BURJ Wind

SCHEDULE I
(Regulation 3(1))

FORM OF APPLICATION

The Registrar
National Electric Power Regulatory Authority (NEPRA)
NEPRA Tower,
Attaturk Avenue (East),
Opposite Federal Flood Commission,
Sector G-5/1,
Islamabad, Pakistan

Subject: **Application for a Generation License for a 13.5MW Wind Power Project**

I, Saleem Uz Zaman, Company Secretary, being the duly authorized representative of Burj Wind Energy Private Limited (the "**Applicant**"), by virtue of Board Resolution dated 17 October 2014, hereby apply to the National Electric Power Regulatory Authority (NEPRA) (the "Authority") for the grant of a Generation License of 13.5MW Wind Power Project to the Burj Wind Energy (Private) Limited pursuant to the 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 (Application and Modification Procedures) Regulations, 1999, 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 Pay Order (PO) No. CHQ/759871/1888078 dated October 20, 2014 in the sum of Rs. 206,928/- (Rupees Two Hundred, Six Thousand, Nine Hundred and Twenty Eight Only), being the non-refundable license Application Fee; calculated in accordance with Schedule II to the National Electric Power Regulatory Authority (Application and Modification Procedures) Regulations 1999, is also attached herewith.

Date: October 21, 2014

BURJ WIND ENERGY (PVT) LTD.

SALEEM UZ ZAMAN
Company Secretary

APPLICATION FOR THE GRANT OF A GENERATION LICENSE

Burj Wind Energy Private Limited

(A project of Burj Capital)

a 13.5MW Wind Power Project at Gujju, District Thatta, Sindh Pakistan

Lead Project Developer:

Burj Power
1909 Gold Crest Executive Tower, JLT,
P O Box 309037,
Dubai, UAE
Tel: +971 4 454 2799
Fax: +971 4 454 2797

October 2014

APPLICATION FOR THE GRANT OF A GENERATION LICENSE

This application is for the Grant of Generation License duly filed by Burj Wind Energy Private Limited, a project of Burj Capital (the "**Applicant**" and/or the "**Project Company**") for its 13.5MW Wind Power Project (the "**Project**") in Gujju, Sindh, Pakistan.

1 The Authority's participation in the process

This Application for the grant of a generation license is made pursuant to Section 15 of the Regulation of Generation, Transmission, and Distribution of Electric Power Act, 1997 (the "**Act**") and Regulation 3 of the National Electric Power Regulatory Authority (Application and Modification Procedure) Regulations, 1999 (the "**AMP Regulations**").

Where;

Section 15 of the Act provides, inter alia, that:

"(1) No person except under the authority of a license issued by the Authority under this Act and subject to the conditions specified in this Act and as may be imposed by the Authority, construct own or operate a generation facility.

(2) An application for the grant of a license for a generation facility shall specify.

- (i) The type of facility for which the license is applied;
- (ii) The location of the generation facility; and
- (iii) The expected life of the generation facility.

Regulation 3 of the AMP Regulations provides that an application for license shall be made in the form specified in the AMP Regulations and also provides a list of documents required to be submitted to the Authority along with the requisite application.

2 Introduction of the Applicant

Burj Wind Energy Private Limited is a Pakistan based company with the sole objective of developing, financing, building and operating up to a 14 MW wind power project in Pakistan. Project Company was issued a Letter of Intent ("**LOI**") in 2012 by the Alternative Energy Development Board ("**AEDB**") after submission of a bank guarantee for setting up a 14MW wind Power Generation Project (the "**Project**") at Gharo-Keti Bandar Wind Corridor, Pakistan.

3 Introduction of the Sponsors

Burj Capital is an international investment firm focused on developing and managing renewable power generation and retailing. Burj Capital aims to create a lasting value for its investors and partners by identifying opportunities where it can either build or unlock value by utilizing its team of industry and business experts who have a proven track record of investing across a variety of sectors and combining them with access to capital. The firm's world class and multi-disciplined professionals have a successful track record of identifying high quality assets and advancing them from development to operations.

4 Introduction of Lead Project Developer

Burj Power is a power project advisory and management company headquartered in Dubai with an objective to acquire, develop, build, own and operate power projects in the Africa and Asia regions. It comprises of a strong team of industry veterans with a

successful track record of developing, operating and managing large power assets globally, including Pakistan, both as a part of the global power company, AES Corporation, as well as on their own.

5 Progress of the Project

Applicant is negotiating loan for the Project from local banks for the financing for the Project.

Project Company is filling tariff petition with NEPRA separately.

Applicant is confident that the Project can achieve financial close by 31st March 2015; and construction can be started in April 2015. Under the terms of the EPC Contract, construction will be completed in 15 months and Commercial Operations Date ("COD") is June 30, 2016.

6 Annexure

Kindly find enclosed the following Annexure:

Annexure-1	:	Form of Application – Schedule 1 of Regulation 3(1)
Annexure-2	:	Extracts of minutes of meeting of the Board of Directors
Annexure-3	:	Affidavit
Annexure-4	:	Prospectus
Annexure-5		Summary of Plant details
Annexure-6	:	Bank Statement of the Project Company
Annexure-7	:	Company Profile of Applicant and Project Sponsors
Annexure-8	:	CV of Senior Management, Technical and Professional Staff
Annexure-9	:	[redacted] Certificate of Incorporation & Memorandum and Articles of Association
Annexure-10	:	EPC Contract (Signature Pages only)
Annexure-11	:	Profiles of EPC Contractor
Annexure-12	:	Experience list of EPC Contractor
Annexure-13	:	Electrical Grid Interconnection Study
Annexure-14	:	Health and Safety Policy of Project Sponsors
Annexure-15	:	Decision (NOC) on Initial Environmental Examination (IEE) by Environmental Protection Agency, Government of Sindh
Annexure-16	:	Copy of Letter of Intent (LOI)
Annexure-17	:	Check List for Examination New Generation Facility (Wind) License Application Regulation 3(5)

The Applicant would be pleased to provide any other information/assistance that the learned Authority may require in the matter of grant of Generation License.

This Application and its Annexures are being submitted in triplicate.

It is most humbly prayed to the esteemed Authority as follows:

A That the Applicant may be granted a Generation License for the development of the Facility.

B That the Honorable Authority may be pleased to treat the Applicant's request for the grant of Generation License on a non-discriminatory basis and any concession offered to comparable projects on the date of filing of this Application and at any stage subsequent to the grant of license may kindly be granted to the Applicant as well.

We hope that the information provided above meets your requirements, and we remain available to assist you if you have any further quarries.

Respectfully submitted for and on behalf of the Applicant;

SALEEM UZ ZAMAN
Company Secretary
Burj Wind Energy Private Limited
Ground Floor, OICCI Building,
Talpur Road, I. I. Chundrigar Road,
Karachi, Pakistan.
Ph. No. 0213 246 8041,
Fax. No. 0213 246 8039

BURJ WIND ENERGY (PVT) LIMITED

EXTRACT FROM THE MINUTES OF THE BOARD OF DIRECTORS MEETING OF THE COMPANY HELD ON 17 OCTOBER 2014 AT 2.00 P.M. AT GROUND FLOOR OICCI BUILDING TALPUR ROAD, OFF I.I. CHUNDRIGAR ROAD , KARACHI.

The Following resolutions were passed in respect of the Company's application for grant of generation license to NEPRA for its 14 MW wind power project in Gujjo.

RESOLVED THAT Burj Wind Energy (Private) Limited, ("**BWEL**") be and is hereby authorized to file application for the grant of Generation License for submission at National Electric Power Regulatory Authority (NEPRA) in respect of its 14 MW wind power generation project to be located at Gujjo, District Thatta, Province of Sindh, Pakistan (the "Project") and in relation thereto, enter into and execute all required documents, make all fillings and pay all applicable fees, in each case, of any nature whatsoever as required.

FURTHER RESOLVED THAT in respect of application for the grant of Generation License for submission to NEPRA, Mr. Saleem Uz Zaman as Company Secretary be and hereby empowered and authorized for and on behalf of the Company to:

I. Review, execute, submit and deliver the Generation License Application (including any modification to the application for the Grant of Generation License) and related documentation required by NEPRA, including any contacts, documents, power of attorney, affidavits, statements, letters, forms, applications, deeds, guarantees, undertakings, approvals, memoranda, amendments, letters, communications, notices, certificates, request, statements and any other instruments of any nature whatsoever;

II. Sign and execute necessary documentation, pay the necessary fees, appear before NEPRA as needed, and do all acts necessary for completion and processing of the Generation License Application (modification to the application for the Grant of Generation License);

III. Do all such acts, matters, and things as may be necessary for carrying out the purposes aforesaid and giving full effect to the above resolution(s).

AND FURTHER RESOLVED THAT Mr. Saleem Uz Zaman as Company Secretary be and is hereby authorized to delegate all or any of the above powers in respect of the foregoing to any other official of the company as deemed appropriate.

Ground Floor, OICCI Building, Talpur Rd [illegible] Phone: +92 21 3246 8041 – 44 Fax: +92 21 3246 8039

I certify that the meeting was duly convened and held as per the Company's Memorandum & Articles of Association on 17 October 2014 at 2 pm in Karachi at Ground Floor OICCI Building, Off I.I. Chundrigar Road, Karachi and minutes of the meeting have been duly recorded in the minute book of the Company.

Saleem uz Zaman
Company Secretary

Ground Floor, OICCI Building, [illegible] Phone: +92 21 3246 8041 - 44 Fax: +92 21 3246 8039

BURJ WIND ENERGY (PRIVATE) LIMITED

Burj Wind Energy Private Limited ("**BWE**" or "**Project Company**") is a Pakistan based company with the sole objective of developing, financing, building and operating a 14MW wind power project in Pakistan (the "**Project**"). The Project is being pursued under the terms of a Letter of Intent ("**LOI**") issued by AEDB in 2012 and is being developed under the build-own-operate ("**BOO**") scheme, with non- recourse financing.

A. SPONSORS

Burj Capital is an international investment firm focused on developing and managing renewable power generation and retailing. Burj Capital aims to create a lasting value for its investors and partners by identifying opportunities where it can either build or unlock value by utilizing its team of industry and business experts who have a proven track record of investing across a variety of sectors and combining them with access to capital. The firm's world class and multi-disciplined professionals have a successful track record of identifying high quality assets and advancing them from development to operations.

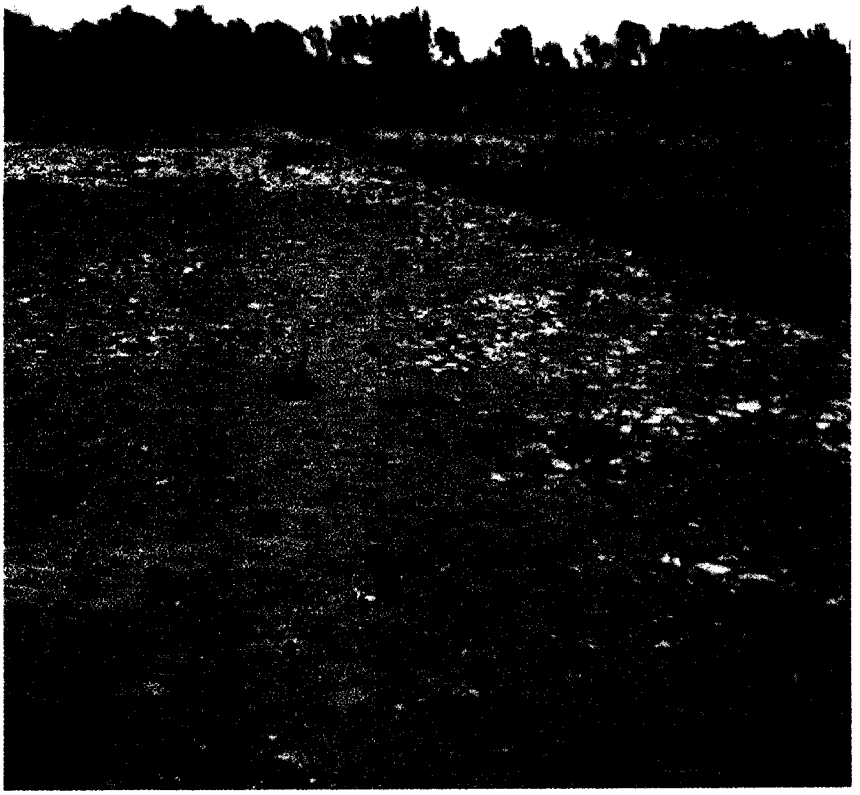
B. PROJECT DEVELOPER

The Project is being developed by Burj Power. Burj Power ("**BP**") is a power project advisory and investment company with an objective to acquire, develop, build, own and operate power projects in the Africa and Asia region. It was organized by a strong team of industry veterans with a successful track record of developing, operating and managing large power assets globally, including Pakistan, both as a part of the global power company, The AES Corporation as well as on their own. The team has a proven track record of developing sustainable and profitable projects both in AES and outside.

C. THE SITE:

Burj Wind Energy (Pvt) Limited has acquired private agriculture survey land around 250 acres, by way of lease of 20 years extendable to further 10 years for the Project Company's 14 MW wind power project, situated in Gujjo, Deh: Pir Jharion, Thatta, Sindh. It falls within the Gharo-Keti Bandar wind corridor. The site was selected after going through various technical studies of terrain and assessment of wind.

The site pictures are given below;



Geo-technical study has been carried out on the Project Site. Soil conditions were found to be favorable for road construction and for installing underground facilities such as wind turbine foundations etc. The bearing capacity is high and stable. A comprehensive geotechnical study will be conducted under the supervision of EPC Contractor.

D. EPC CONTRACTOR, MACHINES AND O&M CONTRACTOR

BWE circulated Request for Proposal ("**RfP**") to various equipment suppliers and EPC Contractors of wind power plant soliciting EPC proposals. In response, only following two companies showed serious interest and submitted their proposals.

1. Dongfang Electric International Corporation; and
2. HydroChina Huadong Engineering Corporation with GoldWind as wind turbine supplier.

The Project Company engaged Lahmeyer International for thorough evaluation of EPC proposals besides reviewing proposals internally. Project Company selected Dongfang for the Project.

Please find below the key features of WTG to be supplied by Dongfang;

Model	FD89-1500 kW
Diameter	89 m
Number of blades	03

Dongfang will provide brand new plant and equipment including WTGs' and entire plant and equipment will be reliable, efficient and of highest international standard with proven technology.

E OUTSOURCED O&M

O&M will be carried out by the WTG supplier after COD.

F: WIND ASSESSMENT

Assessment of the wind resource is a complex process involving several stages of data collection, modeling and statistical analysis. Project Company has engaged Lahmeyer to carry out wind resource assessment and estimation of Annual Energy Production ("**AEP**") for the Project.

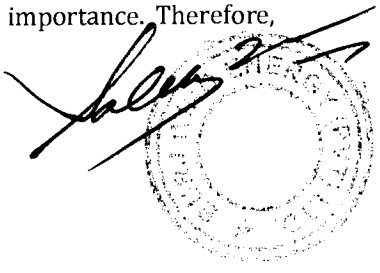
Wind is abundant in the summer months with peak winds during May to July and lower winds in the winter months from November to January. Assessment of wind data clearly indicates that the Gujju site is located within the vicinity of one of the best wind corridors in the country i.e. Gharo ~ Kati Bander Wind Corridor.

G GRID INTERCONNECTION

In order to assess the impact of the Project and the National Grid on each other, a detailed grid interconnection study has been carried out. The power from the Project will be delivered to the grid at an approved interconnection point. NTDC is reviewing the grid interconnection study and will form their opinion in due course.

H ENVIRONMENTAL STUDIES

As per the requirements of Section 12 of Pakistan Environmental Protection Act (PEPA), 1997, Project Company has completed the Initial Environmental Examination ("**IEE**") report for the Project. The Project is not likely to have any significant adverse environmental impacts, which could be irreversible or could affect sensitive eco-system, requires involuntary resettlement, or has an unprecedented impact. The Project has no gaseous and other emissions. Sewerage will be treated and reused at the Project Site for sprinkling on the unpaved site to reduce fugitive dust. The Project is also not located in the vicinity of sensitive location of national importance. Therefore,



Project falls under Category "B" according to "Pakistan Environmental Protection Agency, Review of IEE & EIA Regulations 1997/2000 (revised)". Sindh Environmental Protection Agency has issued No Objection Certificate ("NOC") to the Project Company on August 28, 2013.

I SOCIAL RESPONSIBILITY

The Sponsors of Project Company always regard corporate social responsibility as an important force in building a harmonious society. They also believe in paying full attention to human factors, exercising environmental protections and conservation, increasing employment, and helping build the community. Every year they support numerous educational, sporting, and charity programs designed to help a wide range of people. Operations of the Plant will provide job opportunities especially to the local people. Poverty alleviation, though at minor scale, will be another benefit besides meeting power shortage in Pakistan.

J PROJECT AGREEMENTS

Project Company will sign;

i. Implementation Agreement with the Government of Pakistan through Alternative Energy Development Board
ii. Energy Purchase Agreement with National Transmission And Despatch Company Limited (through its Central Power Purchasing Agency on behalf of ex-WAPDA Distribution Companies)

K FINANCING

Total Project Cost, expressed in United States Dollars, has been calculated after thorough analyses, evaluation, and understanding of the dynamics that affects the development, construction, and operations of a wind farm in Pakistan.

The Project cost will be financed by a combination of loan and equity. Maximum Loan Equity ratio for the Project is assumed as 75%:25%.

Equity: Sponsors have lined up the required equity for the Project. Burj Capital will contribute 100% of the required equity

Loan: Project Company is negotiating loan for the Project with local banks and will arrange 100% local currency financing for the Project.

There is no encumbrance on the Facility.

L TARIFF

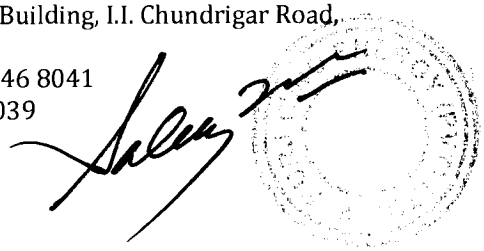
Project Company is filing tariff petition under Cost-plus regime with NEPRA separately.

M TIMELINE

Tentative financial close date of the Project is 31st March 2015 and construction will start in April 2015. Under the terms of the EPC Contract, construction will be completed in 15 months and Commercial Operations Date ("COD") is June 30, 2016.

N CONTACT DETAILS

Saleem Uz Zaman
Company Secretary
Burj Wind Energy (Private) Limited
Ground Floor, OICCI Building, I.I. Chundrigar Road,
Karachi, Pakistan.
Landline : +92 213-246 8041
Fax : +92 213-246 8039



SUMMARY OF PLANT DETAILS

Regulations 3(5), 3(6), and Schedule III of the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999

Name of Applicant:	Burj Wind Energy (Private) Limited
Registered Office	Ground Floor, OICCI Building, Talpur Road, Karachi, Pakistan. Ph. No. 0213-246 8041, Fax. No. 0213-246 8039
Business Office:	Ground Floor, OICCI Building, Talpur Road, Karachi, Pakistan. Ph. No. 0213-246 8041, Fax. No. 0213-246 8039
Plants Location:	Gujju, District Thatta, Sindh
Type of Facility	Wind
Proposed Buyer	National Transmission And Despatch Company Limited (through its Central Power Purchasing Agency on behalf of ex-WAPDA Distribution Companies)
Plant Configuration a) Plant Size b) De-rated Capacity c) Auxiliary Consumption d) Total Net Capacity e) Type of Technology f) Number of Unit g) Unit Size h) Unit Make and Model i) Commissioning Date j) Expected life of the Project from COD	 13.50 MW EBOP Loss: 550KW 130KW 12.82 MW without wake losses Wind 9 1.5MW each Dongfang FD89-1500KW June 30, 2016 20 Years
Plant Characteristics a) Generation Voltage b) Power Factor c) AGC (Automatic Generation Control/ AVR (Automatic Voltage) d) Ramping Rate e) Alternate Fuel f) Auxiliary Consumption g) Time to Synchronize	690V at generator terminal and 132kV at the point of interconnection with the grid 0.95 lagging/leading at turbine output. 0.95 lagging/ leading at interconnection point. Not applicable Not applicable Not applicable 130KW As per NTDC's approved specifications
Proposed Tariff	Project is applying for the tariff under Cost-plus regime.

