development issues;
- Greater two-way flow of information between ADB and stakeholders, including Project affected people, in order to promote participatory development; and
- Transparency and accountability of ADB operations.

2.14.5 Core Labor Standard

ADB adopted a commitment to Core Labor Standards (CLS) as part of its Social Protection Strategy in 2001. Since then, ADB ensures that CLS are duly considered in the design and implementation of its investment Projects. In this regard, a handbook for CLS has been developed by ADB with the cooperation of the International Labor Organization (ILO). The objective is to convince decision makers that the introduction of CLS and labor standards in general will not impede development. The labor standards are simply the rules that govern the treatment of workforce. Labor standards cover a very wide variety of subjects, mainly concerning basic human rights at work, respect for safety and health and ensuring that people are paid for their work. CLS are a set of four internationally recognized basic rights and principles at work:

- Freedom of association and the effective recognition of the right to collective bargaining;
- Elimination of all forms of forced or compulsory labor;
- Effective abolition of child labor; and
- Elimination of discrimination in respect of employment and occupation.

The detailed ADB guidelines of Safeguard Policy Statement 2009 are attached as Annexure-VI.

2.15 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.
- 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)

2.16 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 Shafi Energy Pvt. 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 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 C, 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 SEPL 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.

2.17 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

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 Shafi Energy 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 Shafi Energy Pvt. Limited. Moreover there are two to three permanent settlement or hamlet within the designated area. Project Land has been leased by the Sindh Government to SEPL.

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.

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.

2.18 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 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

2.19 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.

2.20 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.

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 166 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 412 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.

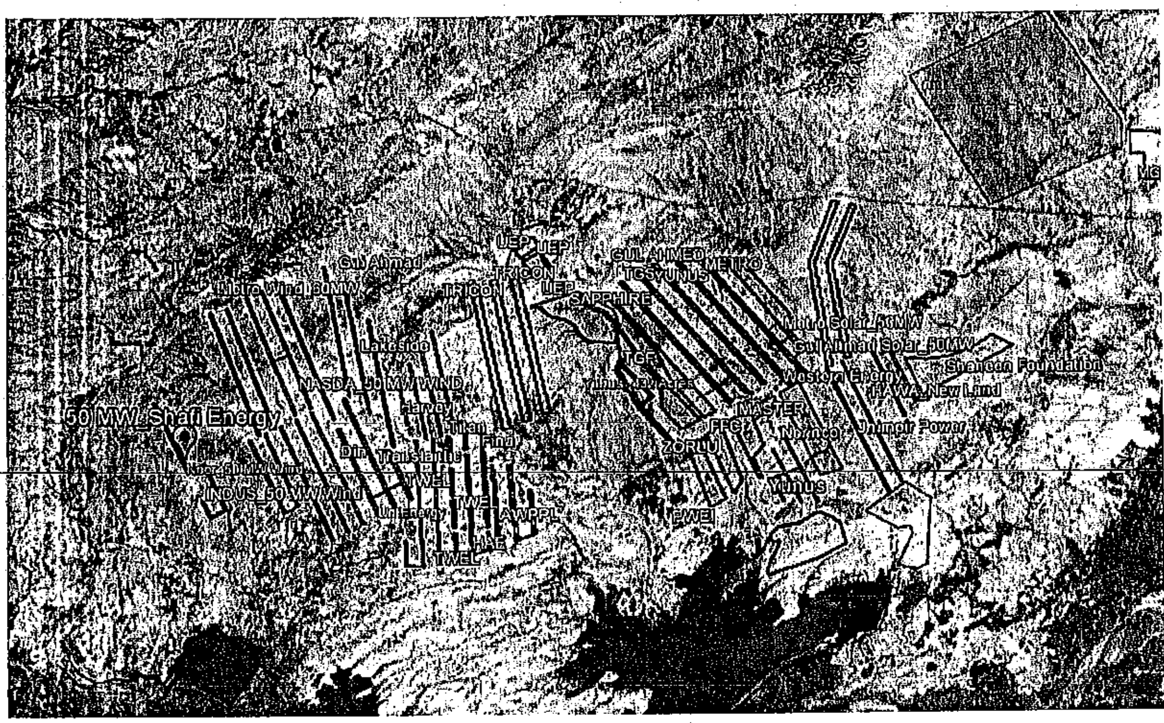

Figure 3.1: SEPL Project Site Layout

Table 3.1: Land Coordinates

S. No.	Latitude	Longitude
1.	24°54'57.57"N	67°38'12.12"E
2.	24°54'53.50"N	67°38'9.27"E
3.	24°53'23.04"N	67°41'1.16"E
4.	24°53'27.73"N	67°41'2.61"E
5.	24°54'0.30"N	67°41'23.71"E
6.	24°53'55.47"N	67°41'22.17"E
7.	24°53'0.91"N	67°43'15.68"E
8.	24°52'57.30"N	67°43'11.80"E
9.	24°52'29.42"N	67°42'55.05"E
10.	24°52'24.49"N	67°42'53.78"E
11.	24°52'51.52"N	67°42'12.33"E
12.	24°52'47.22"N	67°42'9.79"E

The Project area is open and can be seen from images below in Figure 3.2;

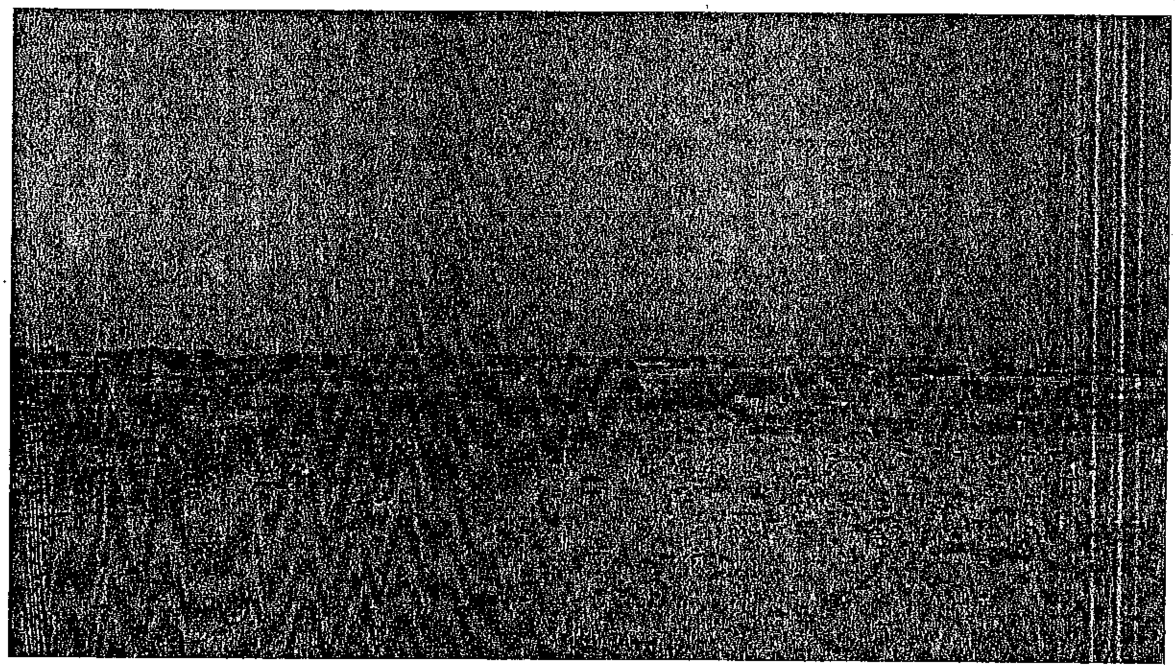

Figure 3.2: A View of Project Site

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 166 km.

The satellite overview of the track from Karachi to the Project site through Karachi-Hyderabad Motorway is shown in Figure 3.3.

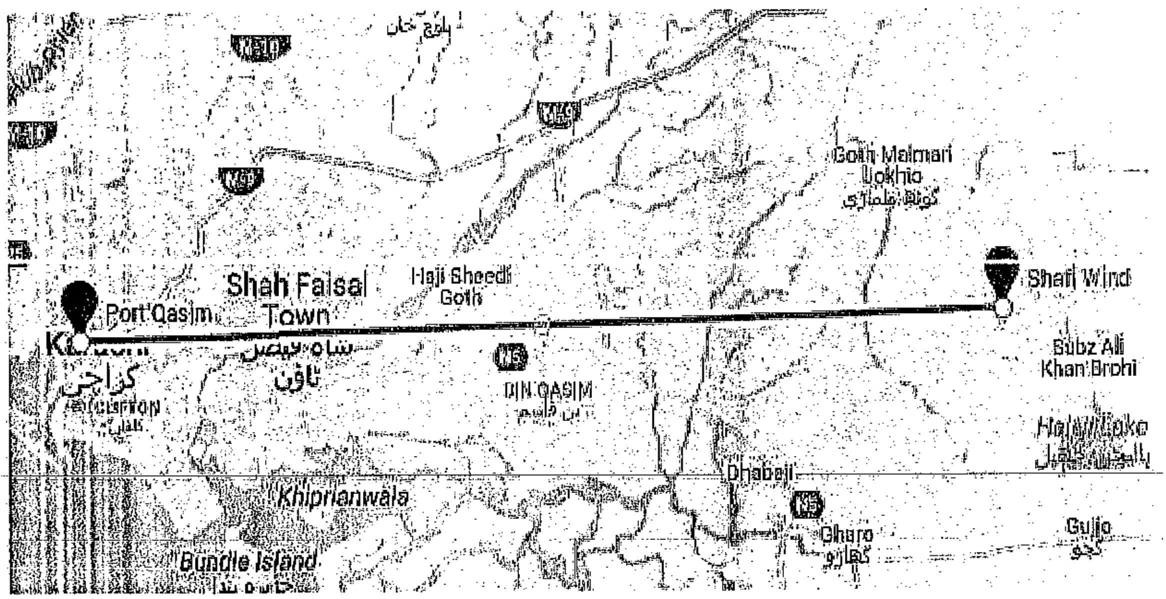

Figure 3.3: Ariel View of Complete Track (Through Karachi-Hyderabad Motorway)

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.

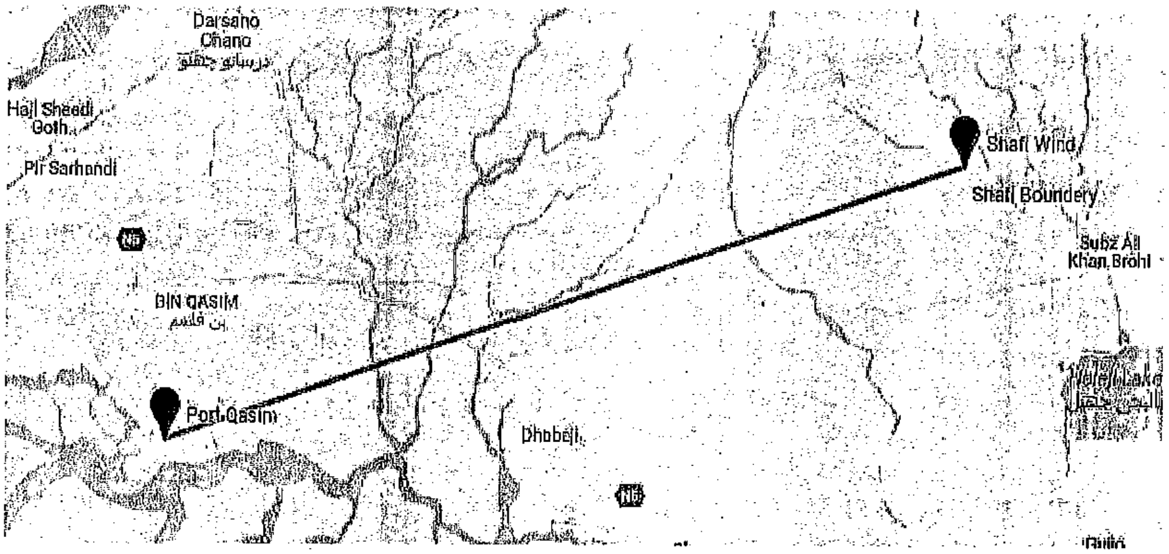

Figure 3.4: Orientation of Site from Port Qasim (Aerial View)

Aerial distance between the Port to the site is 29.2 km. Total track length between Port Qasim Karachi and site is approximately 146 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.

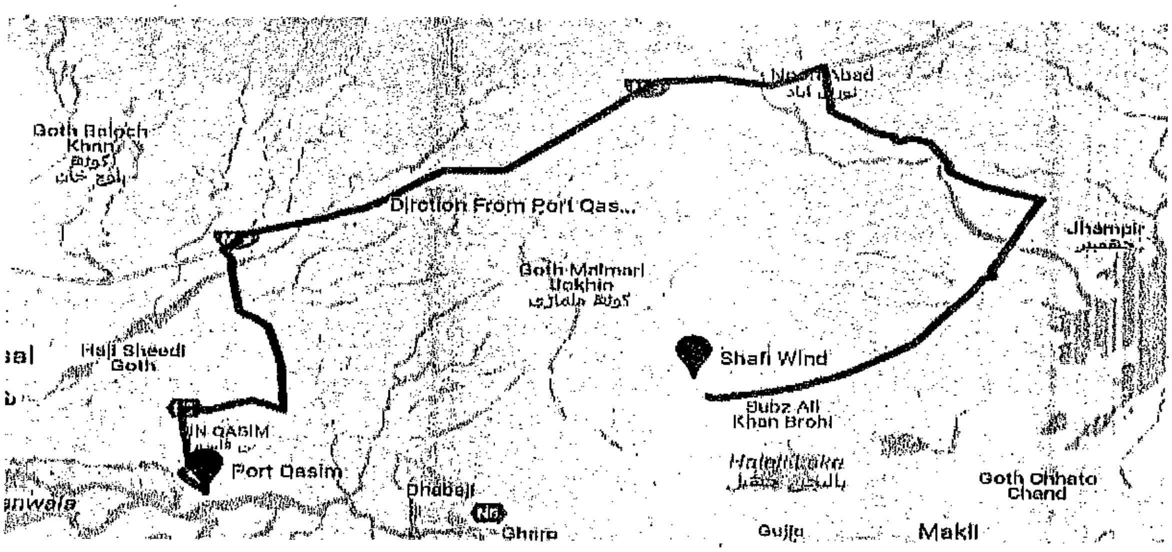

Figure 3.5: Detailed Access from Port Qasim to the Site

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: SEPL Site with Respect to Neighbouring Wind Farms in Jhimpir

3.3 PROJECT SIZE AND COMPONENTS

The Project is of 50 MW capacities. Following WTG will be installed:

- Gamesa114 – 2.0 MW – Total 25 WTGs

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
- 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 2016. 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 2017. The planned COD is the 1st Quarter of 2019.

Activity / Milestone	2016	2017				2018				2019	
	4th QTR	1st QTR	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											

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 twenty one (21) Kilometers.

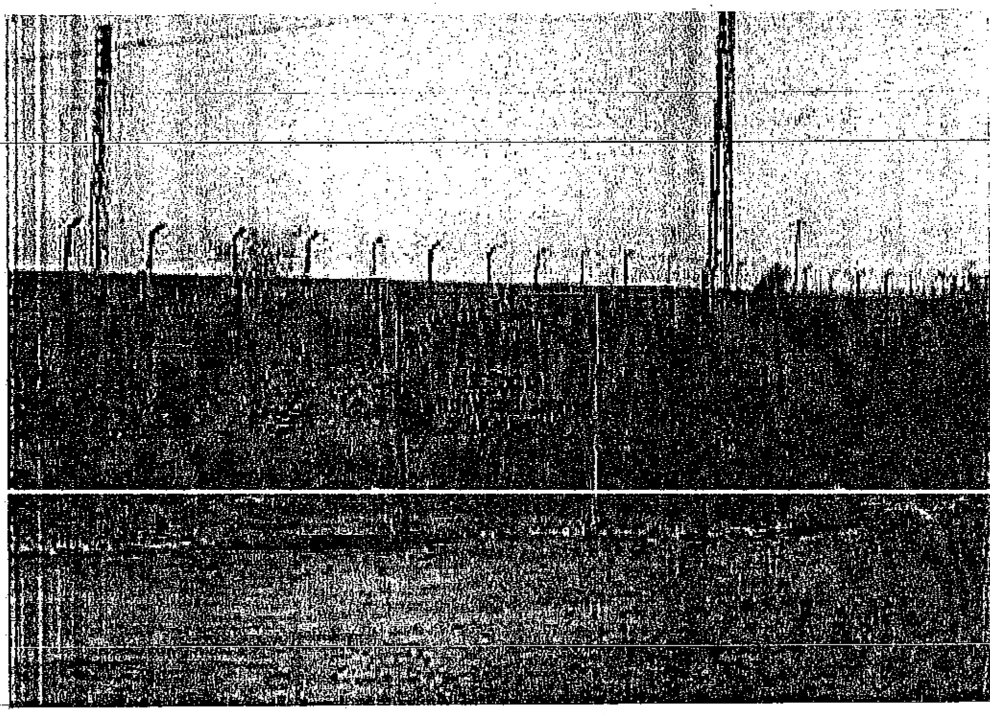


Figure 3.7: Nearest HESCO grid station

Another Grid Station of 220kV is under construction and will be available by end of 2017 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 of Wind Turbine

Make	Gamesa114
Rated Power	2.0
Hub Height	80 meters
No of Turbines	25

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

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

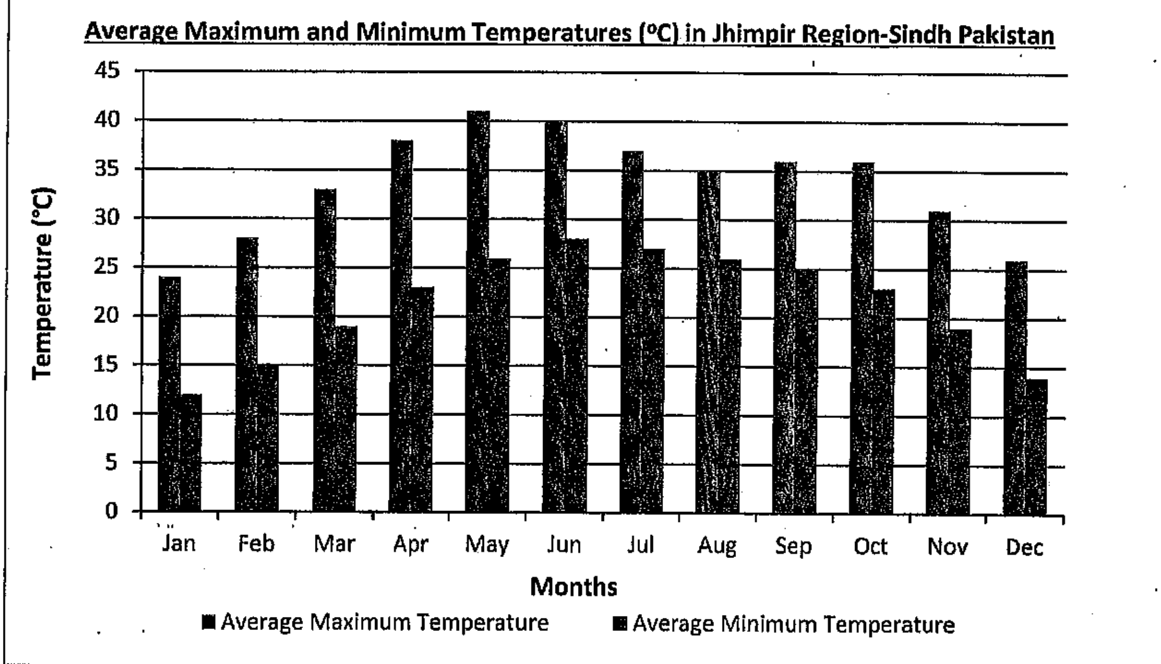


Figure 4.1: Graph of Average Maximum and Minimum Temerature (°C)

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.

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 27.5 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.

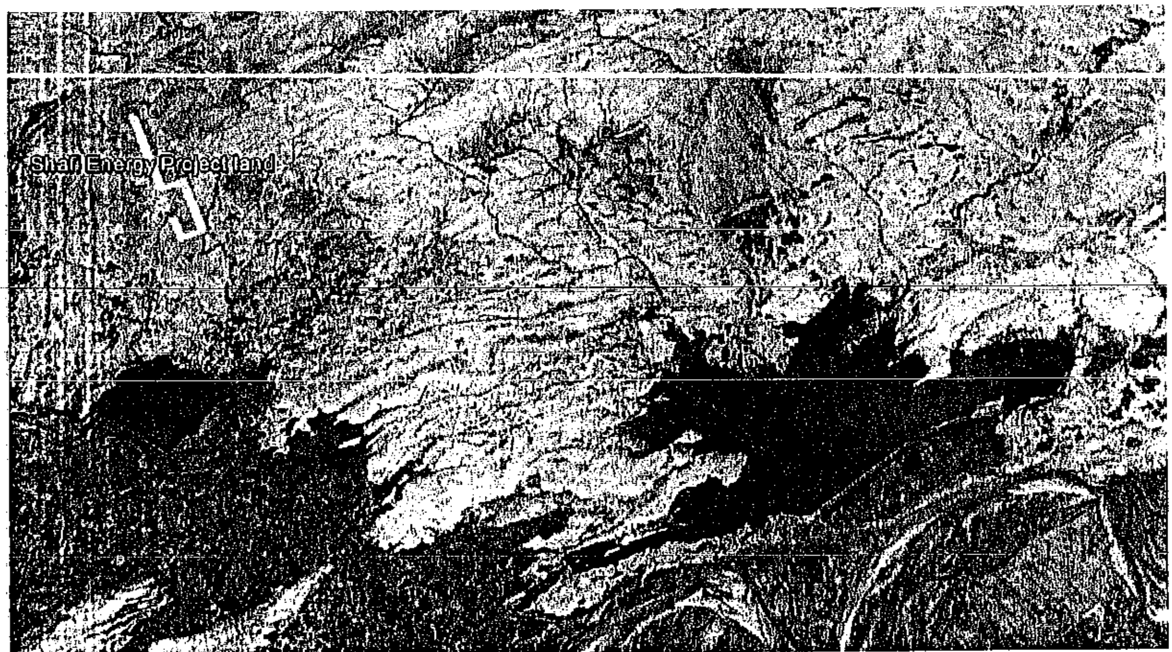


Figure 4.2: Satellite View of Keenjhar/Kalri Lake near Project Site

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.

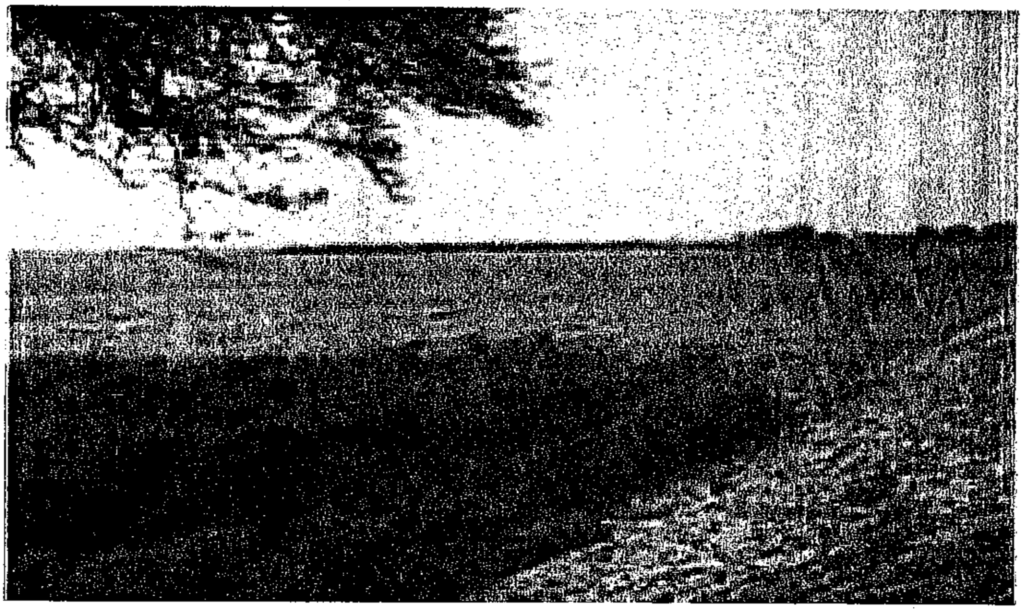


Figure 4.3: View of Kinjhar/Kalri Lake near Project Site

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.

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 27.5 km from Keenjhar Lake.

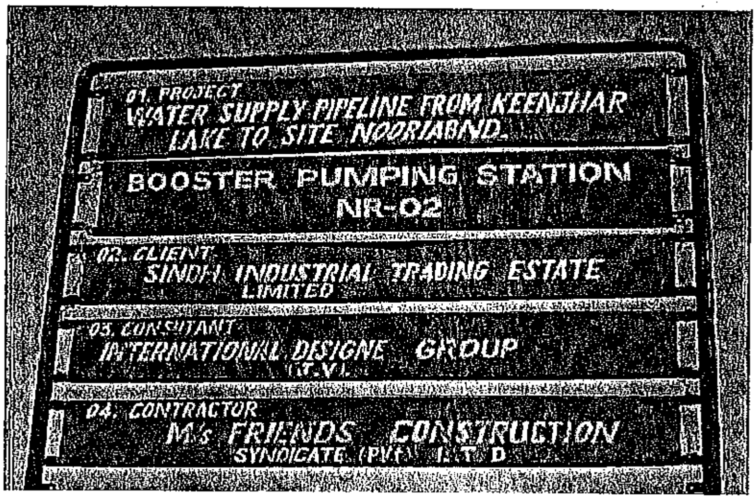


Figure 4.4: Booster Pumping Station from Kinjhar Lake to Nooriabad IndustriaL Estate

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.**

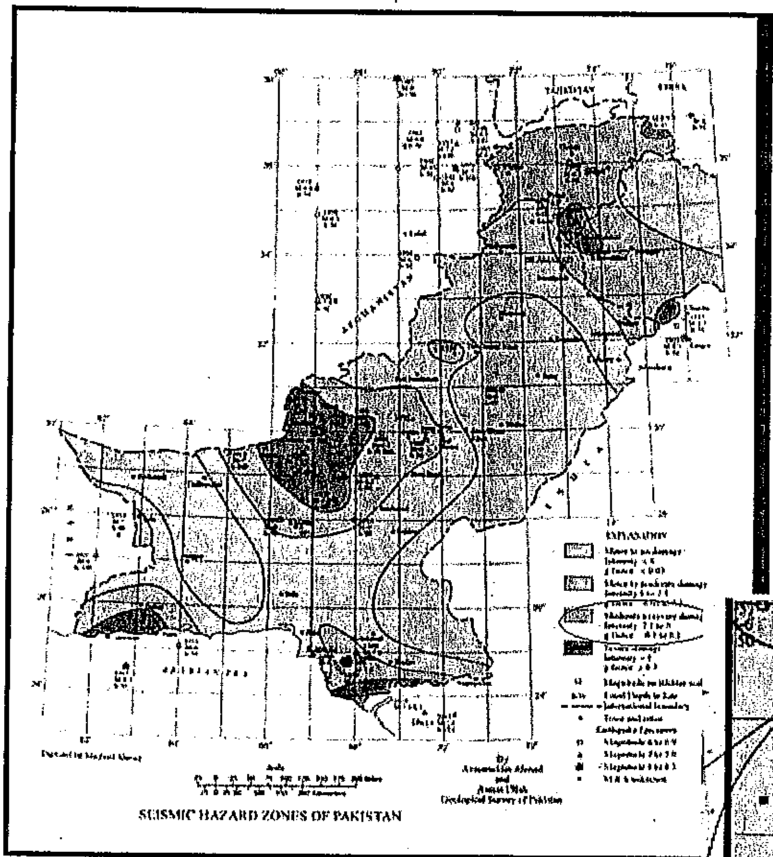
4.4 NOISE QUALITY

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 38.1 dB (A) and 46.2 dB (A) with the average at 40.0 dB (A), which is characteristic of wilderness and well within 75 dB (A) the level suggested by NEQS.

