BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

APPLICATION FOR A GENERATION LICENSE FOR WIND POWER GENERATION FACILITY

Pursuant to enabling provisions of NEPRA Act 1997 read with enabling provisions of rules made there under, Licensing (Application & Modification Procedure) Regulations and Licensing (Generation) Rules 2000 & The Federal Government's

ON BEHALF OF

'POLICY OF RENEWABLE ENERGY FOR POWER GENERATION 2006'

BURJ WIND ENERGY (PRIVATE) LIMITED

FOR NEPRA'S GRANT OF GENERATION LICENSE FOR BURJ WIND ENERGY (PRIVATE) LIMITED

FOR A POWER PROJECT OF 13.80 MW (THE PROJECT)

AT

GUJJU, DISTRICT THATTA, SINDH, PAKISTAN

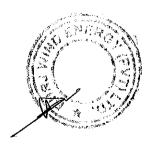
DATED: MAY 22, 2018

BURJ WIND ENERGY (PRIVATE) LIMITED

BUSINESS & REGISTERED ADDRESS : 3RD FLOOR, FAYSAL BANK BUILDING

16, ABDULLAH HAROON ROAD, KARACHI

PHONE # : (+92) 21 35631536-7





Ref: BWEPL/NEPRA/304/2018

Date:22.05.2018

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

SUBJECT:

APPLICATION FOR GRANT OF GENERATION LICENSE TO BURJ WIND ENERGY (PVT.) LIMITED FOR ITS 13.80 MW WIND POWER GENERATION PROJECT TO BE LOCATED AT GUJJU, DISTRICT THATTA, PROVINCE OF SINDH

I, Saleem Uz Zaman (Chief Executive Officer), being the duly authorized representative of **Burj Wind Energy (Pvt.) Limited** by virtue of BOARD RESOLUTION dated January 3, 2018, hereby apply to the National Electric Power Regulatory Authority for the grant of a **GENERATION LICENSE** to Burj Wind Energy (Pvt.) Limited pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

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 (Application and Modification Procedure) Regulations, 1999 ("AMPR"), and undertake to abide by the terms and provisions of the above-said regulations. 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.

A Bank Draft in the sum of Rs. 233,532/- (Rupees Two Hundred Thirty Three Thousand Five Hundred Thirty Two Only) dated: 18.05.2018 bearing Pay Order No: 550656, being the non-refundable license application fee calculated in accordance with Schedule II of the AMPR, is also attached herewith. Further, additional documents/ information, pursuant to the AMPR, are attached herewith. Any further documents that may be required by the Authority will be submitted.

Mr. Saleem Uz Zaman Chief Executive Officer

Burj Wind Energy (Pvt.) Limited

CERTIFIED TRUE COPY

BURJ WIND ENERGY (PVT.) LTD.

COMPANY SECRETARY



EXTRACT FROM RESOLUTION PASSED BY THE DIRECTORS OF BURJ WIND ENERGY (PRIVATE) LIMITED PURSUANT TO ARTICLE 43 OF ARTICLES OF ASSOCIATION OF BURJ WIND ENERGY (PRIVATE) LIMITED ON JANUAYR 3, 2018

"RESOLVED that an application for the Generation License (the "GL Application") be filed by and on behalf of Burj Wind Energy (Pvt.) Limited (the "Company") with the National Electric Power Regulatory Authority ("NEPRA"), in connection with the GL Application for the Company in respect of the Company's 14 MW Wind Power Project in the province of Sindh (the "Project").

RESOLVED FURTHER that Mr. Saleem Uz Zaman, Director & Chief Executive Officer of the Company, be and is hereby authorized to sign the GL Application, and any documentation ancillary thereto, pay all filing fees, and provide any information required by NEPRA in respect of the Project, and do all acts and things necessary for the processing, completion and finalization of the GL Application.

Saleem uz Zaman

Director & Chief Executive Officer

CERTIFICATION

CERTIFIED, that, the above resolution by circulation was duly passed by the Board of Directors of Burj Wind Energy (Pvt.) Limited on January 3, 2018, for which the quorum of directors was present.

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

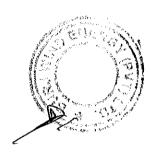
Shabbir Ahmed Company Secreta

CERTIFIED TRUE COPY

BURJ WIND ENERGY (PVT.) LTD

COMPANY SECRETARY

APPLICATION FOR GENERATION LICENSE



1. BACKGROUND TO GENERATION LICENSE APPLICATION

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

1.1.1 Issuance of "Letter of Intent"

BURJ WIND ENERGY (PVT.) LIMITED (BWEPL) (a company duly organized and existing under the laws of Pakistan, with its office located at 3rd Floor, Faysal Bank Building, 16, Abdullah Haroon Road Karachi), (the **Project Company**), was incorporated on 20th June 2012 to develop, own and operate an approximately 13.80 MW wind power project in Gujju, Thatta (**Project**) pursuant to an Alternative Energy Development board (AEDB) LETTER OF INTENT dated 31st Oct, 2012 (and amended from time to time).

1.1.2 Submission of the Feasibility Study

Pursuant to the relevant provisions of the Policy for Development of Renewable Energy for Power Generation 2006 (the RE Policy 2006) and the LOI, the Project Company completed the detailed technical feasibility study (the Project Feasibility Study) for the Project and submitted to AEDB. The Feasibility Study is attached in Annexure A.

1.1.3 Submission of Initial Environmental Examination (IEE)

Technical consultants Ectech Environment Consultants completed the IEE for the Project and the Project Company submitted the same to the Sindh Environmental Protection Agency (the SEPA).

After careful review and analysis of the Initial Environmental Examination, the SEPA accorded its approval and extended for the Project through its decision 2013/8/21/IEE/127/18 dated: 27.02.18 (the IEE Approval Decision). A copy of the IEE Approval Decision is attached hereto as Annexure B for NEPRA's perusal.

1.1.4 Grid Interconnection Studies

Grid Interconnection Study was carried out by Power Planners International (PPI). The National Transmission and Dispatch Company (NTDC) has vide letter no. GMPP/CEMP/TRP-380/1811-15 dated: 07.04.2017, accorded its approval of the Grid Study to the Project Company. A copy of the approval of the Grid Study and Equivalency Letter from the PPI is attached hereto as ANNEXURE M for NEPRA's perusal, which is submitted to CPPA wide letter No: BWEPL/CPPA/292/2018 dated:21.02.2018 is also attached.

1.1.5 Location of Project & Lease of Land

The Project will be located on private land around 250 acres. The site is located in Gujju, District Thatta, Sindh a city of the province Sindh. The distance between the Project site and Karachi is about 80 km and the road distance of site from Port Qasim is 73-75 km. The distance between Project site and the coastal line of Arabian Sea is approximately 45 km. The north latitude of the site is 24°44′05.43″N, and the east longitude is 67°49′03.54″E. The monsoon from the Indian Ocean, which is stable in its direction and high in quality brings rich wind energy resource to the site. A copy of the MoU in respect lease of lands for the project is attached hereto as ANNEXURE C for NEPRA's perusal.

1.1.6 Brief Technical Synopsis of the Project

The Project shall have an installed capacity of 13.80 MW with 06 General Electric wind turbine generators (WTG) of 2.3 MW each and will dispatch electricity to HESCO/NTDC grid station. Please refer to (Annex G of Annexure A (Feasibility Study) for the Grid Interconnection Study carried out by PPI and Equivalency letter by PPI.

1.1.7 Tariff

BWEPL will submit a separate tariff petition on cost plus tariff basis. Upon issuance of the Generation License and award of the Cost-Plus tariff, the Project Company will execute the Energy Purchase Agreement with the CPPA-G and aims to achieve financial close for the Project within 12 months of granting of the Tariff. The expected commercial operations date of the Project is to be within 15 months of Financial Close.

1.1.8 Request for grant of a generation license

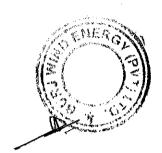
Based on the matters provided in Sections 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6 and 1.1.7 above whereby the Project Company, on its part, has completed all activities required for procurement of approvals of the relevant matters from various stakeholders, it is submitted that the requirements of the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

1.2 Submission

- 1.2.1 Under the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of) 1997 (the NEPRA Act) and the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, the National Electric Power Regulatory Authority (NEPRA) is responsible for and has the authority to, *inter alia*, grant licenses for the generation of electric power and other terms and conditions for the supply of electricity through generation.
- 1.2.2 PURSUANT TO Sections 7(2)(a) and 15 of the NEPRA Act read with other enabling provisions of the NEPRA Act, the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations 1999, National Electric Power Regulatory Authority.

Licensing (Generation) Rules 2000, <u>AND</u> in accordance with the RE Policy 2006: **BWEPL** <u>HEREBY SUBMITS</u>, for NEPRA's kind and gracious consideration, the application for the grant of a generation license along with supporting documents (the **Generation License Application**) for its 13.80 MW power generation facility to be located at Gujju, District Thatta, Sindh, Pakistan.

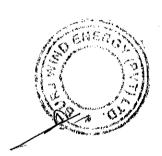
- 1.2.3 Given the advance stage of the Project, NEPRA is kindly requested to process this Generation License request at the earliest, thereby enabling the Project Company to proceed further with the development process.
- 1.2.4 This Generation License Application is submitted in triplicate.
- 1.2.5 The generation license fee, payable by the Project Company, in respect of this Generation License Application is also enclosed in the form of a pay order for an amount of PKR. 233,532 /= (Two Hundred Thirty Three Thousand Five Hundred Thirty Two) dated 18.05.2018 drawn in favor of NEPRA.



2. APPLICANT – BWEPL

- 2.1 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.
- 2.2 The Project Company (following grant of a generation license and approval of the Project Company's reference generation tariff by NEPRA) proposes to design, engineer, construct, insure, commission, operate and maintain the Project constituting of a 13.80MW power generation facility (the Facility) to be located at Gujju, District Thatta, Province of Sindh, Pakistan (the Site).
- 2.3 For the purposes of designing, engineering, procuring, constructing, installing, testing, completing, commissioning, operation and maintenance of the Project, the Project Company has finalized the contract with HUADONG ENGINEERING CORPORATION (HDEC). The profile of HDEC is attached herewith as **ANNEXURE D**.
- 2.4 The following supporting documents relating to the Project Company are attached herewith as follows:

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



3. FACILITY UTILIZATION

3.1 ELECTRICITY DEMAND & WIND CORRIDOR

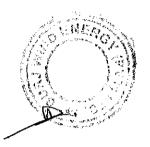
- 3.1.1 Pakistan is a developing economy having a constant growth in industrialization coupled with a constantly rising demand for electricity. The non-availability of natural resources for expansion of the power sector has widened the gap between demand and supply, which has resulted in excessive and frequent load shedding.
- 3.1.2 Pakistan currently has around 25.374 GW (State of Industry Report 2016) of installed capacity for electricity generation. Conventional thermal plants (oil, natural gas, coal) account for 65.5%, with hydroelectricity making up 28%, nuclear 3.1% and Renewable Energy (Wind, Solar & Bagasse) 3.4% of Pakistan's capacity. Pakistan's huge energy crisis is jeopardizing its economic progress and social development. The major reasons for the energy crisis are the lack of investment in power sector in the past, non-development of renewable energy sector i.e. hydel, wind and solar etc. and the depleting oil and gas reserves. It is imperative for Pakistan to look for indigenous/inexpensive energy resources such as renewable energy (Wind energy) for sustainable growth through self-reliance.
- 3.1.3 The wind power program in Pakistan was initiated around ten (10) years ago by installation of wind measuring stations in the coastal areas of Sindh, Pakistan. The energy potential of 346,000 MW in the country is estimated by National Renewable Energy Laboratory, USA and only the Gharo Keti Bander Hyderabad wind corridor (the **Wind Corridor**) has a potential of 50,000 MW of wind power generation. If harnessed adequately, wind energy alone could eradicate energy shortages in the country.
- 3.1.4 The Government of Pakistan has clearly articulated its support for the development of renewable energies through wind based independent power producers (the Wind IPPs).
- 3.1.5 In light of compliance by the Project Company of all requirements under the RE Policy 2006 for eligibility of an application for a generation license and following grant of a generation license and approval of Project Company's reference generation tariff, in each case, by NEPRA, the Project Company will finance, design, engineer, procure, construct, install, test, complete, commission, insure, operate and maintain the Project at Site.
- 3.1.6 The proposed Project has the advantage of being located in the Wind Corridor with sufficient wind resource.

3.2 POWER OFF-TAKE

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

3.2.2 The EPA will be finalized and executed by and between the Project Company and the Power Purchaser following NEPRA's approval of the Project Company's twenty five (25) years

reference generation tariff, the grant of a generation license to the Project Company and the issuance by the AEDB of the Letter of Support.



4. THE SPONSOR

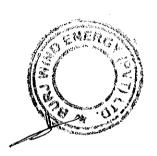
4.1 AN INTRODUCTION

BURJ CAPITAL (the "Project Sponsor") is the Sponsor of the Project.

Burj Capital is a developer, investor, and co-owner of renewable power plants. Headquartered in Dubai, UAE, Burj Capital also maintains a project development office in Karachi, Pakistan.

Burj Capital actively originates, develops and constructs high quality renewable power projects in select markets to reliably deliver electricity at the lowest possible cost.

The proposed Project is the second wind power project being set up by the Project Sponsor. Burj Capital's first Wind IPP, 50 MW Jhimpir Power Limited (JPL) has been commercially operational since March 2018. Hence the Project Sponsor has the technical know-how and financial ability to set up renewable projects in Pakistan.



5. RESOURCES

5.1 SENIOR MANAGEMENT & PERSONNEL

- 5.1.1 The Project is being developed by highly qualified personnel of the Sponsor along with top ranking consultants in wind sector. This team will continue to develop the project and, at the appropriate time (usually after financial close) the Company will be fully staffed with its own resources to construct and operate the Project.
- 5.1.2 Curriculum vitae of the key individuals developing the Project are attached herewith at ANNEXURE H:

	Name of Individuals	Position	ANNEXURE
1.	MR. SALEEM UZ ZAMAN	Chief Executive officer	H
2.	MR. OMAR MASRUR	Chief Development Officer	Н
3.	MR. FAISAL IFTIKHAR	Project Director	Н

5.2 INDEPENDENT CONSULTANT

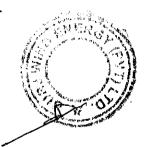
5.2.1 The Project Company appointed **OMS (PRIVATE) LIMITED** as independent consultant to select an EPC based on NEPRA Guidelines for the selection of EPC.

5.3 THE EPC CONTRACTOR

5.3.1 The Independent Consultant, after a thorough review of technical and commercial bids, recommended HUADONG ENGINEERING CORPORATION LIMITED (HDEC) as the EPC Contractor for the Project.

5.4 <u>LEGAL ADVISOR</u>

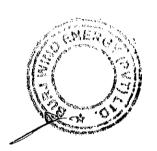
5.4.1 AFRIDI AND ANGEL is advising the Project Company on legal aspects.



6. CAPITAL BUDGET

- 6.1 The estimated total project cost (the **Total Project Cost**), expressed in United States Dollars, has been calculated after thorough analysis, evaluation and understanding of the dynamics that affect the development and operation of a wind farm. The Total Project Cost is approximately USD 27,725,697/- (US Dollar Twenty Seven Million Seven Hundred Twenty Five Thousand Six Hundred Ninety Seven Only).
- 6.2 The capital structure of the Project is shown below:

	USD	
DEBT	20,794,273	75%
EQUITY	6,931,424	25%
TOTAL PROJECT COST	27,725,697	100%



7. FINANCIAL PLAN

The Total Project Cost of approximately USD 27,725,697/- (US Dollar Twenty Seven Million Seven Hundred Twenty Five Thousand Six Hundred Ninety Seven Only).is to be financed in a debt to equity ratio of 75%/25%, which is in accordance with the RE Policy 2006.

7.1 **DEBT**

7.1.1 The Project Company has secured interest from Meezan Bank (Mandated Bank) for project financing signifying confidence and keen interest of lenders in the Project. A copy of Meezan Bank's interest in financing is attached hereto as **ANNEXURE I**.

7.2 EQUITY

- 7.2.1 Based on the Debt to Equity ratio of 75%/25%, the equity required to be injected by shareholders (the **Equity**) amounts to USD 6,931,424 (US Dollar Six Million Nine Hundred Thirty One Thousand Four Hundred Twenty Four Only). Equity arrangements will be as shown in **ANNEXURE E.**
- 7.2.2 The financial strength and net worth of Burj Capital (being the primary sponsors of the Project Company) are illustrated by its consolidated balance sheet in ANNEXURE J. Based on audited December 31, 2016, financial statement, Burj Capital had consolidated assets in excess of USD 65 million.



8. THE PROJECT & THE FACILITY

8.1 PROJECT BACKGROUND

- 8.1.1 Since the issuance of the LOI, the Project Company conducted various studies to assess the feasibility of the Project. These studies *inter alia* included wind resource assessment, geo technical investigation, digital topographic map, initial environmental examination and grid interconnection study.
- 8.1.2 To select EPC and O&M contractors for the Project, the Project Company hired an independent consultant, OMS, and carried out a bidding process in line with National Electric Power Regulatory Authority (Selection of Engineering, Procurement and Construction Contractor by Independent Power Producers) Guidelines, 2017, for awarding the turnkey EPC contracts for the development of the Project.
- 8.1.3 After an extensive technical, financial and commercial evaluation process, the independent consultant recommended HDEC ENGINEERING (PVT.) LIMITED (HDEC) as its Engineering, Procurement & Construction (EPC) contractor with GE's 2.3–116m wind turbines. HDEC will also run O&M for the first two years.

8.2 PROJECT COMMENCEMENT AND COMPLETION SCHEDULE

- Activities	Project Company
Issuance Of LOI	✓
Allocation of Land	✓
All Technical Wind Related Studies	✓
Installation of Wind Masts	✓
Land Lease Execution	✓
Request for Proposal (RFP) sent to EPC contractors	✓
Selection of EPC & O&M Contractor	✓
Grid Interconnection Study submission and approval	✓
Indicative Term Sheet with Lead Advisor & Arranger	✓
Submission of Generation License to NEPRA	Current Step
Submission of Tariff Petition to NEPRA	Current Step
Submission of Performance Guarantee & Issuance of LOS	
Execution of Concession Documents	
Execution of Financing Documents	
Achievement of Financial Close	
Achievement of Commercial Operations Date	

8.3 PROJECT SITE

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

- Location in the wind corridor;
- Wind conditions at the site;
- Topographic conditions;
- Site accessibility; and
- Location of the grid with reference to the Site for interconnection.
- 8.3.2 BWEPL has locked in approximately 250 acres of land for the Project. The site is located in the Gharo Keti Bander Wind Corridor.

The site was selected after going through various technical studies of terrain and assessment of wind. The land identification process was driven by technical, economic and environmental factors to determine location having the lowest combined investment and lifetime operating cost with lowest environmental impacts.

8.3.3 Land Description of the Project Site:

S. No.	Longitude	Latitude
A	67°49'03.54"East	24°44'05.43"North
В	67°48'59.84"East	24°44'06.34"North
С	67°49'01.17"East	24°4410.74"North
D	67°48'47.83"East	24°44'10.30"North
E	67°48'41.64"East	24°44'27.83"North
· F	67°48'43.76"East	24°44'30.83"North
G	67°48'32.44"East	24°44'30.91"North
Н	67°48'25.81"East	24°44'22.08"North
I	67°48'21.20"East	24°4417.21"North
J	67°48'18.64"East	24°44'17.38"North
K	67°48'12.12"East	24°43'51.48"North
L	67°48'25.45"East	24°43'45.66"North
M	67°48'26.21"East	24°43'37.40"North
N	67°48'47.06"East	24°43'40.04"North
O	67°48'52.65"East	24°43'39.64"North
P	67°48'16.08"East	24°4416.54"North
Q	67°49'01.65"East	24°43'55.70"North

8.3.4 In addition, the site selection criteria included comparative evaluation of different factors as site accessibility, land availability and costs, interconnection with the national grid, and geotechnical features. The land is un-inhabited, and there is no issue of habitat resettlement. There is no wild life sanctuary, protected area or known habitat of any kind. The site poses no risk to archeological sites or any aviation hazard as the nearest airport (Karachi) is at a considerable distance away.

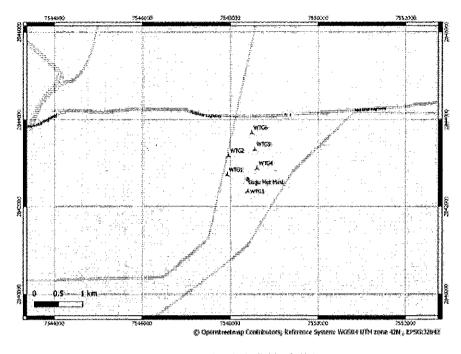
8.3.5 Gujju is almost 80 km on National Highway from Karachi. The site is linked with both the ports of Karachi; therefore, the turbines can be easily shifted from both the ports through the National Highway.

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

- 8.4.1 The Project Company is located in Gujju, District Thatta, Sindh within the same wind corridor as many other wind power projects. The Bin Qasim Port, which is the point of delivery of equipment for the Project, is located towards the Southwest of the Project.
- 8.4.2 A detailed Transportation and Site Access Study has been carried out by the technical consultants (refer to Annex B of Annexure A (Feasibility Study).
- 8.4.3 Access to Project Site is planned from Port Qasim using National Highway. The route was evaluated considering track quality, elevations, waterways, nearby surroundings, and overall suitability.
- 8.4.4 The study includes considerations for road construction for movement of heavy vehicles, hardware and execution of civil works.
- 8.4.5 Under the turnkey EPC Contract, the EPC Contractor is responsible for the construction of roads at the Project Site and 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.
- 8.4.6 Furthermore, the procurement of utilities for the staff colony and construction activities is the responsibility of the Contractor under the EPC and O&M contracts. During construction, electricity will be provided by generators and water will be transported via bowsers. Septic tanks will be constructed for all waste disposal and disposal of waste is the responsibility of the EPC Contractor.
- 8.4.7 With regards to the telecommunication, the wire-based land line network is available in nearby towns and, if required, can be requested for the Project Site. Furthermore, all major mobile operators already have coverage in the Site area. The Project Site will have a microwave antenna for dedicated high-speed data and voice communications.

8.5 WIND FARMS LAYOUT AT PROJECT SITE

8.5.1 Wind Turbines will have a 94m hub height. See figure below for the sketch map for the WTG towers location setting parameters for the project. The tentative micro sitting is given in figure below:



Met Mast → 6 x GE 2.3-116 100HH

8.6 TOPOGRAPHICAL AND GEOLOGICAL CONDITIONS AT PROJECT SITE

8.6.1 <u>Topographical conditions</u>:

The Project Site 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.

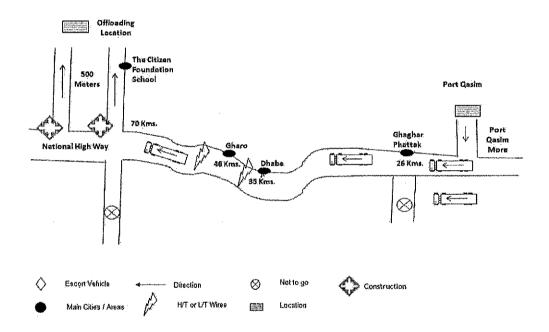
8.6.2 Geological conditions:

Geotechnical Investigation of BWEPL Project at Gujju, District Thatta, Sindh was carried out in order to determine geotechnical parameters of subsurface deposits. Three (03) boreholes were drilled at the site at the depth of 40.0 meters below the existing ground level as a part of the field investigation. Soil and ground water samples were collected during field investigation. Laboratory testing of these samples has been carried out in the Soil Testing Services laboratory, Karachi. The deposition of the area mainly consists of 'stiff to hard sandy silt', and 'loose to very dense, fine to coarse grained silty sand'. Groundwater table was encountered in the depth range of 1.6 meters to 1.8 meters below the existing ground level in the boreholes drilled at site at the time of this geotechnical investigation.

This substratum is not considered competent to sustain anticipated loads unless its strength characteristics are improved by special ground improvement techniques or the loads are transferred to deeper horizon- by using deep/pile foundations as per recommendation of the report by Consultants.

8.7 SITE ACCESSIBILITY

8.7.1 The major track from Karachi to Gujju is via the Karachi-Thatta National Highway, and another access to the Project site is through Jhimpir. When travelling via the Karachi-Hyderabad Motorway, the access from Jhimpir 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 Gharo and Jhimpir. There is no requirement to establish roads or tracks for movement of traffic. The total distance from Karachi to the site is approximately 80 km. The route is given in Figure below.



8.8 TELECOMMUNICATION AT PROJECT SITE

- 8.8.1 Wire based telecommunication is available close to the site. Cellular phone suppliers, Pakistan Telecommunication Mobile Ltd (Ufone, Telenor Mobink, Zong, Warid) are offering services at the site. GPRS services are also available in the region.
- 8.8.2 For the SCADA system of the wind farm, a wire-based telecommunication infrastructure will be installed.

8.9 AVAILABILITY OF SEMI-SKILLED AND SKILLED LABOR

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

8.10 TRAINING AND DEVELOPMENT OF STAFF

- 8.10.1 The Operations & Management (O&M) of the Project shall be managed by the EPC Contractor for initial 2 years post-COD under the Warranty Period of the EPC 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.
- 8.10.2 As per the EPC & O&M Contracts, the Contractors have provided 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. The Contractor will ensure that the personnel working on the wind farm during the construction and the operation period are correctly trained and qualified for the roles that they are performing and that a record of their training is maintained.
- 8.10.3 The Contractor is required to provide Health & Safety (H&S) training 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 Contractor as having attended the full H&S training, thus gaining sufficient appreciation of the H&S requirements to operate the Project.
- 8.10.4 Although the content of training modules will be finalized between the Contractors and the Project Company prior to COD, some specific training needs that will be covered include the following:
 - a) Procedures for operation and maintenance of the wind farm and its associated equipment.
 - b) Awareness and application of safe systems of work and responsibilities of all staff involved in operations and maintenance duties.
 - c) Fire control and prevention (including equipment maintenance and management and 'emergency plan').
 - d) First-aid provision (including 'emergency plan').
 - e) Working at heights (including 'emergency plan').
 - f) Working on, at or near rotating plant.
 - g) Working on, at or near high and low voltage AC and DC apparatus (HV & LV) and the differences between live, not live and dead circuits.
 - h) Working on, at or near energized systems (such as pressure vessels, accumulators, springs, gearing, torque arms, unearthed electrical systems and dampers).
 - i) Working on, at or near hazardous substances (oils, chemicals, insulators and gases).

- j) Confined space works and requirements therein.
- 8.10.5 The Contractor shall provide or procure the provision of these training needs for all O&M personnel in order that the O&M services may be performed in accordance with the Project Agreements and Prudent Industry Practices.

8.11 PROJECT SITE SECURITY

8.11.1 The Project Company will use implement seamless security at offices, accommodation and site through construction and operating phases.

8.12 SAFETY PLANS & EMERGENCY PLANS

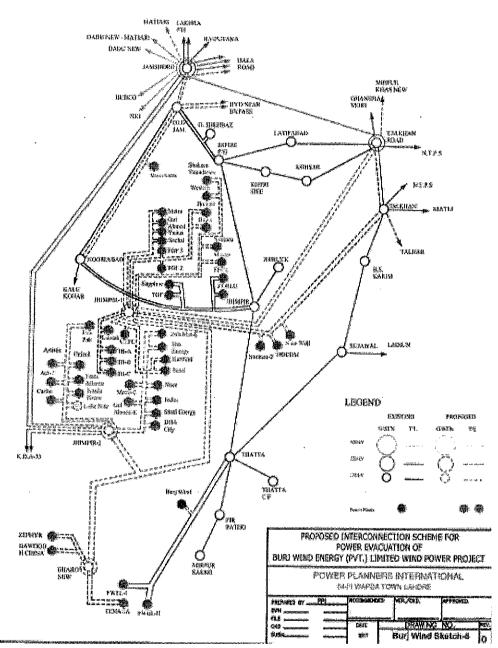
- 8.12.1 The Project has carried out a comprehensive environmental study to assess the impact of the Project on the environment. As per the study, the Project has no significant hazardous impact on the environment. However, the study has addressed minor adjustments that shall be required during the construction phase in order to ensure the safety of the environment and Project personnel. The study also details an environment management plan, which will be enforced by the project team and the EPC contractor. A copy of the IEE has been provided to the EPC Contractor as part of the EPC Contract.
- 8.12.2 In addition, the EPC Contractor is 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 is required to use reasonable efforts to keep the Site clear of unnecessary obstruction. Furthermore, the EPC Contractor shall be responsible for provision of lighting, guarding and watching of the facility during construction of the Project. The EPC Contract shall also require the EPC Contractor to provide temporary roadways, footways, guards and fences during construction for the use and protection of the public and of owners and occupiers of adjacent land.
- 8.12.3 Similarly the O&M Contractor is required under the O&M Contract to provide security in accordance with prudent industry practices. The O&M Contractor is also required to comply with reasonable health and safety requirements established from time to time by the legal and regulatory authorities. The O&M Contract also requires the O&M Contractor to take all reasonable precautions to ensure safety of the Complex, Project Company and O&M Contractor's Personnel, sub- contractors, public and the environment
- 8.12.4 With regards to the health and safety of the personnel during the construction and operation of the Project, the guideline of "safety first, (accident) prevention foremost" will be practiced. Comprehensive management and supervision will be applied to all staff members and the whole operation process, in order to ensure safe operation of the equipment and personal safety of workers.

- 8.12.5 A safety and health supervision department will be established on the wind farm for education, training and management of safety and health related issues after the project is put into operation.
- 8.12.6 The systems of patrol inspection, operation guardianship, maintenance and over-haul will be established for the daily maintenance of production equipment, instruments and apparatus. The safety and health supervision department will provide sound meter and other appropriate inspection equipment, as well as necessary public education service for production safety.
- 8.12.7 A comprehensive safety system will be established during the preparation phase, and carefully implemented during the construction and operation process. The systems of work sheet, operation sheet, shift relief, patrol inspection, operation guardianship, maintenance and overhaul will be strictly implemented. The Safety Regulation of the wind farm will also be seriously observed to preclude accidents such as fall, fire, or electric shock.

8.13 GRID CONNECTIVITY

8.13.1 The Project would be connected by an existing looping in-out the existing 132kV Circuit from Thatta towards FWEL-1. The proposed interconnection scheme for the evacuation of power from the project is shown below:





Proposed Interconnection Scheme For Power Evacuation of Burj Wind Energy (Pvt) Ltd. Wind Power Project

8.14 ANNUAL ENERGY PRODUCTION

8.14.1 The Annual Energy Production is estimated at 49.7 GWh. The tables below show key details relating to power generation from the Project.



Installed Gross ISO Capacity of	13.80 MW
Project	
Annual Energy Generation	49.7 GWh
Capacity Factor(P)	41.1%

8.15 WTG TECHNOLOGY & EPC BIDDING PROCESS

- 8.15.1 To select EPC and O&M contractors for the Project, the Project Company hired an independent consultant, OMS, and carried out a bidding process in line with National Electric Power Regulatory Authority (Selection of Engineering, Procurement and Construction Contractor by Independent Power Producers) Guidelines, 2017, for awarding the turnkey EPC contracts for the development of the Project.
- 8.15.2 After an extensive technical, financial and commercial evaluation process, the independent consultant recommended HDEC ENGINEERING (PVT.) LIMITED (HDEC) as its Engineering, Procurement & Construction (EPC) contractor with GE's 2.3–116m wind turbines. 06 wind turbines will be installed. Further, GE will be the O&M operator
- 8.15.3 HDEC will construct the plant in 15 months and will also be responsible for O&M of the complete facility for the first two years. Our technical partners, HDEC and GE, are top-rated global powerhouses in wind sector (technically + financially) and have the largest market share in Pakistan of installed wind projects (in their respective areas).
- 8.15.4 The combination of HDEC and GE, their global capability as well as experience in Pakistan and their experience in working with us on a 50MW project that has been completed on scheduled time give significant boost to our ability to deliver and run BWEPL on time and within specifications.

8.16 GENERAL ELECTRIC (GE) – THE WTG MANUFACTURER

GE is the selected WTG suppliers. Please see Annexure D for a brief profile of GE.

Below, please see brief specifications of the WTG selected for the Project:

(i).	Wind Turbine Type, Make & Model	GE 2.3 MW - 116
(ii).	Installed Capacity of Wind Farm (MW)	13.80MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	06 x 2.3MW
(iv).	Number of blades	3

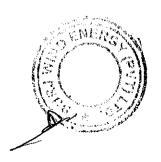
(v).	Rotor diameter	116m
(vi).	Hub Height	94m
(vii).	Generator Voltage	690 V
(viii).	Cut-in wind speed	3 m/s
(ix).	Cut-out wind speed	22 m/s
(x).	Survival wind speed	52 m/s

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

-1	Total Installed/Gross ISO Capacity (MW)	13.8
-2	Total Annual Full Load Hours	3600
-3	Average Wind Turbine Generator(WTG) Availability	97%
-4	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	62.7
-5	Array & Miscellaneous Losses (GWh)	8.67
-6	Availability Losses (GWh) .	3.25
-7	Balance of Plant Losses (GWh)	1.08
-8	Annual Energy Generation (20-year equivalent Net AEP) GWh	49.7
-9	Net Capacity Factor (@P75)	41.1%

8.17 EPC CONTRACTOR

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



CONCLUSION

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

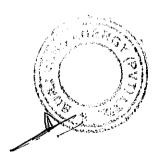
Respectfully submitted for and on behalf of: BURJ WIND ENERGY (PRIVATE) LIMITED

SALEEM UZ ZAMAN (CHIEF EXECUTIVE OFFICER)

AUTHORIZED REPRESENTATIVE OF

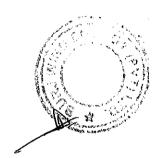
BURJ WIND ENERGY (PRIVATE) LIMITED

SCHEDULE - I AND II



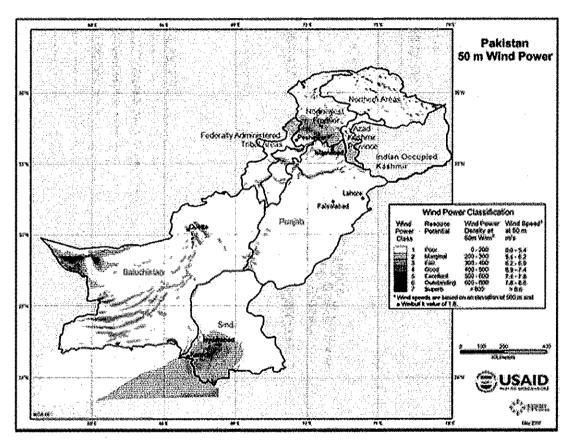
SCHEDULE I

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.



Site Location of the Generation Facility/Wind Power Plant for Burj Wind Energy (Pvt.) Limited

The Project is located in Gujju, which is situated approx. 80 km away from Karachi (Pakistan's biggest metropolitan city) and is a small town of approximately 100,000 inhabitants in Thatta District, Sindh, Pakistan. Gujju falls within the Gharo-Keti Bandar wind corridor, which is amongst the best wind corridors of the country. The geographical location of the project is shown in figure below:



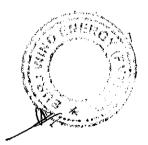
Project Size

The Project shall have an installed capacity of approx. 13.8 MW rated power. The number of WTGs are 06 with capacity of 2.3 MW each.

Layout of Generation Facility/ Wind Power Plant of Burj Wind Energy (Pvt.) Limited

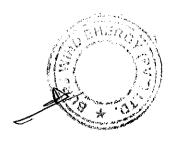
The general layout of 14 MW BWEPL Wind Farm is shown in figure below:



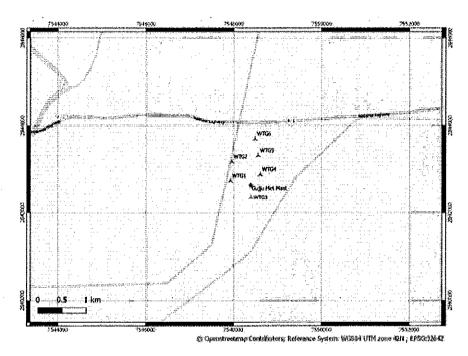


Coordinates of the Generation Facility/ Wind Farm

S. No.	Longitude	Latitude
A	67°49'03.54"East	24°44'05.43"North
В	67°48'59.84"East	24°44'06.34"North
С	67°49'01.17"East	24°4410.74"North
D	67°48'47.83"East	24°44'10.30"North
Е	67°48'41.64"East	24°44'27.83"North
F	67°48'43.76"East	24°44'30.83"North
G	67°48'32.44"East	24°44'30.91"North
Н	67°48'25.81"East	24°44'22.08"North
I	67°48'21.20"East	24°4417.21"North
J	67°48'18.64"East	24°44'17.38"North
K	67°48'12.12"East	24°43'51.48"North
L	67°48'25.45"East	24°43'45.66"North
M	67°48'26.21"East	24°43'37.40"North
N	67°48'47.06"East	24°43'40.04"North
О	67°48'52.65"East	24°43'39.64"North
Р	67°48'16.08"East	24°4416.54"North
Q	67°49'01.65"East	24°43'55.70"North



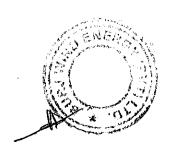
Micro-sitting of the Generation Facility/Wind Power Plant with Coordinates of Burj Wind Energy (Pvt.) Limited



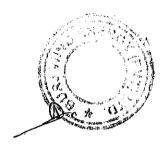
4 Met Mest & 6 x GE 2,3 116 100 mg

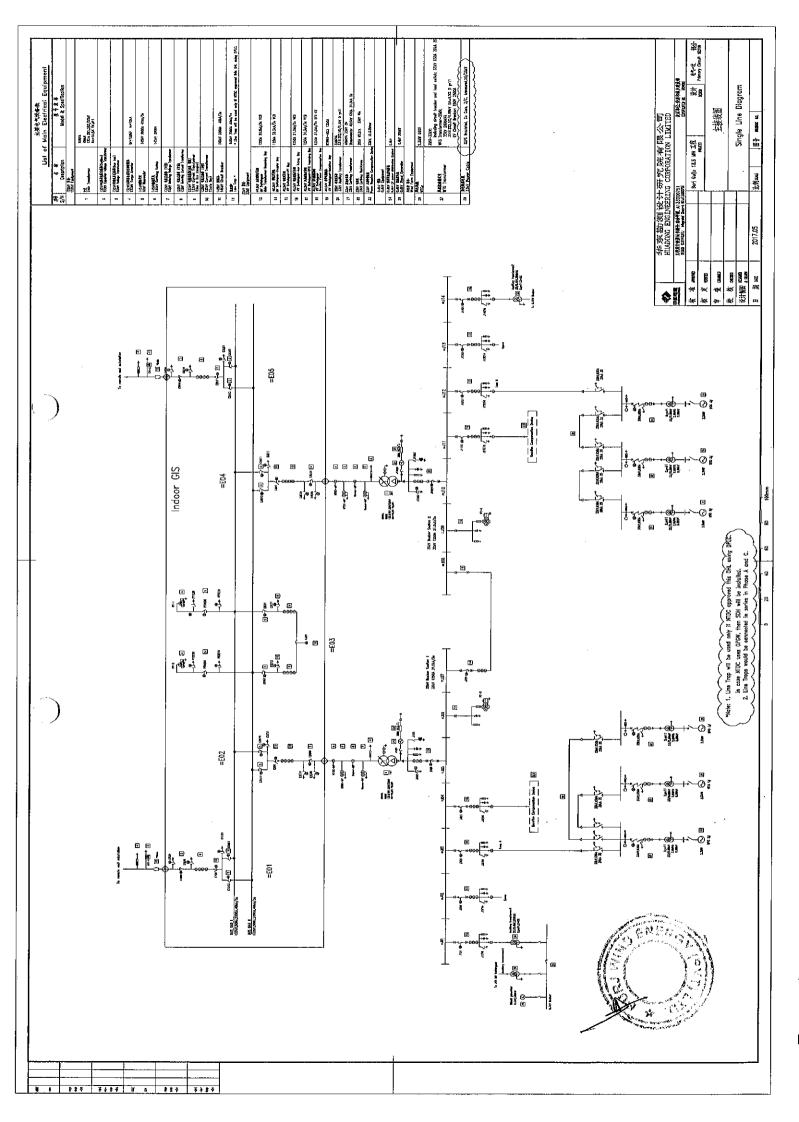
The coordinates are WTGs are given in table below.

in in Site 10	Magazi Lau Longitude da Ma	Batitude
WTG1	379067	2735698
WTG2	379099	2736089
WTG3	379493	2735343
WTG4	379689	2735823
WTG5	379646	2736214
WTG6	379589	2736558



Electrical System Single Line Diagram of Generation Facility/Wind Farm

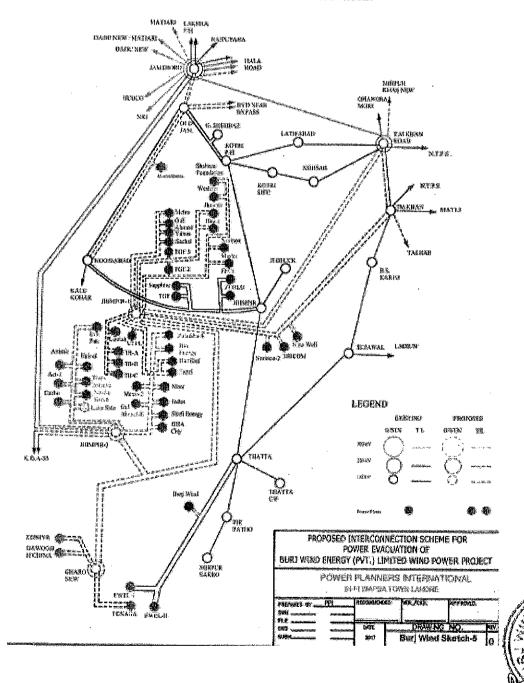




Interconnection Arrangement for Dispersal of Power from the Generation Facility/Wind Power Plant of Burj Wind Energy (Pvt.) Limited

The Project would be connected by an existing looping in-out the existing 132kV Circuit from Thatta towards FWEL-1. The proposed interconnection scheme for the evacuation of power from the project is shown below:

Proposed Interconnection Scheme For Power Evacuation of Burj Wind Energy (Pyt) Ltd. Wind Power Project



Detail of Generation Facility/Power Plant/ Wind Farm

A. General Information

	i.	Name of Applicant	Burj Wind Energy (Private) Limited
		Company	. •
	ii.	Registered/Business Office	16, Abdullah Haroon Road,
		- ,	3 rd floor, Faysal Bank Building,
			Karachi
Γ	iii.	Plant Location	Gujju, District Thatta, Sindh
	iv.	Type of Generation Facility	Wind Power

B. Wind Farm Capacity & Configuration

i.	Wind Turbine Type, Make	General Electric GE 2.3-116
	& Model	
ii.	Installed Capacity of Wind	13.80 MW
	Farm (MW)	
iii.	Number of Wind Turbine	06 x GE 2.3-116
	Units/Size of each Unit	
	(KW)	