BankIslami Pakistan Limited
Duplicate Statement of Account
SHAHRAH-E-FAISAL

Statement Issue date: 23-10-2014
Currency: Pakistani Rupee

Account Number : 102610453180001
Account Type : Current Account

BURJ WIND ENERGY PRIVATE LIMITED
GROUND FLOOR OICCI BUILDING
TALPUR ROAD, OFF I.I CHUNDIGAR
ROAD KARACHI.32468041-32468044

KARACHI
32468041

From Date : 01-05-2014 To Date : 23-10-2014 **Opening Balance as on 01-05-2014** 0.00

Date	Description	Withdrawal	Deposit	Balance
07-08-2014	Online Cash Withdrawal Charges dt:28-07-2014 0728201415821 HEAD OFFICE	25.00		200,196.60
13-08-2014	Inward Clearing.. TO 900184301140586 # 1782805,Cheque No:12146186 Cheque No:12146186	163,054.00		37,142.60
22-08-2014	Inward Clearing.. TO 900184301140586 # 1796497,Cheque No:12146184 Cheque No:12146184	7,000.00		30,142.60
27-08-2014	A/C-A/C Trf with Chq From 102610453180031 # 1804158,Cheque No:12145202 Cheque No:12145202		50,250.00	80,392.60
01-09-2014	A/C-A/C Trf with Chq From 102610453180031 # 1810788,Cheque No:12145204 Cheque No:12145204		1,624,982.50	1,705,375.10
03-09-2014	Same Day I/W Clering TO 900183186010586 # 1815897,Cheque No:12146191 Cheque No:12146191	539,000.00		1,166,375.10
09-09-2014	Inward Clearing.. TO 900184301140586 # 1822794,Cheque No:12146189 Cheque No:12146189	1,036,800.00		129,575.10
11-09-2014	Cash Withdrawal # 135709,Cheque No:12146193 Cheque No:12146193 CLOTH MARKET BRANCH KARACHI	19,000.00		110,575.10
23-09-2014	A/C-A/C Trf with Chq From 102610453180031 # 1850385,Cheque No:12145205 Cheque No:12145205		3,069,705.10	3,180,280.20
24-09-2014	Online Cash Withdrawal Charges FED dt:11-09-2014 0911201413012 HEAD OFFICE	4.00		3,180,276.20
24-09-2014	Online Cash Withdrawal Charges dt:11-09-2014 0911201413011 HEAD OFFICE	25.00		3,180,251.20
25-09-2014	Inward Clearing.. TO 900184301140586 # 1852816,Cheque No:12146195 Cheque No:12146195	2,902,140.00		278,111.20
25-09-2014	A/C-A/C Trf with Chq From 102610304260001 # 1854530,Cheque No:12131773 Cheque No:12131773		500,000.00	778,111.20
25-09-2014	Cash Withdrawal # 1854536,Cheque No:12146198 Cheque No:12146198	500,000.00		278,111.20
25-09-2014	Charges- Cash Withdrawal #1854536 , Cheque No:12146198 Cheque No:12146198	2,500.00		275,611.20
30-09-2014	A/C-A/C Trf with Chq From 102610453180031 # 1862333,Cheque No:12145209 Cheque No:12145209		5,111,614.88	5,387,226.08
02-10-2014	Same Day I/W Clering TO 900183186010586 # 1866411,Cheque No:12146203 Cheque No:12146203	5,099,000.00		288,226.08
03-10-2014	Inward Clearing.. TO 900184301140586 # 1868095,Cheque No:12146194 Cheque No:12146194	37,500.00		250,726.08
09-10-2014	A/C-A/C Trf with Chq From 102610453180031 # 1871687,Cheque No:12145210 Cheque No:12145210		2,146,606.25	2,397,332.33
10-10-2014	Cash Withdrawal # 1874911,Cheque No:12146207 Cheque No:12146207	10,278.00		2,387,054.33
10-10-2014	Cash Withdrawal # 1874913,Cheque No:12146205 Cheque No:12146205	1,000.00		2,386,054.33
14-10-2014	Inward Clearing.. TO 900184301140586 # 1877484,Cheque No:12146210 Cheque No:12146210	1,036,800.00		1,349,254.33

APPLICANT

The legal and commercial name of the Project Company is Burj Wind Energy Power Private Limited. It was established in 2012 as a private limited liability company organized under the provisions of the Companies Ordinance 1984 in Pakistan. The Project Company's registered office is located in Karachi, Pakistan.

Burj Wind Energy Private Limited (the "**Project Company**") is a Pakistan based company with the sole objective of developing, financing, building and operating a 14MW wind power project (the "**Project**") in Pakistan. The Project is being pursued under the terms of a Letter of Intent ("**LOI**") issued by the Alternative Energy Development Board ("**AEDB**") in 2012 to the Project Company.

Burj Power was mandated to develop the Project in 2013.

BURJ CAPITAL - *Profile*

Burj Capital is an international investment firm focused on developing and managing renewable power generation and retailing. Burj Capital aims to create a lasting value for its investors and partners by identifying opportunities where it can either build or unlock value by utilizing its team of industry and business experts who have a proven track record of investing across a variety of sectors and combining them with access to capital. The firm's world class and multi-disciplined professionals have a successful track record of identifying high quality assets and advancing them from development to operations.

Burj Capital's business objective is to achieve long term capital appreciation for its shareholders by developing Greenfield initiatives or investing in companies requiring expansion or growth capital. The company's target markets are Pakistan, the Middle East and Africa. Burj Capital is also evaluating select opportunities of acquiring and developing renewable energy generation companies and projects in Europe.

Headquartered in Dubai, United Arab Emirates, Burj Capital maintains presence in Singapore Karachi and Islamabad through its own and its representatives' offices.

Business Verticals

- Renewable Power: Burj Capital is developing the following projects:

  Projects under advanced stage of development:

  Pakistan:
  50 MW Jhimpir wind power project, in Jhimpir, Sindh
  15 MW Gujju wind power Project, Gujju, Sindh
  15 MW Gharo wind power project Gharo, Sindh

  Projects pipeline:

  Pakistan:
  200 MW wind power project in Sindh
  11 MW waste to power generation project in Karachi

UAE:
4 MW landfill waste gas to power project in Ras Al Khaimah UAE

Kenya:
2 x 40 MW wind power projects in Meru and Lambwe Valley
20 MW solar power project in Meru

West Africa:
5 x 20 MW solar power projects in UEMOA countries in West Africa

Europe:
100 MW wind

- **Oil & Gas:** Burj Capital owns Gray Mackenzie Oilfield Services ("GMOS"), a UK based oil & gas services company with a 13-year track record in the Middle East. GMOS provides E&P companies end-to-end services including procurement, human resources, turnkey project development, and operations management. GMOS is currently underway expanding its operations to Pakistan.

- **Retailing:** Burj Capital holds franchise for Nine West in Pakistan. It operates three flagship stores in Karachi, Lahore and Islamabad. Nine West is a leading international brand for ladies footwear, handbags and other fashion accessories. Two additional stores are now being planned for Karachi and Lahore along with franchise opportunities under review for other main cities of Pakistan. Burj Capital is also planning diversification into fast food, men's fashion, and supermarkets.

- **Investment Banking:** Operating under the brand name "Burj Capital", it is offering its services on a regional basis by a team of investment banking professionals with an unrivalled depth of experience in conventional and Islamic banking, having led transactions for clients in Middle East, Pakistan and Africa. Its investment banking professionals have in-country, hands on global investment, operating and transaction execution experience. By combining corporate advisory with access to a diverse capital base, regional knowledge and proven execution, the investment banking vertical is strategically positioned to address the diverse needs of conventional and Islamic clients in the target region. Firm's investment banking platforms include Burj Capital Pakistan, Burj Partners, UAE and joint ventures in Zambia and Ghana. Deal execution is carried out from Karachi and Dubai.

- **Waste Management:** In 2013, Burj Capital partnered with a leading waste management company in the Middle East, Ceres Associates Gulf ("Ceres"). Ceres, with offices in the UAE, KSA and Pakistan, has been responsible for design, development, construction and operation of entire waste management systems across seven major cities in the Middle East which include cities of Medina, Jeddah, Ras Al Khaimah and Umm Al Quwain. Total value of waste management facilities delivered by Ceres is over AED 200 million and it handles more than 13,000 tons of solid municipal waste daily. Ceres is currently constructing a state-of-the-art zero waste system for Qaseem municipality in Saudi Arabia. Burj Capital is expanding Ceres' operations in the UAE, Pakistan and Oman.

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MR. SHAHZAD QASIM, CEO Burj Power&Burj Wind Energy

Shahzad Qasim has over 25 years of experience in the power sector globally and has previously worked with The AES Corporation, McKinsey and Stone & Webster.

Prior to Burj Power, Shahzad was President of the Europe, CIS, and Africa regions for The AES Corporation and was responsible for the regional business with revenues of USD 1.4 billion and over 12,000 MW of generation and 3 distribution companies with 1.7 million customers.

While at AES, Shahzad was directly responsible for developing, financing, constructing and operating power plants in Oman, Qatar, Pakistan, Bangladesh, Jordan and India with an installed capacity of over 3,000 MW and capital investment of $2 billion.

Shahzad trained as an engineer and has MS in Energy Management and Policy from Wharton.

MR. SAAD ZAMAN, CEO Burj Capital

Burj Capital is the initiative of Saad, a leading and accomplished banking professional who has successfully established and managed a number of conventional and Islamic banks in the region. Saad during his time with Dubai Islamic Bank, led it's international expansion and investment banking expansion, and clearly established DIB as a leading financial player in the Islamic Financial Services Sector

Prior to establishment of Burj Capital, Saad had been part of the following leading organisations:

- CEO of DIB Capital Limited, formerly known an Millennium Capital Limited (MCL), a fully owned full service investment bank for DIB, DIBC is a DFSA regulated entity
- Led the establishment of DIB Pakistan, a locally incorporated, wholly owned subsidiary of DIB. Remained CEO from inception until January 2008 and ensured a successful roll out of the bank in Pakistan
- Chairman Millennium Finance Corporation, an investment advisory company regulated by Dubai Financial Services Authority
- Led the management team in establishment and deployment of Emirates & Sudan Bank
- Served on the Executive Committee of the board of the Bank of Khartoum, Sudan

Prior to joining DIB, he was associated with Citibank. He served as the Managing Director/CEO of Citi Islamic Investment Bank and was responsible for Citi's Islamic offerings globally. Earlier Saad held the position of Corporate Finance and Investment Banking Head Citibank for Middle East, Pakistan and Levant based out of Dubai.

MR. RAZI UR RAHAN KHAN, Group CFO, & Director

Razi has extensive experience in banking, open and close-end mutual funds management, equity brokerage and private equity investment. A chartered accountant by background Razi has served in various important positions in a number of public and private sector organizations, including Securities and Exchange Commission of Pakistan (SECP) as Chairman; JP Morgan Chase as Country Manager for Pakistan; National Investment Trust (NIT) as Chairman and Managing Director; Hub Power Company (HUBCO) as Finance Director; ANZ Merchant Bank, London as Director International & Islamic Finance; ANZ Grindlays Pakistan as Chief Manager

As the Chairman of SECP, Razi was instrumental in development and implementation of Governance and transparency measures in capital market of the country and introduction of various capital market regulations in Pakistan.

Razi was responsible for conceiving, structuring and executing the first major Islamic Unit Trust in Pakistan. He has advised and arranged more than USD 1.5 BN worth of deals in Islamic Finance.

MR. ZAFAR MASUD, Director

Zafar is a Founding Partner and Director of Burj Capital. Prior to Burj Capital Zafar was a member of Barclays Emerging Markets Management Committee and the Regional Managing Director for Southern Africa at Barclays Bank plc and was responsible for managing the total balance sheet size of US$3Bn in assets and over 4000 permanent staff. As the Regional MD, Zafar increased the banks' Consumer, Corporate and Treasury business by introducing new products and customers.

Previously, Zafar was a founding member of Dubai Islamic Bank team in Pakistan and where his work resulted in DIB investing US$100Mn in Pakistan. Zafar was the inaugural Head of Corporate and Investment Banking Business and was responsible for attracting foreign strategic investors to Pakistan. Notable deals included $375Mn port expansion project, $150Mn palm oil refinery project as well as assisting the first ever leading international cosmetic brands entry into the Country.

Zafar has also been a member of the Country Management Committee at Citibank Pakistan and was responsible for handling Government and Public Sector business. He was involved in all the major deals done by Citibank between 1999-2005 including issuance of First-ever US $600Mn Government of Pakistan Islamic Sukuk, US $350Mn PIA-US Exim Bank Deal, First-ever Derivative/ Interest Rate Swap with Pak Arab Refinery Company, set-up US $100Mn OPIC guaranteed financing facility for KESC and implementation of Management solution for Pakistan State Oil.

Zafar has recently been appointed on the Central Board of Directors of the State Bank of Pakistan (the Central Bank of the country) as an Independent Director. He is also a Member of the Board's HR and InvestmentCommittees of the State Bank of Pakistan.

Zafar has also been recently appointed on the Board of Oil and Gas Development Company Limited (OGDCL).

* * *

Annexure i

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

[Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No. **0080255**

I hereby certify that **BURJ WIND ENERGY (PVT.) LIMITED** is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is **limited by shares.**

Given under my hand at **Karachi** this **Twentieth** day of **June,** Two **Thousand** and **Twelve.**

Certified to be True Copy
07/11/2014
Asstt. Deputy Registrar of Companies

Fee Rs. 4,500/-

(Sidney Custodio Pereira)
Joint Registrar of Companies
Karachi

07/11/14

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Annexure-II

THE COMPANIES ORDINANCE 1984

PRIVATE COMPANY LIMITED BY SHARES

MEMORANDUM

OF

ASSOCIATION

OF

BURJ WIND ENERGY (PRIVATE) LIMITED

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THE COMPANIES ORDINANCE, 1984
(PRIVATE COMPANY LIMITED BY SHARES)

Memorandum of Association of

BURJ WIND ENERGY (PRIVATE) LIMITED

I. 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.

2. 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, transmission towers, 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 aforesaid substances.

5. 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.

6. 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 overhead and underground distributions network, high voltage underground cables, and low voltage AC and DC installations, rectifier, capacitor installations and consumer services.

9. 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.

11. 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.

12. To represent deal and trade in all kind of power and energy related plants, turbines, 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, alter remove 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, refineries, 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, drawing 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.

20. 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, treat, purify, blend, reduce, distil, 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, utensils, appliances, equipment, stoves, heaters, apparatus, utensils, substances, raw materials, chemicals, natural gas, liquefied petroleum gas, fuel oil, coal, lubricants, articles and things and to manufacture, experiment with render marketable and deal in all products, appliances, equipment, apparatus, products, materials, substances, articles and things capable of being used in any such business as aforesaid 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 treat and deal in all products and residual and bye-products incidental 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.

27. 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, acquire, secure and grant agency, distribution rights, representations and trade in or

deal 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 fittings, machinery, apparatus, convenient or necessary for the purposes of the Company, and connection with power generating 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 fittings, engines, meters, indices, apparatus for testing and measurement, stoves, cookers, gassings, ranges, pipes, mains for lighting, heating, motive power, ventilating, 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, lectures, meetings and conferences and by providing or contributing to the scientific or technical professors or teachers 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 carry on.

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 any 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, retailers, 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 funds 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 Pakistan 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 the Company's business or any branch or department thereof and to use,

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 time 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 carrying 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 carrying on or proposing to carry on any business which this Company is authorized to

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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 arrangements from banks, or other financial institutions, or Directors in such manner as the Company may think fit and in particular by issue of debentures, debenture stock, perpetual or otherwise convertible into shares and to mortgage, or charge the whole or any part of the property or assets of the Company, present or future, by special assignment or to transfer or convey the same absolutely or in trust as may seem expedient and to, purchase, redeem or payoff any such securities.

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 its 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

servants or employees of the Company to be insured against risk of accident in the course of their employment by the Company.

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

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

62. To guarantee the performance of contract and obligations of the Company in relation to the payment of any loan, debenture-stock, bonds, obligations or securities issued by or in favor of the Company and to guarantee the payment or return on such investments.

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

64. To cause the Company to be registered or recognized in any foreign country.

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

66. To accept, design, display, publish, transmit, distribute or reproduce in any 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 undertake 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 indulge into business of radio and television broadcasting/ transmission.

67. To accept securities of any person or any property or interest therein of whosoever nature, in payment or part payment for any services rendered, or for any sale or supply made to, or debt owing from, any such person.

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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 floating), 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 law.

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.

71. 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,

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 profits 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, property and undertaking of the company or any asset or part thereof for any consideration which the company may see fit 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

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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, annuities, 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 as 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 aforementioned 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, a 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 obtain the listing of any of the securities of the company, or of any derivative securities 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.

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 conducive 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.

97. 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.

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 company sent opposite to our respective names :-

S. No.	Name & Surname (Present, Former) in full (In Block Letter)	Fathers Name in Full	NOC No / (Passport No.) If Foreigner	Nationality with any former Nationality	Occupation	Residential Address	No. of Shares taken by each Subscriber	Signature
1	AROOJ ASGHAR	ASGHAR ALI SHEIKH	35202-6311856-5	PAKISTANI	BUSINESS	HOUSE NO 60, STREET 32, SECTOR F6/1, ISLAMABAD	10 (Ten)	
2	WASIM AHMAD BARLAS	SAEED AHMED KHAN	61101-2744711-7	PAKISTANI	BUSINESS	HOUSE 474, STREET 75, SECTOR G8/1, ISLAMABAD	10 (Ten)	
						Total (Twenty Only)	20	

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

Serial No........ Burj Wind Energy (Pvt) Ltd.
...20.06.2012

Joint Registrar of Companies
Companies Registration Office
Karachi.

Certified to be True Copy

Asstt./Deputy Registrar of Company

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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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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 or addition to its regulations by Special Resolution as prescribed by the said Ordinance; be such as are contained in these Articles.

INTERPRETATION

2. 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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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 masculine 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

3. 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 fifty, provided that for the purpose of this provision, where two or more persons hold one or more shares in the Company jointly, they shall be treated as 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 ~~or reduce~~ the same and to divide the shares into several classes.

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.

9. 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, firms 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 fit particularly by the issue of debentures of the Company, or by

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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 fifteen 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 fit, 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.

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, if any, shall preside as Chairman at every general meeting of the Company, but if there is no such Chairman, or if 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 quorum 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 aforesaid, 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.

27. 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

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

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.

37. 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

40 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. The

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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 time 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 retirement 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.

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, losses 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, or upon which any

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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 strict 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

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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We the several persons whose name and addresses are subscribed below are desirous 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 :-

S. No.	Name & Surname (Present, Former) in full (In Block Letter)	Fathers Name in Full	NOC No / (Passport No.) If Foreigner	Nationality with any former Nationality	Occupation	Residential Address	No. of Shares taken by each Subscriber	Signature
1	AROOJ ASGHAR	ASGHAR ALI SHEIKH	35202-6311856-5	PAKISTANI	BUSINESS	HOUSE NO 60, STREET 32, SECTOR F6/1, ISLAMABAD	10 (Ten)	
2	WASIM AHMAD BARLAS	SAEED AHMED KHAN	61101-2744711-7	PAKISTANI	BUSINESS	HOUSE 474, STREET 75, SECTOR G8/1, ISLAMABAD	10 (Ten)	
						Total (Twenty Only)	20	

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

Serial No. .... Burj Wind Energy (Pvt) Ltd.
Name of the ...
Brief Description ...
Then date on which ... reconed. 20-06-2012

... of Companies
Companies Registration Office
Karachi.

Certified to be True Copy
07/11/2015
Asstt. Deputy Registrar of Company

Annexure III)

THIRD SCHEDULE

(Se section 156)

FORM A - ANNUAL RETURN DF COMPANY HAVING SHARE CAPITAL

1. Registration No.	0080255
2. Name of the Company	BURJ WIND ENERGY (PVT.) LIMITED
3. Form A made upto (Day/Month/Year)	20/12/2013
4 Date of AGM (Day/Month/Year)	20/12/2013

PART - A

5 Registered Office Address	F-52/2, Bath Island, Kehkashan 7, Clifton 6, KARACHI Sindh 74200
6. Email Address	kazim.raza@burjcap.com
7. Office Tal. No.	00922132469141
8. Office Fax No.	
9. Nature of Business	-POWER GENERATION - ALLIED (OTHER)

10. Authorized Share Capital

Type of Shares	No. of Shares	Amount	Face Value
Ordinary Shares		500,000.00	

11. Paid up Share Capital

Type of Shares	No. of Shares	Amount	Issue Price
Ordinary Shares		200.00	

12. Amount of indebtedness on the date upto which form A is made in respect of all Mortgages/Charges	0.00

13. Particulars of the holding company

Name			
Registration No.		% Shares Held	

14. Chief Executive

Name	SHAHZAD SYED QASIM	NIC	4230109000361
Address	HOUSE NO. 32/2 A KHAYABAN-E-MOMIN DHA PHASE-V KARACHI		

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Certified to be True Copy

07/11/2014

Deputy Registrar of Company

89202 dt 07/11/14

07/11/2014

15. Chief Accountant

Name	SYED SOHAIL RAZA ZAIDI	NIC	4210108027943
Address	HOUSE NO. 239/14 NASEERABAD F B AREA KARACHI		

16. Secretary

Name	SALEEM UZ ZAMAN	NIC	4230109483555
Address	HOUSE NO F-52/2 BLOCK-7 CLIFTON KARACHI		

17. Legal Advisor

Name	
Address	

18. Auditors

Name	TAHIR JAWAD IMRAN FECTO (CHARTERE
Address	309, PROGRESSIVE CENTRE MAIN SHAHRAH-E-FAISAL KARACHI

19. List of Directors on the date of Form-A

Name of Director	Address	Nationality	NIC (Passport No. if Foreigner)
SAAD UZ ZAMAN	HOUSE NO F-52/2 BLOCK-7 CLIFTON	Pakistan	4230184899977
ZAFAR MASUD	HOUSE NO 7-E, 7TH STREET PHAS	Pakistan	4230116313089
RAZI UR RAHMAN KHAN	HOUSE NO 35-J, 9TH STREET GIZR	Pakistan	4230182751961
SHAHZAD SYED QASIM	HOUSE NO 32/2 A KHAYABAN-E-MU	Pakistan	4230109000361

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19. List of Directors on the date of Form-A

Name of Director	Address	Nationality	NIC (Passport No if Foreigner)

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PART-B

20. List of members & debenture holders on the date upto which this Form A is made

Folio	Name of Members/Debenture Holders	Address	Nationality	No. of Shares	NIC (Passport No. if Foreigner)
	SAAD UZ ZAMAN	HOUSE NO F-52/2 BLOCK-7 CLI	Pakistan	5	4230184899977
	ZAFAR MASUD	HOUSE NO. 7-E, 7TH STREET I	Pakistan	5	4230116313089
	RAZI UR RAHMAN KHAN	HOUSE NO. 35-J, 9TH STREET	Pakistan	5	4230182751961
	SHAHZAD SYED QASIM	HOUSE NO. 32/2 A KHAYABAN	Pakistan	5	4230109000361