There is number of human settlements 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.



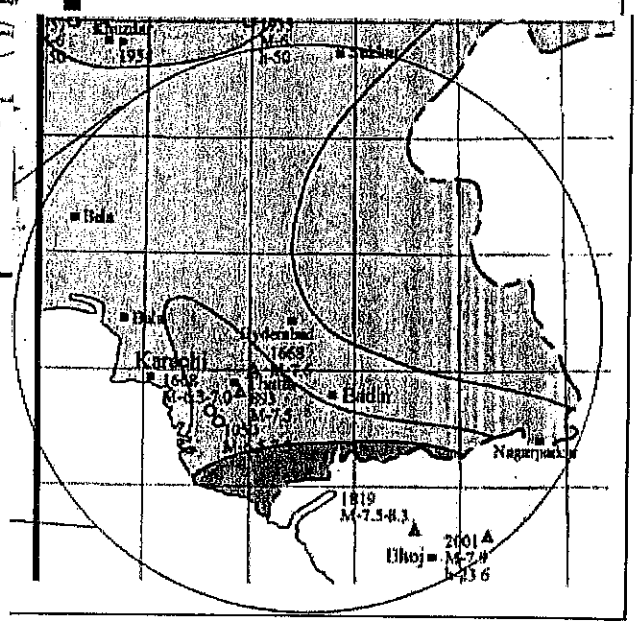


Figure 4.5: Seismic Hazard Zones of Pakistan

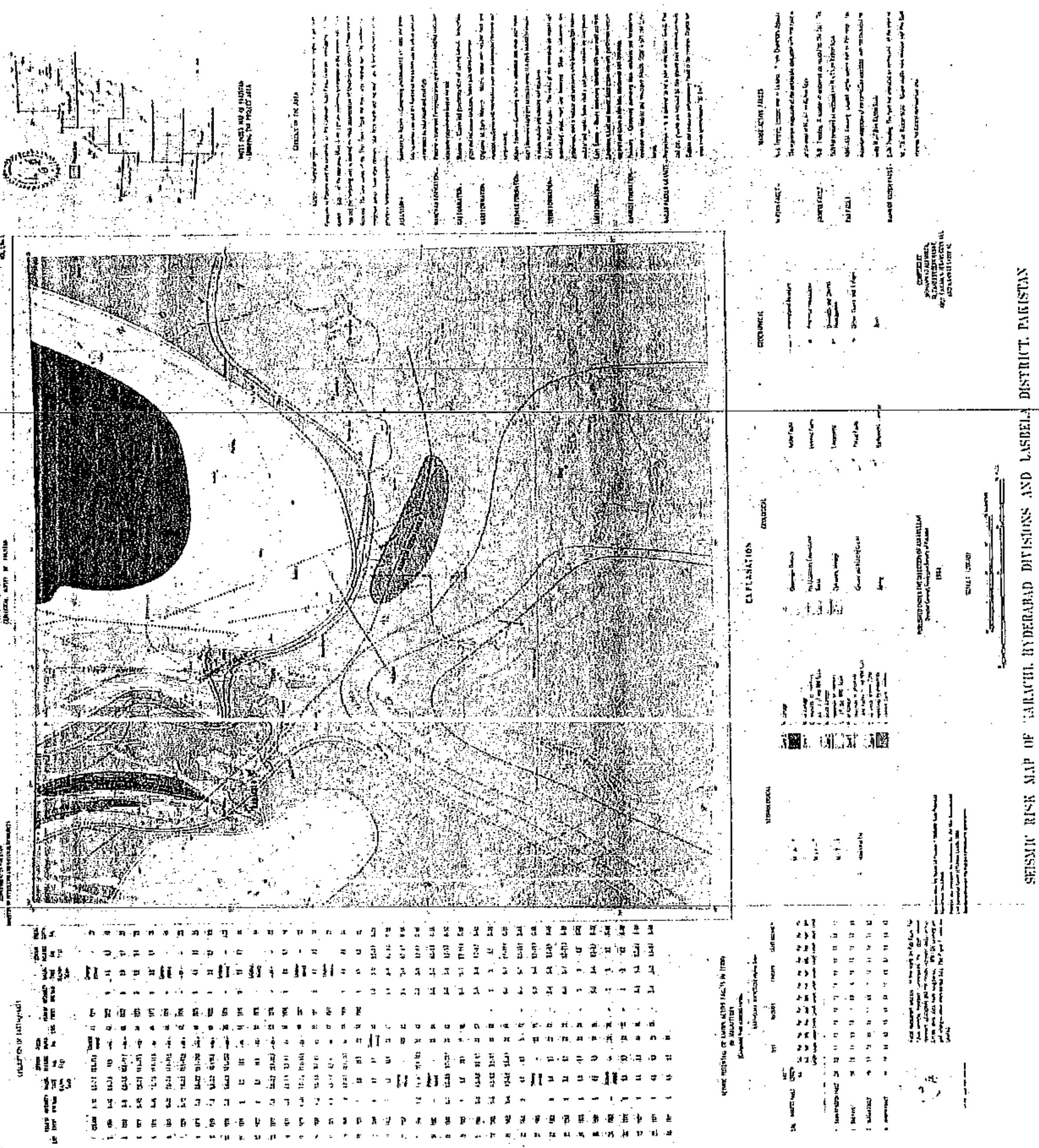


Figure 4.6: Seismic Map of Pakistan

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.

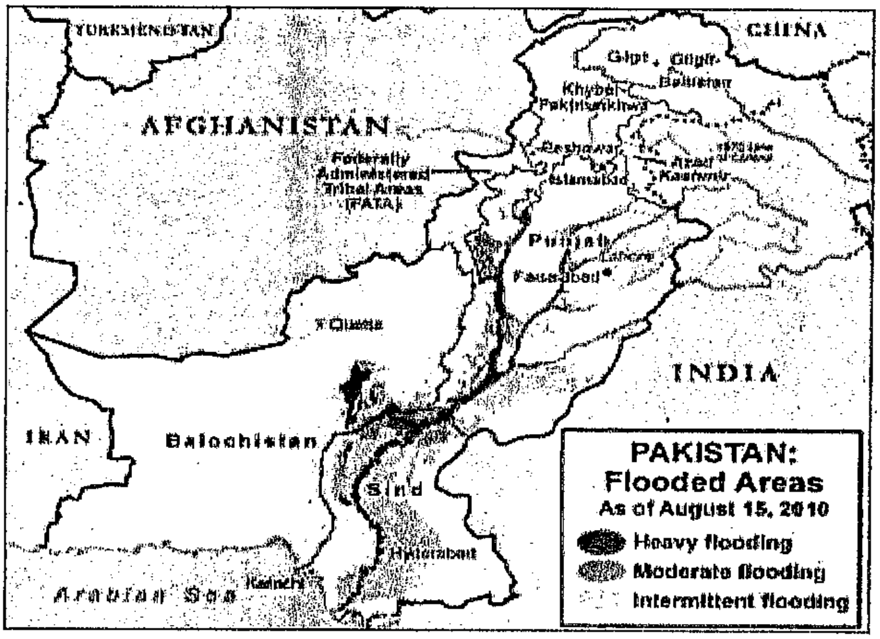


Figure 4.7: Flood Map of Pakistan

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 angle 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

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.	Goth Haji Esha Jhokio	24°54'24.44"N 67°38'42.50"E	350m	50-70	Permanent
2.	Settlement	24°54'28.59"N 67°38'57.07"E	0m (inside the project boundary	15-20	Permanent
3.	Goth Haji Khairo Jhokio	24°54'29.19"N 67°39'8.21"E	50m	20-25	Permanent
4.	Settlement	24°54'5.98"N 67°40'20.71"E	500m	5-10	Permanent
5.	Goth Khair Mohammad	24°53'53.54"N 67°42'1.13"E	375m	40-50	Permanent
6.	Goth Haji Kareem Baksh Jhokio	24°53'23.03"N 67°42'41.26"E	97m	50-70	Permanent
7.	Goth Hammal Khan	24°54'20.01"N 67°41'59.11"E	01km	100-150	Permanent
8.	Primary School	24°53'15.86"N 67°42'41.70"E	0m (Inside the project boundary)	-	Permanent

Average household size is 5-7; houses built in nearby villages are single room houses, made of mud and bushes; there are eight settlements found in the proximity of the proposed project area nearest settlement are found inside the project boundary. All the settlements are permanent settlements and there are no seasonal /temporary settlements near the project site. The population of the settlements varies from 20 – 150+ 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.

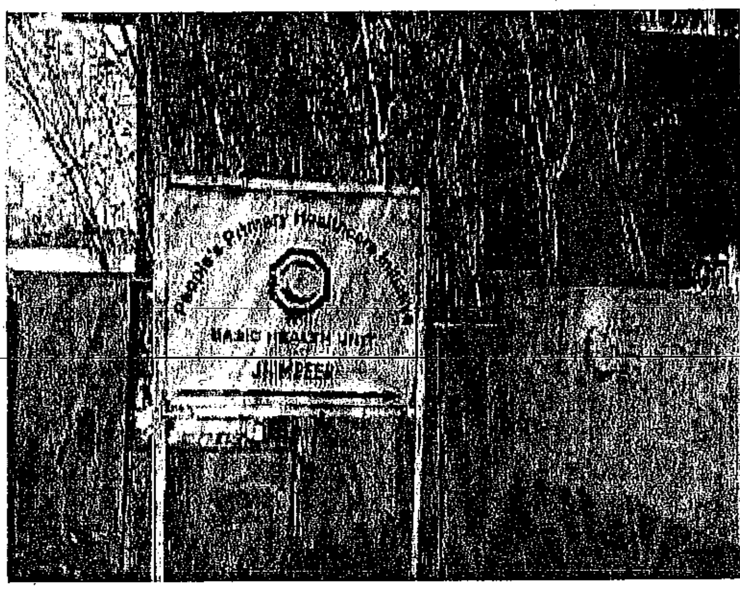


Figure 4.8 A Basic Health Unit in Jhimpir

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. The two primary schools and one Madrasah is located in the area.

Government primary school has been observed in the vicinity. 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 primary school is present near the Haji Kareem Baksh Goth. There is dire need of high school and to make primary school functional.

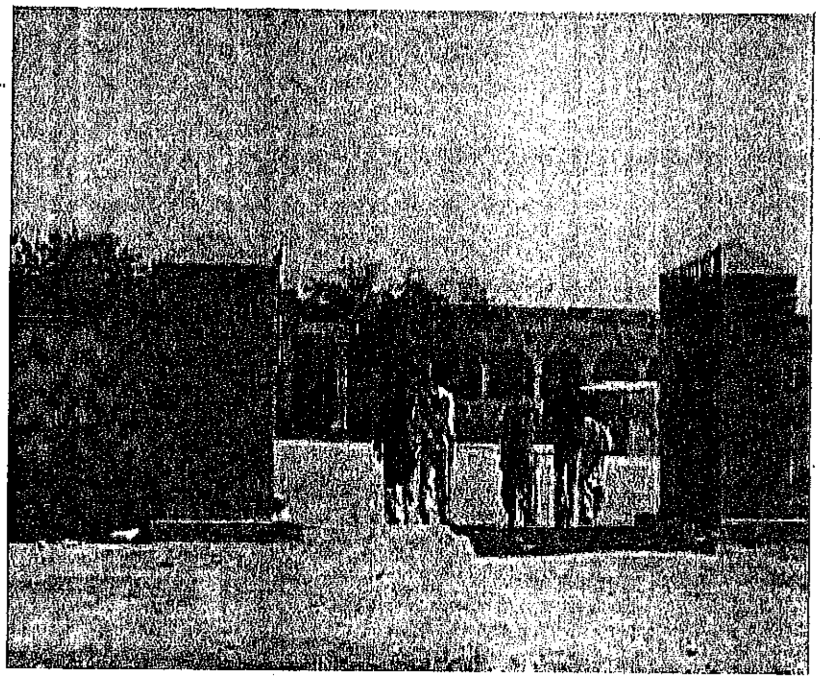


Figure 4.9: A View of School nearby Project Area

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 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 Shafi 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 29.5 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.

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.

Secondary data were collected through literature search, previous studies conducted in the surroundings of the Project Area, and the information collected from the local communities and the Sindh Wildlife Department.

Field Surveys were made in the project area in December, 2016 to collect data about the bio-ecology 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.

The vegetation surveys were carried out by laying 20 m x20 m quadrates within study area. The plant communities were determined within the habitat.

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.

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
- Undulating rocky area
- sandy plain with sand dunes
- Small patches of ploughed barani agriculture land
- Small villages

4.11.1 Flora

Flora survey conducted by Project team experts revealed that, during the fieldwork in the Project Area, 10 plant species belonging to 08 families were identified sampled in the main locations within the Project Area. Out of these, 08 species were perennial and 2 were annuals. 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 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 and Capparis decidua. There is also ploughed Barani agriculture land and also some vegetated area.

Project Area has 10 plant species belonging to 08 families were identified sampled in the main locations within the project Area. Out of these, 08 species were perennial, 02 were annual and 02 were herbs the. The quantitative analysis of the floral composition was made and three 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	03 species
2	Shrubs	05 species
3	Herbs	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

Table 4-7 Faunal Attributes in the Project Area

Attributes	Numbers
Mammals	12 species
Birds	23 species
Reptiles	08 species
Plants	10 species

A. Mammals

During the present survey, 12 species were recorded. The area has very thin population of mammals. Only solitary individuals of big mammals such as Indian Jackal could be sighted. Small mammals such as Five Striped Palm Squirrel, Indian and Desert Gerbils, House Mouse and Roof Rat were less common. Desert Hedgehog, Indian Hare, Indian Porcupine, Desert Cat and Indian Pangolin have been reported from the area as rarely occurring species.

B. Birds

23 species were recorded from the area (Table 4-7). The area supports Pigeon, Doves, Mynah, Crested Lark, Grey Shrike, White-cheeked Bulbul, Desert Wheatear, Green Bee-eater, Indian Robin, Purple Sunbird, Black Kite, Common Babbler, House Sparrow and House Crow were frequent near the villages. Common Kestrel, Variable Wheatear, Greater Hoopoe Lark, House Swift and Barn Swallow were recorded as winter visitors.

C. Reptiles

As regards the Reptiles, 08 species were recorded during the present survey (Table 4-7). Snakes such as Saw-scaled Viper and Indian Sand Boa have been reported from the area. Blue Lizard tailed and Indian Desert Monitor were found to be scarce, while Indian Garden Lizard and Indian Spiny tailed Lizard were frequent in the area.

List of Flora and Fauna found in the Project area is attached as Annexure VIII

D. Protected Areas

There is no Wildlife Protected Area in the close vicinity of the site. Keenjhar Wildlife Sanctuary is more than 16.7 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 (14.34km), and Keenjhar Lake (28.6km).

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.

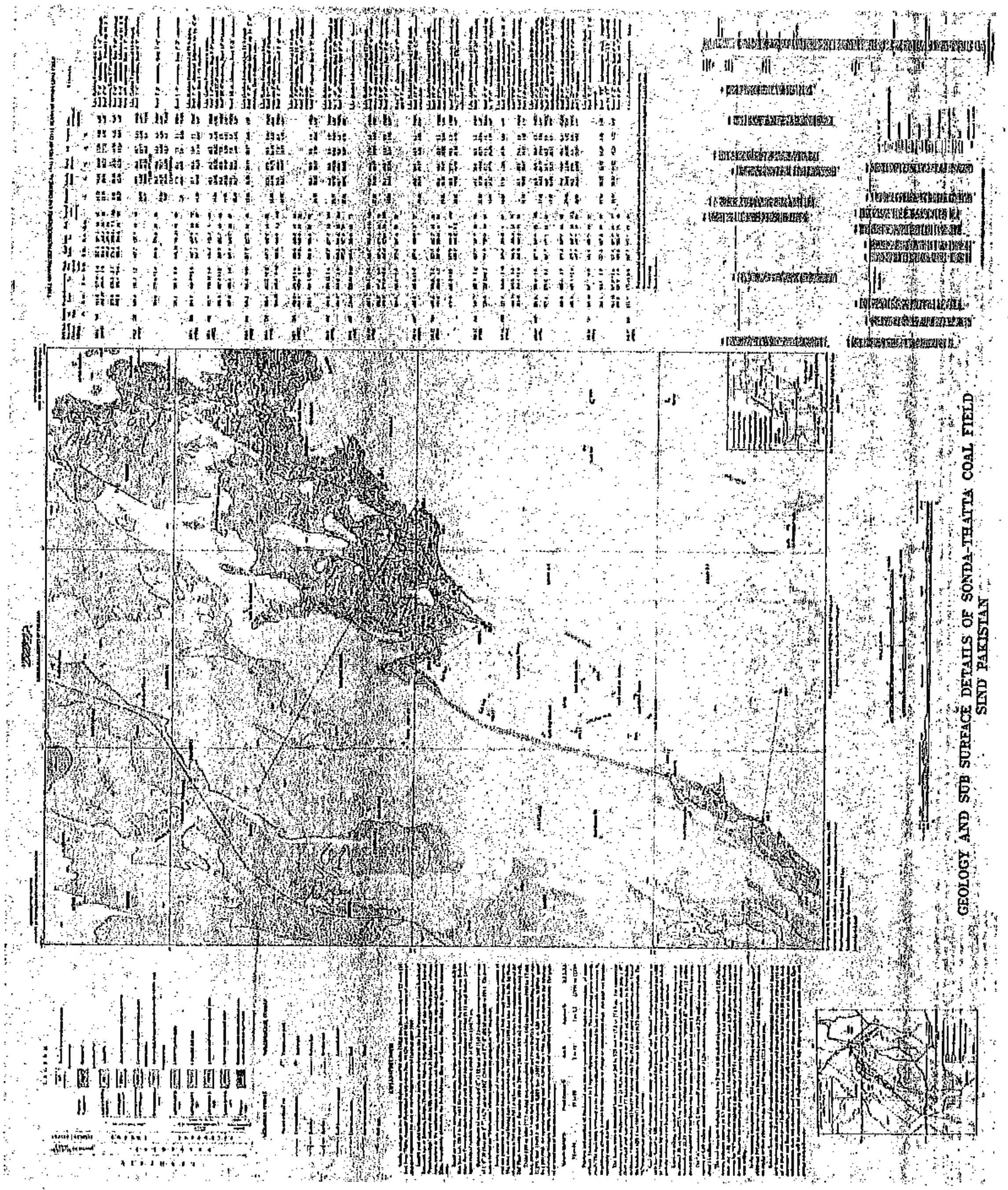


Figure 4.9: Geological and Sub Surface Details of Jhimpir

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.

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 power generation from RE.

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.

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 412 acres. At the Project site, there has been an absence of the following since the past few decades:

- Any commercial activity on the land to support the livelihood of local residents nearby
- Any green field, wetland or protected area

There are eight settlements/Goths near/inside the project area, which are located 0meter to 01 kilometer away from the project site and may/may not be affected due to construction and operation activities of the project.

Therefore, there may be threat to the existing land use or degradation due to the project activities, and there may be net impact on the land use.

Extent of displacement of existing land use or other environmental resources	◇◇ = Medium

◇◇◇	=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 50m 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.

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	◇◇ = Medium
Impact on Noise Quality during Operation	◇ = Low

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

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 at three different timings as mentioned in the **annexures VII** which ranges between 38-46 dB (A), close noise monitoring will be performed during construction and operation phases to keep in permissible limits.

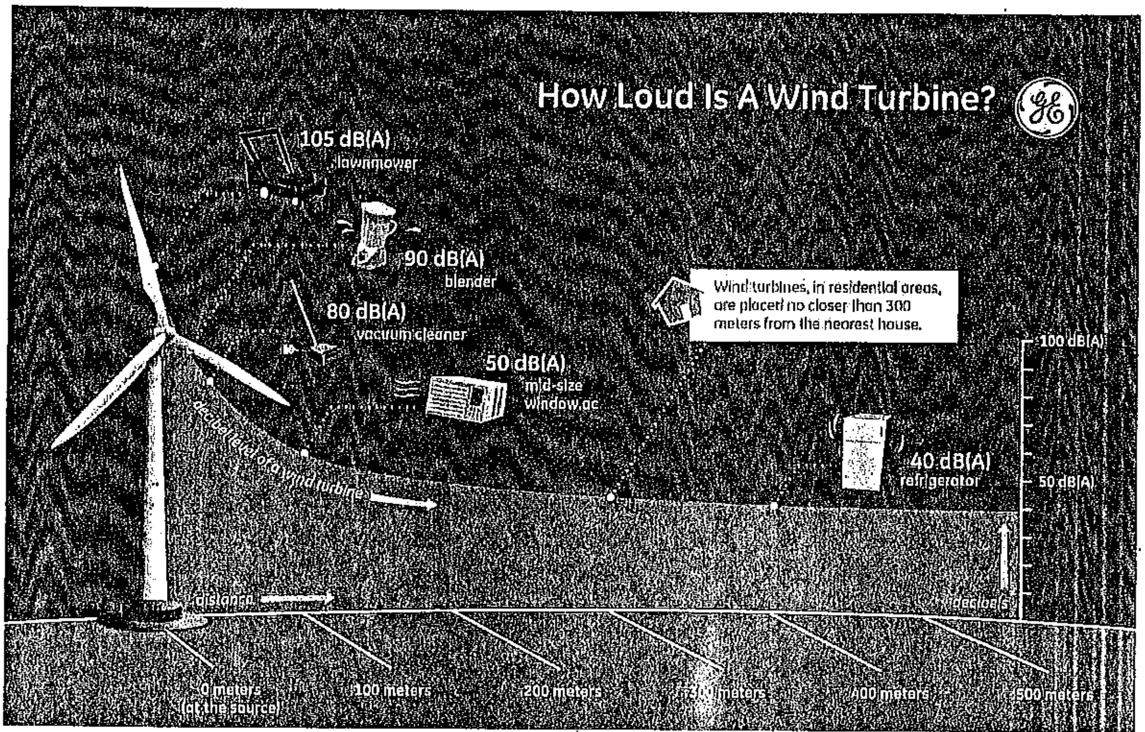


Figure 6.1: Noise Generating from Wind Turbine[2]

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.

[2] GE Global Research; National Institute of Deafness and other Communication Disorders (NIDCD part of NIH)

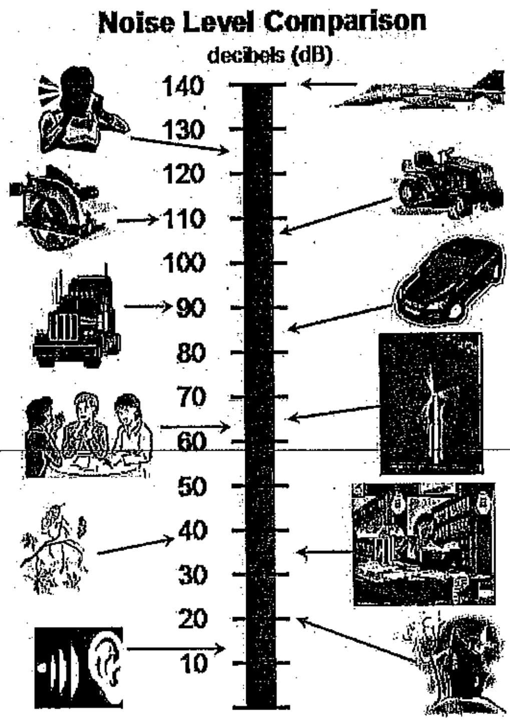


Figure 6.2: Noise Generating from Wind Turbine[3]

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)

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.

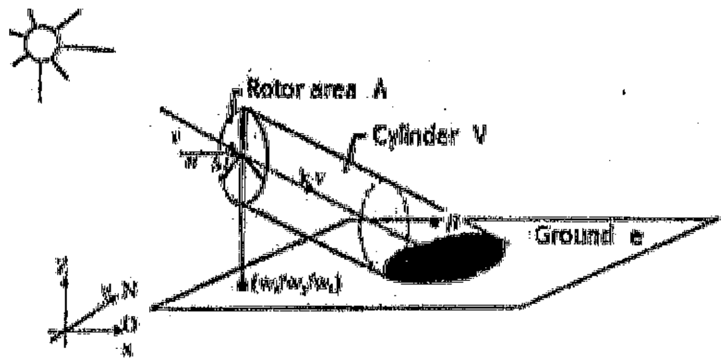


Figure 6.3: Shadow Flicker of Wind Turbine

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]

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.

[4] http://www.decc.gov.uk

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 to 2000 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

◇◇◇	=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.

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

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.

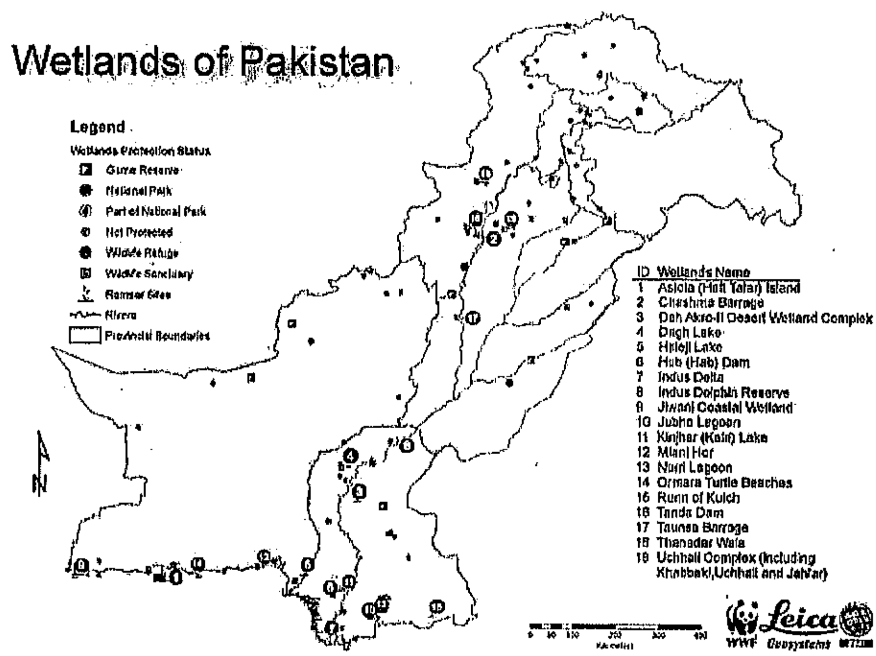


Figure 6.4: Wetlands of Pakistan[5]

[5]www.pakistanwetland.org

Out of 19 Ramsar sites, 10 sites are located in the province of Sindh, which are shown in Figure 6.5.