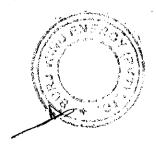
C. Wind Turbine Details

C. VY	ind ruibine Details		
a. Rotor			
i.	Rotor Power	2.3MW	
ii.	Number of Blades	03	
iii.	Rotor Speed	8 to 15.7 rpm	
iv.	Rotor Diameter	116 m	
v.	Swept Area	10568m ²	
vi.	Power Regulation	Combination of Blade pitch angle	
		adjustments, and generator/convertor torque	
	·	control	
vii.	Rated power at	12.5 m/s Air density of 1.225 kg/m3)	
viii.	Cut-in Wind Speed	3m/s	
ix.	Cut-out Wind Speed	22m/s	
Χ.	Survival Wind Speed	52m/s	
xi.	Pitch Regulation	Electric motor drives a ring gear mounted to	
		the inner race of the blade pitch bearing.	
b. Blades			
i.	Type Description	Pitching blade	
ii.	Blade Length	56.9m	
iii.	Material	Glass fiber reinforced polyester. PVC and	
		balsa foam	
iv.	Weight	11,000 kg (per piece)	
c. Gear Box			
i.	Type	Planetary/ Planetary/ Helical	

iii. Oil Quantity iv. Main Shaft Bearing Roller Bearing mounted in a pillow block housing arrangement d. Generator i. Power 2385 kW ii. Voltage 690 V iii. Type Doubly fed Induction 1820rpm, Synchronous speed 1500. v. Coupling Flexible Coupling vi. Efficiency 297 vii. Weight Viii. Power Factor 4-0.95 e. Yaw System i. Type Description Active electrical motor power through geared ground with bolt bearings and hydraulic breaks. ii. Yaw Bearing Roller Bearing iii. Brake Planetary Yaw drives v. Speed 0.5 degree/s f. Control System i. Type Automatic and Manually Controlled ii. Grid Connection Via back to back Remote monitoring of more than 300 different parameters, example temperature sensors, pitch parameters, speed, generator torque, wind speed and direction. p. Brake i. Design Electromechanical pitch control for each blade (3 self-contained systems) iii. Secondary Brake Hydraulic parking brake h. Tower i. Type Tubular Steel Tower	ii.	Material	Cast Iron GGG 700/400						
iv. Main Shaft Bearing Roller Bearing mounted in a pillow block housing arrangement d. Generator i. Power 2385 kW ii. Voltage 690 V iii. Type Doubly fed Induction Rated speed 1820 rpm, Range 1000-1820rpm, Synchronous speed 1500. Flexible Coupling Vi. Efficiency Vii. Weight S,450 kg Viii. Power Factor Viii. Power Factor Viii. Power Factor Active electrical motor power through geared ground with bolt bearings and hydraulic breaks. Roller Bearing Viii. Brake Planetary Yaw drives V Yaw driving device V Speed D.5 degree/s f. Control System i. Type Automatic and Manually Controlled Via back to back Grid Connection Via back to back Remote monitoring of more than 300 different parameters, example temperature sensors, pitch parameters, speed, generator torque, wind speed and direction. iv. Recording Prake i. Design Electromechanical pitch control for each blade (3 self-contained systems) ii. Secondary Brake Hydraulic parking brake h, Tower i. Type Tubular Steel Tower	1								
housing arrangement d. Generator i. Power 2385 kW ii. Voltage 690 V iii. Type Doubly fed Induction iv. Speed Rated speed 1820 rpm, Range 1000-1820rpm, Synchronous speed 1500. v. Coupling Flexible Coupling vi. Efficiency ≥97 vii. Weight 8,450 kg viii. Power Factor +/-0.95 e. Yaw System i. Type Description Active electrical motor power through geared ground with bolt bearings and hydraulic breaks. ii. Yaw Bearing Roller Bearing iii. Brake Planetary Yaw drives iv. Yaw driving device 4 Planetary yaw drives iv. Yaw driving device 4 Planetary yaw drives v. Speed 0.5 degree/s f. Control System ii. Type Automatic and Manually Controlled iii. Grid Connection Via back to back iii. Scope of Monitoring Remote monitoring of more than 300 different parameters, example temperature sensors, pitch parameters, speed, generator torque, wind speed and direction. v. Recording Production data event list long and short g. Brake i. Design Electromechanical pitch control for each blade (3 self-contained systems) ii. Operational Brake Hydraulic parking brake h. Tower i. Type Tubular Steel Tower									
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iii. Type Doubly fed Induction iv. Speed Rated speed 1820 rpm, Range 1000- 1820rpm, Synchronous speed 1500. v. Coupling Flexible Coupling vi. Efficiency ≥97 vii. Weight 8,450 kg viii. Power Factor +/-0.95 e. Yaw System i. Type Description Active electrical motor power through geared ground with bolt bearings and hydraulic breaks. ii. Yaw Bearing Roller Bearing iii. Brake Planetary Yaw drives iv. Yaw driving device 4 Planetary yaw drives v. Speed 0.5 degree/s f. Control System i. Type Automatic and Manually Controlled ii. Grid Connection Via back to back iii. Scope of Monitoring Remote monitoring of more than 300 different parameters, example temperature sensors, pitch parameters, speed, generator torque, wind speed and direction. iv. Recording Production data event list long and short g. Brake i. Design Electromechanical pitch control for each blade (3 self-contained systems) ii. Operational Brake Hydraulic parking brake h. Tower i. Type Tubular Steel Tower									
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v. Coupling Flexible Coupling vi. Efficiency ≥97 vii. Weight 8,450 kg viii. Power Factor +/-0.95 e. Yaw System i. Type Description Active electrical motor power through geared ground with bolt bearings and hydraulic breaks. ii. Yaw Bearing Roller Bearing iii. Brake Planetary Yaw drives v. Yaw driving device 4 Planetary yaw drives v. Speed 0.5 degree/s f. Control System i. Type Automatic and Manually Controlled ii. Grid Connection Via back to back iii. Scope of Monitoring Remote monitoring of more than 300 different parameters, example temperature sensors, pitch parameters, speed, generator torque, wind speed and direction. iv. Recording Production data event list long and short g. Brake i. Design Electromechanical pitch control for each blade (3 self-contained systems) ii. Operational Brake Aerodynamic Brake achieved by feathering blades iii. Secondary Brake Hydraulic parking brake h. Tower i. Type Tubular Steel Tower	17.	Speed	1 ,						
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			Tubular Steel Tower						
	ii.	Hub Heights							

D. Other Details

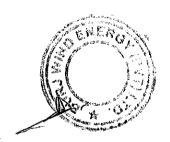
D. O	inci Detans	
i.	Project Commissioning	July 2020 (anticipated)
	Date (Anticipated)	
ii.	Expected Life of the	25 years
	Project from Commercial	
	Operation Date (COD)	



Power Curve of GE 2.3MW – 116 Wind Turbine Generator (Tabular)

Wind Speed [m/s]	Power [kW]	Thrust Coefficient Ct
3.5	53.33	1
4	125.74	0.92
4.5	212.88	-0.89
5	316.16	0.87
5.5	438.64	0.85
6	579.6	0.84
6.5	745.68	0.84
7	936.22	0.83
7.5	1155.8	0.82
8	1403.4	0.79
8.5	1662.2	0.74
9	1907.8	0.67
9.5	2122.6	0.6
10	2249.2	0.53
10.5	2300	0.46
11	2300	0.39
11.5	2300	0.34
12	2300	0.29
12.5	2300	0.26
13	2300	0.23
13.5	2300	0.2
14	2300	0.18
14.5	2300	0.16
15	2300	0.15
15.5	2300	0.13
16	2300	0.12
16.5	2300	0.11
17	2300	0.1
17.5	2300	0.1
. 18	2300	0.09
18.5	2300	80.0
19	2300	80.0
19.5	2300	0.07
20	2300	0.07
20.5	2300	0.06
21	2300	0.06
21.5	2300	0.06

22	2300	0.05
22.5	1200	0.05
23	1200	0.05
23.5	1200	0.05
24	1200	0.05
24.5	1200	0.05
25	1200	0.05
25.5	1200	0.05
26	1200	0.05
26.5	1200	0.05
27	1200	0.05
27.5	1200	0.05
28	1200	0.05
28.5	1200	0.05
29	1200	0.05
29.5	1200	0.05
30	1200	0.05
30.5	1200	0.05
31	1200	0.05
31.5	1200	0.05
32	1200	0.05



<u>Power Curve of GE 2.3MW – 116 Wind</u> <u>Turbine Generator (Graphical)</u>

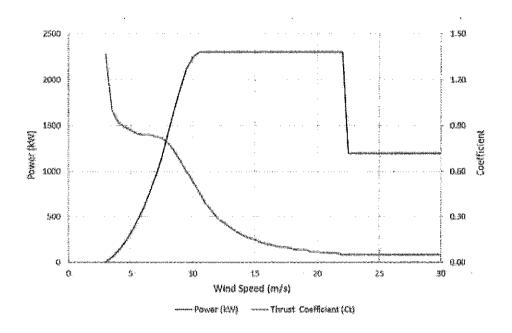


Figure C-2: GE 116 2.3 MW Power and Thrust Curves



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/ Windfarm of Licensee is given in this Schedule.

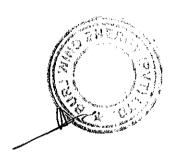


SCHEDULE II

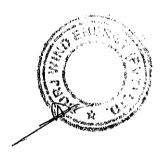
-1	Total Installed/Gross ISO Capacity (MW)	13.8
-2	Total Annual Full Load Hours	3600
-3	Average Wind Turbine Generator(WTG) Availability	97%
-4	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	62.7
-5	Array & Miscellaneous Losses (GWh)	8.67
-6	Availability Losses (GWh)	3.25
-7	Balance of Plant Losses (GWh)	1.08
-8	Annual Energy Generation (20-year equivalent Net AEP) GWh	49.7
- 9	Net Capacity Factor (@P75)	41.1%

Note:

All the above figures are indicative as provided by the Licensee. The Net Capacity available to Power Purchaser for dispatch will be determined through procedures contained in the Energy Purchase Agreement.



ANNEXURE – A FEASIBILITY STUDY





Date:10/05/2018

To,

Mr. Sheeraz Anwar Khan Director (Wind-I) Alternative Energy Development Board 2nd Floor OPF Building Shahrah-e-Jumhuriat G-5/2, Islamabad

SUB: <u>Burj Wind Energy (Private) Limited 14MW Wind Power Project in Guiju District: Thatta</u>
Revised Feasibility Study

Dear Sir,

This is with reference to letter of Extension in LOI No. B/3/1/BP/12 dated: 10-April-2018 (Copy attached). BWEPL has met all the formalities under LOI for feasibility studies and hereby submits Revised Feasibility Study for your information and requisite action.

Further to this, BWEPL now intends to use GE - 2.3MW-116 WTG model and for this change in make of WTG, BWEPL has obtained the requisite equivalency certificate in connection with Grid Study approval.

BWEPL hereby submits the 01 Color and 2 black hard copies and 02 CDs of Revised Feasibility Study report.

Thanking you,

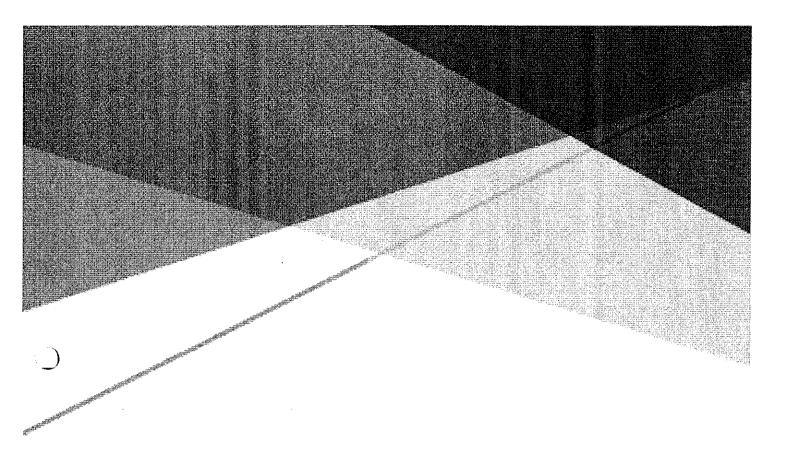
Saléem uz Zaman

Chief Executive Officer

Burj Wind Energy (Private) Limited

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14 MW WIND POWER PROJECT AT GUJJU BY BURJ WIND ENERGY PRIVATE LIMITED

Technical Feasibility
MAY 2018

CERTIFIED TRUE COPY

PREPARED BY: OMS PRIVATE LIMITED

BURJ WIND ENERGY (PVT.) LTD.





APPROVAL SHEET

TITLE : Feasibility Study Report for 14 MW Wind

Power Project of Burj Wind Energy (Pvt.) Ltd

at Gujju, Sindh-Pakistan

DOCUMENT NUMBER

OMS/BWEPL/FSR/01

Issue: 01

CLASSIFICATION

CONTROLLED

SYNOPSIS

This document is a feasibility study report of the 14MW Wind Power Project for Burj Wind Power Project at Gujju Sindh-Pakistan. The study briefly covers Energy Yield Estimates, Power Evacuation to Grid Network, Balance of Plant Electrical Interface, civil works, basic design and the project cost. It also covers the Initial Environment Examination, Site topography, Soil investigations, Grid interconnection studies with Grid Network and project management information. This report is prepared by M/s OMS (Private) Limited, Pakistan.

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LIST OF ABBREVIATIONS

AC	Alternate Current
AEDB	Alternative Energy Development Board
BWEPL	Burj Wind Energy (Pvt.) Ltd
CPPA-G	Central Power Purchase Agency – Guarantee
DISCOs	Distribution Companies
EE PROPERTIES	Energy Efficiency
EMP	Environment Management Plan
EPA	Energy Purchase Agreement
EPC	Engineering, Procurement and Construction
GDP	Gross Domestic Product
GENCOs	Generation Companies
GoP	Government of Pakistan
GPS	Global Positioning System
IEE	Initial Environmental Examination
IA	Implementation Agreement
LOI	Letter of Intent
LOS	Letter of Support
m²	Mefer square
m³/h	Meter cube per hour
NEPRA	National Electricity Power Regulatory Authority
NOCs	No Objection Certificates
NREL	National Renewable Energy Laboratories
OMS	Operation & Maintenance Solutions (Pvt.) Ltd
PEPA	Pakistan Environment Protection Act
	Pakistan Meteorological Department
R&D	Research and Development
SEPA	Sindh Environmer FRIII III IR WE COPY

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ACKNOWLEDGEMENTS

The management of Burj Wind Energy (Private) Limited (BWEPL) is thankful to the Ministry of Energy, GoP and the dedicated team of Alternative Energy Development Board (AEDB) for generous support at all stages of project development and is looking forward for continuous support in the future.

The management of Burj Wind Energy Private Limited also looks forward to the cooperation of Government departments that is extended to the Project.

DISCLAIMERS

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

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DOCUMENT INFORMATION

Purpose and Scope:

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

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1 EXECUTIVE SUMMARY

Located on the western stretch of the South Asian Continent, The Islamic Republic of Pakistan is largely under the influence of 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 a land rich in wind energy resources. The costal wind-energy-rich areas normally refer to Southern Sindh and the vast plateau to the east and the northeast of Karachi city. The relative shortage of conventional energy resources in Pakistan and the unstable of fuel prices worldwide spurred the Pakistan Government to find alternative sources, including wind power.

Alternative Energy Development Board (AEDB) is the sole representing agency of the Federal Government that was established in 2003 with the main objective to facilitate, promote and encourage development of Renewable Energy in Pakistan. AEDB appreciates the private investments in generation and awarded Letter of Intent (LOI) of 14 MW Wind Power Project to Burj Wind Energy (Pvt.) Limited (BWEPL) in Oct, 2012.

At present, total eighteen (18) Wind power projects of approx. 930 MW are in operation. More six 06 projects (all of 50 MW each) have achieved financial close and are under construction.

Burj Wind Energy (Pvt.) Ltd is sponsored by Burj Capital, a Dubai based investment and financial advisory firm focused on investment banking, oil & gas, power generation, retail and agriculture sectors. The Project is being developed by Burj Capital.

OMS (Pvt.) Limited (OMS) is the technical consultant for Burj Wind Energy (Pvt.) Ltd for developing this project. The project is being developed as Independent Power Producer on BOO (Build Own Operate) mode.

1.1 PROJECT OVERVIEW AND SITE

The proposed land for wind farm Project is in Gujju, Sindh, that is around 50 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project will be developed on private land. BWEPL has locked approximately 250 acres of land in Gujju, Sindh, Pakistan. Gujju falls within the Gharo-Keti Bandar wind corridor. The overview of the project site is shown in *Figure 1*.

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Figure 1: Proposed site location - Burj Wind Energy Limited

1.1.1 Project Size

The Project site consists of 250 acres of land and the Project will have an installed capacity of 14 MW.

1.1.2 Project Status and Calendar

The project calendar is given on the next page:

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Table 1-1: Project Planned Milestones

A Maria Carrier		2018			2020			
Activity / Milestone	2 nd QTR	3rd QTR	4th QTR	1 st QRT	2 nd QTR	3rd QTR	4th QTR	1st QTR
Submission of Feasibility Study	11.0							
Approval of Feasibility Study								
Generation License								
Tariff								
Signing of EPA	,		and an					
Signing of IA								
Financial Close	;							
Final Natice to Proceed (FNTP)								
Project Construction								
Start of Operations								

Table 1-2: Project Construction Scheduling

Activity / Month	I	2		4	5	6	7	8	9	1 0	1	1 2	1 3	1 4
Engineering and Mobilization														
Detail Design (Electrical & Mechanical)														
Detail Design (Civil Structural & Architectural)														
Construction of Temporary Establishment		20.00				_								
Civil Works of WTGs and Substation				d										
Construction of Substation (Foundations, Columns, Plinth Beams & Roof Slabs, External Development Works)														
Supply of WIGs and Towers														
Supply of EBOP Equipment														
Erection and Installation			L											
Cables and Interconnection for WTGs														
Cables and Interconnection for EBOP														
Testing and Commissioning of WTGs														
Testing and Commissioning of EBOP	_													
EPA Tests and Reliability Run Test														

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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 correlations. The study is attached as Annex-C.

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. The study is attached as Annex-D.

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 9. The detailed Geotechnical Investigation Report is attached as Annex-E.

1.1.6 Design of Civil Works

Information related to the civil works is given in later section.

1.1.7 Design of Electrical Works

The Project will have an installed capacity of 14 MW, comprising of wind turbine generators (WTG), each with a capacity 2.3MW and an output voltage of 0.69 kV. A substation consisting of step up transformer and other EBOP equipment would be connected by looping in-out the existing 132 kV circuit from Thatta towards FWEL-I at BWEPL. Power from all the WTGs in the plant will be supplied to the MV substation, and step-up to HV from the step up transformers to the 132KV In-house GIS Grid Station, built within the boundaries of the wind power plant. Power Evacuation will be by two circuits from GIS Bays from Burj Wind Energy Private Limited to HESCO Network (N-1) Contingency. Switchgear gantries will be the point of metering and connection to the two 132 kV Transmission lines.

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

Please refer to the Grid Interconnection Study attached as Annex-G.

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1.1.8 Construction Management

Information related to the construction management is given in Section 12.

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 Field 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 Contractor will be required to engage personnel who are adequately trained for the task and technical support is available via regular visits to project site by Contractor personnel and the availability of 24/7 remote monitoring and diagnostics service.

The turbines will be monitored on 24 hour basis by manned personnel stationed at the control room of the plant and remotely monitored by the Contractor RM&D Center. The scheduled maintenance will be undertaken by trained Contractor personnel under the supervision of WTG/OEM specialists including EBOP in accordance with the maintenance manuals.

1.1.10 Environmental Management

A separate environment study has been carried out and the Initial Environment Examination (IEE) report is attached as Annex-H. The IEE study has been approved by EPA Sindh.

There are no significant hazards. The minor adjustments required during construction phase have been addressed with 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, 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 oversee the education training appropriagement of safety

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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 development 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.

Contractor shall be responsible to submit the HSE Field Plan including the following:

- Purpose
- Scope
- Quality, Health, Safety and Environment Policy
- Objectives
- Management Structure
- Flow chart HSE control procedure
- Site HSE philosophy, organization and responsibilities

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1.2 LIST OF ANNEXURE

ANNEX - A: Global & Local Wind Industry Profile of Pakistan

ANNEX - B: Transportation and Logistic Study

ANNEX - C: Wind Resource Assessment Report

ANNEX - D: Energy Yield Estimates Report

ANNEX – E: Geo Technical Investigation Report

ANNEX - F: Topographical Survey Report

ANNEX - G: Electrical Grid Interconnection Study Report

ANNEX - H: Initial Environmental Examination (IEE) Report

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1.3 PROJECT TEAM

1.3.1 Burj Wind Energy Private Limited – Project Sponsor

BURJ CAPITAL (the "Project Sponsor") is the Main Sponsor of the Project. BWEPL is the second wind power project in Sindh being set up by the Project Sponsor who has also developed the 50MW Jhimpir Power Limited, and has already achieved its commercial operations in 1st Quarter 2018.

Burj Capital is a developer, investor, and co-owner of renewable power plants. Headquartered in Dubai, UAE, Burj Capital also maintains a project development office in Karachi, Pakistan.

Burj Capital actively originates, develops and constructs high quality renewable power projects in select markets to reliably deliver electricity at the lowest possible cost. Burj Capital's team has led significant investments into over 2GW of wind, solar, hydro and efficient gas platforms with leading players including Engie, Total, Aditya Birla and Africa Finance Corporation across South Asia, Africa, and Latin America.

Hence the Sponsor has unmatched credentials in Pakistan wind sector to undertake this project.

The Sponsors have a valid LOI from AEDB and own 250 acres of land in Gujju, Sindh.

1.3.2 OMS (Pvt.) Ltd - Project Consultant

www.omsltd.net

OMS is a multinational company incorporated in Mauritius, with offices in Pakistan, India, Bangladesh and UAE. OMS was founded with the intention to provide the quality power plants operation & maintenance, training and engineering consultancy services in Asia and African countries. OMS has a dedicated multi-disciplinary team of professionals covering Conventional and Renewable Energy. A diversifies pool of professionals along with strong background experience in the power industry gives a competitive edge in terms of providing prudent international standard engineering, Project Development and power plant O&M services at an affordable cost in today's competitive market. OMS's longstanding experience has included the provision of the following services:

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Project Development;

Techno - Commercial Due-Diligence;

Feasibility and Load Flow Studies;

Project Management;

Construction Supervision, Testing & Commissioning;

Operation & Maintenance;

Warranty Management;

Training of O&M Staff.

OMS always strives for providing value added services to its clients.

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2 COUNTRY AND INDUSTRY OVERVIEW

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

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 30% (respectively) of the country's electricity demand. The primary thermal generation fuels employed are imported. Oil & Gas import is a significant burden on the national exchequer. Import of gas could be seen as a viable option to overcome the depleting domestic reserves, but gas import has significant issues, mainly the need for substantial capital investment in infrastructure, security difficulties and physical terrain concerns. Moreover, it would still be an imported product.

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

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

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3 REGULATORY REGIME

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

- Ministry of Energy (Power Wing).
- ❖ National Electricity Power Regulatory Authority (NEPRA).
- ❖ Hyderabad Electric Supply Company (HESCO).
- Central Power Purchase Agency Guarantee Ltd. (CPPA-GL)

3.1 MINISTRY OF ENERGY (POWER WING)

The Power wing of federal Ministry of Energy 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.

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3.3 HYDERABAD ELECTRIC SUPPLY COMPANY (HESCO)

Hyderabad Electric Supply Company or HESCO is an electric distribution company which supplies electricity to all the districts of Sindh in Pakistan, excluding Karachi. The company was incorporated on 23 April 1998 and certificate for commencement of business was obtained on 1st July 1998 from NEPRA under section 146(2) of Companies Ordinance 1984.

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

CPPA-GL is an agency to purchase power from power plants on behalf of NTDC & DISCOs. CPPA-GL acts as a one window for all affairs related to NTDC/DISCOs 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.

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4 WIND INDUSTRY IN PAKISTAN

4.1 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.

4.1.1 Projects in Operation

Total of eighteen (18) different projects with capacity of more than 900MW have entered Commercial Operations. Followings are the projects that have started commercial operations:

No.	Company	Capacity (MW)	COD
	FFC Energy Ltd	49.5	1st Quarter 2013
2	Zorlu Energy	56.4	2 nd Quarter 2013
3	Foundation Wind Energy I	50	1st Quarter 2015
4	Foundation Wind Energy II	50	4th Quarter 2014
5	Three Gorges First Wind Farm Pakistan (Pvt) Ltd	49.5	4th Quarter 2014
6	Sapphire Wind Energy Ltd	50	4th Quarter 2015
7	Yunus Energy Ltd.	50	4 th Quarter 2016
8	Metro Power Company Ltd.	50	4 th Quarter 2016
9	Gul Ahmed Wind Power Ltd.	50	4 th Quarter 201 <i>6</i>
10	UEP Wind (Pvt) Ltd.	99	2 nd Quarter 2017
11	Sachal Energy Development Limited	49.5	2 nd Quarter 201 <i>7</i>
12	Master Wind Energy Ltd.	52.8	4 th Quarter 2016
-13	Tapal Wind (Pvt) Ltd.	30	4 th Quarter 2016
14	HydroChina Dawood Power (Pvt.) Ltd.	49.5	2 nd Quarter 2017

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No.	Company	Capacity (MW)	COD
15	Tenega Genarsi Ltd.	49.5	ା ^ଖ Quarter 2017
16	HAWA Energy (Pvt.) Ltd.	49.3	1st Quarter 2018
17	Jhimpir Power (Pvt.) Ltd	49.3	- 1 st Quarter 2018
18	Artistic Energy (Pvt.) Ltd	49.3	1st Quarter 2018

Followings are the Projects that have achieved financial close during 2015-16 and are currently under construction and commissioning:

No.	Company	Capacity (MW)
1	Three Gorges Second Wind Farm.	49.5
2	Three Gorges Third Wind Farm.	49.5
3 *	Zephyr Energy (Pvt.) Ltd.	50
4	Tricon Boston – A	49.3
5	Tricon Boston – B	49.3
6	Tricon Boston – C	49.3

4.1.2 PROJECTS AT ADVANCED DEVELOPMENT STAGES

Followings are the Projects that have reached the Generation License / Tariff stage:

No.	Company	Capacity (MW)
1	Master Green Energy Ltd.	50
2	Metro Wind Power Ltd.	60
3	Gul Ahmed Electric Ltd.	50
4	ACT2 Wind (Pvt) Ltd.	50
5	Artistic Wind Power (Pvt) Ltd.	50
6	UniEnergy Ltd.	50
7	Zulaikha Energy (Pvt.) Ltd.	50
8	Noor Solar Energy (Pvt.) Ltd.	50
9	Lakeside Energy (Pvt.) Ltd.	TRUE (19PY

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No.	Company	Capacity (MW)
10	Indus Wind Energy Ltd.	50
11	Shaheen Renewable Energy.	50
12	Iran-Pak Wind Power (Pvt.) Ltd.	50
13	Tricom Wind Power (Pvt.) Ltd.	- 50
14	Transatlantic Wind (Pvt.) Ltd.	50
15	Cacho Wind Energy (Pvt.) Ltd	50
16	Lootah Energy (Pvt.) Ltd	50
17	Trans-Atlantic Energy (Pvt.) Ltd	50
18	Norinco Int'l Thatta Power (Pvt.) Ltd	50
19	Noringo Int'l Thatta Power (Pvt.) Ltd - II	50
20	Din Energy Ltd	50

4.2 TARIFF REGIME IN PAKISTAN

4.2.1 Negotiated Tariff for Wind IPPs

The Negotiated or Cost Plus initial regime will be opted by Burj Wind Energy (Pvt.) Ltd. The Project Company will justify all expenses and financial position to NEPRA through a petition. The NEPRA in return will determine the project tariff on a "cost plus" basis. The Project Company will be allowed 15% ROE on IRR basis. There are four projects so far at cost plus tariff and all are currently in operation phase.

4.2.2 Upfront Tariff for Wind IPPs

NEPRA announced few upfront tariffs from time to time in the 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 or pay" basis. The indexations such as LIBOR / KIBOR, US\$ and inflation were available.

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5 PROJECT IN TERMS OF POLICY FRAMEWORK

5.1 LETTER OF INTENT (LOI)

First step was to obtain Letter of Intent that was accomplished in Oct 2012 and further extended in April 2018. This letter entitled the Project Company to start working on wind power project at official level and get support from AEDB. The feasibility is being submitted within validity of LOI and in accordance of the requirements.

5.2 ACQUISITION OF LAND

The land has been acquired by the project company.

5.3 FEASIBILITY STUDY

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

5.4 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.

5.5 TARIFF DETERMINATION

A separate tariff petition shall be filled to NEPRA.

5.6 LETTER OF SUPPORT (LOS)

Once the tariff is approved, the Project Company is required to move for arrangement of financing. AEDB 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.

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5.7 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 tariff is filed, the Project Company shall enter discussions of EPA.

5.8 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.

5.9 FINANCIAL CLOSE

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

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6 PROJECT SITE

6.1 WIND CORRIDOR OF PAKISTAN

Pakistan has 1,046 km long coastal line with very encouraging wind regime. As per 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 2*.

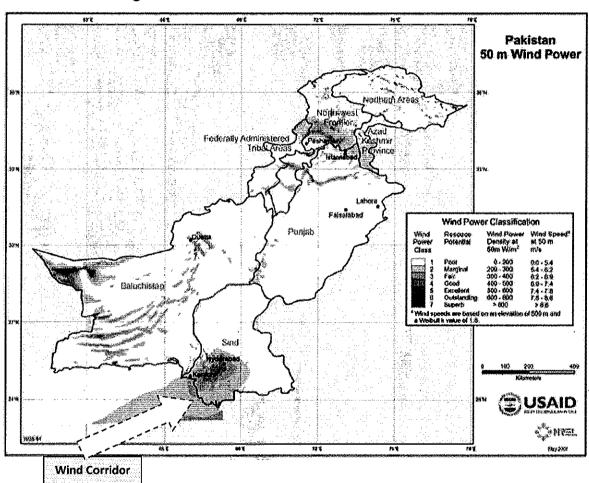


Figure 2: Wind Map of Pakistan by NREL

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Based on the wind potential, Government of Pakistan initiated the wind power projects and facilitated land to the potential investors. The lands were allocated in Gharo, Bhambore and Jhimpir, where different wind power developers have taken the land. The Sponsor has a valid LOI from AEDB and has 250 acres of land in Guiju, Sindh which is towards the North East of Karachi as shown in **Figure 3**.



Figure 3: Site Overview

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

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6.2 TRANSPORTATION AND ACCESS NETWORK

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

The route has been surveyed from Port Qasim, Karachi to Gujju Project Site along the unclassified road to the site entrance. The Google map identify the locations that will be followed for transportation of consignments.



The Route from Port Qasim to approximate site at Guiju is 73-75 kms.

6.3 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:

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Table 6-1: Maximum & Minimum Temperatures in Gharo Region¹

S. No.	Month	Mean (°C)	Median (°C)	Min (°C)	Max (°C)	Std. Dev. (°C)
	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	∴ ∰Máy 🖁	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
11:0	Nov	25.8	³ 25	17,9	35.9	4.4
12	Dec	21.8	21.6	9.9	34.8	5.7

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14mm	6mm	7mm	6mm	5mm	12mm	21mm	50mm	13mm	3mm	0mm	l6mm
2	1	0	1	0	1	3	4	1	0	0	1

Table 6-2: Average Precipitation and Rainfall Days in Gujju site²

6.4 EARTHQUAKES

According to the seismic zoning map of Pakistan, the Gujju site 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.

² Meteorological Department of Pakistan

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¹ Meteorological Department of Pakistan





7 WIND RESOURCE ASSESSMENT AND ENERGY YIELD ESTIMATES

The detailed wind resource assessment report and energy yield estimates have been prepared as Annex-C & Annex-D respectively of this document.

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8 SELECTION OF WTG AND EPC CONTRACTOR

Burj Wind Energy (Pvt.) Ltd has finalized (Hydrochina EPC – Contractor and General Electric GE 2.3 turbine model) after healthy competition and meeting all the formalities as per guidelines of NEPRA. The details of EPC Contractors and WTGs offered during shortlisting process are as follows:

EPC Contractor	TURBINES OFFERING	CAPACITY OF TURBINE (MW)				
DESCON	Goldwind GW 3.4-140	3,4				
Hydro China	General Electric GE 2.3	2.3				
Xinjiang	Vestas V3.45-112	3.45				

Turnkey EPC proposals were invited through a bidding process as per NEPRA guidelines, which were evaluated on techno-commercial basis.

The main aspects to select the WTG and EPC Contractor were 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) Technical guarantees, warrantees and obligations
- e) Time for Completion
- f) The commercial and legal terms of the EPC package

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9 GEOLOGICAL CONDITIONS

Geotechnical Investigation for feasibility study of 14 MW Burj Wind Energy Private Limited at Gujju, Sindh was carried out in to determine geotechnical parameters of subsurface deposits. Three (03) boreholes were drilled up to depth of 40m from the existing ground level as a part of the field investigation. Soil and ground water samples were collected during field investigation. Laboratory testing of these samples has been carried out in the Soil Testing Services laboratory, Karachi. The ground conditions observed at the site indicate the presence of silty clay/ clayey silt from the existing ground surface up to a maximum depth of 24 meters. Rock deposits including mudstone and limestone were also encountered at the site. The RQD values of these rock deposits vary from very poor to fair. According to the strength characteristics these rock deposits can be classified as very weak to weak.

9.1 OBJECTIVES OF GEOTECHNICAL STUDIES

- To execute 03 boreholes, at the site of each proposed location with 40m of depth.
- ❖ To execute field and laboratory aeotechnical testing.
- ❖ To investigate the surface and sub-surface soil condition, to evaluate foundation design parameters.
- ❖ To provide shallow and deep foundation recommendations.

9.2 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 tribe to the prominent strikes of the tribe to the prominent strikes.

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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 region are shown in *Figure 4 & Figure 5*:

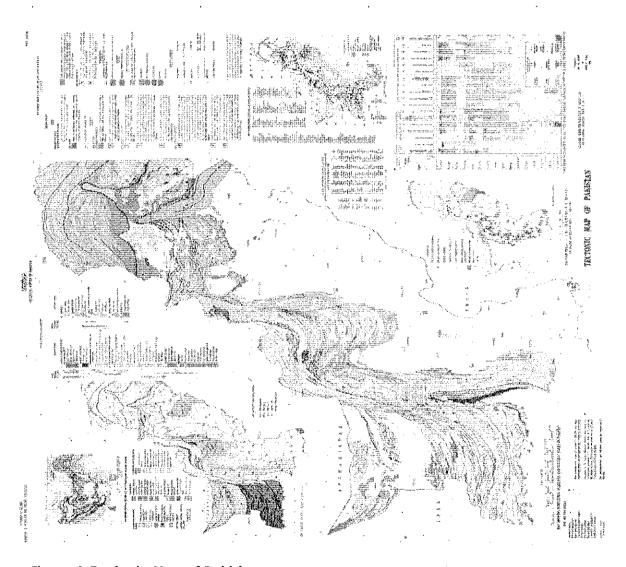


Figure 4: Tectonic Map of Pakistan

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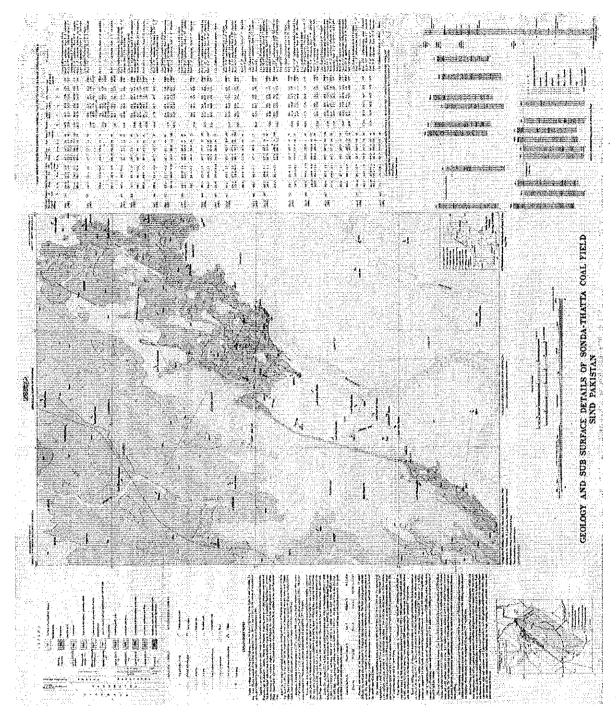


Figure 5: Geological and Sub Surface details of Gharo

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9.3 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 9-1: Earthquake Records around Karachi

Year	Longitude	Latitude	Depth	Scale	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-VI	Gharo 🔃
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	Gharo
1972	25.35	66.71	33	4.50	v	Karachi
1973	25.00	68.00		5.00	VI	Gharo
1973	25.48	66,33	57	4.90	V i	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	ν	Karachi
1984	25.86	66.41	33	5.00	ΔI	Karachi
1985	24.90	67.39	33	5.00	V.	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	Ž		Karachi 🖠
1998	25.69	66.46	33	4.40	V	Karachi
1998	24.85	66.35	33	4.50	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Karachi

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The seismic parameters of Karachi region are given in the table below along with the map in *Figure 6*:

Table 9-2: Seismic Parameters of Karachi

Seismic Parameters	Value
UBC Zone	2B
Max Peak Ground Acceleration	16% - 20% of 'g' (g = 9.8 m/s²)
Seismic Hazard	Upper Moderate
Magnitude (Richter Scale)	5.5 to 6.5
Intensity (MM Scale)	VI – VII

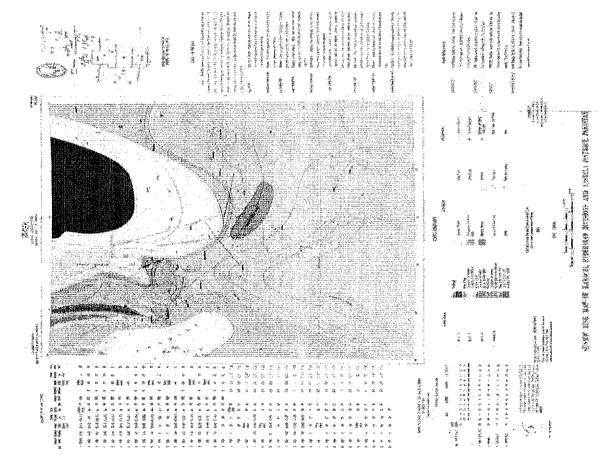


Figure 6: Seismic Map of Pakistan

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9.4 FIELD WORK

9.4.1 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.

9.4.2 Rock Core Drilling

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

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9.4.3 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

9.5 CONCLUSIONS OF GEOTECHNICAL STUDIES

Geotechnical Investigation for feasibility study of 14 MW Burj Wind Energy Private Limited at Gujju site, Sindh was carried out in November 2012. Scope of field work included drilling of three (03) boreholes up to the maximum depth of 40.0 meters below existing ground level. Soil and groundwater water samples were collected during the field investigation. Laboratory testing on these samples has been carried out in the lab and includes determination of index properties through specific gravity, natural moisture content, density etc. Chemical characteristics of soil and 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, type of structure and the expected loads being transferred to the founding stratum, pile foundations have been recommended as the main foundation system. Allowable pile capacities for various depths and diameters have been provided. Exposure to chloride and sulphate salts is 'moderate' for water samples; therefore, Ordinary Portland Cement (OPC) with slag may be used for underground concreting.

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10 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.

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11 ELECTRICAL ENGINEERING DESIGN

The basic electrical design of the wind farm is discussed in this chapter. In order to conduct the grid interconnection study, the required basic input data of the existing NTDC/HESCO network including data of Power plants, grid stations, transmission lines, load demand etc. has been obtained from NTDC as per requirements of the grid code addendum for wind energy approved by NEPRA: As part of the grid interconnection study (attached as Annex G), complete modeling of the wind farm has been performed. Load Flow Studies, Short Circuit Analysis, and Transient Stability Analysis along with the Contingency (N-1) and Power Quality Analysis have also been performed on the existing and future expansion plan of NTDC/HESCO network as part of the report.

The following scheme has been proposed for evacuation of Power from 14 MW Burj Wind Energy (BWEPL) Power project to the NTDC/HESCO Network:

"BWEPL Wind Power Plant would be connected by looping in-out the existing 132kV Circuit from Thatta towards FWEL-I at BWEPL Wind Power Plant. The distance of the looping point from the farm substation would be approx. 0.5km. The conductor used would be 132kV Greely Conductor. The length may changes slightly during the implementation of the Project".

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 Generator Step up Transformers (GSUs), and the other at the substation from MV to HV level. The MV level shall be at 33 kV and the HV level shall be at 132 kV. The Wind Farm shall have two 132 kV outgoing lines. The termination points of the lines on the two remote ends have been identified, which will be firmed up during the construction phase 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 two collector groups. Every WTG shall be equipped with own step-up transformer and shall be connected with the successive WTGs 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 new factor requirements of the national grid code (0.95 lagging).

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The 132 kV substation shall consist of double bus bar scheme with bus coupler and two GIS bays for main transformers with two line bays connected to 132 kV overhead transmission lines (OHL) as shown in Single Line Diagram (Figure 7) for reference. The Main Transformers shall meet the N-1 grid code criteria and thus would be two (02) in number (16 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 Company and shall be installed and connected by NTDC/HESCO. The HV/MV switchgear, main power transformers and other protection equipment shall be of reputable manufacturers, conforming to the requirements to be spelled out in detail in the EPC Contract and in the EPA. Further, the detailed electrical design of the substation will be subject to approval of both Burj Wind and NTDC as per the requirements of EPC Contract and EPA.

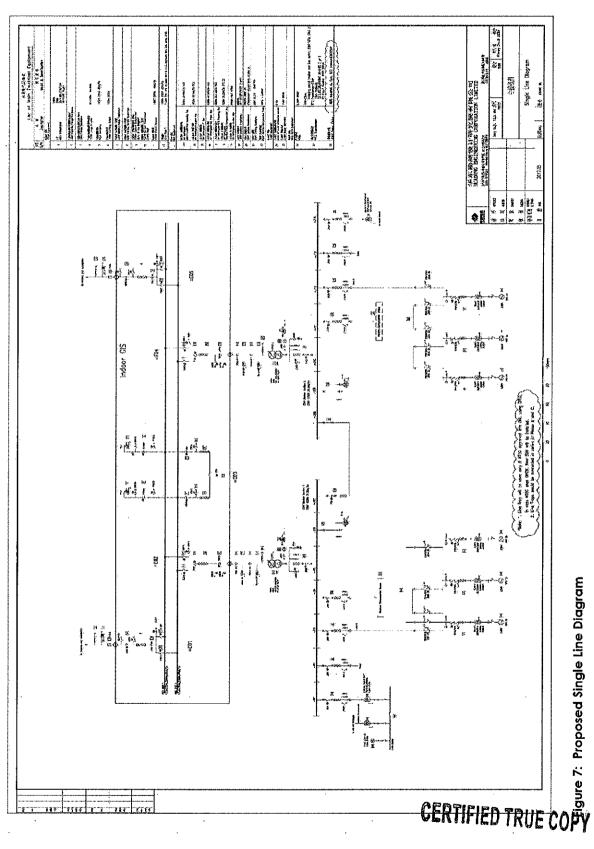
In this regard, the concept mentioned in this section serves as guidelines and firm design will be prepared during construction phase, which may be somewhat different from predicted here.

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12 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 Buri Wind Energy (Pvt.) Ltd shall become to supervise and monitor everything.

Burj Wind Energy (Pvt.) Ltd personnel will supervise construction activities right from the beginning. The Burj Wind 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.

Burj Wind Energy (Pvt.) Ltd requires careful management for construction. To achieve this, Burj Wind Energy (Pvt.) Ltd will prepare a Construction Management Master Plan taking 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.

To manage all the above operations correctly, Burj Wind Energy (Pvt.) Ltd shall have a consultant as a "Construction Supervisor" who shall supervise the quality and progress of all contractors on day to day basis and give approvals of the milestones.

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The project construction shall take 14 months from the date of planning till the COD. The activity structure and timelines are given in table below:

Table 12-1: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	1 0	1	1 2] 3	1 4
Engineering and Mobilization														
Detail Design (Electrical & Mechanical)								L						
Detail Design (Civil Structural & Architectural)														
Construction of Temporary Establishment		22222												
Civil Works of WTGs and Substation		_				3343443743	100000							
Construction of Substation (Foundations, Columns, Plinth Beams & Roof Slabs, External Development Works)												,		
Supply of WIGs and Towers														
Supply of EBOP Equipment														
Erection and Installation				_									-	
Cables and Interconnection for WTGs														
Cables and Interconnection for EBOP														
Testing and Commissioning of WTGs			_	_		_								
Testing and Commissioning of EBOP													.	
EPA Tests and Reliability Run Test														

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13 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-H.

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 effectivelyenvironmental impacts are likely to result from the proposed power project. mitigation monitoring, specific selection 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.

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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 Burj Wind 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 Burj Wind 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 Burj Wind 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 appropriate of the project sites.

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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 14 MW wind power project by Burj Wind Energy (Pvt.) Ltd will have no adverse environmental impact and the project can be regarded as an Environmental Friendly Green Project.

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14 CONCLUSIONS OF FEASIBILITY STUDY

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

The wind climate observed on the site indicates good annual average wind speed. Thus, the annual energy estimates are also good and it is feasible to develop the project based on turbines as discussed in section 8.

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.

The project site is conveniently located close to the NTDC/HESCO Network.

From here onwards, the project may enter 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 discussions with lenders at some stage.

It is expected that the Project will achieve financial close by 1st quarter of year 2019 and construction will be completed by 1st quarter of year 2020. It is anticipated that the Burj Wind Energy (Pvt.) Ltd Project would be a valuable addition to the NTDC/HESCO Network for generating electricity and contribute to overcome the current energy crises of Pakistan.

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ELECTRICAL GRID STUDIES

For

14 MW Wind Power Plant by Burj Wind Energy Private Limited (BWEPL)



Final Report (March 2017) Power Planners International

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Executive Summary

- The study objective, approach and methodology have been described and the plant's data received from the client Burj Wind Energy Pvt. Ltd. (BWEPL) has been validated. The Final Interconnection Study Report for 14 MW Burj Wind Energy Pvt. Ltd. (BWEPL) is being submitted herewith with new connectivity of Jhimpir Cluster and incorporating the comments received from NTDC with vide their letter no. GMPP/CEMP/TRP-380/2481-83 dated: 09-06-2016.
- 1 The wind project by Burj Wind Energy Private Limited, referred to as BWEPL 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.
- 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 fie in the southern part of Jhimpir namely Nasda Green, Lakeside, DHA City, Noor, Indus, Iran Pak, Metro-2, Uni-energy and Shaff Energy WPPs, are proposed to be connected to the newly proposed Jhimpír-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

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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 inloop 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, BWEPL Wind Power Plant would be connected by looping in-out the existing 132 kV Circuit from Thatta towards FWEL-I at BWEPL WPP. The distance of the looping point from the farm substation would be approx. 0.5 km. The conductor used would be 132 kV Greeley conductor. The lengths may change slightly during the implementation of the project.
- The scheme of interconnection of these newly proposed WPPs 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.