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21. Transfer of shares (debentures) since last Form A was made

No.	Name of Transferor (Members)	Name of Transferee	Number of Shares Transferred	Date of Registration of
1	AROOJ ASGHAR	SHAHZAD SYED QASIM	5	20/12/2013
2	AROOJ ASGHAR	RAZI UR RAHMAN KHAN	5	20/12/2013
3	WASIM AHMAD BARLAS	SAAD UZ ZAMAN	5	20/12/2013
4	WASIM AHMAD BARLAS	ZAFAR MASUD	5	20/12/2013

22. I certify that this return and the accompanying statements state the facts correctly and completely as on the date upto which this Form-A is made

Date (DD/MM/YYYY) 22/01/2014

Signature SALEEM

Designation ☐ Chief Executive

☑ Secretary

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PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE, MANAGING AGENT, SECRETARY, CHIEF ACCOUNTANT, AUDITORS AND LEGAL ADVISERS, OR OF ANY CHANGE THEREIN

THE COMPANIES ORDINANCE 1984

[SECTION 205]

FORM 29

1. Incorporation Number: 0080255
2. Name of Company: BURJ WIND ENERGY (PVT.) LIMITED
3. Fee Paid (Rs.): 900.0 — Name and Branch of Bank: KARACHI MCB - Uni Tower (1105)
4. Receipt No: E-2013-198048 — 22/01/2014
5. Mode of Payment (Indicate): Bank Challan

6. Particulars*:

6.1 New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation*** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)
SYED SOHAIL RAZA ZAIDI	4210198037843	SYED HASAN RAZA ZAIDI	HOUSE NO. 378-14 NASEERABAD F.B AREA KARACHI	Chief Accountant	Pakistan		20/12/2013	Appointed
SALEEM UZ ZAMAN	4230104463555	QAMAR UZ ZAMAN	HOUSE NO F-2/2 BLOCK-7 CLIFTON KARACHI	Secretary	Pakistan		20/12/2013	Appointed
SAAD UZ ZAMAN	4230184899977	QAMAR UZ ZAMAN	HOUSE NO F-2/2 BLOCK-7 CLIFTON KARACHI	Director	Pakistan		20/12/2013	Appointed
ZAFAR MASUD	4230118313089	MUNWAR SAEED	HOUSE NO. 1-E 7TH STREET PHASE-I DHA KARACHI	Director	Pakistan		20/12/2013	Appointed
RAZI UR RAHMAN KHAN	4230182751981	ABDUL MANAN KHAN	HOUSE NO. 35-J 9TH STREET GIZRI PHASE-IV DHA KARACHI	Director	Pakistan		20/12/2013	Appointed
SHAHZAD SYED QASIM	4230109090361	SYED SHAH ABDUL QASIM	HOUSE NO. 30/2 A KHAYABAN-E-MOMIN DHA PHASE-V KARACHI	Director	Pakistan		20/12/2013	Appointed
SHAHZAD SYED QASIM	4230109090361	SYED SHAH ABDUL QASIM	HOUSE NO. 30/2 A KHAYABAN-E-MOMIN DHA PHASE KARACHI	Chief Executive	Pakistan		20/12/2013	Appointed
TAHIR JAWAD IMRAN FECTO CHARTERED ACCOUNTANTS			308 PROGRESSIVE CENTRE MAIN SHAHRAH-E-FAISAL KARACHI	Auditor	Pakistan		20/12/2013	Appointed

6.2 Ceasing of Officer/Retirement/Resignation

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation*** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)
Riaz Ahmed Saqib Gohar and Company Chartered Accountants			Shaheen C.H.S. Main Nazir Bhatti Road off Shaheed Millat Road Karachi	Auditor	Pakistan		20/12/2013	Retired
WASIM AHMED BARLAS	6110127447817	SAEED AHMED KHAN	HOUSE 474 STREET 22 SECTOR G8/1 ISLAMABAD Islamabad Capital Territory (I.C.T.) Pakistan	Director	Pakistan		20/12/2013	Retired
AROOJ ASGHAR	3520263118565	ASGHAR ALI SHEIKH	HOUSE NO. 50 STREET 32 SECTOR F6/1 ISLAMABAD Islamabad Capital Territory (I.C.T.)	Director	Pakistan		20/12/2013	Retired
AROOJ ASGHAR	3520263118565	ASGHAR ALI SHEIKH	HOUSE NO. 50 STREET 32 SECTOR F6/1 ISLAMABAD PAKISTAN	Chief Executive	Pakistan		20/12/2013	Retired

6.3 Any other change in particulars relating to columns (a) to (g) above

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation*** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)

Name of Signatory: SALEEM — Designation: SECRETARY

Signature of Chief Executive/Secretary: — Date (DD/MM/YYYY): 2?/01/2014

89202

07/11/2014

Certified to be True Copy

07/11/2014

(Deputy Registrar of Company)

Annexure (IV)

BankIslami Pakistan Limited
Duplicate Statement of Account
SHAHRAH-E-FAISAL

Statement Issue date: 07-11-2014
Currency: US Dollar

Account Number : 102610453180031
Account Type : Current Account

BURJ WIND ENERGY PRIVATE LIMITED
GROUND FLOOR OICCI BUILDING
TALPUR ROAD, OFF I.I CHUNDIGAR
ROAD KARACHI.32468041-32468044

KARACHI
32468041

From Date : 01-07-2014 To Date : 06-11-2014 **Opening Balance as on 01-07-2014** 14,540.94

Date	Description	Withdrawal	Deposit	Balance
27-08-2014	A/C-A/C Trf with Chq TO 102610453180001 # 1804158,Cheque No:12145202 Cheque No:12145202	500.00		14,040.94
29-[redacted]-2014	Swift Transfer From 900181303010586 # 3445820,USD @ 102.05 6427000240FC USD @ 102.05 6427000240FC HEAD OFFICE		15,962.50	30,003.44
01-09-2014	A/C-A/C Trf with Chq TO 102610453180001 # 1810788,Cheque No:12145204 Cheque No:12145204	15,962.50		14,040.94
23-09-2014	Swift Transfer From 900181303010586 # 3528096,USD @ 102.74 5480000265FC USD @ 102.74 5480000265FC HEAD OFFICE		29,942.50	43,983.44
23-09-2014	A/C-A/C Trf with Chq TO 102610453180001 # 1850385,Cheque No:12145205 Cheque No:12145205	29,942.50		14,040.94
30-09-2014	Swift Transfer From 900181303010586 # 3553209,USD @ 102.59 4900600272FC USD @ 102.59 4900600272FC HEAD OFFICE		49,942.50	63,983.44
3[redacted]-2014	A/C-A/C Trf with Chq TO 102610453180001 # 1862333,Cheque No:12145209 Cheque No:12145209	49,942.50		14,040.94
03-10-2014	Swift Transfer From 900181303010586 # 3567504,USD @ 102.59 3247700275FC USD @ 102.59 3247700275FC HEAD OFFICE		20,942.50	34,983.44
09-10-2014	A/C-A/C Trf with Chq TO 102610453180001 # 1871687,Cheque No:12145210 Cheque No:12145210	20,942.50		14,040.94
23-10-2014	Swift Transfer From 900181303010586 # 3624582,USD @ 102.98 5229900295FC USD @ 102.98 5229900295FC HEAD OFFICE		17,142.50	31,183.44

BankIslami Pakistan Limited
Duplicate Statement of Account
SHAHRAH-E-FAISAL

Statement Issue date: 07-11-2014
Currency: US Dollar

Account Number : 102610453180031
Account Type : Current Account

BURJ WIND ENERGY PRIVATE LIMITED
GROUND FLOOR OICCI BUILDING
TALPUR ROAD, OFF I.I CHUNDIGAR
ROAD KARACHI.32468041-32468044

KARACHI
32468041

From Date : 01-07-2014 To Date : 06-11-2014 **Opening Balance as on 01-07-2014** 14,540.94

Date	Description	Withdrawal	Deposit	Balance
24-10-2014	A/C-A/C Trf with Chq TO 102610453180001 # 1896679,Cheque No:12145211 Cheque No:12145211	17,142.50		14,040.94
		Closing Balance as on 06-11-2014		**14,040.94**
		Available Balance as on 06-11-2014		**14,040.94**

Dongfang Electric Corporation (DEC), with its headquarter in Chengdu, China is one of the largest backbone enterprise groups under the direct administration of Chinese Central Government.

With, DEC has become a comprehensive group specialized in manufacturing industry, R&D of cutting edge technology, contracting international engineering projects, exporting complete plants and equipment, and international economic and technical cooperation with over half a century R&D experience.

Being an active international Contractor, DEC takes the lead in China particularly in contracting international power stations and a wide variety of large engineering projects, and exports of complete plants and equipment to over 30 countries in such diverse fields as power generation, electric and mechanical works, power distribution and transmission, railways, environmental protection, heavy duty mining and metallurgy equipment, traffic and transportation, communication etc. DEC has been selected as one of The Top 225 International Contractors in the world for many years by the well-reputed Engineering News Record of USA.

DEC possesses comprehensive technical R&D abilities and is honored by the Central Chinese Government as a National Research & Development Center. DEC has achieved the annual production of power generating equipment for more than 30,000MW consisting of hydro, thermal, nuclear, wind, combine-cycle generating unit. DEC presently enjoys one-third domestic market share in thermal power and two-fifths in hydro power.

DEC has two main manufacturing bases for Wind Turbine Generators covering Double Fed WTG (Type 3) and Permanent Mangetic Direct Dirve WTG (Type 4). WTG sets with unit capacity of 1.0MW, 1.5MW, 2.0MW, 2.5MW, 3.0MW, 5.0MW, 5.5MW suitable for different wind and climate conditions are being manufactured in these bases. The annual production capacity is 3500 sets.

In Pakistan DEC acted as Equipment Supplier/ Contractor for Nandipur Power Project, Lakhra Coal Fired Power Plant, Ghazi Brother Hydro power plant, Jinnah Hydro Power Plant, Khan Khwar Hydro Power Plant and Allai Khwar Hydro Power Plant

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure B: *Point 2; Technology, size of plant, number of units*

Technology	:	Dongfang
WTG Model	:	FD89-1500KW
Size of Plant	:	13.5MW
Number of Units	:	9

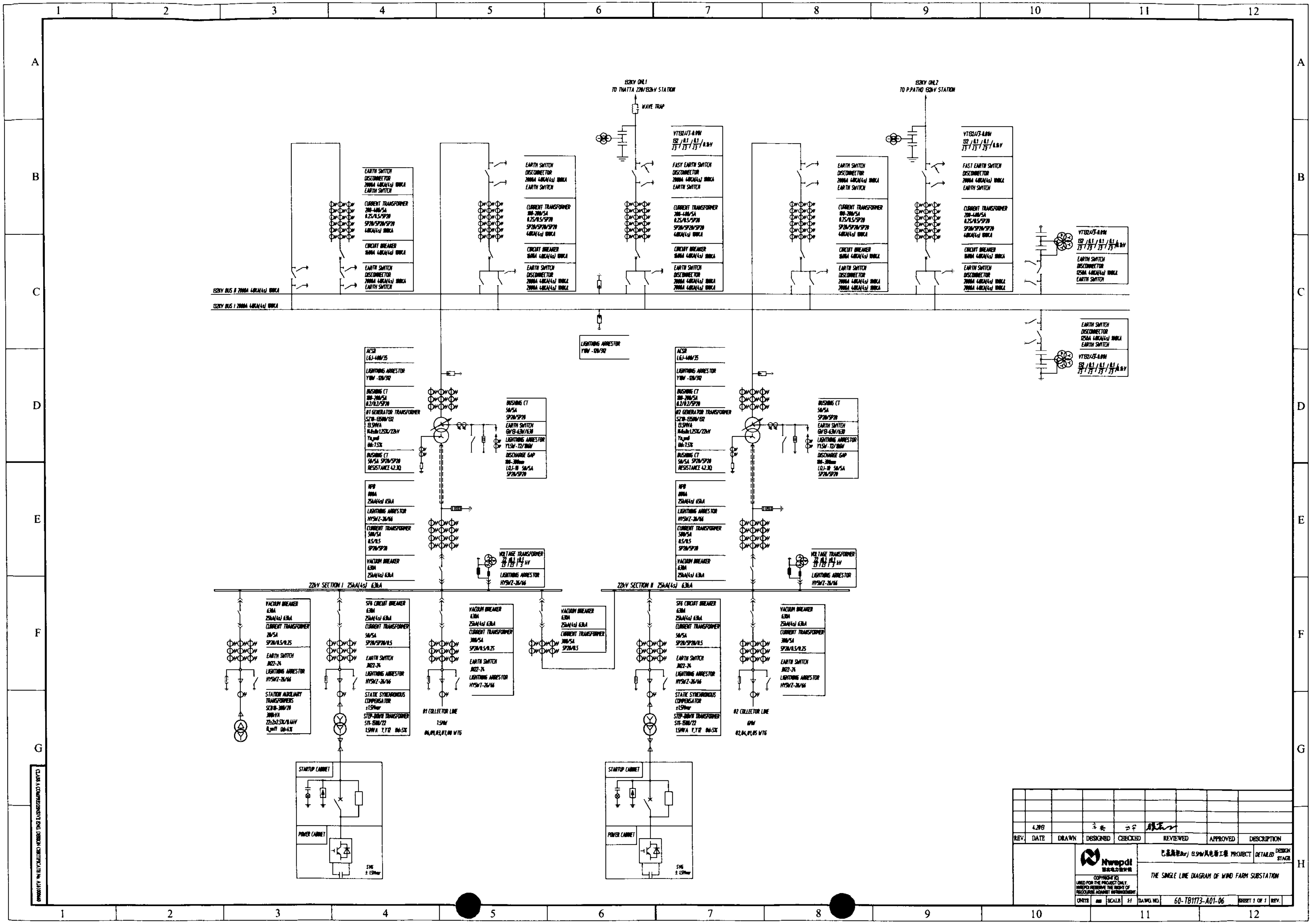
Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure C: *Point 6; Interconnection with National Grid Co. distance and name of nearest grid, voltage level (single line diagram)*

Project would be connected looping in-out one circuit of the 132KV Double Circuit from Thatta towards FWEL-I and FWEL-II at the farm substation of BWEPL-Gujju WPP. The distance of the looping point from the wind farm would be 4-5KM.
Final route/distance of transmission line has not been confirmed by NTDC/ HESCO.

Name of nearest grid	:	Thatta Substation
Voltage level	:	132kV
Single Line diagram	:	Annexure C.1

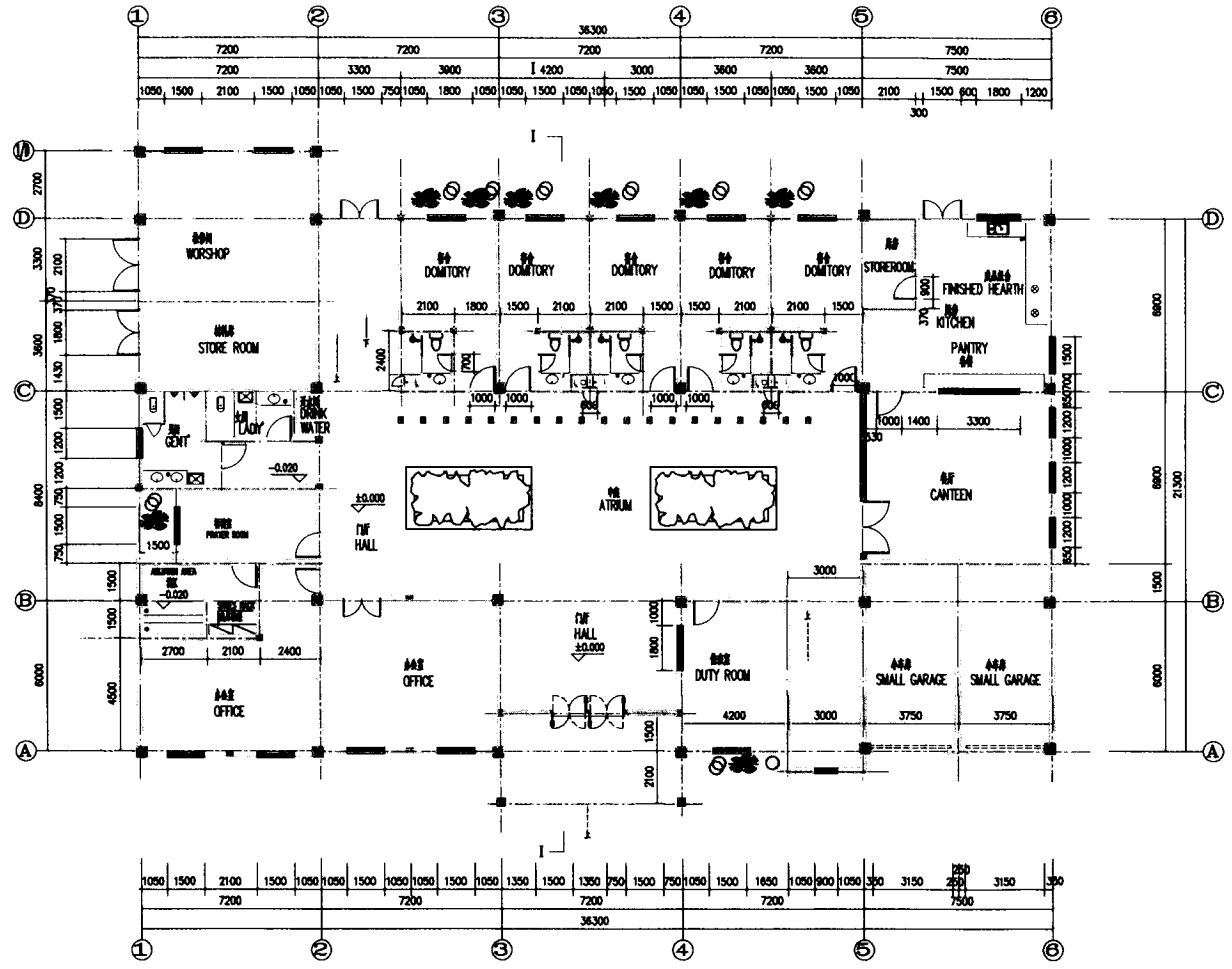

132KV OHL1
TO THATTA 220/132kV STATION
WAVE TRAP
132KV OHL2
TO P.PATHO 132kV STATION
132KV BUS II 2000A 40KA(4s) 100KA
132KV BUS I 2000A 40KA(4s) 100KA
LIGHTNING ARRESTOR
22kV SECTION I 25kA(4s) 63kA
22kV SECTION II 25kA(4s) 63kA
#1 COLLECTOR LINE
#2 COLLECTOR LINE
STARTUP CABINET
POWER CABINET
REV.
DATE
DRAWN
DESIGNED
CHECKED
REVIEWED
APPROVED
DESCRIPTION
4.2013
Nwepdi
COPYRIGHT (C)
USED FOR THE PROJECT ONLY.
NWEPDI RESERVE THE RIGHT OF RECOURSE AGAINST INFRINGEMENT
PROJECT
DETAILED DESIGN STAGE
THE SINGLE LINE DIAGRAM OF WIND FARM SUBSTATION
UNITS
SCALE
DAWG NO.
60-TB1173-A01-06
SHEET 1 OF 1
CLASS A COMPREHENSIVE ENG. DESIGN CERTIFICATE

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure D: *Point 7; Infrastructure: roads, rail, staff colony, amenities*

Staff colony : Annexure D.1
Project layout : Annexure D.2



一层平面图

PLAN OF THE 1st FLOOR

一层建筑面积 =811m²

1st FLOOR BUILDING AREA =811m²

总建筑面积 =1311m²

TOTAL BUILDING AREA =1311m²

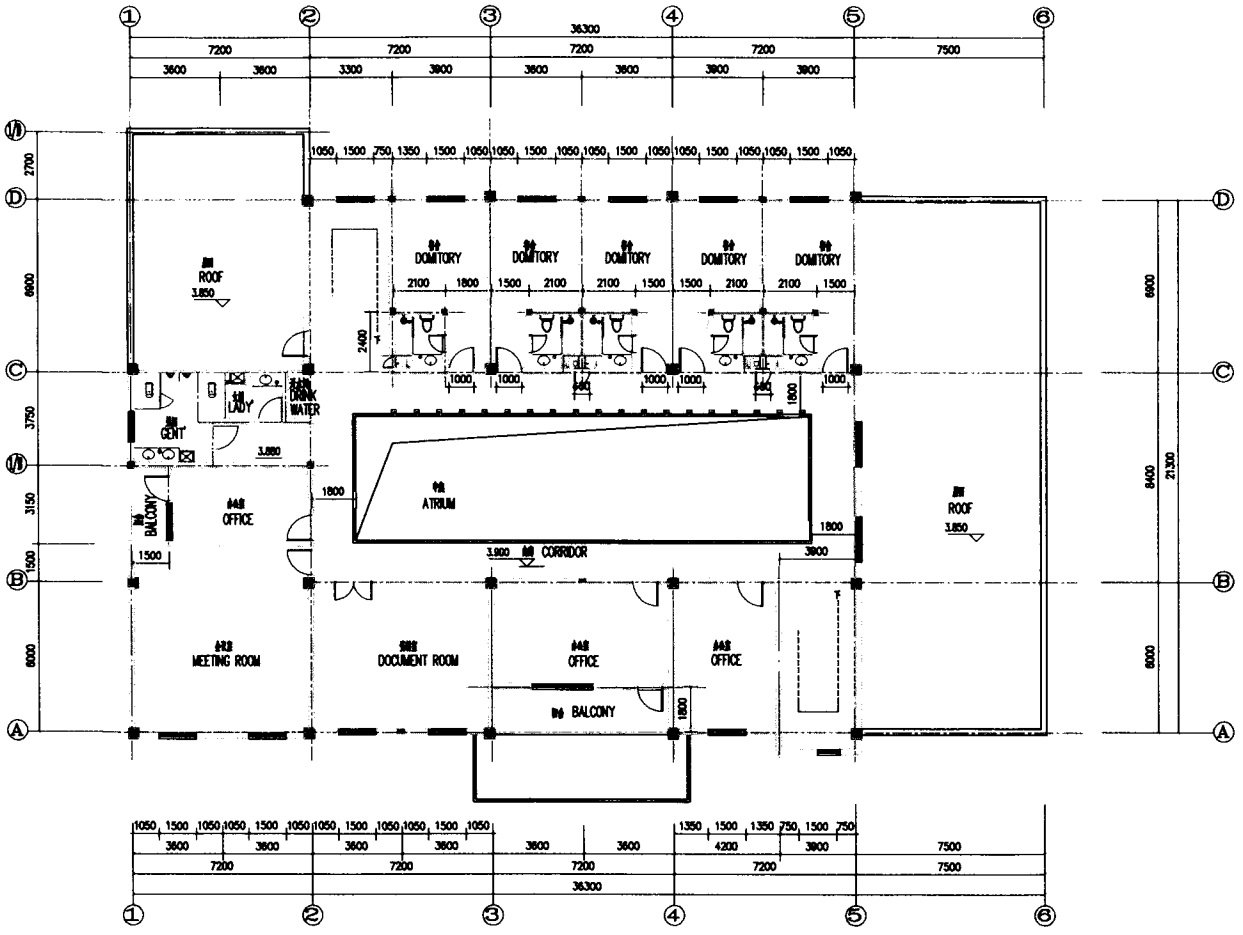
REV	DATE	DRAWN	DESIGNED	CHECKED	REVIEWED	APPROVED	DESCRIPTION
0	2014.08						

Nwepdi

BWEPL WIND FARM PROJECT PROPOSAL DESIGN STAGE

PLAN OF THE 1st FLOOR OF PRODUCTION COMPLEX BUILDING

TB1173-A01-09



二层平面图

PLAN OF THE 2nd FLOOR

二层建筑面积 =500㎡

2nd FLOOR BUILDING AREA =500㎡

REV.	DATE	DRAWN	DESIGNED	CHECKED	REVIEWED	APPROVED	DESCRIPTION
0	2014.08						

Nwepdi

BWEPL WIND FARM PROJECT PROPOSAL DESIGN STAGE

PLAN OF THE 2nd FLOOR OF PRODUCTION COMPLEX BUILDING

NTS	SCALE 1:100	DRAWING NO. TB1173-A01-10	SHEET 1 of 1	REV. 0

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure E: *Point 8; Project cost, information regarding sources and amounts of equity, debt*

Project Cost : Up to Rs. 4 billion

Debt from local banks : Up to Rs. 3 billion

Equity : Up to Rs. 1 billion.