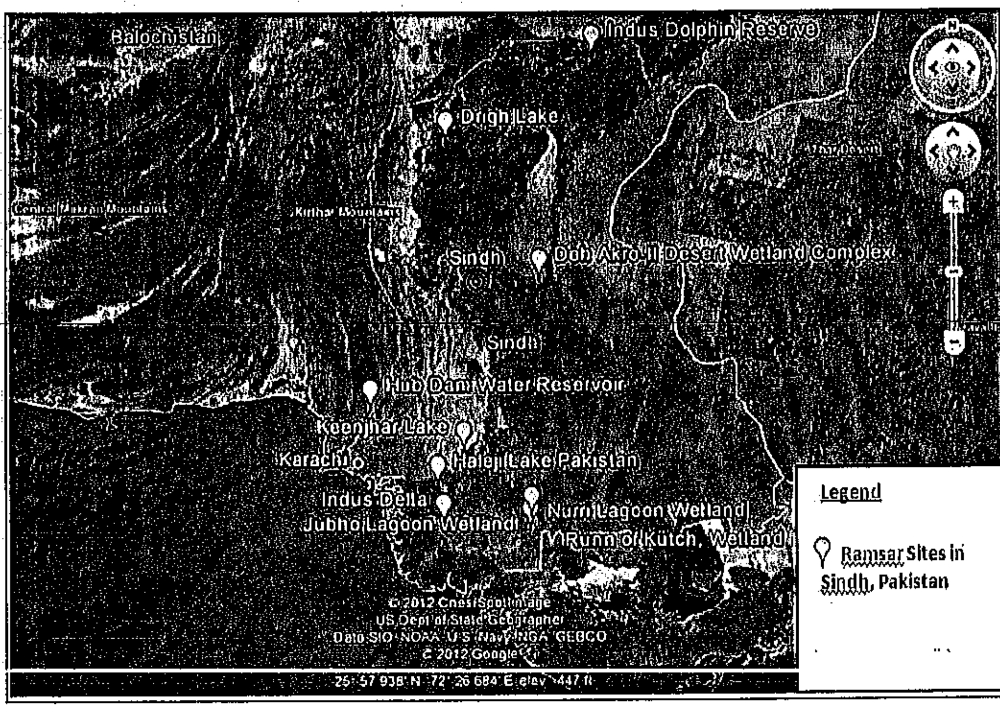


Figure 6.5: Wetland located in Sindh

Keenjhar Lake is the declared wildlife sanctuary, and the Ramsar site is located at a distance of 16.5 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.

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

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.

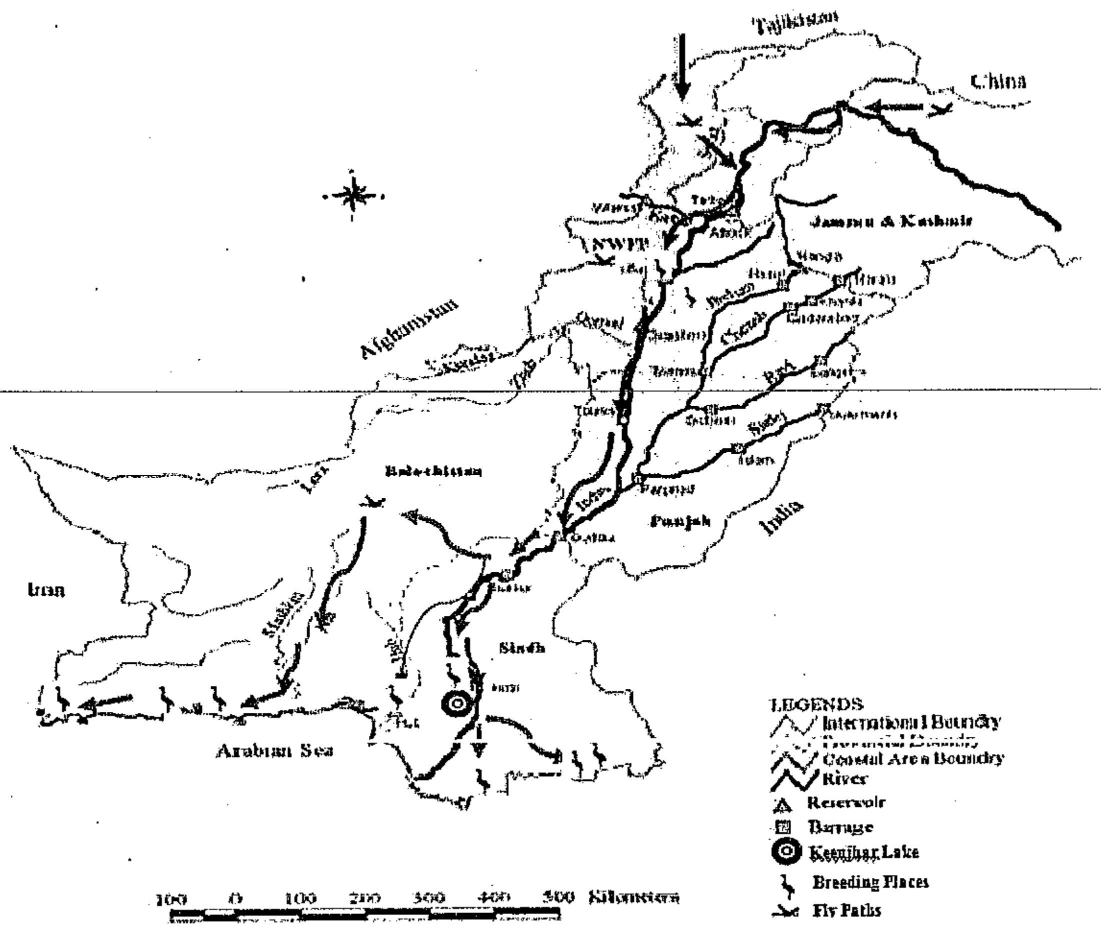


Figure 6.6: Indus Flyway for Migratory Birds/Green Route No.04

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.

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 28 km away from western side of Keenjhar Lake, and birds usually do not land and stay in the western part of Keenjhar Lake.

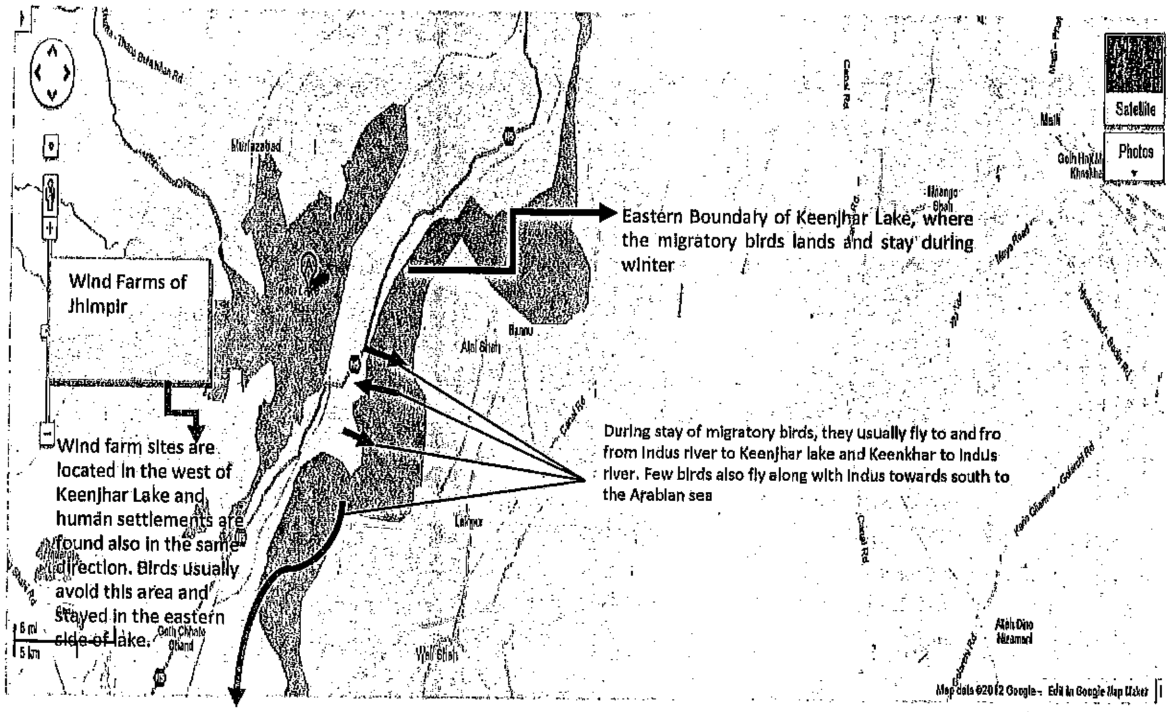


Figure 6.7: Birds Flying and Staying Patterns on Keenjhar Lake with Respect to Wind Farms

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. The CAF / Indus Flyway mainly passes along the River Indus which is about 34 km from the Project Site, as shown in figure 6.8;

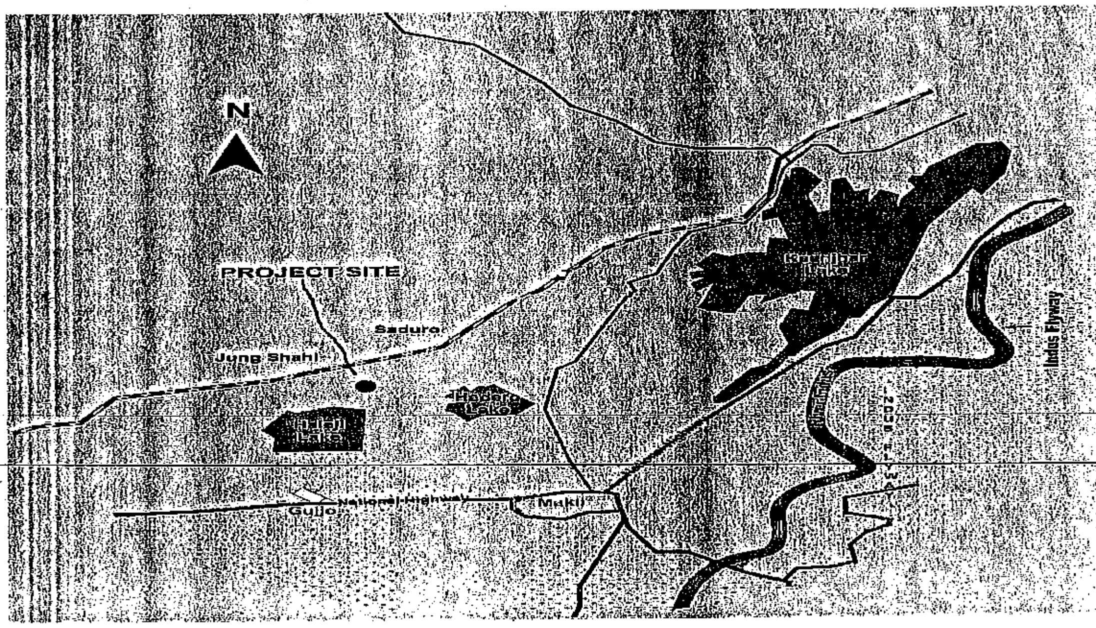


Figure 6.8: Indus Flyway from project site

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 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

[8]http://www.gao.gov/new.items/d05906.pdf
[9]American Wind Energy Association: Facts about Wind Energy & Birds, 5pp.-Internet Article

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.
- 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.
- Shafi Energy Pvt. Ltd will work with the local WWF located in Thatta and remain involved in the conservation efforts of threatened species

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.

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. Some of the settlements are located inside the project boundary which may be affected, and 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 138km 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), 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.

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 SEPL shall provide the safe drinking water through RO filter plant to nearby communities
Educational Facility	Unavailability of Teachers, and School (High 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	Akbar Ahmed	Labor	Goth Hamal Khan
2	Gul Ahmad	Farmer	Goth Hamal Khan
3	Ghulam Rasool	Labour	Goth Hamal Khan
4	Abdul Razaq	Labor	Goth Ali Ahmed Jhokio Bahd
5	Abdul Hafiz	Labor	Goth Ali Ahmed Jhokio Bahd
6	Ali Zaman	Farmer	Goth Ali Ahmed Jhokio Bahd
7	Karim Rinn Jokhio	Labour	Goth Haji Khairo Jhokio
8	Sajawal	Farmer	Goth Haji Esha
9	Suhrab Khan	Unemployed	Goth
10	Shudha Ali	Labour	Goth
11	Azam Khan	Farmer	Goth
12	Abdul Rehman	Labour	Goth
13	Muhammad Ramzan	Labour	Goth
14	Zafarullah	Farmer	Goth

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) Sindh Wild Life Department (Conservator)

A consultation meeting was held on December, 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. 27.5 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 health facilities, clean drinking water and sanitation etc.

b) Sindh Forest Department (Karachi Office)

A consultation meeting was held on December, 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. 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 December, 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 December, 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. 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
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.

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. SEPL) 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.

Shafi Energy (Pvt.) 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. Shafi Energy (Pvt.) 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 supporting staff, together forming the Environmental and Social Unit, appointed by Shafi 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 Shafi Energy (Pvt.) Limited (SEPL) 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

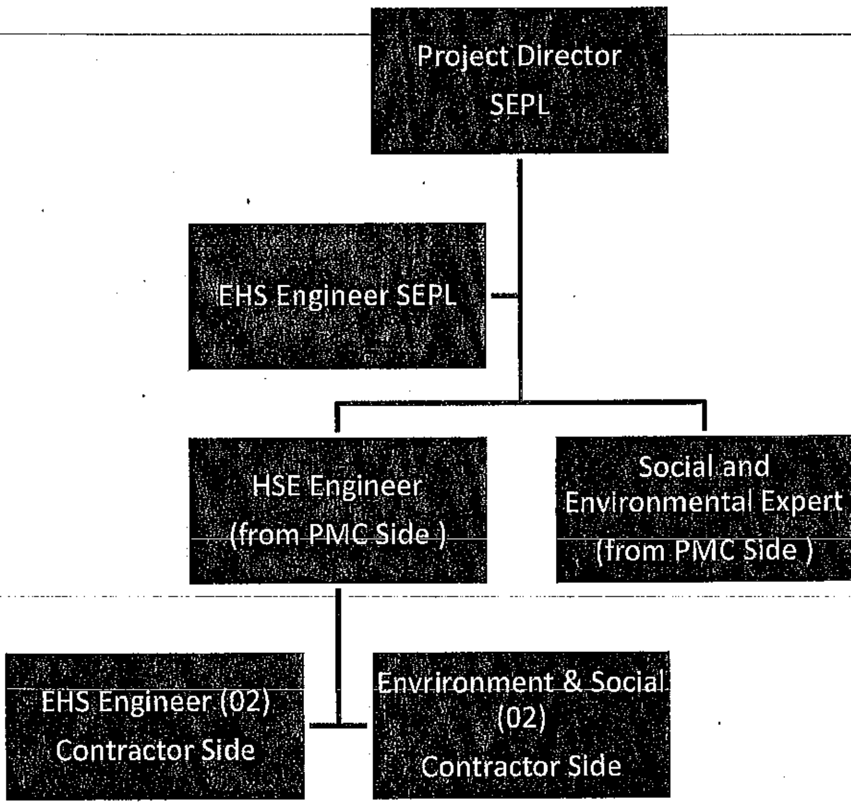
The contractor will be responsible for the following:

- ❖ 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

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.

Shafi Energy (Pvt.) 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 SEPL 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

Shafi Energy (Pvt.) Limited (SEPL) will disclose this IEE and EMP to all the stakeholders before the commencement of the proposed Project. The IEE 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 SEPL 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 Shafi Energy Pvt. Ltd (SEPL) cost shows the environmental monitoring / training cost that will be borne by the Shafi Energy Pvt. Ltd through the EMSC. Detailed cost is shown in **Annexure –II.**

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. Aamir Khalid 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.

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 Shafi Energy 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 Shafi Energy Pvt. Ltd (SEPL) 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 Shafi Energy Pvt. Ltd (SEPL) 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.

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.

Annexure – C
Grid Interconnection Study, Approval of Grid Study

NATIONAL TRANSMISSION & DESPATCH CO. LTD (NTDC)

General Manager Power System Planning, NTDC

No.GMPP/CEMP/TRP-380/ 3122-26

Dated: 01-06-2017

Chief Executive Officer CPPA(G) Ltd.
Shaheed-e-Millat Secretariat,
6th Floor, Jinnah Avenue, Blue Area,
Islamabad.
Fax#:051-9213616

Sub: Approval of Electrical Grid Study Report for 50 MW Shafi Energy (WPP) at Jhimpir, District Thatta, Sindh by M/s Shafi Energy Private Limited

Ref: CPPA-G letter No. CPPA(G)L/CEO/DGMT-II/MT-V/SEPL/19183-84 dated 31-03-2017.

This office has received the final grid interconnection study report of the subject WPP vide above referred letter. After review of the report, it was found that some corrections in the studies were needed which were communicated to M/s PPI and M/s PPI submitted the required corrections on 30-05-2017. Therefore, the grid interconnection study report of Shafi Energy WPP is approved at NTDC end as per assumptions and study results presented in the report.

It is intimated that the Grid Code Addendum for Wind Power Projects is being updated at present and after its approval from NEPRA, the developers of the subject wind power project will be required to follow/implement the requirements/recommendations as given in the Grid Code Addendum for Wind Power Projects. It is added that during EPA, if there is any major change in the parameters of the subject WPP as used in the subject grid interconnection study, then relevant studies will have to be revised.

It is also important to intimate that the subject report has been approved only for power evacuation/ interconnectivity aspects of the subject WPP. Moreover, there may be some modification in the interconnection arrangement of the subject WPP depending on variation in its COD as well as other power plants in the area. Any commitment regarding project execution or for any other purpose should be discussed with CPPA(G) Ltd. and relevant departments of NTDC/HESCO. Moreover, the comments of HESCO on the subject report may also be obtained.

(Imtiaz Ahmad Shad)
Chief Engineer (Resource Planning)

cc:

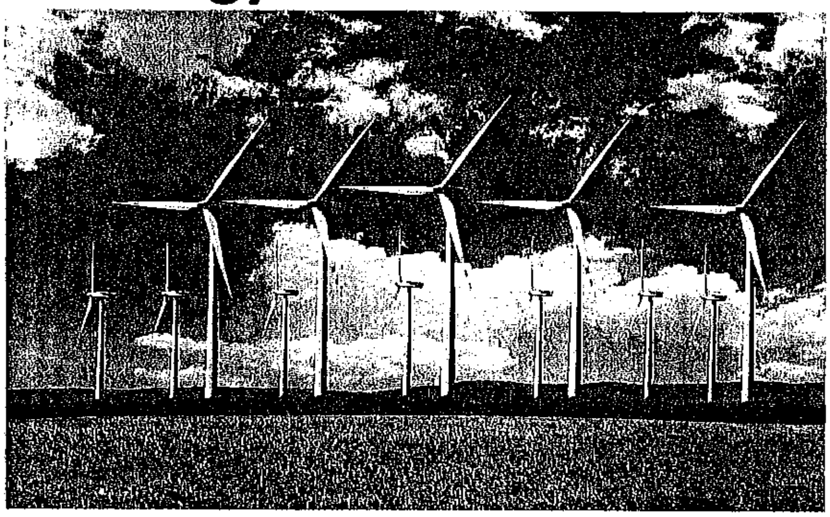
- Chief Executive Officer, HESCO.
- General Manager (Services Division) NTDC.
- Director, Shafi House, 35-A/3, Lalazar, Opp. Beach Luxury Hotel, P.O Box 4524, Karachi.
- M/s PPI, 64-F/1 Wapda Town, Lahore.
- *Master File (MP)*

Report No. PPI-238.2-Final-Shafi/17

ELECTRICAL GRID STUDIES

For

50 MW Wind Power Plant by Shafi Energy Private Limited



Final Report
(March 2017)

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Executive Summary

- The study objective, approach and methodology have been described and the plant's data received from the client Shafi Energy Private Limited has been validated.
- The wind project by Shafi Energy Private Limited, referred to as Shafi WPP in the remainder of the report, is expected to start commercial operation by summer 2019. Therefore, the scenario of August/September 2019 has been selected to carry out the study as it will help to determine the maximum impact of the project.
- The latest generation, transmission plan and load forecast provided by NTDC has been used for the study, attached in Appendix – 2, vide data permission letter no. GMPP/CEMP/TRP-380/5097-99 dated 29-11-2016.
- Recently a study of 10 WPPs was carried out by NTDCL planning department to fill the power capacity vacated by NBT Wind Power Pakistan II & III. A new 220kV grid station with the name of Jhimpir-2 was proposed which was connected by loop in-loop out configuration of Jamshoro – KDA 220kV single circuit and Jhimpir-1 – Gharo 220kV single circuit. This study is carried out for 15 new WPPs in integration with the already planned WPPs and other upcoming WPPs in its vicinity.
- Out of these 15 WPPs, 9 plants which lie in the southern part of Jhimpir namely Shafi, Lakeside, DHA City, Noor, Indus, Iran Pak, Metro-2, Uni-energy and Nasda Green WPPs, are proposed to be connected to the newly proposed Jhimpir-2 220/132kV Grid station. Since the site of Jhimpir-2 220/132kV grid station has recently been finalized hence a site visit was carried out on 25th January 2017 along with NTDC official to verify the distances of the upcoming 220kV circuits emanating from this grid station. Moreover sites of the above mentioned 9 WPPs were also visited to develop technically correct as well as least cost scheme for evacuation of power from these WPPs. Based on the location of the WPPs, two loops (each having 8 WPPs) were proposed at Jhimpir-2 grid station.

The configuration of the new loops is shown in Appendix-4 and the list of WPPs in each loop is provided below:

First Loop: Lakeside, Nasda, Trans-Atlantic, Uni-Energy, Iran Pak, Artistic, Act-2 and Cacho WPPs

Second Loop: Gul Ahmed, Metro-2, Zulaikha, Din Energy, Noor, Indus, Shafi Energy and DHA-City WPPs

- Sites of 3 plants out of these 15 WPPs which lie in the northern part of Jhimpir namely Norinco-2, Sinowell and Tricom WPPs were also visited and they are proposed to be connected via loop in-loop out of upcoming Jhimpir-1 - T.M Khan 132kV single circuit. Similarly Burj WPP is proposed to be connected via loop in-loop out of Thatta – FWEL-I 132kV S/C and Master Green WPP which is located in Jamshoro district is proposed to be connected by loop in-loop out configuration of the newly proposed Nooriabad - Jamshoro old 132kV single circuit. Lastly, Lootah Energy WPP is proposed to be connected via loop in-loop out of upcoming Jhimpir-1 – Tricon-A 132kV S/C.
- As discussed above, Shafi WPP which is the plant under study, has been placed in the second loop at newly proposed 220/132kV Jhimpir-2 grid station. Shafi Wind Power Plant would be connected by a double circuit of 132 kV looping in-out with a sub cluster connecting neighboring Wind Power Plants of Indus 50 MW, DHA-City 50 MW and other 5 WPPs in the second loop with Jhimpir-2 220/132 kV collector substation. It should be noted that the length of circuits used for the simulations are confirmed from site visit and agreed with NTDC official. They may change slightly during the implementation of the project. In addition, the connectivity of Shafi WPP with neighboring wind power plants may change, depending upon the COD of the project.
- The scheme of interconnection of Shafi WPP proposes the following reinforcements in place at Jhimpir cluster.
    - 220 kV D/C transmission line approx. 5km long on twin bundled Greeley conductor looping In/out of second circuit of existing Jamshoro – KDA-33 D/C transmission line at the proposed Jhimpir-2 220/132 kV substation

- Addition of 4th 220/132 kV transformer at the newly proposed Jhimpir-2 220/132 kV substation.
- 132kV double circuit transmission line approx. 135 km long on twin bundled Greeley conductor for connecting 8 WPPs in the first loop to Jhimpir-2 220/132 newly proposed substation.
- 132kV double circuit transmission line approx. 168 km long on twin bundled Greeley conductor for connecting 8 WPPs in the second loop to Jhimpir-2 220/132 newly proposed substation.
- In this scheme the interconnection of Shafi WPP (which is placed in second loop) includes 132 kV D/C transmission line approx. 7 km long, on twin bundled Greeley conductor for looping in/out on the 132kV single circuit from Indus WPP to DHA-City WPP grid station.

➢ The existing grid system of HESCO and NTDC in the vicinity of Shafi WPP has been studied in detail by performing load flow, short circuit and dynamic analysis for the conditions prior to commissioning of Shafi WPP and no bottlenecks or constraints have been found in the grid system.

➢ Wind Farm of Shafi WPP has been modeled considering Type-3 WTGs. They are Doubly Fed Asynchoronous Generators which are designated as Type-3 WTG. The terminal voltage is 0.69 kV. The medium voltage level of wind farm has been selected as 22 kV for unit step-up transformers, for collector circuits and step-up from MV to HV (132 kV) at Farm substation to connect to the Jhimpir-2 220/132 kV grid station of NTDC.

➢ The design of scheme of 132/22 kV substation of Shafi Wind Farm has been provided by the Client and is attached in Appendix – 2.

➢ Load flow analysis has been carried out for peak and Off Peak scenarios of August/September 2019 considering the COD targeted by Shafi WPP and a future scenario of 2022, for the dispersal of power from Shafi WPP into NTDC system using the latest load forecast, generation and transmission expansion plans of NTDC and HESCO. The above mentioned interconnection scheme has been evolved by performing the load flow studies testing the steady state performance for normal as well as N-1 contingency conditions fulfilling the Grid Code criteria of Wind Power Plants. The reactive power requirement at point of common coupling to meet PF of ± 0.95, voltage and line loading criteria are fulfilled by these studies. All the scenarios have been studied by considering maximum dispatch from all the existing/planned WPPs in the Jhimpir and Gharo Clusters.

- For the base case of summer 2019, capacity constraint was observed in 500kV network emanating from Jamshoro and upwards in case of some critical outages of 500kV circuits. Due to this capacity constraint, partial curtailment in the output of all WPPs under study was proposed to bring the loading on the 500kV network within limit. Hence output of Shafi WPP is curtailed to 7 MW in case of some contingency events. For the future scenario of 2022, this issue of capacity constraint is resolved due to the following major reinforcements:
    - 660kV HVDC from Matiari to Lahore
    - 660kV HVDC from Port Qasim to Faisalabad West
- With the proposed reinforcements highlighted earlier and the curtailment process for the base year of 2019 under special circumstances, the load flow results for peak and Off Peak scenarios establish that the proposed scheme of interconnection of Shafi WPP shows no bottlenecks or capacity constraints in the adjoining 500 kV, 220 kV and 132 kV network in terms of absorbing all the output of Shafi WPP and other proposed WPPs under normal as well as the contingency conditions.
- Maximum and minimum short circuit levels for three-phase faults and single-phase faults have been evaluated. The maximum SC levels have been evaluated for the year 2022 and minimum short circuit level for the year 2019 for the most stringent conditions. The fault levels of Shafi 132 kV are 7.53 kA and 7.26 kA for 3-phase and single phase faults respectively for 2022. This is much less than the switchgear rating of 40 kA recommended for Shafi Farm Substation as per NTDC requirements for 132 kV. The fault levels for Shafi 22 kV are 18.13 kA and 20.23 kA for 3-phase and single-phase faults respectively for year 2022.

Therefore the short circuit rating for 22 kV switchgear is recommended as 31.5 kA. It has been found that the proposed scheme provides maximum SC strength for the evacuation of Shafi WPP power to the grid.

The switchgear ratings for Shafi WPP substation are as follows:

132 kV:

Short circuit rating = 40 kA (3 sec.)