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- 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 integrated study, the interconnection of BWEPL WPP is done by looping in-out the existing 132 kV Circuit from Thatta towards FWEL-I at BWEPL WPP.
- The existing grid system of HESCO and NTDC in the vicinity of BWEPL WPP has been studied in detail by performing load flow, short circuit and dynamic analysis for the conditions prior to commissioning of BWEPL WPP and no bottlenecks or constraints have been found in the grid system.
- Wind Farm of BWEPL WPP has been modeled considering Type-3 WTGs. They are Doubly Fed Asynchronous Generators which are designated 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 HESCO/NTDC Grid.
- Load flow analysis has been carried out for peak and Off Peak scenarios of August/September 2019 considering the COD targeted by BWEPL WPP and a future scenario of 2022, for the dispersal of power from BWEPL 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

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maximum dispatch from all the existing/planned WPPs in the Jhimpir and Gharo Clusters.

- The load flow results for peak and Off Peak scenarios also establish that the proposed scheme of interconnection of BWEPL WPP shows no bottlenecks or capacity constraints in the adjoining 132 kV network in terms of absorbing all the output of BWEPL WPP 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 BWEPL WPP 132 kV are 5.14 kA and 5.10 kA for 3-phase and single phase faults respectively for 2022. This is much less than the switchgear rating of 40 kA recommended for BWEPL WPP Farm Substation as per NTDC requirements for 132 kV. The fault levels for BWEPL WPP 22 kV are 7.71 kA and 8.71 kA for 3-phase and single-phase faults respectively for year 2022. Therefore the short circuit rating for 22 kV switchgear is recommended as 25 kA. It has been found that the proposed scheme provides maximum SC strength for the evacuation of BWEPL WPP power to the grid.

The switchgear ratings for BWEPL WPP substation are as follows:

132 kV:

Short circuit rating = 40 kA (3 sec.)

Continuous rating = 2500 A

22 kV:

Short circuit rating = 25 kA (3 sec.)

Continuous rating = 2500 A

➤ Transient Stability analysis has been carried out for BWEPL 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 BWEPL WPP WTG unit's dynamic characteristics and the grid connectivity is strong enough to maintain stability under all disturbances. In turn, any disturbance from BWEPL WPR side disturbance TRUE COPY

- 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 14 MW of BWEPL 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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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. Burj Wind 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 14 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:

- Impact of BWEPL Wind Power Plant on the System
- 2. Impact of the System on BWEPL 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.

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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:

- To develop a feasible scheme of interconnections of BWEPL 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.
- 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 BWEPL 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 BWEPL Wind Farm and the NTDC/HESCO substations of 132 kV connecting with the BWEPL Wind Farm.
- 6. To check the minimum short circuit strength of the system to handle large variation of generation of wind turbine

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- 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 BWEPL WPP in response to Grid disturbances and vice versa the dynamic impact of disturbances in BWEPL WPP on the Grid.
- To check the ability of the wind turbine generators of BWEPL WPP to 9. 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

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.

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- 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.
- 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

Operating Criteria

The operating requirements to be fulfilled by the proposed BWEPL 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:

- The Wind Power Plant will manage for (i)
 - (a) Smooth Synchronization
 - (b) Smooth De-Synchronization
- The above operations, achieved through appropriate equipment, will be (ii) without jerk(s), felt on the grid system

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Power Generation Capability Forecasting Requirement:

- Power Generation Capability Forecasting, of average power on hourly basis, (1) will be managed by the Wind Power Plant as required from conventional power plants, except provisions of clause (ii) & (iii) below.
- The forecasting, as required in (i), will be estimated by Wind Power Plant (ii) 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.
- The forecasted values will not be a binding upon the wind power plant as (iv) actual wind speeds may differ significantly from predicted values over short durations.

1.5 Input Data

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 BWEPL WPP 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.

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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 BWEPL WPP.

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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. BWEPL 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 BWEPL WPP as provided by the Client Burj Wind 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.

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- 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 BWEPL WPP.

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3. Analysis of Network Prior to BWEPL WPP Interconnection

3.1 Description of the Network

The electrical grid, which is relevant for interconnection of BWEPL 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)

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- 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" BWEPL 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 BWEPL 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 BWEPL 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 CERTIFIED TRUE COPY

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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	FWEL-I to Thatta 132kV Single Circuit Out
Exhibit - 3.2	Thatta to Jhimpir 132kV Single Circuit Out
Exhibit - 3,3	Jhimpir to Kotri-GTPS 132kV Single Circuit Out
Exhibit - 3.4	Kotri-GTPS to Jamshoro-Old 132kV Single Circuit Out
Exhibit - 3.5	Jamshoro-Old to Jamshoro-New 132kV Single Circuit Out
Exhibit - 3.6	Noorlabad to Jamshoro-Old 132kV Single Circuit Out
Exhibit - 3.7	Jamshoro-New to Hala Road 132kV Single Circuit Out
Exhibit - 3.8	Jhimpir-1 to T.M.Khan 132kV Single Circuit Out

The load flow results of the network in the close vicinity of BWEPL 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.

The load flow results thus show that the network existing before BWEPL WPP and the double circuit from Thatta towards FWEL-I and FWEL-II is enough to absorb the power of the WPPs on that double circuit under normal and N-1 contingency conditions. We will check the adequacy of network after adding BWEPL WPP in Chapter 6.

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4. Development of Interconnection Scheme

4.1 Interconnection of BWEPL 14 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 BWEPL WPP, the nearest substation is the collector substation of Thatta 132 kV which will be operational before the commissioning of the said power plant.

4.2 Proposed Interconnection Scheme

The scheme of interconnection of newly proposed WPPs 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.

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- 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 integrated study, the interconnection of BWEPL WPP is done by looping in-out the existing 132 kV Circuit from Thatta towards FWEL-I at BWEPL WPP.

The connection scheme of BWEPL WPP for the scenario of August/September 2019 as shown in Appendix - 4 is by looping in-out the existing 132 kV Circuit from Thatta towards FWEL-I at BWEPL WPP. The distance of the looping point from the farm substation would be approx. 0.5 km. The conductor used would be 132 kV Greeley conductor. The lengths may change slightly during the implementation of the project.

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Modeling of BWEPL Wind Farm

5.1 Electrical Layout of Wind Farm

5.1.1 BWEPL WPP Energy Selection

BWEPL WPP has selected Type-3 Gamesa WTGs which they are considering to install on their Wind near Thatta. 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 1-4

 $(4 \times 2 = 8 MW)$

Line – 2

WTGs 5-7

 $(3 \times 2 = 6 MW)$

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-5 to Farm Substation

Since each collector would carry a max of approximately 8 MW at normal rating, the 22 kV collector circuits loading capacity should be in the range of 10 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.

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5.1.3 22 kV Collector Circuits

The MV voltage level selected by BWEPL WPP for interconnection of collector groups of WTGs in the Farm is 22 kV. Underground cables will be used with length of approx. 2.5 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
- Two breaker bays to connect two collector double circuits of WTG Lines 1 & 2
- Two breaker bays to connect two transformers of 132/22 kV
- One breaker bays for connecting two auxiliary transformers of 22/0.4 kV
- One breaker bays to connect switched shunt capacitor banks

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Rating of all the breakers and bus bar equipment would be

Short circuit rupturing capacity = 25 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 15 MVA ONAN OLTC transformers, 140±8×1.25%/22kV, to fulfill N-1 criteria of Grid Code
- One station auxiliary transformers 22/0.4 kV
- One switched shunt capacitor banks of the size of 6 MVAR (2 x 3 MVAR) with contactors and PLC (Programmable Logic Controller).
- Energy meters would be installed on HV side (132 kV) of the 132/22kV transformers.

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6. **Load Flow Analysis**

Load flow analysis has been carried out for the proposed scheme of interconnection of BWEPL 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 BWEPL medium voltage bus named BWEPL-MV 22 kV and BWEPL 132 kV, with two inter-bus transformers of 15 MVA each. These transformers are capable 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.

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Reactive Power Requirements

BWEPL 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 14 MW generating capacity is required to pump 4.6 MVAR to the grid at full output of 14 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. 4.6 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 BWEPL 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.

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The integrated case has been studied for the system conditions of summer 2019, the time line associated with the COD of BWEPL 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 BWEPL WPP, 13.2 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 6 MVAR at 22 kV bus bar is supplying 3.2 MVAR at (22.6 kV) voltage and, after VAR loss across 132/22 kV transformers, supplying about 4.2 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 \pm 5 % off the nominal.

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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	Burj-Wind 132/22 kV Single Transformer Out
Exhibit - 6.1.2	FWEL-I to Burj-Wind 132kV Single Circuit Out
Exhibit - 6.1.3	Burj-Wind to Thatta 132kV Single Circuit Out
Exhibit - 6.1.4	Thatta to Jhimpir 132kV Single Circuit Out
Exhibit - 6.1.5	Jhimpir to Kotri-GTPS 132kV Single Circuit Out
Exhibit - 6.1.6	Kotri-GTPS to Jamshoro-Old 132kV Single Circuit Out
Exhibit ~ 6.1.7	Jamshoro-Old to Jamshoro-New 132kV Single Circuit Out
Exhibit - 6.1.8	Nooriabad to Jamshoro-Old 132kV Single Circuit Out
Exhibit - 6.1.9	Jamshoro-New to Hala Road 132kV Single Circuit Out
Exhibit - 6.1.10	Jhimpir-I to T.M.Khan 132kV Single Circuit Out

The load flow results of the network in the close vicinity of BWEPL WPP shown plotted in Exhibits 6.1.1 to 6.1.10 indicate that all the power flows on the lines are within the rated limits of this network.

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 6 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,

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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	Burj-Wind 132/22 kV Single Transformer Out
Exhibit - 6.2.2	FWEL-I to Burj-Wind 132kV Single Circuit Out
Exhibit - 6.2.3	Burj-Wind to Thatta 132kV Single Circuit Out
Exhibit - 6.2.4	Thatta to Jhimpir 132kV Single Circuit Out
Exhibit - 6.2.5	Jhimpir to Kotri-GTPS 132kV Single Circuit Out
Exhibit - 6.2.6	Kotri-GTPS to Jamshoro-Old 132kV Single Circuit Out
Exhibit - 6.2.7	Jamshoro-Old to Jamshoro-New 132kV Single Circuit Out
Exhibit - 6.2.8	Noorlabad to Jamshoro-Old 132kV Single Circuit Out
Exhibit - 6.2.9	Jamshoro-New to Hala Road 132kV Single Circuit Out
Exhibit - 6.2.10	Jhimpir-1 to T.M.Khan 132kV Single Circuit Out

The load flow results of the network in the close vicinity of BWEPL WPP shown plotted in Exhibits 6.2.1 to 6.2.10 indicate that all the power flows on the lines are within the rated limits of this network.

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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	Burj-Wind 132/22 kV Single Transformer Out
Exhibit - 6.3.2	FWEL-I to Burj-Wind 132kV Single Circuit Out
Exhibit - 6.3.3	Burj-Wind to Thatta 132kV Single Circuit Out
Exhibit - 6.3.4	Thatta to Jhimpir 132kV Single Circuit Out
Exhibit - 6.3.5	Jhimpir to Kotri-GTPS 132kV Single Circuit Out
Exhibit - 6.3.6	Kotri-GTPS to Jamshoro-Old 132kV Single Circuit Out
Exhibit - 6.3.7	Jamshoro-Old to Jamshoro-New 132kV Single Circuit Out
Exhibit - 6.3.8	Nooriabad to Jamshoro-Old 132kV Single Circuit Out
Exhibit - 6.3.9	Jamshoro-New to Hala Road 132kV Single Circuit Out
Exhibit - 6.3.10	Jhimpir-1 to T.M.Khan 132kV Single Circuit Out

The results show that power flows on intact 132 kV circuits remain within their rated limits.

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6.6 Conclusion of Load Flow Results

The proposed interconnection scheme would require looping in-out the existing 132 kV circuit from Thatta towards FWEL-I at the Farm Substation of BWEPL WPP. Greeley conductor will be used with the capacity of 184 MVA per circuit. The distance of the looping point from the farm substation is approx. 0.5 km.

The load flow results of the proposed scheme of interconnection of BWEPL WPP shows no bottlenecks or capacity constraints in the adjoining 132 kV network in terms of absorbing all the output of BWEPL WPP under normal as well as the contingency conditions for all the scenarios studied.

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

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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 \pm 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 BWEPL 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 BWEPL 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 BWEPL WEPL TRUE COPY

have assumed the minimum short circuit calculations i.e. just one collector group with partial output of approx. 8 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

detail for each faulted bus bar.

7.2.1 Maximum Short Circuit Levels for the Year 2022

The short circuit levels have been calculated and plotted on bus bars of 132 kV of substations lying in the electrical vicinity of our area of interest i.e. Thatta, Jhimpir, Kotri-GTPS, Nooriabad and Jamshoro Old 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 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

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.

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The fault levels of BWEPL 132 kV are 5.14 kA and 5.10 kA for 3-phase and single phase faults respectively for 2022. This is much less than the switchgear rating of 40 kA recommended for BWEPL Farm Substation as per NTDC requirements for 132 kV. The fault levels for BWEPL 22 kV are 7.71 kA and 8.71 kA for 3-phase and single-phase faults respectively for 2022. Therefore the short circuit rating recommended for 22 kV switchgear is recommended as 25 kA.

Table-7.1 Maximum Short Circuit Levels with BWEPL WPP - 2022

Substation	3-Phase Fault Current (kA)	1-Phase Fault Current (kA)
BWEPL 132 kV	5.14	5.10
BWEPL MV 22 kV	7.71	8.71
FWEL-1 132 kV	4.17	4.41
FWEI-II 132 kV	4.17	4.07
Thatta 132 kV	6.62	6.43
Jhimpir 132 kV	11.45	10.48
Kotri GTPS 132 kV	19.73	19.01
Nooriabad 132 kV	11.92	13.16
Jamshoro Old 132 kV	23.84	22.87

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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 BWEPL WPP 2019

Substation	3-Phase Fault Current (kA)	1-Phase Fault Current (kA)	
BWEPL 132 kV	3.74	3.38	
BWEPL MV 22 kV	6.21	6,62	
FWEL-I 132 kV	2,86	3.20	
FWEI-II 132 kV	2.86	3.20	
Thatta 132 kV	4.74	4.33	
Jhimpir 132 kV	7.31	7.10	
Kotri GTPS 132 kV	13.25	12.25	
Nooriabad 132 kV	7.88	6.82	
Jamshoro Old 132 kV	15,93	14.35	

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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 BWEPL 132 kV are 5.14 kA and 5.10 kA for 3-phase and single phase faults respectively for 2022. This is much less than the switchgear rating of 40 kA recommended for BWEPL Farm Substation as per NTDC requirements for 132 kV.

The fault levels for BWEPL 22 kV are 7.71 kA and 8.71 kA for 3-phase and single-phase faults respectively for 2022. Therefore the short circuit rating recommended for 22 kV switchgear is 25 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.

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8. Transient Stability Analysis

The objective of transient stability study is to see:

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

8.1 Assumptions & Methodology

8.1.1 Type-3 WTG Dynamic Model

BWEPL 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: BWEF	L 132 kV bus bar		
Fault Duration: 5 eyel	es (100 ms)		
Line Tripping: BWEP	L to Thatta 132kV Single Circuit		
Variable	Bus/Line	Response	Figure No.
Voltage	 BWEPL 132 kV BWEPL MV 22 kV FWEL-1 132 kV Thatta 132 kV Jhimpir 132 kV Nooriabad 132 kV 	The voltages of all the bus bars recover after fault clearance	8.1.1
Frequency	BWEPL 132kV	Recovers after fault clearance	8.1,2
Plant MW OutputPlant MVAR Output	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.1.3

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	Speed Pmechanical	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.1.4
9	Torque Pitch Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.1.5
0	Paero Shaft Twist Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.1.6
	Turbine Rotor Speed Deviation Generator Speed Deviation	BWEPL Collector Group-2 0.69 kV Recovers after damping down oscillations		8.1.7
0	Pitch control Pitch compensation	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.1.8
•	FWEL-1 Collector Group-1		Attains steady state value after damping of oscillations	8.1.9
•	MW Line Flow MVAR Line Flow	BWEPL to FWEL-1 132 kV intact single circuit	Recovers after damping down oscillations	8.1.10
Ro	tor Angles	 Kotri GTPS 132 kV Thatta132 kV Lakhra 132 kV Nooriabad 132 kV Atlas 220 kV Guddu-New (Reference) 	Damps down quickly and attain a steady state value	8.1.11

8.2.2

Fault Type: 1-Phase		<u>,</u>	
Fault Location: BWI	3PL 132 kV bus bar		
Fault Duration: 9 cy	cles (180 ms)		
Line Tripping: BWE	PL to Thatta 132kV Single Circu	it	
Variable	Bus/Line	Response	Figure No.
Voltage	 BWEPL 132 kV BWEPL MV 22 kV FWEL-1 132 kV Thatta 132 kV Jhimpir 132 kV Nooriabad 132 kV 	The voltages of all the bus bars recover after fault clearance	8.2.1

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Fr	equency	BWEPL 132kV	Recovers after fault clearance	8.2.2
	Plant MW Output Plant MVAR Output BWEPL Collector Group-2 0.69 kV		Recovers after damping down oscillations	8.2.3
0	Speed Pmechanical	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.2.4
● .	Torque Pitch Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.2.5
8	Paero Shaft Twist Angle	BWEPL Collector Group-2 0.69 kV Recovers after damping down oscillations		8.2.6
8	Turbine Rotor Speed Deviation Generator Speed Deviation	BWEPL Collector Group-2 0.69 kV Recovers after damping down oscillations		8.2.7
•	Pitch control Pitch compensation	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.2.8
9	MW Output MVAR Output	FWEL-1 Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.2.9
•	MW Line Flow MVAR Line Flow	BWEPL to FWEL-1 132 kV intact single circuit Recovers after damping down oscillations		8,2.10
Ro	otor Angles	 Kotri GTPS 132 kV Thatta132 kV Lakhra 132 kV Nooriabad 132 kV Atlas 220 kV Guddu-New (Reference) 	Damps down quickly and attain a steady state value	8.2.11

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Fault Type: 3-Phase	A A A A A A A A A A A A A A A A A A A	100000	
Fault Location: BWEPL	-MV 22 kV bus bar		
Fault Duration: 9 cycles			
Line Tripping: One Coll	ector Group of 8 MW		1000
Variable	Bus/Line	Response	Figure No.
Voltage	 BWEPL MV 22 kV BWEPL 132 kV FWEL-1 132 kV Thatta 132 kV Jhimpir 132 kV Nooriabad 132 kV 	The voltages of all the bus bars recover after fault clearance	8.3.1
Frequency	BWEPL 132kV	Recovers after fault clearance	8.3.2
 Plant MW Output Plant MVAR Output 	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8,3,3
SpeedProcedure	BWEPL Collector Group-2 0,69 kV	Recovers after damping down oscillations	8.3.4
TorquePítch Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.3.5
PaeroShaft Twist Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.3.6
Turbine Rotor Speed Deviation Generator Speed Deviation	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.3.7
Pitch controlPitch compensation	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.3.8
MW Output MVAR Output	FWEL-1 Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.3.9
MW Line FlowMVAR Line Flow	BWEPL to FWEL-1 132 kV intact single circuit	Recovers after damping down oscillations	8.3.10
Rotor Angles	 Kotri GTPS 132 kV Thatta132 kV Lakhra 132 kV 	Damps down quickly and	8.3.11 ED TRI

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

8.2.4

Fault Type: 3-Phase			
Fault Location: BWEP	L-MV 22 kV bus bar		· · · · · · · · · · · · · · · · · · ·
Fault Duration: 9 cycle			
Line Tripping: BWEPL	. 132/22 kV Single Transformer		
Variable	Bus/Line	Response	Figure No.
Voltage	 BWEPL MV 22 kV BWEPL 132 kV FWEL-1 132 kV Thatta 132 kV Jhimpir 132 kV Nooriabad 132 kV 	The voltages of all the bus bars recover after fault clearance	8.4.1
Frequency	BWEPL 132kV	Recovers after fault clearance	8.4.2
Plant MW OutputPlant MVAR Output	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.4.3
SpeedPmechanical	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8,4,4
TorquePitch Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.4.5
Paero Shaft Twist Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.4.6
Turbine Rotor Speed Deviation Generator Speed Deviation	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.4.7
Pitch control Pitch compensation	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.4.8
MW Output MVAR Output	FWEL-1 Collector Group-1 0.7 kV	Attains steady state value after	8.4.9 E RTIFIE

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and the second s		damping of oscillations	
MW Line FlowMVAR Line Flow	BWEPL 132/22 kV intact Single Transformer	Recovers after damping down oscillations	8.4.10
Rotor Angles	 Kotri GTPS 132 kV Thatta132 kV Lakhra 132 kV Nooriabad 132 kV Atlas 220 kV Guddu-New (Reference) 	Damps down quickly and attain a steady state value	8.4.11

Fault Type: 3-Phase			
Fault Location: Jhimpir	-2 220 kV bus bar		
Fault Duration: 5 cycle	s (100 ms)		
Line Tripping: Jhimpir-	2 to KDA-33 220kV Single Circ	uit	
Variable	Bus/Line	Response	Figure No.
Voltage	 Jhimpir-2 220 kV Jhimpir-2 132 kV KDA-33 220 kV T.M.Kh. Rd. 220kV Jamshoro 220 kV BWEPL 132 kV 	The voltages of all the bus bars recover after fault clearance	8.5.1
Frequency	BWEPL 132kV	Recovers after fault clearance	8.5.2
Plant MW OutputPlant MVAR Output	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.5.3
SpeedPmechanical	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.5.4
TorquePitch Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.5.5
PaeroShaft Twist Angle	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.5.6

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6	Turbine Rotor Speed Deviation Generator Speed Deviation	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.5.7
9	Pitch control Pitch compensation	BWEPL Collector Group-2 0.69 kV	Recovers after damping down oscillations	8.5.8
0	MW Output MVAR Output	FWEL-1 Collector Group-1 0.7 kV	Attains steady state value after damping of oscillations	8.5.9
0	MW Line Flow MVAR Line Flow	Jhimpir-2 to KDA-33 220kV intact Single Circuit	Recovers after damping down oscillations	8.5.10
Ro	otor Angles	 Kotri GTPS 132 kV Thatta132 kV Lakhra 132 kV Nooriabad 132 kV Atlas 220 kV Guddu-New (Reference) 	Damps down quickly and attain a steady state value	8.5.11

8.3 Conclusion of Stability Study

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

There are no constraints of connecting BWEPL 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.

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

$$P_{\text{st}\Sigma} = P_{\text{ft}\Sigma} = \frac{1}{S_k} \cdot \sqrt{\sum_{i=1}^{N_{\text{wl}}} (c_i(\psi_k, \nu_{\alpha_i}) \cdot S_{n,i})^2}$$

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.

 $N_{\rm WL}$ is the number of wind turbines connected to the PCC.

PCC is the point of common coupling of WTGs that is MV bus of BWEPL 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 BWEPL Wind farm reduced ERMFIED TRUE COPY



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as 25 % of its rated capacity. Therefore taking one collector group as one equivalent generator of 4x2 = 8 MW we have calculated as follows;

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

 $N_{WT} = 4$

 S_k for MV bus = 240 MVA

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

$$c(\psi_{k}) = P_{\text{st,fic}} \cdot \frac{S_{k,\text{fic}}}{S_{n}}$$

where

 s_n is the rated apparent power of the wind turbine;

Sk.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

 $P_{St\Sigma} = P_{It\Sigma} = 0.0185 = 1.85 \%$

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 BWEPL 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;

- 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)

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$$P_{\text{st}\Sigma} = \frac{18}{S_k} \cdot \left(\sum_{i=1}^{N_{\text{ed}}} N_{10,i} \cdot (k_{f_i}(\psi_k) \cdot S_{0,i})^{3.2} \right)^{0.34}$$

$$P_{\text{lt}\Sigma} = \frac{8}{S_{\text{k}}} \cdot \left(\sum_{i=1}^{N_{\text{wl}}} N_{120,i} \cdot (k_{\text{f,l}}(\psi_{\text{k}}) \cdot S_{\text{n,i}})^{3.2} \right)^{0.31}$$

where

 $N_{10,\mathrm{J}}$ and $N_{120,\mathrm{J}}$

are the number of switching operations of the individual wind turbine within a 10 min and 2 h period respectively:

te. Am. Y

is the flicker step factor of the individual wind turbine;

 S_n

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;

 $P_{Sty} = 0.464817$

 $P_{lt\Sigma} = 0.446319$

For switching conditions of (c) these values would be less as the frequency of

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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_{It} 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];

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

Where

Swka = MVA rating of the WTG

S_{KE} = Short circuit MVA at connection point

Skss = 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

Swka = 2.22 MVA for the equivalent WTG of a collector group for the minimum case

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S_{KE1} for one WTG in collector group = 210 MVA (Exhibit 7.1.2)

 $S_{KSS} = 230 \text{ MVA}$ (Exhibit 7.1.2)

Substituting these values we get

 $\Delta V = 0.000919255 = 0.0919255 \%$

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].

 $\sqrt{\Sigma}$ (P_{WKA} /S_{KE})²≤ 1/25 or 4 %

Where

PWKA = MW rating of the WTG

S_{KE} = Short circuit MVA at connection point

Punching all the numbers in this equation, we get

Voltage Fluctuation = 0.00952381 = 0.952381 %

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

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10-Conclusions & Recommendations

- Interconnection Study has been carried out for 14 MW BWEPL WPP which is proposed to be connected by loop in-loop out configuration of Thatta - FWEL-L 132kV single circuit. The scheme of interconnection of newly proposed WPPs 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 integrated study, the interconnection of BWEPL WPP is done by looping in-out the existing 132 kV Circuit from Thatta towards FWEL-I at BWEPL WPP. The distance of the looping point from the farm substation would be approx. 0.5 km. The conductor used would be 132 kV Greeley conductor.
- The existing grid system of HESCO and NTDC in the vicinity of BWEPL WPP has been studied in detail by performing load flow, short circuit and dynamic analysis for the conditions prior to commissioning of BWEPL WPP and no bottlenecks or constraints have been found in the grid system.
- > Wind Farm of BWEPL has been modeled considering Type-3 WTGs. They are which designated Doubly Fed Asynchoronous Generators are 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

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- circuits and step-up from MV to HV (132 kV) at Farm substation to Connect to the HESCO/NTDC Grid.
- > Load flow analysis has been carried out for peak and Off Peak scenarios of August/September 2019 considering the COD targeted by BWEPL WPP and a future scenario of 2022, for the dispersal of power from BWEPL 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.
- > The load flow results for peak and Off Peak scenarios also establish that the proposed scheme of interconnection of BWEPL WPP shows no bottlenecks or capacity constraints in the adjoining 132 kV network in terms of absorbing all the output of BWEPL WPP under normal as well as the contingency conditions.
- Maximum and minimum short circuit levels for three-phase faults and singlephase 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 BWEPL 132 kV are 5.14 kA and 5.10 kA for 3-phase and single phase faults respectively for 2022. This is much less than the switchgear rating of 40 kA recommended for BWEPL Farm Substation as per NTDC requirements for 132 kV. The fault levels for BWEPL 22 kV are 7.71 kA and 8.71 kA for 3-phase and single-phase faults respectively for year 2022.

Therefore the short circuit rating for 22 kV switchgear is recommended as 25 kA. It has been found that the proposed scheme provides maximum SC strength for the evacuation of BWEPL WPP power to the grid.





The switchgear ratings for BWEPL WPP substation are as follows:

132 kV:

Short circuit rating = 40 kA (3 sec.)

Continuous rating = 2500 A

22 kV:

Short circuit rating = 25 kA (3 sec.)

Continuous rating = 2500 A

- Transient Stability analysis has been carried out for BWEPL 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 BWEPL WTG unit's dynamic characteristics and the grid connectivity is strong enough to maintain stability under all disturbances. In turn, any disturbance from BWEPL 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 14 MW of BWEPL 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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Burj Wind Energy (Pvt) Ltd 13.5MW Wind Power Plant

Initial Environmental Examination (IEE)

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BURJ WIND ENERGY (PVT.) LTD.

COMPANY SECRETARY

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EXECUTIVE SUMMARY

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BURJ WIND ENERGY (PVT.) LTD.

EXECUTIVE SUMMARY

Pakistan is energy deficient. The total installed power generation capacity of Pakistan in 2010-11 was 23,412 MW. Out of this, 16,070 MW was thermal (69 percent), 6,555 MW was hydroelectric (28 percent) and 787 MW was nuclear (3 percent). The growth in energy supply continues to lag behind the growth in energy demand.

Fossil fuels are already in short supply, and their local availability is fastly depleting along with price hike taking place during very short intervals of time. At the same time they are causing serious environmental concerns. Import bills of fossil fuels are swelling at a very fast rate. The fragile economy of Pakistan cannot afford to continue with the present situation.

Consequently, the present state demands to utilize other sources which could at least partially replace the fossil fuels presently in use. Wind is one among other non-conventional energy sources which provides one of the most promising alternatives for generation of grid quality power.

According to Wind Map (WM) of the country; developed by National Renewable Energy Laboratory (NREL) USA with active collaboration of USAID, Pakistan Meteorological Department (PMD) and Alternative Energy Development Board (AEDB) utilizing the data from PMD and satellite images; the Gharo – Keti Bandar Wind Corridor stretching 60 KM along the cost line of Sindh and deeper than 170 KM toward the land has a potential for generation of more than 60,000 MW of electricity. Whereas the total wind energy potential of the country, as estimated by NREL, USA stands at 346,000MW.

The Alternative Energy Development Board (AEDB) issued to Burj Wind Energy (Private) Limited (BWEPL), Ground Floor, OICCI Building, Talpur Road, Karachi; Letter of Intent (LoI) No. B/3/16/2007- 134 dated the 31st October, 2012, for establishment of a 13.5 MW Wind Farm at Gujju Taluka (Tehsil) and District Thatta, in the Gharo – Keti Bandar Wind Corridor, Sindh Province, Pakistan.

The AEDB also issued Letters of Intent (Lols) to other 43 IPPs pursuing development of wind power projects. Land was allocated to 19 IPPs for 50 MW wind power projects each in Gharo - Keti Bandar Wind Corridor. Projects with a cumulative capacity of approximately 9,700 MW are at various stages of development on these lands.

This Initial Environmental Examination (IEE) report has been prepared as legal requirement under the Pakistan Environmental Protection Act (PEPA), 1997, Section 12.

This IEE report gives a comprehensive account of the policy, legal and administrative framework as applicable in the perspective of Pakistan.

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The proposed project is not likely to have significant adverse environmental impacts which could be irreversible, affect sensitive eco-system, involuntary resettlement, etc., or un-precedent impact. The project is not to be located in the vicinity of sensitive location of national or regional importance. Under this situation according to "Pakistan Environmental Protection Agency, Review of IEE & EIA Regulations 1997/2000 (revised)" the project falls under Category B.

The proposed Wind Farm is to be located Gujju a small town not more than about 12km from Thatta and connected to Karachi through N5 via Karachi-Hyderabad SuperHighway—Motorway (M-9). Burj Wind Energy (Private) Limited (BWEPL) had already purchased 258.4 acres of land at Gujju, Taluka (sub-division) and District Thatta. Each WTG will require 289 Sq. meters area per foundation. This area can be spared from the total area of the available land for 9 wind power installation.

The estimated cost of the project stands at US\$ 41,907,632.0 and it will be completed within 10 months after the financial closure.

Burj Wind Energy (Private) Limited (BWEPL), has decided M/S GE about the supplier of wind turbines:

GE Model 77

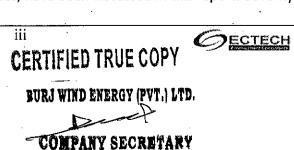
A total of 9 wind turbines will be installed at BWEL Wind Power Farm. The project is expected to become operational within about 10 months if everything goes well.

According to the findings, it is worth noting that all the wetlands including Mancher Lake, Keenjhar (Kalri) Lake, Drig Lake, Haleji Lake, Jubho Lagoon, Nurri Lagoon, and Deh Akro, are situated far too beyond the area of influence of the proposed project site, therefore, the project siting at the proposed location has absolutely no influence on these wetlands.

The nearest human settlement -village (Goth) is at about 2 km away. The site at which the WF is to be installed is owned by BWEL. The project site and area around the project site is virtually barren where some small bushes are found. Some small patches of land are under cultivation, where due to poor category of the land the crop yield very poor.

There are not any endangered habitat, park, forest, wildlife, estuary, historical or cultural resource within the area of influence of the project. There is no industry or any other commercial activity around the project site.

Potential (Unmitigated) Environmental, Health and Safety Impacts have been reported in this IEE report. Summarily, methodology for anticipating environmental impacts, during construction and operational phases, have been discussed in this report. Severity



of each impact has been described. According to the evaluation, the intensity of all possible impacts varies between minor to medium.

During construction and regular operation phases, there will be some environmental pollution. Specific environmental pollutants that will be generated during construction and operational phases of this project and mitigation measures have been given in this report to address the environmental issues so as to keep all the pollutants in line with applicable National Environmental Quality Standards (NEQs) and National Environmental Quality Standards for Ambient Air (NEQSAA) 2010: National Environmental Quality Standards for Drinking Water Quality (NEQSDW) 2010: National Environmental Quality Standards for Noise (NEQSN) 2010.

During site clearing activities some bushes have to be removed and they will be used as fuel for cooking by the poor people of the villages as they use them in routine due to shortage of fuel for cooking. During excavation, some top soil and sub- soil will be piled up and dust will also be generated. Dust will be taken care of by restraining the activities to the designated areas and sprinkling water at sites of dust generation. A lot of solid wastes and sewage will also be generated especially from construction camps. These have to be disposed off in environmentally sustainable manner.

The adverse environmental impacts during the functional phase of the proposed project under normal operating conditions are from bird mortality/avian impact, noise and solid waste generation.

In order to address the scientific disposal of the waste to be generated during construction and regular operation phases, Environment Management Plan (EMP) and Environmental Monitoring Program (EMtP) are given in this report.

The EMP will cover all aspects of waste and wastewater management and staffing during construction, including implementation of best practice standards such as reduce, re-use and recycle.

Monitoring recommendations are presented in this report for documenting the compliance of the project to the NEQS Pakistan.

The project will save a lot of Green House Gases emissions as compared to power plants based on fossil fuels. Therefore, the project stands merit for earning Carbon Credits.

Public Consultations/Disclosure was held. Therefore, a chapter on the details on the Public Consultation is added to the IEE report. Summarily, the people of the study area perceive overall positive impacts as a result of installation of the plant. The people believe that installation of the power plant in the area, especially during construction phase will open up employment opportunities which in turn follow a chain of indirect

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socio-economic benefits. They expect that due to the Wf, the price of their land and other may go up.

They also perceive accelerated economic activity due to the business opportunities likely to emerge in the area. Directly or indirectly, some reasonable number of the local people will get employment and business from the installation of the plant, e.g. shop keepers, traders, suppliers, contractors, transporters, technicians etc

Formal and informal grievance redressing mechanisms for compensations on account of damages due project mal-operations have included in this report.

On the basis of the IEE report, it is concluded that the project by all means merits for implementation at the designated site.

1.0 INTRODUCTION

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1.0 INTRODUCTION:

M/S Burj Wind Energy (PvT.) Limited, Ground Floor, OICCI Building, Talpur Road, Karachi are in the process of installing 13.5 MW Wind Power Plant at Gujju, Taluka and District Thatta, In compliance with the legal requirements of the Pakistan Environmental Protection Act-1997 (PEPA-1997), Section 12 – ANNEXURE-I; before starting any construction activity at the project site; No Objection Certificate (NOC)/Environmental Approval (EA), is required from Environmental Protection Agency (EPA), Government of Sindh, Karachi.

According to the "Guidelines for the preparation and review of Environmental Reports, November 1997" revised in Year 2000 - ANNEXURE-II, the project falls under category "B" therefore, this Initial Environmental Examination (IEE) has been prepared for submission to the EPA Sindh for the grant of No Objection Certificate (NOC)/Environmental Approval (EA).

Briefly, this IEE Report describes environmental, social, physical and other aspects associated with the project and also explains necessary measures to be put into practice for mitigating environmental impacts on any segment of the environment around the project site both during construction and normal operation. The IEE report also provides information as desired under the format used to help decision makers, EPA Sindh in the present case, before issuing the desired NOC/EA.

1.1 Project Proponent & Consultants Who Prepared the Report:

Project Proponent:

M/S Burj Wind Energy (PvT.) Limited, is a private limited company, incorporated in Pakistan for the development of wind power project in Pakistan.

CONTACT PERSON:

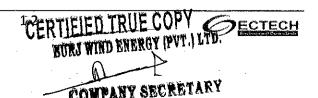
Mr. Arooj Asghar, M/S Burj Wind Energy (PvT.) Limited, Ground Floor, OICCI Building, Talpur Road, Karachi

Consultants Who Prepared the IEE Report:

ECTECH-Environment Consultants; Suite 4, 2nd Floor, Link Arcade, Model Town Link Road, Lahore

Phone: 042-35925693, 35887517 Fax: 042-35855508

Email: ectech_ectech@yahoo.com



1.2 Project Background

Pakistan currently faces severe power shortages, which result in so frequent long drawn out load shedding. The frequency of the load shedding is also on the increase. Unreliability and unavailability of power has led businesses to fail and Pakistani families to struggle. The power shortage is well documented by the Government of Pakistan (GoP) and is estimated at over 6,000MW. This gap in power supply and demand is on the increase.

The total installed power generation capacity of Pakistan in 2010-11 was, 412 MW. Out of this, 16,070 MW was thermal which is 69 percent of the total generation capacity. Thermal power plants are mostly run by furnace oil.

Indigenous supply of fossil fuels is not only becoming short supply, but also their fast price hike in the international markets, are swelling import bills of the fossil fuels. Lacking adequate environmental controls, use of fossil fuels has already caused a lot of damage to the environment of the country.

Fragile economy of Pakistan cannot afford to continue importing fossil fuels spending so hard earned foreign exchange. Under these circumstances, there is an immediate need to find a practical solution whereby, the dire need for electricity of the country could be met with minimum pressure on the national exchequer. One among other solutions to the present state is to use alternate/non-conventional cheaper and cleaner sources of energy production which could fully or partially replace the fossil fuels presently in use.

There are a number of other means of harnessing energy which are cheaper and have less damaging impacts on environment. Of these, some possible non-conventional energy sources which provide one of the most promising alternatives for generation of grid quality power alternatives are listed below:

- Solar
- Wind Power
- Geothermal
- Tides
- Hvdroelectric
- Biomass
- Wave power
- Nuclear
- Hydrogen

Of these, wind is one among other non-conventional energy sources which can provide one of the most promising alternatives for generation of grid quality

power. Of all the non-conventional sources, wind power is becoming more cost effective, besides virtually with none of the environmental or social costs as in case of the conventional sources.

Wind Power Potential

For wind farming, according to the feasibility studies carried out by the Meteorological department of Pakistan with help from the National Renewable Energy Laboratories (NREL), USA under USAID assistance program, a large corridor of wind-swept area was identified in district Thatta, the southern most district of Sindh. The wind corridor is 60 km wide between the cities of Gharo (north east of Karachi, on N5 highway) and old port of Keti Bandar close to where Indus River joins the Arabian Sea. The corridor extends 180 km upwards to Hyderabad.

This corridor has the exploitable potential of 50,000 MW of electricity generation through wind energy alone. The whole coastal belt of Pakistan is considered very feasible for wind energy. According to an estimate more than 5000 villages can be electrified through wind energy in Sindh, Balochistan and Northern areas. The total wind energy potential of the country, as estimated by NREL, USA stands at 346,000MW.

The Alternative Energy Development Board (AEDB); issued to Burj Wind Energy (Private) Limited (BWEPL), Ground Floor, OICCI Building, Talpur Road, Karachi; Letter of Intent (LoI) No. B/3/16/2007-134 dated the 31st October, 2012 (copy attached as **ANNEXURE-III**) for 13.5MW wind power generation project in Gharo wind corridor. The validity of this LoI is (18) calendar months from the date of its issue, where after it will automatically lapse immediately (unless extended pursuant to clauses 5 or 6), being April 30, 2014(the expiry date).

Burj Wind Energy (Private) Limited (BWEPL), had already purchased 258.4 acres of land at Gujju, Taluka (sub-division) and District Thatta; vide documents ANNEXURE-IV

Each WTG will require 289 Sq. meters area per foundation. This area can be spared from the total area of the available land for 9 wind power installation.

The estimated cost of the project stands at US\$ 41,907,632.0 and it will be completed within 10 months after the financial closure.

The proposed project at Gujju site lies in the Gharo – Keti Bandar Wind Corridor. Gujju a small town situated at a distance of about 12 Km from Thatta city. The town is approachable to Thatta by N5 road.

This corridor has the exploitable potential of 50,000 MW of electricity generation through wind energy [Figure -1.1 below].

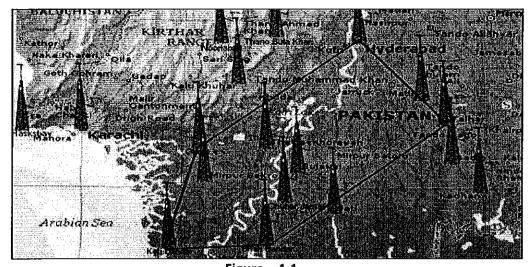


Figure – 1.1

Source: Meteorology Department Government of Pakistan
Gujju site lies in the Gharo – Keti Bandar Wind Corridor

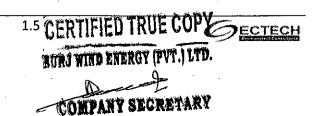
1.3 Project Purview:

As also mentioned earlier, the Alternative Energy Development Board (AEDB); issued to Burj Wind Energy (Private) Limited (BWEPL), Letter of Intent (LoI) No. B/3/16/2007-134 dated the 31st October, 2012 to install a 13.5MW wind power in Gharo- Keti Bandar Wind Corridor [figure below].

As mentioned earlier also; Alternative Energy Development Board (AEDB); issued to Burj Wind Energy (Private) Limited (BWEPL), Letter of Intent (LoI) No. B/3/16/2007-134 dated the 31st October, 2012

Evacuation of Electric Power from the Proposed Project:

The National Transmission and Dispatch Company (NTDC) will purchase the power to be produced from the project. Electric power to be produced from the proposed wind power Farm at Gujju, will be delivered to **Thatta-Makli 132 kV Grid Station 12 Km** away from the project site. The National Transmission and Distribution Company (NTDC) will provide a transmission line from the project site and connect it with the 132 KV transmission line already passing at a distance of 5 Km from the Wind Mill Project site. According to NTCD, by the year 2015, another 220KV Grid Station at Gharo will be built and at the same time another high tension line will be added to the existing single line. The new HT Line will be especially provided to evacuate the electric power from the Proposed Wind power Farm.



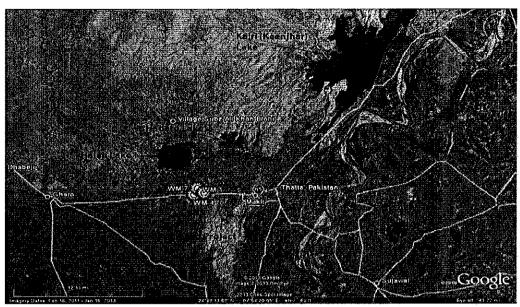


Figure – 1.2

Showing the project site.

Courtesy: Google

Burj Power Wind Farm Project Site:

The proposed 13.5MW Gujju Wind Power Project (GWPP); to be located at Gujju, in Thatta Taluka of Thatta District; is shown as below:



Figure – 1.3

Showing the project site.