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure F: *Point 9; Project commencement and completion schedule with milestones*

Project Construction Commencement : 1st July 2015
Completion schedule with milestone : Annexure F.1

Annexure 17: *Check List for Examination New Generation Facility (Wind) License Application Regulation 3(5)*

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company	: **M/s Burj Wind Energy (Private) Limited**
Capacity	: 13.50MW, Wind power plant

Annexure G: *Point 10; ESSA (Environmental and Social Soundness Assessment)*

ENVIRONMENT AND SOCIAL RESPONSIBILITY

1. GENERAL

As per the requirements of Section 12 of Pakistan Environmental Protection Act (PEPA), 1997, Burj Wind Energy Private Limited (the "**Project Company**") has completed the Initial Environmental Examination ("**IEE**") report for 14MW wind power project (the "**Project**") in Gujju. Thatta(the "**Project Site**").Project Company engaged ECTECH Environment Consultants to determine the social & environmental impact on environment due to installation of a wind farm in the Jhimpir area..

The key environment related issues identified for detailed evaluation were;

- Collisions of migratory birds /avian impact
- Noise
- Health and safety
- Shadow
- Visibility
- Atmospheric emissions
- Clearing of land for road and building construction
- Delivery of equipment 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
- Solid waste management

Based on the study, it was concluded that the intensity of all possible impacts varies between minor to medium, and Project activity has no probable environmental degradation in the Project area.

The comprehensive IEE report highlights the policy, legal, and administrative framework applicable on the Project. The methodology for anticipating environmental impacts during construction and operational phases was also evaluated.

2. THE SITE

2.1 General

The Project Site for the proposed wind farm is located in the Indus delta at a distance of approximately 110 km along the Super highway from Karachi to Hyderabad.The Project Site is a barren tract of land with small scanty bushes scattered here and there. Human settlements in the form of small villages (Goths) are situated far off from the Project Site. There are no endangered habitats, parks, forests, wildlife, estuaries,historical or cultural resources within the area of influence of the Project.

2.2 Geological Setting

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 Karachi-Jati-Allah Bund Fault. The main faults between Karachi and Rann of Kutch are generally easterly oriented and slightly concave to the north. Project Site doesn't fall under the fault line hence it is

safe from earthquake effects. The damage Zone classification of theThatta Region, where the WF site islocated, is in Zone II b (moderate tosevere damage) and the G factor isg=0.1-0.3.

2.3 Soils

The land in this area consists of 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.

2.4 Temperatures, Humidity, & Rainfall

Average temperature in the Project area is 28°C. Temperatures in the Project area frequently rise above 46 C (115 F) between May and August, and below 2°C (36 F) between December and January. July, August, and September are the most humid months in the area, whereas May and June are the least humid months.

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.

3. AIR QUALITY

Environmental monitoring on site ambient was carried out to assess the state of environment on the Project Site. It is expected that during construction and operations, there will be some environmental pollution. Sponsors are determined to take all the necessary measures according to the guidelines of 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, and National Environmental Quality Standards for Noise ("**NEQSN**") 2010 to handle such specific environmental pollutants. Implementation of the proposed EMMP further guarantees protection of the environmental settings as they exist now. During operation, the wind farm will work as a pollution free power plant andcontribute to power generation without emitting a single gram of GHG gases.

4. WASTE DISPOSAL

The wind power plant does not generate any waste whether it is gaseous, liquid orsolid hazardous chemicals during its construction & operation. The issue of disposingoff the normal spent lubricants in very limited quantities is not of any significantconcern. There are standard practices to dispose of these lubricants and the Project Company willfollow the same. The packing material is largely re-usable.

5. WATER USE & QUALITY

The Project requirement of water for drinking, domestic purposes, and forfoundation construction will not have any impact on groundwater resources.The roads within the wind farm will bedeveloped such that the natural drainagepattern will not be impeded. It is in the betterment of the Project that the naturaldrainage of the site will remain un-changed so that during rains, there should begood slope available for effective surface rain water flow.

6. IMPACT ON BIRDS

One of the significant issues for installing wind masts can be related to the migratory birds' and their collision with the wind turbines and associated infrastructure. According to a survey conducted by WWF in 2009; the quantum of birds in and around Keenjhar Lake has reduced drastically. By nature, local birds avoid wind turbines by flying around them, and migrating birds tend to fly well above the height of wind turbine. These birds have tendency to fly at an altitude of 400 to 500 meters and turbine blades will be at around 120 meter height from the ground level, hence, there is no chance of collision with the wind towers& turbine blades at the Project Site.

7. AVIATION HAZARD

No aviation hazard will be created by the Project as it is located 110 km from thenearest airport at Karachi. Moreover, the hub height of the wind turbine will be onlyaround 80m, not posing anyhazard to the aircrafts.In addition, the towers will be provided with air traffic warninglights to make the structure more visible / detectable at night.

8. NOISE

Noise of wind turbine and background noise level increases with the increase in wind speed. However, noise level is at a low level when wind turbines cut-in. Noise generation from most of the wind turbines (running at full swing) is estimated to be less than 45dB(A). With the increase in distance between the source and receptor, the noise level decreases. No potential threat was established. Noise of wind turbines will be kept within the parameters given in NEQSN.

9. SHADOW/FLICKERING EFFECT

Rotating rotor blades make moving shadows during sun shine and normally affect the visibility close to the turbine, whereas shadow may spread over long distance on a sunny day, which may be inconvenient for the people around. Correct positioning of wind turbines, and a minimum distance from dwellings will suffice to avoid this problem. The distance between the proposed wind farm Site and the nearest population village (Goth) is about 3 km, therefore, shadow/flickering effect will not have any adverse impact on the local population..

10. VISIBILITY

Wind turbines comprise of large structures. Surveys conducted indicate that by and large, majority of the local people were in favor of development of wind power plants. Local residents are used to the visibility of tall towers as 2 wind power projects 50MW each are already operating in the area, and a number of meteorological masts are also installed, therefore the new wind farm will not create unpleasant situation for the local residents. Under the given situation severity of this issue is categorized as low.

11. LAND CLEARING FOR ROADS AND BUILDING CONSTRUCTION

Indiscriminate removal of bushes and shrubs will be avoided and will only be restricted to those areas where civil work is required. The severity of this issue is categorized as low.

12. TRANSPORTATION ROUTE OF EQUIPMENTS AT SITE

The imported equipment will be transported from Port Qasim to the Project Site. Of the two different modes of transportation – rail & road - the road route is preferable on the basis of technical limitations. Presently available road infrastructure is stable and can accommodate the expected traffic from Project activity. The severity of this issue can be categorized as moderate to low.

13. FOUNDATION CONSTRUCTION -TOWER AND CRANES PLATEFORM

Approximately 20m x 30m area will be leveled and compacted for the cranes at each turbine site. Heavy duty cranes will be used to lift the tower sections &wind turbine generator. During construction of tower foundations & crane platform, topsoil will be stripped off and stored separately from the subsoil. After installation of wind turbines, the subsoil will be used as backfill which will be covered by stripped off topsoil, thus completing the backfilling rehabilitation work. Damage to vegetation will be minimized by restricting the earth based activity to the minimum possible area. The severity of this issue can be categorized as moderate to minimal.

14. HISTORICAL HERITAGE

There are no formally registered sites of historic or historic archaeologicalsignificance at Jhimpir Site. During geo-technical investigations no archaeologicalfindings were observed. The nearest ones, which are far away from project site, areBhambhore, Amri, Harappa &Mohenjo-daro.

15. RESETTLEMENT

No resettlement is required as the Project is located on Government-owned barrenland. Settlements and individual dwellings in the local area are located at least 3 - 4km away, thus the development will not require any rehabilitation or resettlement.Moreover, the project will not cause any negative effect on the population as therewill be no emissions.

16. SOCIAL RESPONSIBILITY

Project Company always regards corporate social responsibility as an important force in building a harmonious society, and is committed to develop a Corporate Social Responsibility Plan to ensure that its daily activities adhere to a set of morals and respect for people and the environment. It also believes in paying full attention to human factors, exercising environmental protections and conservation, increasing employment, and helping build the community.

Being a responsible corporate citizen, Project Company firmly believes in giving back to the communities it operates in and provides support and encouragement to the people who need it the most. Every year Project Sponsors support numerous educational, sporting, and charity programs designed to help a wide range of people. Sponsors have always shown commitment and support for public health & education, and have participated in awareness initiatives.

The people of the area believe that installation of the power plant in their area will open up numerous employment opportunities, especially during construction, which in turn follows a chain of indirect socio-economic benefits. Either directly or indirectly, a reasonable number of local people will get employment and business from the installation of the Plant, e.g. shop keepers, traders, suppliers, contractors, transporters, technicians etc. Operations of the Plant will also provide job opportunities especially to the local people. Poverty alleviation, though at minor scale, will be a benefit besides meeting power shortage in Pakistan.

CONCLUSION

The proposed Project is not likely to have any significant adverse environmental impacts which could be irreversible or could affect sensitive eco-system. Involuntary resettlement will not be required because of the Project construction & operation; the Project has no gaseous and PM emissions. The Project is also not located in the vicinity of sensitive location of national importance. Therefore, Project falls under Category "B" according to "Pakistan Environmental Protection Agency, Review of IEE & EIA Regulations 1997/2000 (revised)".

Sindh Environmental Protection Agency has issued No Objection Certificate ("NOC") to the Project Company.

* * *

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure H: *Point 11; Safety plans, emergency plans*

Project Company will adopt EPC Contractors 'Environment, Health and Safety Management Manual'.

Environment, Health and Safety Management Manual Annexure H.1

Health, Safety and Environment

Management Plan

Table of Contents

DEFINITION OF TERMS

Accident	An unplanned or undesired event that can result in harm to people, property or the environment
Exposure	The measurement of time during which the subject is at risk from a hazard
FAT	Factory Acceptance Testing
Fatality	Death due to a work related incident or illness regardless of the time between injury or illness and death.
Harm	Includes death, injury, physical or mental ill health, damage to property, loss of production, or any combination of these
Hazard	A source or a situation with a potential to cause harm, including human injury or ill health, damage to property, damage to the environment, or a combination of these
Housekeeping	Maintaining the working environment in a tidy manner
HSE	Health, Safety and Environment
Incident	An event that: - Results in death or injury to person where the injury requires medical attention (including first aid); - Results in injury/damage to persons, property or process; - Is not in compliance with statutory requirements, safe work procedures or in house guidelines.

Interface Document	A document that clearly identifies how the Owner's HSE expectations and the Shipyard's HSE management systems will be interlinked during the work program
Lost Time Injury (LTI)	Work related injury or illness that renders the injured person unable to perform any of their duties or return to work on a scheduled work shift, on any day immediately following the day of the accident.
Medical Treatment Case (MTC)	Work related injury or illness requiring more than first aid treatment by a physician, dentist, surgeon or registered medical personnel.
MSDS	Material Safety Data Sheet
Near Miss	A Near Miss is an event where no contact or exchange of energy occurred and thus did not result in personal injury, asset loss or damage to the environment.
Personal Protective Equipment (PPE)	All equipment and clothing intended to be utilized, which affords protection against one or more risks to health and safety. This includes protection against adverse weather conditions.
Restricted Work Case	Work related injury or illness that renders the injured person unable to perform all normally assigned work functions during a scheduled work shift or being assigned to another job on a temporary or permanent basis on the day following the injury.
Risk	A measure of the likelihood that the harm from a particular hazard will occur, taking into account the possible severity of the harm

Risk Assessment	The process of analyzing the level of risk considering those in danger, and evaluating whether hazards are adequately controlled, taking into account any measures already in place.
Risk Management	The process of identifying hazards, assessing risk, taking action to eliminate or reduce risk, and monitoring and reviewing results
Training	The process of imparting specific skills and understanding to undertake defined tasks
Unsafe act or condition	Any act or condition that deviates from a generally recognized safe way or specified method of doing a job and increases the potential for an accident
SWL	Safe Working Load
Work Program	The work being undertaken by a site on behalf of the Company
Worksite	The premises where any building operations or works of engineering construction related to the work program are being carried out

1. **SCOPE**

This plan covers the requirements of the accident prevention rules and safety program to be applied to the contraction work for 13.5MW BURJ Wind Farm Project that will be performed by Contractor and his Construction Subcontractor.

The primary purpose of this plan is to provide a guideline for preventing any accidents which may injure Employees or damage property of the Owner, Contractor and his Contraction Subcontractor (hereinafter called Subcontractor) at the construction site. Contractors shall abide by all safety rules and other regulations imposed at the site by the Laws of the country and the provisions of applicable laws, rules and regulations, including rules and procedures as applicable from the Owner. (PMC Procedures)

2. **ORGANIZATION**

2.1 General

The safety requirements stipulated in this plan shall be strictly met and maintained by the safety organization at construction site.

2.2 Safety Committee

2.2.1 Contractor shall organize a safety committee consisting of Contractor's Site Manager, Contractor's Safety Manager, and the Subcontractor's Field Safety Manager.

2.2.2 Safety Committee shall:

1) Monitor and ensure the operation of safety program in a proper manner.
2) Direct, coordinate and orient the safety activities.
3) Promulgate the spread of policy, objectives, rules and/ or regulations.
4) Look for, detect, and identify risky conditions
5) Perform a thorough investigation of all accidents and review the recommendations to avoid any repetition of the accident.

2.3 Responsibility

2.3.1 Contractor's Site Manager

Contractor's Site Manager shall:

1) Have the prime responsibility for ensuring the site safety.

2) Establish a realistic safety policy and safety targets for the site.

3) Promote the setting up of safety plan, regulations and rules and of a safety training plan, etc.

4) Organize and preside over safety committee.

5) Direct the Subcontractor's construction Manager, Field Safety Manager and other managers in carrying out their duties and responsibilities.

2.3.2 Contractor's Safety Manager shall:

1) Chair a weekly safety committee meeting.

2) Coordinate the safety activities between the Owner and Construction Subcontractor.

3) Review and approve the Construction Subcontractor's safety program and procedures, advise and recommend any corrective actions necessary.

4) Conduct periodic safety audits to ensure that the established safety program is implemented in a proper manner for construction work.

2.3.3 Subcontractor's construction Manager shall:

1) Be responsible for all safety activities, including fire prevention during the construction period.

2) Organize the safety committee.

3) Submit a safety program including safety measures for the work to the Field Safety Manager prior to commencement of the work.

4) Establish, implement and maintain the safety program through the Safety Supervisor and Workers.

5) Conduct independent audits to assure conformance with the established safety program and determine the effectiveness of individual elements of the program.

2.3.4 Subcontractor's Field Safety Manager shall:

1) Conduct daily safety four reports to Contractor.

2) Conduct a safety program under the direction of the Construction Manager.

3) Patrol the work site periodically to verify that the work is carried out under safe conditions, with no violations of safety requirements.

4) Advise promptly the Construction Supervisors and Workers of corrective action when any unsafe conditions or violations are observed.

5) Check each work procedure from the safety point of view and advise the Construction Supervisors before commencement of work and, or while working

6) Submit accident report to Contractor Safety Manager and Owner's representative.

7) Maintain the published safety literature, safety regulations, codes and other communications in accordance with contract. Advise management of compliance and conditions requiring attention.

8) Make thorough analysis of the statistical data through inspection, delineate problem areas, and make recommendations for solutions.

9) Check on the use of all types of personal protective equipment, evaluate effectiveness and suggest improvements.

2.3.5 Subcontractor's Supervisor/ Foreman shall:

1) Organize sites so that the work is carried out in accordance with the safety standards required for the minimum risk to employees and property.

2) Know the safety requirements stipulated in the safety program.

3) Give precise instructions as to the requirements for correct work method.

4) Coordinate with his Subcontractors to avoid any confusion about areas of responsibility.

5) Make sure that suitable personal protective equipment is available and in use.

6) Ensure that new employees are properly instructed in precautions to be taken before they are allowed to start work.

2.3.6 Subcontractor's Worker shall:

1) Do nothing to endanger him or coworkers.

2) Use the correct tools and equipments for the job.

3) Keep tools in good condition.

4) Use proper personal safety equipment provided at all times.

3. SAFETY REPORTS/MEETINGS AND NOTICES

3.1 Accident Reports

3.1.1 All accidents are to be immediately reported orally to the supervisor in the cases described below and will be followed by a written report.

1) All fatal injuries.

2) All injuries requiring first aid treatment.

3) All damages, to the Owner's or Contractor's properties.

4) All fires.

5) All releases or spills of hazardous materials.

3.1.2 A written accident report shall describe in detail the circumstance, and include the results of the accident investigation and analysis.

This report describes the accident classification, cause, time, date, and location, etc. Written incident reports shall be submitted to Safety Manager and Owner's representative through Contractor within 12 hours.

3.1.3 A daily first aid record must be kept on all employees requiring first aid treatment.

3.2 Safety Committee Meeting

3.2.1 A safety committee meeting shall be held on a weekly basis and chaired by the Contractor's Safety Manager and attended by all Safety Committee members.

3.2.2 All Safety Committee members prior to holding a meeting shall conduct a joint site safety inspection and the inspection results shall be discussed at the meeting.

3.3 Notices for Corrective Actions

3.3.1 If the Construction Subcontractor fails or refuses to fulfill his safety responsibility or to correct unsafe conditions or practices, he will be ordered by Contractor to take the necessary corrective action.

3.3.2 When any negligence of safety and/ or unsafe practices are detected, Contractor shall immediately advice and or instruct the Construction Subcontractor to correct them.

3.3.3 If the Construction Subcontractor fails to heed the instruction or advice or neglects fire precautions described in the work permit, Contractor shall issue the letter of instruction for corrective action to the Construction Subcontractor. The unsafe work will be stopped. The work will not commence again until corrective action has been taken.

3.3.4 Daily safety inspections Daily safety tour shall be made by Subcontractor's Field Safety Manager who will record and submit 1 copy of the daily safety check list to the Contractor's safety Manager.

4. SAFETY ORIENTATION AND EDUCATION

4.1 It is mandatory for each employee to attend the Safety Orientation program on his first day of work. No worker will be permitted to work on the site without attending the Safety Orientation Program and attached safety requirements.

4.2 The orientation will be given by the Subcontractor's Field Safety Manager and must include followings:

1) Brief explanation of the program.
2) Safety/ Security control policy.
3) Outlines of applicable regulations and requirements for the project.
4) Emergency procedures.
5) First aid services.
6) Each worker's responsibilities.

4.3 Biweekly Monday morning (2 times per month) before start of work a safety education is held by the Subcontractor's Field Manager for all workers and staffs and the record of safety education shall be kept and maintained by the Subcontractor.