Continuous rating = 2500 A

22 kV:

Short circuit rating = 31.5 kA (3 sec.)

Continuous rating = 2500 A

- Transient Stability analysis has been carried out for Shafi WPP based on their selection of Type-3 WTGs, with connectivity of proposed scheme. Different disturbances have been simulated to apply stresses from the system faults on the wind farm and vice versa and it was found that Shafi WTG unit's dynamic characteristics and the grid connectivity is strong enough to maintain stability under all disturbances. In turn, any disturbance from Shafi WPP side did not cause any stress on the main grid or the power plants nearby and in the HESCO area such that the whole system remained stable under all events.
- The LVRT requirements have been tested to fulfill 100 ms (5 cycles) under normal clearing time and 180 ms (9 cycles) for contingency condition of delayed fault clearing due to stuck-breaker (breaker failure) reason. The simulations have proved that the proposed machine fulfills the LVRT criteria as required in the Grid Code for Wind IPPs.
- The issues of power quality like flicker, unbalance and harmonic resonance have been studied in detail. The results have indicated that the levels of flicker and unbalance are within the permissible limits of IEC and other International Standards.
- There are no technical constraints whatsoever in the way of bringing in the 50 MW of Shafi Wind Power Plant at the proposed site and scheduled time of

commissioning, in any respect of steady state (load flow) or short circuit or dynamic performance (stability) or power quality issues related to this plant.

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Appendix –2: Data

- 2.1: Generation Plan
- 2.2: Transmission Expansion Plan
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Appendix –7: Plotted Results of Chapter 7

Appendix –8: Plotted Results of Chapter 8

Appendix –9: Dynamic Data For Stability Analysis

1. Introduction

1.1 Background

There exists a huge wind corridor in coastal Sindh, starting from Gharo-Ketti Bandar up to Jhimpir and upward, that has been identified by AEDB with an actual potential of about 50,000 MW. There are many entrepreneurs coming forward to tap this huge natural resource of power.

Study of 10 WPPs was recently carried out by NTDCL Planning Department after cancellation of LOIs of NBT-II and NBT-III. New Jhimpir-2 220/132 kV substation was proposed to evacuate power from these WPPs. For further evacuation of power from Jhimpir area, an integrated study was required depicting optimal utilization of resources. Hence a study of 15 new WPPs was carried out in integration with the already planned / existing WPPs. Shafi Energy Private limited is amongst those entrepreneurs who have come forward with a Wind Power Plant within this cluster at Jhimpir.

The proposed wind farm shall have the installed capacity of about 50 MW of electricity. The project is being developed in the private sector and the electricity generated from this project would be supplied to power grid of NTDC. The services of Power Planners International have been engaged to perform the impact studies of penetration of this wind power in the national grid to evolve the most feasible interconnection scheme for this plant.

1.2 Objectives

The overall objectives of this study are:

1. Impact of Shafi Wind Power Plant on the System
2. Impact of the System on Shafi Wind Power Plant

These impacts are to be studied for different operating conditions of Plant as well as the System. The operating condition of the plant may vary from its 100 % output to 0 % i.e. no output at all. The system conditions would be peak load, off-peak load for the spot year of study i.e. 2019. A future scenario of 2022 is also studied.

The impacts are required to be studied for steady state as well as the dynamic and disturbed conditions of the system. The specific objectives are:

1. To develop a feasible scheme of interconnections of Shafi Wind Power Plant (WPP) with HESCO/NTDC network at 132 kV for which right of way (ROW) and space at the terminal substations would be required to be made available.
2. To check the load-ability of lines and transformers to be within their rated limits satisfying the clauses OC 4.8, OC 4.9, and OC 4.10 of NEPRA Grid Code regarding the criteria of operation of frequency, voltage and stability under normal and contingency conditions for peak and off-peak load conditions of grid as well as the plant.
3. To check the voltage profile of the bus bars of the neighboring interconnected network under different operating conditions
4. To check the reactive power limitations of the wind turbines and the neighboring generators of the system; and evaluate the size of switched shunt capacitor banks at Medium Voltage level of substation of collector system of Shafi Wind Farm to regulate the voltage under steady state and contingency conditions to fulfill the Grid Code criteria of ± 0.95 Power Factor at the point of common coupling (interface point) interconnecting Wind Farm and the Grid i.e. 132 kV gantries of outgoing circuits.
5. To check if the contribution of fault current from this new plant increases the fault levels at the adjoining substations at 220 kV and 132 kV voltage levels to be within the rating of equipment of these substations, and also determine the short circuit ratings of the proposed equipment of the Medium Voltage substation of collector system of Shafi Wind Farm and the NTDC/HESCO substations of 132 kV connecting with the Shafi Wind Farm.

6. To check the minimum short circuit strength of the system to handle large variation of generation of wind turbine
7. To check if the interconnection with the grid withstands transient stability criteria of post fault recovery with good damping satisfying the NEPRA Grid Code.
8. Transient stability to see the dynamic performance of Shafi WPP in response to Grid disturbances and vice versa the dynamic impact of disturbances in Shafi WPP on the Grid.
9. To check the ability of the wind turbine generators of Shafi WPP to remain connected following major disturbances and grid disruptions i.e. the Low Voltage Ride Through (LVRT) capability to satisfy the Grid Code requirement of LVRT for 180 ms.
10. Analysis of power quality issues such as flicker, voltage-unbalance, harmonics and resonance of the system.

1.3 Planning Criteria

The planning criteria required to be fulfilled by the proposed interconnection as enunciated in NEPRA Grid Code including Addendum No.1 for WPPs are as follows:

Voltage	± 5 %, Normal Operating Condition
	± 10 %, Contingency Conditions
Frequency	50 Hz, Continuous, ± 1% variation steady state
	49.4 - 50.5 Hz, Under Contingency

Short Circuit:

132 kV Substation Equipment Rating 40kA

Dynamic/Transient and Low Voltage Ride through (LVRT):

The WTGs should remain connected during voltage dip upto 30 % level, under fault conditions by ride through capability for the following sequence of disturbance

1. Total normal fault clearing time from the instant of initiation of fault current to the complete interruption of current, including the relay time and breaker

interruption time to isolate the faulted element, is equal to 100 ms (5 cycles) for the systems of 132 kV and above.

2. In case of failure of primary protection (stuck breaker case), the total fault clearing time from the instant of initiation of fault current to the complete interruption of current to isolate the faulted element, including the primary protection plus the backup protection to operate and isolate the fault, is equal to 180 ms (9 cycles) for 132 kV and higher voltage levels.

3. LVRT of 100 ms for normal fault clearing and 180 ms for the case of failure of primary protection (stuck breaker case).

Reactive Power and Power factor:

Reactive Power Control to maintain the power factor within the range of 0.95 lagging to 0.95 leading, over full range of plant operation, according to Dispatch Instructions/manual voltage adjustment requirements.

Power Quality Requirements:

As per IEC61400-21standards

1.4 Operating Criteria

The operating requirements to be fulfilled by the proposed Shafi WPP as enunciated in NEPRA Grid Code for WPPs (Addendum No.1) are as follows:

Black Start and Islanded Operation:

Exempted

Active Power and Frequency Control:

Exempted from precise frequency control responsibility

Synchronization / De-Synchronization:

(i) The Wind Power Plant will manage for

  (a) Smooth Synchronization

  (b) Smooth De-Synchronization

(ii) The above operations, achieved through appropriate equipment, will be without jerk(s), felt on the grid system

Power Generation Capability Forecasting Requirement:

(i) Power Generation Capability Forecasting, of average power on hourly basis, will be managed by the Wind Power Plant as required from conventional power plants, except provisions of clause (ii) & (iii) below.

(ii) The forecasting, as required in (i), will be estimated by Wind Power Plant through

(a) Expected availability of plant during the period of forecast.

(b) Predicted value of wind speed at site based upon analysis of historic wind data available.

(iii) The forecasting, as required in (i), will be on the basis of total Wind Power Plant and break-up for each WTG will not be required.

(iv) The forecasted values will not be a binding upon the wind power plant as actual wind speeds may differ significantly from predicted values over short durations.

1.5 Input Data

The input data of HESCO / NTDC has been used in this study as per letter No. GMPP/CEMP/TRP-380/5097-99 dated 29-11-2016. The load forecast and the generation expansion plan of NTDC provided vide this letter has been used as shown in Appendix 2.

The input data regarding Shafi Wind Farm has been provided by the client who has indicated to use 2 MW Gamesa-G114 Type-3WTG. The main parameters of the WTGs have been attached in Appendix-2.

2. Description of Problem & Study Approach

2.1 Description of the Problem

In Pakistan, there is big wind power generation potential in the Southern parts of Sindh province, which is untapped as yet. However now with the establishment of Alternative Energy Development Board, this sector of power generation has taken an unprecedented stride and many entrepreneurs have come forward to build small and big Wind farms in this area.

The peculiar nature of wind power turbine is such that its output fluctuates in terms of MW and MVAR, being dependent on the wind speed and its direction. So long as the capacity of wind farm is less significant compared to the size of the power grid it is connected, these fluctuations are absorbable without compromising the power quality. But as the penetration of wind power in the power grid increases, the capability of the power grid may not be as strong as may be required to absorb constant variations of MW, MVAR and hence rapid deviation in voltage and frequency from the system's normal operating set point.

The existing power plants nearest to the vast wind farm areas of Jhimpir in the existing power grid are Kotri and Jamshoro Power Plants. Next to them is Hub with 1200 MW and Lakhra with 150 MW installed capacities respectively. Apparently this amount of generation in Southern grid seems strong enough to absorb the penetration of wind power. But there are other variables that necessitate detailed studies like strengths of nodes of connectivity, loading capacity of the transmission lines to evacuate power from Wind Farm area and dynamic response of wind turbine generators and neighboring conventional synchronous generators.

The dynamic response of power plants in the neighborhood may not be uniform; as some of them are gas turbines and some are steam turbines i.e. Kotri has gas turbines whereas Jamshoro, Lakhra and Hub have steam turbines. Normally gas turbines are faster than the steam turbines to respond to changes in the system. The dynamic studies will determine how they respond to dynamic behavior of Shafi WPP.

The above-mentioned thermal power plants do not run at their full capacity all along the whole year. During high water months when cheaper hydel power is abundantly available in the Northern grid of NTDC, many generating units of these plants are shut down for the sake of economic dispatch. Therefore in high hydel season, which is low thermal season by default, the southern power grid would get weaker in terms of system strength, especially during off-peak hours. The dynamics of this season is different than that of high thermal season.

There are different models of different sizes and make available in the market viz. GE, Vestas, Nordex, Gamesa, Siemens, Goldwind and Vensys etc. The dynamics of each model may be different with respect to grid's dynamics. Shafi Wind Power Plant is considering using 2 MW Gamesa G-114 Type-3 WTGs which are doubly fed asynchronous generators.

2.2 Approach to the problem

We will apply the following approaches to the problem:

- According to the COD of Shafi WPP as provided by the Client Shafi Energy Private Limited, we have decided to perform our analysis for the scenario of August/September 2019 to judge the maximum impact of the plant after the COD of the plant when the 220/132 kV Substation of Jhimpir-2 is commissioned.
- The base case for the year 2019 comprising all 500kV, 220kV and 132 kV, and 66kV system would be prepared envisaging the load forecast, the generation additions and transmission expansions for each year particularly in the Southern parts of the country. The case would include all the proposed and existing Wind Power Plants which have been developed or are going to be developed on a fast track basis and are expected to be commissioned by 2019 as per the latest schedule of AEDB.
- Interconnection scheme without any physical constraints, like right of way or availability of space in the terminal substations, would be identified.

- Perform technical system studies for peak load conditions of high wind seasons' power dispatches, to confirm technical feasibility of the interconnections.
- The proposed interconnection scheme will be subjected to steady state analysis (load flow), short circuit and transient stability to test the robustness of the scheme under normal and contingency conditions by checking steady state and transient/dynamic behavior under all events.
- Determine the relevant equipment for the proposed technically feasible scheme of interconnection.
- Perform sensitivity studies considering adjacent wind farms to check their impact on HESCO/NTDC Grid. This sensitivity check can be performed for the ultimate planned number of Wind Power Plants in the neighborhood of Shafi Wind PP.

3. Analysis of Network Prior to Shafi WPP Interconnection

3.1 Description of the Network

The electrical grid, which is relevant for interconnection of Shafi Wind PP, is the 500, 220 and 132 kV network that stretches through South of Hyderabad and Jamshoro up to coastal areas of Southern Sindh. The sketch of this network for the spot year 2019 after the addition of reinforcements in the area is shown in Appendix-4.

In this sketch, all the existing and proposed WPPs in the Jhimpir and Gharo clusters are modeled. Newly proposed 220/132kV substation of Jhimpir-2 is connected in loop in-out of the 220 kV Jamshoro – KDA double circuit and Jhimpir-1 – Gharo-New 220 kV single circuit. On 25th January 2017 a site visit was carried out to develop technically correct as well as least cost scheme for evacuation of power from these WPPs. Based on the location of the WPPs, two loops (each having 8 WPPs) were proposed at Jhimpir-2 grid station. The list of WPPs in each loop is provided below:

First Loop:

- Lakeside (50 MW)
- Nasda (50 MW)
- Trans-Atlantic (50 MW)
- Uni-Energy (50 MW)
- Iran Pak (50 MW)
- Artistic (50 MW)
- Act-2 (50 MW)
- Cacho (50 MW)

Second Loop:

- Gul Ahmed (50 MW)
- Metro-2 (60 MW)
- Zulaikha (50 MW)
- Din Energy (50 MW)
- Noor (50 MW)
- Indus (50 MW)

- Shafi Energy (50 MW)
- DHA-City (50 MW)

The details of the other 6 newly proposed WPPs is provided below:

- 14 MW Burj WPP connected via loop In-Out of 132 kV Thatta – FWEL-I single circuit
- Norinco-2 (50 MW), Sino Well (50 MW) and Tricom (50 MW) connected via loop In-out of the 132kV Jhimpir-1 – T.M.Khan 132kV single circuit
- Master Green (50 MW) connected via loop In-out of the proposed Nooriabad – Jamshoro Old 132kV single circuit
- Lootah Energy (50 MW) connected via loop In-out of the upcoming Jhimpir-1 – Tricon-A 132kV single circuit

We have carried out the studies of the case "without" Shafi WPP but including all the other planned and existing WPPs which have COD by 2019 to ascertain if there are any constraints in the system prior to Shafi WPP's commissioning.

3.1.1 Load Forecast

The load forecast of NTDC attached in Appendix-2 has been used for the preparation of all the study scenarios.

3.1.2 Generation and Transmission Expansion Plan

There is a sizable addition of generation in the Southern part of the country. The latest generation and transmission expansion plan provided by NTDCL has been used and is attached in Appendix-2.

3.2 Load Flow Analysis

Load flow analysis has been carried out for the NTDC / HESCO network including all the existing and planned wind power plants at Jhimpir and Gharo clusters but without including Shafi WPP to see if the network was adequate for dispersal of wind power without it. The case has been studied for the system conditions of August/September 2019. The month has been selected so that the Jhimpir-2 220/132 kV substation is completed before the commissioning of the said WPPs. In order to ensure proper economic dispatch in the southern area for this High Wind High Water Season, it was essential to have a reasonable energy mix with contributions from both thermal and wind power plants. We kept the dispatch of the nearby power plants such as Thatta, Nooriabad and Kotri-Site at its maximum. Kotri GTPS was operated at 50% capacity. Output from all the existing/ under construction/ planned Wind Plants was kept at maximum. The results are shown plotted in Exhibit 3.0 in Appendix-3 which indicates that no circuit is loaded more than its rated power carrying capacity and the voltage profile at all the bus bars of 132 kV, 220 kV and 500 kV is within the permissible range. All power plants are running at lagging power factor within their rated range.

The N-1 contingency check has also been applied and the results are attached in Appendix-3 as below:

Exhibit 3.1	Indus to DHA-City 132 kV Single Circuit Out
Exhibit 3.2	Gul Ahmed-E to Jhimpir-2 132 kV Single Circuit Out
Exhibit 3.3	DHA-City to Jhimpir-2 132kV Single Circuit Out
Exhibit 3.4	Lake Side to Jhimpir-2 132kV Single Circuit Out
Exhibit 3.5	Jhimpir-2 220/132 kV Single Transformer Out
Exhibit 3.6	Jhimpir-1 to T.M.Khan 132 kV Single Circuit Out
Exhibit 3.7	Jhimpir to Kotri GTPS 132 kV Single Circuit Out
Exhibit 3.8	Kotri GTPS to Jamshoro Old 132kV Single Circuit Out
Exhibit 3.9	Jhimpir-1 to T.M.Khan Road 220kV Single Circuit Out
Exhibit 3.10	Jhimpir-1 to Jhimpir-2 220kV Single Circuit Out
Exhibit 3.11	Jhimpir-2 to KDA-33 220kV Single Circuit Out
Exhibit 3.12	Jhimpir-2 to Jamshoro 220kV Single Circuit Out
Exhibit 3.13	Jamshoro 500/220 kV Single Transformer Out
Exhibit 3.14	Matiari to Dadu 500kV Single Circuit Out
Exhibit 3.14a	Matiari to Dadu 500 kV Single Circuit Out - Curtailment of Wind Generation by 600 MW
Exhibit 3.15	Jamshoro to Dadu 500kV Single Circuit Out

Exhibit 3.15a Jamshoro to Dadu 500 kV Single Circuit Out - Curtailment of Wind Generation by 600 MW

The load flow results of the network in the close vicinity of Shafi WPP shown plotted in Exhibits 3.1 to 3.13 indicate that all the power flows on the lines are within the rated limits of this network.

For some critical outages of 500kV circuits shown in Exhibit 3.14 and 3.15, capacity constraint was observed in 500kV network emanating from Jamshoro and upwards. Due to this capacity constraint, partial curtailment in the output of all WPPs under study was proposed to bring the loading on the 500kV network within limit. Results are shown in Exhibit 3.14(a) and 3.15(a). The details of the curtailment of WPPs are provided below:

Plant Name	Gross output	Curtailed Output
Nasda	50 MW	7 MW
Uni-Energy	50 MW	7 MW
Indus	50 MW	7 MW
Noor	50 MW	7 MW
Sino Well	50 MW	7 MW
Lootah	50 MW	7 MW
Shafi Energy	50 MW	7 MW
Master Green	50 MW	7 MW
Iran Pak	50 MW	7 MW
Metro-2	60 MW	9 MW
Norinco-2	50 MW	7 MW
DHA City	50 MW	7 MW
Tricom	50 MW	7 MW

Otheir power, and has no limitations in terms of power transfer capacity under normal as well as N-1 contingency, prior to connection of Shafi WPP. We will check the adequacy of network after adding Shafi WPP in Chapter 6.

4. Development of Interconnection Scheme

4.1 Interconnection of Shafi 50 MW WPP

To connect the wind farms to the main grid of NTDC / HESCO, one may think of connecting each Farm with any nearby available 132 kV substation by laying a direct 132 kV circuit from the gantry of each Farm's substation. But it is important to first see if the nearby substation has enough short circuit strength to connect to a Wind farm having characteristics of time-varying output because flicker and harmonics' resonance are a function of short circuit MVA of that node where this variation would be occurring.

In case there is a potential of developing of several Wind Farms in the same area, then a better interface or common coupling point may be a collector substation where each Wind Farm is connected and then this collector substation is connected to suitable node or nodes of the main national grid system. From suitable node or nodes we mean the nodes (bus bars) having relatively higher short circuit levels to mitigate the impact of time-variant generation from WTG.

In case of Shafi WPP, the nearest substation is the collector substation of Jhimpir-2 220/132 kV which is proposed for evacuation of power from already planned 10 WPPs and will be operational before the commissioning of the said power plant.

4.2 Proposed Interconnection Scheme

The scheme of interconnection of Shafi WPP proposes the following reinforcements in place at Jhimpir cluster.

- 220 kV D/C transmission line approx. 5km long on twin bundled Greeley conductor looping In/out of second circuit of existing Jamshoro – KDA-33 D/C transmission line at the proposed Jhimpir-2 220/132 kV substation
- Addition of 4th 220/132 kV transformer at the newly proposed Jhimpir-2 220/132 kV substation.

- 132kV double circuit transmission line approx. 135 km long on twin bundled Greeley conductor for connecting 8 WPPs in the first loop to Jhimpir-2 220/132 newly proposed substation.
- 132kV double circuit transmission line approx. 168 km long on twin bundled Greeley conductor for connecting 8 WPPs in the second loop to Jhimpir-2 220/132 newly proposed substation.
- In this scheme the interconnection of Shafi WPP (which is placed in second loop) includes 132 kV D/C transmission line approx. 7 km long, on twin bundled Greeley conductor for looping in/out on the 132kV single circuit from Indus WPP to DHA-City WPP grid station.

The connection scheme of Shafi WPP for the scenario of August/September 2019 as shown in Appendix - 4 is by interconnecting Shafi in the second loop proposed at Jhimpir-2 220/132 kV substation. Shafi Wind Power Plant would be connected by a double circuit of 132 kV looping in-out with a sub cluster connecting neighboring Wind Power Plants of Indus 50 MW, DHA-City 50 MW and other 5 WPPs in the second loop with Jhimpir-2 220/132 kV collector substation. It should be noted that the length of circuits used for the simulations are confirmed from site visit and agreed with NTDC official. They may change slightly during the implementation of the project. In addition, the connectivity of Shafi WPP with neighboring wind power plants may change, depending upon the COD of the project.

5. Modeling of Shafi Wind Farm

5.1 Electrical Layout of Wind Farm

5.1.1 Shafi WPP Energy Selection

Shafi has selected Type-3 Gamesa WTGs which they are considering to install on their Wind Farm at Jhimpir. It is a doubly fed asynchronous generator. Each WTG would step up from its terminal LV voltage of 0.69 kV to a medium voltage (MV) that will be 22 kV.

5.1.2 Electrical Layout

The WTGs would be connected to MV collector cables of 22 kV laid down in the Farm connecting each line (row) of the WTGs to the Farm substation. The layout is shown in **Sketch – 3** (Appendix-5), briefly described as follows;

Line – 1	WTGs 1-6	(6 x 2= 12 MW)
Line – 2	WTGs 7-12	(6 x 2 = 12 MW)
Line – 3	WTGs 13-18	(6 x 2= 12 MW)
Line – 4	WTGs 19-25	(7 x 2= 14 MW)

The average length of cable between the two WTGs has to be enough to completely out do the wake effect from the adjoining WTG based on thumb rule to leave 4xD (rotor diameter) between the WTGs to take care of wake effect. In actual micro-siting the distances between WTGs might be slightly different due to many other factors. We have taken about 400 meters distances between the WTGs.

The Farm Substation has been assumed to be located somewhere in the middle of the Farm.

The four collector circuits of 22 kV would thus be laid as shown in Sketch-3 and explained as follows;

Collector Line-1	from WTG-1 to Farm Substation
Collector Line-2	from WTG-7 to Farm Substation
Collector Line-3	from WTG-13 to Farm Substation
Collector Line-4	from WTG-19 to Farm Substation

Since each collector would carry a max of approximately 14 MW at normal rating, the 22 kV collector circuits loading capacity should be in the range of 16 MVA each, giving some margin for reactive power at 0.95 Power Factor and some losses in the circuits with certain overload capacity as well.

5.1.3 22 kV Collector Circuits

The MV voltage level selected by Shafi for interconnection of collector groups of WTGs in the Farm is 22 kV. Underground cables will be used with length of approx. 3 km. Further details regarding the type of cable is provided in Appendix - 2.

5.2 Wind Farm Substation 132/22 kV

A substation would be built in the middle of the Farm to collect all the power from the WTGs, spread out in the Farm, at medium voltage (MV) level of 22 kV and step-up this power to high voltage (HV) level of 132 kV so that the Farm's output may be evacuated to the main grid of NTDC. The single line diagrams of the substation are briefly shown in Sketch-1 and 2 in Appendix-5 for 22 kV and 132 kV respectively.

Keeping in view the data provided by the Client, the bus bar scheme for 132 kV level is double bus with a coupler i.e. double bus-single-breaker scheme. Keeping in view the NTDC/DISCOs practice, we propose to provide good reliability to a power plant as follows:

- Single bus scheme with a sectionalizer to enable to have two bus sections at 22 kV.
- Double-bus single-breaker scheme with a Bus Coupler at 132 kV

The schemes are shown in Sketch-1 and 2 respectively and described as follows.

5.2.1 Conceptual Design of 22 kV

The single line diagram SLD–1 in Appendix-5 shows the conceptual design of 22 kV (MV) bus bar of the Farm substation. It comprises of

- Two single bus-sections of 22 kV with a bus sectionalizer
- Four breaker bays to connect four collector double circuits of WTG Lines 1-4
- Two breaker bays to connect two transformers of 132/22 kV

- Two breaker bays for connecting two auxiliary transformers of 22/0.4 kV
- Two breaker bays to connect switched shunt capacitor banks

Rating of all the breakers and bus bar equipment would be

Short circuit rupturing capacity = 31.5 kA

Normal continuous current = 1250 A for line breakers

= 2500A for Bus Sectionalizer and Power TF

5.2.2 Conceptual Design of 132 kV

Single-line-diagram SLD–2 (Appendix–5) shows 132 kV bus bars of the Farm substation, which would comprise as follows:

- Double bus bars with a Bus Coupler
- Two breaker bays to connect two transformers 132/22 kV
- Two breaker bays to connect two circuits of 132 kV i.e. double circuit on single tower overhead line to connect to the grid system.

Rating of all the breakers and bus bar equipment would be

Short circuit rupturing capacity = 40 kA

Normal continuous current = 1250 A for line and TF breakers

= 2500 A for Bus Sectionalizer

The other equipment of the substation consists of:

- Two 132/22 kV, 30/40/50 MVA ONAN/ONAF1/ONAF2 OLTC transformers, 132±11×1%/22kV, to fulfill N-1 criteria of Grid Code
- Two station auxiliary transformers 22/0.4 kV
- Two switched shunt capacitor banks each of the size of 10 MVAR (5 x 2 MVAR) with contactors and PLC (Programmable Logic Controller).
- Energy meters would be installed on HV side (132 kV) of the 132/22kV transformers.

6. Load Flow Analysis

Load flow analysis has been carried out for the proposed scheme of interconnection of Shafi WPP with NTDC grid for the base scenario of September 2019.

6.1 Modeling of Wind Farm in Load Flow

Representation of all the individual machines in a large Wind Farm is inappropriate in most grid impact studies [1]. There is a provision in the model structure of PSS/E to allow single equivalent WTG machine model to represent multiple WTGs. However there are limitations. Disturbances within the local collector grid cannot be analyzed, and there is some potentially significant variation in the equivalent impedance for the connection to each machine. A single machine equivalent requires the approximation that the power output of all the machines will be the same at a given instant of time. For grid system impact studies, simulations are typically performed with the initial wind of sufficient speed to produce the rated output on all the machines. Under this condition, the assumption that all the machines are initially at the same (rated) output is not an approximation [2]. Otherwise this assumption presumes that the geographic dispersion is small enough that the wind over the farm is uniform. Though simulations of bulk system dynamics using a single machine equivalent are adequate for most planning studies, we have adopted a rather more detailed level of modeling by using an equivalent machine just for one group of WTGs connected to one collector feeder. Since we have four collector feeders connecting to four groups of WTGs, therefore there are four equivalent WTGs assumed for each collector group in this study report.