Courtesy: Google



Table - 1.1 Proposed WEPP Coordinates

Control point

Ī	Geo DMS: WGS 84					
	Longitude	Latitude	Z	Object name	Horizontal	Vertical
					uncertainty	uncertainty
			[m]		[m]	[m]
Α	67°49'03.54" East	24°44'05,43" North	5.0	388	0.0	0.0
В	67°48'59,84" East	24°44'06.34" North	5.1	389	0.0	0.0
C	67°49'01.17" East	24°44'10.74" North	5.7	390	0.0	0.0
D.	67°48'47.83" East	24°44'10.30" North	6.3	391	0,0	0.0
Ξ	67°48'41.64" East	24°44'27.83" North	10.0	392	0:0	0.0
F	67°48'43.76" East	24°44'30.83" North	8.2	393	0.0	0.0
G	67°48'32,44" East	24°44'30.91" North	7.2	394	0.0	0.0
H	67°48'25.81" East	24°44'22.08" North	9.7	395	0.0	0.0
1	67°48'21.20" East	24°44'17.21" North	9.3	396	0.0	0.0
J	67°48'18.64" East	24°44'17.38" North	9.0	397	0.0	0.0
K	67°48'12.12" East	24°43'51.48" North	6.5	398	0.0	0.0
L	67°48'25.45" East	24°43'45.66" North	5.0	399	0.0	0.0
M	67°48'26.21" East	24°43'37.40" North	5.1	400	0.0	0.0
N	67°48'47.06" East	24°43'40.04" North	7.4	401	0.0	0.0
					•	_
			[m]		[m]	[m]
0	67°48'52.65" East	24°43'39,64" North	9.1	402	0.0	0.0
P	67°48'16.08" East	24°44'16.54" North		403	0.0	0.0
Q	67°49'01.65" East	24°43'55.70" North	8.3	404	0.0	0,0

Line objects

The proposed Wind Power Plant is to be located at the already purchased land as shown in the above Figure 2.4

BURJ POWER Wind Farm, Showing installation of 9 wind power turbines No. 1 to 9.Coordinates

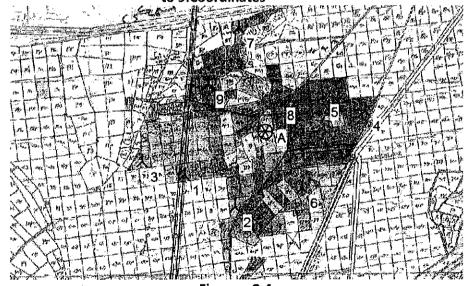


Figure – 2.4

Coordinates of positioning of each of the 9 turbines is given here under:

Table - 1.2: WTG Sitting UTM WGS84 Zone: 42

East	North	Z(m)
1 379,023	2,735,712	6.3
2 379,398	2,735,412	5
3 378,698	2,735,862	5.5
4 380,523	2,736,012	5
5 380,198	2,736,162	5.4
6 379,948	2,735,487	6
7 379,598	2,736,787	7.3
8 379,848	2,736,187	5.9
9 379,298	2,736,387	9.1

The sign Y shows the wind turbine installed at site.

1.4 Brief Description of Environmental Aspects

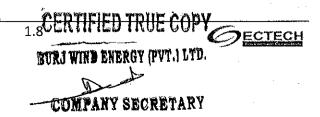
The environmental aspects, of the project site at the Gujju, have also been taken into consideration. According to the findings there will be No Impact on the flora and fauna of the area. Since there is no grazing land, national park, protected wildlife zones or birds sanctuary present near the wind farm, therefore, the project sitting will not be of any adverse impact.

The study has also been undertaken for noise, shadow flickering and visualization impact. The findings show that there will not be any adverse impact on account of these factors.

The land being sole property of the project proponent, hence it is free from resettlement issues. There are no Indigenous People in the project area or around.

Since the wind farm requires no fuel burning process in the entire project life cycle for its operation, it will be a 100% Green Power Generation Plant without emitting a single gram of Green House Gases. Further, no environmentally dangerous liquid/solid waste will be produced by the wind farm. So the wind farm will not be polluting any element of the environment in the surroundings as well as human health.

The other issues during equipment transportation and plant construction are of minute and temporary nature and will not cause any environmental concern. Even otherwise, the project activity comprises of installation and operation of 9



Wind Energy Turbines, which is not a big activity. Therefore, it will not have any worth mentioning environmental or health impacts during construction or regular operation phases.

However, BEL, with its vast experience in controlling environmental issues, will ensure through its contractors that it will be further minimized to the extent possible.

Keeping in view the above environment related studies and findings, thereof; it is obvious that installation of wind Power Project in Gujju by BEL will not have any adverse Environmental Impact and that the project can be regarded as Environmental Friendly and Green Project. The project will save a lot of Green House Gases emissions in case the power plant has to run using coal as fuel. Therefore, the project also merits for earning Carbon Credits.

1.5 Extent of the IEE Study:

As describe at the start of this Section, in compliance with the legal requirements of the Pakistan Environmental Protection Act-1997 (PEPA-1997), Section 12 – ANNEXURE-I; before starting any construction activity at the project site; No Objection Certificate (NOC)/Environmental Approval (EA) is required from Environmental Protection Agency (EPA), Government of Sindh, Karachi. Accordingly, following the "Guidelines for the Preparation and Review of Environmental Reports, November 1997" revised Year 2000-ANNEXURE-II, since the project falls under category "B" therefore, this Initial Environmental Examination (IEE) has been prepared for submission to the EPA, Sindh for the grant of No Objection Certificate (NOC)/Environmental Approval (EA).

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1.6 Persons Who Performed this Study:

Table − 1.3: Performed this Study

Name of the EIA/IEE team	Qualification and brief experience	Position in the EIA Team and role*
Dr. Muhammad Hanif (Chief Executive) ECTECH-Environment Consultants and APEX Environment Laboratory	A-Qualifications: 1 • M.Sc. (Chem. Tech.) Punjab Uni; Lahore; 1962. 2-Ph.D. (Chemistry) Charles University, Czech Republic; 1968. 3 • Post Doctorate-Alex. Humboldt. Foundation, Senior Post Doctorate Fellow, Germany; 1974-75. B-Experience/past Positions: 1-Director General (R), PCSIR Labs. Complex, Lahore. 2-Director General (Ex.) Ministry of Environment, Local Government and Rural Development, Govt; of Pakistan. 3 • (ex.) Consultant Environment, Category-A, Asian Development Bank. 4 • (ex.) Consultant Environment, UN—ESCAP 5 • Worked on World Bank Funded Project. 6 • Author of the National Environment Quality Standards (NEQS) 7 • Author of: i • 104 Scientific Research papers ii • Over 60 technical end project reports on environment. 8 • Carried out EIA for 28 projects and reviewed over 15 EIA reports. 9—Among many others, EIA carried out on behalf of the Asian Development Bank regarding Katmandu Valley (Nepal) Industrial Sites. 10-EIA-Saindak Gold/copper Project, Pakistan. 11-EIA Pakistan Steel, Karachi; 12-ESIA Report (According to OPIC Environmental Handbook Format) for D.G. Cement Company Limited, Kallar Kahar, District Chakwal, Pakistan. - ESIA Report (According to OPIC Environmental Handbook Format) for D.G. Cement Limited, Pezu, District Lakki Marwat, North West Frontier Province, Pakistan. - ESIA Report (According to OPIC Environmental Handbook Format) for D.G. Cement Limited, Kallar Kahar/ Khairpur Project, District Chakwal Pakistan. - ESIA Report (According to OPIC Environmental Handbook Format) for Chakwal Cement Company Limited, District Chakwal Pakistan.	- Project Team LeaderPrincipal author of the EIA report Coordination, supervision, guidance and co author of the EIA reportOver all monitoring of the project work, supervision, guidance and participation in all activities to ensure quality of work.
Mr. Muhammad Saif- Ur-Rehman	-B.Sc. (Chemical Engineering), Punjab Uni, Lahore, PakistanM.Sc. (Applied Environmental Sciences), Punjab Uni, Lahore, Pakistan.	-Senior Team Member -Project on site monitoring & related activities.

	Environmental Management Practices and Waste Water Treatment Technologies. -General Manager, APEX Environment LabChief Engineer Monitoring, ECTECH -Experience in Environment: For the last over 10 years working in the field of environment on the following subjects: - Prepared 10 EIA reports, in the field of cement, textile, oil & gas, power generation, fertilizer, power alcohol and chemical industryDesigning, fabrication, installation and operation of Waste Water Treatment Plants; So far three plants have been installed Carrying out environmental Audit: Around 18 industrial units have been completed so far Lab. Testing of effluents and water: For the last 5 years lab. testing services have been providedFull time participation in the assignments under serial 12 – under Dr. M. Hanif's contributions.	report Collection of demographic data Preparation of environmental management plan.
Mr. Muhammad Anees.	B.A; L.L.B; Expert on Environment Law - Full time participation in the assignments under serial 12 – under Dr. M. Hanif's contributions (legal aspects).	Guidance on various aspects of Environmental Law as applicable to EIA. Environmentalist. Preparation of Environmental management plan,
Mr. Muhammad Mujahid	M.Sc. (Env. Sciences), University of the Punjab, Lahore M.Phil (Env. Sciences), University of the Punjab, Lahore - Senior Lab. Analyst, APEX Environment Laboratory & Senior Monitoring Engineer - Senior Environmentalist ECTECH-Environment Consultants - Environmental monitoring of over 25 projects for EIA reports plus help in writing these reports. Also participated in - EIA Report (According to OPIC Environmental Handbook Format) for 10 projects IEE reports of 15 projects.	On site monitoring and lab. testing of samples and data processing. Report writing. Preparation of environmental management plan Environmental monitoring Lab. Testing of pollutants
Mr. Hasnain Sabir	M. Phil Environmental Sciences (GCU Lahore)	On site monitoring and lab. testing of samples and data processing.
		- Report writingPreparation of environmental management plan
Mr. Adnan Latif	M.Sc. (Env. Sciences), University of the Punjab, LahoreSenior Environmentalist, APEX Environment Laboratory -Senior Monitoring Engineer	-On site monitoring and lab. testing of samples and data processing. - Report writing.

		T
	ECTECH-Environment Consultants	-Preparation of
	-Environmental monitoring of over 30 projects for EIA	environmental
	reports plus help in writing these reports.	management plan
	Also participated in	
	- EIA Report (According to OPIC	- Environmental
	Environmental Handbook Format) for 10 projects.	monitoring
	- IEE reports of 20 projects.	- Lab. Testing of
		pollutants
		- Data processing
. '		/handling
Mr. Mudassar Adil	M.Sc. Environmental Sciences	On site monitoring and lab.
	(G.C University Faisalabad)	testing of samples and data
	Lab. Analyst,	processing.
	APEX Environment Laboratory	- Report writing.
	Monitoring Engineer	-Preparation of
	ECTECH-Environment Consultants	environmental
	-Environmental monitoring of over 12 projects for EIA	management plan
	reports plus help in writing these reports.	_ ,
Mr. Zahir Sajjad	M.Sc Environmental Sciences	Lab. Analyst,
••	(P.U Lahore)	APEX Environment
		Laboratory ·
		Monitoring Engineer
		ECTECH-Environment
		Consultants
Mr. Zohaib Ahmad	M.Sc Chemistry (Analytical)	On site monitoring and lab.
	(University of Gujrat)	testing of samples and data
	Lab. Analyst,	processing.
	APEX Environment Laboratory	- Report writing.
	Monitoring Engineer	-Preparation of
	ECTECH-Environment Consultants	environmental
	-Environmental monitoring of over 12 projects for EIA	management plan
	reports plus help in writing these reports	
Mazhar Hussain Khan	M.Sc Environnemental Sciences	-Lab. Analyst,
	(P.U Lahore)	-Monitoring Engineer
į	(1.10 23.110.5)	-Co-author for IEE and EIA
		reports.
		-Field surveys, public -
		consultation, public
		hearings and data
		processing
		hincessing

1.7 IEE Report Structure:

Summarily, this IEE Report describes environmental, social, physical, relevant legal framework applicable to the project and other associated aspects. The report also explains necessary measures to be taken for mitigating environmental impacts on any segment of the environment around the project site both during construction and normal operation. Baseline environmental conditions prevailing at the project site have been recorded. Public Consultations were held with all possible Stakeholders and their written views are reported in this IEE report. The report also describes the way the project activity will add to economic, social, agricultural, cultural development and welfare of the people of the area. Names of the expertise their qualifications and experience, who carried out this study and prepared the IEE report have also been recorded.

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

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2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Policy

Of the salient features of Government policies, for facilitating investment in Pakistan, some are described as under:

2.1.1 Deregulation of the economy

Deregulation is the policy of the Government of Pakistan. Under this policy deregulation of the economy and privatization of the state owned companies is going on.

2.1.2 Import policy

Import policy has been liberalized to a great extent through giving various incentives. There is an increased reliance on development of the industrial sector and enhancement of international trade.

2.1.3 Infrastructure facilities

Infrastructure facilities such as road network, water and power supply, means of transportation and communications etc. are being improved speedily.

2.1.4 Incentives

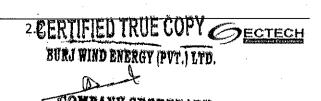
To keep Pakistan competitive in international markets and support the viability of investments in the country, the following incentives are available to both foreign and local investors:

- a-Initial depreciation allowance (IDA),
- b- Amortization and
- c- Normal tax rates.

2.2 Legal and Administrative Framework

Comprehensive environmental framework is available in the country covering environmental management to control environmental degradation.

With the approval of the 18th Amendment in the Constitution of The Islamic Republic of Pakistan-1973, the subject of environment has largely been delegated to the provinces. The federal Ministry of Environment has been abolished and instead the Ministry of National Disaster Management has been



created under which: Pakistan Environmental Protection Council; Pakistan Environmental Protection Agency; Pakistan Environmental Planning and Architectural Consultants Limited; Global Environmental Impact Study Centre; Islamabad policy, legislation, plans, strategies and programme with regard to disaster management including environmental protection and preservation, coordination, monitoring and implementation of environmental agreements with other countries, international agencies and forums have been put. The Pakistan Environmental Protection Agency (Pak EPA) looks after the environment related issues for the federally controlled areas and territories. Lacking laws at the provincial levels; the laws, rules, regulations etc., those already available at the federal level and operational at the provincial levels will continue as such.

Hereunder, the major legal framework is given:

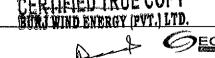
2.2.1 National Conservation Strategy (NCS)-Pakistan.

The National Conservation Strategy (NCS) - Pakistan as approved by the Federal Cabinet in March 1992 is the guiding document on the environmental issues in the country (Ref. EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources.

The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the envisaged project are pollution prevention and abatement, restoration of supporting forestry and plantations, and preservation of cultural heritage. A mid-term review, of the achievements, impacts and prospects of Pakistan's NCS, was undertaken between years 1999 - 2000.

The Pakistan Environmental Protection Act (PEPA), 1997 (ANNEXURE-I) is the legal controlling instrument. The Sindh Environmental Protection Council (SEPC) and the Sindh Environmental Protection Agency (SEPA) are responsible for administering the provisions of the Act.

Among the members of the SEPC, major ones include representatives of the Provincial Government especially the Sindh Environmental Protection Agency (SEPA), industry, non-governmental organizations, academia, environment experts, The Sindh Chamber of Commerce and Industry and the private sector, NGOs, etc. The SEPA is required to ensure compliance with the National Environmental Quality Standards (NEQS) (ANNEXURE-V) and establish monitoring and evaluation systems. As a primary implementing agency in the hierarchy, it is responsible for identifying the need for, as well as initiating legislation whenever necessary. SEPA is also authorized to delegate powers to its



lower staff. One of the functions of the SEPA is the review and approval of Environmental Impact Assessment (EIA) and Initial Environmental Examination (IEE) reports of the projects undertaken in their respective jurisdictions.

2.3 Pakistan Environmental Protection Act (PEPA) 1997

Among many other salient features of the Environmental Protection Act, 1997 it empowers the Pakistan SEPA to:

- identify categories of projects to which the Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) provisions will apply;
- develop guidelines for conducting IEE and/or EIA and procedures for the submission, review and approval of the same;
- develop environmental emission standards for parameters such as air, water and noise and
- Enforce the provisions of the PEPA -1997 through environmental protection orders and environmental tribunals headed by magistrates with wide-ranging powers, including the right to fine violators of the Act.

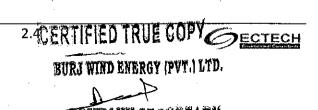
The SEPA can frame environmental regulations tailored to the requirements of the province. They are also required to review and approve EIAs/IEEs of all the development projects undertaken in the Sindh province.

2.4 National Environmental Quality Standards (NEQS)

The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and have been amended in 1995

The following standards are specified therein:

- Maximum allowable concentrations of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers).
- Maximum allowable concentrations of pollutants (32 parameters) in Drinking water (including physical, chemical, biological, organic and radioactive parameters).
- Maximum allowable concentrations of pollutants (16 parameters) in gaseous and particulate matter emissions from industrial sources.
- Maximum allowable concentrations of pollutants in gaseous and particulate matter emissions from ambient air.
- Maximum allowable concentrations of noise in ambient air.



The Guidelines for "Self-Monitoring and Reporting" (SMART) **ANNEXURE-VI** for the industry as approved by the Pakistan Environmental Protection Council (PEPC) and adopted by the SEPA are also enforced.

2.4.1 Regulations for Environmental Assessment

Under Section 12 (and subsequent amendment) of the PEPA-1997, ANNEXURE-I a project failing under any category specified in Schedule I (SRO 339 (I)/2000), requires the proponent to file an IEE with the concerned PEPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the federal agency. Within ten working days of the IEE or EIA having been deposited, the federal/provincial agency will confirm that the document submitted is complete for the purpose of review. During this time, should the federal/provincial agency require the proponent to submit any additional information, it will return the IEE or EIA to the proponent for revision, clearly listing those aspects that need further discussion. Subsequently, the federal agency shall make every effort to complete an IEE review within 45 days and an EIA review within 90 days of filing.

At the time of application, the project proponent is also required to pay a specified official fee to the PEPA to process the case.

2.4.2 Guidelines for Environmental Assessment

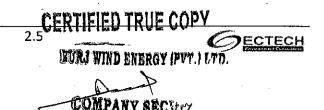
The Pak-EPA published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. These guidelines have been adopted by the Sindh EPA. The guidelines that are relevant to the proposed project are listed below:

2.4.3 Guidelines for the Preparation and Review of Environmental Reports:

The guidelines on the preparation and review of environmental reports target the project proponents, and specify:

- the nature of the information to be included in environmental reports,
- the minimum qualifications of the EIA conductors appointed,
- the need to incorporate suitable mitigation measures at every stage of project implementation and
- the need to specify monitoring procedures.

The report must contain baseline data on the project area, detailed assessment thereof, and mitigation measures.



2.4.5 Guidelines for Public Consultation:

These guidelines deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures that their concerns are incorporated in any impact assessment study.

2.4.6 National Resettlement Policy and Ordinance

At this point, the only legislation relating to land acquisition and compensation is the Land Acquisition Act (LAA) of 1894. Following a national consultative process, a national resettlement policy and a related ordinance were drafted. The draft policy and the ordinance are presently being reviewed by the provinces, and have yet to be approved and notified by the government. The salient applicable features of the Draft Resettlement Policy are given below:

- The SEPA will be responsible for both environment-related as well as resettlement-related matters.
- All categories of 'loss' arising from development projects that entail resettlement, need to be addressed: these include not only loss of land, builtup property, other infrastructure, and crops and trees, but also loss of income, job opportunities, and access to natural resources, etc.
- Vulnerable groups whose issues need to be addressed in particular include: women, children, destitute persons, tribal communities, squatters, those with usurper rights, and landless groups.
- There should be a special emphasis on consultation with affected groups when preparing a Resettlement Action Plan (RAP).

2.5 Institutional Framework

The capability of regulatory institutions for environmental management largely, ensures the success of environmental assessment for ensuring that development projects are environmentally sound and sustainable. For decision-making and policy formulation in the environmental and conservation issues, the institutional framework, as it exists in Pakistan, is described below.

2.5.1 National Environmental Regulatory/Legal Requirements:

After the 18th Amendment to the Constitution of The Islamic Republic of Pakistan-1973, the regulation & management of environment has largely been delegated to the Provinces. The Federal Ministry of Environment has been abolished and instead the Ministry of National Disaster Management (MoNDM) has been created which shall be controlling: Pakistan Environmental Protection Council; Pakistan Environmental Protection Agency; Pakistan Environmental

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Planning and Architectural Consultants Limited; Global Environmental Impact Study Centre; and federal policy, legislation, plans, strategies and programmes with regard to disaster management including environmental protection and preservation, coordination, monitoring and implementation of environmental agreements with other countries, international agencies and forums. Therefore, wherever the name of the previous Ministry of Environment (MoE) in mentioned it deemed to mean the MoNDM.

The Pakistan Environmental Protection Agency (Pak EPA) looks after the environment related issues for the federally controlled areas and territories. Lacking laws at the provincial levels; the laws, rules, regulations etc., those already available at the federal level and operational at the provincial levels will continue as such.

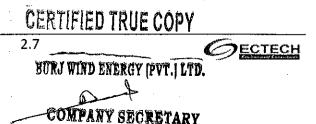
2.5.2 Pakistan Penal Code (1860)

The Pakistan Penal Code usually called PPC is a penal code for all offences charged in Pakistan. It was originally prepared by Lord Macaulay in 1860 on the behalf of the Government of British India as the Indian Penal Code. After the partition of British India in 1947, Pakistan inherited the same code and subsequently after several amendments [e.g. Protection of Women (Criminal Laws Amendment) Act, 2006, Criminal Laws (Amendment) Act, 2004 (I of 2005), Criminal Law (Amendment) Ordinance (LXXXVI of 2002), Criminal Laws (Reforms) Ordinance (LXXXVI of 2002), etc.] it is now mixture of Islamic and English Law.

Pakistan Penal Code is a general criminal law, applies all over the country, and contains specific provisions on the subject. Thus it prohibits mischief by killing or maiming animals, or damaging works of irrigation or a river or a road or a bridge or drain or firing explosive substances with intent to cause damage. The Code also prohibits public nuisance by acting negligently to spread the infection of disease or disobeying quarantine rule or causing adulteration of food or drink or drug, or fouling water or making the atmosphere noxious to health etc.

2.5.3 Policy and Procedures for the Filing, Review and Approval of Environmental Assessments

This document sets out the key policies and procedural requirements. It contains a brief policy statement on the purpose of environmental assessment and the goal of sustainable development and requires that environmental assessment be integrated with feasibility studies. It also defines the jurisdiction of the Federal and Provincial EPA's. It lists down the responsibilities of the proponent and states the duties of responsible authorities. It provides schedules of reports that require either an IEE or EIA.



2.5.4 Guidelines for the preparation and review of Environmental Reports (NOVEMBER 1997/2000)

These guidelines are descriptive documents regarding the format and content of IEE/EIA reports to be submitted to EPA for "No-Objection Certificate (NOC)/Environmental Approval (EA)". Following are the major areas, which are covered by these guidelines:

- The IEE/EIA report (scope, alternatives, site selection, format of IEE report)
- Assessing impacts (identification, analysis and production, baseline data, significance)
- Mitigation and impact management (and preparing an environmental management plan)
- Reporting (drafting style, main features, shortcomings, other forms of presentation)
- Review and decision making (role, steps, remedial options, checks and balances)
- Monitoring and auditing (systematic follow up, purpose, effective data management)
- Project Management (inter-disciplinary teams, programming and budgeting)

2.5.5 Guidelines for Public Consultations

These guidelines deal with possible approaches to public consultation (PC) and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their legitimate concerns in any impact assessment study. These guidelines cover:

- Consultation, involvement and participation of Stakeholders
- Techniques for public consultation (principles, levels of involvements, tools, building trust)
- Effective public consultation (planning, stages of EIA where consultation is appropriate)
- Consensus building and dispute resolution
- Facilitation involvement (including the poor, women, building community and NGO capacity

2.5.6 Guidelines for Sensitive and Critical Areas

These guidelines identify sensitive and critical areas in Pakistan, in relation both to the natural environment and the cultural aspects.

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2.5.7 National Resettlement Policy and Ordinance

At this point, the only legislation relating to land acquisition and compensation is the Land Acquisition Act (LAA) of 1894. Following a national consultative process, a national resettlement policy and a related ordinance were drafted. The draft policy and the ordinance are presently being reviewed by the provinces, and have yet to be approved and notified by the government. The salient applicable features of the Draft Resettlement Policy are given below:

- The Pak-EPA will be responsible for both environment-related as well as resettlement-related matters,
- The responsibilities for implementation at a provincial level are to be delegated to the concerned provincial EPAs with overall control of the provincial Planning and Development (P&D) Departments.
- All categories of 'loss' arising from development projects that entail resettlement, need to be addressed: these include not only loss of land, builtup property, other infrastructure, and crops and trees, but also loss of income, job opportunities, and access to natural resources, etc.
- Vulnerable groups whose issues need to be addressed in particular include: women, children, destitute persons, tribal communities, squatters, those with usurper rights, and landless groups.
- There should be a special emphasis on consultation with affected groups when preparing a Resettlement Action Plan (RAP).

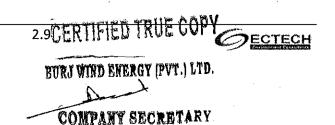
The provisions of the Draft Resettlement Policy are consistent with the requirements of the World Bank OD 4.30 on involuntary resettlement.

2.5.8 Forest Act, 1927

All India Forest Act, 1927 was adopted by the Government of Pakistan, which was subsequently implemented by the respective provinces. Basically, the law was enacted to conserve and protect the forest resources of the country for sustainable development. It lays down Rules and Regulations for exploitation of various categories of forests such as reserved, protected or unclassified. Further, the Act spells out the licensing method for timber cutting, grazing, hunting etc. It also gives the details of magisterial powers of Forest Department officers and penalties for offences committed with regard to forest resources and products.

2.5.9 Industrial Relation Ordinance, 2002

The ordinance has been promulgated to amend, consolidate and rationalize the law relating to formation of trade unions, regulation and improvement of relations between employers and workmen and avoidance and settlement of any differences or disputes arising between them Pakistan's labour laws trace



their origination to legislation inherited from India at the time of partition of the Indo-Pak subcontinent. The laws have evolved through a continuous process of trial to meet the socio-economic conditions, state of industrial development, population and labour force explosion, growth of trade unions, level of literacy, Government's commitment to development and social welfare. To meet the above named objectives, the government of the Islamic Republic of Pakistan has introduced a number of labour policies, since its independence to mirror the shifts in governance from martial law to democratic governance.

While Article 18 of the Constitution affords every citizen with the right to enter upon any lawful profession or occupation, and to conduct any lawful trade or business, the Industrial and Commercial Employment (Standing Orders) Ordinance was enacted in 1968 to address the relationship between employer and employee and the contract of employment. The Ordinance applies to all industrial and commercial establishments throughout the country employing 20 or more workers and provides for security of employment. In the case of workers in other establishments, domestic servants, farm workers or casual labour engaged by contractors, their labour contracts are generally unwritten and can be enforced through the courts on the basis of oral evidence or past practice.

The Constitution of Pakistan contains a range of provisions with regards to labour rights found in Part II: Fundamental Rights and Principles of Policy.

- Article 11 of the Constitution prohibits all forms of slavery, forced labour and child labour;
- Article 17 provides for a fundamental right to exercise the freedom of association and the right to form unions;
- Article 18 proscribes the right of its citizens to enter upon any lawful profession or occupation and to conduct any lawful trade or business;
- Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone;
- Article 37(e) makes provision for securing just and humane conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment.

2.5.10 Industrial Relations Ordinance 2011 Promulgation

The Government has promulgated Industrial Relations Ordinance 2011. The Ordinance has been approved by the President on the Advice of the Prime Minister. The Government has promulgated Industrial Relations Ordinance, 2011 in view of the current legal vacuum created due to deletion of the concurrent Legislative List through the 18th Constitutional Amendment. The Industrial Relations has also been transferred to the Provinces which have promulgated

provincial laws to regulate industrial relations. However, there is no law in place to deal with Industrial Relations in the Islamabad Capital Territory or in respect of national level trade federations and for resolutions of trans-provincial industrial issues. The Parliament has yet to promulgate the Ordinance as law.

2.5.11 Other Relevant Laws

Some of the other relevant laws and legislations are listed below:

- Canal and Drainage Act, 1873
- The Explosives Act, 1884
- The Fire Wood and Charcoal (Restriction) Act, 1964
- Motor Vehicles Ordinance, 1965
- The West Pakistan Regulation and Control of Loudspeaker and Sound Amplifier Ordinance, 1965
- Agriculture Pesticides Ordinance, 1971
- The Antiquities Act, 1975

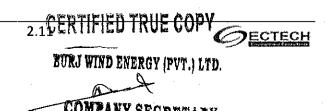
2.5.12 National Electric Power Regulatory Authority (NEPRA) Act 1997

The NEPRA Act was approved by Parliament and signed into law in December 1997. It seeks to create an autonomous, independent regulatory authority, which will be solely responsible for the power sector. It will be responsible for the oversight of the power sector and will exercise control through its power to license power generation, transmission and distribution. It will regulate tariffs for all these activities. It will perform its functions through transparent processes to be enshrined in rules that are being framed in a transparent manner through appropriate rules.

2.5.13 Power Policy 1998

The revised power policy was implemented in 1998. The objective and intentions of the Government of Pakistan (GOP) to new policy is to move towards the creation of a competitive power market in Pakistan. It proposes to do so by restructuring and privatizing the existing thermal power generation, the power transmission and distribution functions and assets of existing public sector utilities (WAPDA/KESC), by the creation of a fully autonomous regulatory authority, the National Electric Power Regulatory Authority (NEPRA), and through its future IPP policy.

The salient features of the Policy are;



- The basis for selection of private power project will be minimum levelized tariff through International Competitive Bidding. Variable tariffs over the life of the project will be permitted under terms specified prior to bidding. The process of selection will involve pre-qualification, issuance of a Request for Reports (RFP), bidding and evaluation of bids against bid criteria clearly laid out in the RFP.
- It is recognized that without a proper feasibility study for a particular sitespecific hydel or indigenous coal based project, it will not be possible to invite competitive bids and receive firm offers. Thus, detailed feasibility studies for such projects will be prepared before bids are invited.
- Hydel projects will be implemented on a Build-Own-Operate-Transfer (BOOT)
 basis; to be transferred to the province in which it is situated at the end of
 the concession period, and thermal projects on a Build-Own-Operate (BOO)
 basis.
- Competitive Tariffs will comprise an Energy Purchase price and a Capacity Purchase Price with adequate provisions for escalation.

2.5.14 Factories Act, 1934

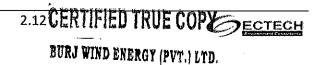
There is no independent legislation on occupational safety and health issues in Pakistan. The main law, which governs these issues, is the Chapter 3 of Factories Act, 1934. All the provinces, under this act, have devised Factories Rules. The Hazardous Occupations Rules, 1963 under the authority of Factories Act is another relevant legislation. These rules not only specify some hazardous occupations but also authorize the Chief Inspector of Factories to declare any other process as hazardous.

The other related laws are:

- Workmen Compensation Act, 1923
- Provincial Employees Social Security Ordinance, 1965
- West Pakistan Shops and Establishments Ordinance, 1969
- Boilers and Pressure Vessels Ordinance, 2002

Chapter 3 of the Act has general provisions on health and safety at the workplace. Provincial governments are allowed to make rules under this Act and inspectors under this Act also have discretion in defining the rules. Chapter 3 talks about various safety arrangements. This list is being provided just to show how meticulously labor law covers these issues.

- Cleanliness
- Disposal of wastes and effluents
- Ventilation and temperature



- Dust and fume
- Artificial humidification.
- Overcrowding
- Lighting
- Drinking water
- Latrines and urinals
- Spittoons
- Precautions against contagious or infectious disease
- · Compulsory vaccination and inoculation.
- Power to make rules for the provision of canteens
- Welfare officer
- · Precautions in case of fire
- Fencing of machinery
- Work on or near machinery in motion
- Employment of young persons on dangerous machines
- Striking gear and devices for cutting off power
- Self-acting machines
- Casing of new machinery
- Prohibition of employment of women and children near cotton openers
- Cranes and other lifting machinery
- Hoists and lifts
- Revolving machinery
- Pressure plant
- Floors, stairs and means of access
- Pits, sumps, opening in floors, etc.
- Excessive weights
- Protection of eyes
- Power to require specifications of defective parts or tests of stability
- Safety of building, machinery and manufacturing process
- Precautions against dangerous fumes
- Explosive or inflammable dust, gas, etc.
- Notice of certain accidents

2.6 Environment Related Relevant International Agreements in Pakistan's context

Pakistan is a party to the following treaties and agreements in furtherance of its environmental goals and programme.

Treaty	Pakistan Status
Convention on the Protection of Ozone Layer on Dec. 18, 1992.	Ratified
The Amendment to Montreal Protocol on Substance that Depleting Ozone layer	Signed
UN Framework Convention on Climate Change on June 13, 1992	Signed
Convention on the Continental Shelf on October 31, 1958	Signed
The Convention on High Seas on October 31, 1958	Signed

Convention on the Fishing and Conservation of the living Resources of the High Seas on October 1958.	Signed
The UN Convention on Law of the Sea on December 10, 1982	Signed
The Convention on Territorial Sea and the Contagious Zone and the Agreement for the establishment of Network of Aquaculture Centers in Asia and the Pacific	Signed
The Convention on Wetlands of the International Importance on July 23, 1976	Ratified
The Convention on protection of the World Cultural and Natural Heritage on July 23, 1976	Ratified
The Convention on International Trade in Endangers Spice of Wild Fauna and Flora	Signed
The Convention on Conservation of Migratory Specie of Wild Animal on Dec 01, 1987	Signed
The Convention on Biological Diversity in 1994 and became party to the CBD, Convention duly recognizes the intrinsic value of biological diversity, genetic, social, economic, cultural, educationist, recreational and esthetic values of biodiversity and its components	Ratified
The International Plant Protection Convention.	Signed
The Plant Protection Agreement for Area & pacific region	Signed
The Agreement for the establishment of a convention for controlling the desert lost in eastern region of its Distribution Area in South East Asia	Signed
The Treaty Banning Nuclear Weapon Test in the Atmosphere,	Signed

in Outer Space and under Water on March 3, 1988		
in Outer Space and under water on water 5, 1988		
The International Convention on Oil Pollution Preparedness	Signed	
Response and Corporation	Jigned	
The Convention on prohibition of Military or any other Hostile		
Use of Environmental Modification Techniques and Accession	Acceded	
of Feb 27, 1986		
Pakistan became a party to Montreal Protocol by Ratifying the		
protocol and its London amendment on Dec 18, 1982.the	Ciano a d	
subsequent amendments known as Copenhagen Amendment	Signed	
which, accelerate the phase out for rectified in Jan 1995.		
Convention of International trade Endangerous Species (CITS)	Signed	
World heritage Convention Ramsar Convention	Signed	
United Nation Convention to Combat Ozone Depletion (CCD).	Signed	
The convention signed and ratified in 1996		
Stockholm Convention for Phasing out Parenting Organic	Signed	
pollutants (POPs) in 2001.	4.0	

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3- DESCRIPTION OF THE PROJECT

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3.0 DESCRIPTION OF THE PROJECT:

This section of the report describes the following components of the project:

- Type and category of the project.
- Objectives of the project.
- Alternatives considered, and reasons for their rejection.
- Location plan.
- Size or magnitude of the operation, including capital cost, and associated activities:
- Proposed schedule for implementation (tentative).
- Details of restoration and rehabilitation at the end of the project life.

3.1 Type and category of the project.

Wind is very promising non-conventional proven source which is already generating grid quality power besides being more cost effective in comparison to thermal and nuclear power in addition to its being environmentally safe.

As already explained in the earlier part of this report, according to the Pakistan's Wind Map (WM) developed by National Renewable Energy Laboratory (NREL) USA with active collaboration of USAID, Pakistan Meteorological Department (PMD) and Alternative Energy Development Board (AEDB) utilizing the data from PMD and satellite images the Gharo – Keti Bandar Wind Corridor stretching 60 KM along the coast line of Sindh and deeper than 170 KM toward the land, has a potential for generation of more than 60,000 MW of electricity. And the total wind energy potential of the country is estimated stands at 346,000MW.

Pakistan's first commercial-scale wind power generation began in April 2009 from the 6 MW first phase of what is to be 55 MW wind farm in Jhimpir, Thatta District, Sindh. The national target for renewable energy generation is 9,700 MW by year 2030 (@5.0% of the total energy which as of today on March 5, 2013Been further enhanced to 20. %).

The Alternative Energy Development Board (AEDB) was established in 2003 actively assists in the development and implementation of plans and projects, working with potential developers and with concerned authorities and provincial Governments.

Government is seeking to develop this sector through private investment, AEDB, through its analytical studies, persistent media campaigns and continuous facilitation has been success full in attracting local and foreign investment in this fast growing sector in Pakistan.

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Current State of the Art:

I- 22projects of 50 MW each are at various stages of development:

- Out of these, 11 developers have so far completed their feasibility studies
- IPPs have acquired generation license from NEPR
- 3 IPPs have are negotiating Energy Purchase Agreements (EPA) and
- Implementation Agreements (IA) with concerned authorities.

II- 50MW Wind Power Project Fauji Fertilizer Energy Limited:

The country's first ever 50MW wind power project in Jhampir near Thatta by Fauji Fertilizer Energy Limited, was inaugurated by the President of Pakistan on December 24, 2012.

III- Zorlu Enerji Pakistan Ltd.:

- Zorlu Enerji Pakistan Ltd., awarded tariff of US cents 12. 1057/KWh, has commenced execution of its 50 MW wind power projects in Jhampir, Thatta.
- Zorlu Enerji completed five wind turbines in Jhimpir area, each capable of producing 1.2 megawatts of electricity. Though initially 6 MW of electricity will be produced by the company, the project will be expanded to 50 MW in the next few years.

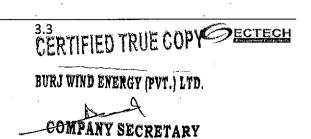
IV- The AEDB signed an MOU with China Three Gorges Corp. (CTGPC),

On 18th December 2010 for development of 2,300 MW wind power and solar energy projects in Pakistan of worth approx US\$ 6.5 billion. CTGPC is a large state owned enterprise in China that built, owns and operates the Three Gorges Hydropower Station and other hydropower projects in China and abroad. CTGPC is also a large international clean energy group with its main focus on wind and solar.

In Pakistan, the company is represented by its subsidiary "China International Water & Electric Corporation" (CIWEC) active in power sector in Pakistan since 2003. This MOU is the CTGPC's 10 year plan to invest in the renewable energy sector in Pakistan. According to MOU CTGPC would set up 2000 MW wind power and 300 MW solar power plants in Punjab and Sindh Provinces.

V- M/s Pakistani Wind Energy Generation Company (Pvt) Ltd

Are developing a 5 MW Wind Power Project on their own land.



VI- A 150 kW wind turbine installed by

A private industry is currently availing fiscal and financial incentives. AEDB is also encouraging use of wind energy for self consumption and grid-spillover.

VII-M/S Dewan Energy (Pvt.) Ltd (DEL), 49.5 MW Wind Power Plants at Jhimpir, District Thatta.

It is with this background that M/S Dewan Energy (Pvt.) Ltd (DEL) are in the process of installing 49.5 MW Wind Power Plant at Jhimpir, District Thatta. A total land mass of 1011.88 acres, on 30 years lease, has been allotted by the Government of Sindh, Land Utilization Department to the party.

DEL has proposed to install thirty three (33) wind turbines each with a capacity of 1.5 MW. Total capacity works out at 49.5 MW (say 50 MW).

VIII- 13.5 MW Wind Power Plant, Gujju.

The present 13.5 MW Wind Power Plant, under reference of this project proposal, to be installed at Gujju, is yet another proof of utilization of the wind power potential in Pakistan.

WEPP Capacity & Description

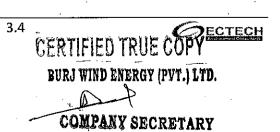
The Burj Wind Energy (Private) Limited (BWEPL), is to install a total of 9 Wind Turbines GE Model 77 each of 1.5 MW capacity. A total of 13.5MW energy is to be harnessed.

Evacuation of Electric Power from the Proposed Project:

Electric power to be produced from the proposed wind power Farm at Gujju, will be delivered to **Thatta-Makli 132 kV Grid Station 12 Km** away from the project site. The National Transmission and Distribution Company (NTDC) will provide a transmission line from the project site and connect it with the 132 KV transmission line already passing at a distance of 5 Km from the Wind Mill Project site. According to NTCD, by the year 2015, another 220KV Grid Station at Gharo will be built and at the same time another high tension line will be added to the exsitng single line. The new HT Line will be especially provided to evacuate the electric power from the Proposed Wind power Farm.

The site for the proposed BURJ POWER Wind Farm was selected for mainly following reasons:

It is located in the one of the world's best wind corridor.



- Site area is least populated and is away from any rural setting.
- Site can be easily accessed from N-5, which has direct link with Karachi Port.
- The site area is devoid of topographical barriers, natural features, archaeological sites, heritage, fauna and vegetation. In other words, there is no sensitivity of the environment at the proposed project site.
- Project's area of influence is devoid of any wetlands and watercourses.
 Nearest wetland, Hale Ji Lake is about 8 Km by road, from proposed Wind Farm site.
- The land for the wind form is owned by the porject proponent.
- There is no industrial, commercial or major human activity within the vicinity of proposed wind farm area.
- Site's elevation from sea level will provide efficient and appropriate wind generation capacity.
- Nesting habitats for any large or significant avian populations are not in the vicinity of the proposed site.

Available wind data (ref: Section -2.5) confirms strong availability of wind throughout the year.

The relevant details about the turbines are given here under:

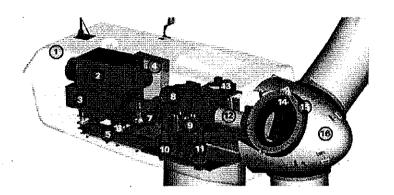
GE Model 77:

The GE 1.5 MW wind turbines are active yaw and pitch regulated with power/torque control capability and an asynchronous generator. The yaw system is electro-mechanically driven with wind direction sensor and automatic cable unwinding. Power is varied using active blade pitch control. The blade pitch angle is continually adjusted for optimum rotational speed and maximum lift-to-drag at each wind speed.

The variable speed operation ensures the turbines work at high efficiency, and variable speed operation absorbs the loads from the gust and converts them to electric power. Cut-in and cut-out wind speeds are 3 m/s and 25 m/s respectively. The three blades give a rotor diameter of 77 m with a swept area of 4,657 m². Rotor speed is variable between 10.1 rpm and 20.4 rpm.

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Nacelle (1), Heat Exchanger (2), Generator (3), Control Panel (4), Main Frame (5), Impact Noise Reduction (6), Hydraulic Parking Brake (7), Gearbox (8), Impact Noise Reduction (9), Yaw Drive (10 and 11), Main Shaft (12), Oil Cooler (13), Pitch Drive (14), Rotor Hub (15) and Nose Cone (16).

GE 1.5 MW Wind Turbine Nacelle Details.

Generator torque in the turbines is controlled by the frequency converter. The turbine rotor can over speed in strong, gusty winds to reduce torque loads in the drive train. GE's turbines store the energy in gusts by accelerating the rotor. Operating speed range is notably wider than the slip range used by some other wind generators, which produce heat rather than electric power when regulating power in strong, gusty winds.

The conversion system generates reactive power or current leading voltage to improve transmission efficiencies and voltage stability, particularly useful in weak grid applications. It automatically maintains defined grid voltage levels and power quality in fractions of a second.

The wind generator's fail-safe braking system has electromechanical pitch control for each blade with three self-contained systems and a hydraulic parking brake. Lightning receptors are installed on blade tips, with surge protection for the electrical components.

The turbines can remain on-line and feed reactive power to the electric grid right through major system disturbances. A Low Voltage Ride Thru (LVRT) feature enables wind turbines to meet transmission reliability standards similar to those demanded of thermal generators.

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GE General Data

Rotor diameter: 77 m
 Swept area: 4656.63 m²
 Power density: 0.04 m²/Kw

Nominal power: 1500 KwNumber of blades: 3Power control: Pitch

Hub Weight: 50 tonsRotor Weight: 31 tons

Minimum rotor speed: 11 rd/minMaximum rotor speed: 20 rd/min

Start-up wind speed: 3 m/s
Nominal wind speed: 14 m/s

Maximum wind speed: 25 m/sGear Box Speed number: 3

• Gear Ratio: 1:98

Generator Type: DFIG

• Maximum generator output speed: 1800 rounds/minute

Output voltage: 690 VTubular Steel Tower

Minimum hub height: 61,4 mMaximum hub height: 80 m

The project does not require any water for its operation.

Each wind turbine will have step up transformers, mounted at the bottom of each tower. Underground electrical collection cabling system will be provided within the wind farm which will lead to the project substation.

Project operations and control building, which will also house the substation and grid connection to NTDC system.

The National Transmission and Dispatch Company (NTDC) will purchase the power to be produced from the project.

Wind energy projects are "green energy projects" because there are no environmental issues related to their operation. There is no sensitivity of environment on or around the project site. The land is barren. The size of the project is 13.5 MW and as such it is small project. Therefore, according to the "Pakistan Environmental Protection Agency, Review of IEE & EIA" ANNEXURE-VII the project falls in category B.

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3.2 Objectives of the project

As above the project aims at production of 13.5 MW wind energy for commercial purpose. The power to be produced will be sold to The National Transmission and Dispatch Company (NTDC).

3.3 Alternatives considered, and reasons for their rejection

The following reasons were of importance for sitting the project at the proposed site:

3.3.1 Need for energy and No Alternative

Due to ever widening gap in energy production and demand load shedding are so frequent and are prolonging day by day. Resultantly, all walks of life including industry, commercial, social, education, domestic etc are badly affected. Drastic decrease in industrial productivity has resulted in heavy cutting of exports. Resultantly, very fast shortfall in foreign exchange earnings has taken place and the trend is further on the increase.

This has necessitated producing electricity through the exploitation of all possible methods. Accordingly, this project aiming at production of energy through wind power is an urgent need of the time. Under the circumstances, there is no question of project alternative.