4.4 Every morning before start of work a safety talk session is held by the Supervisor with the foremen of each work place to instruct and discuss:

1) Work procedures.
2) Safety instructions for using equipment and tools.
3) Particular hazardous conditions and precautions to be taken.
4) Workmen's health conditions and other required information.

4.5 A written record will be maintained on all employees stating that they have received the safety training and fully understand the rules and regulations. This form will be signed and dated by each employee and kept on file in the Subcontractor's safety Department for auditing and other relevant purposes.

4.6 Periodic updating of the safety training procedure and requirements is provided for supervisors and foremen every two or three month.

5. GENERAL SITE REGULATIONS

5.1 Employee Requirements

All employees must be in good physical condition, i.e. appear healthy, have adequate hearing and sight, possess all limbs, do not suffer from vertigo, etc.

5.2 Vehicles and Equipment.

5.2.1 Employees will comply with all safety rules and signs regarding traffic and vehicle use. Vehicles must be parked only in areas approved by Contractor.

5.2.2 Speed limit within the site is controlled according to site and road condition.

5.2.3 All equipment, machinery and tools for use on the job site must be approved by Contractor, and shall be subject to initial and periodic inspection by Contractor, Any equipment, machinery and tools, which have not been approved, must be removed from the site.

5.2.4 The engines of all vehicles and equipment should be stopped during refueling.

5.3 Alcohol and/ or Controlled Drugs

5.3.1 Alcoholic drinks and / or Controlled Drugs are not to be used or allowed on the site at any time.

5.3.2 Anyone found under the influence of, or in possession of, alcohol or Drugs will be immediately removed from the site and refused future access.

5.4 Smoking

5.4.1 Smoking is not permitted except in specified areas of workshops and buildings, Temporary buildings used may be Contractorlared smoking areas under special permits. Smoking in vehicles on the site is not permitted.

5.4.2 Smoking is not permitted in any building under construction.

5.4.3 Smoking is not allowed in the site except certain designated area.

5.4.4 Matches and lighters are not allowed in the plant. Cigarette butts should be discarded only in proper receptacles.

5.5 Safety Signs

5.5.1 Contractor's Subcontractors and all personnel shall observe the requirements of all safety signs on site.

5.5.2 Contractor, Subcontractors and all personnel will not remove any safety chain Barrier, tag, marking or sign unless so directed by the proper authority.

5.6 Holographic Equipment and Radios

5.6.1 Holographic equipment (camera, video, etc.) are not permitted on the site without prior approval in writing from Owner.

5.6.2 The use of transistor radios, two- way radios, mobile telephones and pack link system inside the plant is not permitted until approved by Contractor and Owner.

5.7 Environmental Control

5.7.1 The Construction Subcontractor is responsible for the environmental control specified for the job site including all equipment and machines used.

5.7.2 Do not dispose of any used oil or liquid waste direct to the ground, pit or storm drain. Dispose of these materials only in properly labeled containers.

6. PERSONAL SAFETY EQUIPMENT

6.1 General

6.1.1 Each Construction Subcontractor is totally responsible for providing personal protective equipment for the protection of their employees as needs or requested.

It is also the Construction Subcontractor's responsibility to ensure that his employees are well trained and use properly the personal safety equipment at all time in the Site and out of site while working.

6.1.2 All tools and equipment are required to be maintained in good working condition. The Safety Supervisor shall inspect all tools and equipment periodically.

6.2 Head Protection

6.2.1 Safety hats or helmets are rigid headgear made of various materials and designed to protect the heat from impact, flying particles, electric shock, or any combination of the three. Each helmet has two parts, a shell and a suspension cradle.

6.2.2 Any modification of the safety helmet, especially punching holes in shell, is prohibited.

6.3 Eye and Face Protection

6.3.1 Protection of the eyes and face from physical or chemical agents are of prime importance in an industrial environment. And also, due to intensive sun exposure,

uncontrolled dust and high humidity, locally used cotton Scarf should be issued to open area workers during construction period.

6.3.2 To select the type of protection will depend on the properties of possibly imposed hazard, but it should be borne in mind that all eye protection and most face protection devices must be considered as optical instruments. They must be selected, fitted, and used with regard to both the type of hazard and the optical condition of the user.

6.3.3 Industrial grade safety glasses (with shield) required at all times during working hours in shop or in construction site.

1) Welding and cutting
2) Excavation
3) Driving nails
4) Grinding
5) Drilling

6.4 Hand protection

6.4.1 The kind of gloves used depends primarily upon the material or equipment being handled.

6.4.2 Gloves should not be used near rotating machinery as they can be caught and trap the hand.

6.4.3 Suitable gloves should be worn on most construction work.

6.5 Foot Protection

6.5.1 The safety shoe or boot is fitted with a metal toecap. The toecap is capable of withstanding both compression and impact loads.

6.5.2 Safety footwear for construction work must be able to withstand a compressive load of 1,100 kg and an impact load of 33 kg.

6.5.3 Foot guards must be worn when using jack hammers, tampers and similar equipment.

6.6 Safety Belts (or Harness), Lifelines and Lanyards should be worn while working elevation is 3 m high form ground or platform level.

6.6.1 Lifelines, safety belts, and lanyards shall be used only for worker safeguarding. Any lifeline, Safety belt, or lanyard actually subjected to in-service loading, as

distinguished from static load testing, shall be immediately removed from service and shall not be used again for worker safeguarding.

6.6.2 Lifelines shall be secured above the point of operation to an anchorage or structural member.

6.6.3 Safety belt lanyard shall be a minimum of 14mm nylon, or equivalent, with a proper length of falling distance no greater than 1.8 m.

6.7 Safety Nets

6.7.1 When workplaces are more than 7.5 meters above the ground or water surface or other surface, and ladders, scaffolds, catch platforms, temporary floors, safety lines or safety belts are not being used, safety nets must be hung with sufficient clearance to prevent contact with the surfaces or structures below.

6.7.2 Nets must extend 2.5 meters beyond the edge of the work surface where employees are exposed and must be installed as close under the work surface as practical but in no case more than 7.5 meters below such work surfaces.

6.8 Respiratory Protection

6.8.1 Where industrial processes create atmospheric Contaminant, which may be hazardous to the health of employees, the first consideration always should be the application of engineering measures to control release of the contaminants.

6.8.2 In some cases, engineering control measures are not practical and the worker should therefore be supplied with personal respiratory protective equipment.

6.8.3 Ventilators, fans, air moves, dust mask or a combination of these should be used in dusty atmospheres. Users of dust masks, breathing air masks and respirators must be fit- tested and trained in their use.

7. SIGNS, SIGNALS AND BARRICADES

7.1 Accident Prevention Signs, Tags and Markings.

7.1.1 When hazardous work is to be performed the appropriate signs and symbols must be posted prior to starting work and must be removed or covered promptly when the hazards no longer exist.

7.1.2 Danger signs must be used only where an immediate hazard exists.

7.1.3 Caution signs must be used only to warn against potential hazards or to caution against unsafe practices.

7.1.4 Accident prevention signs, tags and markings are used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc., until the defective equipment can be repaired or removed.

7.2 warning Barricades

7.2.1 Warning barricades will be erected before work begins or as soon as specific hazard is identified (in some situations a rigid guardrail will be needed).

7.2.2 Warning barricades must be erected and maintained at least two (2) meters from the edge of an excavation or opening.

8. FIRE PROTECTION

8.1 All employees must know where fire extinguishers are and how to use them.

8.2 Flammables shall be stored in properly labeled containers.

8.3 Accumulation of trash, oily rags, combustible materials and similar fire hazards of any nature will not be permitted.

8.4 All welding and cutting torches must be equipped with flame valve and standard operational gauges.

8.5 All alleyways, driveways, roads, stairway, ladder and transformers shall be kept clear of hazardous material and equipment.

8.6 Refueling of petrol and diesel equipment shall be done only in prescribed areas and with approved equipment.

Employees shall take all measures to minimize spills and to clean up immediately and spills which may accidentally occur. Refueling equipment with the engine running is prohibited.

8.7 The Construction Subcontractor shall install and maintain fire extinguisher and firefighting equipment to be available all times at the construction site and site office.

8.7.1 There must be a fire extinguisher, water hose or other fire control equipment easily accessible for each welding, cutting, burning or other such operation.

8.7.2 During any hot work operation, a pressurized fire hose and 2-piece of 10lb dry chemical power fire extinguisher must be provided at place of hot work. All Contractor's personnel shall be properly trained and know how to use such extinguishers and fire hose.

9. FIRST AID

9.1 Construction Subcontractor shall provide First Aid facilities for his employees on the site.

9.2 In the event of accident, all possible efforts to keep on lookers from the scene must be made. The only employees required in such areas are those directly engaged in assisting in the emergency.

9.3 Shock

9.3.1 Any person who has suffered a severe injury or even someone who has narrowly escaped injury is likely to be suffering from shock.

9.3.2 It is essential that persons administering first aid be aware of the symptoms of shock and take action to treat these symptoms in addition to the other injuries sustained.

9.4 Artificial Respiration

9.4.1 Electric shock, gassing, drowing, or suffocation may cause breating to stop.

9.4.2 Artificial respiration must be started immediately and continued until the patient recovers or until professional medical aid takes over. If you are alone, do not leave the patient to seek help until his normal breathing has resumed.

9.5 Chemicals

9.5.1 Actions to be taken in the event of worker accidently comes into physical contract with dangerous chemicals are as follows:

If splashed by chemical, goggles should be left in place unit chemicals have been washed off. Unless chemicals have entered the eyes under the goggles, eye protection should be removed only ofter the chemicals have been washed from the surrounding area.

The eyes should be washed with clean water for at least 15 minutes. Chemicals on the skin should be washed off with water using a safety shower where available. When it

is necessary to remove clothing, it should be removed while under shower or water spray medical attention is essential in their cases.

9.6 Head Injuries

9.6.1 Action in cases of head injury is to get the patient under medical care without delay.

9.6.2 No head injury should be regarded lightly. Every patient who has had even a mild injury to the head is liable to develop complications, which can be serious.

Treatment shall be as follows:

1) Loosen all tight clothing around neck, chest, and waist.
2) Check to see if the patient is breathing and initiate artificial respiration, if required.
3) Ensure that his throat and air passages are clear of secretions, foreign bodies, and false teeth.
4) Check for other injuries
5) Arrange for the patient to be carefully transported to a hospital.

9.7 Bleeding

9.7.1 Every effort should be made to stop bleeding by direct pressure such as by applying a sterilized pad or dressing.

9.7.2 The wound should be firmly bandaged. Applying mild pressure on the artery between the wound and the heart may control arterial bleeding.

9.8 Fractures

9.8.1 Where a fracture is suspected, the limb must be immobilized. If possible, the injured part should be averted to reduce discomfort and swelling.

9.8.2 Fracture of the spine or pelvis must be treated with great care.

9.8.3 The casualty must not be moved, but should be covered with a blanket and made comfortable. Competent ambulance employee should only remove him.

9.9 Minor wounds

9.9.1 All minor wounds, cuts, and scratches should be attached to immediately, as delay increases the risk of infection.

9.9.2 The wound should be cleaned and then covered with a sterilized dressing or adhesive plaster. If the injury become painful, or is inflamed, medical attention should be obtained.

10. TOOLS -HAND AND POWER

10.1.1 Any tools or equipment deemed unsafe shall be marked promptly and or repaired or replaced.

10.1.2 Each worker must satisfy himself that all tools and equipment to be used by him are in first class condition and appropriate for the job that they are to be used on. Any defect and/or in proper functioning should be repaired to next user and or supervisors.

10.1.3 Any tools hand and power shall not be used for pry bars.

10.1.4 Tools shall be used only for the purpose for which they are designed.

10.1.5 Proper guards or shields must be installed on all power tools.

10.1.6 All portable power operated tools are of a certified or approved design and are safe to use.

10.2 Pneumatic Tools

10.2.1 Compressed air should not be used to clean the working space.

10.2.2 Tools must not be modified or the labels and inscriptions defaced or removed.

10.2.3 Competent persons must carry out maintenance of pneumatically operated equipment at regular intervals.

10.3 Guarding

10.3.1 When power operated tools are designed to accommodate guard, they shall be equipped with such guard when in use.

10.3.2 Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating or moving parts of equipment must be guarded if such are exposed to contact by employees.

10.3.3 Each worker must satisfy himself that all tools and equipment to be used by him are in good condition and appropriate for the job that they are to be used on.

10.4 If by using hand and power tools, employees are exposed to the hazard of flying, falling abrasive and splashing objects, or exposed to harmful dusts, fumes, mists, vapors, or gases,, they must be provided with and shall wear the appropriate personal protective equipment necessary to protect them from the hazard.

11. CRANES AND LIFTING EQUIPMENT

11.1 General

11.1.1 The manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks shall be complied with.

11.1.2 Rated load capacities, recommended operating speeds, special hazard warnings, or instruction must be visible to the operative while he is at his control station.

11.1.3 Rigging equipment must be inspected by a competent person and/or operator prior to use on each shift and as necessary during its use to ensure that it is safe. Defective rigging equipment must be tagged out of service and removed from the work area.

11.1.4 A competent person shall make a through, monthly inspection of the hoisting machinery. The operator shall maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.

11.1.5 Standard operating signals should be agreed upon and should be used to direct all operations.

11.1.6 No modifications or additions, which affect the capacity of safe operation of the equipment, shall be made without the manufacturer's written approval.

11.1.7 Accessible areas within the swing radius of the rear of the rotating superstructure of the crane, either permanently or temporarily mounted, must be barricaded to prevent any worker from being struck or crushed by the crane.

11.1.8 Overhead and gantry cranes shall be plainly marked on each side of the crane as to its rated load capacity.

11.1.9 Ensure that personnel do not ride on the hook or on a load.

11.1.10 Ensure that personnel do not stand, walk or crawl beneath a slung load.

11.1.11 Ensure that the hoist rope is vertical to prevent swinging.

11.1.12 Avoid twisting or kinking wore rope.

11.1.13 Never use nuts and bolts to join a broken chain

11.1.14 Never drop any item of lifting gear from a height.

11.1.15 Do not put any strain on ropes which are kinked.

11.2 Operator

11.2.1 The operator must be in possession of a current Government Crane Operator's License. In addition, he must be fully familiar with and competent to operate the particular type of crane to which he is assigned.

11.2.2 An operator may be certified to operate more than one type of crane, but under no circumstances is an operator permitted to operate a crane for which he has not been certified.

11.2.3 A supervisor must ensure that his operator is physically fit and mentally alert. If the operator shows any signs of illness, he must be removed from the crane.

11.3 Slinger/Rigger

11.3.1 The slinger/rigger is responsible for properly attaching the load to the crane and giving the correct hand signals to the crane operator.

11.3.2 He must be properly trained in slinging/rigging, the standard lifting hand signals, and the general capabilities of the crane with which he is working.

12. EXCAVATION AND TRENCHING

12.1 Excavations such as ditches, trenches or holes shall be sloped sufficiently to prevent cave-in or slide. Of sloping is impractical, shoring shall be used whenever the vertical dimension exceed 1.5 meters.

12.2 Worker removing shoring after completion of work shall not be in the bottom of the excavation. Shoring shall be removed in a manner to prevent cave-in on worker.

12.3 Barricades, handrails, signals or other appropriate warring devices to protect worker from any hazardous operation or excavation shall be provided. Open trenches, excavations, etc., shall be covered when handrails or barricades do not provide adequate protection.

12.4 Grade lines, ropes, chains, and other tripping hazards shall be sufficiently marked to be clearly visible in the day or night.

12.5 Excavation by powered equipment is prohibited closer than 1.2 meters to any underground cable. Tiles covering electric cables shall not be removed without prior approval.

12.6 Located underground obstacles, cables and piping shall be marked, i.e. physically identified, in the field and will be updated on drawings of underground.

12.7 Ground water shall be removed from and kept out of, the bottoms of all trenches and excavations.

13. CONCRETE FORMS AND SHORING

13.1 Form work and shoring shall be designed, erected, supported, braced and maintained so that it will safely support all vertical and lateral loads that may be imposed upon it during placement of concrete.

13.2 Stripped forms and shoring shall be removed and stockpiled promptly after stripping, in all areas which persons are required to work or pass. Protruding nails, wire ties, and other form accessories not necessary to subsequent work shall be pulled, cut of other means taken to eliminate the hazard.

13.3 Imposition of any construction loads in the partially completed structure shall not be permitted unless such loading has been considered in the design and approved by the engineer.

14. FLOOR AND WALL OPENING, AND STAIRWAYS

14.1 Floor and Wall Openings

14.1.1 All floor, grating or roof openings within a building, or other structure during the course of construction, alterations, or repairing, shall be covered with planks so as to carry safely any load which may be required to be supported thereon, or shall be fenced in on all sides by a standard railing and toe board.

14.1.2 Wall openings, from which there is a drop of more than 1.2 meters, and the bottom of the opening is less than 90 cm above the working surface, must be guarded by standard guardrails. Is the bottom of the wall opening is less than 10 cm above the working surface toe boards must be installed.

14.2 Guarding of Open-Sided Floor and Platforms

14.2.1 Standard guardrails and toe boards must guard every open-sided floor or platform 1.8 meters or more above adjacent floor or ground level.

14.2.2 Regardless of height, open-sided floors, walkways, platforms, or runways above or adjacent to dangerous equipment, pickling or galvanizing tanks, degreasing units and similar hazards must be guarded with a standard railing and toe board.

14.3 Guardrails, Stair, Railings and Toe boards

14.3.1 A standard railing shall consist of top rail, intermediate rail, toe board, and posts, and shall have a vertical height of approximately 1 meter from upper surface of top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be halfway between the top rail and the floor, platform, runway, or ramp. Minimum requirements for standard railing under various types of construction are as follows:

1) For pipe railings, posts and top and intermediate railings shall be a least1/2inches nominal diameter with posts spaced not more than 2.4 meters on centers.
2) For structural steel railings, posts and top and intermediate rails shall be 50 mm by 50mm by 10mm angles or other metal shapes of equivalent bending strength, with posts spaced not more than 2.4 meters on centers.

14.3.2 Stair railing

A stair railing shall be of construction similar to a standard railings, but the vertical height shall be not more than 85cm nor less than 75cm from upper surface of top rail to surface of tread in line with face of riser at forward edge of tread.

14.3.3 Stairs and Stairways on all structures, two or more floors (6 meters or over) in height, stairways, ladders, or ramps, shall be provided for employees during construction period. Debris, slippery and other loose materials shall not be allowed on or under stairways.

Stairs shall be installed at angles to the horizontal of between 30 and 50.Rise height and tread width shall be uniform throughout any flight of stairs including any foundation structure used as one or more treads of the stairs. Stairways having one or both open sides shall have a stair railing along the open side or sides.

15. LADDERS AND SCAFFOLDING

15.1 Ladders

15.1.1 All ladders shall be made of the proper material and be in good condition.

15.1.2 The use of ladders with broken or missing rungs or steps, broken rails, or other defective construction is prohibited.

15.1.3 Metal ladders shall not be used when they can become part of an electrical circuit.

15.1.4 All straight ladders shall be tied off.

15.1.5 Ladders shall be placed so that they from an angle no greater than 30degrees from vertical.

15.1.6 Ladders shall extend at least 1 meter above the level to be served.

15.1.7 Spikes, for use in soft ground.

15.1.8 Ensure that footwear is not greasy, muddy or slippery and has a good grip on the rung.

15.1.9 Face the ladder and hold on with both hands.

15.2 Step ladders

15.2.1 Always open fully, set level on all four feet, and lick spreaders in place. Do not use like a straight ladder.

15.2.2 Do not place tools or material on steps or platform.

15.2.3 Get specific approval before using two-man stepladders.

15.2.4 Must be tied off under certain conditions.

15.3 Scaffolding

15.3.1 Makeshift scaffold, such as boxes, crates, drums and poles are prohibited.

15.3.2 Metal tube scaffolding is preferred. Any other scaffold material requires prior approvals.

15.3.3 Scaffolding and related material shall be carefully inspected at regular intervals and particularly just before use.

15.3.4 Sufficient sills and underpinning shall be provided for all scaffolds erected on filled or otherwise soft ground.

15.3.5 Scaffolds shall be plumb and level at all times.

15.3.6 Running scaffold shall be anchored to wall approx. every 9 meters of length and 6 meters of height. Additional anchors may be required when using pulley arms.

15.3.7 All scaffolding must be equipped with handrails, midriffs and toe boards regardless of height.

15.3.8 Scaffold shall not be used as material hoist towers, for mounting derricks or to support pipe or equipment.

15.3.9 Timber boards used in the construction of work platform(s) shall be of good quality and reasonably straight grained, free from injurious ring shakes, cracks, splits, cross grains, unsound knots, knots in Contractor rease the strength of the timber. Planking shall not be painted, as this will conceal defects.

15.3.10 Planks used for platforms shall be uniform thickness and laid close together.

Planks shall be overlapped at the bearers by at least 0.6 meters, with the bearing in the center of the overlap.

When overhang a bears more than one-tenth of the length of the span, the planks shall be securely fastened to the bearer at the opposite end to prevent tipping.

15.3.11 Daily inspections shall be performed to ensure that no overstressing of structural members of scaffold will take place.

15.3.12 Safety belts or harness and lifeline shall be used if other adequate protection against falls cannot be provided during erection or dismantling.

15.3.13 Scaffolds and associated equipment shall not be modified in any manner that affects the designed performance. Only heavy tube scaffolding acceptable to heavy construction is allowed.

15.3.14 Adjusting screws together with proper blocking shall be used to compensate for unevenness of ground.

15.3.15 Braces shall not be forced to fit. the scaffold shall be adjusted until the proper fit can be made easily.

15.3.16 only ladders shall be used when climbing scaffold; the cross braces shall not be used.