The Farm Substation is represented by two bus bars as Shafi medium voltage bus named Shafi-MV 22 kV and Shafi 132 kV, with two inter-bus transformers of 30/40/50 MVA each. These transformers have an overload capacity of 50 MVA for a limited time to cover N-1 contingency criteria of Grid Code i.e. in case of outage of one transformer, the other can take up the full output of Farm i.e. 50 MVA.

6.2 Reactive Power Requirements

Shafi is considering using 2 MW Gamesa Type-3 WTGs, which are doubly fed asynchronous generators, in their WPP. Its power factor is 0.95 lagging (capacitive/generating) and 0.95 leading (inductive/absorbing).The maximum reactive power output that can be available at the 0.69 kV terminal is 0.66 MVAR for each WTG. Part of this reactive power will be consumed by the 0.69/22 kV step-up (GSU) transformer and the rest may be consumed in the MV collector cables of the wind farm. However some reactive power might reach the MV bus bar of Farm substation. That means each WTG is self sufficient to meet VAR absorption requirement of its step-up transformer with some contribution of VARs to the Farm MV network.

The Grid Code Addendum No.1 requires to meet the criteria of ± 0.95 power factor at the point of interconnection with the NTDC/HESCO grid at 132 kV (point of common coupling). Therefore a Farm of 50 MW generating capacity is required to pump 16.43 MVAR to the grid at full output of 50 MW. The VAR generating capability of WTG at 0.95 PF will not be able to fully meet this VAR demand of the system because of VAR loss in step-up transformers, collector cables and the HV/MV i.e. 132/22 kV transformers at the Farm substation. In order to meet the Grid Code criteria, we need to install switched shunt capacitor bank at 22 kV bus of the Farm substation of sufficient size capable of delivering approx. 16.42 MVAR at 132 kV bus after VAR loss across 132/22 kV transformers.

6.3 Load Flow Analysis for Peak Load Scenario of August/September 2019

Load flow analysis has been carried out for the NTDC / HESCO network to see the steady state impact of adding the generation of Shafi WPP on the network including the existing/under-construction/planned WPPs in the Jhimpir and Gharo Cluster. The network configuration is same for Jhimpir and Gharo clusters as indicated in Appendix-4 and discussed in Ch. 3.

The integrated case has been studied for the system conditions of summer 2019, the time line associated with the COD of Shafi WPP and after the commissioning of the newly proposed 220/132 kV substation in the southern part of Jhimpir. In order to ensure proper economic dispatch in the southern area for this High Wind High Water Season, it was essential to have a reasonable energy mix with contributions from both thermal and wind power plants. We kept the dispatch of the nearby power plants such as Thatta, Nooriabad and Kotri-Site at its maximum. Kotri GTPS was operated at 50% capacity. Output from all the existing/ under construction/ planned Wind Plants was kept at maximum.

Load flow simulations have been run for normal and contingency conditions. The results are shown plotted in Appendix-6.

6.3.1 Normal Case

Exhibit 6.1.0 shows the normal case under the system conditions of summer 2019. All the wind farms in Jhimpir and Gharo clusters with installed capacity of 50 MW or 49.5 MW have been assumed after deducting Farm losses and given some diversity in the maximum output of all the Wind Power Plants at one time. For Shafi WPP, 47.9 MW is assumed to be delivered at the point of delivery to grid at 132 kV.

All these loadings are within the rated limits of these circuits. The bus voltages on all the substations in Southern HESCO grid are within the normal limits of operation.

We see that all the WTGs are running at a power factor above its rated value of 0.90 not using full reactive power capability leaving enough margin to cover contingencies. The switched shunt capacitor bank of 20 MVAR at 22 kV bus bar is supplying 20.42 MVAR at (22.39 kV) voltage and, after VAR loss across 132/22 kV transformers, supplying about 16.42 MVAR (nearly 0.95 PF) at 132 kV bus i.e. fulfilling the Grid Code criteria at the point of interconnection. The voltage profile on all the bus bars of 132 kV of HESCO grid are well within the normal operating criteria of ± 5 % off the nominal.

6.3.2 Contingency cases and evolving of reliable scheme

The N-1 contingency cases have been run and the results have been shown plotted as under:

Exhibit 6.1.1	Shafi Energy 132/22 kV Single Transformer Out
Exhibit 6.1.2	Shafi Energy to DHA-City 132kV Single Circuit Out
Exhibit 6.1.3	Indus to Shafi Energy 132kV Single Circuit Out
Exhibit 6.1.4	Lake Side to Jhimpir-2 132kV Single Circuit Out
Exhibit 6.1.5	DHA-City to Jhimpir-2 132kV Single Circuit Out
Exhibit 6.1.6	Jhimpir-2 220/132 kV Single Transformer Out
Exhibit 6.1.7	Jhimpir-1 to T.M.Khan 132 kV Single Circuit Out
Exhibit 6.1.8	Jhimpir to Kotri GTPS 132 kV Single Circuit Out
Exhibit 6.1.9	Kotri GTPS to Jamshoro Old 132 kV Single Circuit Out
Exhibit 6.1.10	Jhimpir-1 to TM.KH.RD 220 kV Single Circuit Out
Exhibit 6.1.11	Jhimpir-1 to Jhimpir-2 220 kV Single Circuit Out
Exhibit 6.1.12	Jhimpir-2 to KDA-33 220 kV Single Circuit Out
Exhibit 6.1.13	Jhimpir-2 to Jamshoro 220 kV Single Circuit Out
Exhibit 6.1.14	Jamshoro 500/220 kV Single Transformer Out
Exhibit 6.1.15	Matiari to Dadu 500 kV Single Circuit Out
Exhibit 6.1.15a	Matiari to Dadu 500 kV Single Circuit Out - Curtailment of Wind Generation by 600 MW
Exhibit 6.1.16	Jamshoro to Dadu 500 kV Single Circuit Out
Exhibit 6.1.16a	Jamshoro to Dadu 500 kV Single Circuit Out - Curtailment of Wind Generation by 600 MW

The load flow results of the network in the close vicinity of Shafi WPP shown plotted in Exhibits 6.1.1 to 6.1.14 indicate that all the power flows on the lines are within the rated limits of this network.

For some critical outages of 500kV circuits shown in Exhibit 6.1.15 and 6.1.16, capacity constraint was observed in 500kV network emanating from Jamshoro and upwards. Due to this capacity constraint, partial curtailment in the output of all WPPs under study was proposed to bring the loading on the 500kV network within limit. Hence output of Shafi WPP is curtailed to 7 MW in case of these contingency events. Results are shown in Exhibit 6.1.15(a) and 6.1.16(a). The details of the curtailment of WPPs are provided below:

Plant Name	Gross output	Curtailed Output
Lake Side	50 MW	7 MW
Nasda	50 MW	7 MW
Uni-Energy	50 MW	7 MW
Indus	50 MW	7 MW
Noor	50 MW	7 MW
Sino Well	50 MW	7 MW
Lootah	50 MW	7 MW
Shafi Energy	50 MW	7 MW
Master Green	50 MW	7 MW
Iran Pak	50 MW	7 MW
Metro-2	60 MW	9 MW
Norinco-2	50 MW	7 MW
DHA City	50 MW	7 MW
Tricom	50 MW	7 MW

Total Wind Capacity: 724 MW
Wind Capacity after curtailment: 113 MW

The results also show that under all events of outages the switched shunt capacitor banks at 22 kV bus regulates the voltage under all events. The reactive power being supplied by the 20 MVAR switched shunt capacitor banks as proposed by the client connected at 22 kV bus, maintains the supply of VARS to the grid under all contingencies adjusting its output according to the system requirement.

In addition, twin bundled Greeley conductor (368 MVA) is used for the interconnection of all the wind farms coming in this second loop at Jhimpir-2 220/132 kV collector substation. In the load flow simulation, however, the MVA capacity is assumed to be 404 MVA taking into account the increase in MVA capacity of the conductors at high wind speed during high wind season. This is true for all the conductors in the area, whether lynx or rail, a 10% increase in the thermal rating is assumed.

6.4 Load Flow Analysis for Off-Peak Load Scenario of August/September 2019

Load flow analysis has been carried out for the off-peak conditions of August/September 2019 for the NTDC / HESCO network to see the steady state impact of reduced loads and generations as a higher loading on the circuits is expected during the off-peak conditions.

Load flow simulations have been run for normal and contingency conditions. The results are shown plotted in Appendix-6.

Exhibit 6.2.0 shows the normal case under the off-peak system conditions of August/September 2019. All these loadings are within the rated limits of these circuits. The bus voltages on all the substations in Southern HESCO grid are within the normal limits of operation.

The N-1 contingency cases have been run and the results have been shown plotted as under:

Exhibit 6.2.1	Shafi Energy 132/22 kV Single Transformer Out
Exhibit 6.2.2	Shafi Energy to DHA-City 132kV Single Circuit Out
Exhibit 6.2.3	Indus to Shafi Energy 132kV Single Circuit Out
Exhibit 6.2.4	Lake Side to Jhimpir-2 132kV Single Circuit Out
Exhibit 6.2.5	DHA-City to Jhimpir-2 132kV Single Circuit Out
Exhibit 6.2.6	Jhimpir-2 220/132 kV Single Transformer Out
Exhibit 6.2.7	Jhimpir-1 to T.M.Khan 132 kV Single Circuit Out
Exhibit 6.2.8	Jhimpir to Kotri GTPS 132 kV Single Circuit Out

Exhibit 6.2.9 Kotri GTPS to Jamshoro Old 132 kV Single Circuit Out

Exhibit 6.2.10 Jhimpir-1 to TM.KH.RD 220 kV Single Circuit Out

Exhibit 6.2.11 Jhimpir-1 to Jhimpir-2 220 kV Single Circuit Out

Exhibit 6.2.12 Jhimpir-2 to KDA-33 220 kV Single Circuit Out

Exhibit 6.2.13 Jhimpir-2 to Jamshoro 220 kV Single Circuit Out

Exhibit 6.2.14 Jamshoro 500/220 kV Single Transformer Out

Exhibit 6.2.15 Matiari to Dadu 500 kV Single Circuit Out

Exhibit 6.2.15a Matiari to Dadu 500 kV Single Circuit Out - Curtailment of Wind Generation by 600 MW

Exhibit 6.2.16 Jamshoro to Dadu 500 kV Single Circuit Out

Exhibit 6.2.16a Jamshoro to Dadu 500 kV Single Circuit Out - Curtailment of Wind Generation by 600 MW

The load flow results of the network in the close vicinity of Shafi WPP shown plotted in Exhibits 6.2.1 to 6.2.14 indicate that all the power flows on the lines are within the rated limits of this network.

For some critical outages of 500kV circuits shown in Exhibit 6.2.15 and 6.2.16, capacity constraint was observed in 500kV network similar to the peak scenario discussed above. Hence curtailment of WPPs as discussed above was carried out in this off-peak scenario as well. Results after curtailment are shown in Exhibit 6.2.15(a) and 6.2.16(a).

6.5 Load Flow Analysis for Future Scenario of 2022

Load flow analysis has been carried out for the peak conditions for future scenario of 2022 for the NTDC / HESCO network. All the future reinforcements that were proposed till 2022 are modeled in the case.

Load flow simulations have been run for normal and contingency conditions. The results are shown plotted in Appendix-6.

Exhibit 6.3.0 shows the normal case under the peak system conditions of future year 2022. All these loadings are within the rated limits of these circuits. The bus voltages on all the substations in Southern HESCO grid are within the normal limits of operation.

The N-1 contingency cases have been run and the results have been shown plotted as under:

Exhibit 6.3.1	Shafi Energy 132/22 kV Single Transformer Out
Exhibit 6.3.2	Shafi Energy to DHA-City 132kV Single Circuit Out
Exhibit 6.3.3	Indus to Shafi Energy 132kV Single Circuit Out
Exhibit 6.3.4	Lake Side to Jhimpir-2 132kV Single Circuit Out
Exhibit 6.3.5	DHA-City to Jhimpir-2 132kV Single Circuit Out
Exhibit - 6.3.6	Jhimpir-2 220/132 kV Single Transformer Out
Exhibit - 6.3.7	Jhimpir-1 to T.M. Khan 132 kV Single Circuit Out
Exhibit - 6.3.8	Jhimpir to Kotri GTPS 132 kV Single Circuit Out
Exhibit - 6.3.9	Kotri GTPS to Jamshoro Old 132 kV Single Circuit Out
Exhibit - 6.3.10	Jhimpir-1 to TM Khan Road 220 kV Single Circuit Out
Exhibit - 6.3.11	Jhimpir-1 to Jhimpir-2 220 kV Single Circuit Out
Exhibit - 6.3.12	Jhimpir-2 to KDA-33 220 kV Single Circuit Out
Exhibit - 6.3.13	Jhimpir-2 to Jamshoro 220 kV Single Circuit Out
Exhibit - 6.3.14	Jamshoro 500/220 kV Single Transformer Out
Exhibit - 6.3.15	Matiari to Dadu 500 kV Single Circuit Out
Exhibit - 6.3.16	Jamshoro to Dadu 500 kV Single Circuit Out

The results show that power flows on intact 132 kV circuits remain within their rated limits. For this future scenario of 2022, the issue of capacity constraint that was observed in the base case of 2019 is resolved due to the following major reinforcements in the system:

- 660kV HVDC from Matiari to Lahore
- 660kV HVDC from Port Qasim to Faisalabad West

6.6 Conclusion of Load Flow Results

With the proposed reinforcements and the curtailment process for the base year of 2019 under special circumstances, the load flow results of the proposed scheme of interconnection of Shafi WPP shows no bottlenecks or capacity constraints in the adjoining 500 kV, 220 kV and 132 kV network in terms of absorbing all the output of Shafi WPP under normal as well as the contingency conditions for all the scenarios studied.

Shafi Wind Power Plant would be connected by a double circuit of 132 kV looping in-out with a sub cluster connecting neighboring Wind Power Plants of Indus 50 MW, DHA-City 50 MW and 5 other WPPs in the same loop to Jhimpir-2 220/132 kV collector substation. Twin bundled Greeley conductor with the capacity of 368 MVA per circuit is assumed to have a thermal limit of 404 MVA taking into account the increase in MVA capacity of the conductors at high wind speed during high wind season.

References:

1- WECC Wind Generator Modeling Group; *Generic Type-3 Wind Turbine-Generator Model for Grid Studies; Version 1.1*, September 14, 2006, p. 2.2

2- *Ibid.* p:3.1

7. Short Circuit Analysis

7.1 Methodology and Assumptions

The methodology of IEC 909 has been applied in all short circuit analyses in this report for which provision is available in the PSS/E software used for these studies. For calculations of maximum fault levels the bus voltage has been assumed as 1.1 PU i.e. 10 % above the nominal as per IEC909. For calculations of minimum fault levels the bus voltage has been assumed as 0.9 PU i.e. 10 below the nominal. That covers the entire ± 10 % range of the ratings of the equipment.

7.1.1 Assumptions for maximum and minimum short circuit levels

7.1.1.1 Assumptions-Maximum short circuit levels

For evaluation of maximum short circuit levels we have assumed contribution in the fault currents from all the installed generation capacity of hydel, thermal and nuclear plants in the system in the future year of 2022 to assess the maximum impact of Shafi WPP.

The maximum fault currents have been calculated with the following assumptions under IEC909:

- Set tap ratios to unity
- Set line charging to zero
- Set shunts to zero in positive sequence

Desired voltage magnitude at bus bars set equal to 1.10 P.U. i.e. 10 % higher than nominal, which is the maximum permissible voltage under contingency condition.

However tabular results of some significant bus bars of 220 kV and 132 kV in the electrical vicinity of Shafi WPP have also been produced and placed in Appendix-7.

7.1.1.2 Assumptions-Minimum Short Circuit Levels

The minimum fault currents are important for the evaluation of power quality issues such as flicker, unbalance, sudden voltage dip and harmonics.

To assess the minimum short circuit levels we have considered conditions of 2019 to simulate the minimum short circuit strength of southern grid. For Shafi WPP we have assumed dispatch of 25% of its capacity for the minimum short circuit calculations i.e. just one collector group with partial output of approx. 12 MW is on bar.

For minimum fault currents we have applied the following assumptions under IEC 909:

- Set tap ratios to unity
- Set line charging to zero
- Set shunts to zero in positive sequence

Desired voltage magnitude at bus bars set equal to 0.9 P.U. i.e. 10 % lower than nominal, which is the minimum permissible voltage under contingency condition.

7.2 Fault Currents Calculations

7.2.1 Maximum Short Circuit Levels for the Year 2022

The short circuit levels have been calculated and plotted on the bus bars of 500 kV, 220 kV and 132 kV of substations lying in the electrical vicinity of our area of interest i.e. Jhimpir, T.M.Khan Road, Jamshoro and Gharo area, and are shown plotted in the Exhibit 7.2 for the scenario of 2022 and attached in Appendix-7. Both 3-phase and 1-phase fault currents are indicated in the Exhibit which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabular output of the short circuit calculations is also attached in Appendix-7 for the 500 kV, 220 kV and 132 kV bus bars of our interest i.e. the substations connecting in the three branches of 132 kV running South of Hyderabad up to Southern Sind coast line. The tabular output is the detailed output showing the contribution to the fault current from the adjoining sources i.e. the lines and transformers connected to that bus. The phase currents, the sequence currents and the sequence impedances are shown in detail for each faulted bus bar.

The total maximum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 7.1. We see that the maximum fault currents do not exceed the short circuit ratings of the equipment at these 132 kV substations which normally are 25 kA or 31.5 kA for older substations and 40 kA for new substations.

The fault levels of Shafi 132 kV are 7.53 kA and 7.26 kA for 3-phase and single phase faults respectively for 2022. This is much less than the switchgear rating of 40 kA recommended for Shafi Farm Substation as per NTDC requirements for 132 kV.

The fault levels for Shafi 22 kV are 18.13 kA and 20.23 kA for 3-phase and single-phase faults respectively for 2022. Therefore the short circuit rating recommended for 22 kV switchgear is recommended as 31.5 kA.

Table-7.1

Maximum Short Circuit Levels with Shafi WPP – 2022

Substation	3-Phase Fault Current (kA)	1-Phase Fault Current (kA)
Shafi 132 Kv	7.53	7.26
Shafi MV 22 kV	18.13	20.23
DHA-City 132 kV	10.29	8.20
Indus 132 kV	7.45	7.27
T.M.Khan132 kV	14.80	14.24
Hala Rd. 220 kV	29.68	22.90
Hala Road 132 kV	22.36	21.44
Jamshoro New 132 kV	25.25	24.90
Jamshoro Old 132 kV	23.84	22.88
Nooriabad 132 kV	11.92	13.16
TM.KH.RD 200 kV	22.56	18.46
Jhimpir-2 132 kV	24.21	22.22
Jhimpir-2 220 kV	29.86	21.96
Jhmipir-1 220 kV	23.18	18.06
Gharo-New 220 kV	10.17	8.00

Gharo-New 132 kV	10.37	9.81
Kotri Gtps 132 kV	19.73	19.01
Jhimpir-1 132 kV	30.36	26.69
Jhimpir 132 kV	11.45	10.49
Thatta 132 kV	6.62	6.50

7.2.2 Minimum short circuit levels

The minimum fault levels have been calculated for minimum dispatch of power in the grid system. The plotted results of short circuit analysis are attached as Exhibit 7.1. Both 3-phase and 1-phase fault currents are indicated in the Exhibit which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the faulted bus bar.

The tabular output of the short circuit calculations is also attached in Appendix-7 for the 132 kV bus bars of our interest.

The total minimum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 7.2.

Table-7.2

Minimum Short Circuit Levels with Shafi WPP 2019

Substation	3-Phase Fault Current (kA)	1-Phase Fault Current (kA)
Shafi 132 kV	5.36	5.23
Shafi MV 22 kV	13.60	14.01
DHA-City 132 kV	7.75	6.47
Indus 132 kV	5.15	5.16
T.M.Khan132 kV	10.92	10.64
Hala Rd. 220 kV	18.13	14.89
Hala Road 132 kV	15.58	15.20

Jamshoro New 132 kV	16.89	16.90
Jamsro Old 132 kV	15.93	15.61
Nooriabad 132 kV	7.88	8.41
TM.KH.RD 200 kV	14.89	12.92
Jhimpir-2 132 kV	16.98	16.26
Jhimpir-2 220 kV	19.00	15.65
Jhmipir-1 220 kV	14.88	13.40
Gharo-New 220 kV	7.42	6.31
Gharo-New 132 kV	7.44	7.52
Kotri Gtps 132 kV	13.25	12.28
Jhimpir-1 132 kV	18.25	18.97
Jhimpir 132 kV	7.31	6.89
Thatta 132 kV	4.74	4.71

7.3 Conclusions of Short Circuit Analysis

As a whole for the peak scenario of 2022, the fault levels at all the 132 kV bus bars are well below the short circuit rating of the equipment at these substations.

The fault levels of Shafi 132 kV are 7.53 kA and 7.26 kA for 3-phase and single phase faults respectively for 2022. This is much less than the switchgear rating of 40 kA recommended for Shafi Farm Substation as per NTDC requirements for 132 kV.

The fault levels for Shafi 22 kV are 18.13 kA and 20.23 kA for 3-phase and single-phase faults respectively for 2022. Therefore the short circuit rating recommended for 22 kV switchgear is 31.5 kA.

Similarly for minimum short circuit case for the year 2019, the fault levels are also well below the short circuit rating of the equipment at these substations.

The short circuit strength is very important for Power Quality issues like flicker, harmonics and voltage unbalance. Exhibit 7.1.1 and 7.1.2 show the results of minimum fault levels in MVA to be used in Power Quality analysis carried out in Ch.9.

The fault levels indicate that there are no constraints in terms of short circuit ratings of the equipment of the adjoining substations and there is improvement in minimum fault levels. The proposed interconnection scheme holds well on the basis of short circuit analysis as well.

8. Transient Stability Analysis

The objective of transient stability study is to see:

1. Dynamic impact of Shafi Wind Power Plant on the System
2. Dynamic impact of the System on Shafi Wind Power Plant

8.1 Assumptions & Methodology

8.1.1 Type-3 WTG Dynamic Model

Shafi is considering using Doubly Fed Asynchronous Generator which is designated as Type-3 WTG in their Wind Power Plant. We have used the generic Type-3 wind turbine-generator model, which has been developed and has been made available by Siemens–PTI to their users of PSS/E software. Only the main parameters have been incorporated in this model, whereas other details and minute control parameters have been based on assumptions in the controllers of generic model of Siemens-PTI software PSS/E.

8.2 Dynamic Impact of System Disturbances

8.2.1

Fault Type: 3-Phase			
Fault Location: Shafi 132 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: Shafi to DHA-City 132 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Shafi 132 kV 2. Shafi MV 22 kV 3. DHA-City 132 kV 4. Indus 132 kV 5. Jhimpir-2 132 kV 6. Jhimpir-2 220 kV	The voltages of all the bus bars recover after fault clearance	8.1.1
Frequency	Shafi	Recovers after fault clearance	8.1.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.1.3

• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.1.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.1.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.1.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.1.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.1.8
• **MW Line Flow** • **MVAR Line Flow**	Shafi to Indus 132 kV intact single circuit	Recovers after damping down oscillations	8.1.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.1.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.1.11

8.2.2

Fault Type: 1-Phase			
Fault Location: Shafi 132 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: Shafi to DHA-City 132 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Shafi 132 kV 2. Shafi MV 22 kV 3. DHA-City 132 kV 4. Indus 132 kV	The voltages of all the bus bars recover after fault clearance	8.2.1

	5. Jhimpir-2 132 kV 6. Jhimpir-2 220 kV		
Frequency	Shafi	Recovers after fault clearance	8.2.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.2.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.2.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.2.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.2.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.2.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.2.8
• **MW Line Flow** • **MVAR Line Flow**	Shafi to Indus 132 kV intact single circuit	Recovers after damping down oscillations	8.2.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.2.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.2.11

8.2.3

Fault Type: 3-Phase			
Fault Location: Shafi 132 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: Shafi to Indus 132 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure**

			No.
Voltage	1. Shafi 132 kV 2. Shafi MV 22 kV 3. DHA-City 132 kV 4. Indus 132 kV 5. Jhimpir-2 132 kV 6. Jhimpir-2 220 kV	The voltages of all the bus bars recover after fault clearance	8.3.1
Frequency	Shafi	Recovers after fault clearance	8.3.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.3.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.3.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.3.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.3.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.3.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.3.8
• **MW Line Flow** • **MVAR Line Flow**	Shafi to DHA-City 132 kV intact single circuit	Recovers after damping down oscillations	8.3.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.3.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.3.11

8.2.4

Fault Type: 1-Phase			
Fault Location: Shafi 132 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: Shafi to Indus 132 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Shafi 132 kV 2. Shafi MV 22 kV 3. DHA-City 132 kV 4. Indus 132 kV 5. Jhimpir-2 132 kV 6. Jhimpir-2 220 kV	The voltages of all the bus bars recover after fault clearance	8.4.1
Frequency	Shafi	Recovers after fault clearance	8.4.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.4.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.4.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.4.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.4.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.4.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.4.8
• **MW Line Flow** • **MVAR Line Flow**	Shafi to DHA-City 132 kV intact single circuit	Recovers after damping down oscillations	8.4.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.4.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV	Damps down quickly and	8.4.11

	3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	attain a steady state value	

8.2.5

Fault Type: 3-Phase			
Fault Location: Shafi MV 22 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: Shafi 132/22 kV Single Transformer			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Shafi MV 22 kV 2. Shafi 132 kV 3. DHA-City 132 kV 4. Indus 132 kV 5. Jhimpir-2 132 kV 6. Jhimpir-2 220 kV	The voltages of all the bus bars recover after fault clearance	8.5.1
Frequency	Shafi 132 kV	Recovers after fault clearance	8.5.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.5.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.5.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.5.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.5.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.5.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.5.8
• **MW Line Flow** • **MVAR Line Flow**	Shafi 132/22 kV single transformer	Recovers after damping down oscillations	8.5.9

• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.5.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.5.11

8.2.6

Fault Type: 3-Phase			
Fault Location: Shafi MV 22 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: Shafi one collector group of 12 MW			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Shafi MV 22 kV 2. Shafi 132 kV 3. DHA-City 132 kV 4. Indus 132 kV 5. Jhimpir-2 132 kV 6. Jhimpir-2 220 kV	The voltages of all the bus bars recover after fault clearance	8.6.1
Frequency	Shafi 132 kV	Recovers after fault clearance	8.6.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.6.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.6.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.6.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.6.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.6.7

• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.6.8
• **MW Line Flow** • **MVAR Line Flow**	Shafi 132/22 kV single transformer	Recovers after damping down oscillations	8.6.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.6.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.6.11

8.2.7

Fault Type: 3-Phase			
Fault Location: Indus 132 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: Indus to Shafi 132 kV			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Indus 132 kV 2. Shafi 132 kV 3. Shafi MV 22 kV 4. DHA-City 132 kV 5. Jhmipir-2 132 kV 6. Jhimpir-2 220 kV	The voltages of all the bus bars recover after fault clearance	8.7.1
Frequency	Shafi	Recovers after fault clearance	8.7.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.7.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.7.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.7.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.7.6

• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.7.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.7.8
• **MW Line Flow** • **MVAR Line Flow**	Indus to Noor 132 kV intact single circuit	Recovers after damping down oscillations	8.7.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.7.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.7.11