3.3.2 Cheaper Energy Production Option;

Fossil fuels are not only in short supply from within the country but they are also very costly for power generation. The wind power is one among other renewable energy sources, cheaper and environment friendly source for power production. The proposed site has been declared by the Government of Pakistan to provide an air corridor as the most suitable for the project. Therefore, Siting of the project at Gujju is the best option.

3.3.3 Grid Availability

Electric power to be produced from the proposed wind power Farm at Gujju, will be delivered to **Thatta-Makli 132 kV Grid Station 12 Km** away from the project site.

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3.3.4 Raw materials availability

The only raw material required during the project operation is wind which is available to harness its potential for power generation. Therefore, the Gujju site for the project is quite suited.

3.3.5 Conflicts

The land for power station for the wind power plant is ownership of the project proponents. This point also goes in favor of wind farms to be installed at Gujju.

3.3.6 Basic infrastructure

The required basic infrastructure like roads, railway and telecommunication grid for evacuation of power from the project are available. They can be further developed as and when required. The site is located close to Karachi through Karachi – Hyderabad Super Highway (M-9) and National Highway. These facilities also strongly support the site at Gujju for the project.

3.3.7 Air Traffic

The Gujju site is clear of any restriction from all type of air traffic. This is another plus point for the suitability of Gujju site.

3.3.8 Telecommunication

The site has no interference whatsoever from telecommunication point of view. This is another point in favour of the Gujju site for the project.

3.3.9 Topographic Features

There are no topographic barriers or features located on or around the proposed project site which may cause interference in air movement.

3.3.10 Indigenous People

There are no indigenous people in the project area which is also favorable for the project siting.

3.3.11 Environmental Sensitivity

In the first place, during regular operation of the project there will not be any air pollutants, or solid or liquid wastes or else in the form of waste. As such, the project is "environmentally green". On other hand, there is no wetland,

3.9

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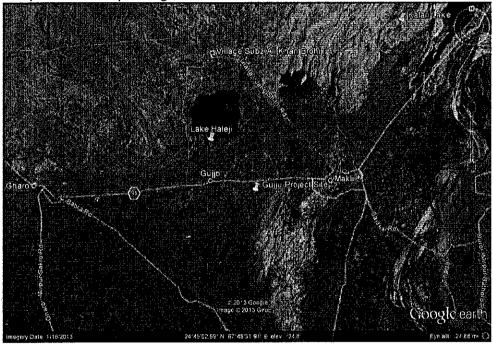
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watercourses, forest of any type, wild life, agriculture land, flora or faunal, archeological site, no nesting habitats, etc., in the vicinity of the proposed project site. The nearest water body -The Kalri Lake is situated at a distance of about 8 Km.

It means that there is no sensitivity of environment around project site. The project area is flat, stony and barren. All the above factors strongly support the Jhimpir site for the project.

3.4 Location plan

The plant location plan is given here under.



Size or magnitude of the operation, including capital cost, and associated 3.5 activities:

The maximum rated capacity of the wind power plant is about 13.5 MW. The estimated project cost is US\$???????? Million. The project will produce electricity and nothing else



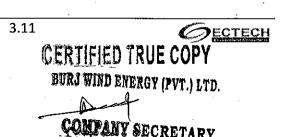
3.6 Proposed schedule for implementation (tentative)

Tentative project schedule, subject change after detailed project feasibility is ready, is presented below:

TENTATIVE BURJ P									_						· · · · · ·	
Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Activity .																
Submission of basic design											,					
Review & approval of basic design									l							
Construction of access road																
Construction of site office & residential area																
Construction of internal roads																
Wind turbine foundation construction																
Construction of substation building						27.0				į						
Erection of WTG towers & WTGs																
Placement of WTG unit transformer & main transformer										100						
Placement of equipment in 132kv GIS & 22kv switch gears					-											
Placement of control & protection panels.																
Placement of emergency diesel generator																
Cable laying from WTGs to substation.																
Optical fiber laying from WTGs to substation																
Mechanical completion of all WGs			•									Conversed to				
Mechanical completion of GIS																
Mechanical completion of 22kv switch gears																
Commissioning of GIS & 22kv switch gears																
Commissioning of WTGs																•
Completion of acceptance tests																
COD																

3.7 Details of restoration and rehabilitation at the end of the project life.

At the end of the present life of the project, adequate repair and maintenance of the plant will be done. Attached basic infrastructure will be updated. Even, wherever required, new machinery will be installed and old one to be sold in the market. This will provide a new life for the plant to be run for its new lifetime.



All activities will be carried out in accordance with strict environmental management and controls so as to avoid any damage to any segment of environment or human health.

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4.0 BASELINE CONDITIONS IN AREA POTENTIALLY AFFECTED BY PROJECT

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4.0 BASELINE CONDITIONS IN AREA POTENTIALLY AFFECTED BY PROJECT

4.1 Spatial and Temporal Boundaries Adopted for the Various Aspects of the Study

The state of the environmental settings on and around the project site along with future trends of any likely development with related possible changes to occur in the land use pattern, especially industrialization trends, housing or else were the main considerations for spatial and temporal boundaries while keeping in view of the existing and future envisaged conditions.

4.2 Existing (baseline) condition of the biophysical and socio-economic environment, trends and anticipated future environmental conditions should the project not go ahead.

The total land mass of Thatta District, in which Gujju project to be sited, is 17,355 square kilometers. Regarding its physical aspects, the Thatta District has varied features ranging from coastal swamps to fresh water marshes and lakes and from river islands to coastal deltas. Due to lack of water in the Indus River, this wide variation has diminished. The current terrain of the district consists of the Makli Hills (32 kilometers in length) close by the Thatta Town, are well known on account of the ancient tombs which are located here. The north western part of the district consists of bare and mostly composed of limestone. The hilly tracts are known as Kohistan. The valleys are covered with grass or brushwood. Southwards, the area degenerates into sandy wastes, uncultivated and almost devoid of vegetation (1).

Gujju project site is a barren tract of land with small scanty bushes scattered here and there. The underground water aquifer is somewhere deep. There are no canals or river water specifically in the project area. Human settlements in the form of small villages (Goths) are situated at quite far off from the project site.

There is no industry near or around the project site.

Since the present project is clean from environment point of view, therefore, the environment will remain virtually pollution free. Implementation of the proposed EMMP further guarantees protection of the environmental settings as they exist now. Because the project is to operate in compliance with the requirements of the National Environment Quality Standards (NEQS), National Environment Quality Standards for Ambient Air (NEQSAA) Effective 1st January, 2013 & National Environment Quality Standards for Noise (NEQSN) Effective 1st July, 2012 ANNEXURE-VIII/&IX respectively, Pakistan; under the Pakistan Environmental Protection Act-1997 ANNEXURE-I therefore, this also provides safeguard against pollution from the project activity.



With operation of the project, it will provide job opportunities especially to the people of the area around the project site; Government will get large volumes of earnings in the form of taxes and duties on recurring basis. Poverty alleviation, though at minor scale, will be yet another benefit besides meeting power shortage in Pakistan and its downstream benefits in industrial sector and other socio economic fields.

As a result of serious power shortage, load sheddings are so frequent in Pakistan. The gap between power supply and demand is further on the increase. Consequently, all walks of life are adversely affected. Pakistan has an installed electric generating capacity of about 19,400 MW. Projection for the demand in year 2030 is 100,000 MW.

To sustain growth, Pakistan needs an integrated National Energy Plan. The Government of Pakistan (GoP) is making concerted efforts to ensure development of all type of energy resources. The government has encouraged the private sector to meet this additional demand. In order to bridge the gap between power demand and supply, Pakistan Government liberalized its investment policies.

The policy has resulted in not only investments in power production sector from local resources, but also foreign investments are pouring in large amounts.

Evidently, in case the project is not installed, there will not be any change in the existing status of the environment or a status quo will be maintained with regard to all environmental, social and economic factors.

4.3 Physical Geography (Climate, Geology, Topography)

(Physical resources of the project area: Topography and Geology; Soils and Climate; Water; Ecological Resources: Fisheries and Aquatic Biology, Biodiversity, Forestry, Wildlife, Scientific Institutions, Socio-economic, Cultural and other Heritage)

4.3.1 Physical Resources of the Project Area

Physical resources of the project area are described hereunder.

4.3.1.1 Topography and Geology

Pakistan lying in the northwestern part of the Southern Asian Subcontinent, occupies the western end of the Indo-Genetic Plain, which is beyond bounded in the north by mountain wall of the Great Himalayas and their offshoots.



Physiology of the earth is description of the behavior of the upper crust. Accordingly, some knowledge of the geology is desirable. From physical environment, topography and geological point of view, the proposed project site is situated in the Indus Basin. The Indus Basin essentially forms the western extension of Indo-Gangetic Plain, and has been made up of the silt brought by the Indus and its numerous tributaries, like Jhelum, Chenab, Ravi and Sutlej on the east bank, and Kabul, Kurram, Tochi, and others on the west bank. The Plain is known for its agricultural fertility and cultural development throughout history. On the basis of hydrology and land form, the Indus Plain can be divided into the Upper and Lower Indus Plains. The Upper Indus Plain differs from the Lower Indus Plain (where the project area is located) primarily because of the major tributaries (Jhelum, Chenab, Ravi and Sutlej) divide the land surface into several interfluves or 'doabs'. The two planes are separated by a narrow corridor near Mithankot where the Sulaiman range approaches the Indus River. The Lower Indus

Plain is very flat, generally sloping to the south with an average gradient of 95 mm per km (6 inches per mile). The Lower Indus Plain can be divided in five distinct micro-relief land forms: active flood plain; meander flood plain; cover flood plain; scalloped interfluves; and the Indus delta. The proposed project site is located in the last of the micro-relief forms listed above.

Topographically, Sindh can be divided into four distinct parts with the dry and barren Kirthar Range in the west, a central alluvial plain bisected by the Indus River, a desert belt in the east, and the Indus delta in the south. On the basis of this classification, the project area is located in the Indus delta.

4.3.1.2 Geological Setting (1&2):

The prevailing geologic conditions in the region are the results of extensive inundation, depositions, coastal movements, and erosions 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 resulting 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 feebly visible particularly in the Indus Plain, and it is only by considering the geology on a broader regional scale, as well as in site specific detail, that the effects can be appreciated

Parts of Sindh are covered either by recent alluvium or wind-borne sand. The principal features of geological significance are to be found in the hilly portions of the province, towards the west of the Indus. Outlying extensions of this hilly tract occur east of the Indus as well, near Sukkur, Hyderabad and Jerruck. The



isolated hills of Nagarparkar on the northern border of the Rann of Kutch belong to quite a different system both geographically and geologically.

The geological studies of the proposed site have not been conducted in detail. However, the studies carried out in the vicinity of Port Qasim area not far away from the proposed site reveal that Port Qasim and its adjoining areas have been formed in the middle and upper Tertiary and the soil formation found in the area are fresh and slightly weathered with recent and sub-recent shoreline deposits. These formations are derived from Gaj / Manchar formation of lower Miocene to middle Miocene to Pliocene age. Similar deposits are found all along the coastal belt of Karachi and adjoining areas.

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⁽¹⁾ Atlas of Pakistan, Government of Pakistan, 1997. Sindh State of Environment and Development, IUCN, 2004.

⁽²⁾ Socioeconomic Study of Badin/Thatta-A document of World Bank

The earthquake hazard in the Indus Delta and the estuaries on the passive continental margin is mainly from intra-plate active faults particularly Rann of Katch Fault also known as the Karachi-Jati-Allah Bund Fault. It has three other segments namely Jhimpir Fault, Pab Fault and Surjani Fault. The main faults between Karachi and Rann of Kutch are generally oriented easterly and slightly concave to the north. Two severe earthquakes occurred in the vicinity of Karachi, one in the year 1050 at Bhambore in which 0.15 million casualties were reported and the other in the year 1668 at Pipri near Steel Mill which is only 60 km away from Karachi.

4.3.1.3 Soils (1)

The land in this area consists of the alluvial soil deposited by the waters of the river Indus, so it is naturally very fertile. Combined with water it develops into rich mould and in the absence of water it degenerates into desert. Water generally contains a lot of silt.

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^{(1):} Atlas of Pakistan, Government of Pakistan, 1997. Sindh State of Environment and Development, IUCN, 2004.

4.3.1.4 Land use

Agriculture, followed by forestry, is the main land use in the central alluvial plain. Although more than 50 percent of the total geographical area is cultivable, only 26 percent of it is actually located in the central plain. The land inside the Indus embankments is almost equally employed by agriculture and forestry, while that outside the embankments is more extensively utilized for agriculture in the form of sparsely distributed irrigated plantations. The land use in Sindh is given in the table hereunder:

Land Use in Sindh

Land Use	Area (Million Ha)	Percentage		
Not Sown	3.022	21.446		
Current Fallow	1.439	18.935		
Cultivable Waste	2.688	10.212		
Total Available for Cultivation	7.149	50.593		
Not Available for Cultivation	5.830	41.374		
Forest	1.125	7.984		
Unreported	0.007	0.049		
Total	14.091	100.000		

Source: Sindh State of Environment and Development, IUCN, 2004.

4.3.1.5 Meteorology and Climate

Meteorology

Generally, the climate of most parts of the Sindh is arid with four distinct seasons in a year:

- winter from Mid-November to February,
- spring during March and April
- summer from May to Mid-September and
- autumn from Mid-September to Mid-November

Except coastal belt where usually dry and humid condition persists round the year. There exist several meteorological stations in Sindh; data recorded at some of these stations is given in the following sections.

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Temperatures

The province of Sindh is situated in a subtropical region; it is hot in the summer and cold in winter. Temperatures frequently rise above 46 °C (115 °F) between May and August, and the minimum average temperature of 2 °C (36 °F) occurs during December and January.

Sindh is divided into three climatic regions: Siro (the upper region, centred on Jacobabad), Wicholo (the middle region, centred on Hyderabad), and Lar (the lower region, centred on Karachi).

The thermal equator passes through upper Sindh. The highest temperature ever recorded in Mohenjo-daro (Sindh) on 26 May 2010 was 53.5 °C (128.3 °F). It was not only the hottest temperature ever recorded in Pakistan but also the hottest reliably measured temperature ever recorded in the continent of Asia and the fourth highest temperature ever recorded on earth. The previous record for Sindh, Pakistan, and for all of Asia, had been 52.8 °C (127.0 °F) on 12 June 1919.

Mean monthly maximum temperatures and mean monthly minimum temperatures are in the following tables:

Table: Mean Monthly Maximum Temperatures

Degree Celsius

	Degree Ceisius				
Month	Hyderabad ^a	Umerkot ^b	Sanghar	Badin ^d	Jacobabad ^e
January	25.04	26.49	24.31	25.78	22.60
February	28.15	29.6	27.06	28.59	25.24
March	33.38	34.52	33.29	34.02	31.28
April	38.87	39.12	39.25	38.40	38.0
May	41.62	41.49	43.53	39.85	43.08
June	40.15	39.72	43.23	38.02	44.33
July	37.40	36.19	40.37	35.11	40.56
August	36.30	34.51	38.60	33.61	38.24
September	36.84	35.70	38.14	34.36	37.00
October	37.19	37.12	37.14	35.80	35.32
November	31.95	32.98	31.59	31.87	30.06
December	26.27	27.95	25.53	26.68	24.11
Annual	34.47	34.52	35.19	33.48	34.15

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi a measured at Hyderabad. b measured at Umerkot, c measured at Sanghar,, d measured at Badin, e measured at Jacobabad,



Table: Mean Monthly Minimum Temperatures

Degree	Celsius	
Icoha	had ^e	

Month	Hyderabad ^a	Umerkot ^b	Sanghar ^c	Badin ^d	Jcobabad ^e
111011111	11,000,000	giiidi kot	Janan		
January	11.08	5.42	5.92	8.73	7.68
February	13.62	8.71	8.72	11.60	10.48
March	18.50	14.29	14.22	16.80	16.30
April	22.98	20.12	19.71	21.80	22.33
May	26.16	24.50	24.59	25.47	26.74
June	28.07	27.17	27.67	27.46	29.38
July	27.81	26.82	27.60	27.04	29.22
August	26.71	25.73	26.33	26.06	28.25
September	25.34	23.88	23.77	24.87	25.85
October	22.27	18.54	18.18	21.70	20.29
November	17.29	11.89	12.28	15.86	14.08
December	12.50	6.62	7.39	10.10	8.74
Annual	21.03	17.84	18.00	19.76	19.95

Source:

Data Processing Centre, Pakistan Meteorological Department,

Climate data for Hyderabad, Pakistan

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C	33.3	38.2	43.4	46.0	48.4	48.5	45.5	43.9	45.0	44.0	41.0	36.0	48.5
(°F)	(91.9)	(100.8)	(110.1)	(114.8)	(119.1)	(119.3)	(113.9)	(111.0)	(113.0)	(111.2)	(105.8)	(96.8)	(119.3)
Average high	24.7	28.1	33.8	38.8	41.4	40.1	37.3	36.0	36.5	36.9	31.0	26.0	34.2
°C (°F)	(76.5)	(82.6)	(92.8)	(101.8)	(106.5)	(104.2)	(99.1)	(96.8)	(97.7)	(98.4)	(87.8)	(78.8)	(93.6)
Average low °C (°F)	11.1 (52.0)	13.8 (56.8)	18.6 (65.5)	22.9 (73.2)	26.1 (79.0)	28.0 (82.4)	27.7 (81.9)	26.6 (79.9)	25.3 (77.5)	22.4 (72.3)	17.3 (63.1)	12.8 (55.0)	21.1 (70.0)
Record fow °C	3.3	4.0	9.0	12.0	19.0	20.0	21.4	22.8	20.6	15.0	6.0	3.0	3.3
(°F)	(37.9)	(39.2)	(48.2)	(53.6)	(66.2)	(68.0)	(70.5)	(73.0)	(69.1)	(59.0)	(42.8)	(37.4)	(37.9)
Rainfall mm	1.5	5.4	4.8	6.0	3.6	9.6	53.0	62.3	19.4	4.2	1.9	2.5	174.2
(inches)	(0.059)	(0.213)	(0.189)	(0.236)	(0.142)	(0.378)	(2.087)	(2.453)	(0.764)	(0.165)	(0.075)	(0.098)	(6.858)
Mean monthly sunshine hours	272.8	257.1	288.3	288.0	313.1	279.0	235.6	251.1	285.0	306.9	279.0	272.8	

Courtesy: GOOGLE

June is the hottest month in most parts of Sindh, with mean daily maximum temperature Recorded as 44.33 C... January is the coldest month in the project area, with mean daily Temperature as 5.42° C.



^a measured at Hyderabad. ^b measured at Umerkot, ^c measured at Sanghar, d measured at Badin, e measured at Jacobabad

Wind:

Gharo is one of the sites in Sindh where the wind data have been recorded by Pakistan Meteorological, Department (PMD). According to the study, the annual mean wind speed, estimated is 6.86m/s at 50 meter above ground level and the annual power density of area is 408.6 W/m2. This means that the site falls in good category of power potential and that the area is suitable for large economically viable wind farm.

Table: Monthly Average Wind Speeds for Gharo

Month	Мон	nthly Ben	chmark	Wind Sp	eed	
	30m 50m		60m	67m	80m	
January	4.7	5.1	5.2	5.3	5.4	
February	5.1	5.4	5.5	5.6	5.7	
March	5.3	5.7	5.8	5.9	5.9	
April	7.0	7.3	7.4	7.6	7.6	
May	8.9	9.4	9.6	9.7	9.8	
June	10.3	10.9	11.1	11.2	11.3	
July	8.4	8.9	9.0	9.2	9.2	
August	9.3	9.8	10.0	10.2	10.3	
September	7.6	8.1	8.2	8.3	8.4	
October	4.3	4.6	4.7	4.7	4.8	
November	3.8	4.1	4.2	4.3	4.4	
December	4.6	4.9	5.1	5.2	5.3	
Annual Average		6.6	7.1	7.2	7.3	
	7.	.0				

Courtesy: Pakistan Meteorological Department.

On the basis of analysis of the data recorded by Pakistan Meteorological Department it was revealed that desert areas of Sindh Province, have been recorded much higher than the wind speeds in South Western Zone.

Humidity

July, August and September are the most humid months in the area, whereas May and June are the least humid months. Average monthly relative humidity (RH) values at various locations in the project area are provided in the following table:

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Table: Meteorological Data - Relative \Humidity

	7	(
_		_

Month	Hyderabad ^a	Umerkot ^b	Sanghar ^c	Badin ^d	Jacobabad ^e
	,		Jangnai	200	Jacobanaa
January	47.90	45.52	59.98	50.38	50.88
February	45.38	44.45	56.00	48.81	48.23
March	42.40	42.55	50.62	48.36	42.76
April	41.88	42.73	44.66	48.97	33.01
May	46.96	46.81	42.63	53.10	30.93
June	56.35	56.40	51.81	60.70	41.16
July	63.42	67.23	62.10	69.61	56.18
August	65.26	70.15	66.06	72.55	62.20
September	61.37	64.73	62.38	69.78	59.38
October	47.65	50.78	55.16	59.15	48.87
November	46.40	44.58	59.48	53.88	45.75
December	49.26	46.84	62.74	52.46	52.73
\\\\\\\Annual	51.19	52.11	56.03	57.56	47.70

Source:

Data Processing Centre, Pakistan Meteorological Department, Karachi ^a measured at Hyderabad. ^b measured at Umerkot, ^c measured at Sanghar, d measured at Badin, e measured at Jacobabad,

Rainfall:

Average annual rainfall in the project area ranges between 110 mm (Jacobabad) and 222 mm (Badin). Maximum rainfall (about 60% of the total annual) occurs during the Monsoon season (July, August and September), while the period of minimum rainfall or drier period is October and November.

Climate (i)

Pakistan's latitudinal and longitudinal extents and its northern rim of lofty mountains are the two factors, which have a great bearing not only on the temperature and rainfall patterns, but also on the general circulation of the atmosphere on the southern Asia.

Climate of Pakistan according to Koppen's classification falls under the following five types:

Tropical Semi-arid with Dry Winter:

This climate type prevails in Karachi, Hyderabad, and Southern Khairpur Division. The mean annual temperature is above 18 °C.

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Tropical Arid:

This is characterized by average annual temperature of about 18 °C with dry winters. This includes southern Kalat and whole of the Indus Plain.

Cold Semi-arid With Dry Summer:

This climate type covers central Kashmir, Peshawar, D.I. Khan, Quetta and northern half of Kalat Division.

Snow Forest Climate:

This climate type is characterized by average temperature of coldest month below 0 °C. Mean temperature of the warmest month is between 10 and 22 °C. It includes northern mountainous areas and parts of Kashmir.

Extreme Cold:

This climate type is characterized by average temperature of the warmest months between 10 and 0 °C. It comprises eastern and northern parts of Kashmir, Chitral, Gilgit and Laddakh.

Based upon the above classification, most parts of the proposed project area are included in the Tropical Arid climate zone, while some southern parts of Sindh are located in the Tropical-arid with Dry Winter climate zone.

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⁽i): Atlas of Pakistan, Government of Pakistan, 1997. Sindh State of Environment and Development, IUCN, 2004.

4.3.1.6 Ambient Air Quality on the Project Site

On site ambient environmental monitoring was carried out to know about the state of the existing environment as base line environment on the project site. The monitoring was carried out for gases including Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x) and Carbon Monoxide (CO); Particulate Matter (PM) and Noise levels. The points at which monitoring was carried out are shown in the figure below.

Figure showing the points where ambient monitoring was carried out on the project site:

Ambient Gaseous Monitored Data

Reference Point	SO ₂ (µg/m³) 24 hourly/8 hourly values	NO₂ (μg/m³) 24 hourly/8 hourly values	CO (mg/m³) 24 hourly/8 hourly values
Eastern side of project site	B.D.L	B.D.L	B.D.L
Western side of project site	B.D.L	B.D.L	B.D.L
Northern side of project site	B.D.L	B.D.L	B.D.L
Southern side of project site	B.D.L	B.D.L	B.D.L
Mid side of project site	B.D.L	B.D.L	B.D.L
NEQS Limiting Value	120	80	5

Note: Below Detectable Limit

B.D.L= Below Detection Limit

B.D.L for:

 $SO_2 = 10 \mu g/m^3$

 $NO_x = 6.0 \, \mu g/m^3$

 $CO = 20 \, \mu g/m^3$

i. Nitrogen oxides (NOx) in the ambient air consist primarily of nitric oxide (NO) and nitrogen dioxide (NO2) have much higher toxicity. Nitric oxide is readily converted to the much more harmful nitrogen dioxide by chemical reaction with ozone present in the atmosphere. The direct effects of NO₂, depending upon exposure time and concentration of NO2, on the respiratory system include increased airway resistance, increase incidence of respiratory illness and damage to lung tissues and emphysema. Emphysema is a long-

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term, progressive disease of the lungs that primarily causes shortness of breath.

- ii. Sulfur Dioxide is particularly irritating to mucous membrane of upper respiratory tract. Chronic effects include rhinitis, dryness of the throat, and cough. Acute over exposure may result in death from asphyxia. Chronic exposure may result in nasopharyngtis, fatigue, altered sense of smell and chronic bronchitis symptoms such as dyspnea on exertion cough and increased mucous excretion.
- iii. Carbon monoxide combines with hemoglobin to form Carboxyhemoglobin which interferes with the oxygen carrying capacity of blood, resulting in a state of tissue hypoxia. The typical signs and symptoms of acute CO poisoning are headache, dizziness, drowsiness, nausea, vomiting, collapse, coma and death. Initially the victim is pale; later the skin and mucous membranes may be cherry red in color. Loss of consciousness at about the 50% Carboxyhemoglobin level. Sever CO poisoning has been reported to permanently damage the extra pyramidal system, including the basic ganglia.

Particulate Matter (PM)

The onsite monitored concentrations of PM in the ambient air are given below:

Environmental Monitoring Data for Ambient Particulate Matter

Reference Point	Ambient Particulate Matter (µg/m³) 24 hourly/8 hourly values
Eastern side of project site	110.3
Western side of project site	88.95
Northern side of project site	78.24
Southern side of project site	96.60
Mid side of project site	112.40
NEQS Limiting Value	500.0

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4.3.1.6 Noise Levels:

Values of the noise levels as measured on the project site are given below:

Baseline Noise Levels Monitored Data*

Reference Point # 1: Eastern side of project site

Date							Leq				
		. dB(A)									
07-02-13	55	55	55	55	56	56	56	56	57	57	55.86

Reference Point # 2: Western side of project site

Date		-										
		dB(A)										
07-02-13	51	51	51	51	52	52	52	- 52	53	53	51.86	

Reference Point # 3: Northern side of project site

Date												
		dB(A)										
07-02-13	57	57	57	57	58	58	58	58	59	59	57.86	

Reference Point # 4: Southern side of project site

Date											
					dB(A)						
07-02-13	53	53	53	53	54	54	54	54	55	55	53.86

Reference Point # 5: Mid side of project site

Date		dB(A)									Average
07-02-13	59	59	59	59	60	60	60	60	61	61	59.86

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Surface Water Resources (i)

The River Indus is the major surface water resource of not only the project area but also throughout the Sindh province and so also Pakistan. Over 60% of the total area of the Indus basin is in Pakistan and Azad Jammu and Kashmir. The river rises in Tibet, at an altitude of around 18,000 feet (5,486 m) amsl, The total catchment area of the river is 654,329 km2 and its length flowing through the country is about 2,750 km. The five major rivers joining the River Indus include Sutlej, Beas, Ravi, Chenab and Jhelum besides the other two minor rivers - Soan and Harrow also drain into the Indus. On the western side, a number of small rivers join Indus, the biggest of which is River Kabul with its main tributaries i.e. Swat, Panjkora and Kunar. Several small streams such as Kurram, Gomal, Kohat, Tai and Tank, also join the Indus on the right side.

The Indus River exhibits great seasonal variations, with more than 80% of the total annual flow occurring during the summer months, peaking in June, July and August. The Indus River and its tributaries on an average bring about 154 MAF of water annually.

This includes 144.9 MAF from the three western rivers and 9.14 MAF from the eastern rivers.

Most of this, about 104.7 MAF is diverted for irrigation, 39.4 MAF flows to the sea and about 9.9 MAF is consumed by the system losses which include evaporation, seepage and spills during floods. The flows of the Indus and its tributaries vary widely from year to year and within the year. As is the case with the water availability there is significant variation in annual flows into sea.

The Indus Delta:

Historically, the Indus Delta has formed in an arid climate under conditions of high river discharge to the proportion of 4 billion tons of sediment per year. In the past, this has contributed to a pro-grading seaward of the delta as a result of interaction of fluvial and marine processes and a moderate tide range of approximately 2.6 meters.

During the past six decades, however, the construction of dams and barrages and extensive engineering works upstream has reduced the sediment load to 100-650 million tons per year (based on different studies).

What makes Indus delta unique is the fact that it experiences the highest wave energy of any river in the world. During the monsoon season, from May-September, the delta front receives more wave energy in a single day than the Mississippi delta receives in the entire year.

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The Indus delta is triangular in shape and occupies a large part of the province of Sindh, covering about $30,000 \text{ km}_2$. It is about 240 km in length along the axis of the river and 220 km at its widest, from Karachi to the great Rann of Kutch.

River Water Quality (i):

The water quality of Indus River is generally considered excellent for irrigation purposes. The total dissolved solids (TDS) range from 60 mg/l in the upper reaches to 375 mg/l in the lower reaches of the Indus, which are reasonable levels for irrigated agriculture and also as raw water for domestic use. The disposal of saline drainage from various irrigation projects has been a major factor in the increased TDS in the lower reaches of the rivers in the Indus Plain. There is progressive deterioration downstream and the salinity is at its maximum at the confluence of the Chenab and Ravi rivers, where the TDS ranges from 207 to 907 mg/l. A slight improvement in water quality is noted further downstream at Panjnad due to dilution from the inflow from Sutlej River. The quality of the Indus water at Guddu, however, is within acceptable limits for agriculture; TDS being in the range of 164-270 mg/l.

In the upper reaches of the Indus River, the Dissolved Oxygen (DO) content remains above 8.5 mg/l which is well above the acceptable levels of 4 mg/l. The Biochemical Oxygen Demand (BOD) downstream of Attock has been recorded as 2.9 mg/l. At Kotri, it has a suspended solid (SS) content of 10 to 200 mg/l. Indus River water quality has been studied at the Dadu - Moro Bridge and Kotri Barrage, with nitrate levels at 1.1 and 7.5 mg/l, phosphate at 0.02 and 0.3 mg/l, BOD at 2.4 and 4.1 mg/l, feacal coliforms at 50 and 400 per ml, and aluminum at 1.8 and 0.2 mg/l respectively. Due to industrial waste discharges from Punjab and Sindh, a high content of heavy metals such as nickel, lead, zinc and cadmium have also been found in Indus water.

Lakes:

Several fresh and brackish water lakes exist in the Thatta district. These include the Kalri and Haleji lakes and Jhuddo lagoon.

Kalri Lake (also called Keenjhar) is a large freshwater lake providing drinking water to Karachi. Keenjhar Lake which is at a distance of about?????????Km from Gujju project site. The sweet water Lake Keenjhar, is situated in the dry and stony desert at a distance of about 20 km north and north-west of Thatta. It is 24 km long and 6 km wide and has an area of 14000 ha.

The lake is fed by the Kalri Bagar feeder canal from the north-west as well as by small seasonal streams entering it from the north and the west. The feeder is

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also the conduit for the industrial wastes of Kotri town. The only outlet is the Jam Branch canal in the south-east end of the lake.

It was declared a Ramsar site in 1976 and later became a wildlife sanctuary under the Sindh Wildlife Protection Ordinance.

Jhimpir town, on the Western banks of the lake, is the main town on Keenjhar besides twelve large and twenty small villages scattered around it. About 50,000 people are dependent on the lake and in 2005-06 about 800 boats of different size are said to be operating in it (declining from 2200 in 1988-89 and 1710 in 1998-99). There are four fish landing centres at Chilya, Sonahri, Jhimpir and Khumbo⁽ⁱⁱ⁾

Haleji Lake is an artificial freshwater lake with marshes and a brackish Seepage lagoon. Considered a game reserve in 1971, this lake was declared a wildlife sanctuary and in 1976, the lake proceeded to become a Ramsar site. Haleji serves as an important source of water for Karachi besides being a popular recreational destination.

Jubho Lagoon is a shallow, small brackish water lagoon with mudflats and marshes that support a large concentration of migratory birds including flamingos and endangered Dalmatian pelicans, a rare species in the world. This was declared a Ramsar site in 2001 because of the efforts made by IUCN Pakistan.

4.3.1.7 Groundwater Resources

The Indus Basin was formed by alluvial deposits carried by the Indus and its tributaries. It is underlain by an unconfined aquifer covering about 15 million acres (60,700 km2) in surface area. In Sindh, about 28% of the area is underlain by fresh groundwater. This is mostly used as supplemental irrigation water and pumped through tube-wells. Some groundwater is saline. Water from the saline tube-wells is generally put into drains and, where this is not possible, it is discharged into large canals for use in irrigation, after diluting with the fresh canal water.

Before the introduction of widespread irrigation, the groundwater table in the Indus Basin varied from about 12 m in depth in Sindh and Bhawalpur areas to about 30 m in Rechna Doab (the area between Ravi and Chenab Rivers). After the introduction of weir-controlled irrigation, the groundwater table started rising due to poor irrigation management, lack of drainage facilities and the resulting additional recharge from the canals, distributaries, minors, water courses and irrigation fields. At some locations, the water table rose to the



ground surface or very close to the surface causing water-logging and soil salinity, reducing productivity.

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⁽i) Sindh State of Environment and Development, IUCN, 2004.

⁽ii) Preliminary Socio Economic Baseline Assessment by Shirkat Gah, WWF-Indus for All, March 2007.

4.4 Biological Environment/Resources

This section presents a brief overview of the eco-zones, wild flora and fauna, and the habitat conditions as it exists at the proposed project site. The information reported in here is based upon relevant literature, knowledge gathered through actual visits of the experts to the project site, reports of the IUCN, WWF special literature and books and other relevant documents.

4.4.1 Original Eco-zones of Project Area (1)

Tropical Thorn Forest Eco-zone

The habitat, the most extensive eco-zone of the Indus plain, presently exists only in places where human interventions not converted into habitation or for agriculture. This habitat encompasses low forests of thorny and hard-wooded tree species and dominated by Acacia spp.

The trees found in these forests have short boles and low branching crowns. Their canopies of these trees touch each other in exceptionally favorable spots. The trees are of usual height raging from 20-30 feet. Other forest plants mixed with Acacia include: Salvadora, Prosopis, Capparis, and Tamarix. The shrubs include Calotropis, Zizyphus, Suaed, while herbs of the area include Chenopodium, Calligonum, Haloxylon besdides various species of grasses are also available.

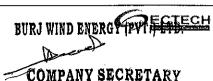
Among major wildlife mammal species include Desert Hare, Long-eared Hedgehog, Porcupine, Jackal, Bengal Fox, Desert Fox, Desert Wolf, Indian Desert Cat, Caracal, Jungle Cat, Wild Boar, Honey Badger, Small Indian Civet, Grey Mongoose, Small Indian Mongoose, Striped Hyena, Nilgai, Blackbuck and Chinkara Gazelle.

Birds of this eco-zone comprises of Peafowl, Common Quail, Grey Partridge, Ring Dove, Red Turtle Dove, Little Brown Dove, Green Pigeon, Hoopoe, Spotted Owlet, Barn Owl, Dusky

Horned Owl, Pied Woodpecker, Wood Shrike, Indian Nightjar, Wryneck, Golden-backed woodpecker, Great Grey Shrike, Rufous-backed shrike, Fantail Flycatcher, Common babbler, Jungle babbler, Houbara Bustard, Great Indian Bustard and a number of many other species of passerine birds are found.

Riverine Tract Habitats

Originally the riverine habitats used to have heavy, seasonal floods. Since forecasting and prior warning were not available to the rural people, these



habitats were not occupied for agriculture and habitation. Natural resource exploitation was also not extensive. As a result, this natural flora along the rivers flourished. These included: Tamarix, Saccharum, populus and Acacia. Typha growth was common wherever the water was stagnant or slow moving.

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⁽¹⁾⁻Climatic Regions of West Pakistan, Pakistan Geographical Review. Kazi, S. A., 1952.

4.4.2 Modified Nature of Habitat

Major parts of the original habitats described above have been modified into new habitats, primarily as a result of extensive cultivation and expanding urban centers as well as rural settlements. These new habitat types are briefly discussed below:

Agricultural Habitats

Most parts of Sindh are under very intensive irrigated cultivation. In addition, livestock rearing is also practiced extensively, and milk animals are common. The use of the chemical fertilizers and pesticides is very common. Several species of wildlife have adapted to the changed habitat. These include: Jackal; Jungle Cat, Bengal Fox, Small Indian Mongoose, Shrew, Rodent pests including Porcupine, Fruit Bats and Wild Boar. The avifauna which survived the modified habitat include Doves, Black Partridge, Cuckoos, Koel, Woodpeckers, Parakeets, Bulbuls, Babblers, Black Drongo, Bee-eaters, Finches and House Sparrow. The reptilian species of this modified habitat include Krait, Cobra, Saw-scaled Viper, Rat Snake and Monitor Lizard. The project site is situated in this type of the habitat.

Rural and Urban Habitats

These include human habitations within agriculture areas, as well as the urban centers. Jackals search their food from garbage dumps and human feces, house sparrows live in the houses, Bank Mynas and Cattle Egrets feed on grasshoppers, whereas Banyan and Peepal trees continue to grow in villages upon which Green Pigeons and barbets feed.

Migratory Birds

Out of the checklist of a total of 660 birds species found in Pakistan, 30 % of the birds are species which visit the country for a sizeable period yearly, while 43 % of the total checklist are either Palearctic or Oriental Species which come to Pakistan only for breeding, 28 % of the total numbers of species are regular winter visitors which breed extortionate and mainly in trans-Himalayan northern regions.

4.4.3 Wetlands (1)

Wetlands are among the most productive ecosystems all over the world. Since Pakistan is situated on the flyway to Central Asia and South Asia, the birds breeding in Central and Northern Asia, migrate through Afghanistan to the Indus Valley, particularly to the wetlands across Sindh which are major wintering



grounds of migratory water birds. Hereunder, some of the important wetlands are briefly described below:

The Indus Dolphin Reserve extends from Sukkur upstream to the Guddu Barrage spreading over 135 km. The entire area was declared as home of the endangered Blind Dolphin in 1974, the major threats it faces include Split populations of the dolphins due to dams and barrages visitors which breed extortionate. The number of dolphins at the site has increased from 150 in 1974 to 620 in 2001.

Manchar Lake, Located about 12 miles west of Sehwan Sharif, Mancher Lake spread over an area of 100 square miles. The lake was once renowned for its beauty and the large population of migratory birds and wild fowl. It was considered the largest freshwater lake in Asia.

The water supply to Lake depends upon the water flows from River Indus via Aral Wah and Danistar Wah, storm water and hill torrents from Kirthar Hills and effluents from drainage units via Main Nara Valley Drain. Due to saline and toxic effluents discharged into the Lake, during the last two decades, the fresh water intake of the lake has declined.

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⁽¹⁾ Sindh State of Environment and Development, IUCN, 2004.

Keenjhar (Kalri) Lake Keenjhar also known as Kalri Lake is one of the largest freshwater lakes in Pakistan. The lake spreads over a length of about 24 km, width 6 km and capacity of 0.53 million acre feet. It is about 122 km east from Karachi and 19 km north-east of Thatta town. The lake was created in 1930s from the two smaller lakes Keenjhar and Kalri by the construction of a dam at Chilya and a 12 km embankment on the eastern side. Indus provides Keenjhar, the required water through Kalri Baghar (KB) Feeder. KB Feeder starts from Kotri Barrage. Since the area is arid and receives less than 200 mm annual rainfall, hence Indus is the only source of water for the lake. The lake serves as a major source of drinking water for Karachi. The lake has extensive reed-beds, particularly in the shallow western and northern parts and rich submerged and floating vegetation. The natural vegetation of the surrounding area is tropical thorn forest. The climate is dry subtropical monsoonal.

The lake is internationally important for a wide variety of breeding, staging, passage and wintering water birds including shorebirds, flamingos, ducks and geese, cormorants, herons and egrets, ibises, coots, gulls, terns etc. The breeding birds reported include Cotton Teal, Night Heron; Pheasant tailed Jacana and Purple Moorehen.

This lake is rich in submerged and floating aquatic vegetation. The natural vegetation of the surrounding area is tropical thorn forest. The Lake is rich in fish fauna and supports the livelihood of about 50,000 local people.

Main activities at the site are commercial fishing, nature conservation and public recreation. Keenjhar Lake was declared a Game Sanctuary in 1971 and designated as a Wildlife Sanctuary in 1977.

Drigh Lake: Situated at a distance of about 18 km west of Larkana, Drigh is a small, slightly brackish lake, with extensive marshes, situated in the Indus floodplain. The lake is fed by water from the nearby canal system and by local run-off from monsoon rains. The lake is surrounded by cultivated plains it is a semi-natural wetland, supporting rich and diverse aquatic vegetation.

The site regularly hosts over 20,000 water birds, mostly ducks, geese and coot in winter. It is a breeding and wintering area for a wide variety of water birds and an important roosting site for night-heron. The wintering birds also include shorebirds, cormorants, pelicans, flamingos, jacanas, gulls and terns. This lake was designated as a Wildlife Sanctuary in 1972.

Haleji Lake, The Lake located in Thatta district on 24° 47 N, 067°46′E coordinates. is a perennial freshwater lake with marshes and a brackish seepage lagoon. While this lake in 1971 was considered a game reserve and further

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declared a wildlife sanctuary, in 1976 the lake proceeded to become a Ramsar site. Haleji serves as an important source of water for Karachi besides being a popular recreational destination.

Jubho Lagoon The lagoon is located in Thatta district on 24° 20 N, 068°40′E coordinates. It is a shallow, small brackish water lagoon with mudflats and marshes that support a large concentration of migratory birds including flamingos and endangered Dalmatian pelicans, a rare species in the world. Because of the efforts made by IUCN Pakistan, it was declared a Ramsar site in 2001.

Nurri Lagoon, The lagoon located in Badin district 24° 30 N, 068°47′E on coordinates, is also a brackish, privately owned lagoon with barren mudflats that is visited by large concentrations of migratory water birds. It was also declared a Ramsar site in 2001. Increased salinity, sea intrusion, population pressures, agricultural and industrial pollution are major threats to this site.

Deh Akro located in Nawabshah district, is a wildlife sanctuary consisting of four major habitats; desert, wetland, marsh, and agricultural. It is a natural inland wetland ecosystem, which supports a variety of rare and endangered wildlife species. This area hosts a considerable number of rare fauna. Many indigenous fish species are also found here.

Water scarcity during a persistent dry spell is adversely affecting this area. Other lakes of the province include Badin and Kadhan Lagoons, Charwo Lake, Ghauspur Jheel, Hadiero Lake, Hamal Katchri Lake, Khango Lake, Khipro Lakes, Langh Lake, Mahboob Lake, Phoosna Lakes, Pugri Lake, Sadhori Lake, Sanghriaro Lake, Shahbuder and Jaffri Lake, Soonhari Lake and Tando Bago Lake.

It is worth noting that since all of the wetlands described above are far too beyond the area of influence of the proposed project site, therefore, the project siting at the declared location has absolutely no influence on these wetlands.

4.5 Socioeconomic Description of the Project Area

This section presents Administrative Setup, Demographic Features of the Area; Culture, Ethnicity, Quality of life and Aesthetic Values; socioeconomic status, Ethnicity and Culture, Physical Infrastructure, Education and Literacy, Health and Diseases, Agriculture Agro-ecological Zones, Fishing, Developmental Activities in the Area, Sites of Archeological, Historical, Cultural or Religious Significance.

Cultural and aesthetic values:

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Quality of life at and around the proposed project site etc.

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4.5.1 Administrative Setup

Gujju, the project site is in Taluka and District Thatta, Province of Sindh. District Thatta is divided in talukas i.e. sub-division of a district (also called tehsil) namely Thatta, Sujawal, Mirpur Bathoro, Jati, Mirpur Sakro, Ghorabari, Keti Bunder, Kharo Chann and Shah Bunder. These talukas include 55 union councils, 7,200 villages and 185,477 households with the average size of 6 individuals per household.

The wind power plant site is situated in one of the union councils of the Thatta Taluka. Like rest of the country, the local government system operates in Sindh Province as well. This system consists of the elected representatives as well as government functionaries. Under the system, each district is governed by the district government, which is headed by the District Nazim - an elected representative, and the District Coordination Officer (DCO) - a government official. Each district comprises several talukas (or tehsils), which are governed by their respective Taluka/Tehsil Municipal Administration (TMA). In turn, each tehsil or taluka comprises several unions, which is governed by the Union Administration (UA).

4.5.2 Demographic Features of the Area

The Thatta District covers an area of 17,355 square kilometers (about 4.3 million acres), and according to the 1998 census, had a population of 1,113,194 individuals living in 185,477 households. This population constituted 589,343 males and 523,853 females, with a growth rate of 2.26 percent, and having a density of 67 individuals per square kilometer.

The Thatta Taluka, where the proposed site is located, is distributed in 15 union councils, 61 revenue villages, 1,106 villages and 41,408 households. The total population according to the 1998 census was 253748 individuals.