15.4 Rolling and Tower Scaffolds

15.4.1 Tower of a height greater than three times the minimum base dimension shall be used.

15.4.2 Caster brakes shall be locked when not in motion.

15.4.3 Tower shall be free of men, material and equipment before being moved.

15.4.4 Surface over which a tower scaffold is being moved shall be cleaned of rubber or any material that could cause the tower to tip over.

15.4.5 Fixed towers shall be guyed or tied-off every 6 meters of elevation.

15.5 Suspended Scaffolding

15.5.1 10mm (minimum) steel wire rope shall be used to support or suspend scaffolds. All suspended scaffolds shall be anchored to prevent swinging.

15.5.2 The suspended support shall be electrically insulated when are welding is to be performed to guard against arcing and subsequent failure.

15.5.3 Worker on suspended scaffolds work platforms must use independent safely lines and safety harness with lifeline and lanyards.

16. STEEL ERECTION

16.1 Personal Protection

16.1.1 In all structures, all employees exposed to hazard more than 3m high shall wear safety belt or harnesses. Lifelines shall be installed as needed to due to facilities tying-off. When the use of safety belt is not appropriate due to the hazard of being pinched or struck by incoming steel, connectors will be only permitted to unhook their safety harness during the actual receiving and positioning of structural members.

As soon as it is safe and appropriate to do so (generally as soon as the connection bolts have been installed), the connector will be required tore hook his safety belt.

16.1.2 Safety nets are only an acceptable substitute for safety belt when the use of safety belts is impractical. When safety nets are used, they will generally be used on the interior of the structure only. Lifeline will be installed along the perimeter and within the structure whenever employees are exposed will be tie-off whenever they are so exposed.

16.1.3 For the protection of other crafts, signs and barricades will be installed at the area where the erection of steel is in progress.

16.1.4 It should be emphasized that this mandatory and must be followed at all times. Any person who is found violating this procedure will be subject to removal from the site.

16.2 Rigging

16.2.1 A competent worker prior to initial use on the project shall inspect rigging equipment and monthly thereafter to ensure that it is safe.

16.2.2 Damaged rigging equipment shall be removed from service immediately.

16.2.3 Riggers must be qualified to rig and signal.

17. WELDING AND BURNING

17.1 Welding or cutting torches and horsed shall not be connected to cylinders when stored in any enclosure or building.

When work is shut down and hoses disconnected all valves at the gas and oxygen cylinders must be closed.

17.2 Gas and oxygen cylinders shall be handled with care, properly supported in an upright position away from any source of heat or flames and securely tied-of f. All cylinders not in use shall have the protective valve cap in place, shall be vertically secured, and be stored outside the work area.

17.3 Oxygen cylinders in storage and not I use shall be separated from gas cylinders by a fire retardant partition or a minimum distance of 6 meters.

17.4 When hoisting equipment, a basket lifts gas and oxygen cylinders, cradle or similar handling device shall be closed.

17.5 When oxygen or gas cylinders are transported, protective valve caps shall be in place and valves shall be used.

17.6 Special care (use of welding blankets) shall be taken during overhead cutting and welding operations to safeguard the work and prevent failing sparks from starting a fire or causing damage. Warning signs shall e posted around and at each level below the area of overhead welding or burning operation. Fire extinguishers will be ready and available, or the plant approved fire houses must be attached to firewater hydrants ready for use.

17.7 Gas and oxygen cylinders shall be used when secured on a cylinder carrier. Loose cylinders shall never be used.

17.8 Oxygen cylinders and equipment shall be kept free from oil or grease.

17.9 Gas and oxygen cylinders shall not be taken into confined spaces.

17.10 Welding cables and oxygen gas hoses shall be inspected regularly. The hoses shall be fitted by means of tight hose clamps.

17.11 The ground cable shall be attached as close as possible to the work piece by means of

a clamp. The ground cable shall not be attached to an existing installation or apparatus. Welding of the ground cable is forbidden.

17.12 Welder and his helpers must use adequate eye and face protection while welding. Welding shields (curtains) must be used to protect the eyes of nearby workers from flash burn exposure.

17.13 Oxygen and gas cylinders must be transferred to a designated location away from operating units and tank farms after working hours.

17.14 When not in use, diesel welding machines, generators, and transformers must be turned off. When in use they must be protected by suitable covers for general protection. Refueling shall be done with machines turned off.

17.15 When employees are working with welding and cutting equipment, adequate ventilation has to be furnished.

17.16 All combustible material in the vicinity the welding or cutting operation must be removed, or of this is not possible, covered by fire resistant materials.

17.17 All welding cables and oxygen hoses shall hanged 1m high steel column wall not to disturb on passage or access.

17.18 The work area must be kept clean and wooden, all combustible material must be removed.

17.19 Welding machines shall be turned off at the end of your shift.

17.20 Never do electric welding from a metal ladder.

17.21 Gas and oxygen cylinders shall be provided with turn-off wrench during use.

17.22 Must be check regulator well fitted to cylinder.

17.23 Do not use matches or cigarettes to light a torch.

17.24 Do not use compressed gas to clean your clothing, blow out cinch anchor holes or otherwise clean your working area.

17.25 Gas cylinders shall be handled with care and shall not be dropped.

17.26 Gas cylinder shall not be misused as rollers, support or for any other similar purpose.

18. ELECTRICAL WORK

18.1 Qualified and experienced workers shall perform all electrical woks, equipment shall be locked or secured to prevent starting by unauthorized person.

18.2 Warning signs or posters, such as DANGER, NO ENTRY, DONOT TOUCH, etc., shall be posted at dangerous places, such as substations, switchboxes, and overhead or underground cable.

18.3 Electrical parts to be used shall be in good condition, including cords for connection. The extension and outlets to connect tools have to be polarized.

18.4 Transfonner Banks or high voltage equipment shall be barricaded with a fence. The entrance shall be locked.

18.5 Circuit Breakers shall be provided for all electrical equipment, to prevent worker from being injured be electrical shock.

18.6 Temporary switch boxes shall be installed in the space provided with a waterproof roof and door which can be locked. Switch boxes shall be grounded with vinyl-insulated copper wire.

18.7 Before welding machines are used, insulation shall be tested and certified to be in safe operating conditions. Automatic ant electric discharge devices shall provided for all welding machines. All exposed terminals shall be covered safely with insulation tape.

18.8 To prevent a short circuit or electric discharge, special precautions, such as grounding, shall be taken for wiring work where metal scaffolds or steel structures are erected. Grounding shall be secured by connecting the wire to on earth and buried firmly in the ground.

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure I: *Point 12; System studies, load flow, short circuit, stability, reliability*

Grid Interconnection Study

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure J: *Point 13; Plant characteristics: generation voltage, power factor, frequency, automatic* generation control, ramping rate, control metering and instrumentation

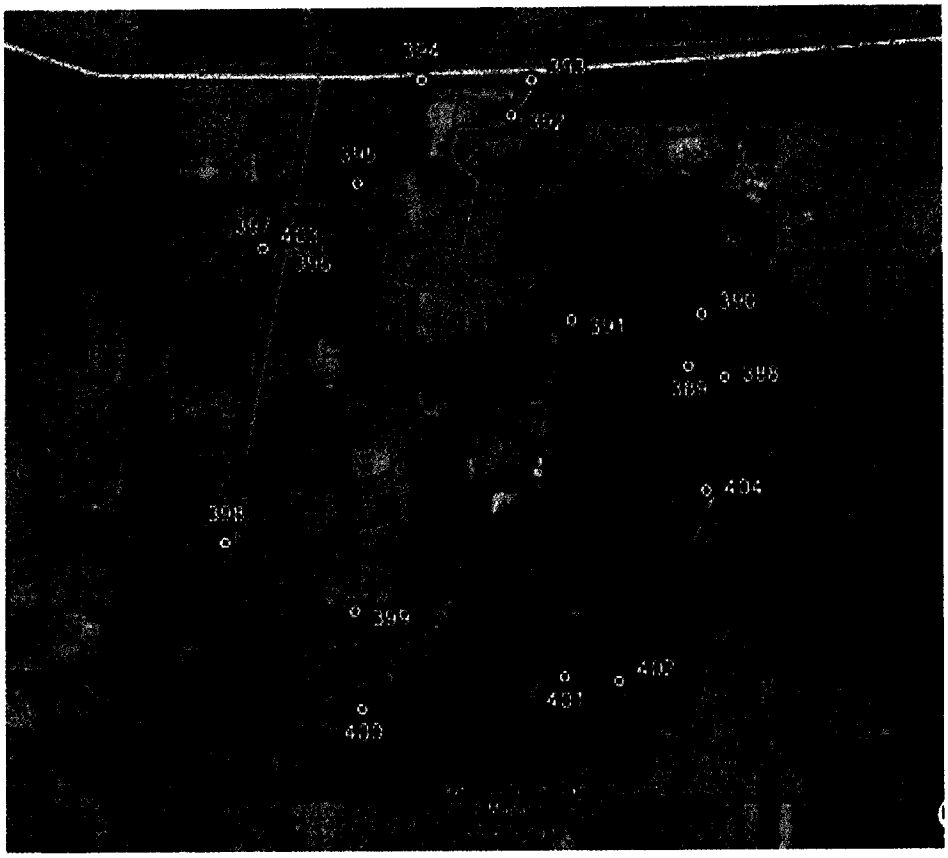
Generation voltage	:	690V at generator terminal and 132kV at the point of interconnection with the grid
Power factor	:	0.95 leading and 0.95 lagging. At point of interconnection with the grid at 132kV level the power factor will be maintained at [0.95] lagging/leading,
Control, Protection & Supervision	:	A control and monitoring system shall be provided for monitoring operation of the Complex and providing telecommunication and tele-metering to the Control Room.
Metering system	:	Metering system shall be installed as per NTDC approved specifications. Metering System on the high voltage side of the Power Transformer(s) at the substation shall be provided for export and import metering. Independent current transformers of accuracy class [0.2s] and voltage transformers of accuracy class [0.2] shall be provided at the Substation for providing input to the Metering panels. A separate air-conditioned room in the Complex's Substation shall be provided for metering system. All cabling between the Meters and associated Current Transformers and Voltage Transformers shall be laid as per prudent engineering practices. Backup metering system shall also be provided.
Power Curve	:	Annexure J.1

At standard air density

Wind Speed m/s	Electric Power kW	Thrust Coefficient
3	12.6353	1.08024
3.5	41.145	0.964635
4	77.5526	0.877035
4.5	128.067	0.802804
5	187.213	0.780182
5.5	260.106	0.785139
6	347.967	0.788812
6.5	452.301	0.791638
7	574.504	0.793883
7.5	715.055	0.79069
8	858.827	0.747384
8.5	1011.03	0.707994
9	1171.43	0.673306
9.5	1332.34	0.636086
10	1489.9	0.596909
10.5	1500	0.481233
11	1500	0.402662
11.5	1500	0.344292
12	1500	0.29831
12.5	1500	0.260945
13	1500	0.23043
13.5	1500	0.204714
14	1500	0.183046
14.5	1500	0.164528
15	1500	0.148605
15.5	1500	0.134813
16	1500	0.122785
16.5	1500	0.112266
17	1500	0.103037
17.5	1500	0.094847
18	1500	0.087588
18.5	1500	0.081122
19	1500	0.075329
19.5	1500	0.070123
20	1500	0.065423

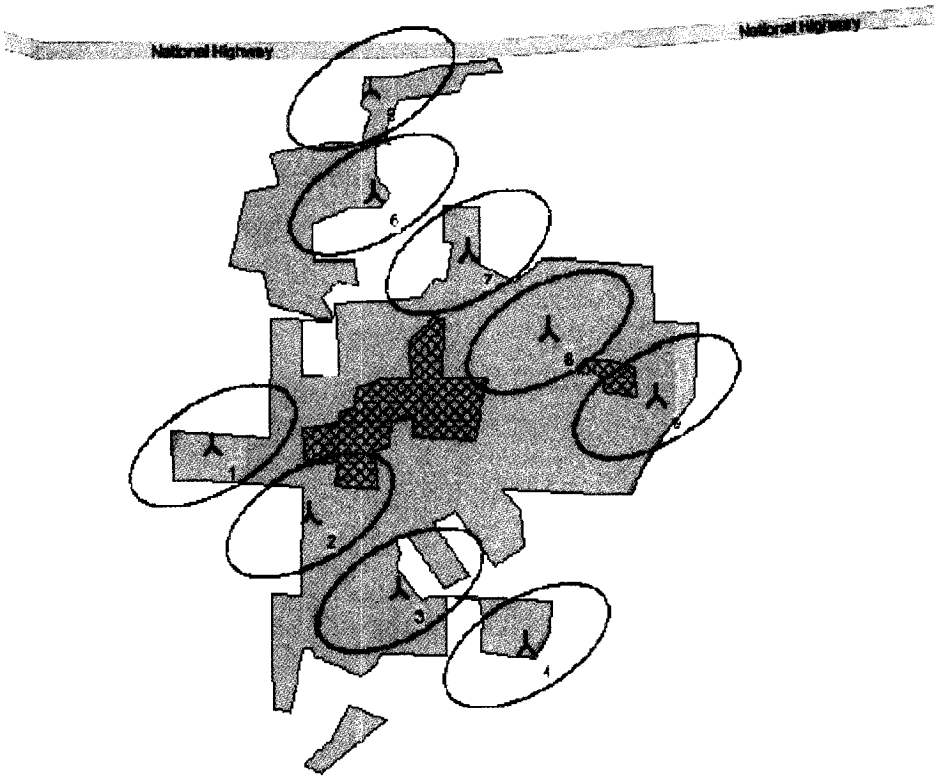
Annexure J.1: *Point 13; Summary of Technology Information, Single Line Diagram, Power Curve*

Lay Out of Wind Farm



Annexure J.1: *Point 13; Summary of Technology Information, Single Line Diagram, Power Curve*

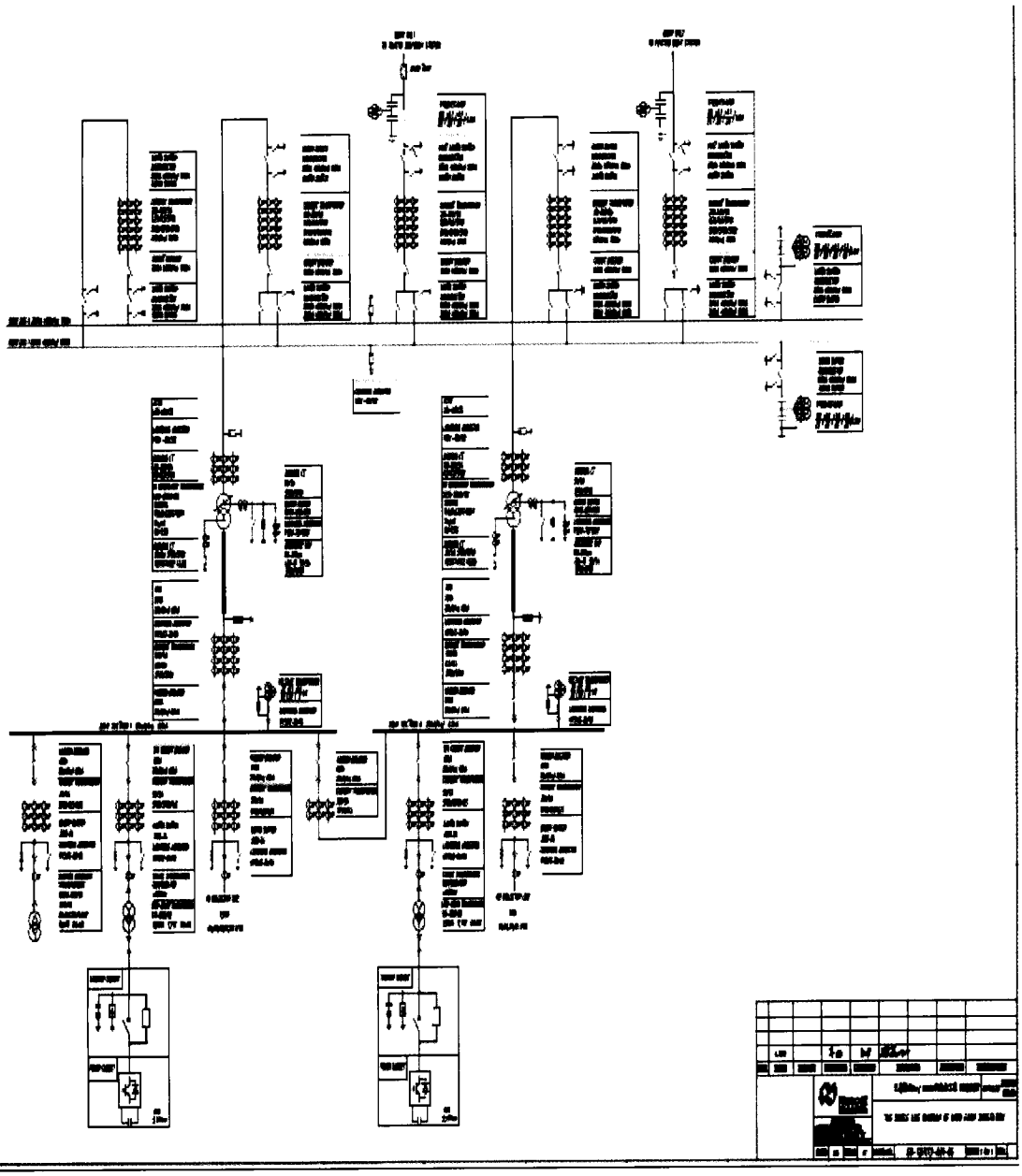
Micro-Sitting of Wind farm



Turbine Label	Coordinates (UTM z42 WGS84)		Height a.s.l. [m]
	Easting [m]	Northing [m]	
1	379,116	2,735,769	7
2	379,394	2,735,566	7
3	379,652	2,735,348	7
4	380,017	2,735,183	8.4
5	379,588	2,736,793	7.4
6	379,592	2,736,487	7
7	379,862	2,736,314	6
8	380,096	2,736,084	8.9
9	380,407	2,735,891	9

Annexure J.1: *Point 13; Summary of Technology Information, Single Line Diagram, Power Curve*

Single Line Diagram of Electrical System of Wind Farm



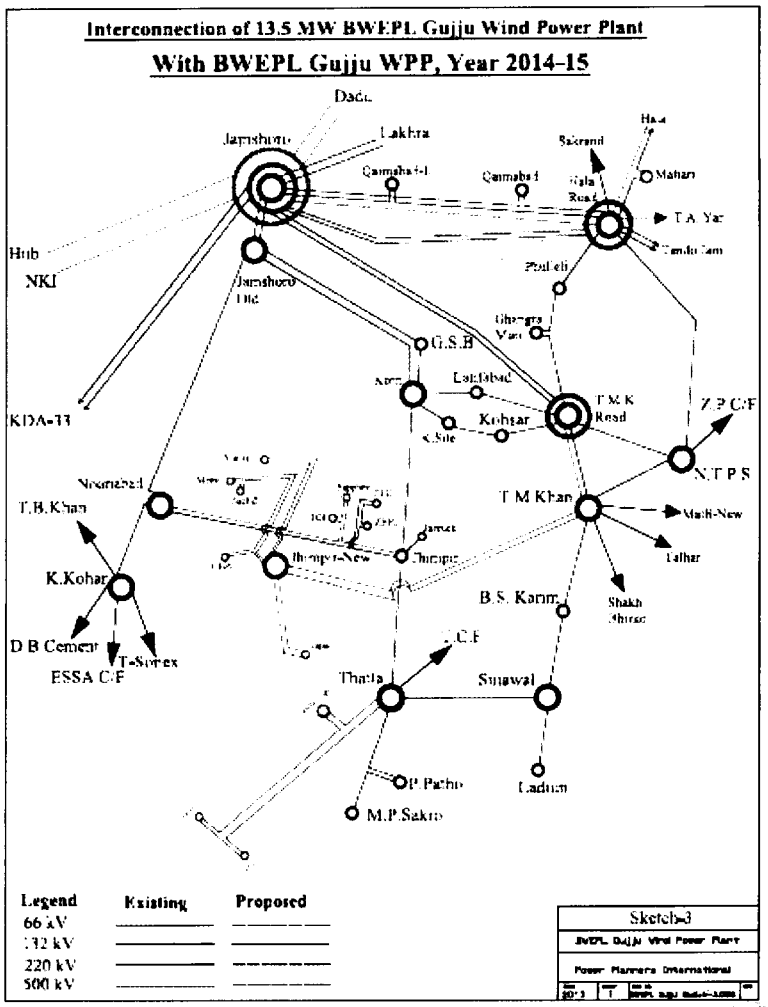
Annexure J.1: *Point 13; Summary of Technology Information, Single Line Diagram, Power Curve*

INTERCONNECTION
ARRANGEMENT FOR DISPERSAL OF POWER
FROM THE WIND FARM

- The power generated from the Wind Farm (WF) shall be dispersed to the Load Center/Ring of NTDC, at 132 KV voltage level.
- Project would be connected looping in-out one circuit of the 132KV Double Circuit from Thatta towards FWEL-I and FWEL-II at the farm substation of BWEPL-Gujju WPP. The distance of the looping point from the wind farm would be 4-5KM.
- Any change in the final Interconnection and Transmission Arrangement(s), for the dispersal of power other than the above, as agreed among Project Company, NTDC and HESCO shall be communicated to NEPRA in due course of time.