8.2.8

Fault Type: 1-Phase			
Fault Location: Indus 132 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: Indus to Shafi 132 kV			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Indus 132 kV 2. Shafi 132 kV 3. Shafi MV 22 kV 4. DHA-City 132 kV 5. Jhmipir-2 132 kV 6. Jhimpir-2 220 kV	The voltages of all the bus bars recover after fault clearance	8.8.1
Frequency	Shafi	Recovers after fault clearance	8.8.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.8.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.8.4

• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.8.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.8.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.8.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.8.8
• **MW Line Flow** • **MVAR Line Flow**	Indus to Noor 132 kV intact single circuit	Recovers after damping down oscillations	8.8.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.8.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.8.11

8.2.9

Fault Type: 3-Phase			
Fault Location: DHA-City 132 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: DHA-City to Shafi 132 kV			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. DHA-City 132 kV 2. Shafi 132 kV 3. Shafi MV 22 kV 4. Indus 132 kV 5. Jhmipir-2 132 kV 6. Jhimpir-2 220 kV	The voltages of all the bus bars recover after fault clearance	8.9.1
Frequency	Shafi	Recovers after fault clearance	8.9.2

• Plant MW Output • Plant MVAR Output	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.9.3
• Speed • Pmechanical	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.9.4
• Torque • Pitch Angle	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.9.5
• Paero • Shaft Twist Angle	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.9.6
• Turbine Rotor Speed Deviation • Generator Speed Deviation	Shafi Collector Group-1 0.7 kV	Recovers	8.9.7
• Pitch control • Pitch compensation	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.9.8
• MW Line Flow • MVAR Line Flow	DHA-City to Jhimpir-2 132 kV intact single circuit	Recovers after damping down oscillations	8.9.9
• MW Output • MVAR Output	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.9.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.9.11

8.2.10

Fault Type: 1-Phase			
Fault Location: DHA-City 132 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: DHA-City to Shafi 132 kV			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. DHA-City 132 kV 2. Shafi 132 kV 3. Shafi MV 22 kV 4. Indus 132 kV	The voltages of all the bus bars recover after fault clearance	8.10.1

	5. Jhmipir-2 132 kV 6. Jhimpir-2 220 kV		
Frequency	Shafi	Recovers after fault clearance	8.10.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.10.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.10.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.10.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.10.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.10.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.10.8
• **MW Line Flow** • **MVAR Line Flow**	DHA-City to Jhimpir-2 132 kV intact single circuit	Recovers after damping down oscillations	8.10.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.10.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.10.11

8.2.11

Fault Type: 3-Phase			
Fault Location: Jhimpir-2 220 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: Jhimpir-2 to KDA-33 220 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**

Voltage	1. Jhimpir-2 220 kV 2. Jhimpir-2 132 kV 3. KDA-33 220 kV 4. Jamshoro 220 kV 5. Gharo-New 220 kV 6. Shafi 132 kV	The voltages of all the bus bars recover after fault clearance	8.11.1
Frequency	Shafi 132 kV	Recovers after fault clearance	8.11.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.11.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.11.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.11.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.11.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.11.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.11.8
• **MW Line Flow** • **MVAR Line Flow**	Jhimpir-2 to KDA-33 220 kV intact single circuit	Recovers after damping down oscillations	8.11.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.11.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.11.11

8.2.12

Fault Type: 1-Phase			
Fault Location: Jhimpir-2 220 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: Jhimpir-2 to KDA-33 220 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	7. Jhimpir-2 220 kV 8. Jhimpir-2 132 kV 9. KDA-33 220 kV 10. Jamshoro 220 kV 11. Gharo-New 220 kV 12. Shafi 132 kV	The voltages of all the bus bars recover after fault clearance	8.12.1
Frequency	Shafi 132 kV	Recovers after fault clearance	8.12.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.12.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.12.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.12.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.12.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.12.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.12.8
• **MW Line Flow** • **MVAR Line Flow**	Jhimpir-2 to KDA-33 220 kV intact single circuit	Recovers after damping down oscillations	8.12.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.12.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV	Damps down quickly and attain a steady	8.12.11

	4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	state value	

8.2.13

Fault Type: 3-Phase			
Fault Location: Jhimpir-1 220 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: Jhimpir-1 to T.M.Khan Road 220 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Jhimpir-1 220 kV 2. TM Khan 220 kV 3. Jhimpir-2 220 kV 4. Jamshoro 220 kV 5. Jhimpir-1 132 kV 6. Shafi 132 kV	The voltages of all the bus bars recover after fault clearance	8.13.1
Frequency	Shafi 132 kV	Recovers after fault clearance	8.13.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.13.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.13.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.13.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.13.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.13.7
• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers	8.13.8
• **MW Line Flow** • **MVAR Line Flow**	Jhimpir-1 to TM Khan Road 220 kV intact single circuit	Recovers after damping down oscillations	8.13.9

• MW Output • MVAR Output	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.13.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.13.11

8.2.14

Fault Type: 1-Phase			
Fault Location: Jhimpir-1 220 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: Jhimpir-1 to T.M.Khan Road 220 kV Single Circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	7. Jhimpir-1 220 kV 8. TM Khan 220 kV 9. Jhimpir-2 220 kV 10. Jamshoro 220 kV 11. Jhimpir-1 132 kV 12. Shafi 132 kV	The voltages of all the bus bars recover after fault clearance	8.14.1
Frequency	Shafi 132 kV	Recovers after fault clearance	8.14.2
• **Plant MW Output** • **Plant MVAR Output**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.14.3
• **Speed** • **Pmechanical**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.14.4
• **Torque** • **Pitch Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.14.5
• **Paero** • **Shaft Twist Angle**	Shafi Collector Group-1 0.7 kV	Recovers after damping down oscillations	8.14.6
• **Turbine Rotor Speed Deviation** • **Generator Speed Deviation**	Shafi Collector Group-1 0.7 kV	Recovers	8.14.7

• **Pitch control** • **Pitch compensation**	Shafi Collector Group-1 0.7 kV	Recovers	8.14.8
• **MW Line Flow** • **MVAR Line Flow**	Jhimpir-1 to TM Khan Road 220 kV intact single circuit	Recovers after damping down oscillations	8.14.9
• **MW Output** • **MVAR Output**	DHA-City Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.14.10
Rotor Angles	1. Kotri GTPS 132 kV 2. Thatta132 kV 3. Lakhra 132 kV 4. Nooriabad 132 kV 5. Atlas 220 kV 6. Guddu-New (Reference)	Damps down quickly and attain a steady state value	8.14.11

8.3 Conclusion of Stability Study

The transient stability analysis performed as discussed above indicates that the NTDC system connecting to Shafi WPP through the proposed scheme of interconnection is strong enough to absorb the worst disturbances on either side i.e. on Shafi WPP side or the Grid side.

There are no constraints of connecting Shafi WPP with the NTDC grid in terms of transients or dynamic behavior of system under the disturbed conditions either on the Farm side or on the Grid side.

9- Power Quality

The issues of power quality are of particular importance to wind turbines that may cause flicker and distortions in the power supply due to harmonics and unbalance. These issues are more significant for weak systems of low short circuit strength. Therefore we have investigated these issues for the case of minimum short circuit of 2019 for the proposed scheme of interconnection. The same case has been re-evaluated with per unit MVA values and plotted for 3-phase faults in Exhibits 7.1.1 and 7.1.2 in Appendix-7

9.1 Flicker

We have used IEC61400-21 for the calculations of flicker levels for steady-state continuous operation and for switching conditions [1].

9.1.1 Continuous Operation

The probability of 99th percentile flicker emission from a single wind turbine during continuous operation for short time $P_{St\Sigma}$ and longer time flicker levels $P_{lt\Sigma}$ are assumed same and calculated by the following formula

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

where

$c(\psi_k, v_a)$ is the flicker coefficient of the wind turbine for the given network impedance phase angle, ψ_k at the PCC, and for the given annual average wind speed, v_a at hub-height of the wind turbine at the site;

S_n is the rated apparent power of the wind turbine;

S_k is the short-circuit apparent power at the PCC.

N_{wt} is the number of wind turbines connected to the PCC.

PCC is the point of common coupling of WTGs that is MV bus of Shafi Farm substation.

For minimum short circuit case we have assumed the same case as discussed in paragraph 7.1.1.2 of Chapter 7 in which output of Shafi Wind farm reduced as low as

25 % of its rated capacity. Therefore taking one collector group as one equivalent generator of 6x2 = 12 MW we have calculated as follows;

S_n= 2.22 MVA at 0.90 PF (For 1 WTG)

N_{WT} = 6

S_k for MV bus = 520 MVA

The value of c (ψ_k) at 10 minute average speed (v_a) is supplied by the manufacturer after filed measurements of $P_{St,\ fic}$ for different operating conditions using the following formula.

$$c(\psi_K) = P_{st,fic} \cdot \frac{S_{k,fic}}{S_n}$$

where

S_n is the rated apparent power of the wind turbine;

$S_{k,fic}$ is the short-circuit apparent power of the fictitious grid.

The value of c (ψ_k) may not be greater than 1, therefore for the present analysis we may assume it as 1 for the worst case.

Putting this data in the above Equation, we find

$P_{St\Sigma}$ =$P_{lt\Sigma}$= 0.010457437= 1.0457437 %

Whereas the acceptable value is 4 % as mentioned in Ref. [2]. Therefore we are much less than the maximum permissible level and the WTGs at Shafi Wind farm would not cause any flicker problem during steady state operation even in the weakest system conditions of minimum short circuit level.

9.1.2 Switching Operation

The most common switching operations would be as follows;

a. Wind turbine start-up at cut-in speed
b. Wind turbine start-up at rated wind speed
c. The worst case of switching between the WTGs

The flicker emission from the wind farm of many machines can be calculated by the following equation as per IEC61400-21 (Section 8.3.2)

$$P_{st\Sigma} = \frac{18}{S_k} \cdot \left(\sum_{i=1}^{N_{wt}} N_{10,i} \cdot \left(k_{f,i}(\psi_k) \cdot S_{n,i} \right)^{3,2} \right)^{0,31}$$

$$P_{lt\Sigma} = \frac{8}{S_k} \cdot \left(\sum_{i=1}^{N_{wt}} N_{120,i} \cdot \left(k_{f,i}(\psi_k) \cdot S_{n,i} \right)^{3,2} \right)^{0,31}$$

where

$N_{10,i}$ and $N_{120,i}$	are the number of switching operations of the individual wind turbine within a 10 min and 2 h period respectively;
$k_{f,i}(\psi_k)$	is the flicker step factor of the individual wind turbine;
$S_{n,i}$	is the rated power of the individual wind turbine.

The values of N_{10} and N_{120} are usually provided by the manufacturers based on field measurements, but if these are not available then IEC61400-21 proposes in section 7.6.3 to use as follows;

For switching conditions of (a) and (b)

$N_{10} = 10$

$N_{120} = 120$

For switching conditions of (c)

$N_{10} = 1$

$N_{120} = 12$

The value of flicker step factor $k_{f,i}$ (ψk) is also provided by the manufacturer after the field and factory measurements; but for the present analysis we assume it to be equal to 1.

Substituting the numbers in the above equations, we find for switching conditions of (a) and (b) as follows;

$P_{St\Sigma} = 0.243264199$

$P_{lt\Sigma} = 0.233583342$

For switching conditions of (c) these values would be less as the frequency of occurrence assumed i.e. N_{10} and N_{120} are 10 times less.

Engineering Recommendation P28 (Electricity Association, 1989) specifies an absolute maximum of P_{St} on a network from all sources to be 1.0 with a 2 hour P_{St} value of 0.6. However, extreme caution is advised if these limits are approached as the risk of complaints increases when the limits are reached, therefore, an assessment method proposed in the same document is based on P_{St} not exceeding 0.5. British Standard (1995) is less stringent specifying that over a one week period P_{lt} must be less than 1 for 95 % of the time. Gardner (1996) describes P_{St} limits from a number of utilities in the range of 0.25 to 0.5 [2].

The values evaluated above are less than the values recommended in the references of above standards.

9.2 Voltage Unbalance

9.2.1 Voltage Step-Change

The voltage step change would occur when a WTG will be energized, assuming just one WTG in the collector for the minimum No. of units in the collector being energized.

The limit on the voltage change is based on the impedance of the circuit between the point of connection and the MV transformer bus bar together with the apparent power of the wind turbine generators. The following equation needs to be satisfied [2];

$$\Delta V = \sum S_{WKA} [(1/S_{KE}) - (1/S_{KSS})] \leq 1/33 \text{ or } 3\ \%$$

Where

S_{WKA} = MVA rating of the WTG

S_{KE} = Short circuit MVA at connection point

S_{KSS} = Short circuit MVA at MV bus of the wind farm substation

For the minimum short circuit case, we have calculated minimum fault levels in MVA as shown in Exhibit 7.1.2

S_{WKA} = 2.22 MVA for the equivalent WTG of a collector group for the minimum case

S_{KE1} for one WTG in collector group = 310 MVA (Exhibit 7.1.2)

S_{KSS} = 510 MVA (Exhibit 7.1.2)

Substituting these values we get

$$\Delta V = 0.002808349 = 0.2808349\ \%$$

Which is much less than the limit of 3 %

9.2.2 Voltage Fluctuation

For the limits of voltage fluctuation, we need to satisfy the following equation [2].

$$\sqrt{\sum (P_{WKA}/S_{KE})^2} \leq 1/25 \text{ or } 4\ \%$$

Where

P_{WKA} = MW rating of the WTG

S_{KE} = Short circuit MVA at connection point

Punching all the numbers in this equation, we get

Voltage Fluctuation = 0.006451613 = 0.6451613 %

Which is less than the maximum permissible specified as 4 %.

10- Conclusions & Recommendations

- Interconnection Study has been carried out for 50 MW Shafi WPP which is proposed to be placed in the first loop at newly planned Jhimpir-2 220/132 kV collector substation. The scheme of interconnection of Shafi WPP proposes the following reinforcements in place at Jhimpir cluster.
  - 220 kV D/C transmission line approx. 5km long on twin bundled Greeley conductor looping In/out of second circuit of existing Jamshoro – KDA-33 D/C transmission line at the proposed Jhimpir-2 220/132 kV substation
  - Addition of 4th 220/132 kV transformer at the newly proposed Jhimpir-2 220/132 kV substation.
  - 132kV double circuit transmission line approx. 135 km long on twin bundled Greeley conductor for connecting 8 WPPs in the first loop to Jhimpir-2 220/132 newly proposed substation.
  - 132kV double circuit transmission line approx. 168 km long on twin bundled Greeley conductor for connecting 8 WPPs in the second loop to Jhimpir-2 220/132 newly proposed substation.
  - In this scheme the interconnection of Shafi WPP (which is placed in second loop) includes 132 kV D/C transmission line approx. 7 km long, on twin bundled Greeley conductor for looping in/out on the 132kV single circuit from Indus WPP to DHA-City WPP grid station.
- The existing grid system of HESCO and NTDC in the vicinity of Shafi WPP has been studied in detail by performing load flow, short circuit and dynamic analysis for the conditions prior to commissioning of Shafi WPP and no bottlenecks or constraints have been found in the grid system.
- Wind Farm of Shafi WPP has been modeled considering Type-3 WTGs. They are Doubly Fed Asynchoronous Generators which are designated as Type-3 WTG. The terminal voltage is 0.69 kV. The medium voltage level of wind farm has been selected as 22 kV for unit step-up transformers, for collector

circuits and step-up from MV to HV (132 kV) at Farm substation to connect to the Jhimpir-2 220/132 kV grid station of NTDC.

- The design of scheme of 132/22 kV substation of Shafi Wind Farm has been provided by the Client and is attached in Appendix – 2.
- Load flow analysis has been carried out for peak and Off Peak scenarios of August/September 2019 considering the COD targeted by Shafi WPP and a future scenario of 2022, for the dispersal of power from Shafi WPP into NTDC system using the latest load forecast, generation and transmission expansion plans of NTDC and HESCO. The above mentioned interconnection scheme has been evolved by performing the load flow studies testing the steady state performance for normal as well as N-1 contingency conditions fulfilling the Grid Code criteria of Wind Power Plants. The reactive power requirement at point of common coupling to meet PF of ± 0.95, voltage and line loading criteria are fulfilled by these studies. All the scenarios have been studied by considering maximum dispatch from all the existing/planned WPPs in the Jhimpir and Gharo Clusters.
- For the base case of summer 2019, capacity constraint was observed in 500kV network emanating from Jamshoro and upwards in case of some critical outages of 500kV circuits. Due to this capacity constraint, partial curtailment in the output of all WPPs under study was proposed to bring the loading on the 500kV network within limit. Hence output of Shafi WPP is curtailed to 7 MW in case of some contingency events. For the future scenario of 2022, this issue of capacity constraint is resolved due to the following major reinforcements:
    - 660kV HVDC from Matiari to Lahore
    - 660kV HVDC from Port Qasim to Faisalabad West
- With the proposed reinforcements highlighted earlier and the curtailment process for the base year of 2019 under special circumstances, the load flow results for peak and Off Peak scenarios establish that the proposed scheme of interconnection of Shafi WPP shows no bottlenecks or capacity constraints in the adjoining 500 kV, 220 kV and 132 kV network in terms of absorbing all the

output of Shafi WPP and other proposed WPPs under normal as well as the contingency conditions.

- Maximum and minimum short circuit levels for three-phase faults and single-phase faults have been evaluated. The maximum SC levels have been evaluated for the year 2022 and minimum short circuit level for the year 2019 for the most stringent conditions. The fault levels of Shafi 132 kV are 7.53 kA and 7.26 kA for 3-phase and single phase faults respectively for 2022. This is much less than the switchgear rating of 40 kA recommended for Shafi Farm Substation as per NTDC requirements for 132 kV. The fault levels for Shafi 22 kV are 18.13 kA and 20.23 kA for 3-phase and single-phase faults respectively for year 2022.

  Therefore the short circuit rating for 22 kV switchgear is recommended as 31.5 kA. It has been found that the proposed scheme provides maximum SC strength for the evacuation of Shafi WPP power to the grid.

  The switchgear ratings for Shafi WPP substation are as follows:

  132 kV:

  Short circuit rating = 40 kA (3 sec.)

  Continuous rating = 2500 A

  22 kV:

  Short circuit rating = 31.5 kA (3 sec.)

  Continuous rating = 2500 A

- Transient Stability analysis has been carried out for Shafi WPP based on their selection of Type-3 WTGs, with connectivity of proposed scheme. Different disturbances have been simulated to apply stresses from the system faults on the wind farm and vice versa and it was found that Shafi WTG unit's dynamic characteristics and the grid connectivity is strong enough to maintain stability under all disturbances. In turn, any disturbance from Shafi WPP side did not cause any stress on the main grid or the power plants nearby and in the HESCO area such that the whole system remained stable under all events.
- The LVRT requirements have been tested to fulfill 100 ms (5 cycles) under normal clearing time and 180 ms (9 cycles) for contingency condition of delayed fault

clearing due to stuck-breaker (breaker failure) reason. The simulations have proved that the proposed machine fulfills the LVRT criteria as required in the Grid Code for Wind IPPs.

- The issues of power quality like flicker, unbalance and harmonic resonance have been studied in detail. The results have indicated that the levels of flicker and unbalance are within the permissible limits of IEC and other International Standards.
- There are no technical constraints whatsoever in the way of bringing in the 50 MW of Shafi Wind Power Plant at the proposed site and scheduled time of commissioning, in any respect of steady state (load flow) or short circuit or dynamic performance (stability) or power quality issues related to this plant.

Annexure – G
Memorandum & Articles of Association

THE COMPANIES ORDINANCE, 1984

(COMPANY LIMITED BY SHARES)

MEMORANDUM OF ASSOCIATION

OF

SHAFI ENERGY (PRIVATE) LIMITED

I. The name of the company is 'SHAFI ENERGY (PRIVATE) LIMITED' (the "Company").

II. The Registered Office of the Company will be situated in the Province of Sindh.

III. The objects for which the Company is established are all or any of the following:-

1. To carry on all or any of the businesses of generating, supplying, converting, transforming, distributing, selling, purchasing, importing, exporting and dealing in electricity and all other forms of energy and to deal in all products derived from or relating to such business including but without limitation to, steam, fuel, lignite, coal, ash, conversion of ash into bricks and any other products derived from or connected with any other form of energy, including, but without limitation to conventional sources such as heat, thermal, hydel and/or from nonconventional sources such as tidal wave, wind, solar, geothermal, biological, biogas and coal bed methane.

2. To locate, finance, set-up, develop, own, acquire, establish, construct, design, equip, operate, use, manage, invest in and maintain power generation facilities / power plants (including power generation facilities / power plants utilizing wind, hydel, solar, thermal, tidal, coal, gas, diesel oil, and/or any other means of energy or fuel), jetties, power grid station, transforming, switching, conversion, and transmission facilities, distribution facilities, cables, overhead lines, sub-stations, switching stations, tunnels, cable bridges, link boxes, heat pumps, plant and equipment for combined heat and power schemes, offices, computer centers, shops, depots, factories, workshops, plants, warehouses and other storage facilities, together with all machinery, equipment, cables, wires, lines, accumulators, and works ancillary to the aforesaid anywhere in or outside Pakistan and to do all such acts, deeds and things, without limitation whatsoever, as may be necessary or desirable in that connection.

3. To carry on the business as dealers of and to buy, sell, hold, acquire or invest the capital and funds of the Company in securities and Investments of every kind and description including but not limited to shares, stocks, fixed income securities, modaraba certificate, musharaka certificates, participation term certificates, term finance certificates, mutual fund certificates, units, certificates of investments, commercial papers, debentures, debenture stocks, bonds, obligations or securities

Certified True Copy of
Company Secretary

issued or guaranteed in Pakistan or abroad by any company incorporated or registered in Pakistan by the Government or public body or Authority both for short term or long term gains and to realize such gains.

4. To acquire or undertake the whole or any part of the business, goodwill, and assets of any person, firm, or company and as part of the consideration for such acquisition to undertake all or any of the liabilities of such person, firm or company, or to acquire an interest in, amalgamate with, or enter into partnership or into any arrangement for sharing profits, or for co-operation, or for mutual assistance with any such person, firm or company, or for subsiding or otherwise assisting any such person, firm or company, and to give or accept, by way of consideration for any of the acts or things aforesaid or property acquired, any shares, debentures, debenture stock or securities that may be agreed upon.

5. To carry out all types of services relating to development and operation of business of generation, purchase, sale, transmission and distribution of power/energy and to perform all other acts which are necessary or incidental to the business of electricity generation, supply, transmission, distribution and trading of energy.

6. To develop business plans, feasibility studies, carry out surveys, make investments and do such other activities that are incidental and ancillary to the foregoing, pertaining to the business of power generation, transmission and distribution or such other business as considered appropriate by the directors of the Company from time to time.

7. To purchase or by any other means acquire and take options over any property whatever, and any rights or privileges of any kind over or in respect of any property as deemed desirable by the Company.

8. To invest and deal with any moneys of the Company in bonds, stocks or any other securities or such other investments and in such manner as may from time to time be determined by the Company and to hold, sell or otherwise deal with such investments.

9. To provide engineering, construction, consultancy and design services and any facilities, equipment and installations whether related to such services and systems or otherwise.

10. To carry on all or any of the businesses of wholesalers, retailers, traders, importers, exporters, suppliers, distributors, designers, developers, manufacturer, installer, filters, testers, repairers, trainers, maintainers, contractors, constructors, operators, users, inspectors, re-conditioners, improvers, alterers, protectors, removers, hirers, replacers, importers and exporters of and dealers in, electrical appliances, systems, products and services used for energy conservation and generation, equipment, machinery, materials and installations, including but not limited to cables, wires, meters, tracks, rails, pipelines and any other plan, apparatus, equipment, systems and

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things incidental to the efficient generation, procurement, transformation, supply and distribution of electricity.

11. To construct, acquire and maintain roads, bridges, rail sidings, pipelines and storage facilities for water, petroleum products, natural gas, oil, coal and other substances, water desalination and treatment plants, and such other works as may be required for all or any of the above purposes.

12. To carry on the business of electrical engineers, electricians, engineers, consultants, agents, suppliers of services and manufacturers of electrical plant, machinery, and generally to install, acquire, execute, provide, operate and maintain all necessary plant, machinery, equipment, cables, wires, accumulators, lamps, exchanges, telephones, and apparatus and to provide any services related or incidental thereto.

13. To import, export, buy, sell, hire or deal in plant, machinery, equipment, cables, wires, accumulators, lamps, exchanges, telephones, fixtures and fittings and apparatus of every kind with special reference to plant, machinery, equipment or apparatus connected with the producing, storing, supplying, distribution, transmission, using, regulating or measuring the supply or facilitating the use of electricity or electrical currents or force.

14. To buy, sell, import, export, hire, manufacture, deal in and turn to account plant, machinery, implements, conveniences, provisions, articles and products capable of being used in connection with the operations of or required by workmen and other employer by the Company or incidentally or conveniently connected with any such business as aforesaid.

15. To conduct, promote and commission research of all kinds and research and development activities of all kinds, whether related to the generation, transmission, distribution and supply of electricity or other forms of energy or otherwise, and to exploit and turn to account the results of any such research or research and development carried out by or for the Company.

16. To establish laboratories and to employ and promote scientific research and invention, patronize such invention and enter into manufacture in collaboration with outside parties for transfer of technology from abroad and to promote transfer of technology from Pakistan abroad and to carryon business in all other allied fields permissible by law.

17. To enter into lease and hire purchase agreements and contracts and other deeds and instruments for attainment of the objects contained therein and to assign and transfer the same for consideration.

18. To purchase, take in exchange or on lease, rent, occupy or otherwise acquire any lands, hereditaments and estates and any property and effects therein or used or

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connected therewith and to acquire any grants, concessions, leases, rights, easements, licenses, privileges and any other interests in land.

19. To enter into, make, and perform contracts and arrangements of every kind and description that may be conducive to the Company's object or objects and for any lawful purpose, with the government or authority (public, supreme, municipal or otherwise), and with any firm, person, corporation or company without any limit as to amount, and to obtain from such government, authority, firm, company or persons any rights, privileges, contracts, concessions and dispose of or turn to account the same.

20. To enter into any arrangement with the Federal Government of Pakistan, the Provincial Government or with any authorities local or otherwise for the purpose of carrying out the objects of the company or furthering its interest and to obtain from such Government or authority or person any charters, subsidies, loans, indemnities, grants, contracts, rights, powers, concessions, privileges or immunities which the Company may think desirable to obtain and to carry out, exercise and comply with any such arrangements, rights, privileges and concessions.

21. To sell, lease, improve, manage, develop, mortgage, exchange, turn to account or otherwise deal with, dispose of absolutely, conditionally, or for any limited interest, and grant any leave or license in respect of all or any of the property, rights or privileges of the Company, and to distribute in specie as dividend or bonus any money, shares, debentures, or debenture stock that may be accepted as consideration for any such sale, lease, exchange or other disposition.

22. To pay for technical know-how, technical and engineering assistance and information and/or service rights or privileges acquired by the Company in a manner the Company deems appropriate, either by cash or through its shares.

23. To undertake or promote scientific research related to any business or class of business in which the Company is interested.

24. To train personnel and workers both in Pakistan and abroad, to obtain technical proficiency in various specialties connected with the business of the Company.

25. To give any employee of the Company commission in the profits of the Company's business or any branch thereof and for the purpose, to enter into any agreement or scheme of arrangement as the Company may deem fit.