4.5.3 Culture, Ethnicity, Quality of life and aesthetic values:

Culture

The project area has rich culture, customs and traditions like in the entire province of Sindh. There is a significant influence of the Arabian culture on the local population, though the traces of ancient Sindhi culture as well as Hindu, Buddhism and other religious thoughts are also present in the attitudes and approaches of the local communities.

The Pirs and Murshids (religious leaders, saints) are held in high esteem amongst the particularly in the uneducated and poor class of the villages. Annual festivals



at the shrines of saints are regularly held in which the people take part enthusiastically. Similarly, the Hindus also hold great confidence and reverence in Thakurs and Brahmans (the higher castes). The Brahmans usually perform spiritual rites of Hindus.

Ethnicity:

Strong bradari (communal) system especially in the rural areas defines the interand intra-community hierarchy and allegiance. The system plays important role in conflict resolution at the local levels. Every social group has its own Sardar (Chief), who represents the entire community. Most of the disputes are resolved at village level by the Sardar.

Language

Sindhi is the common language in the project area whereas Urdu is also spoken in some urban parts of the district.

Religions

Majority of the population in the project area is Muslims. Most of the population in Thatta district belongs to Sayed, Samma, Jokhio, Palejo, Baloch, Rind, Khaskheli, Khawaja, Memon, Mallah, Mirbahar, Jat and Lashari castes. The Thatta Taluka, particularly the area near the project site, is dominated by Rinds, Khaskhelis, Jats, Katiars, Mallahs, Hadyas, Sammas, Lasharis and Sathyas.

Quality of life:

The project site and land around the project area is arid. Average land holdings are very small. The people also supplement their income also by rearing of goats, sheep and cows on a limited scale. Fairly about 75 % of the people of the area are generally poor.

Since the area is not industrialized, therefore, job opportunities are very low. People mostly follow old traditions in almost all walks of heir life. Elders are very much respected and play vital role in decision-making. Old people are mostly illiterate. Old customs are being practiced. Arranged marriage system is followed and it is quite successful. People are proud of their traditions and customs. Guests are welcome as a tradition from the old past. Life style is simple.

Cultural and aesthetic values:

Old traditional cultural and aesthetic values prevail among most of the people. A large number (about 75%) of the people are living life below poverty levels.

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Financial and religious factors influence aesthetic and culture values of a society. People religiously have commitment to Islam. This relation contributes to good aesthetic and cultural values among the people.

People cannot sustain life on single agriculture source. Resultantly, aesthetic and cultural practices of a poor and medium type of society are dominant among a large cross section of the society. On the over all basis, century old traditions of typical villages of Sindh are prevalent in culture and aesthetic sense of life. Most of the old people are illiterate.

4.5.4 Physical Infrastructure:

The area is well connected to the entire country through the National Highway passing through Thatta and Karachi – Hyderabad Super Highway (M-9) in the north of Thatta Taluka. The main Karachi-Lahore-Peshawar railway line also passes through the northern parts of the Thatta district. A well developed road network connects various parts of the Taluka with the National Highway.

Electricity is generally available in the area. The water supply system exists in most of the communities, but net worked systems are quite limited to the urban areas and larger villages/towns only. Government of Pakistan initiated Clean Drinking Water Program, under which each UC will have water purification system.

Where telecommunication link is available in the area, the recent development of mobile phones system has expanded the service coverage to even remote areas which were not connected to the land lines.

Several industrial organizations exist in the Thatta District. Sugar mills, textile mills, cement industry; rice and flour mills are operating in District Thatta whereas no major industry is sited near the project site.

4.5.5 Education and Literacy:

A large number of educational institutes exist in the Thatta District, however many of the schools in the rural areas, are either partially functional, or altogether non-functional for mostly for lack of teachers.

Girls' enrollment is very low in the few schools. For higher education, students have to rely upon institutes in the urban areas such as Gharo and Mirpur Sakro town.

Literacy rate in the project area is quite low. The 22.14% literacy in Thatta district is far below the overall literacy of 45.29% in the Sindh Province. The



literacy in the urban areas is higher than the rural areas. Male literacy is generally higher than the female literacy.

4.5.6 Health and Diseases:

Many health care facilities exist in the Thatta district. They include one district hospital, four Taluka hospitals, 46 Basic Health Units (BHUs) and eight Rural Health Centers (RHCs). One Taluka hospital, nine BHUs and one RHC are located within the Mirpur Sakro Taluka. These health facilities are not only quite inadequate to, but most of these are poorly equipped and under staffed. Resultantly, the local population is forced to go to the larger towns and cities in case of serious diseases.

Among the common diseases in the area include tuberculosis, skin infections, malaria, eye infections, diarrhea, and hepatitis. Lacking suitable quality water for drinking, majority of rural population is victim of water various borne diseases.

4.5.7 Agriculture:

Land use is governed by several interacting factors like physical, biological, social and economic in nature. A clear vision of these factors is essential for increased agricultural productivity. According to this zonation, the project area falls under the Zone I, which is characterized by moderate temperatures, low rainfall, saline soils and poor drainage. Accordingly, the proposed site does not support any agricultural activities such as cultivation or grazing.

Cultivation:

Cultivation is one of the main source of livelihood of the people of the Thatta District in general. Almost all the households possess some piece of land cultivation. Rice, wheat, sugarcane and tomato are major cash crops of the area. During rabbi (winter) season, mostly wheat and vegetables are grown, whereas during kharif (summer) season, mostly rice, sugarcane, and vegetables are grown.

Mostly cultivation methods are traditional therefore crop yield is very low. The agricultural produce is usually sold out to the local wholesale dealers at the rate which is typically lower than the market rate. This is primarily because the villagers do not have much exposure of and access to the open markets in larger towns and cities, and they find it convenient to sell their produce to the whole sale dealers at lower-than-market rates.

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Irrigation:

The Indus River is the main source of irrigation water in Thatta Taluka, the Baghar, Ladhya and Jam Sakro canals originating from Indus and Keenjhar Lake provide the irrigation water. Because of the areas in the Union Council located at the tail of the canal do not receive enough irrigation water. The availability of sweet groundwater in the area is quite limited; therefore, usage of groundwater for the irrigation purposes is quite limited.

Livestock:

Livestock rearing is also one of the key livelihood means for the rural population of the area. Traditionally, the farmers rear a few heads of livestock, ranging from bullocks for draught to cows and buffalos for milk, and poultry for eggs and meat. Traditionally, many communities in the area are exclusively dependent on livestock for their livelihood, several commercial livestock and dairy farms also exist in the Mirpur Sakro Taluka, some of them along the road leading to the site. Produce from these farms is usually transported to cities like Karachi, Hyderabad and Thatta city.

4.5.8 Fishing

Fishing is also one of the important livelihood means of the local population in the Thatta District, particularly along the coastal belt. In these areas, almost every household possesses one to two fishing boats. In Mirpur Sakro Taluka, the union councils Bhuhara and Haji Girano are located in the coastal belt hence fishing is the key occupation in these areas. Kalri Lake is an important fishing area for the people living in area.

4.5.9 Developmental Activities in the Area

No major development projects are reported under implementation in the project area.

4.5.10 Sites of Archeological, Historical, Cultural or Religious Significance

Thatta is an historic town of 220,000 inhabitants (1997) in the south east Sindh province of Pakistan. It is 100 Kilometers from the metropolis of Karachi and Hyderabad.

The city was the capital of Lower Sindh from the 14th century during the ruling period of Soomro Tribe Thatta was the capital of Sindh for 95 years.

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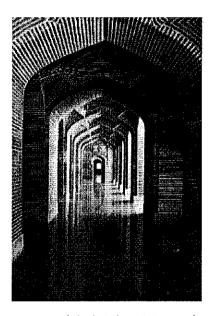
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Archeological, Historical, Cultural or Religious Heritage:

Thatta's has perhaps largest number of monuments listed among the UNESCO's World Heritage Sites.

Among many others the important monuments include:

i- The Jama Mosque (also Shah Jahan Mosque and Badshahi Mosque), built by Shah Jahan in 1647-49 and lined with glazed tiles. This edifice has 101 domes and is designed in such a way that imam's voice can reach every corner of this building without the help of any loudspeaker or other device.



(Shah Jahan Mosque)

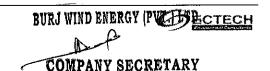
ii- Tombs:

There are also the **tombs** of Jam Nizamuddin, Satihoo Seven Soomro Sisters (reigned in 1461-1509), several Tarkhan rulers and Mughal officials.

iii- Makli Hills.

A vast old necropolis with thousands of graves may be found at the nearby Makli Hills. Makli, is counted among one of the largest necropolis in the world. The mausoleums and [[tombs in Makli are one of the greatest ruins of Sindh from 14 to 18th century.

Apart from the mausoleums of Jam Nizam al-Din and Jan Beg Takhan, Makli has undertaken a lot of Sufis, warriors, poets, intellectuals. The artistic monuments at Makli show proof of Islamic ideologies and the Hindu mythology.



5.0 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

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5-0 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES:

This section of the report deals with following parts of the IEE report:

- Categorization of environmental threats
- Collective impacts on the environment of the area
- Most likely impacts of the project on the area
- · Possible out break of any emergency situation at wind farm site

While preparing this section, conformity with the guidelines for IEE, was taken into account . This process is described hereunder to ensure that:

- · Most likely impacts can be identified and properly assessed
- The interaction between the project components and environment are adequately Described

Possible project activities that can lead to an environmental disturbance are identified separately and described along with the level of intensity.

5.1 Environmental Assessment Methodology

This environmental assessment was carried out in line with the requirement of national regulations. The assessment comprised of review of the project information, meeting with the people of the project area. The criteria, used for the assessment of the intensity of the impacts, are as below:

Classification of the Residual Impacts

Level	Classification Explanation
High	The impact has the potential to threaten sustainability of the resource therefore it should be taken as management concern for which monitoring
	and / or recovery efforts need to be considered for research.
Medium	The impact has the potential to affect the resource to decline for lowering than initial but stable stage in the study area after project closure and even to the fore seeable features. Therefore regional management actions such as research, monitoring and/or recovery initiatives may be required.
Low	The impact has the potential to decline slightly in resource in study area during the project life. Therefore research, monitoring and/or recovery initiatives would not normally be required.
Minimal	Potential impact may result in slight decline in resource in study area during construction phase, but should return to baseline levels.

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This environmental assessment was performed with a view to determine the prospective adverse environmental effects of the project so as to ensure that these are given due consideration in minimizing their effect on the physical, ecological/biological and socioeconomic environments. These activities have been are for construction, regular operation and decommissioning phases of the project.

5.2 Summary of the findings of the Environmental Assessment

As a result of the study, it has been found that none of the project activity can cause environmental damage that can cause potential environmental degradation in the project area. Even some of the project components that have the potential of causing moderate environmental degradation, their magnitude can also be minimized or stepwise avoided in due course of time. The following section provides a detailed account of them in the following order:

- Major Environmental Issues Identified for the Total Project Activity and Mitigations
- Mitigation Measures during Construction Phase/(issues to arise during construction)
- Mitigation Measures during Operational Phase/ (issues during operation)
- Other Issues Mitigation Measures

5.3 Major Environmental Issues Identified for the Total Project Activity and Mitigations

The key environmental relevant issues identified for detailed evaluation are:

- Collisions of Migratory Birds / Avian Impact
- Noise
- Health and Safety
- Shadow
- Visibility
- Atmospheric emissions
- Clearing of land for road and building construction
- Delivery of Equipments at site
- Foundations of Tower and Cranes Construction
- Tower assembly and installation
- Wild life disturbance
- Maintenance activities at later stages
- Global environment Issues
- Historical Heritage

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Solid Waste Management

5.3.1 Collisions of Migratory Birds / Avian Impact

Background

In the context of the project migratory birds' mortalities, through their collision with the wind turbines and associated infrastructure, is the most significant environmental issue. Site avoidance and disruption of migratory behavior of the birds could also be significant issue.

According to a survey, conducted by WWF in 2009, indicated that number of birds in and around Keenjhar Lake have reduced drastically in recent years and these birds have tendency to fly at an altitude of 400 to 500 meters, therefore, there is no chance of collision with wind towers at this specific site.

Though in Pakistan Wind farm technology is being introduced quite recently, yet this technology was developed and being practised in European countries for the last over one decade.

The US Government Accountability Office (GAO) Study Report (Sept. 2005), on the effects of wind energy development on wildlife, determined several hundred utility-scale wind farms currently operating across the (US). According to this report such problems appear to be limited to two project areas. In the context of other sources of avian [mortality], it does not appear that wind power is responsible for a significant number of bird deaths," the report states in its conclusion ⁽¹⁾.

According to another study in the United States, the following sources of avian collision mortality have been estimated ⁽²⁾:

Vehicles: 60 – 80 million

Building and Windows: 98 – 980 million

Power lines: tens of thousands – 174 million

Communication Towers: 4 – 50 million

Wind Generation Facilities: 10,000 – 40,000

Yet according to another study carried out 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 USA, an average of 2.2 fatalities for each of the 15,000 turbines (3). A study in Spain shows 0.13 dead birds per year per turbine.

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y comparison in the USA, over 100 million birds are estimated to die each year from colliding with vehicles, buildings, power lines power lines and other structures, with wind power responsible for just 1 out of every 5,000 - 10,000 avian fatalities.

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⁽¹⁾ American Wind Energy Association: Facts about Wind Energy & Birds, Spp.-Internet Article

Wally Erickson, WEST Inc., Bird and Wildlife Monitoring: presentation at National Wind Power and EA Workshop, Environment Canada: May 12, 2004, Moncton, New Brunswick. (a) http://www.windpower-monthly.com

The above facts and figures show that there will be very little effect of proposed wind farm on the avian mortality and migratory birds.

Mitigation / Management Measures to Avoid Avian Collision

In view of the situation the following mitigation measures are recommended be adopted to avoid avian collision:

- To provide the birds a safe access to the project site for avoiding avian collision, a wider corridor measuring a distance of about 300 meters between two consecutive wind towers needs to be provided.
- In order to avoid nesting facility of any of the birds; checking of the vacuums or holes in the towers should be carried out regularly.
- In order to further reduce chances of avian collision, all power and communication cables to the extent possible, should be placed under ground.
- Data of bird mortality in the immediate vicinity needs to be recorded for at least two to three years from the start of the project. This will help to establish a realistically strong link between the wind turbines and the birds mortality.
- Wind towers need to be painted identically and flashing lamp to avoid avian collision at night.
- The project management representative is require to establish regular contact with the WWF office and Wildlife Department at Thatta, for time to time exchange of views for any further possible measures to be adopted for achieving the goals of minimizing avian mortality.

Intensity of Environmental Threat from the Proposed Project

 The wind farm project is not going to impose any worth mentioning impact on birds of area.

5.3.2 Noise

Background

Noise to be made by the wind turbines can be controlled to the required limits of the National Environmental Quality Standards for Noise (NEQSN), 2010 by carefully designing rotor blades with low rotational speed along with good noise insulation generator to help limit noise emission.

Specifically, at 200m the sound from a modern, medium-sized wind turbine will produce noise to the tune of about 45 dBA, quieter than a typical living room. At

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400m, the sound would be no louder than leaves rustling in a gentle breeze. By keeping enough distance from built-up or other noise sensitive areas, noise pollution is avoided.

Wind turbine noise typically increases with increasing wind speed, as does the background noise levels. The critical period for noise impacts is likely to be at low wind speeds when turbines cut-in and when background noise levels are still relatively low.

Noise generation from wind farm can be separated into the construction and operation phases of the project.

Construction activities generating noise:

- Excavation activities for turbine and building footings including drill and blasting;
- Excavation of cable trenches;
- Crane activities associated with tower erection.
- Transportation movements associated with delivery of machine and construction material
- · Concrete batch plant;
- Construction of access roads, including use of rock breakers and blasting;

Operational phase noises include:

- Wind turbine generator and blade movement;
- Substation transformers; and
- Maintenance equipment noise

Management Measures/Mitigation Measures

The noise produced by the wind turbine is mainly because of the gear boxes and its auxiliaries. When there is no gear box; so there is no excessive noise that crosses the permissible limits. But even then care has to be observed to ensure that all turbines are configured so as to be at the maximum possible distance from residences.

Intensity of Environmental Threat from the Subject

Noise generation from most wind turbines (running at full swing) is estimated to be less than 45dB (A) with increasing distance the source and receptor the noise also decreases and is to ambient outdoor noise. No potential threat is established. For comparison sake refer to the following tables:



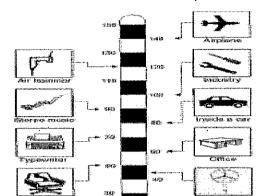


Table: Noise Emission Level and Comparison

Scales of noise emissions:

Source: Danish Wind Turbine Manufacturers Association

(www.windpower.org)
Table: Typical Noise Levels

Device	dBA	
Quiet basement with out mechanical equipment	20	
Quiet Room	28-33	
Computer	37-45	
Refrigerator	40-43	
Typical Living Room	40	
Radio Playing in Background	45-50	
Background Music	50	
Normal Conversation	55-65	
Printer	58-65	
Alarm Clock	60-80	



	T
Phone	66-75
Push Reel Mower	68-72
Inside Car, Windows Closed, 30 MPH	68-73
Inside Car, Windows Open, 30 MPH	72-76
Air Compressor	90-93
¼" Drill Machine	92-95
Maximum Output of Stereo	100-110

Source: http://www.nonoise.org/library/household/index.htm.

5.3.3 Health and Safety Background

In wind farm, health and safety hazards may be experienced at any time during construction and operational phases of wind farm. Although there are very remote chances of hazards, yet some of hazards that can take place include:

- · Accidental or controlled fires;
- Falling turbine blade or damaged turbine
- Damage to turbine components due to high winds;
- Turbine blade failure;
- Vehicle accident;
- Exposure to high voltage
- Accidents while accessing area;
- Public access;
- Accidental access of public inside the turbine or on the turbine tower
- Construction accidents during access and foundations preparation

Management Measures/Mitigation Measures

The proposed DEL wind farm is situated quite far off the scattered population in small villages (Goths). The distance of the nearest village is about 2 km from the wind farm. Therefore, it will be almost difficult for the general public to have any access of visiting the wind farm area and interfere by climbing the turbine tower.

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The wind farm will have adequate safety alarm that can alert the safety personnel of any irregularity at the site. Every turbine will be connected to the latest type of a network of safety instruments and communication devices through which remote monitoring will be done.

Control systems will continuously keep on monitoring of the key operating parameters, and thus ensure that in the event of a problem within the turbine array or within the utility system or anywhere else, the turbines are safely disconnected.

The monitoring staff on the wind farm will be equipped with the latest communication devices thus enabling them to transmit, to concerned agencies, the information regarding any emergency without any delay.

Since the land belongs to Burj Wind Energy, the project proponent, therefore, access to the general public to the wind farm is not possible. So also grazing can take place. If so desired, fencing is possible around the wind farm site. Climbing up of the wind turbines is difficult due to their height. Migration of the people to the land under the wind farm is not possible because the land is the exclusive property of the project proponent. In addition, the project company will keep its check through their security personnel to be deputed on site.

The project activity is very small; therefore, volume of transport to visit the project site during construction phase is not that much. Consequently, vehicular emissions will be minimum. Further, only the transport meeting the required emissions levels as set under the NEQS Pakistan will be engaged. Hazardous chemicals or spill on the projects site will be carefully controlled according to a well planed programme.

The wind turbine tower will be properly insulated and every possible care be taken while connecting the tower to proposed sub station and with remaining turbine towers.

During the assembling and installation phase of sub station transformers and wind turbine generators, fire extinguishers (both powder and liquid type) will be available.

A well equipped and trained Hazards Response Brigade (HRB) with adequate supply of spill prevention and emergency response equipment will be kept on site during the construction phase and when maintenance of turbines is to be performed. The HRB will have staff trained in hazardous materials handling and emergency response procedures.



An adequate supply of spill prevention and emergency response equipment will be kept onsite all times during the construction phase, as well as when maintenance is performed on the turbines. Site personnel will be trained in hazardous materials handling and emergency response procedures.

Used oil, filter and grease cartridges, lubrication containers and other equipment maintenance waste products will be collected and disposed of at the nearest scenically secured waste disposal facility according to international best practices.

Mechanical safety will be made available on priority basis. The staff to work above ground level will be provided with fall restraint equipment.

Severity of Environmental Threat from the Subject

Strict monitoring and compliance of "Work place health and safety regulations" will be the order of the day.

5.3.4 Shadow/Flickering Effect

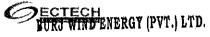
Background

Rotating rotor blades make moving shadows during sun shine. While normally this effect is Visible only very close to the turbine, whereas, on sunny winter days, when the sun is low in the sky, shadow may spread over long distance, and case this shadow is cast onto a house window, it may be inconvenient. Correct positioning of wind turbines, and a minimum distance from dwellings will suffice to avoid this problem.

Shadow flicker takes place where the blades of a wind turbine cast a moving shadow over a window in a nearby house. The effect is not longer lasting but for a short period and occurs only under very specific and rare conditions. Careful site selection, design and planning, and good use of relevant software, can help avoid the possibility of shadow flicker. In case shadow flicker is a problem, quantify the effect and where appropriate, measures be adopted to prevent or ameliorate the potential effect like turning off a particular turbine for a certain duration.

Management Measures/Mitigation Measures

Even otherwise, if shadows cause inconvenience for only a short time in a year, the wind turbine can be put off its operation during such interval and it will not result in too much loss of production. Larger wind turbines rotate more slowly and reduce further any potential shadow flicker effects.



Severity of Environmental Threat

The distance between the proposed wind farm site and the nearest population village (Goth) is about 2 km. Therefore, this issue will not require any special attention.

5.3.5 Visibility

Background

Wind turbines comprise of large structure machines. Human beings over the period have reshaped the countryside. Surveys conducted indicate that people are favorable to wind energy and favour development of wind energy. Therefore, they see wind turbines attractive and interesting.

The proposed wind farm will give new look to the area. The wind turbines, particularly, with the Topographic situation of the project site, will be visible from a distance of around 6-8 km. The residents of the small villages (Goths) scattered remotely around the project site usually cross by un-noticed, the erected mast data towers in the same area. So they are used to the visibility of the towers. Therefore, the new wind farm will not be unpleasant or odd situation for them.

Management Measures/Mitigation

The proposed projects site is located in area which is all a barren tract of land without any feature of scenic beauty. Small scattered bushes are the salient feature of the land. So, project need not to provide any mitigation measures.

Severity of Environmental Threat

Under the given situation severity of this issue is categorized as low.

5.3.6 Atmospheric emissions

Background

Of the most significant change is air emissions during construction phase is increase in particulate emissions from construction phase vehicle movements and disturbance of soil during civil construction work including especially road and foundation construction. These emissions will not add to the Particulate Matter (PM), if dust suppression methods are implemented as required during



the construction phase, Therefore, air emissions are not going to pose any danger to the environment.

Management Measures/Mitigation

Fugitive dust suppression can be controlled to a great extent by sprinkling of water on the unpaved sites confined to the site of civil works. Limiting speed of the vehicles visiting the project will also help to keep the dust emissions under control.

Burning of the cleared vegetation, for developmental purposes, should be the last option if no other environmentally safe method is available.

Severity

Severity of this factor can be categorized as low.

5.3.7 Land Clearing for roads and building construction

Background

Clearing of the site from bushes and shrubs will be restricted to foundation sites and along the surveyed right-of-way. Bush and shrub vegetation will only be removed along surveyed rights-of-way, in foundation sites and work areas.

The existing available road/track may need broadening in order to accommodate heavy traffic that is expected for delivery of equipment. This may lead to a potential destruction of flora mostly shrubs and bushes to be cleared for the purpose.

Management Measures/Mitigation

Indiscriminate removal of bushes and shrubs should be avoided. This may only be restricted to areas where civil work is to be done. Areas requiring vegetation removal may be earmarked after survey of the site. Construction activities may be strictly restricted to the site area.

Severity of Environmental Threat

The severity of this issue can be categorized as low.

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5.3.8 Transportation Route of Equipments at Site Background

The equipment from abroad will be transported from Port Qasim to the project site.

Of the two different modes of transporting the equipment from Port Qasim, the road route will be preferable on the basis of technical limitations. Available roads presently have the infrastructure in place to accommodate the expected traffic. Even then, limited upgrading of existing roads and bridges may be required along the designated route. This upgrading is likely to involve road widening and realignment in some sections. During construction phase of the project, there will be an increase in vehicle movements on public roads.

Management Measures/Mitigation

A main trunk road to the site and a series of spur-ways to individual turbines is suggested to regulate the traffic and minimize the operational loss to environment. It is highly advisable to install temporary reduced speed limits marks on the sides of the roads to minimize the chances of any fatal accident.

Severity of Environmental Threat

The severity of this issue can be categorized as moderate to low.

5.3.9 Tower and Cranes Plate form Foundations' Construction

Background

Approximately $20m \times 30m$ area is required to be duly leveled and compacted for the cranes at each site where wind turbine is to be installed. Accordingly, in total an area of around 5400 m^3 is required for crane and parking places.

Excavation for wind turbines foundations shall be carried out. The topsoil will be striped off and stored separately and the subsoil will be kept separately. After completion of the installation of wind turbine, the subsoil will be used as backfill of the site of its excavation and then stripped off top soil will be put on this and thus the rehabilitation work regarding backfilling of the site will be completed.

Heavy duty cranes will be used to lift the approximately 40-45 tons wind turbine generator up to a maximum height (depending on the type of WTG) of 80-100 meters. During the construction of the foundation for tower and crane plate form, there will be soil disturbance and relocation, admixing of top soil with subsoil. There would be some damage to vegetation and increase in heavy traffic like heavy duty trucks and heavy earth moving machines.



Management Measures/Mitigation

The best use of the displaced soil will be for its reuse as road surfacing material. Soil admixing can be minimized by storing the soils separately. Damage to vegetation could be minimized by restricting the earth based activity to the minimum possible area. In order to maintain maximum safety at work, best management practices are to be strictly adhered to.

Severity of Environmental Threat

The severity can be categorized as moderate to minimal.

5.4 Tower assembly and installation

Background

Turbines will be assembled on site, at temporary marked and isolated site on project area, very near to site where it is to be erected. Heavy duty sophisticated cranes would be engaged to carry out mounting the wind turbines for placement on the towers.

Management Measures/Mitigation

Since construction activity is for very short duration, therefore, potential threat to environment can be minimized by restricting access to working area. During the entire work safety will be the order of the day. All possible safety and precautionary measures are to be adopted to maintain working safety.

Severity of Environmental Threat

The severity of the issue is categorized as moderate to minimal.

5.4.1 Wildlife Disturbance

Background

Wind turbines may interfere with birds' natural behavior thus resulting in increased fatalities. As explained above, since there are no known wildlife reserves or game area within area of influence of the project therefore the factor will be of very limited intensity. The proponent will be conducting mortality figure till the time second phase of the project comes to commissioning.

Generally, wind turbines do not pose hazard to wildlife. Cattle can safely and conveniently graze around. Reasonable clearance between the blades and



ground minimizes to the maximum extent chances of injury to cattle and other animals.

In a few areas of the world where large numbers of wind turbines are concentrated, there have been reports of bird kills. On the other hand, where there are single installations or small clusters of wind turbines, little evidence is available of birds kill in significant numbers. By nature, local birds avoid wind turbines by flying around them, and migrating birds tend to fly well above wind turbine height. Some concerns may be warranted in areas where birds concentrate, such as in wildlife refuges or shoreline feeding and nesting areas.

Management Measures/Mitigation

No special status bird species or nests are reported in the project area. Tubular towers use associated with elimination of any perching/nesting locations will minimize the risk of bird mortality. However, mortality monitoring program up to the start of the second phase of the project area will help to ascertain the real status of the environmental concern on this account. As also recommended in the earlier part of this report, a close liaison will be maintained between the project proponent, the WWF and the Wildlife Department, District Thatta, Govt. of Sindh.

Severity of Environmental Threat from the Subject

The severity is categorized as low.

5.4.2 Maintenance activities at later stages

Background

Regular maintenance and vigilance will ensure safe and reliable operation of the turbines. Half yearly all over inspection and maintenance on regular basis will be the salient feature.

Management Measures/Mitigation

Maintenance staff will be equipped with and trained in the use of fall-restraint equipment and proper handling and storage of hazardous materials.

Severity of Environmental Threat from the Subject

The severity of this issue can be categorized as low.

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5.4.3 Global environment Issues

Background

The availability of fossil fuels in Pakistan is not only becoming difficult, but also their price is going exuberantly high in very short intervals of time. The week economy of Pakistan cannot take up the pressure of importing these fuels. There is therefore, dire need to look for other cheaper & cleaner sources of energy.

Today, wind energy is the vanguard of clean energy technologies. It is the most viable energy option if we are to meet our future electricity needs as well as without causing global warming and climate change. Wind energy can save environmental degradation from the damage taking place by the use of conventional fossil fuels, such as natural gas, coal and oil.

Global climate change is among the most serious environmental threats faced by human race. The globally averaged surface temperature is projected to increase by between 1.4 and 5.8°C by the end of this century.

Global mean sea level is projected to rise by 0.09 to 0.88 meters between 1990 and 2100, causing flooding to low-lying coasts and islands.

Development of renewable energy, including wind energy, is one of the major sources of mitigating climate change.

1 MW Wind Turbine can provide enough electricity for 650 homes and will avoid 175 tonnes of slag and ash and the emission of 2,700 tonnes of the greenhouse gas CO₂, 30 tonnes of Sulphur Dioxide and 10 tonnes of Nitrous Oxide per year, helping to meet our Kyoto Protocol targets and to preserve our environment. Wind farms are supposed to be one of the environmentally safe sources of electricity generation.

Management Measures/Mitigation

It is evident that project will yield substantial reduction in greenhouse gas emissions compared to generating an equivalent amount of energy from fossil fuels. The project has the potential to make a significant contribution to providing an alternative energy source to fossil-fuel derived electricity.

Severity of Environmental Threat

Severity of this issue is categorized as low.

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5.4.4 Historical Heritage

Background

No site has been reported that has any historical importance in the project area.

Management Measures/Mitigation

Since there is no such site, therefore there is no need for any mitigation measure.

Severity of Environmental

Not applicable.

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5.5 Mitigation Measures during Construction Phase/(issues to arise during construction)

These are presented in Table – 5.1 below

Mitigation Measures during Construction Phase/ (Issues to Arise During Construction) Table - 5.1

Potential Impact	Mitigation Action
Contaminated Soil 1.	In the event contaminated areas are identified during construction the following measures need to be followed: (a) Suspend all work in the immediate area. The
	area is to be secured by covering the area with plasticized tarp. Place berms round the tarp to isolate it from other areas.
	(b) Notify Burj Wind Energy (BWE) Site Engineer immediately.
	(c) The contaminated soil should be stored away from any water course, crops, etc.
·	(d) Contaminated area is to be cleaned up as per environmental and standard procedures.
Vegetation Clearing 1.	Clearing of project area should be minimized where possible.
2.	All clearing activities should be confined to Burj Wind Energy approved areas.
3.	Larger bushes & woody materials should be considered for salvage and reuse rather than to burn them.
Erosion Control 1.	Areas where soil or sub-soil has been exposed should be stabilized by grading to a slope and/or applying appropriate erosion and sediment control measures.
2.	Erosion and sediment control structure should be installed prior to site disturbance.
POL Handling/Storage	1. Fueling & lubrication of equipment and machinery should be carried out at designation and approved location.
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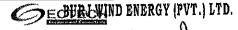
- 2. Washing, servicing and fueling of mobile equipment should not be allowed within 30 meters of any waterway or drainage systems.
- 3. Waste oils and lubricants should be retained in a tank or closed container and disposed of in an approved manner.
- 4. Greasy or oily rags or materials subject to spontaneous combustion should be deposited and stored in an appropriate receptacle. This material should be removed from the work site on a regular basis and should be disposed of in an approved existing waste disposal facility.
- 5. All hazardous materials should be stored with in secondary containment and properly signed and record to be maintained.

Hazardous Spills

- 1. Any hazardous material spill should be immediately reported to Burj Wind Energy and Sindh EPA.
- 2. Adequate measures should be taken to contain the spill and reduce the spread or impact.
- Clean-up activities should be undertaken to recover as much spill as possible. Disposal of the recovered materials should be undertaken to the satisfaction of Burj Wind Energy and Sindh EPA and properly disposed.

Site Layout

- 1. The Contractor's construction site and camp should be established in the manner that it does not adversely affect the environment.
- 2. The construction and camp area should be kept to the minimum.
- 3. The site and camp layout should take cognizance of access for deliveries and services. Likely disturbance to neighbors as well as security implications should be considered.
- 4. The Contractor should restrict all his activities, materials, equipment and personnel to within the area specified. The Contractor should ensure that the approved construction area will be adequate to cover the project without further space adjustments being required at a later date.



- 5. All private property outside of the construction areas (including any bypass routes) as set out in the site layout plan should be considered no-go areas.
- 6. The Contractor should erect temporary fencing along the perimeter of designated no-go areas.
- 7. Ablution facilities: The Contractor is responsible for the erection and maintenance of adequate ablution facilities and for enforcing the use of these facilities. The Contractor should be responsible for ensuring that all ablution facilities are maintained in a clean and sanitary condition to the satisfaction of the Burj Wind Energy. Adequate Ablution facilities must be provided at all construction camp areas where there will be a concentration of labour.
- 8. Eating areas: the Contractor should provide adequate temporary shade within the construction areas to ensure that site personnel do not move off site to eat. The Contractor should provide adequate refuse bins at all eating areas to the satisfaction of the Burj Wind Energy. If deemed necessary by the BWE, the Contractor should demarcate designated eating areas. No feeding of wild animals should be allowed.
- 9. Domestic solid waste: The Contractor should provide metal refuse bins or equivalent plastic refuse bins, all with lids, for all buildings. Refuse should be collected and removed from all facilities at least twice per week. Domestic waste should be transported to the approved refuse disposal site in covered containers or trucks.
- Wastewater: Water from kitchens, showers, toilets, laboratories, sinks etc. shall be discharged into a conservancy tank for removal from the site after adequate treatment. Runoff from fuel depots / workshops / machinery washing areas and concrete batching areas shall be collected into a conservancy tank, adequately treated and disposed off at a site approved by the BWE.
- 11. Waste Management: Waste management on site should be strictly controlled and monitored. Only approved waste disposal methods should be allowed. The Contractor should ensure that all site

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- personnel are instructed in the proper disposal of all waste.
- 12. Communicable diseases (sexually transmitted disease), in order to prevent the STD among the worker regular medical check up should be carried out. In case any such occurrence it should be duly treated.

Air Quality

- 1. Vehicles transporting loose construction material (clay, sand etc.) to be covered with tarpaulins.
- Limit on speed and movement of vehicles, where considered appropriate speed-breakers should be installed.
- 3. Use low emissions trucks for material transport where possible (e.g. use of diesel particulate filter).
- 4. Routine service and maintenance of vehicles and machines to reduce vehicular emissions.
- 5. During periods with abnormal wind speeds, in particular during dry weather conditions, workers on the construction site should be provided with adequate inhalation and eyes protection gears. In case particulates in air hamper a clear view over the site completely, so that safety is impaired, the construction should be interrupted until weather conditions improve.
- To reduce generation of dust in the construction process, onsite roads and parking areas, as far as possible, would be constructed with asphalt over a compacted sub base.
- Spraying exposed soil with water to reduce PM₁₀
 emissions and particulate matter deposition. Water
 to be applied at a rate to maintain a moist surface,
 but not create surface water runoff or erosion
 conditions.
- Provide wheel washers for vehicles to remove particulate matter that would otherwise be carried offsite by vehicles that would decrease deposition of particulate matter on area roads and subsequent entrainment from those roads.
- Routing and scheduling construction trucks to reduce delays to traffic during peak travel times would reduce secondary air quality impacts caused



- by a reduction in traffic speeds while waiting for construction trucks.
- 10. As far as possible planting vegetative cover (matching the local climate), as soon as possible after grading, would reduce windblown particulate matter in the area.

Surface Water

- 1. All liquid materials and lubricants (e.g. sanitary waste water, etc.) that accumulate during construction phase shall be stored in closed septic tanks, and in containers or barrels stored in specifically identified areas at the construction site.
- 2. Packaging material like bags of cement etc. shall be stored in containers to avoid leaching out of any remaining particles in the event of rain fall, etc.

Water Supply

- 1. During construction, non-potable water would be supplied by trucks to provide dust control.
- 2. Potable drinking water for construction workers would be provided by a water service to be contracted by the site contractor.

Ground Water

- Any liquid material and lubricants (e.g. hydrostatic testing water and wastewater) that accumulate during the construction phase should not infiltrate into the soil. Septic tanks shall be used for any waste water collection. Each tank, when filled and closed, should be brought to the closest wastewater treatment plant for further treatment.
- Closed tanks should be removed from the site as soon as possible and should not be allowed to remain on the construction site as an interim storage until the end of the construction phase.
- Monitoring of the characteristic of waste water collected in the septic or other tanks should be carried out on routine basis.
- 4. Maintenance and washing of all heavy mobile machinery & vehicles should be carried out at adequate service stations. Good and regular maintenance of all vehicles and machines used on



- site is mandatory and untreated waste water should not be allowed to drain into nearest drains.
- 5. Maintenance and re-fueling (if necessary) of any construction equipment shall be done at a decent distance from the excavation area and only be undertaken on sealed area. Any re-fuelling must be handled carefully taking particular attention to not spilling any fuel.
- On site storage of fuel, engine oil and lubricants (if any) shall be in locked tanks, sealed and shadowroofed area.
- 7. On site storage of fuel, engine oil and lubricants that might be stored shall be collected at the end of construction phase and brought to either a disposal point for hazardous waste or be brought back for re-use to the place it was rented for the purpose of this construction.

Solid Waste

- 1. All solid wastes shall be disposed off according to a set procedure and record of sales will be kept to track at any time when it is required.
- The contractors to whom any waste is to be sold shall be fully made aware of the environmental impacts and health effects of the waste to be sold to him. He shall be provided instructions for reuse/handling of such wastes in environmentally sustainable way.

Soil

- 1. Construction activities must be limited to the designated areas.
- Refilling of excavated soil should be done as far as possible. Where possible reuse of excavated soil should be done.
- Prevention measures should be developed in the event of an accident or threat (e.g. massive, uncontrolled leakage of waste water into unsealed soil on-site).

Fauna and flora

1. Planting of indigenous vegetation in the site should be carried out. If not earlier practical, such measures should be implemented after the completion of all construction activities.



Noise

- 1. Power mechanical equipment like bulldozers, air compressors, concrete pumps, excavators, concrete mixers etc. shall only be used with low sound power, whenever possible.
- 2. Optimize transportation management to avoid needless truck trips; avoidance of truck movements in residential areas at least during night time.
- 3. The construction machinery equipment shall be well-maintained and serviced regularly during construction phase.
- Construction activities shall be scheduled in such a way that noise intensive operations side by side with an increased net noise level will be avoided.
- 5. Workers on the construction site should be equipped with ear protection in particular those directly exposed to higher noise levels.

5.6 Mitigation Measures during Operation Phase/ issues to arise during operation

Mitigation measures during operation phase are presented in Table – 5.2 below.

Operation and Maintenance activities will not be very extensive. The normal greasing and cleaning activities will be done, except for the annual shutdown of the turbine for maintenance. Even during this time it is not expected that any major work will be required each year.

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Mitigation Measures During Operation Phase/ Issues to Arise During Operation

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Potential Impact		<u>Nitigation Action</u>
Ground Water	1.	Regular inspection of facilities for intercepting leaking and spilled liquids.
	2.	During O & M operation hazardous chemicals shall be handled only in appropriate segregated, sealed and bundled areas at site.
Solid Waste	1.	During O & M operation all solid wastes shall be disposed-off according to a set procedure and record of sales will be kept to track at any time
	2.	when it is required. The contractors to whom any waste is to be sold shall be fully made aware of the environmental impacts and health effects of the waste to be sold to him. He shall be provided instructions for reuse/handling of such wastes in environmentally sustainable way.
Noise	1.	Noise measures are not proposed as the wind turbines used will have noise impact within regulatory requirement. Equipment will be acoustically shielded and /or lagged as far as possible.
	2.	A noise measurement campaign during full operation as operation start should be implemented to verify the real noise levels are in line with the standards under International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines for Wind Energy (April 30, 2007).
	3.	Workers should be obliged to use ear protection in areas within the plant and for specific work that exceed the tolerable maximum noise limits.
Avian Collision	1.	Regular checking of vacuum or holes in the towers

Avian Collision

1. Regular checking of vacuum or holes in the towers should be carried out to avoid nesting facilities of birds.

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2. Bird mortality count, in the immediate vicinity of the wind farm, should be carried out after commissioning of the wind turbines.

5.7 Other Issues and Mitigation Measures:

A) Economic Environment

The Project could have, both positive and negative, impacts on the economic environment.

Whilst there is significant potential for positive economic benefits of the Project, the extent to which it is likely to lead to economic development and or inflation depends on the Project approach to providing services to its workers, which has not yet been finalized.

Mitigation: The Company needs to consider the Socio-economic baseline context and consult community leaders and civil society when making economic development agreements.

B) Employment, Livelihoods and Income Generating Activities

Access to Project Employment is a key priority for local stakeholders, which is not surprising given the levels of poverty and unemployment in affected communities.

During both construction and operational phases there is an opportunity for maximizing positive impacts of the Company on local employment through involving unskilled (and where possible skilled) labour from all Project communities. However, although the generations of employment opportunities, resulting from Project activities, are expected as a positive impact, there is a risk that conflicts could arise between local inhabitants and new comers or outsiders over such employment opportunities. Furthermore there is high risk that, unless Project employment by the Company and contractors is managed appropriately, nepotism would influence the recruitment procedure, meaning that people without connections would not get access to Project opportunities — namely employment and other livelihood benefits. This could lead to a moderate risk of social conflict.

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Mitigation Measures:

- The Company should work actively to promote local access to Project employment in both the construction and the operations phases.
- The Company needs to identify the skills that it needs for its construction and operations phases that could be provided as part of a community skills development program providing basic vocational training in the communities.

C) Hazard Prevention & Emergency Response

Definition

A major emergency in a works is one, which has the potential to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption both inside and outside the works. It would normally require the assistance of emergency services to handle it effectively. The overall objectives of the emergency plan will be:

- To localize the emergency and, eliminate it; and
- To minimize the effects of the accident on people and property.

Elimination will require prompt action by operations and works emergency staff using, for example, fire-fighting equipment, water sprays etc. Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and giving information promptly to people living nearby.

Emergency Planning

Emergency Response or Disaster Management Plan for a Wind Farm is necessarily a combination of various actions which are to be taken in a very short time but in a present sequence to deal effectively and efficiently with any disaster, emergency or major accident with an aim to keep the loss of men, material, plant/machinery etc. to the minimum.

The main functions of the Disaster Management Cell are to prepare a detailed Disaster Management Plan, which includes:

- Identification of various types of expected disaster depending upon the type of the power plant.
- Identification of various groups, agencies, departments etc. necessary for dealing with a specific disaster effectively.

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- Preparation by intensive training of relevant teams/groups within the organization to deal with a specific disaster and keep them in readiness.
- Establishment of an early detection system for the disaster.
- Development of a reliable instant information/communication system.
- Organization and mobilization of all the concerned departments/ organizations /groups and agencies instantly when needed.
- A major disaster that can be expected in this proposed project be due to fire.

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6-0 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN [EMMP]

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6.0 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN [EMMP]

6.1 Environmental Management Plan

This section of the report presents a draft outline of Environmental & Social Management Plan (ESMP) setting out the management framework for how the environmental and social elements of the Project will be managed from construction to operations.

The Environmental Management Plan (EMP) will be used to ensure that the proposed Wind Farm is operated with minimum environmental impact as permissible under the National Environmental Quality Standards Pakistan (NEQS). In order to accomplish this objective, the environmental management systems described will comprise the following:

- Environmental Management Plan,
- Environmental Monitoring Plan (EMtP), and
- Resources Implementation and Training Program.

This EMP will serve as a guideline for the minimum requirements of the detailed procedure to be developed, updated and revised as needed throughout the construction and operation phases of the Project. The construction vendor will be responsible for preparing and implementing a detailed worker health and safety plan, a copy of which should be provided to project proponent prior to start up of construction activities.

It should be stated that full-time monitoring will be required both during the construction phase and operations phase of the project. The EMP task will likely be administered by the "Environment, Health and Safety (EHS) Department", who will have the authority where necessary to "stop the job" if an environmentally detrimental activity is being conducted.

The EMP operation/implementation will be the responsibility of the "EHS Officer", who will be coordinating, arranging the collection and reporting of the results of all emissions, ambient air quality, noise and water quality monitoring. Environmental Management Plan includes the protection, mitigation and environmental enhancement measures to be implemented to reduce to the minimum the adverse impact on the environment. The adverse environmental impacts during the functional phase of the proposed project under normal operating conditions are from bird mortality/ avian impact, noise and solid waste generation.

Environmental Management Plan (EMP) is presented in this section. Mitigation measures to address the environmental issues during construction of the project

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are discussed in Chapter-5. The mitigation measures essential to meet the requirement during operation of the proposed project are described in Chapter-5.