Annexure J.1: *Point 13; Summary of Technology Information, Single Line Diagram, Power Curve*

Schematic Diagram for Interconnection/Transmission Arrangement for Dispersal of Power from the Project



Annexure J.1: *Point 13; Summary of Technology Information, Single Line Diagram, Power Curve*

Detail of Generation Facility/Wind Farm

A. General Information

i.	Name of Applicant Company	Burj Wind Energy (Private) Limited
ii.	Registered/Business Office	Ground Floor, OICCI Building, Talpur Road, Karachi
iii.	Plant Location	District Thatta, Sindh
iv.	Type of Generation Facility	Wind Power

B. Wind Farm Capacity & Configuration

i.	Wind Turbine Type, Make & Model	Dongfang FD89-1500KW
ii.	Installed Capacity of Wind Farm (MW)	13.5 MW
iii.	Number of Wind Turbine Units/Size of each Unit (KW)	9 x 1.5 MW

C. Wind Turbine Details

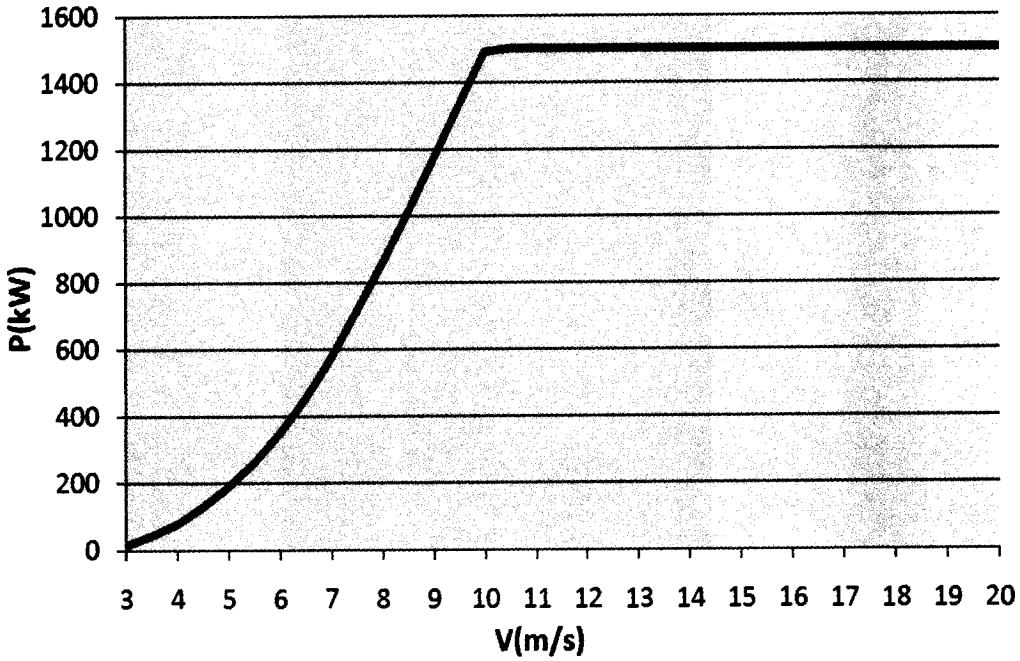
a. Rotor		
i.	Number of Blades	3
ii.	Rotor Speed	10 – 18.15 ±10% rpm
iii.	Rotor Diameter	89 m
iv.	Swept Area	6218 m^2
v.	Power Regulation	Combination of blade pitch angle adjustment, and generator/converter torque control.
vi.	Rated power at	10.5 m/s (air density = 1.225 kg/m^3)
vii.	Cut-in Wind Speed	3. m/s 10minute average
viii.	Cut-out Wind Speed	20 m/s 10minute average
ix.	Survival Wind Speed	52.5m/s
x.	Pitch Regulation	Electric driving variable pitch structure is used to realize independent pitch variation with each blade
b. Blades		
i.	Blade Length	43.5 m
ii.	Material	Glass Fiber Reinforced material
iii.	Weight	6700 kg
c. Gear Box		
i.	Type	a planetary gear and two spur gears
ii.	Gear Ratio	1:110
iii.	Weight	16,000 kg
iv.	Oil Quantity	800 – 900 litres
v.	Main Shaft Bearing	The main shaft bearing is directly mounted on the frame with double-row self-aligning roller bearings as fixing supporting points
d. Generator		
i.	Power	1,560kW
ii.	Voltage	690 V
iii.	Type	Doubly-fed asynchronous type
iv.	Speed	Range: 1100-2000 rpm; Synchronous Speed: 1500 rpm; Speed at rated power: 1800 rpm
v.	Enclosure Class	IP 54
vi.	Coupling	Flexible coupling

vii.	Efficiency	≥97%
viii.	Weight	6,800 kg
ix.	Power Factor	±0.95
e. Yaw System		
i.	Yaw Bearing	Four point contact ball bearing with external gear
ii.	Brake	7 sets of yaw brakes
iii.	Gear driving device	3 sets of gear driven devices
iv.	Speed	0.5degrees/sec
f. Control System		
i.	Type	Automatic or manually controlled
ii.	Grid Connection	Via back-to-back AC-DC-AC power electronics converter connected to rotor winding
iii.	Scope of Monitoring	Remote monitoring of different parameters, e.g. temperature sensors, pitch parameters, speed, generator torque, wind speed & direction, etc.
iv.	Recording	Production data, event list, long & short term trends
g. Brake		
i.	Design	Three independent systems, fail safe (individual pitch)
ii.	Operational Brake	Aerodynamic brake achieved by feathering blades
iii.	Secondary Brake	Mechanical Disc brake
h. Tower		
i.	Type	Cylindrical tubular steel tower
ii.	Hub Heights	Tubular tower 85 m

D. Other Details

i.	Project Commissioning Date (Anticipated)	June 1, 2016
ii.	Expected Life of the Project from Commercial Operation Date (COD)	20 Years

Power Curve With Graphic



Power Curve under Standard Air Density

Power Curve
(Tabular Form)

Wind Speed m/s	Electric Power kW	Thrust Coefficient
3	12.6353	1.08024
3.5	41.145	0.964635
4	77.5526	0.877035
4.5	128.067	0.802804
5	187.213	0.780182
5.5	260.106	0.785139
6	347.967	0.788812
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7	574.504	0.793883
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19.5	1500	0.070123
20	1500	0.065423

Annexure J.1: *Point 13; Summary of Technology Information, Single Line Diagram, Power Curve*

SCHEDULE-II

The Installed/ISO Capacity (MW), De-Rated Capacity at Mean Site Conditions (MW), Auxiliary Consumption (MW) and the Net Capacity at Mean Site Conditions (MW) of the Generation Facilities of Licensee is given in this Schedule

SCHEDULE-II

1	Total Installed Capacity of the plant (Gross ISO)	13.50 MW
2	De-rated Capacity at Mean Site Conditions (on account of Air density, humidity, temperature, Wake effect, wind direction, rain etc)	12.890 MW
3	Auxiliary Consumption & EBOP losses	680KW
4	Total Net Capacity of the Plant at Mean Site Conditions	12.210MW

Note:

All the above figures are indicative as provided by the Licensee. The Net Capacity available to NTDC for dispatch and provision to purchasers will be determined through procedures contained in the Agreements or Grid Code.

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure K: *Point 14; Control, metering, instrumentation and protection*

Control, Protection & Supervision	:	A control and monitoring system shall be provided for monitoring operation of the Complex and providing telecommunication and tele-metering to the Control Room. A complete and comprehensive protection system for the Complex and inter-tripping provisions between Project's substation and the connected Grid Station shall be provided by the Project Company
Metering system	:	The metering points to record the MWh and MVARh exchange between the Complex and the NTDC's Grid System shall be at the HV Side (132kV) of the Power Transformer of the Complex. An exclusive set of current and voltage transformers (0.2s & 0.2 accuracy class respectively) to feed the input to the metering panels shall be provided. The metering panels will be located within the substation in a separate room as per NTDC's specifications. Back-up Metering System shall also be installed, *Protection system:* A suitable protection system to ensure system stability and reliability in the event of faults contributed by the wind farm, substation and the grid as per requirement of NTDC shall be provided.

Check List for Examination of License Application
For New Generation Facility (Wind)
(Regulation 3 read with 3(6)(A) of AMPR)

Name of Company : **M/s Burj Wind Energy (Private) Limited**
Capacity : 13.50MW, Wind power plant

Annexure L: *Point 15; Training and development*

Project Company will adopt EPC Contractors 'Training Plan'.

Project Company Training Plan Annexure L.1

ELECTRICAL GRID STUDIES

For

13.5 MW WIND POWER PLANT BY BURJ WIND ENERGY AT GUJJU

Final Report
(11-11-2013)

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Executive Summary

1. The Draft Final Report for the 13.5 MW Wind Power Plant by Burj Wind Energy Pvt. Ltd.(BWEPL) at Gujju is submitted herewith.

2. BWEPL-Gujju Wind Energy Wind Power Plant would be connected looping in-out one circuit of the 132 kV Double Circuit from Thatta towards FWEL-I & FWEL-II at the farm substation of BWEPL-Gujju WPP. The distance of the looping point from the farm substation would be 4-5 km. The conductor used would be 132 kV Greeley conductor.

3. The scheme of interconnection of BWEPL-Gujju WPP presupposes the following reinforcement already in place in Jhimpir and Gharo clusters by 2015:

   - A 132 kV double circuit T/Line, 64 km long from FWEL-I & FWEL-II WPPs to the existing Thatta 132 kV substation as shown in Sketch-2 & 3.
   - Rehabilitation of the exiting 132 kV lines in the vicinity of WPP clusters, i.e. Jhimpir-Kotri, Jhimpir-Thatta, Thatta-Sujawal and Nooriabad-Jamshoro Old
   - Partial construction of collector station at 132 kV level at Jhimpir, a 132kV double circuit of 82 km using Greeley conductor would be constructed to connect this collector station with T.M. Khan in HESCO network. This collector substation at Jhimpir has been assumed to be completed in two stages, first at 132 kV and second to complete 220/132 kV at later stage.
   - Development of two sub-clusters of 132 kV. One sub-cluster will comprise FFC, Zorlu, TGF and Sapphire whereas the other would evacuate power from the WPPs in the sub-cluster connected to the newly developed Jhimpir-New 132 kV Substation.
   - An interim arrangement of diverting one of existing 220 kV Jamshoro-KDA-33 circuits to Nooriabad to operate at 132 kV as follows:
     - 132 kV S/C T/Line, approx. 4 km from Nooriabad to the nearby exiting 220 kV D/C Jamshoro – KDA T/Line.
     - One of the two 220 kV circuits of Jamshoro -KDA (D/C T/Line) to be energized at 132kV connected with Nooriabad on one end through the arrangement mentioned above and Jamshoro 132 kV bus on the other end.

4. The existing grid system of HESCO and NTDC in the vicinity of BWEPL-Gujju WPP has been studied in detail by performing load flow, short circuit and dynamic analysis for the conditions prior to commissioning of Dewan WPP and no bottlenecks or constraints have been found in the grid system:
5. Wind Farm of BWEPL-Gujju has been modeled considering Dongfang DEC FD89 WTG with capacity of 1.5 MW. It is a Doubly Fed Induction Generator which is designated as Type-3 WTG. Its 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.
6. A conceptual design of scheme of 132/22 kV substation of BWEPL-Gujju Wind Farm has been laid down as follows
    i. For 22 kV;
        a. Two single bus-sections of 22 kV with a bus sectionalizer
        b. Two breaker bays to connect two collector circuits from two collector groups of WTGs
        c. Two breaker bays to connect two 132/22 kV transformers
        d. Two breaker bays to connect two switched shunt capacitor banks of 2 x (2x2) MVAR, one in each bus section
        e. One breaker bay to connect station auxiliary transformer 22/0.4 kV, 300 kVA
    ii. For 132 kV;
        a. Double Bus with Coupler as Farm substation is GIS
        b. Two breaker bays to connect two 132/22 kV transformers
        c. The protection scheme would be designed in compliance of NTDC requirements sent by Chief Engineer Protection, vide letter No.3416-19/CE/SP/MN/50MW CWE WPP Jhimpir dated 23/07/2010
        d. The telecommunication scheme would be designed in compliance of NTDC requirements sent by Chief Engineer Telecommunication, vide letter No. CE (Tel)/NTDC/232/4372 dated 27/08/2010.

iii. Other Equipment:

a. Two 132/22 kV, 13.5 MVA OLTC transformers, 140±8×1.25%/22 kV, to fulfill N-1 criteria of Grid Code

b. One station auxiliary transformer of 22/0.4 kV, 300 kVA

c. Two switched shunt capacitor banks each of the size of 4 MVAR (2 x 2 MVAR) to provide 8 MVAR at 22 kV with contactors and PLC (Programmable Logic Controller).

d. Energy meters would be installed on HV side (132 kV) of the 132/22 kV transformers.

7. Load flow analysis has been carried out for June 2015 considering the Mid 2015 COD targeted by BWEPL-Gujju as September falls in the upcoming high wind season and thus will allow us the judge the maximum impact of the plant on the grid, for the dispersal of load from BWEPL-Gujju WPP into HESCO Grid at 132 kV level using the latest load forecast, generation and transmission expansion plans of NTDC and HESCO. The above mentioned interconnection scheme (item-2) 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. The grid facilities of HESCO are found adequate to absorb output power of BWEPL-Gujju WPP.

8. Maximum and minimum short circuit levels for three-phase faults and single-phase faults have been evaluated for the year 2015, and it has been found that the proposed scheme provides maximum SC strength for the evacuation of BWEPL-Gujju WPP power to the grid.

The switchgear ratings for BWEPL-Gujju 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

9. Transient Stability analysis has been carried out for BWEPL-Gujju 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-Gujju WTG unit's dynamic characteristics and the grid connectivity is strong enough to maintain stability under all disturbances. In turn, any disturbance from BWEPL-Gujju WPP side did not cause any stress on the main grid or the power plants in HESCO area viz. Kotri, Lakhra or Jamshoro such that the whole system remained stable under all events.
10. 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.
11. 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.
12. There are no technical constraints whatsoever in the way of bringing in the 13.5 MW of Gujju 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.

Report Contents

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 50,000MW. There are many entrepreneurs coming forward to tap this huge natural resource of power. Burj Wind Energy Pvt. Ltd. is one such pioneering entrepreneur who has come forward with a Wind Power Plant within this cluster at Gujju.

The proposed wind farm shall have the installed capacity of about 13.5 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 HESCO / NTDC. The services of Power Planners International have been engaged to perform the impact studies of penetration of this wind power in the national grid to evolve the most feasible interconnection scheme for this plant.

1.2 Objectives

The overall objectives of this study are:

1. Impact of 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 under two generation dispatch scenarios with high hydro power availability and low hydro (or high thermal) power generation.

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

1. To develop a feasible scheme of interconnections of BWEPL-Gujju Wind Power Plant (WPP) with HESCO/NTDC network at 132 kV for which right of way (ROW) and space at the terminal substations would be required to be made available.

2. To check the load-ability of lines and transformers to be within their rated limits satisfying the clauses OC 4.8, OC 4.9, and OC 4.10 of NEPRA Grid Code regarding the criteria of operation of frequency, voltage and stability under normal and contingency conditions for peak and off-peak load conditions of grid as well as the plant.
3. To check the voltage profile of the bus bars of the neighboring interconnected network under different operating conditions
4. To check the reactive power limitations of the wind turbines and the neighboring generators of the system; and evaluate the size of switched shunt capacitor banks at Medium Voltage level of substation of collector system of BWEPL-Gujju 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-Gujju Wind Farm and the NTDC/HESCO substations of 132 kV connecting with the BWEPL-Gujju Wind Farm.
6. To check the minimum short circuit strength of the system to handle large variation of generation of wind turbine
7. To check if the interconnection with the grid withstands transient stability criteria of post fault recovery with good damping satisfying the NEPRA Grid Code.
8. Transient stability to see the dynamic performance of BWEPL-Gujju WPP in response to Grid disturbances and vice versa the dynamic impact of disturbances in BWEPL-Gujju WPP on the Grid.
9. To check the ability of the wind turbine generators of BWEPL-Gujju WPP to remain connected following major disturbances and grid

disruptions i.e. the Low Voltage Ride Through (LVRT) capability to satisfy the Grid Code requirement of LVRT for 180 ms

10. Analysis of power quality issues such as flicker, voltage-unbalance, harmonics and resonance of the system.

1.3 Planning Criteria

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

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

Short Circuit:

132 kV Substation Equipment Rating 40kA

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

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

1. Total normal fault clearing time from the instant of initiation of fault current to the complete interruption of current, including the relay time and breaker interruption time to isolate the faulted element, is equal to 100 ms (5 cycles) for the systems of 132 kV and above.

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

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

Reactive Power and Power factor:

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

Power Quality Requirements:

As per IEC61400-21standards

1.4 Operating Criteria

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

Black Start and Islanded Operation:

Exempted

Active Power and Frequency Control:

Exempted from precise frequency control responsibility

Synchronization / De-Synchronization:

(i) The Wind Power Plant will manage for

  (a) Smooth Synchronization

  (b) Smooth De-Synchronization

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

Power Generation Capability Forecasting Requirement:

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

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

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

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

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

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

1.5 Input Data

The latest 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-Gujju Wind Farm has been provided by the client who has indicated to use Dongfang DEC FD89 WTG with capacity of 1.5 MW. It is a Doubly Fed Induction Generator which is designated as Type-3 WTG.

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, a small part of which is being tapped by FFC and Zorlu WPPs. 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 Gharo and Jhimpir in the existing power grid are Kotri and Jamshoro having installed capacity of 120 MW and 600 MW respectively. Next to them are Hub with 1200 MW, Lakhra with 70 MW, and KESC combined generation of about 1600 MW. Apparently this amount of generation in Southern grid seems strong enough to absorb the penetration of wind power of 13.5 MW. 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-Gujju WPP.

The above-mentioned thermal power plants do not run at their full capacity all along the whole year. During high water months when cheaper hydel power is abundantly

available in the Northern grid of NTDC, many generating units of these plants are shut down for the sake of economic dispatch. Therefore in high hydel season, which is low thermal season by default, the southern power grid would get weaker in terms of system strength, especially during off-peak hours. The dynamics of this season is different than that of high thermal season.

There are different models of different sizes and make available in the market viz. GE, Vestas, Nordex, Gamesa, Siemens, Goldwind and Vensys etc. The dynamics of each model may be different with respect to grid's dynamics. BWEPL-Gujju Wind Energy is considering using Dongfang DEC FD89 WTG with capacity of 1.5 MW. It is a Doubly Fed Induction Generator which is designated as Type-3 WTG.

There are other wind farms going to get developed soon in the neighborhood of BWEPL-Gujju wind farm. With the increase of penetration of more wind power in the same power grid, the impact studies would become even more involving from the point of view of dynamic stability.

2.2 Approach to the problem

We will apply the following approaches to the problem:

- The COD of BWEPL-Gujju WPP as provided by the Client BWEPL-Gujju Wind Energy Pvt. Limited is June 2015. Therefore we have decided to perform our analysis for the scenario of Peak June 2015 to accommodate the WPP in Stage-3 of grid development schemes of NTDC to judge the maximum impact of the plant.
- The base case for the year 2014-15 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 the Wind Power Plants which are developing on fast track basis and are expected to be commissioned by mid-2015.
- Interconnection scheme without any physical constraints, like right of way or availability of space in the terminal substations, would be identified.

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

3. Analysis of Network Prior to BWEPL-Gujju WPP Interconnection

3.1 Description of the Network

The electrical grid, which is relevant for interconnection of BWEPL-Gujju Wind PP, is the 132 kV network that stretches through South of Hyderabad and Jamshoro up to coastal areas of Southern Sind. This network, as it stands today is shown in Sketch-1 in Appendix-4. It comprises the following NTDC grid stations;

- Existing 500/220/132 kV grid station at Jamshoro connected through double circuits of 500 kV with Dadu in the North and Hub/New-Karachi in the South.
- Existing 220/132 kV Hala Road connected to Jamshoro 500/220/132 kV grid through a double circuit of 220 kV
- Existing T. M. Khan Road 220/132 kV gird station connected to Jamshoro 500/220/132 kV grid station by a double circuit of 220 kV

The 132 kV network under HESCO has been shown only for the circuits that emanate from Hyderabad, Jamshoro and Kotri to connect to the substations of 132 kV lying South of Hyderabad. There are four existing branches of network of 132 kV that stretch southward and pass close to BWEPL-Gujju WPP near Jhimpir, as follows:

- Jamshoro-Old - Nooriabad – Kalukuhar 132 kV single circuit
- Kotri-Jhimpir-Thatta-P.Patho-M.P.Sakro-Garho 132 kV single circuit
- Hyderabad-T.M.Khan-B.S.Karim-Sujawal-Thatta 132 kV single circuit
- The Jhimpir-Nooriabad 132 kV single circuit on double-circuit-towers (SDT) provides parallel reliability with the other two branches up to Thatta and Nooriabad. This line has been built using double-circuit towers (SDT) and the work of stringing of second circuit is in progress these days and would be completed soon.

Two of the branches connecting Thatta provide parallel reliability to each other up to Thatta. However the single circuit South of Thatta going to Garho via P.Patho and M.P.Sakro does not support the supply to these substations under an outage condition. The under construction 132 kV D/C from Thatta towards FWEL-I and FWEL-II would be the nearest electrical facility passing near the site of BWEPL-Gujju WPP.