26. To establish and support or aid in the establishment and support of associations, institutions, funds and conveniences calculated to benefit persons who are or have been directors of, or who have been employed by or who are serving or have served the Company or any other company which is a subsidiary or associate of the Company or the dependents of such persons and to grant pensions, gratuities,

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allowances, relief and payments in any other manner calculated to benefit the persons described herein.

27. To apply for, tender, offer, accept, purchase or otherwise acquire any contracts and concessions for or in relation to the projection, execution, carrying out, improvement, management, administration or control of works and conveniences, and undertake, execute, carry out, dispose of or otherwise turn to account the same.

28. To carry on the business of general order leasing and licensing as permitted under applicable laws including to government and semi-government agencies, and in this regard to act as lessor or licensor within the scope of the object or objects of the Company and subject to any permission required under the law.

29. To amalgamate, enter into partnership, or to make any arrangement for sharing profits, union of interests, co-operation, joint-venture, reciprocal concession or otherwise with any person, firm or company and to have foreign collaborations and to pay royalties/technical fees to collaborators subject to the applicable laws.

30. To improve, manage, develop, grant rights or privileges in respect of, or otherwise deal with all or any part of the property and rights of the Company.

31. To purchase or otherwise acquire any patents, inventions, trademarks, licenses, concessions and the like conferring any exclusive or non-exclusive or limited right to use any invention which may seem capable of being used for any of the purposes of the Company or the acquisition of which may seem calculated directly or indirectly to benefit the Company, and to use, exercise, develop or grant licenses in respect of or otherwise turn to account, the property and rights so acquired.

32. To carry on the business of leasing, hiring, selling, letting, hire-purchases, and as a hire-purchase finance company carrying as its business hire-purchase transactions or the financing of such transactions and an equipment leasing company carrying on the business of leasing of equipment or the financing of such activity, and to acquire, provide on lease or on hire-purchase or deferred payment or on other similar basis all types of plant and machineries, industrial and office equipment, appliances, vehicles, land and building, real estates, movable and immovable properties and all other assets, required for manufacturing, processing, refining, mining, transportation, electricity generation, shipping, construction, fire-fighting, water and waste treatment, pollution, environment control, medical, energy saving, commercial, trading and for other activities.

33. To carry on any other trade or business whatever which, in the opinion of the directors of the Company, can be advantageously carried on independently or in connection with or ancillary to any of the above mentioned business or is calculated directly or indirectly to enhance the value of, or render profitable any of, the property or rights of the Company.

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34. To act as representatives, for any person, firm or company and to undertake and perform sub-contracts, and also act in the business of the Company through or by means of agents, sub-contractors or otherwise, to do all or any of the things mentioned herein in any part of the world and either alone or in collaboration with others and by or through agents, sub-contractors or otherwise, to invest in subsidiaries to buy, export, transfer, supply or otherwise, and to deal in matters, applications and accessories, ancillary and related to the business, object or objects of the Company or otherwise as permitted by law.

35. To enter into any arrangements with any government or authority (municipal, local or otherwise) that may seem conducive to the attainment of the Company's objects or any of them, and to obtain from any such government or authority any charters, decrees, rights, privileges, concessions, indemnities, contracts, loans, grants and immunities which the Company may think desirable and to carry out, exercise, and comply with any such charters, decrees, rights, privileges, concessions, indemnities, contracts, loans, grants and immunities.

36. To carry on in or outside Pakistan the business of manufacturers, transmitters, suppliers, importers, exporters, indentors, distributors, transporters, dealers in all articles and commodities akin to or connected with any of the business of the Company capable of being conveniently carried on or necessary for the promotion of the objects herein contained, as permissible under law.

37. To purchase, take on lease, or in exchange, hire, apply for or otherwise acquire and hold for any interest, any rights, privileges, lands, buildings, easements, trademarks, patents, patent rights, copyrights, licences, machinery, plants, stock-in-trade and any movable and immovable property of any kind, necessary or convenient for the purposes of or in connection with the Company's business or any branch or department thereof and to use, exercise, develop, and grant licences in respect of or otherwise turn to account any property, rights and information so acquired, subject to any permission required under the law.

38. To acquire by concession, grant, purchase, barter, licence either absolutely or conditionally and either solely or jointly with others any lands, buildings, machinery, plants, equipment, privileges, rights, licences, trademarks, patents, and other movable and immovable property of any description which the Company may deem necessary or which may seem to the Company capable of being turned to account, subject to any permission as required under the law.

39. To establish, promote or assist in establishing or promoting, and subscribe to or become a member of any other company, association or club whose objects are similar or in part similar to the objects of this Company or the establishment or promotion of which may be beneficial to the Company as permissible under law.

40. To open accounts with any bank or banks and to draw, make, accept, endorse, execute, issue, negotiate and discount cheques, promissory notes, bills of exchange,

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bills of lading, warrants, deposit notes, debentures, letters of credit and other negotiable instruments and securities.

41. To borrow or raise money by means of local and foreign currency loans or other legal arrangements from local and foreign banks, or other financial and non-financial institutions, for such purpose or in such manner as the Company may think fit and in particular by issue of debentures, debenture stock, perpetual or otherwise convertible into shares and to mortgage, or charge the whole or any part of the property or assets of the Company, present or future, by special assignment or to transfer or convey the same absolutely or in trust as may seem expedient, and to purchase, redeem or payoff any such securities.

42. To purchase or otherwise acquire and to sell, change, surrender, lease, mortgage, charge, convert, turn to account, dispose of and to deal with property and rights of all kinds and in particular, mortgages, charges, hypothecations, debentures, concessions, options, contracts, patents, licences, shares, bonds, policies, book debts, business concerns, undertakings and actions of all kinds.

43. To sell or otherwise dispose of the whole or any part of the undertaking of the Company, either together or in portions for such consideration as the Company may think fit and in particular, for shares, debenture-stock or securities of any company purchasing the same.

44. To issue all or any part of the original or enhanced share capital of the Company at par or at a premium or discount subject to any permission required by law.

45. To pay all costs, charges, and expenses preliminary or incidental, incurred in the formation or about the promotion and establishment of the Company and to remunerate any person, firm or company for services rendered or to be rendered in or about the formation or promotion of the Company or the conduct of its business.

46. To apply for and obtain necessary consents, permissions and licenses from any Government, State, Local and other Authorities for enabling the Company to carry on any of its objects into effect as and when required by law.

47. To pay for any property, rights or benefits acquired by the Company either in cash or in shares with such rights, in respect of dividend or otherwise, as may be deemed fit by the Company or by any securities which the Company has power to issue or partly in one mode and partly in another and generally on such terms as the Company may approve.

48. To employ contractors, managers, consultants and other skilled persons for the Company.

49. To enter into negotiations with and enter into arrangements and contracts and conclude the same with foreign and/or Pakistani parties and other persons for

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obtaining by grant, license and/or on other terms, rights and benefits, and to obtain technical and engineering information, assistance, and service, know-how for installation of plant and machinery, production and manufacture of any products.

50. To establish and maintain or procure the establishment and maintenance of any contributory or non-contributory pension or superannuation, provident or gratuity funds, for the benefit of and give or procure the giving of donations, gratuities, pensions, allowances or emoluments to any persons who are or where at any time in the employment or service of the Company or for any company which is a subsidiary of the Company, or is allied to or associated with the Company, or with any such subsidiary company or who are or were at any time directors or officers of the company as aforesaid and the wives, widows, families and dependants of any such persons and also to establish and subscribe to any institutions, associations, clubs or funds calculated to be for the benefit of or to advance the interests and wellbeing of the company or of any such other company as aforesaid and make payment to or towards the insurance of any such person as aforesaid and to any of the matters aforesaid either alone or in conjunction with any such privileges and concessions.

51. To distribute any of the Company's property and assets among the members in specie or in any other manner in case of winding up of the Company.

52. To guarantee the performance of contracts and obligations of the Company or any other person.

53. To carry out joint venture agreements with other companies or countries within the scope of the objects of the Company.

54. To take out any insurances that the Company deems necessary or appropriate and to pay the premium thereof.

55. To constitute and regulate subsidiaries, separate branches or departments of the Company's business and to appropriate thereto respectively any of the assets of the Company and any of the capital, issued or to be issued, of the Company and from time to time to vary the constitution or regulations of any such subsidiaries, branches or departments or any such appropriations and if thought fit to amalgamate all or any of the said subsidiaries, branches or departments.

56. To procure the Company to be registered or recognized in any country or place outside Pakistan and to keep branch registers.

57. To institute and defend in any forum legal proceedings of every kind or description whatsoever, enter into arbitration agreements and refer disputes to arbitration, pay, satisfy or receive payments in respect thereof, or compound or compromise any claim, demand, action, suit or proceeding of any nature whatsoever made or brought by or against the Company.

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58. To carry on any other business or activity of any nature whatsoever which may seem to the Company to be capable of conveniently or advantageously carried on in connection or conjunction with any business of the Company hereinabove or hereinafter authorized or to be expedient.

59. To subscribe or guarantee money for any purpose which may be considered likely, directly or indirectly, to further the objects of the Company or for any national, charitable, benevolent, public, general or useful object or for any exhibition.

60. To draw, make, accept, discount, endorse and issue promissory notes, bills of exchange, bills of lading and other negotiable or transferrable securities and only in connection with the business of the Company, to advance, deposit with or lend money, securities or property to such governmental or other authority, person, firm or company and on such terms, with or without security, as the Company deems fit.

61. To do and perform all other acts as are incidental or conducive to the attainment of the above objects or any of them.

62. It is declared that notwithstanding anything contained in the foregoing object clauses of this Memorandum of Association, nothing contained therein shall be construed as empowering the Company to undertake or to indulge in the business of a banking company, forex, illegal brokerage, an investment company, a managing agency, an insurance business or a non-banking finance company, or in any unlawful business directly or indirectly, and the Company shall not launch multilevel marketing, pyramid and ponzi schemes.

63. Notwithstanding anything stated in any object clause, the company shall obtain such other approval or licence from the competent authority as may be required under any law for the time being in force, to undertake a particular business.

IV. The liability of the members is limited.

V. The authorized Share Capital of the Company is Rs.50,000,000/- (Rupees Fifty Million Only) divided into 5,000,000 (Five Million Only) Ordinary Shares of the nominal value of Rs.10/- (Rupees Ten Only) each with the rights, privileges and conditions attached thereto as are provided for the time being, with power to increase and reduce the capital of the Company and to divide the shares in the capital for the time being, into several classes.

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We the several persons, whose names and addresses are subscribed, are desirous of being formed into a company, in pursuance of this Memorandum of Association and we respectively agree to take the number of shares in the capital of the Company set opposite to our names

Name and Surname (Present & Former) in full (in Block Letters)	Father's/Husband's Name in Full	CNIC/ Passport No.	Nationality with any former Nationality	Occupation	Address	Number of Shares taken by each Subscriber
Muhammad Haleem Sheikh	Muhammad Shafi (Late)	35202-2494224-3	Pakistani	Business Executive	House # 85-B, Model Town, Lahore	1 (one)
Muhammad Naseem	Muhammad Shafi (Late)	42201-2326228-7	Pakistani	Business Executive	House # B-17, 3 Gizri Street, Phase 4, DHA, Karachi	1 (one)
Amjad Hafeez	Abdul Hafeez (Late)	42201-2316823-7	Pakistani	Business Executive	House # 69 Al-Hamra Housing Society, Tipu Sultan Road ,Karachi	1 (one)
Tahir Hanif	Muhammad Hanif (Late)	42101-4114447-9	Pakistani	Business Executive	House # 119, Street No. 10, Alhamra Society, Karachi.	1 (one)
Amir M. Shafi	Sheikh Mazhar Hussain	42301-8673498-7	Pakistani	Business Executive	House # 66-W, Phase III, Defence Housing Authority, Lahore, Cantt., Lahore	1 (one)
Muhammad Shafi Tanneries (Pvt.) Ltd through Zahid Haleem Sheikh	N/A Muhammad Haleem Sheikh	1185331-0 42201-2515026-3	N/A Pakistani	N/A Business Executive	35-A/3 Shafi House M.T Khan Road Lalazar, Karachi House No. 105, Street No. 3, Khayaban-e-Muhafiz, Phase 6, Defense Housing Authority, Karachi	1 (one)

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Shafi Texcel Limited through Muhammad Naseem	N/A Muhammad Shafi (Late)	0803022-7 42201-2326228-7	N/A Pakistani	N/A Business Executive	35-A/3 Shafi House M.T Khan Road Lalazar, Karachi House # B-17, 3 Gizri Street, Phase 4, DHA, Karachi	1 (one)
Shafi Glucochem (Pvt.) Ltd through Muhammad Naseem	N/A Muhammad Shafi (Late)	0712061-3 42201-2326228-7	N/A Pakistani	N/A Business Executive	35 A/3 Shafi House M.T Khan Road Lalazar, Karachi House # B-17, 3 Gizri Street, Phase 4, DHA, Karachi	1 (one)
						Total: 8 (eight)

Dated the 9th day of December 2015.

Witness to the above signatures:
Name: NIFT (Pvt.) Limited
Address: 5th Floor, AWT Plaza, I.I. Chundrigar Road
Karachi- 74200, Pakistan

Certified to be True Copy
Deputy Registrar of Companies
16/12/2015

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THE COMPANIES ORDINANCE, 1984

(COMPANY LIMITED BY SHARES)

ARTICLES OF ASSOCIATION

OF

SHAFI ENERGY (PRIVATE) LIMITED

1. TABLE "A" NOT TO APPLY

The Regulations contained in the table marked 'A' of the First Schedule to the Companies Ordinance, 1984, shall not apply to the Company except in so far as the same are repeated or expressly made applicable in these Articles.

2. Interpretation

In these Articles (if not inconsistent with the subject or context or expressly provided to the contrary below) the following words and expressions shall have the following meanings:

"Board" means the Directors collectively or the Directors present at a duly convened meeting of Directors at which a quorum is present, as the context requires;

"Company" means Shafi Energy (Private) Limited;

"Directors" mean the directors or the alternate director for the time being of the Company, as the case maybe;

"month and year" means the calendar month and the calendar year respectively;

"Member" means the member of the Company as defined in Section 2(1) (21) of the Ordinance;

"Ordinance" means the Companies Ordinance, 1984(XLVII of 1984);

"Ordinary Resolution" means a resolution passed at a general meeting when the votes cast (whether on a show of hands or on a poll, as the case may be) in favour of the resolution (including the casting vote, if any, of the Chairman) by members who, being entitled to vote in person or by proxy, do so vote, exceed the votes, if any, cast against the resolution by members entitled to vote and voting thereon;

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"Register" means a Register of Members to be kept pursuant to Section 147 of the Ordinance;

"Registrar" means a Registrar, an Additional Registrar, a Joint Registrar a Deputy Registrar or an Assistant Registrar, responsible under the Ordinance for the registration of companies;

"SECP" means Securities and Exchange Commission of Pakistan.

"Special Resolution" means a special resolution of the Company as defined in Section 2(1)(36) of the Ordinance.

"Seal" means the common seal of the Company;

References to writing shall, unless the contrary intention appears, be construed as including reference to printing, lithography, photography & other modes of representing, transmitting or reproducing words in a legible & non-transitory form.

Words importing singular number only shall include the plural number and vice versa.

Save as aforesaid any words or expressions defined in the Ordinance shall if not inconsistent with the subject or context, bear the same meaning as in these Articles.

Any reference to statutory provision or enactment shall include any statutory modification or re-enactment thereof.

3. PRIVATE LIMITED COMPANY

The Company is a private limited company within the meaning of Clause (28) of Section 2(1) of the Ordinance.

(1) No invitation shall be issued to the public to subscribe for any share of the Company.

(2) The numbers of the members of the Company shall be limited to fifty, provided that for the purpose of this provision, where two or more persons hold one or more shares in the company jointly, they shall be treated as single member; and

(3) The right to transfer shares of the Company is restricted in the manner and to the extent hereinafter appearing.

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4. BUSINESS

The company is entitled to commence business from the date of its incorporation. The business of the company shall include all or any of the objects enumerated in the Memorandum of Association. The business of the company shall be carried out at such place or places anywhere in Pakistan or elsewhere as the Directors may deem proper or advisable from time to time.

PART II - CAPITAL AND SHARES

5. AUTHORISED SHARE CAPITAL

The authorized capital of the Company is Rs.50,000,000/- (Rupees Fifty Million Only) divided into 5,000,000 (Five Million Only) Ordinary Shares of the nominal value of Rs.10/- (Rupees Ten Only), each set out in that Clause with power to increase the capital and to consolidate or sub-divide the shares, issue shares of different kinds or classes therein of higher or lower denominations and to vary, modify or abrogate any such rights or conditions in such a manner as may be authorized by the regulations of the Company and subject to applicable laws.

6. ALLOTMENT OF SHARES

6.1 The shares shall be under the control of the Board, who may subject to applicable law allot or dispose of the same to such persons, firms, cooperation on such terms and conditions and at any such times as the Board shall think fit. Shares may also be allotted in consideration other than cash.

6.2 Shares may be registered in the name of any limited company or other corporate body but not in the name of minor or a firm. Not more than four persons shall be registered as joint holders of any shares.

6.3 Subject to the provisions of the Ordinance, the Companies (Issue of Capital) Rules 1996 and these Articles, the Directors may allot and issue shares in the capital of the Company as payment or part payment of any property sold or transferred, land, machinery, goods supplied or any services rendered to the Company in the conduct of its business and any shares which may be so allotted may be issued as fully paid up shares and if so issued, shall be deemed to be fully paid up shares.

6.4 The share capital of the Company shall comprise of ordinary shares, and subject as aforesaid the Company may issue shares of a single class or of different classes, but where ordinary shares of more than one class are issued the rights as between the various classes of such shares shall be strictly proportionate to the paid up value of the shares as regards voting, dividends and other benefits

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7. RESTRICTION ON ALLOTMENT

The Board shall as regard any allotments of shares duly comply with such of the provisions of Sections 68 to Section 73 of the Ordinance as may be applicable thereto.

8. COMMISSION AND BROKERAGE

Subject to Section 82 and 83 of the Ordinance, the Company may at any time pay a commission to any person for subscribing or agreeing to subscribe whether absolutely or conditionally for any shares in, or debentures or other securities of the Company or procuring or agreeing to procure subscriptions whether absolute or conditional for any shares or debentures or other securities of the Company, provided that the conditions and requirements set out in the Ordinance shall be observed and complied with. Such commission may be satisfied by the payment of cash or the allotment of fully paid shares, or the issuance of securities or by any combination thereof. The rate of commission and brokerage shall not exceed the rate, if any, from time to time fixed by the SECP.

9. SHARES AT DISCOUNT

The Company may under a Special Resolution and with the consent of SECP and upon otherwise, complying with Section 84 of the Ordinance, the Board may issue shares at a discount.

10. TRUST NOT RECOGNIZED

No notice of any Trust expressed, implied or constructive shall be entered on the Register. The Company shall not, save as ordered by a court of competent jurisdiction, or as by statute required, be bound to recognize any benami, equitable, contingent, future, or partial interest in any share, or any other right in respect of a share, except an absolute right thereto in the person or persons from time to time registered as the holder or holders thereof.

11. REGISTER

11.1 The Company shall keep a Register in accordance with Sections 147, 149 and 156 of the Ordinance.

11.2 The Register shall be prima facie evidence of any matters the Ordinance directs or authorizes to be inserted therein.

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PART III – CERTIFICATES

12. CERTIFICATES

The certificates of title of shares shall be issued under the Seal and signed by at least two Directors. Every share certificate shall specify the number and class and the distinguishing number (if any) of the shares to which it relates. A Director's signature on such certificates may be affixed or printed by any mechanical or electronic method. No share certificate shall represent shares of more than one class.

13. MEMBERS RIGHTS TO CERTIFICATES

Every person whose name is entered as a Member in the Register of Members shall, unless the conditions of issue of the shares otherwise provide, be entered without payment to receive within sixty (60) days after the allotment or within forty five (45) days of the application for the registration of the transfer of any shares of the Company, a certificate under the Seal specifying the shares held by him/her and the amount paid up thereon. If any Member shall require additional certificates he/she shall pay for each such certificate, a sum not exceeding Rs.10/- or otherwise as the Board may determine, provided that in respect of any share held jointly by several persons the Company shall not be bound to issue more than one certificate, and delivery of the certificate for a shares to one of the several joint holders shall be sufficient delivery to all.

14. ISSUE OF NEW CERTIFICATES

14.1 Subject to the provisions of Section 75 of the Ordinance, if a share certificate is defaced, lost or destroyed, it may be renewed on payment of such fee (if any) not exceeding Rs.10/- and on such terms (if any) as to evidence and indemnity and the payment of expenses incurred by the Company in investigating evidence, as the Board thinks fit.

14.2 Where some of the share comprised in a share certificate are transferred the old certificate shall be cancelled and a new certificate for the balance of such shares be issued without charge.

14.3 The shares are indivisible but more than one person may have a share in one share but shall be represented by one person towards the Company. The shares may not be represented by negotiable instruments.

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PART IV - TRANSFER AND TRANSMISSION OF SHARES

15. TRANSFER OF SHARES

15.1 Every transfer of shares must be in writing in the form specified in Article 16.2 herein or in any other form that the Board may approve and must be left at the office accompanied by the certificate or, if no such certificate is in existence the letter of allotment of the shares to be transferred and such other evidence, if any, as the Board may require to prove the title of the intending transferor of his/her right to transfer the shares.

15.2 The shareholders and Directors of the Company have a right of priority in the event of one of the shareholders alienating some or all of his/her shares. But any transfer whether to the shareholders or to the Directors of the Company or to third parties must follow the provisions of the applicable law.

16. EXECUTION OF TRANSFER

16.1 The instrument of transfer of any share should be duly stamped and executed both by the transferor and the transferee and the transferor shall be deemed to remain the holder of such shares until the name of the transferee is entered in the Register of Members in respect thereof. Each signature of such transfer shall be duly attested by the signature of one witness who shall add his/her address and occupation.

16.2 Shares in the Company shall be transferred in the following form, or in any usual or common form which the Directors shall approve:

I....................................... of.................................... In consideration of the sum of Rupees........................... paid to me by....................................... of......................... (hereinafter called "the transferee") do hereby transfer to the said transferee...............share(s) numbered............... to.................... inclusive, in **SHAFI ENERGY (PRIVATE) LIMITED** to hold unto the said transferee, his/her executors, administrators and assigns, subject to the several conditions on which I held the same at the time of the execution hereof, and I, the said transferee, do hereby agree to take the said share(s) subject to the conditions aforesaid.
As witness our hand this ......Day of ....

....
Signature Transferor Signature Transferee

Full Name
Full Address
Witness Fathers/Husband's name
Nationality
Occupation

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Signature ....
Full Address ....

Signature...............................
Full Address ....

17. CASES IN WHICH THE DIRECTORS SHALL REFUSE TO REGISTER TRANSFER

The Directors may refuse to register any transfer of any fully paid shares if:

(a) the transfer deed is for any reason defective or invalid, provided that the Company shall within thirty (30) days, from the date on which the instrument of transfer was lodged with it, notify the defect or invalidity to the transferee who shall after removal of such defect or invalidity be entitled to re-lodge the transfer deed with the Company; or

(b) the transfer is in breach of the provisions of Article 16;

If the Company refuses to register the transfer of any share for the reason specified in Article 16, the Company shall within thirty (30) days after the date on which the instrument of transfer was lodged with it, send to the transferee notice of the refusal indicating the reason for such refusal.

18. NO TRANSFER TO AN INSOLVENT OR PERSON OF UNSOUND MIND

No transfer shall be made to an insolvent or person of unsound mind.

19. TRANSMISSION OF REGISTERED SHARES

The executors, administrators, heirs or nominees, appointed under Section 80 of the Ordinance as the case may be, of a deceased Member not being one of several joint holders shall be the only persons recognized by the Company having any title to the shares registered in the name of such Member. In case of death of any one or more of the joint holders of any shares the survivor or survivors shall be the only persons recognized by the Company as having any title to or interest in such share. Before recognizing any executor, or administrator the Board may request him/her to obtain a grant of Probate or Letters of Administration, Successions Certificates or other legal representation(s) as the case may be from a competent court provided nevertheless that where the Board in its absolute discretion thinks fit it shall be lawful for the Board to dispense with the production of Probate or Letters of Administrator or Succession Certificates or such other

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legal representation(s) upon such terms as to indemnity or otherwise as the Board in its absolute discretion may consider necessary.

20. **RIGHT OF PERSONS ENTITLED TO SHARES UNDER ARTICLE 19**

A person so becoming entitled under Article 19 shall subject to the right of the Board to retain such dividends or monies as hereinafter provided have the right to receive and give a discharge for any dividend or other monies payable or other advantages arising in respect of the shares but he/she shall have no right to attend or vote at meetings of the Company or save as aforesaid to any of the rights or privileges of a Member in respect of the shares unless and until he/she shall be registered as the holder thereof.

21. **DIRECTOR MAY DECLINE TO REGISTER PERSONS ENTITLED BY TRANSMISSION**

The Directors shall have the same right to refuse to register a person entitled by transmission to any shares or his/her nominee as if he/she were the transferee named in any ordinary transfer presented for registration.

22. **CLOSURE OF REGISTER**

The Company may on giving seven (7) days previous notice in the manner prescribed in the Ordinance, close the Register for any period not exceeding in the aggregate forty-five (45) days in each year but not exceeding thirty (30) days at any one time.

23. **TRANSFER OF DEBENTURES**

The provision relating to transfer of shares herein contained shall apply mutatis mutandis to transfer of debentures and other securities of the Company.

PART V - ALTERATION OF CAPITAL

24. **POWER TO INCREASE CAPITAL**

The Company may, from time to time, increase its share capital in accordance with the provisions of the Ordinance.

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25. SHARES TO BE OFFERED TO EXISTING MEMBERS

25.1 All new shares shall be offered in the first instance to the Members in proportion as nearly as the circumstances admit to the existing shares held by each Member and such offer shall be made by notice specifying the number to which the Member is entitled and limiting a time within which the offer if not accepted will be deemed to be declined.

25.2 After expiration of the time for acceptance of an offer of new shares specified in paragraph 25.1 of this Article or on receipt of an intimation from the Member to whom such notice is given that he/she declines to accept the shares offered, the Board may, subject to the provisions of Section 86 of the Ordinance, dispose of the same in such manner as they think most beneficial to the Company.

26. RANKING OF NEW SHARES WITH THE ORIGINAL CAPITAL

The new shares shall be subject to the same provisions with reference to transfer, transmission, and otherwise as the shares in the original share capital.

27. REDUCTION OF SHARE CAPITAL

The Company may, by Special Resolution, reduce its share capital, in any manner subject to the provisions of the Ordinance.

28. CONSOLIDATION AND SUB-DIVISION

Subject to the provisions of Section 92 of the Ordinance, the Company may, by Ordinary Resolution:

(a) Consolidate and divide the whole or any part of its share capital into shares of larger nominal value than its existing shares.

(b) Sub-divide its existing shares or any of them into shares of smaller amount than is fixed by the Company's Memorandum of Association, subject nevertheless, to the provisions of clause (d) of sub-Section (1) of Section 92.

(c) Cancel any shares which at the date of the passing of the Ordinary Resolution in that behalf have not been taken or agreed to be taken by any person.

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PART VI - GENERAL MEETINGS

29. ANNUAL GENERAL MEETINGS

The Company shall hold in addition to any other general meeting, a general meeting as its annual general meeting, within eighteen months from the date of its incorporation and thereafter at least once in every calendar year within a period of four months following the close of its financial year and not more than fifteen months after the holding of its last preceding annual general meeting.