Monitoring recommendations are presented in this report for documenting the compliance of the project to the NEQS Pakistan.

The EPC Contractor will be required to establish a team of environmental and social (E&S) professionals that will operate the Environmental Management System (EMS) and undertake all additional studies that will be required during construction. This E&S team will be supervised by the Company Project Team, and will be subject to regular monitoring and auditing.

At this stage many of the detailed requirements have not been finalized, but it will be necessary for the proponent to specify the key deliverables and targets for both themselves (proponent issues) and for the Contractor.

In recent years for projects such as this, the aspect of delivery of project E&S commitments has come to the fore and good practice includes development of control plans in a transparent manner as part of the Environmental Action/Management Plan. Such plans are visible and auditable by any of the Project management stakeholders, including the Client representatives. Whilst at this stage they may be viewed as onerous, they should prove to be an effective tool for efficient delivery and compliant performance.

In simple terms they present the 'how' and 'when' of activities that have potential E&S implications and should be supported by a range of approaches to remedy any problems encountered. These approaches include for example 'Toolbox Talks', which is an industry-wide accepted mechanism for delivering ongoing training during construction. It is expected that the Contractor will develop a series of 'Toolbox Talks' on various technical issues, for example approved traffic route adherence, cleaning up of oil and fuel spillages, following the chain of custody for all waste leaving work sites and so on.

An important mechanism for commencing work with due recognition of E&S standards. It is expected that the Contractor will put all Project staff through an initial Project induction, covering health and safety standards and an overview of E&S Project values, requirements, standards and approaches.

6.2 Waste Management Plan (WMP)

This plan will cover all aspects of waste and wastewater management and staffing during construction, including implementation of practice standards such as reduce, re-use and recycle. The WMP will include details of temporary waste storage, waste transfer and pre-treatment prior to final disposal or recycling. Licensed/approved facilities for solid and liquid waste disposal must

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be used and a duty of care and chain of custody for all waste leaving the site will be followed. As part of the plan, the Contractor will be expected to produce waste handling forms for chain of custody, which will be used to control waste leaving site. Thus the waste controller will keep a copy of the form and the driver will always carry a copy and will ensure that the load is signed for at the final disposal site. All records will be kept by the Contractor for audit purposes and to demonstrate that the Project is complying with good international industry practice and applicable legislation.

6.3 Oil and Fuel Storage Management Plan (OFMP)

This plan will cover all storage, transportation and usage of lube-oils and fuel (naphtha). All oils and fuels will be required to be stored within secondary containment of 110 % capacity and all spillages shall be cleaned up immediately. All categories of spillage will be reported in accordance with the Plan to be developed by the Company. 'Toolbox Talks' would be expected to be delivered on an ongoing basis as 'continued training' and following any significant incident.

6.4 Construction Related Management Plan

This plan will set out the management of construction related effects, in particular covering dust and noise management to reduce disruption to local communities. The plan will provide details of the overall approach to noise and dust management and will link to the social management function, such that residents may contact the Contractor with grievances for their redress.

6.5 Emergency Response Plan

The emergency procedures state the site contingency plans that cover all potential accidents and incidents during both construction and operation. Specific emergency procedures will be developed by the Contractor (during construction) and the proponent (during operation) which will define the control mechanisms, operational requirements and other controls during such events. These procedures will determine the response to incidents on the Company's Project sites such as spills, fires, or personnel injury or rescues. Training programs will be required for workers to ensure an appropriate response in case of accidental events. The Emergency Response Procedures should be developed by the EPC Contractor shortly after mobilization.

6.6 Environmental Monitoring Plan

A preliminary monitoring plan will be required to allow a comparison with baseline sampling protocols and locations. However, as is often the case when a contractor mobilizes, there is expected to be a discussion on monitoring

6.4



locations, parameters and frequencies. This is due to the fact that monitoring for many parameters is expensive and time consuming and the contractor will always want to conduct monitoring of features for which there is a reasonable linkage i.e. source-pathway-receptor. Thus it is anticipated that this discussion to establish the final monitoring programme will be held shortly after mobilization and involve the Company and the Contractor.

6.6.1 Noise

An ambient noise measurement program should be instituted upon initiation of the construction of the project. The monitoring program should consider the noise limits during day-time and night-time at the closest point of public contact.

A noise survey both within operational areas and at the site boundary should be undertaken at regular intervals during the construction and operation phases not less than once every 12 months (during operation). Additional monitoring may be required at various times in response to public complaints (if any), in order to verify that noise emission limits are being met.

In the initial stages of WEPP operation, immediately following commissioning of the wind farm, noise monitoring will be undertaken both within the site, at the site boundaries and at selected receptor locations up to a distance of approximately 0.5 miles from the proposed site. These monitoring results will be compared with the baseline noise levels monitored at the same positions prior to the commencement of plant construction activities.

The monitoring will therefore verify whether the WEPP is operating to the levels specified. The monitoring results will also act as a valuable database of baseline noise levels achieved during normal operation of the plant, for different meteorological and station conditions. This baseline will help determine the need for any subsequent design changes or for mitigation of noise levels in the power station area.

6.6.2 Maintenance

The plant will be maintained to ensure that noise impacts to the environment are minimized. Records will be kept to show what maintenance has been carried out.

6.6.3 Avian Mortality

A regular record of the avian/migratory birds mortality should be maintained and shared with local organizations like World Wildlife Fund.

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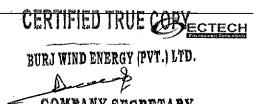
6.6.4 Assigning responsibility for implementation (by name or position)

The WEPP operational workforce will include the Environment Officer (EO). This officer will be suitably trained and be responsible for the following:

- Ensuring that environmental protection procedures are followed;
- Coordinating environmental monitoring;
- Acting as a contact person for liaison with the public, local organizations and Government;
- Ensuring that data on all environmental aspects of plant operation is continuously updated, and available in a form suitable for immediate inspection by authorized personnel of the concerned Environmental Protection Agency (EPA) and internal authority of the plant;
- Monitoring hazardous substances on-site to ensure that the possibility of accidental release is minimized;
- Promoting on-site environmental awareness, and;
- Liaison with the concerned Environmental Protection Agency (EPA) and other local industry.

In order to ensure implementation and effective operation of the EMP, it is of utmost importance that responsibilities be fixed to specific persons so that each one of them should be answerable in case of lapse or mishap. Accordingly, hereunder the same responsibilities have been described:

Official Concerned	Responsibility
1- WEPP Manger	i-Ultimate in-charge and responsible for all the operations of Environmental Management Plan (EMP) set up. ii- He will be responsible to ensure smooth functioning of the EMP system iii-Daily progress on the state of the environmental status will be reported to him in writing by the Shift Engineer/In -charge. iv- He will work as bridge between the Government concerned authorities and the senior most management of the project. v- He will be answerable to the higher management in all matters relating to E.M.P. and report at least monthly about the state of the E.M.P. operations.
2- Environment Officer	i – Responsible for implementation of EMP. ii – Coordination with other



depart	:ments/section	ons with resp	ect	to EMP.	
iii —	Arranging,	collection	&	reporting	of
enviro	nmental moi	nitoring data	an	d publishing	g of
report					

6.6.5 Reporting and reviewing procedures

Environmental monitoring program, as described above, will be the guiding principle and reporting will be done regularly on monthly basis according to the formats of the Self Monitoring and Reporting by Industry (SMART) program as annexed in ANNEXURE-VI.

All monitored data will be reviewed and scrutinized on monthly basis at the WEPP Manager level. The same review of the data will be done twice at the level of the Project Director or Chief Executive. The data will be documented according to appropriate format at the project level. Discrepancies will be duly addressed to.

6.7 Training needs

In order to effectively operate the EMP all the staff to be engaged in this activity should be trained extensively.

The designated Environment Officer will be charged with an ongoing program of environmental training. This will include:

- General promotion of environmental awareness;
- Specific training for staff working in sensitive areas;
- Updating staff on changes to environmental standards; and
- Reporting to staff on the station's environmental performance.

6.8 Social Management Plan

Recommendations and Mitigation Measures

Based on the initial benchmark study following recommendations are made:

• The management of the Project can capitalize on the positive attitude of the people of area towards proposed Project by offering them maximum employment opportunities at the construction stage and stage of operational phase of the power plant.

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- Insufficient and inadequate socio-economic structure of the community of the area also provides ample opportunities to Company management to win sympathies of local people in their favor, by introducing meaningful and manageable plan of community development.
- Sustainable development approach through conservation of natural resources would be the best strategy to compensate negative socioenvironmental impacts.
- Plant management should offer technical training opportunities to the local youth, if possible, to remove relative sense of deprivation.
- Social responsible attitude and stewardship of company management towards local people and resources can make project people friendly.
- Prior to action of the Project installation a comprehensive awareness campaign may be launched at masses level to avoid any conflict.
- To avoid any political, ethnic and value conflict, the administration of the plant may win the confidence of local powerful elites, authorities, leaders and interest groups by adopting informal confidence building measures.

6.9 Auditing and Management Review

An auditing programme is a key component of many EMPs. The primary purposes of the audit programme are:

- To verify continued conformance with respect to all applicable laws and regulations and to the Company's internal policy and procedures;
- To confirm the continued existence and efficacy of management systems to ensure compliance and performance; and
- To assist in the identification of actual and/or potential risks.

The benefits of the audit programme are:

- Assistance to management in identifying and prioritizing activities and/or practices that have opportunities for improvement;
- Reduction in risk through identification of areas of concern and triggering of appropriate corrective action; and
- Assistance with benchmarking and measuring improvement in management system performance.

The benefits of the review process are detailed below:

- Assess whether company personnel have complied with policy and procedures using audit reports;
- Review targets, objectives and environmental performance indicators to establish their continued correctness in the light of changing

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environmental impacts and concerns, regulatory developments, concerns among interested parties, market pressures, internal changes/organizational activity changes and changes in the environment;

- Determine if targets and objectives are being met;
- Review regulatory compliance and whether EMP requirements have been achieved.
- Determine root causes of systemic non-conformances;
- Determine if the operational controls, procedures, corrective actions, preventative measures and continuous improvement efforts have resulted in enhanced environmental performance;
- Determine if energy efficiencies, accounting practices and information management systems are adequate;
- Determine areas of improvement in organizational structure, staff training, work instructions, processes, pollution prevention programs, energy utilization and accounting practices, which may lead to environmental opportunities and increased profit margins;
- Formulate corrective actions and preventative measures as a result of the review of system non-conformance and verify corrective actions are effective and appropriate.

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7.0 PUBLIC INVOLVEMENT AND CONSULTATION

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7.0 PUBLIC INVOLVEMENT & CONSULTATION

While conducting Public Consultations/Disclosure, the following Performa, appearing as ANNEXURE-X were used and the data collected through them have been used for all calculations as appearing in this Section:

- Moderators Guidelines
- Interview Schedule-Part I (Baseline Conditions of the Area)
- Interview Schedule Part II (Community Awareness and Perceptions)
- Public Consultation Performa-Views

On- site Public Meetings (PM) / Dialogues (D) were held. The participants included farmers, agriculturists, workers/labors, religious people; leaders of the villagers etc., the participants were fully apprised of the project details. Free and frank discussions were held among the participants about the various aspects of the project. Questions by the participants were replied in due details. Thereafter, written comments of the group leaders of the participants were recorded. The group leaders represented a large number of the people under their influence.

7.1 Community Awareness and Perception about the Project

During Public Consultations/Disclosure, it was revealed that a large majority of the people of the study area follow the basic professions like agriculture, labour, very small shops etc. A large number of the people from the area also work, mostly as labor in other cities like Thatta, Hyderabad and Karachi.

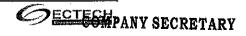
The human settlements in the study area are in the form of very small villages (Goths). The people are traditionally conservative. Social cohesiveness, solidarity, religious and political harmony are the major characteristics of the villages.

Community Awareness and Perception about the Project as experienced during Public Consultations/Disclosures are summarized as below:

- By and large, some people of the project area are aware of siting of the project.
- The people have clear perception that the installation of the power plant in the area is beneficial for the community especially and the area in general.
- Public invasion by the outsiders will not take place because the wind farm is to installed in the land owned by the project proponent.

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- Because of the serious long duration "shut downs of electric power" all over Pakistan, the people appreciate that the Wind Power Plant will be a blessing to reduce the big gap between energy demand and supply.
- Study findings depict that the people of the study area perceive overall positive impacts as a result of installation of the plant. Therefore, their attitude towards the project installation is quite positive.
- As far as the Initial Environmental Examination (IEE) is concerned, positive social impacts are dominant and hardly any negative social impacts were observed during the study.
- The people have good expectations and hope from the plant activity and its management.
- They correlate their positive attitude towards the plant with many direct and indirect socio-economic opportunities and benefits in the form of appreciation of their land especially along with possibility of industrialization of the area.
- The people believe that installation of the power plant in the area, especially during construction phase will open up employment opportunities which in turn follow a chain of indirect socio-economic benefits.
- They also perceive accelerated economic activity due to the business opportunities likely to emerge in the area. Directly or indirectly, some reasonable number of the local people will get employment and business from the installation of the plant e.g. shop keepers, traders, suppliers, vendors, transporters, technicians etc.
- People foresee many socio-cultural and psychological positive impacts on their lives and the community.
- They feel that the plant and its related activities will provide a strong base for social and economic change.
- They reckon that influx of the people and technology in the area will improve the quality of life of the people. It will also improve the level of general awareness of the people about different aspects of life.

A critical analysis of the findings of the Public Involvement/Consultations is presented hereunder:

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7.1.1 Geographical representation of the study

Geographical representation of the study area comprises the following localities situated in the area of influence of the project:

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Name of the Village/locality	Number of Houses (approximate)	Approximate distance from the plant site (km)	App. population (Nos.) (approximate)	Education facility	Medical care availability	Gas availability	Electricity availability	Potable water availability
1-Ghote Muhammad Ibrahim Jokhio	40	5.0	500.0	No	No	Yes	Yes	Rain Water
2-Muhannad Ismail Jokhio	12	4.0	60.0	ON	ON O	ON	Yes	Hand pump/Canal
3-Ghote Gull Shair Jokhio	150	6.0	2500.0	-P.Sc. (B)	No	No	ON	Hand Pump
4-Ghote Khuda Bakhsh	40	2.0	1000.0	-P.Sc. (B)	ON	No	No	Rain Water
5-Ghote Malla	23	3,55	500.0	Ċ	Š	Q.	S	Rain Water
6-Ghote Daras	35	5.0	400.0	S ON	e on	e o		Rain Water
7-Ghote Raiees Dildaar Jokhio	30	3.0	200.0	-P.Sc. (B, G)	ON	No	Yes	Hand Pump
8-Ghote Ali Gohar Jokhio	10	5.0	40.0	O.	No	No	No	Rain Water

HSS-Higher Secondary School; M.Sci.-Middle School; P.Sc. Primary School; (B) for boys; (G) for girls. BHU-Basic Health Unit; PC-Private Clinic; CH; Civil Hospital; RHC--Rural health Centre

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Major topographic characteristics, socio-economic indicators, socio-cultural practices and environmental conditions of all the localities are very much similar.

Some of the people of all the referred localities are directly or indirectly aware about the installation of the power plant, before these PCs. The people perceive many positive impacts during the construction and operational phase of the plant with regard to the job opportunities. They believe that the project will have direct positive impact on their employment.

This shows that people directly co-relate their benefits with the installation of the plant. People consider that this economic activity will also be beneficial for the economic development of Pakistan.

7.1.2 Awareness Level Regarding the Project

Table- showing the level of awareness

	Level of Awareness (%)						
Name of Village	High +ve	Medium +ve	Low +ve				
Ghote Muhammad Ibrahim Jokhio	91	6	3				
Muhannad Ismail Jokhio	67	20	13				
Ghote Gull Shair Jokhio	85	9	6				
Ghote Khuda Bakhsh	72	18	10				
Ghote Malla	58	26	16				
Ghote Daras	65	23	12				
Ghote Raiees Dildaar Jokhio	76	17	7				
Ghote Ali Gohar Jokhio	80	15	5				

Note: +ve means positive

OVERALL SCENARIO

Level of Awareness	Percentage (%) [rounded off]
High	74
Medium	17
Low	9

For commentary/explanation of the above figures, refer to the foot note under the heading

"People's Perception Level Regarding the Project." Serial 7.1.3 below

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7.1.3 People's Perception Level Regarding the Project

	Lev	vel of Awarenes	s				
Name of Village	(%)						
	High +ve	Medium +ve	Low +ve				
Ghote Muhammad	86	9	5				
Ibrahim Jokhio							
Muhannad Ismail	71	19	10				
Jokhio							
Ghote Gull Shair Jokhio	83	13	4				
Ghote Khuda Bakhsh	75	16	9				
Ghote Malla	64	22	· 14				
Ghote Daras	68	20	12				
Ghote Raiees Dildaar	79	13	8				
Jokhio							
Ghote Ali Gohar Jokhio	82	11	7				

Note: +ve means positive

OVERALL SCENARIO

Level of Perception	Percentage (%)
High	7 6
Medium	15
Low	9

It is evident from the figures in the above table under the caption "Overall Scenario" a vast majority of the people of all localities of the area show high level of positive perception and attitude towards the plant installation. They perceive that the plant will help to improve the socio-economic conditions of the community and the area.

7.2 Social-Economic Impacts Perceived by the People of the Study Area

The locality-wise assessment of the perceived socio-economic impacts of construction and operation of the power plant is as below:

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7.2.1 Perceived Positive Impacts During Construction Phase

Positive Impacts During Construction				Name of	[†] Village			
	Ghote Muham mad Ibrahim Jokhio	Muhan nad Ismail Jokhio	Ghote Gull Shair Jokhio	Ghote Khuda Bakhsh	Ghot e Malla	Ghote Daras	Ghote Raiees Dildaar Jokhio	Ghote Ali Gohar Jokhio
Employment Opportunities %	60	25	40	18	15	17	20	35
Business Development %	45	16	28	15	10	13	15	22

Note:Perception of people interviewed.

From the table, it is obvious that the majority of the people perceived that the employment and business development would be the positive impacts on the community especially during the construction phase of the plant.

7.2.2 Perceived Negative Impacts During Construction Phase

Perceived Negetive Impacts During	Name of Village Ghote Muhannad Ghote Ghot								
Construction	Muhammad Ibrahim Jokhio	Ismail Jokhio	Gull Shair Jokhio	Khuda Bakhsh	Malla	Daras	Raiees Dildaar Jokhio	Ali Gohar Jokhio	
Road deterioration/blockade %	20	20	10	35	25	40	15	10	
Noise %	40	15	25	30	20	15	35	40	
Dust %	15	30	35	15	15	10	25	15	
Heavy Traffic %	10	15	10	10	25	20	10	20	
Smoke emissions %	15	20	20	10	15	15	15	15	

Note: Perception of people interviewed

OVERALL SCENARIO

Perceived Negative Impacts During Construction	Percentage (%)
Road deterioration	22
Noise	28
Dust	20
Heavy Traffic	15
Smoke, Emissions	15

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People perceived, more dominantly, the negative impacts of the plant during the construction phase especially road blockade due to heavy traffic, noise, dust emissions and smoke than those by the people of the remaining localities during construction phase of the power plant.

7.2.3 Perceived Positive Social Impacts During Operation Phase

Perceived Positive	. •							
· Social			ľ	Name of Vi	llage			
Impacts During Construction	Ghote Muhammad Ibrahim Jokhio	Muhannad Ismail Jokhio	Ghote Gull Shair Jokhio	Ghote Khuda Bakhsh	Ghote Malla	Ghote Daras	Ghote Raiees Dildaar Jokhio	Ghote Ali Gohar Jokhio
Employment opportunity	60	20	25	20	10	4-5	,	
%	60	30	25	20	10	15	45	55
Business development %	35	17	20	15	13	20	25	40
Road Development %	78	20	17	17	20	25	30	35
	//	20	1.7	17	20	23	30	33
Telephone %	40	10	10	10	15	15	20	25
Natural Gas %	0	0	0	0	0	0	0	0
Health Facilities %	55	12	12	20	20	25	30	35
Educational Facilities %	45	20	15	15	15	25	40	30
Recreational Facilities				15		25	40	30
%	0	0	0	0	. 0	0	0	. 0
Transport %	60	17	17	15	15	25	25	20
Technical Training Centers%	65	20	10	15	15	20	20	25

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OVERALL SCENARIO

Perceived Positive Impacts	Percentage (%)
Employment opportunity	32
Business development	23
Road Development	30
Telephone	18
Natural Gas	0 .
Health Facilities	26
Educational Facilities	25
Recreational Facilities	0
Transport	24
Technical Training Centers	23

By and large, a large majority of the people of the localities in the study area are favorable to the siting of the power plant in the area. They expect many positive, conducive and constructive impacts on their economic life and community, regarding employment and business opportunity.

7.2.4 Perceived Negative Social Impacts during Operation Phase

Perceived Positive Social Impacts During Construction									
	Ghote Muhammad Ibrahim Jokhio	Muhannad Ismail Jokhio	Ghote Guil Shair Jokhio	Ghote Khuda Bakhsh	Ghote Malla	Ghote Daras	Ghote Raiees Dildaar Jokhio	Ghote Ali Gohar Jokhio	
Employment					7	3	3	5	
opportunity %	15	· 3	2	7 ·				-	
Business development %	30	7	5	7	2	5	2	5	
Road Development %	10	5	5	3	2	3	2	2	
Telephone %	20	9	9	5	7	7	5	7	
Natural Gas %	0	0	0	0	0	0	0	0	
Health Facilities %	17	3	3	3	5	5	2	2	
Educational Facilities %	25	5 .	0	0	7	0	5	3	
Recreational Facilities %	0	0 .	0	0	0	. 0	0	0	
Transport %	30	8	7	3	2	5	3	2	
Technical Training Centers%	0	0	0	0	0	0	0	0	

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OVERALL SCENARIO

Perceived Negative Impacts	Impact (%)				
Environmental pollution	23				
Fear from the people invasion	35				
Fear to cultural values	. 15				
Employment fear from outsiders	43				
Noise	25				
Heavy Truck traffic	17				
Water Shortage	0				
Deterioration of grazing land	27				
Diseases	21				

Some people apprehend that pollution may cause problems to them and the community.

Due to job opportunities for males, there will be improvement in the income status of their family which in turn will improve living standards including food, clothing and chances of getting education especially the women.

The Pakistan society follows Islamic values in all walks of life including sociocultural values where free intermixing of male and female is not permitted and neither liked nor practiced. Therefore, influx of mainly male workers and camp followers will not change the gender balance in the areas of construction sites and workers camps. So also there will not be any danger of sexual exploitation. Consequently, no chance of spread of alcohol and drug abuse and health risks like HIV/AIDS.

From the above facts one can conclude that many positive economic and social impacts will appear in the quality of lives of the people of Study Area due to the power plant installation. These positive impacts include improvement in female status, employment and business opportunities, infrastructure development, generating income resources and improving quality of life.

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8.0 GRIEVANCES REDRESSING MECHANISM

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8.0 GRIEVANCES REDRESSING MECHANISM-FORMAL AND INFORMAL CHANNELS

8.1 Formal Channel

8.1.1 Environmental Legislation

The Pakistan Environmental Act (PEPA) -1997 (ANNEXURE-I) provides a complete code of conduct for addressing grievances stemming from damages to any sector of the environment from the project activities.

The project is required to operate at least 95 % of its operational period in strict compliance with the required emission standards of Pakistan as provided in the Pakistan Environmental Protection Act 1997 and the National Environmental Quality Standards (ANNEXURE-V). This ensures that the project proponent is legally bound to observe all legal requirements to avoid damaging the environment around the project.

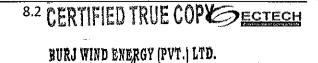
8.1.2 Pakistan Environmental Act and Environmental Management

The Pakistan Environmental Protection Act (PEPA)-1997, covers aspects related to the protection, conservation, rehabilitation and improvement of the environment and the prevention, control of pollution and promotion of sustainable development. Being the prime environmental law, Pakistan Environmental Protection Act-1997 establishes complete regulatory and monitoring bodies, policies, rules, regulations and national environmental quality standards. To ensure enforcement, the act establishes regulating bodies i.e. Pakistan Environmental Protection Council (PEPC) and responsible bodies i.e. Pakistan Environmental Protection Agency (Pak-EPA) at Federal level and Environment Protection Agencies at Provincial level. The act extends to the whole of Pakistan including its territorial waters.

EPA Sindh, in which jurisdiction falls, has the power to arrest without warrant any person against whom reasonable suspicion exists of his having been involved in an offence under the PEPA-1997, and enter, inspect and search without warrant any premises, vehicle or vessel. It also provides for seizing any plant, machinery, equipment, vehicle or substance, record or document. Pak-EPA also provides the power to summon and enforce the attendance of any person and issuance of Environmental Protection Order 16 (EPO 16) in relation to a person who is contravening a provision of the PEPA-1997.

8.1.3 Enforcement of PEPA and Liability

The Government of Pakistan is bound to protect the environment in accordance with its international commitments under various conventions and treaties it has



signed or ratified. The PEPA-1997 translates these commitments into a compliance programme for the industrial establishments. Non-compliance to these commitments may result in loss of credibility, popularity and even financial aid from the international forums.

The EPA Sindh is directly responsible for enforcement of rules and regulation relating to environmental management/ protection in the Sindh province.

The PEPA- 1997 requires:

- That no person (including companies) under its purview will discharge or emit any effluent or noise in contravention of the National Environmental Quality Standards.
- That no proponent of a project shall commence construction or operation unless he has filed with the Pak-EPA or provincial EPA in whose jurisdiction the project falls, an Environmental Assessment report according to the sensitivity of the project or where the project is likely to cause an adverse environmental impact.
- That no person may dispose of waste on public land or on highway on or a land owned or administrated by a local council, unless done in accordance with the provisions of the Pakistan Environmental Protection Act-1997.

The following section of the PEPA -1997 further clarifies the mechanism of Environmental Management and Grievance Redress Mechanism.

Section 11:

Prohibition of certain discharges or emissions (1) Subject to the provisions of this Act and the rules and regulations no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the National Environmental Quality Standards or, where applicable, the standards established under subclause (I) of clause (g) of sub-section (1) of section 6."

(2) The Federal Government or the Provincial Government, in case the project falls in the later provincial jurisdiction, may levy a pollution charge on any person who contravenes or fails to comply with the provisions of sub-section (1), to be calculated at such rate, and collected in accordance with such procedure as may be prescribed.

Section 12:

Initial environmental examination and environmental impact assessment (1) No proponent of a project shall commence construction or operation unless he has

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filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the project is likely to cause an adverse environmental effects an environmental impact assessment, and has obtained from the Government Agency approval in respect thereof".

Section 16:

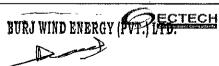
Environmental protection order (1) where the Federal Agency or a Provincial Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of the provisions of this Act, rules or regulations or of the conditions of a licence, and is likely to cause, or is causing or has caused an adverse environmental effect, the Federal Agency or, as the case may be, the Provincial Agency may, after giving the person responsible for such discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures that the Federal Agency or Provincial Agency may consider necessary within such period as may be specified in the order.

- (2) In particular and without prejudice to the generality of the foregoing power, such measures may include;
 - (a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;
 - (b) installation, replacement or alteration of any equipment or thing to eliminate, control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;
 - (c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances; and
 - (d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Federal Agency or, Provincial Agency.

Section 17:

Penalties (1) whoever contravenes or fails to comply with the provisions of sections 11, 12, 13 or section 16 or any order issued there under shall be punishable with fine which may extend to one million rupees, and in the case of a continuing contravention or failure, with an additional fine which may extend

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to one hundred thousand rupees for every day during which such contravention or failure continues:

Provided that if contravention of the provisions of section 11 also constitutes contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2) only.

(2) Whoever contravenes or fails to comply with the provisions of section 14 or 15 or any rule or regulation or conditions of any license, any order or direction, issued by the Council or the Federal Agency or Provincial Agency, shall be punishable with fine which may extend to one hundred thousand rupees, and in case of continuing contravention or failure with an additional fine which extend to one thousand rupees for every day during which such contravention or failure continues.

Contraventions of the provisions of the PEPA-1997 is punishable with impressments extending up to five years, or with fine extending up to one million or with both. Where an offence is committed by a company every Chief Executive Officer (CEO) and the company shall be deem guilty of the offence. Action can even be taken against Government Agencies and Local Authorities.

Government may also constitute an Environmental Tribunal to hear cases relating to the PEPA-1997. The tribunal may only hear cases when the complaint is made in writing by Pak-EPA, or Local Council or any aggrieved person who has given at least thirty days notice to Pak-EPA of the offence and of his intension to make a complaint to the Tribunal. The Tribunal may also hear appeals from the Agencies. Appeals from the tribunal shall go to the High Court.

In order to resolve the disputes relating to the environment issues, Environmental Tribunal Rules 1999 has been promulgated. In trying the offences, the tribunal has to follow the Code of Criminal Procedures 1898. The tribunal shall send the copies of his orders to the parties concerned and the Director General of the Federal EPA and Provincial EPAs. The Tribunal shall dispose of its proceedings within 60 days. An appeal to the Tribunal, accompanying a copy of the impugned order, copies of the documents relied and prescribed fees, shall be sent to the Registrar by the appellant. Generally the proceedings of the Tribunal shall be open.

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8.2 Grievance Redress Mechanism-Informal

8.2.1 **Compensation for Environmental Damages**

As described under serial 9.1.1 above, since the project is also to follow the World Bank (WB) & IFC emission standards, therefore, it is required to operate at least 95 % of its operational time in compliance with the required emission standards of the WB. This ensures that the project operation is legally bound to observe all legal requirements to avoid damaging the environment around the project.

Secondly, as described under serial 9.1.1 under the Pakistan Environmental Protection Act-(PEPA), 1997, the likely damages to be caused to any sector of the environment or property or else will be paid to the affected parties.

Thirdly, under the PEPA -1997, the EPA of the concerned province and the Environment Tribunal can legally prosecute the project proponent for the damages to occur from the pollution generation from the project.

There is complete legal cover to address issues related to compensation for any environmental damage arising out of project activity. However, to address any such issues more expeditiously, the project administration will have a local committee as an Informal Mechanism (IM).

This Informal Mechanism will provide convenient, quick and cost effective decisions for compensation against any environmental damages that occur from the project activity. This informal mechanism will also build confidence between the project administration and public and safeguard the interests of both the project and the public at large.

The project administration, therefore, proposes the following committee at the local level for amicable and speedy resolution of cases pertaining to any environmental damages that likely occur from the project activity. The decision of the committee will be executed in letter and spirit.

8.2.2 Constitution of the Committee:

Chief Executive of the Company or his nominee:

Chairman/Chief

Head of the District Government, Thatta

Ex-officio Member

Head of the District Local Self Government

Ex-officio Member

A dignitary of the project area

Member

Head HSE Department of the project

Member

Representative of the NGO

Member

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Representative of the aggrieved person

Member

An Environmentalist

Member

8.2.3 Time Schedule for Redressing the Grievance

- The committee will be under obligation to decide the grievance within four weeks of the complaint by the aggrieved party.
- Compensation as decided by the committee will be paid to the aggrieved party within one week from the date of decision of the committee.
- The decision of the committee will be binding on both parties, i.e., the project administration as well as the aggrieved party.

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9.0 POTENTIAL CDM CREDITS

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9.0 POTETIAL CDM CREDITS

9.1 The Current Situation

The current commitment period of the Kyoto Protocol extended further for the next 5 years. The required commitments of Annex 1 countries (industrialized and countries in transition which have ratified the Kyoto Protocol) beyond 2012 are currently still unclear and therefore the future market for Certified Emission Reductions (CERs).

Participants of the World Bank's present set of Carbon Funds are primarily interested in buying CERs from projects that will generate sizeable CERs before the end of 2012.

With the regulatory period of the Kyoto Protocol ending in 2012, though extended further for another 5 years, there is even then a period of uncertainty regarding the future international climate regime.

As a response to these challenges, the new proposed Carbon Partnership Facility is designed to develop emission reductions and support their purchase over long periods after 2012. "Learning by doing" approaches will be an essential aspect of the "Carbon Partnership Facility" as it moves from individual projects to programmatic approaches, including methodologies needed for such approaches.

Because this project will not be formally registered in 2013 (at the earliest), in particular in the case of Pakistan which is considered a Low Income Country, rather than an LDC, this will limit the market for CERs. However, as the proposed Carbon Partnership Facility is implemented, there should be opportunities to enter the CERs marketplace.

9.2 The Kyoto Protocol

Basically, the Kyoto Protocol is an agreement under which industrialized countries agree to reduce their collective greenhouse gas (GHG) emissions by 5.2% below 1990 levels for the period from January 2008 until 2012. Countries have been divided into two general categories: Annex I countries which are developed countries who have accepted GHG obligations and Non-Annex I countries which are developing counties who have no GHG obligations. Pakistan falls into this latter category.

The Kyoto Protocol includes three "flexible mechanisms" which are intended to lower the overall costs of achieving emission targets. The flexible mechanisms

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enable Annex I countries to meet emission targets by taking credit for carbon reductions in other countries. The three flexible mechanisms are:

- i- ET (Emissions Trading),
- ii- JI (joint Implementation) and
- iii- CDM (Clean Development Mechanism).

Emissions Trading:

Each Annex I country is given a certain number of AAUs (Assigned Amount Units), which represent the total amount of GHG that the country is allowed to emit in the first commitment period (2008-2012). The AAUs are tradable units that represent $1tCO_2e$ (ton of CO_2 equivalent). Countries can trade AAUs to help meet emissions targets. Alternatively an individual firm can purchase AAUs to meet its own emissions targets.

Clean Development Mechanism:

The CDM allows industrialized countries to meet their domestic emissions targets by purchasing GHG reduction credits from *non-industrialized* countries as an alternative to achieving 100% of the required emissions reductions within its own borders. Since non-industrialized countries have no emissions reduction targets, they have nothing to lose by allowing another country to take credit for emissions reductions. In order to take credit for the reduction, the project developer must demonstrate that the total emissions have been reduced below the business as usual scenario.

Joint Implementation:

Joint Implementation (JI) allows industrial countries to meet their domestic emission reduction targets by purchasing GHG credits from other industrialized countries as an alternative to achieving 100% of the required emission reductions within their own borders. Most JI projects are expected to take place in countries with economies in transition in Eastern Europe and the former Soviet Union for example, where the cost of reducing emissions is considerably lower. JI projects are much less common than CDM projects. This is especially the case for Pakistan.

9.3 CDM Overview

There are many steps to be taken for a CDM project from an idea to eventually generating cash. Hereunder, are outlined different types of CDM projects, the project cycle, and the methods for calculating emissions reduction, and the various ways the CERs can be monetized? FRTIFIED TRUE COPY

Types of CDM Projects:

There are seven types of CDM projects:

- 1. Energy Efficiency -Increase energy efficiency of buildings or commercial/industrial facilities.
- 2. Switch to less carbon intensive fuels
- 3. Methane Recovery Recover methane from animal waste, coal mines, landfills, wastewater sludge, or other sources
- 4. Industrial Process Change Change an industrial process resulting in reduced GHG emissions
- 5. Cogeneration Make use of waste heat from electric generation
- 6. Transport Improve fuel efficiency, Switch to less carbon intensive transport mode, and Reduce frequency of transport
- 7. Agricultural Any agricultural change that results in the reduction of GHG emissions
- 8. Land Use A forestation or reforestation

9.4 The Project Development Cycle

The CDM development cycle consists of the following steps.

1. Project Identification:

To qualify as a CDM project, the project must establish "additionally". Additionally refers to the incremental improvement over the business as usual scenario. Any project that would have been developed without the CDM process would not be considered additional. So the art in CDM projects is to fully justify this position.

2. Project Idea Note:

The developer can submit a project idea note (PIN) to potential carbon credit buyers to gauge the level of interest in the project. The PIN typically includes information on project size anticipated GHG reductions, suggested CER price, financing structure, other economic effects, etc.

3. Stakeholder Participation and Validation:

Local stakeholders are invited to comment on the Project Design Document (PDD) over a 30 day period. The PDD gives a description of the project and outlines the methods for measuring and calculating emission reductions. A report is created to show how relevant concerns were addressed.

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4. Host County Approval:

Host countries are given a great deal of leeway in choosing to accept or reject CDM projects. This approval is required.

5. Validation by Designated Operational Entity (DOE):

In the validation process, the DOE confirms that all the information and assumptions in the PDD are reasonable. DOEs are domestic or international entities that have been accredited by the CDM Executive Board. Typically the project developer is responsible for contracting with and paying the DOE. Validation does not guarantee the issuance of credits.

6. Registration:

Registration of the project with the CDM Executive Board is the act of final acceptance of the project.

7. Implementation and Monitoring:

Once the project is implemented, the project developer needs to monitor the project performance and submit monitoring results to the DOE for verification and certification. The monitoring results are used to determine the number of credits granted. Monitoring must be in accordance with validated monitoring plans.

8. Verification, Certification, and Issuance:

Verification is the periodic review and ex-post determination of GHG reductions. To avoid a conflict of interest, the DOE contracted for verification will generally be different from the DOE contracted for validation.

Certification is the written assurance by a DOE that the project has achieved a given reduction in GHG emissions. The DOE is liable for eventual mistakes, misrepresentations, and fraud. Certification is effectively a form of liability transfer. After certification, the CDM registry administrator will issue CERs by forwarding them to the appropriate accounts.

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10-0 CONCLUSIONS:

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10.0 CONLUSIONS:

The project embarks upon generation of power by installing a wind power plant with 13.5 MW capacity at Gujju. The project falls in B category requiring IEE Report for obtaining Environmental Approval (EA) from the EPA Government of Sind, Karachi.

It has been found at the end of this IEE report that:

- 1- The project has no gaseous and PM emissions.
- 2- Sewerage will be treated and reused at the project site for sprinkling on the unpaved site to reduce fugitive dust.
- 3- There are no sensitive elements / segments of environment around the project site,
- 4- EMP and EMtP as recommended in this IEE Report are to be put in place both during construction and operation phases of the project,
- 5- Annual all out environmental monitoring by a third party also certifies that the project will run in accordance with legal requirements,

On the basis of the IEE report, the project by all means, merits for installation, operation and for issuance of NOC from Sindh Environmental Protection Agency.

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ANNEXURE – B IEE APPROVAL



Reference No: EPA/2013 | 8 | 21 | I EE / 127 | 15 ENVIRONMENTAL PROTECTION AGENCY

GOVERNMENT OF SINDH
Plot # ST - 2/1, Sector 23, Korangi Industrial Area,

Karachi – 74900 Ph: 021 – 35065950, 35065621, 35065946

> epasindh@cyber.net.pk Fax No: 021 - 35065940 Date: 27-02-2018

Chief Executive Officer, Burj Wind Energy (Private) Limited, Karachi.

SUBJECT: EXTENTION IN APPROVAL OF INITIAL ENVIRONMENTAL EXAMINATION OF 13.5 MW OF BURJ WIND POWER PROJECT IN GUJJU, TALUKA DISTRICT THATTA

I am directed to refer to your letter reference no BWEP/SEPA/272/2017 dated: 27th November, 2017 regarding the subject noted above. After careful review of matter, Sindh Environmental Protection Agency (SEPA) extends its approval subject to compliance of the following conditions:

- 1. All mitigation measures recommended in the IEE report and the conditions laid down in the earlier approval issued vide letter No: EPA/2013/8/21/IEE/127 shall be complied in letter and spirit.
- 2. No violation of any regulations, rules, instruction and provision of SEP Act, 2014 shall be made and in case of any such violation of the rules/laws in the approval will stand cancelled without any further notice.
- 3. All the types of adversely effect of wind project on local environment shall be reduced by means of mitigation efforts that should be completed during the design, construction, and operation phase of wind warm by proponent in order to avoid damages to vulnerable ecological systems.
- 4. The proponent shall identify and report HSE and CSR performance in monitoring reports including near misses, accidents, lost time incidents (LTI).
- 5. All the environmental conditions of this approval shall be incorporated in the terms and conditions of Engineering, Procurement, Construction (EPC) & Operational & maintenance (O & M) tender document of the project for commitment and compliance,
- 6. The proponent shall be liable for compliance of SEP Act 2014 & EIA/IEE Regulations 2014, in force relating to conditions for approval, confirmation of compliance, entry, inspection and monitoring

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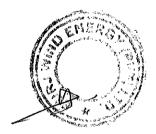
- 7. The proponent shall be liable for compliance of EIA/IEE Regulation 2014 of SEP ACT 2014, which direct for conditions for approval, confirmation of compliance, entry, inspection and monitoring.
- 8. The proponent shall submit the audit report through independent monitoring consultant and same shall be submitted to this agency.
- 9. The Proponent shall closely undertake the task of birds monitoring and same shall be submitted to this agency along with environmental monitoring reports.
- 10. 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.
- 11. This is issued with the approval of Director General EPA Sindh.

Deputy Director (Tech-1)
For Director General

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COMPANY SECRETARY

ANNEXURE – E SHAREHOLDING PATTERN



	Shareholding
Burj Capital	51%
JPL Holding Private Limited	49%
	100%

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BURJ WIND ENERGY (PVT.) LTD.

COMPANY SECRETARY



SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

LIKERI

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

[Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No. 0080255

I hereby certify that <u>BURJ WIND ENERGY (PVI.) LIMITED</u> is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is <u>limited by shares</u>.

Given under my hand at <u>Karachi</u> this <u>Twentieth</u> day of <u>June</u>. Two <u>Thousand</u> and <u>Twelve</u>.

Fee Rs. 4,500t-

(Sidney Custodio Pereira)
Joint Registrar of Companies

Kgrachi

No. 77178 dt. 21/10/13

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COMPART STORY

TRIRD SCHEDULE (Se section (30)

FORM A - ANNUAL RETURN OF COMPANY HAVING SHARE CAPITAL.

4. Registration No.	0080265		
2. Name of the Company	BURJ WIND ENERGY (PVT.) L	IMITED-	
3: Form A.mede upto- (Day/Month/Y.car)-	31/10/2017		
4 Date of AGM:(Day/Month/Yes;)	31/10/2017		Company
5-Registered Office Address:	16, Abdullah Hargon Rosd, 3rd	PART - A Floor, Faysal Benk Building, Kan	rachi Karaeli-Bindi
6: Emeil Address	saleem.caman@purjcsp.com		
7: Office.Tel. No:	30631536		
6. Office Fax No.			
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Name			
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14. Chief Executive			
Name-	Salesm uz Zaman	NIG 42301	11-0948355-8
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BURJ WIND ENERGY (PVT.) LTD.

COMPANY SECRETARY

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7. Legal Advisor James Jacobs B. Auditors J	lame	SALEEM UZ ZAMAN	NIC	42301094835	55			·.
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19. List of Directors on the date of Form-A National Operation of Director Address National Operation of Director Address No. F-52/2, Block 7, Collen Karachi Pakistan 4230163483555 SARD UZ ZAMAN NO.SE-52/2 BLOCK-7 CLIFTON Pakistan 4230164699977 ARACHI PARACHI P	Vama	UHY Hassan Nasem and Co.						
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THE COMPANIES ORDINANCE 1984

PRIVATE COMPANY LIMITED BY SHARES

ARTICLES

OF

ASSOCIATION

OF

BURJ WIND ENERGY (PRIVATE) LIMITED

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BULL WIND ENDROY (TVT.) LTD.

COMMANY SECRETARY

THE COMPANIES ORDINANCE, 1984

PRIVATE COMPANY LIMITED BY SHARES

ARTICLES OF ASSOCIATION

OF

BURJ WIND ENERGY (PRIVATE) LIMITED

1. The regulations contained in Table "A" in the First Schedule to the Companies Ordinance, 1984, ("the ordinance") shall not apply to the Company, except in so far as the same are expressly made applicable by the said Ordinance, or these Articles. The regulation for management of the Company, and for the observance thereof by the members of the Company, and their representatives shall, subject as aforesaid and to any exercise of the statutory power of the Company in reference to the repeal or alteration of a addition to its regulations by Special Resolution as prescribed by the said Ordinance; be such as are contained in these Articles.

INTERPRETATION

- in the interpretation of these Articles, the following expressions shall have the following meanings, unless repugnant to or inconsistent with the subject Articles.
 - 2.1: "The Ordinance" means the Companies Ordinance, 1984, or any statutory modification or re-enactment thereof for time being in force in Pakistan;
 - 2.2: "Board" means a Board of the Directors being the first Directors of the Company under the Ordinance and thereafter as elected by the shareholders, to act on their behalf in the management of the Company affairs;
 - 2.3: "The Company" or "This Company" means BURJ WIND ENERGY (PRIVATE) LIMITED;
 - 2.4: "The Directors" means the Directors and Alternate Directors for the time being of the Company, or as the case may be, the Directors and Alternate Directors assembled at a Board:
 - 2.5: "Dividend" includes bonus shares;
 - 2.6: "Month" means a calendar month:
 - 2.7: "The Office" means the Registered Office for the time being of the Company;

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BURJ WIND ENERGY (NVT.) LED.

COLTACT SECRETARY

- 2.8: "Persons" includes corporation as well as individuals firm, association of persons, etc.;
- 2.9: ___."The Register" means the Register of members to be maintained kept pursuant to the Ordinance;
- 2.10: "In Writing" means written or printed, or partly written and partly printed or lithographed or typewritten, or other substitute for writing:
- 2.11: Words importing singular number include the plural number and vice versa;
- 2.12: Words importing mosculine gender include the feminine gender.
- 2.13: Subject as aforesaid, any words or expressions defined in the Ordinance; shall, except where the subject or context forbids, bear the same meaning in these Articles.

PRIVATE COMPANY

- The Company is a "Private Company" within the meaning of sub section 2(1)
 (28) of the Ordinance and accordingly:
 - (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 (exclusive of persons in the employment of the Company), shall be limited to fiffy, 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 a single member; and
 - (3) The right to transfer shares of the Company is restricted in manner and to the extent herein appearing.

BUSINESS

4. The Company is entitled to commence business from the date of its incorporation. The business of the Company shall include all or any number 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.

SHARES AND CAPITAL

5. The authorized share capital of the Company is Rupees 500,000 /- (Rupees Five Hundred thousand only) divided into 50,000 (Fifty Thousand Only) ordinary shares of Rs. 10/- (Rupees Ten) each with powers of the Company to increase arreduce the same and to divide the shares into several classes.

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COLLIANT SECRETARY

- 6. The shares shall be under the control of the Board of Directors, who may allot or otherwise dispose off the same to such persons, on such terms and conditions and at such times, as the Board of Directors think fit. Shares may also be allotted for consideration otherwise than the cash.
- 7. Fully paid shares shall be allotted to all subscribers in the first instance and the Company shall not be bound to recognize any equitable, contingent, future or partial claim to, or interest in a share on the part of any person other than the registered share holder, save as herein provided, or saves as ordered by some Court of competent jurisdiction.
- 8. The certificate of title to shares shall be issued under the common seal of the Company.
- Every member shall be entitled to one certificate for the shares registered in his name, or at the discretion of the Directors, to several certificates, each for one or more of such shares.

TRANSFER AND TRANSMISSION OF SHARES

- 10. Every person whose name is entered as a member in the Register of Members shall without payment, be entitled to a certificate under the common seal of the Company specifying the shares held by the one or several persons. The Company shall not be bound to issue more than one certificate and delivery of a share certificate to any one of several joint holders shall be sufficient delivery to all.
- 11. The Directors may decline to register any transfer of shares to transferee of whom they do not approve, and shall be bound to show any reasons for exercising their discretion subject to the provisions of Section 77 and 78 of the Ordinance.
- 12. No share can be mortgaged, pledged, sold, hypothecated, transferred or disposed off by any member, to either member or non-member, without the prior sanction of the Board of Directors.
- 13. The legal heirs, executors or administrators of a deceased holder shall be the only persons to be recognised by the Directors as having title to the shares. In case of shares registered in the name of two or more holders, the survivors and the executors of the deceased shall be the only persons to be recognised by the Company as having any title to the shares.

BORROWING POWERS

14. Subject to the provision of the Ordinance, the Directors may from time to time at their absolute discretion raise or borrow any sum, or sums of money for the purpose of the Company from banks, tirms or companies, particularly a person holding the office of the Director, and may secure the payment of money in such manner and upon such terms, and conditions in all respects as they think fill particularly by the issue of debentures of the Company.

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making, drawing, accepting or endorsing on behalf of the Company any promissory note or bills of exchange, or giving, or issuing any other security of the Company.

- 15. Debentures and other securities may be made assignable free from any equities between the Company and the persons to whom the same may be issued.
- 16. Any debentures or other security may be issued at a discount, premium or otherwise, and with any special privilege as to redemption, surrender, drawing, allotment of shares, attending and voting at general meeting of the Company or subject to compliance of the provisions of the Ordinance.

RESERVES

17. The Directors may, from time to time, before recommending any dividend, set aside out of the profit of the Company, such sums as they think fit, as a reserve for redemption of debentures, or to meet contingencies for equalization of, or for special dividends, or for rebuilding, repairing, restoring replacing, improving, maintaining or altering any of the property of the Company, or for such other purpose as the Directors may in their absolute discretion think conducive to the interests of the Company.

GENERAL MEETINGS

- 18. A General meeting, to be called annual general meeting, shall be held, in accordance with the provisions of section 158, within eighteen months from the date of incorporation of the Company, and thereafter once at least in every year within a period of four months following the close of its financial year, and not more than lifteen months after the holding of its last, preceding annual general meeting, as may be determined by the Directors.
- 19. The Directors may, whenever they think lit, call an extra ordinary general meeting of the Company, whereby also be called on such requisition, or in default may be called by such requisitionists, as is provided by section 159 of the Ordinance.

NOTICE AND PROCEEDINGS OF GENERAL MEETING

20. At least Twenty-One days' for a general meetings (inclusive of the day on which the notice is served or deemed to be served, but exclusive of the day for which notice is given) specifying the place, the day and the hour of meeting and, in case of special business, the general nature of that business, shall be given in manner provided by the Ordinance, to such persons as are under the Ordinance, or the regulations of the Company, entitled to receive 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.

BURI WIND PRESIDE (PVT.) LTD

COMPARY SECRETARY

21. All businesses shall be deemed special if is transacted at an extraordinary general meeting, and also are transacted at annual general meeting, with the exception of declaring dividend, the consideration of the accounts, balance sheet and the reports of the Directors and auditors, the election of the Directors, the appointment of, and the fixing of the remuneration of the auditors.

QUORUM

- 22. No business shall be transacted at any general meeting unless a quorum of members is present at that time when the meeting proceeds to business; save as herein otherwise provided, members having fifty percent of the voting power present in person or through proxy and two members personally present will comprise quorum of the Company's meeting.
- 23. If within half an hour from the time scheduled for the meeting, a quorum is not present, the meeting, if called upon the requisition of members, shall be dissolved: in any other case, it shall stand adjourned to the same day in the next week at the same time and place, and, if at the adjourned meeting, quorum is not present within half an hour from the time scheduled for the meeting, the members present being not less than two, shall be a quorum.
- 24. The Chairman of the Board of Directors, it any, shall preside as Chairman at every general meeting of the Company, but if there is no such Chairman, or it at any meeting he is not present within fifteen minutes after the time scheduled for the meeting, or is unwilling to act as Chairman, any one of the Directors present may be elected to be Chairman, and if none of the Directors is present, or willing to act as Chairman, the members present shall choose one of their number to be the Chairman for a meeting.
- 25. The Chairman may, with the consent of any meeting at which the quarum is present (and shall if so directed by the meeting), adjourn the meeting from time to time, but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which the adjournment took place. When the meeting is adjourned for ten days or more, notice of the adjourned meeting shall be given as in the case of an original meeting. Save as aforesald, it shall not be necessary to give any notice of an adjournment of the business to be transacted at an adjourned meeting.
- 26. At any general meeting, a resolution put to the vote of the meeting shall be decided on a show of hands unless a poll is (before or on the declaration 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, being carried, or carried unanimously, or by particular majority, or lost 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.

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BURI WIND EMPRICAY (NUT.) LAD

COTTARY SECRETARY

- A poll may be demanded only in accordance with the provisions of section 167 of the Ordinance.
- 28. 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.
- 29. A poll demanded on the election of Chairman or on a question of adjournment shall be taken at once.
- 30. In the case of an equality of votes, whether on a show of hand or on a poll, the Chairman of the meeting at which the show of hands take place, or at which the poll is demanded, shall have, and exercise, a second or casting vote.

VOTES OF MEMBERS

- 31. Subject to any rights or restrictions for the time being attached to any class or classes of shares, on a show of hands every member present in person shall have one vote except for election of Directors, in which case, the provisions of section 178 of the Ordinance shall apply. On a poll every member shall have voting rights as laid down in section 160 of the Ordinance.
- 32. A member of unsound mind, or in respect of whom an order has been made by any Court having jurisdiction in lunacy, may vote, whether on show of hands, or on a poll, by his committee or other legal guardian, and any such committee or guardian may, on a poll vote by proxy.
- 33. On a poll votes may be given either personally or by proxy.
- 34. (1) The instrument appointing a proxy shall be in writing under the hand of the appointer or of his attorney duly authorized in writing. A proxy must be a member.
 - (2) The instrument appointing a proxy and the power of attorney or other authority (if any) under which it is signed, or a notarially certified copy of that power or authority, shall be deposited at the registered office of the Company not less than forty-eight hours before the time for holding the meeting at which the person named in the instrument proposes to vote, and in default the instrument of proxy shall not be treated as valid.

DIRECTORS

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35. The number of Directors shall not be less than two. The following persons shall be the first Directors of the Company and shall hold the office upto the date

BURU WIND ENERGY (PVT.) LTD.

of the First Annual General Meeting unless earlier removed by the members in a general meeting.

- 1. Arooj Asghar
- 2. Wasim Ahmad Barlas
- 36. The remuneration of the Directors shall from time to time be determined by the Company in Board of Directors meeting subject to the provisions of the Ordinance.
- Save as provided in Section 187 of the Ordinance, no person shall be appointed as a Director unless he is a member of the Company.

POWERS AND DUTIES OF DIRECTORS

- 38. 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 provided by the Ordinance or any statutory modification thereof for the time being in force, or by these regulations, required to be exercised by the Company in general meeting, subject nevertheless to the provisions of the Ordinance or to any of these regulations, and such regulations being not inconsistent with the aforesaid provisions, as may be prescribed by the Company in general meeting, but no regulations made by the Company in general meeting shall invalidate any prior act of the Directors which would have been valid if that regulation had not been made.
 - 39. The Directors shall appoint a chief executive in accordance with the provisions of sections 198 and 199 of the Ordinance.

DISQUALIFICATION OF DIRECTORS

No person shall become the Director of the Company if he suffers from any of the disabilities or disqualifications mentioned in section 187 of the Ordinance and, if already a Director, shall cease to hold such office from the date he so becomes disqualified or disabled.

Provided, however, that no Director shall vacate, his office by reason only of his being a member of any Company which had entered into contracts with, or done any work for, the Company of which he is Director, but such Director shall not vote in respect of any such contract or work, and if he does so vote, his vote shall not be counted.

PROCEEDINGS OF DIRECTORS

41. The Directors may meet together for the dispatch of business, adjourn and otherwise regulate their meetings, as they think fit. Questions arising at any meeting shall be decided by a majority of votes. In case of an equality of votes, the Chairman shall have and exercise a second or casting vote.

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Chief Executive shall, at any time, summon a meeting of Directors, It shall not be necessary to give notice of a meeting of Directors to any Director for the time being absent from Pakistan.

- 42. The Directors may elect the chairman of their meetings and determine the period for which he is to hold office; but, if no such chairman is elected, or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same, or is unwilling to act as chairman, the Directors present may choose one of their number to be chairman of the meeting.
- 43. A resolution in writing signed by seventy five percent majority of Directors for the fime being entitled to receive notice of a meeting of the Directors shall be as valid and effectual as if it had been passed at a meeting of the Directors duly convened and held.

FILLING OF VACANCIES

- 44. At the first annual general meeting of the Company, all the Directors shall stand retired from office, and new Directors shall be elected in their place in accordance with section 178 of the Ordinance for a term of three years.
- 45. A retiring Director shall be eligible for re-election.
- 46. The Directors shall comply with the provisions of sections 174 to 178 and sections 180 and 184 of the Ordinance relating to the election of Directors and matters ancillary thereto.
- 47. Any casual vacancy occurring on the board of Directors may be filled up by the Directors, but the person so chosen shall be subject to refirement at the same time as if he had become a Director on the day on which the Director in whose place he is chosen was last elected as Director.
- 48. The Company may remove a Director but only in accordance with the provisions of the Ordinance.

DIVIDENDS AND RESERVE

49. The Company in general meeting may declare dividends, but no dividend shall exceed the amount recommended by the Directors. No dividends shall be paid otherwise than out of the profits of the Company.

THE SEAL

50. The Directors shall provide for the safe custody of the Company seal and the seal shall not be affixed to any instrument except by the authority of a resolution of the Board of Directors, or by a committee of Directors authorized in that behalf by the Directors, and in the presence of at least one Director or Company Secretary; and such Director or the Company Secretary shall sign every instrument to which the seal of the Company is so affixed in his/her presence.

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COMPANY SECRETARY

ACCOUNTS

- .51. The Directors shall cause to be kept, proper books of account as required under section 230 of the Ordinance.
- 52. The books of account shall be kept at the registered office of the Company, or at such other place as the Directors shall think fit.
- 53. The Directors shall, under sections 233 and 236 of the Ordinance, cause to be prepared, and laid before the Company in general meeting, such profit and loss accounts or income and expenditure accounts and balance sheets duly audited, together reports as are referred to in those sections.

AUDIT

- 54. Once at least in every year, the accounts of the Company shall be audited and the correctness of profit and loss accounts, or income and expenditure accounts and balance sheet ascertained by an auditor or auditors, and the provisions of the Ordinance in regard to audit, and the appointment and qualification of auditors, shall be observed.
- 55. Auditors shall be appointed and their duties regulated in accordance with sections 252 to 255 of the Ordinance.

WINDING UP

56. If the Company is wound up, whether voluntarily or otherwise, the liquidator may, with the sanction of a special resolution, divide amongst the contributories, in specie or kind, the whole or any part of the assets and liabilities of the Company, subject to the section 421 and other provisions of the Ordinance, as may be applicable.

INDEMNITY

- 57. Every Director, and other officer or servant of the Company shall be indemnified by the Company against, and it shall be the duty of the Directors to pay out of the funds of the Company, all costs, lasses and expenses, which any such officer or servant may incur or become liable to, by reason of any contract entered into or thing done by such officer or servant as such in any way in the discharge of the duties of such officer or servant, including traveling expenses.
- 58. No Director or other officer of the Company shall be liable for the acts, receipts, neglect or default of any other Director or officer, or for joining in any receipt or other act for conformity, or for any loss or expenses happening to the Company through the insufficiency or deficiency of title to any property acquired by order of the Directors for, or on behalf of the Company, or for the insufficiency or deficiency of any security or investment in the property of the company.

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of the money of the Company shall be invested, or for any loss or damage arising from bankruptcy, insolvency or tortuous act of any person with whom any money, securities or effects shall be deposited, or for any loss occasioned by any error of Judgment or oversight on his part, or for any other loss, damage or misfortune, whatever which shall happen in the execution of his office; or in relation thereto, unless the same happens through his dishonesty.

NOTICES

- 59. (1) A notice may be given by the Company to any member either personally, or by sending it by post to him to his registered address or (if he has no registered address in Pakistan) to the address, if any, within Pakistan, supplied by him to the Company for the giving of notices to him.
 - (2) Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, prepaying and posting a letter containing the notice, and unless the contrary is proved, to have been effected at the time at which the letters would be delivered in the ordinary course of post.
- 60. A notice may be given by the Company to the joint-holders of the share by giving the notice to the joint-holder named first in the register in respect of the share.

ARBITRATION

61. Whenever any difference arises between the Company on the one hand, and any of the members, their executors, administrators or assignees on the other hand, touching the intent or construction, or the incidence or consequences of these presents, or of the statute or touching any thing then or thereafter done, executed, omitted, or suffered in pursuance of these presents, or of the statute or touching breach or alleged breach, or otherwise relating to the premises, or to any statute effecting the Company, or to any of the affairs of the Company, including the fixing of the fair value of the shares of the Company; every such difference shall be referred to the decision of an arbitrator to be appointed by the parties in difference, or if they cannot agree upon a single arbitrator, to the decision of two arbitrators of whom one shall be appointed by each of the parties in difference, or any umpire to be appointed by the two arbitrators.

SECRECY CLAUSE

62. Every Director, manager, member of the committee, officer, servant, accountant or other person employed in the business of the Company shall, if so require by the Directors before entering upon his duties, sign a declaration pledging to observe a slict secrecy respecting all transactions of the Company with the customers and the state of accounts with individuals, matters relating thereto, and shall by such declaration pledge himself not to reveal any of the matters which come to his knowledge in the discharge of

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his duties, except when required to do so by the Directors, or by a Court of Law, and except so far as may be necessary in order to comply with any of the provisions in these presents contained.

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COMART SECRETARY

We the several persons whose name and addresses are subscribed below are destrous of being formed into company pursuance of this Articles of Association respectively agreed to take the number of shares in the capital of the company sent opposite to our respective names :-

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p-a	AROOJ ASGHAR	ASGHAR ALI SHEIKH	35202-6311856-5	PAKISTANI	BUSINESS	HOUSE NO 60.	10 (Ten)	
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N	WASIM AHMAD BARI AS	SAEED AHMED	61101-2744711-7	PAKISTAN	BUSINESS	HOUSE 474, STREET	To (Tee)	
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						SLAMABAD		
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Dated: 05th day of June 2012.

Witness to above signature:

Signatures Name:

:National Institutional Facilitation Technologies (Pvt) Ltd Father's name

CNIC No. Occupation: Address:

: 5th Floor AWT Plaza I. I. Chundrigar Road Karachi

the security of Communications Companies Registration Office Rarachi.

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THE COMPANIES ORDINANCE 1984

PRIVATE COMPANY LIMITED BY SHARES

MEMORANDUM

OF

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OF

BURJ WIND ENERGY (PRIVATE) LIMITED



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COLTARY SECRETARY

THE COMPANIES ORDINANCE, 1984 (PRIVATE COMPANY LIMITED BY SHARES)

Memorandum of Association of

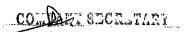
BURJ WIND ENERGY (PRIVATE) LIMITED

- [1. The name of the Company shall be "BURJ WIND ENERGY (PRIVATE), LIMITED".
 - II. The Registered Office of the Company shall be situated in the Province of Sindh, in the Islamic Republic of Pakistan.
- III. The objects for which the Company is established are all or any one or more of the following: -
- (1. To carry on, primarily, the business of power generation, as independent power producer of wind, thermal, hydel, nuclear, solar, steam, and/or any other alternative / renewable energy sources, and bio-energy.
 - To generate, produce and sell power to utility companies, power distribution networks and organizations in the power sector, within and outside the country.
- 3. To set up, operate and manage one or more Power Plants in order to generate, sell and supply electricity to industrial and other consumers, through distribution networks established, owned and operated by the company Itself or by any other person, corporate body, autonomous or semi-autonomous corporation or authority or local body, and for that purpose to acquire land, whether freehold or leasehold, machinery and equipment, and construct, install, operate and maintain thereon power houses, civil and mechanical works and structures, grid stations, fransmission lowers, power lines, buildings, workshops and other facilities as may from time to time be necessary for the attainment of the objects of the company.
- 4. To take over, acquire, renew, unitize and hold any exploration, prospecting, development and production concessions of whatever nature or otherwise acquire any estate or interest, develop resources of work, dispose of or otherwise turn to account land or sea beds in from, and to search for or participate in the exploration for petroleum or any other oil in any from, asphalt, bitumen or similar substances, or natural gas, or any substance, used, or which may be capable of use, and to organize, equip and employ expeditions, experts and other agents and to carry out drilling and other exploratory operations, and to establish, and operate oil and gas wells and other undertakings to, estimate the reserves of oil, and gas and for the extraction of any of the oforesaid substances.
- To produce, refine, sell, supply, market, distribute, transport and otherwise dispose of crude oil, condensate LPG, NGL and Natural Gas and refinery gases and by-products pursuant to any of the objects mentioned in this

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Memorandum for domestic, commercial or industrial uses or for lighting, heating power generation or any other purpose whatsoever.

- To carry out construction, installation, erection of hydel, Steam, thermal, nuclear, geothermal power station; solar energy projects and wind farms.
- 7. To undertake business in the areas relating to hydel, thermal, solar, energy & wind power installations, controls, protection, communication and instrumentation system for power plants, substations, industrial installation and pumping compressor stations, energy conversation system.
- 8. To offer and to engage in supply, implementation and installation of EHV and HV transmission lines, medium and low voltage everhead and underground distributions network, high voltage underground cables, and low voltage AC and DC installations, rectifier, capacitor installations and consumer services.
- To carry out complete electrification of industrial units, municipal electrifications, seaport and airport lighting systems, cathode and lightning protection installation.
- 10. To act as contractor, sub-contractors, advisors, designers, supervisors, purchasers, project managers with regards, to turnkey construction, development, improvement of Hydel, Wind, Steam, thermal and Nuclear Power Stations, Grid-stations, Transmission and Distribution Lines, Civil Works and work of every description connected with power related sector in general, and to act as contractors, agents, estimators, evaluators, appraisers, surveyors for any other electrical and mechanical work of any kind, whatsoever, anywhere in the world, subject to the approval of authority.
- To act as electrical/mechanical/civil work contractors to local and foreign Governments, agencies, authorities, municipalities, autonomous corporations, private and public companies in power sector.
- To represent deal and trade in all kind of power and energy related plants, furbines, equipments, products, cables, termination equipment, tools, accessories, technologies and services.
- 13. To apply for and obtain necessary consents, permissions and licenses from relevant 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.
- 14. To enter into any arrangements or agreements with any authorities, Central or any Provincial Government, Municipal, Local or otherwise and to obtain from any such authority any rights, privileges, rebates, licenses, Permits and concessions which the Company may consider desirable to obtain and to carry out exercise and comply with such arrangements, agreements, rights, privileges, rebates and concessions.
- 15. To manufacture construct, equip, maintain, erect, lay, repair, altercorps STED pressure control, metering stations, gas works and works connected therewith.

with all necessary machinery and apparatus, pipes, mains meters, conduits, services pipes, lamps posts, and other materials and apparatus for supplying gas for heating, motive power, industrial, commercial, domestic, pre-stressed concrete products, structures, beam, pillars, gilders and structural materials to be used in the building of power plants and to carry out civil work for the construction of power plants and any other purpose whatsoever.

- 16. To construct, erect, equip, maintain, improve and work or aid in, contribute or subscribe to the construction, erection, equipment, maintenance, improvement and working of any railways, tramways, piers, jetties, wharves, docks, roads, canals, waterways, waterworks, reservoir tanks storage installations, pipe-lines, mills, factories, relineries, laboratories, electric works, gasworks, hydraulic and other works, telegraphs, telephones, plant, machinery, appliances, dwelling houses and other buildings.
- 17. To acquire, work and dispose of, and deal in any mines, metals, minerals, clay and other like substances and to acquire, refine, prepare for market, produce, manufacture, deal in or otherwise turn to account any mineral, animal or vegetable substances or products.
- 18. To carry on the business of estimation, drowing up of specifications for works relating to mechanical and electrical engineering.
- 19. To carry on the business of electrical engineers, electricians, engineers, contractors, consultants, agents and manufacturers of electrical plant, machinery, equipment and apparatus, and of generating, producing and supply light, heat, sound and power by electricity, galvanism, magnetism or otherwise, suppliers of electricity whether for the purpose of light, heat, motive power, telephonic, telegraphic, industrial or other purposes and generally to install, execute, provide, work and maintain all necessary plant, machinery, equipment, cables, wires, accumulators, lamps exchanges, telephones and apparatus.
- To carry on the work of heavy steel fabrication for power plants, transmission lines and other steel structures within the scope of the object of the Company.
- 21. To undertake engineering, design, erection, installation testing / commissioning and maintenance of electrical power, communication and mechanical works as well as certain civil engineering and environmental projects related to power based industry.
- 22. To purchase or otherwise acquire, produce, manufacture, refine, treat, purify, blend, reduce, distil, store, transport, market, distribute, supply, sell and otherwise dispose of and generally trade in any and all kinds of petroleum and petroleum products, oils, gas, hydrocarbons, petrochemicals, asphalt, bituminous substances and the products and by- products which may be derived, produced, repaired, developed, compounded, made or manufactured there from and or acquire and take over the running or likely to be running business of alike nature with or without assets, liabilities, rights,

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privileges, goodwill, registration, trade mark, import and export registration, or any other facilities.

- 23. To carry on the business of oil and petroleum, fabricate, contract, erect, lay, and manufacturers of plant, machinery and apparatus for oil and petroleum, gas and chemical installations and to purchase or otherwise acquire, produce, manufacture, refine, liedt, purify, blend, reduce, distill, store, transport, market, distribute, supply, sell and otherwise dispose off and generally trade in any and all kinds of petroleum and petroleum products.
- 24. To buy, sell, manufacture, repair, alter, improve, or otherwise treat, exchange. hire, let-out on hire, import, export and deal in all works, plant, machinery, tools, engines, tanks, cylinders, valves, regulators, testing equipment, tools, utensiis, appliances, equipment, stoves, heaters, apparatus, utensiis. substances, raw materials, chemicals, natural gas, liquefied petroleum gas, fuel oil, coal, lubricants, articles and things and to manufacture, experiment with render marketable and deat in all products, appliances, equipment, apparatus, products, materials, substances, articles and things capable of being used in any such business as aforesald or required by any customers of, or persons having dealing with the Company, or any such other company or body as herein mentioned, or commonly dealt in by, persons engaged in any such business, or which may seem capable of being profitably dealt with in connection with any of the said business and to manufacture, experiment with, render marketable and otherwise freat and deal in all products and residual and bye-products inclaental to, or obtained, or capable of being made use of, in any of the business carried on by the Company or any such other company or body herein mentioned.
- 25. To carry on the business as petroleum engineers, providing consultancy services, preparation of feasibilities for all sorts of petroleum related industries and to manufacture, buy, sell, import, export and to deal in all sorts of oil field equipments.
- 26. To refine, process, formulate, produce, buy, sell, export, import, indent or otherwise deal in all types of chemicals, petrochemicals and petroleum industry or any material used or capable of being used in the petrochemical industry, industrial chemicals or any mixtures, derivatives and compounds thereof.
- To set up, install, erect, establish, run, control, manage and operate an
 industrial undertaking for the manufacture, production, formulation and
 blending of lubricating oils any where in Pakistan.
- 28. To own prospect for, explore, acquire by lease, license or otherwise, open work, develop and maintain natural deposits of gas, petroleum and other mineral and chemical substances of all kinds and to carry on and conduct the business of working, obtaining and supplying to other persons such gas, oil, petroleum, and other substances.
- 29. To buy, import, export, indent, stock, contract, tender, distribute and the STED secure and grant agency, distribution rights, representations and trace in or

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deat in any manner in gases of all kinds and gas plant, machinery, instruments, implements, appliances, equipments, tools, dies, presses and apparatus.

- 30. To carry on the business of contractors, suppliers and manufacturers of gas regulators and component parts of gas appliances and all other buildings and works, meters, pipes littings, machinery, apparatus, convenient or necessary for the purposes of the Company, and connection with power generaling plant for the generation of electric power and or in connection with supply, transmission and distribution of electric power.
- 31. To manufacture, sell, deal in, let for hire, fix, repair and remove natural gas apparatus, appliances and filtings, engines, meters, indices, apparatus for testing and measurement, stoves, cookers, gassings, ranges, pipes, mains for lightling, heating, motive power, vertilating, cooking, refrigerating or any other purpose.
- 32. To carry on the business of natural gas engineers, contractors, agents, manufacturers of plant, machinery, gas apparatus and works for the sale, supply, distribution, storage, use, regulation and measurement of gas.
- 33. To carry on all or any of the business of storing, transporting, transmitting, distributing, supplying and exporting natural gas for lighting, heating, motive power, generation of electricity, or any other purpose whatsoever.
- 34. To establish, provide, maintain and conduct or otherwise subsidize research laboratories and experimental workshops for scientific and technical research, experiments and tests of all kinds; and to promote studies and research, both scientific and technical investigations and inventions by providing, subsidizing, endowing or assisting laboratories, workshops, libraries, fectures, meetings and conferences and by providing or contributing to the scientific or fechnical professors or feachers and by providing or contributing to the award of scholarships, prizes, grants to studies or otherwise and generally to encourage, promote and reward studies, researches, investigations, experiments, tests, and inventions of any kind that may be considered likely to assist any business which the Company is authorized to
- 35. To carry on in all or any of the branches of the Company all or any of the business of dealers in natural gas and any component, constituent, product or bye-product thereof, wharfingers, merchants, carriers, shipowners and charterers, lightermen, berge owners, factors and brokers and all other kindred business usually carried on by gas companies and to treat and turn to account in ony manner whatsoever natural gas or any component, constituent, product or bye-product thereof.
- 36. To carry on business and obtain licenses for shipping agents, clearing and forwarding agents, purchasing and indenting agents, selling agents, (except managing agent) on such terms and conditions as the Company may think proper, subject to any permission as required under the law.

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- 37. To carry on and undertake trading business of all sorts and to act as indenters, importers, exporters, traders, suppliers, and commission agents of products, commodities and materials in any form or shape manufactured or supplied by any company, firm, association of persons, body, whether incorporated or not, individuals, Government, Semi-Government or any local authority.
- 38. To apply for, tender, offer, accept, purchase or otherwise acquire any contracts and concessions for or in relation to the projection, execution, carrying out, improvements, management, administration or control of works and conveniences and undertake, execute, carry out, dispose of or otherwise turn to account the same.
- 39. To carry on the business of general order suppliers including Government, Semi-Government Agencies, Armed Forces, Army, Military or Defence and to act as commission agents, indenters, traders, general merchants, wholesalers, retallers, dealers, distributors, stockists in any goods or products or within the scope of the object of the Company and subject to any permission required under the law.
- 40. To carry on in or outside Pakistan the business of manufacturers, importers, exporters, indenters, 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.
- 41. To invest and deal, from time to time, with the surplus moneys of the Company not required for its main business in any manner and in particular to accumulate tunds or to acquire or to take by subscription absolute or conditional, purchase or otherwise howsoever and to hold, and dispose of shares and other securities of any other company, association, undertaking in Pakiston or abroad.
- 42. To invest and deal with the moneys of the Company in such new projects, companies, works and research as may be directed by the Government of Pakistan.
- 43. To carry on agency business (except managing agency) and to acquire and hold selling agencies and to act as selling agents, commission agents, manufacturers' representatives and distributing agents of and for the distribution of all kinds of merchandise, goods, commodities, products, materials, substances, articles and things whether finished, semi-finished, raw, under process, refined, treated or otherwise pertaining to trade and commerce and for that purpose to remunerate them and to open and maintain depots and branches.
- 44. To purchase, take on lease or in exchange, hire, apply for or otherwise acquire and hold for any interest, any rights, privileges, lands, building, easements, trade marks, patents, patent rights, copyrights, licenses, 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 STED the Company's business or any branch or department thereoform to be a stocked to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company's business or any branch or department thereoform to be a support of the company of th

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exercise, develop, grant licenses in respect of or otherwise turn to account any property, rights and information so acquired, subject to any permission required under the law.

- 45. To acquire by concession, grant, purchase, barter, license either absolutely or conditionally and either solely or jointly with others any lands, buildings, machinery, plants, equipments, privileges, rights, licenses, trade marks, 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.
- 46. 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 and 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.
- 47. To go in for, buy or otherwise acquire and use any patent design, copyright, license, concession, convenience, innovation, invention, trade marks, rights, privileges, plants, tools or machinery and the like in Pakistan or elsewhere, which may for the lime being appear to be useful or valuable for adding to the efficiency or productivity of the Company's work or business, as permissible under the law.
- 48. To acquire and carry on all or any part of the business or property and to undertake any liabilities of any person, firm, association or company's possession of property suitable for any of the purposes of the Company or carryling on any business which this Company is authorized to carry on and in consideration for the same, to pay cash or to issue shares of the Company.
- 49. To purchase, build, charter, affreight, hire and let out for hire or for chartering and affreightment, and otherwise to obtain the possession of, and use, operate and dispose of, and employ or turn to an account ships, lighters, barges, tugs, launches, boats and vessels of all kinds (including tankers and tank vessels), marine equipment, automobiles, lorries, motor trucks and tractors, airplanes, locomotives, wagons, tanks, cars and other rolling stock and otherwise to provide for and employ the same in the conveyance of petroleum and other minerals, movable properties and merchandise of all kinds, and the transportation of personnel, employees, customers and visitors and to purchase or otherwise acquire any shares or interests in any ships or vessels, airplanes, railways, motor transportation, or in any companies, possessed of or interested in any ships, vessels, airplanes, railways and motor transportation.
- 50. To enter into partnership, to amalgamate or merge movable with immovable and / or to buy on all interests, assets, liabilities, stocks 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 carring on or proposing to carry on any business which this Company is sufficient.

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carry on or which is capable of being conducted so as directly or indirectly to benefit this Company and to have foreign collaborations and to pay royalties / technical fees to collaborators, subject to the provisions of the Companies Ordinance, 1984.

- 51. 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 the law.
- 52. 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, bills of lading, warrants, deposit notes, debentures, letter of credit and other negotiable instruments and securities.
- 53. To arrange local and foreign currency loans from scheduled banks, industrial banks and financial institutions for the purpose of purchase, manufacture, market, supply, export and import of machinery, construction of factory, building and for the purpose of working capital or for any other purpose.
- 54. 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.
- 55. To borrow money by means of loans or other legal arrangerrients from banks, or other financial institutions, or Directors in such manner as the Company may think fit and in parlicular 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.
- 56. To pay all costs, charges, and expenses preliminary or incidental incurred in 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 lts business.
- 57. To remunerate any person, firm or company rendering services to this Company, under a contract of employment, management or otherwise, whether by the payment of cash or by the allotment of shares or securities of the Company, during the continuation of such services, the furtherance thereof, or termination of such services howsoever.
- 58. To give any servant or 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 as the Company may deem fit and to procure any

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servants or employees of the Company to be insured against risk of accident in the course of their employment by the Company.

- To establish and support or old 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 or connection of such persons and to grant pensions, grafulties, allowances, relief and payments in any other manner calculated to benefit the persons described herein.
- 60. To carry on any other business, whether manufacturing or otherwise, which may seem to the Company capable of being conveniently carried on in connection with any of the objects specified herein, or calculated directly or indirectly to enhance the value of, or render profitable, any of the Company's property or rights,
- To distribute any of the Company's property and assets among the members 61. in specie or in any manner whatsoever in case of winding up of the Company,
- To guarantee the performance of contract and obligations of the Company 62. in relation to the payment of any loan, debenture-stock, bonds, obligations or securifies issued by or in favor of the Company and to guarantee the payment or return on such investments,
- To carry out joint venture agreements with other companies or countries 63, within the scope of the objects of the Company.
- To cause the Company to be registered or recognized in any foreign country. 64.
- To do and perform all other acts and things as are incidental or conductive to 65. the attainment of the above objects or any of Ihem.
- To accept, design, display, publish, transmit, distribute or reproduce in any 66. form whatsoever, advertisements and publicity and promotional material of the Company; to acquire, dispose of, and use advertising time and space in any media; to develop, produce and underlake advertising, publicity and promotional campaigns and competitions for itself; to undertake, promote and sponsor any product, service event, individual or publications which in the opinion of the Company will promote, advance or publicize any activity of the Company; and generally to carry on the business of advertising, public relations and publicity consultants and agents, but not to include into business of radio and television broadcasting/transmission.
- To accept securities of any person or any property or interest therein 67. whosoever nature, in payment or part payment for any services entering. for any safe or supply made to, or debt owing from, any such pels

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- 68. To represent persons at meetings of local, national and international organizations, and bodies concerned with business activities connected or associated with any of the business of the company, to provide services of all kinds to such organizations and bodies and to negotiate and enter into national and international agreements, and standards relating to matters of concern or interest of the company or persons represented by, or having dealings with the company.
- 69. To borrow money or secure or discharge any debt or obligation of the Company in such manner as may be thought fit by the Company and in particular, but without prejudice to securities of any kind or mortgages or charges (fixed or fivaling), founded or based upon all or any part of the undertaking, property, assets and rights (present and future) of the Company, or without any such security and upon such terms as to priority or otherwise as the Company shall think fit, and to receive money on deposit and advance payments with or without allowance of interest thereon, subject to the conditions/restrictions/imposed under any faw.
- 70. To apply for purchase or otherwise acquire any patents, patent rights, brevets d'invention, licenses, secret marks, commercial names and designs, copyrights, trade marks, service licenses, concessions, and the like, conferring any exclusive or nonexclusive or limited right to use, or any secret or other information as to 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, rights or information so acquired as permissible under law.
- To carry out joint venture agreements, with other companies or countries within the scope of the objects of the Company.
- 72. To distribute any of the property of the Company in specie among the members in the event of winding up or otherwise.
- 73. To open any current, overdraft, cash credit account, fixed account with any banker.
- 74. To adopt such means of making known the business and / or services of the Company as may seem expedient and in particular by advertising in the press, or in the other media or by of participation in exhibitions.
- 75. To employ or appoint any persons, experts, consultants, advisers, contractors (including O & M contractors), brokers in connection with the business of the Company.
- 76. To employ and remunerate officials and servants of the Company, or any person or firm or company rendering services to the Company.
- 77. To provide engineering, construction, consultancy and design services and radio and other communication systems and services, and any facilities **ATTESTED**

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equipment and installations whether related to such services and systems or otherwise.

- 78. To create any reserve fund, sinking fund, insurance fund, or any other special fund, whether for depreciation or for repairing, insuring, improving, extending or maintaining any of the property of the Company, or for any other purpose conducive to the interests of the Company.
- 79. To capitalize such portion of the profils of the Company as are not distributed among shareholders of the Company in the form of dividends, and as the directors of the Company may think fit and to issue bonus shares, as fully paid up, in favor of the shareholders of the Company.
- 80. To advance, lease or deposit money to any person with or without taking any security therefore and upon such other terms as may be thought fit by the company, but only in furtherance of objects of the company.
- 81. To insure any property, asset, matter or interest and against any potential liability or loss of the company or of any other person and the life or health of any person for the benefit of the company.
- 82. To apply for, secure, acquire by grant, legislative enactment, assignment, transfer, purchase or otherwise, and to exercise, carry out and enjoy any license, and to exercise, carry out and enjoy any license, franchise, concession, right, privilege, authority, grant; and to pay for, aid in, and contribute towards carrying, the same into effect and do all things required of the company there under.
- 83. To apply for, promote and obtain (alone or with others) under any statute, order, by-law, charter, rule, regulation or other authorization or enactment, which may seem calculated, directly or indirectly, or benefit the company and (alone or with others), to oppose any bills, proceedings or applications which may seem calculated or likely, directly or indirectly, to prejudice the interests of the company or persons having dealings with the company.
- 84. To sell, dispose of or transfer the business, properly and undertaking of the company or any asset or part thereof for any consideration which the company may see til to accept, and in particular (but without prejudice to the generality of the foregoing), to sell or otherwise dispose of any of the debts due or to become due to the company, to factors or others for collection, and to enter into any obligations or recourse or otherwise in connection therewith.
- 85. To promote, establish, acquire, subscribe to, or take any interest in, alone or with others, any company, body corporate, fund, trust, or other person or body of persons, whether incorporated or not, and whether or not having objects similar to those of the company.
- 86. To purchase or otherwise acquire all or any of the business, property and liabilities of any person carrying on a business, including all or any part of the purposes within the objects of the company, or a business which in the objects of the company, or a business which in the objects of the company.

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opinion of the company, may be conveniently or advantageously carried on by the company, or a business having rights in assets, the acquisition of which is in the opinion of the company likely to be in its interest, and to conduct, carry on and expand or liquidate and wind up any such business.

- 87. To establish, purchase, maintain and contribute to any pension, provident, gratuity, superannuation, retirement, redundancy, injury, death benefit or insurance funds, trusts, schemes, entities, or policies for the benefit of, and to give or procure the giving of pension, annulties, allowances, gratuities, donation, emoluments, benefits, of any description (whether in kind or otherwise), incentives, bonuses, assistance (whether financial or otherwise) and accommodation in such manner and on such terms as it thinks fit to, and to make payments for or towards the insurance of, any individuals who are or were at any time in the employment of, or directors or officers of (or held comparable or equivalent office in), or acted os consultants or advisers to, or agents for the company or any company which is its holding company, or is a subsidiary of the company or any such holding company, or any person to whose business the company or any subsidiary of the company is, in whole or In part, a successor directly or indirectly, or any person which is otherwise allied to or associated with the company, and to other individuals whose service has been of benefit to the company, or who the company considers have a moral claim on the company, and the spouses, widows, widowers, families and dependents of any such individuals as aforesaid; and to establish, provide, manage and maintain and provide financial assistance to welfare, sports and social facilities, associations, clubs, funds and institutions which the company considers likely to benefit, or further the interests of any of the aforementioned individuals and spouses, widows, widowers, families and dependents of any such aforementloned individuals, and to mange, maintain, support and provide financial assistance to any such facility, association, club, fund or institution which has been established, provided for, managed, maintained, supported or subscribed to, by any person to whose business the company or any subsidiary of the company is, in whole or in part, d successor.
- 88. From time to time, to subscribe or contribute (in cash or in kind) to, or to promote, any charitable, benevolent or useful object of a public character, or any object which may in the opinion of the company be likely, directly or indirectly, to further the interests of the company, its employees or its employees or its members.
- 89. To do all or any of the matters hereby authorized in any part of the world, either alone or in conjunction with, or as factors, contractors, principals, and to act as or secretary, registrar or adviser or consultant to, undertake and execute any trust.
- 90. To apply for, assist in, process, procure and abtain the listing of any of the securities of the company, or of any derivative securifies of the company, or of any Global Depository Receipts pertaining to the securities of the company, on any stock exchange in any part of the world; and to engage advisors, consultants or agents, and to do all acts and things necessary or incidental for the same.

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COMPANY SECRETARY

- 91. To enter Into any guarantee, contract of indemnity or surety ship, in order to secure the performance of any contracts, obligations or commitments, with or without consideration, calculated to benefit the Company or the holding company of the Company or any subsidiary of the holding company or any subsidiary of the company, whether by personal obligation, or by mortgaging or charging all or any part of the undertaking, property and assets (present and future) of the Company.
- 92. Generally to do all such other things as in the opinion of the company are or any be incidental or conducive to the attainment of the above objects or any of them, provided same are not contrary to law in force.
- 93. To do all or any of the above things in any part of the world as principals, agents, contractors, sub-contractors, otherwise and by or through trustees, agents, subsidiary company or otherwise and either alone or in conjunction with others.
- 94. To do all and everything necessary, suitable or proper or incidental or conductive to the accomplishment of any of the purposes or the attainment of any of the objects or the furtherance of any of the powers hereinbefore set forth, either alone or in association with other corporate bodies, firms or Individuals or with any Government authority or public or quasi-public authority or any other authority, and to do every other act or thing incidental or appurtenant to or arising out of or connected with the business or powers of the Company or part thereof, provided the same be lawful.
- 95. To do all such other things as are incidental or conducive to the attainment of the above objects, this general statement of objects being deemed as enabling and not in any way as restrictive of the foregoing objects.
- 96. The Company shall not engage in Banking Business, Business of an Investment Company, Non-Banking Finance Company, Leasing Company and Insurance Company, Business of managing agency or any unlawful business and nothing in object clauses shall be construed to entitle company to engage in such business, directly or indirectly. The Company shall not launch multilevel marketing, pyramid and ponzi scheme.
- Notwithstanding any thing stated in any object clause, the company shall
 obtain such other approval or license from competent authority, as may be
 required under any law for the time being in force, to undertake a particular
 business,

It is hereby declared that the word "Company" save when used in reference to this Company shall be deemed to include any partnership or other body of persons whether incorporated or not incorporated, whether domiciled in Pakistan or elsewhere and that in the interpretation of this clause, the powers conferred on the Company by any paragraph shall not be restricted by reference to any other paragraph and that in the event of ambiguity, this clause and every paragraph hereof shall be considered independent and

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construed in such a way as to widen and not to restrict the power of the Company.

- IV. The liability of the members is limited.
- V. The authorized capital of the company is Rupees 500,000 /- (Rupees Five Hundred thousand only) divided into 50,000 (Fifty Thousand Only) ordinary shares of Rs.10 (Rupees Ten) with power to increase the capital of the company and to divide the shares in the capital for the time being into several classes and to attach thereto respectively such preferential deferred, qualified or special rights, privileges or conditions as may be determined by or in accordance with the articles of association of the company and to vary, modify or abrogate any such rights privileges or conditions in such manner as may for the time being be provided by the articles of association of the company.

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COMPART STORMARY

We the several persons whose name and addresses are subscribed below are desirous of being formed into company pursuance of this Memorandum of Association respectively agreed to take the number of shares in the capital of the

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	Signature							
!	No. of Shares faken by	Subscriber	10 (Ten)	- ,	10 (Ten)			2
•	Residential Address		HOUSE NO 60,	SIREET 32, SECTOR F6/1, ISLAMABAD	HOUSE 474, STREET 75, SECTOR G8/1,	SLAMABAD	7.42.7	Total Inventy Only
	Occupation		BUSINESS	3- 3 -11	BUSINESS			
	Nationality with any former Nationality		PAKISTAN		PAKISTANI			
ines :-	NOC No / (Passport No.) If Foreigner		35202-6311856-5		61101-2744711-7			
our respective no	Fathers Name in Full		ASGHAR ALI SHEIKH		SAEED AHMED KHAN			
ŧl.	Name & Surname (Present, Former) in full (in Block Letter)		AROOJ ASGHAR		WASIM AHMAD BARLAS			
)	ġ Ż				74			

Dated: 05th day of June 2012.

Witness to above signature;

Signatures Name:

:National Institutional Facilitation

Technologies (Pvt) Ltd father's name Occupation: CNIC No.

: 5th Floor AWT Plaza I. I. Chundrigar Road Karachi ATTESTED

Certified to be must

Joint Registrar of Companies Companies Registration Office Karachi.

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