30. EXTRAORDINARY GENERAL MEETING

All general meetings of the Company other than the annual general meeting shall be called extraordinary general meetings ("EGM"). The Board may whenever it thinks fit convene an EGM and an EGM shall also be convened on such requisition, or, in default may be convened by such requisitions, as provided by Section 159 of the Ordinance. An EGM may be held in such places as the Board may determine.

32. NOTICE OF MEETINGS

All general meetings of the Company shall be called by not less than twenty-one clear days notice in writing. The notice shall specify the place, the day and the hour of the meeting along with a statement of the business to be transacted at the general meeting and in case of special business, a the general nature of that business , shall be given in the manner provided by the Ordinance for the general meeting, to such persons as are, under the Ordinance or the regulations of the Company entitled to receive such notices from the Company; but the accidental omission to give notice to, or the non-receipt of notice by, any Member shall not invalidate the proceedings at any general meeting.

33. PROXIES

In every notice calling a meeting of the Company there shall appear with reasonable prominence a statement that a Member entitled to attend and vote is entitled to appoint a proxy to attend the vote in his/her stead and that a proxy need not be a Member.

34. ENTITLEMENT TO RECEIVE NOTICE AND ARRANGEMENT FOR MEETINGS

Subject to any restrictions contained in the Ordinance or in any of the Articles every Member shall be entitled to attend a general meeting in person or by proxy.

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35. BUSINESS AT GENERAL MEETINGS

All business that is transacted at an EGM shall be deemed special, and also all that is transacted at an annual general meeting with the exception of declaring a dividend, the consideration of the accounts, balance sheet and the reports of the Directors and auditors, the election of Directors, the appointment of, and the fixing of the remuneration of the auditors.

36. QUORUM

No business shall be transacted at any general meeting unless quorum of Members is present at the time when the meeting proceeds to business, save as herein otherwise provided. At least 2 Members having not less than twenty-five percent (25%) of the voting power present in person or through proxy shall be the quorum at any general meeting of the Company.

37. EFFECT OF QUORUM NOT BEING PRESENT

If within half an hour from the time appointed for the meeting a quorum is not present, the meeting, if convened upon the requisition of Members, shall be dissolved, in any other case, it shall stand adjourned to the same day in the following week at the same time and place. The quorum for any such meeting shall remain as provided for in Article 36 above.

38. CHAIRMAN OF GENERAL MEETING

The Chairman, if any, elected under Article 58 shall preside as Chairman at every general meeting of the Company, but if there is no such Chairman or if at any general meeting the Chairman is not present within fifteen minutes after the time appointed for holding the meeting, or is unwilling to act as Chairman, the Members present whether in person or by the proxy shall choose one of their number to be Chairman of the meeting.

39. POWER TO ADJOURN GENERAL MEETING

39.1 The Chairman of a general meeting may at any time with the consent of the general meeting at which a quorum is present (and shall if so directed by the meeting) adjourn the meeting to another time or place. In addition the Chairman may at any time without the consent of the meeting adjourn the meeting to another time or indefinitely if it appears to the Chairman that:

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(I) The number of persons wishing to attend cannot be conveniently accommodated in the place(s) appointed for the meeting; or

(II) The unruly behavior of any person attending the meeting prevents or is likely to prevent the orderly conduct of the business of the meeting; or

(III) An adjournment is otherwise necessary so that business of the meeting may be properly conducted.

No business shall be transacted at any adjourned meeting other than business left unfinished at the meeting from which the adjournment took place.

39.2 When a meeting is adjourned for an indefinite period, the date, time and place of the adjourned meeting shall be fixed by the Board. When a meeting is adjourned for 60 days or more, notice of the adjourned meeting shall be given as in the case of the original meeting. When a meeting is adjourned for more than 14 days but less than 60 days (or for 14 days or less if the date of the adjourned meeting is fixed by the Board), notice of the day, time and place of the adjourned meeting shall be given in the same manner as in the case of an original meeting and notice of the business to be transacted at such an adjourned meeting shall not be required. Where a meeting is adjourned for 14 days or less, and the date of the adjourned meeting is fixed by the Chairman of the meeting, it shall not be necessary to give any notice of the adjourned meeting or of the business to be transacted at an adjourned meeting whatever the reason for the adjournment.

40. MODE OF DECIDING QUESTIONS AT MEETINGS

At any general meeting, a resolution put to the vote of the meeting shall, unless a poll is demanded, be decided on a show of hands unless a poll is (before or on the declaration of the result of the show of hands) demanded. Unless a poll is so demanded, a declaration by the Chairman that a resolution has, on a show of hands, been carried, or carried unanimously, or by a particular majority, or lost, and an entry to that effect in the book of the proceedings of the Company shall be conclusive evidence of the fact, without proof of the number or proportion of the votes recorded in favour of, or against, that resolution.

41. POLL

41.1 A poll may be demanded only in accordance with the provisions of Section 167 of the Ordinance. If a poll is duly demanded, it shall be taken in accordance with the manner laid down in Section 168 of the Ordinance and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.

41.2 A poll demanded on the election of the Chairman or on a question of adjournment shall be taken at once.

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42. RIGHT OF DIRECTORS TO ATTEND GENERAL MEETINGS

Subject to Section 162 of the Ordinance every Director of the Company shall have the right to attend any general meeting of the Company and also to take part in the discussions thereat, but he/she shall not be entitled to cast a vote at a general meeting of the Company unless he/she is Member of the Company.

PART VII - VOTES OF MEMBERS

43. VOTES OF MEMBERS

Subject to any rights or restrictions attached to any shares and to the provisions of these Articles, on a show of hands every Member who is present in person shall have one vote and on a poll every Member present in person or by a representative or proxy shall have one vote for each share held by him/her. Provided that in case of election of Directors, the provisions of Article 53 shall apply.

44. REPRESENTATION OF COMPANIES OR CORPORATIONS AT GENERAL MEETING

Any company or corporation which is a Member of the Company may by resolution of its Board of directors or in such manner as may be permitted or required by its constitution, authorize, in writing, any person or persons to act as its representative at any general meeting of the Company or any class of Members in respect of its entire holding or any part thereof. A person so authorized shall be entitled to exercise the same powers on behalf of the company or corporation he/she represents as that company or corporation could exercise if it were an individual Member of the Company. A representative so appointed shall not be deemed to be a proxy.

45. JOINT HOLDERS

In the case of joint holders of a share the vote of the senior who tenders a vote, whether in person or by proxy, shall be accepted to the exclusion of the votes of the other joint holders and for this purpose seniority shall be determined by the order in which the names stand in the Register in respect of the shares.

46. THE INSTRUMENT OF PROXY

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The instrument appointing a proxy shall be in writing and be signed by the appointer or his/her attorney duly authorized in writing or if the appointer or his/her attorney duly authorized in writing or if the appointer is a body corporate be under its seal or be signed by an officer or any attorney duly authorized. A proxy need not be a Member. A proxy who is appointed for a specified meeting only shall be called a Special Proxy. A special proxy shall be valid only for the meeting to which it relates and it shall not be used for more than one meeting. An instrument appointing a proxy may be in the following form or a form near thereto as may be approved by the Directors:

SHAFI ENERGY (PRIVATE) LIMITED

I-----------------------------------of-------------------------being a member of SHAFI ENERGY (PRIVATE) LIMITED hereby appoint---------------------------of------------------------------as my proxy to vote for me and on my behalf at the annual/extraordinary general meeting of the Company to be held on the ______ day of__________, ______and at any adjournment thereof.

Dated: ______________ Signed: ----------------

47. INSTRUMENT APPOINTING A PROXY TO BE DEPOSITED AT THE OFFICE OF THE COMPANY

The instrument appointing a proxy and the power of attorney or other authority, if any under which it is signed or a notarized certified copy of that power or authority shall be deposited at the office of the Company not less than 48 hours before the time for holding the meeting or adjourned meeting at which the person named in the instrument proposed to vote and in default the instrument of proxy shall not be treated as valid. Delivery of an instrument appointing a proxy shall not preclude a Member from attending and voting in person at the meeting or poll concerned.

48. REVOCATION OF AUTHORITY

A vote given in accordance with the terms of an instrument appointing a proxy shall be valid notwithstanding the previous death or insanity of the Member or revocation of the proxy or of the authority under which the proxy was executed or the transfer of the shares in respect of which the proxy is given unless intimation in writing of the death, insanity, revocation or transfer shall have been received by the Company at least forty eight (48) hours before the commencement of the meeting or adjourned meeting at which the proxy is used. Provided nevertheless that the Chairman of any meeting shall be entitled to require such evidence as he/she may in his/her discretion think fit of the due execution of an instrument of proxy and that the same has not been revoked.

49. EQUALITY OF VOTES

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In case of an equality of votes, whether on a show of hands or on a poll, the Chairman of the meeting at which the show of hands takes place, or at which the poll is demanded, shall have and exercise a second or casting vote.

PART XIII - DIRECTORS

50. NUMBER OF DIRECTORS

a) The following shall be the first Directors of the Company:-

1. MUHAMMAD HALEEM SHEIKH
2. MUHAMMAD NASEEM
3. AMJAD HAFEEZ
4. TAHIR HANIF
5. AMIR M. SHAFI

b) Save as provided in Section 187 of the Ordinance, no person shall be appointed as a Director unless he/she is a Member of the Company.

51. REMUNERATION OF DIRECTORS

The remuneration of the Directors shall from time to time be determined by the Company in general meeting subject to the provisions of the Ordinance.

52. DIRECTORS MAY CONTRACT WITH COMPANY

No Director or intending Director shall be disqualified by his/her office from entering into any contract, arrangement, transaction or proposal with the Company either acting in a professional capacity as a vendor, purchaser or otherwise, nor shall any contract, arrangement, transaction or proposal entered into by or on behalf of the Company in which any Director shall be so concerned or interested, be liable to account to the Company for any profit realized by any such contract, arrangement, transaction or proposal by reason of such Director holding that office or of the fiduciary relation thereby established provided that the nature of his/her interest has been disclosed by him/her at the time and in the manner specified in Section 214 of the Ordinance. Provided further that any such contract, arrangement, transaction or proposal as afore-mentioned shall not be entered into with the Company by a Director or intending Director without the approval of the Board. In a Board meeting held for the purposes of granting such afore-said approval, the Director who is directly or indirectly interested or concerned in any way shall not take part in the discussion, nor vote in such meeting.

PART IX - APPOINTMENT, ELECTION AND REMOVAL OF DIRECTORS

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53. ELECTION OF DIRECTORS

53.1 At the first annual general meeting of the Company, all the Directors shall stand retired from office, and directors shall be elected in their place in accordance with Section 178 for a term of three years.

53.2 A retiring Director shall be eligible for re-election.

53.3 The Directors shall comply with the provisions of Sections 174 to 178 and Sections 180 and 184 relating to the election of Directors and matters ancillary thereto.

53.4 Subject to the provisions of the Ordinance, the Company may from time to time increase or decrease the number of Directors.

53.5 Any casual vacancy occurring on the Board of Directors may be filled up by the Directors, but the person so appointed shall be subject to retirement at the same time as if he/she had become a Director on the day on which the Director in whose place he/she is chosen was last elected as Director.

53.6 The Company may remove a Director in accordance with the provisions of the Ordinance

54. VACATION OF OFFICE OF DIRECTOR

The office of a Director shall be vacated if:

(a) He/she becomes ineligible to be appointed as a Director on any or more of the grounds enumerated in clause (a) to (h) of Section 187 of the Ordinance subject always to the proviso to such Section;

(b) He/she absents himself/herself from three consecutive meetings of the Board or from all meetings of the Board for a continuous period of three months whichever is the longer without leave of absence from the Board and the Board resolve that his/her office be vacated;

(c) He/she or any firm of which he/she is a partner or any private company of which he/she is a Director;

(i) without the sanction of the Company in general meeting, accepts or holds any office of profit under the Company other than that of Chief Executive or a legal or technical advisor or a banker; or

(ii) accepts a loan or guarantee from the Company in contravention of Section 195 of the Ordinance.

(d) He/she fails to obtain the share qualification, if any necessary for his/her appointment, or ceases to hold share qualification necessary for his/her appointment.

55. ALTERNATE DIRECTORS

Subject to Section 192 of the Ordinance, a Director may with the approval of the Board, appoint any person to be his/her alternate Director during his/her absence, if not less than three months, from Pakistan and such appointment shall have effect and such appointee while he/ she holds office as an alternate director shall be entitled to notice of meetings of the Board and to attend and vote thereat accordingly and generally to exercise all the rights of such absent Director subject to any limitations in the instrument appointing him/her. Any appointment or removal under this Article shall be effected by notice in writing under the hand of the Director making the same.

PART X - PROCEEDINGS OF DIRECTORS

56. MEETING OF DIRECTORS

The Board may meet together for the dispatch of business, adjourn, and otherwise regulate their meetings, as they think fit. Such meetings may be held in such places in or outside Pakistan as the Board may determine. The Board may invite such persons as they may deem fit to attend the meetings of the Board of Directors as observers. Meetings of the Board may be held by teleconference, video conference or other electronic media facilities enabling Directors to participate in meetings without being in the same physical location.

57. POWER OF DIRECTOR TO SUMMON A MEETING; NOTICE OF MEETING

A meeting of the Board can be convened at any time on the requisition of a Director; provided that seven (7) clear days' notice of the meeting shall ordinarily be given to all Directors including those who were/are not for the time being resident in Pakistan. In case of urgent business a meeting of the Directors may be called at shorter notice provided that notice of such meeting is sent to all the Directors by facsimile at the facsimile numbers if any provided by the Directors or by any other expeditious means.

58. CHAIRMAN

The Board may from time to time appoint one or more of their body to be the holder of the office of Chairman and determine the period for which he/she is to hold office. The Chairman so elected shall preside over meetings of the Board.

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59. QUORUM

The quorum for a meeting of the Board shall be a minimum of two (2) Directors.

60. EFFECT OF QUORUM

A meeting of the Directors for the time being at which a quorum is present shall be competent to exercise all or any of the authorities, powers and discretions by or under Articles of the Company for the time being vested in or exercisable by the Directors generally.

61. RESOLUTION WITHOUT A MEETING OF THE DIRECTORS

A resolution in writing signed by all Directors for the time being in office shall be valid and effectual as if it had been passed at a meeting of the Board duly called and constituted. For this purpose, it shall be permissible to circulate the text of the proposed resolution duly signed by the Chief Executive and obtain signatures of all the other Directors thereon.

62. DIRECTOR MAY ACT NOTWITHSTANDING ANY VACANCY

The continuing Directors may act notwithstanding any vacancy in their body, but if their number falls below the minimum fixed by or under these Articles the Directors shall not, except for the purpose of filing vacancies on the Board or summoning a general meeting, act so long as the number is below the minimum.

PART XI - POWERS OF DIRECTORS

63. POWERS OF DIRECTORS

63.1 The business of the Company shall be managed by the Directors who may pay all expenses incurred in promoting and registering the Company and may exercise all such powers of the Company as are not by the Ordinance or these Articles required to be exercised by the Company in a general meeting, provided that no regulation made by the Company in general meeting shall invalidate any prior act of the Board which would have been valid if that regulation had not been made.

63.2 The Directors shall exercise all powers enumerated under Section 196 of the Ordinance, including issuance/execution of cheques, promissory notes, drafts, bills of exchange and other instruments whether negotiable or transferable or not, and all receipts for moneys paid to the Company, shall be signed, drawn, accepted, endorsed or otherwise executed, as the case may be, in such manner as the Board shall from time to time by resolution determine.

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63.3 The Board shall cause minutes to be made in books provided for the purpose:

(a) of all appointments of officers made by the Board;

(b) of the names of the Directors present at each meetings of the Directors and of any committee of the Board; and

(c) of all resolutions and proceedings at all meetings of the Company, and of the Directors, and of committees of the Board.

PART XII - CHIEF EXECUTIVE

64. APPOINTMENT OF CHIEF EXECUTIVE

The Company shall have a Chief Executive appointed in accordance with the provisions of Section 198 and 199 of the Ordinance.

65. CHIEF EXECUTIVE DEEMED TO BE A DIRECTOR

The Chief Executive shall if he/she is not already a Director elected under Article 53 be deemed to be one and be entitled to all the rights and privileges and subject to all the liabilities of that office. Subject as aforesaid the terms and conditions of appointment of the Chief Executive shall be determined by the Board.

66. REMOVAL OF CHIEF EXECUTIVE

The Board by resolution by not less than three-fourths of their total number for the time being or the Company by a Special Resolution may remove a Chief Executive before the expiration of his/her term of office.

PART XIII - THE SEAL

67. CUSTODY OF SEAL

67.1 The Board shall provide for the safe custody of the Seal and the Seal shall not be affixed to any instrument except by the authority of the Board or a committee authorized by the Board itself.

67.2 Every instrument to which the Seal shall be affixed shall be signed autographically in any of the following manners.

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(i) By two Directors; or

(ii) By a person duly authorized by the Board either generally or in relation to specific instruments or instruments of specific descriptions.

67.3 Notwithstanding the provisions of paragraph 67.2 of the Articles the Board may resolve to dispense with autographic signatures of all or any person referred to in that paragraph in relation to specific instruments or instruments of specified descriptions, and in substitution therefore to authorize signatures to be affixed by some method or system of mechanical signature approved by the Board.

PART XIV – DIVIDENDS AND RESERVES

68. RESERVES

The Board may, before recommending any dividend, set aside out of the profits of the Company such sums as they think proper as a reserve or reserves which shall, at the discretion of the Board, be applicable for meeting contingencies or for equalizing dividends or for any other purpose to which the profits of the Company may be properly applied and pending such application may, at the like discretion, be employed in the business of the Company or be invested in such investments, as the Directors may, subject to the provisions of the Ordinance, think fit.

69. DECLARATION OF DIVIDENDS

The Company in general meeting may declare dividends, but no dividends shall exceed the amount recommended by the Board.

70. PAYMENT OF DIVIDENDS

No dividend shall be paid otherwise than out of the profits of the Company.

71. INTERIM DIVIDENDS

The Board may from time to time declare and pay to the Members such interim dividends as appear to the Board to be justified by the profits and position of the Company.

72. TIME FOR PAYMENT OF DIVIDEND

Any dividend declared pursuant to Article 69 shall be paid within the period laid down in Section 251 of the Ordinance.

73. DIVIDEND TO JOINT HOLDERS

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Any one of several persons who are registered as the joint holders of any shares may give effectual receipt for any dividend payable in respect of such shares.

74. **EFFECT OF TRANSFER**

A transfer of shares shall not pass the right to any dividend declared thereon before the registration of the transfer.

75. **RETENTION OF DIVIDEND**

The Directors may retain the dividend payable upon shares in respect of which any person is under Article 20 entitled to become a Member or which any person under that Article is entitled to transfer until such person shall become a Member in respect thereof or shall duly transfer the same.

76. **UNCLAIMED DIVIDENDS**

Subject to the applicable provisions of the Ordinance, all dividends unclaimed after having been declared may be invested or otherwise made use of by the Board for the benefit of the Company until claimed.

77. **DIVISION OF DIVIDEND**

All dividends of the Company shall be apportioned and paid pro rata among the Members in proportion to the number of shares held by them respectively during any portion or portions of the period in respect of which the dividend is paid.

PART XV – MINUTES AND BOOKS

78. **MINUTES TO BE RECORDED**

The Company shall cause a fair and accurate summary of all proceedings of general meetings and meetings of its Board and committees along with the name of those participating in such meetings to be entered in properly maintained books.

79. **BOOKS OF ACCOUNTS TO BE KEPT**

The Board shall cause to be kept proper books of accounts with respect to all sums of money received and expenditures incurred all sales and purchases of goods by the Company and all assets and liabilities of the Company.

80. **BOOKS OF ACCOUNTS TO BE KEPT AT OFFICE OF THE COMPANY**

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The books of accounts shall be kept at the office of the Company or at such other place in Pakistan as the Board may decide and when the Board so decides the Company shall within seven (7) days of the decision, file with the Registrar a notice in writing giving the full address of that other place.

81. ANNUAL ACCOUNTS AND BALANCE SHEET

The Directors shall as required by Section 233 and 236 of the Ordinance cause to be prepared and to be laid before the Company in general meeting such profit and loss accounts and balance sheets duly audited and reports as referred to in the above referred Sections.

PART XVI – AUDIT

82. APPOINTMENT OF AUDITORS

Auditors shall be appointed and their duties regulated in accordance with Sections 252 to 255 of the Ordinance. The auditors shall be entitled to attend any general meeting of the Company and to receive all notices of and other communications relating to any general meeting which any Member is entitled to receive and be heard there at, on any part of the business of the meeting which concerns him/her as auditor.

PART XVII – NOTICES

83. PROCEDURE FOR GIVING NOTICES

A notice may be given by the Company to any Member either personally or by sending it by post to him/her at his/her registered address or if he/she has no registered address in Pakistan, to the address, if any within or outside Pakistan, supplied by him/her to the Company for the giving of notices to him/her.

84. NOTICE SENT BY POST

Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, preparing and posting a letter containing the notice and, unless the contrary is proved, to have been effected at the time at which the letter would have been delivered in the ordinary course of post.

85. NOTICE TO JOINT HOLDERS

A notice may be given by the Company to the joint holders of a share by giving the notice to the joint holder named first in the Register in respect of the shares.

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86. **NOTICE TO PERSON ENTITLED BY TRANSMISSION**

A notice may be given by the Company to the person entitled to a share in consequence of the death or insolvency of a Member by sending it through the post in a prepaid letter addressed to them by name or by the title of representatives of the deceased or assignees of the insolvent of by any like description at the address if any in Pakistan, supplied for the purpose by the persons claiming to be so entitled or until such an address has been so supplied by giving the notice in any manner in which the same might have been given if the death or insolvency had not occurred.

PART XVIII – SECRECY

87. **SECRECY**

Every Director, manager, advisor, auditor, member of a committee of the Board, officer, servant, agent, accountant or other person employed in the business of the Company shall, if so required by the Board, before entering upon his/her duties, sign a declaration pledging himself/herself to observe a strict secrecy respecting all transactions of the Company with its customers and the state of accounts with individuals and in matters relating thereto, and shall by such declaration pledge himself/herself not to reveal any of the matters which may come to his/her knowledge in the discharge of his/her duties except when required to do so by the Directors or by any applicable law or by any general meeting or by any court of law and except so for as may be necessary in order to comply with any of the provisions of these Articles.

PART XIX – INDEMNITY

88. **INDEMNITY**

Every officer, Director or agent for the time being of the Company may be indemnified out of the assets of the Company against any liability incurred by him/her in defending any proceedings, whether civil or criminal arising out of his/her dealings in relation to the affairs of the Company whether the outcome of any such proceedings is in her/his favour or otherwise except those brought by the Company against him/her, or in connection with any application under Section 488 in which relief is granted to him/her by the Court.

PART XX - WINDING UP

89. **DISTRIBUTION OF ASSETS**

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89.1 If the Company is wound up, the liquidator may, with the sanction of a Special Resolution of the Company and any other sanction required by the Ordinance, divide amongst the Members, in specie or in kind, the whole or any part of the assets of the Company, whether they consist of property of the same kind or not.

89.2 For the purpose aforesaid, the liquidator may set such value as he/she deems fair upon any property to be divided as aforesaid and may determine how such division shall be carried out as between the Members or different classes of Members.

89.3 The liquidator may, with the like sanction, vest the whole or any part of such assets in trustees upon such trusts for the benefit of the contributories as the liquidator, with the like sanction, thinks fit, but so that no Member shall be compelled to accept any shares or other securities whereon there is any liability.

PART XXI - DISPUTE RESOLUTION

90. DISPUTE RESOLUTION

90.1 In the event that a dispute, claim or controversy arises between the Company, its management or its shareholders, or between the shareholders inter-se, or the directors inter-se, all steps shall be taken to settle the dispute and resolve the issue through mediation by an accredited mediator before taking recourse to formal dispute resolution such as arbitration or litigation.

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We the several persons, whose names and addresses are subscribed, are desirous of being formed into a company, in pursuance of these Articles of Association and we respectively agree to take the number of shares in the capital of the Company set opposite to our names:

Name and Surname (Present & Former) in full (in Block Letters)	Father's/Husband's Name in Full	CNIC/ Passport No.	Nationality with any former Nationality	Occupation	Address	Number of Shares taken by each Subscriber
Muhammad Haleem Sheikh	Muhammad Shafi (Late)	35202-2494224-3	Pakistani	Business Executive	House # 85-B, Model Town, Lahore	1 (one)
Muhammad Naseem	Muhammad Shafi (Late)	42201-2326228-7	Pakistani	Business Executive	House # B-17, 3 Gizri Street, Phase 4, DHA, Karachi	1 (one)
Amjad Hafeez	Abdul Hafeez (Late)	42201-2316823-7	Pakistani	Business Executive	House # 69 Al-Hamra Housing Society, Tipu Sultan Road ,Karachi	1 (one)
Tahir Hanif	Muhammad Hanif (Late)	42101-4114447-9	Pakistani	Business Executive	House # 119, Street No. 10, Alhamra Society, Karachi.	1 (one)
Amir M. Shafi	Sheikh Mazhar Hussain	42301-8673498-7	Pakistani	Business Executive	House # 66-W, Phase III, Defence Housing Authority, Lahore, Cantt., Lahore	1 (one)
Muhammad Shafi Tanneries (Pvt.) Ltd through Zahid Haleem	N/A Muhammad Haleem Sheikh	1185331-0 42201-2515026-3	N/A Pakistani	N/A Business Executive	35-A/3 Shafi House M.T Khan Road Lalazar, Karachi House No. 105, Street No. 3, Khayaban-e-Muhafiz, Phase 6,	1 (one)

Certified True Copy of [illegible]

Sheikh					Defense Housing Authority, Karachi	
Shafi Texcel Limited through Muhammad Naseem	N/A Muhammad Shafi (Late)	0803022-7 42201-2326228-7	N/A Pakistani	N/A Business Executive	35-A/3 Shafi House M.T Khan Road Lalazar, Karachi House # B-17, 3 Gizri Street, Phase 4, DHA, Karachi	1 (one)
Shafi Glucochem (Pvt.) Ltd through Muhammad Naseem	N/A Muhammad Shafi (Late)	0712061-3 42201-2326228-7	N/A Pakistani	N/A Business Executive	35-A/3 Shafi House M.T Khan Road Lalazar, Karachi House # B-17, 3 Gizri Street, Phase 4, DHA, Karachi	1 (one)
						Total: 8 (eight)

Dated the 9th day of December 2015.

Witness to the above signatures:

Name: NIFT (Pvt.) Limited
Address: 5th Floor, AWT Plaza, I.I. Chundrigar Road
Karachi- 74200, Pakistan

Certified to be True Copy
Deputy Registrar of Companies
16/12/2015

Annexure – H
Certificate of Incorporation

A011459

SECP

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

[Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No. **0096697**

I hereby certify that **SHAFI ENERGY (PVT.) LIMITED** is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is **limited by shares.**

Given under my hand at **Karachi** this **Fourteenth** day of **December,** Two **Thousand** and **Fifteen**.

Incorporation fee Rs. **62,000/=** only

(Sidney Custodio Pereira)
Joint Registrar of Companies
Karachi

Certified True Copy of
Company Secretary

Annexure – N
Plant Characteristics

PLANT CHARACTERISTICS;

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

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