The network as it is planned with wind power plants scheduled prior to commissioning of BWEPL-Gujju WPP in 2015 is shown in Sketch-2 in Apendix-4. FFC and Zorlu are already in operation, another one i.e. TGF is going to be in operation by mid June 2014 and UEP WPP is expected to be in operation by June 2015. For further addition of WPPs, a comprehensive study under directions of NEPRA has been recently carried out jointly by NTDC, PPI and HESCO which establishes a scheme of stage by stage additions of WPPs in consonance with the corresponding stage by stage reinforcement in the grid to evacuate power from WPPs upcoming in Jhimpir and Gharo areas. The corresponding reinforcements are going to be in place by June 2015 in Stage-3:

- A 132 kV double circuit T/Line, 64 km long from FWEL-I & FWEL-II WPPs to the existing Thatta 132 kV substation as shown in Sketch-2 & 3.
- Rehabilitation of the exiting 132 kV lines in the vicinity of WPP clusters, i.e. Jhimpir-Kotri, Jhimpir-Thatta, Thatta-Sujawal and Nooriabad-Jamshoro Old.
- Partial construction of collector station at 132 kV level at Jhimpir, a 132kV double circuit of 82 km using Greeley conductor would be constructed to connect this collector station with T.M. Khan in HESCO network. This collector substation at Jhimpir has been assumed to be completed in two stages, first at 132 kV and second to complete 220/132 kV at later stage.
- Development of two sub-clusters of 132 kV. One sub-cluster will comprise FFC, Zorlu, TGF and Sapphire whereas the other would evacuate power from the WPPs in the sub-cluster connected to the newly developed Jhimpir-New 132 kV Substation as shown in Sketch-2 and 3. An interim arrangement of diverting one of existing 220 kV Jamshoro-KDA-33 circuits to Nooriabad to operate at 132 kV as follows:
    - 132 kV S/C T/Line, approx. 4 km from Nooriabad to the nearby exiting 220 D/C Jamshoro – KDA T/Line.
    - One of the two 220 kV circuits of Jamshoro -KDA (D/C T/Line) to be energized at 132kV connected with Nooriabad on one end through the arrangement mentioned above and Jamshoro 132 kV bus on the other end.

Of the two sub clusters developed in Jhimpir area, one sub-cluster will comprise FFC, Zorlu, TGF and Sapphire whereas the second cluster would connect other upcoming WPPs in the Jhimpir Cluster via the Jhimpir-New 132 kV Collector Substation.

We have carried out the interconnection study assuming that 2x50 MW WPPs in the Gharo Cluster and 9x50 MW and 1x30 MW WPPs in Jhimpir cluster might be commissioned prior to BWEPL-Gujju, as per the latest Transmission and Generation Plan of NTDC without including BWEPL-Gujju WPP to ascertain if there are any constraints in the system prior to BWEPL-Gujju WPP's commissioning.

3.1.2 Transmission Expansion

Because of sizable additions of generation scheduled in South, the following transmission expansion has been planned to reinforce 500 kV and 220 kV network in South;

500 kV

- Guddu-Multan 2nd circuit 500 kV In-Out at D. G. Khan 2013-14
- Guddu-Multan 3rd circuit 500 kV In-Out at R. Y. Khan 2013-14
- Guddu-R.Y. Khan 500 kV circuit In-Out at Guddu-New PP 2013-14
- Guddu-New Power Plant to M. Garh 500 kV S/C 2013-14
- Guddu-Dadu 1st circuit 500 kV In-Out at Shikarpur New 2014-15
- Guddu-Dadu 2nd circuit 500 kV In-Out at Shikarpur New 2014-15
- Jamshoro-Moro 500 kV S/C 2016-17
- Moro-R.Y. Khan 500 kV S/C 2016-17
- Dadu-Moro 500 kV S/C 2016-17

220 kV

- Rohri New – Shikarpur 220 kV D/C 2012-13
- Dadu-Khuzdar 220 kV D/C 2013-14
- Uch-1-Shikarpur S/C in-out at Uch-2 Power Plant 220 kV 2013-14
- Uch-Guddu S/C In-Out at D. M. Jamali 2013-14
- Uch-2 Power Plant – Sibbi 220 kV D/C 2014-15
- Uch-1-Guddu S/C in-out at Shikarpur New 220 kV \ 2014-15
- Hala Road – T. M. Khan Road 220 kV S/C 2015-16
- Hala Road–T. M. Khan Road 220kV S/C In-Out at MirpurKhas New 2015-16

- Jhimpir-T. M. Khan Rd. 220 kV D/C 2015-16
- Gharo-Jhimpir 220 kV D/C 2015-16

3.2 Load Flow Analysis

Load flow analysis has been carried out for the NTDC / HESCO network including the connections provided to new wind power plants FWEL-I and FWEL-II have been modeled in the Gharo cluster. FFC, Zorlu, TGF and Sapphire are connected the Nooriabad to Jhimpir 132 kV Double Circuit and UEP, Metro, Sachal, Tapal and Yunus in the Jhimpir Cluster are connected to the Jhimpir-New 132 kV Collector Substation have been modeled, as mentioned earlier, but without including BWEPL-Gujju WPP to see if the network was adequate for dispersal of wind power without it. The case has been studied for the peak system conditions of June 2015. The month of June 2015, being the high wind season, has been selected as the benchmark month to ascertain the maximum impact of the WPPs on the system. The dispatch of the thermal plants in the South has been set to their maximum. We kept the dispatch of Kotri the nearby power plant at 132 kV at 120 MW and other Captive Power plants such as Thatta, Nooriabad and Kotri-Site have been modeled in the case with their full generation in order to see the maximum distributed generation on 132 kV network prior to commissioning of BWEPL-Gujju WPP. With this dispatch, the power flow conditions on 132 kV network around Jhimpir, Thatta and Nooriabad area would be almost same irrespective of High or Low Water dispatch conditions on the primary network of NTDC. 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 for the three Southward branches each, and the results are attached in Appendix-3 as below:

Exhibit-3.1	FWEL-I to Thatta 132 kV Single Circuit Out
Exhibit-3.2	Thatta to Sujawal 132 kV Single Circuit Out

Exhibit-3.3	Thatta to Jhimpir 132 kV Single Circuit Out
Exhibit-3.4	Jhimpir to Kotri-GTPS 132 kV Single Circuit Out
Exhibit-3.5	Sapphire to Jhimpir 132 kV Single Circuit Out
Exhibit-3.6	Zorlu to Jhimpir 132 kV Single Circuit Out
Exhibit-3.7	Zorlu to FFC to 132 kV Single Circuit Out
Exhibit-3.8	FFC to Nooriabad 132 kV Single Circuit Out
Exhibit-3.9	TGF to Nooriabad 132 kV Single Circuit Out
Exhibit-3.10	Nooriabad to Jamshoro-New 132 kV Single Circuit Out

The load flow results of the network in the close vicinity of BWEPL-Burj WPP shown plotted in Exhibits 3.1 to 3.10 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-Gujju 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-Gujju WPP in Chapter 6.

3.3 Short Circuit Analysis

In order to assess the short circuit strength of the network of 132 kV without BWEPL-Gujju WPP for the grid of Southern HESCO especially in the vicinity of the site of this Wind Farm, fault currents have been calculated for balanced three-phase and unbalanced single-phase short circuit conditions. The fault levels also include the contributions from other Wind Farms such as FWEL-I and FWEL-II in the Gharo cluster and FFC, Zorlu, TGF, Sapphire, Tapal, Sachal, Metro, Yunus and UEP in the Jhimpir Cluster and, as mentioned earlier, which are expected to be in operation before BWEPL-Gujju WPP as per AEDB's latest generation schedule.

The results of this analysis will not only give us the idea of the fault levels without BWEPL-Gujju WPP but also it will, by comparison, let us know as to how much the contribution of fault current from BWEPL-Gujju WPP may add to the existing fault levels. From this analysis we also get a feel of the probable nodes to connect the Wind Farm depending on their relative short circuit strength. The calculations have been

made for maximum and minimum short circuit levels considering maximum and minimum generation dispatch conditions of the system in high water and low water seasons.

3.3.1 Maximum Fault Levels

A case for the year 2014-15 has been developed in which all the hydel and thermal generating plants have been dispatched to cover the highest possible fault current contributions.

PSS/E software provides an option of calculating the fault currents using the IEC 909 criteria, and we have used this option for all the fault calculations for this study. For maximum 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 1.1 P.U. i.e. 10 % higher than nominal, which is the maximum permissible voltage under contingency condition.

The short circuit levels have been plotted on the bus bars of 132 kV of substations lying in the electrical vicinity of our area of interest i.e. Thatta area, and are shown plotted in the Exhibit 3.11 attached in Appendix-3.

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-3 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 detail for each faulted bus bar.

The total maximum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 3.1. 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.

Table 3.1

Maximum Short Circuit Levels Without BWEPL-Gujju-WPP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
Jhimpir New 132kV	4.09	2.64
Jhimpir 132kV	7.77	6.00
Thatta 132kV	4.74	4.06
Sujawal 132kV	4.02	2.97
T.M Khan 132 kV	10.71	8.49
Hyd TMRD 132 kV	14.21	12.60
Jamshoro-O 132 kV	18.65	17.56
Nooriabad132 kV	9.07	7.79
Kotri GTPS 132 kV	17.46	17.39
FWEL-I 132kV	2.99	2.19
FWEL-II 132kV	2.97	2.17
Pirpatho 132kV	2.98	2.19
Jamshoro 220 kV	23.39	24.43
T.M.Khan Road 220 kV	15.17	12.63

3.3.2 Minimum Fault Levels

For minimum fault levels minimum generation dispatches are assumed which in practice may correspond to minimum load conditions. We normally have minimum thermal power dispatch during High Water season and it gets further minimum during off-peak hours. Especially in Southern Sind, the thermal generation would be at its minimum during minimum load conditions of high water season. Therefore we have calculated the minimum short circuit levels under High Water off-peak conditions. Also the dispatch of WTGs from other wind farms of FWEL-I and FWEL-II in the Gharo cluster and FFC, Zorlu, TGF, Sapphire, Sachal, Tapal, Metro, Yunus and UEP

in the Jhimpir Cluster and is also assumed as minimum to have the minimum fault contributions from these Farms. The results are shown in Appendix-3.

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.

The plotted results of the minimum fault currents are attached in Exhibit 3.12 the same way as before focusing on the significant 132 kV bus bars of substations in the electrical vicinity of Thatta. The tabular output of minimum fault currents shown in Appendix-3 is the detailed output showing the contribution to the fault current from the adjoining sources i.e. the lines and transformers connected to that bus. The phase currents, the sequence currents and the sequence impedances are shown in detail for each faulted bus bar.

The minimum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 3.2.

Table 3.2

Minimum Short Circuit Levels without BWEPL-Gujju-WPP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
Jhimpir New 132 kV	2.99	2.01
Jhimpir 132 kV	5.01	3.92
Thatta 132 kV	3.14	2.39
Sujawal 132 kV	2.86	2.07
T.M Khan 132 kV	6.86	5.78
Hyd TMRD 132 kV	8.42	7.86
Jamshoro-O 132 kV	10.27	9.95
Nooriabad 132 kV	5.58	4.66
Kotri GTPS 132 kV	9.26	9.07

FWEL-I 132kV	2.13	1.48
FWEL-II 132kV	2.12	1.47
Pirpatho 132kV	2.14	1.49
Jamshoro 220 kV	10.78	10.87
T.M.Khan Road 220 kV	8.28	7.35

3.3.3 Comparison of Fault Levels

Comparing the short circuit strengths, both in terms of maximum and minimum, of the existing substations of 132 kV in the vicinity of BWEPL-Gujju WPP *viz.* Jhimpir, Nooriabad and Thatta, we find that Jhimpir and Nooriabad are strong points with relatively higher short circuit levels compared to Thatta. In fact Nooriabad draws strength from its direct connection with Jamshoro-old having direct connection with a very strong source of Jamshoro. Jhimpir draws its strength from its direct connection with Kotri where sits a medium size gas turbine power plant and also have connection with Jamshoro. The issues of power quality would be investigated in Chapter 9 of the study and would establish the viability of BWEPL-Burj from a power quality perspective.

4. Development of Interconnection Scheme

4.1 Interconnection of BWEPL-Gujju 13.5 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-Gujju WPP, the nearest substation is Thatta 132 kV Substation.

4.2 Proposed Interconnection Scheme

Given that there can be 10 WPPs coming in commercial operation in the Jhimpir region and 2 WPPs coming in commercial operation in the Gharo region around the time that BWEPL-Gujju WPP also comes into commercial operation, the following reinforcements in the system would be pre-requisite before we connect BWEPL-Gujju WPP with the system as shown in Sketch-2:

- A 132 kV double circuit T/Line, 64 km long from FWEL-I & FWEL-II WPPs to the existing Thatta 132 kV substation as shown in Sketch-2 & 3. This circuit passes close to the site of BWEPL-Gujju WPP at a distance of about 4-5 km.
- Rehabilitation of the exiting 132 kV lines in the vicinity of WPP clusters, i.e. Jhimpir-Kotri, Jhimpir-Thatta, Thatta-Sujawal and Nooriabad-Jamshoro Old

In addition for the WPPs in the Jhimpir cluster, the following reinforcements would be needed:

- Construction of collector station at 132 kV level at Jhimpir, a 132kV double circuit of 82 km using Greeley conductor would be constructed to connect this collector station with T.M. Khan in HESCO network. This collector substation at Jhimpir has been assumed to be completed in two stages, first at 132 kV and second to complete 220/132 kV at later stage.
- Development of two sub-clusters of 132 kV. One cluster would be catered by the Jhimpir-Nooriabad 132 kV Double Circuit and the other would be connected through 132 kV double circuits using Greely conductor with Jhimpir-New collector grid station as shown in Sketch-2 and 3. An interim arrangement of diverting one of existing 220 kV Jamshoro-KDA-33 circuits to Nooriabad to operate at 132 kV as follows:
    - 132 kV S/C T/Line, approx. 4 km from Nooriabad to the nearby exiting 220 D/C Jamshoro – KDA T/Line.
    - One of the two 220 kV circuits of Jamshoro -KDA (D/C T/Line) to be energized at 132kV connected with Nooriabad on one end through the arrangement mentioned above and Jamshoro 132 kV bus on the other end.

Due to the location of BWEPL-Gujju WPP, the connection scheme of BWEPL-Gujju WPP for the scenario of June 2015, as shown in Sketch-3, would be by connecting BWEPL-Gujju WPP by looping in-out one circuit of the 132 kV Double Circuit from Thatta towards FWEL-I & FWEL-II at the farm substation of BWEPL-Gujju WPP. The distance of the farm substation for the looping point would be about 4-5 km and the conductor used would be Greeley 132 kV Conductor.

5. Modeling of BWEPL-Gujju Wind Farm

5.1 Electrical Layout of Wind Farm

5.1.1 BWEPL-Gujju Wind Energy Selection

BWEPL-Gujju Wind Energy has selected Dongfeng DEC FD89 WTG with a capacity of 1.5 MW which they are considering to install on their Wind Farm at Jhimpir. It is a Doubly Fed Induction Generator WTG which is designated as Type-3 WTG. A total of nine WTGs would be required to be installed to make a total Farm output of 13.5 MW. Each WTG would step up from its terminal LV voltage of 0.69 kV to a medium voltage (MV) that will be 22 kV.

5.1.3 Electrical Layout with DEC FG89 1.5 MW WTGs

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 – 5 (Appendix-5), briefly described as follows;

Line – 1	WTGs 6, 9, 3, 7 and 8	(5 x 1.5 = 7.5 MW)
Line – 2	WTGs 2, 4, 1 and 5	(4 x 1.5 = 6.0 MW)

The average length of cable between the two WTGs has to be enough to completely outdo 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 300 meters distances between the WTGs.

The Farm Substation has been assumed to be located somewhere in the middle of the Farm. The two collector circuits of 22 kV would thus be laid as shown in Sketch-5.

Since each collector would carry approximately 7.5 MW at normal rating, the 22 kV collector circuits loading capacity should be in the range of 9 MVA each, giving some margin for reactive power at 0.95 Power Factor and some losses in the circuits with certain overload capacity as well.

5.1.4 22 kV Collector Circuits

The MV voltage level selected by BWEPL-Gujju Energy for interconnection of collector groups of WTGs in the Farm is 22 kV. Underground cables will be used.

The collector cable ratings would be 22 kV as the rated kV level and 9 MVA as the loading capacity of collector cables.

Maximum nominal current of 22 kV cable = (9/22xsqrt (3)) x 1000= 236 A

With 10 % safety margin, maximum nominal current of 22 kV cable = 360 A

BWEPL-Gujju WPP is advised to use cables of ampacity capable of evacuating this power.

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 HESCO/NTDC. The single line diagrams of the substation, as a conceptual design, are briefly shown in SLD-1 and SLD-2 in Appendix-5 for 22 kV and 132 kV respectively.

Keeping in view of the current practices in NTDC and DISCOs, the substations for power plants of the order of BWEPL-Gujju WPP, the 132 kV bus bars are double bus with a coupler i.e. double bus-single-breaker scheme. However for 132/11 kV substations, the MV bus i.e. 11 kV a single bus with or without sectionalizers. 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 Bar with Coupler at 132 kV, as the substation is AIS

The schemes are shown in SLD-1 and SLD-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 22V (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 circuits of WTG Lines A and B
- Two breaker bays to connect two transformers of 132/22 kV
- One breaker bay for connecting auxiliary transformer of 22/0.4 kV
- Two breaker bays to connect switched shunt capacitor banks

Rating of all the breakers and bus bar equipment would be

Short circuit rupturing capacity = 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–2A (Appendix–5) shows 132 kV bus bars of the Farm substation, which would comprise as follows:

- Double Bus with Coupler as Farm substation is AIS
- 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

5.2.3 Other Equipment

The other equipment of the substation consists of:

- Two 132/22 kV, 13.5 MVA ONAN OLTC transformers, 140±8×1.25%/22kV, to fulfill N-1 criteria of Grid Code
- One station auxiliary transformer 22/0.4 kV, 300 kVA
- Two switched shunt capacitor banks each of the size of 4 MVAR (2 x 2 MVAR) with contactors and PLC (Programmable Logic Controller).
- Energy meters would be installed on HV side (132 kV) of the 132/22kV transformers.

5.2.3 Protection and Telecommunication Scheme

The protection scheme would be designed in compliance of NTDC requirements intimated by Chief Engineer Protection, vide letter No.3416-19/CE/SP/MN/50MW CWE WPP Jhimpir dated 23/07/2010 (attached in Appendix-5).

The telecommunication scheme would be designed in compliance of NTDC requirements intimated by Chief Engineer Telecommunication, vide letter No. CE (Tel)/NTDC/232/4372 dated 27/08/2010 (attached in Appendix-5).

6. Load Flow Analysis

Load flow analysis has been carried out for the proposed scheme of interconnection of BWEPL-Gujju WPP with NTDC / HESCO grid for the base case of Peak June 2015 as per Sketch-3 in Appendix-4.

6.1 Modeling of Wind Farm in the 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 two collector feeders connecting to two groups of WTGs, therefore there is one equivalent WTGs assumed for each collector group in this study report.

The Farm Substation is represented by two bus bars as BWEPL-Gujju-MV 22 kV and BWEPL-Gujju 132 kV, with two inter-bus transformers of 13.5 MVA each. Thus in the case of the outage of one transformer, the other can take up the full output of Farm i.e. 13.5 MVA to cover N-1 contingency criteria

6.2 Reactive Power Requirements

BWEPL-Gujju is considering Dongfang DEC FD89 with capacity of 1.5 MW. The machine is Type-3 Doubly Fed Induction Generator WTG. 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 0.492 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 13.5 MW generating capacity is required to pump 4.43 MVAR to the grid at full output of 13.5 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 4.43 MVAR at 132 kV bus after VAR loss across 132/22 kV transformers.

6.3 Load Flow Analysis for Peak Load Case of June 2015

Load flow analysis has been carried out for the NTDC / HESCO network to see the steady state impact of adding the generation of BWEPL-Gujju WPP on the network including the connections provided to other wind power plants already scheduled having been connected. These are FWEL-I and FWEL-II in the Gharo cluster and FFC, Zorlu, TGF, Sapphire, Sachal, Metro, Tapal, Yunus and UEP in the Jhimpir Cluster, as mentioned earlier.

BWEPL-Gujju Wind Power Plant would be connected by looping in-out of one circuit of the 132 kV Double Circuit from Thatta towards FWEL-I & FWEL-II at the farm substation of Gujju-BWEPL WPP. The distance of the farm substation from the looping point is about 4-5 km. The network configuration is same for Jhimpir and Gharo clusters as indicated in Sketch-3 of Appendix-4 and discussed in Ch. 3.

As the expected COD provided by BWEPL-Gujju is before mid-2015, therefore the integrated case has been studied for the peak system conditions of June 2015, the time line associated with Stage-3 of NTDC scheme of evacuation of wind power plants from Jhimpir. We kept the dispatch of Kotri the nearby power plant at 132 kV at 120 MW, and other Captive Power plants such as Thatta, Nooriabad and Kotri-Site are operating at their maximum therefore we can see the maximum distributed generation on 132 kV network. With this dispatch, the power flow conditions on 132 kV network around Jhimpir, Thatta and Nooriabad area would be almost same irrespective of High or Low Water dispatch conditions on the primary network of NTDC.

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 6.0 shows the normal case under the peak system conditions of June 2015. All the wind farms in Gharo and Jhimpir clusters with installed capacity of 50 MW or 49.5 MW has been assumed dispatching nearly 45 MW at point of delivery (132kV) to the grid after deducting Farm losses and given some diversity in the maximum output of all the Wind Power Plants at one time. For BWEPL-Gujju WPP we assume to deliver the full 13.5 MW at the point of delivery to grid at 132kV.

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 0.95 not using full reactive power capability leaving enough margin to cover contingencies. The switched shunt capaciter bank of 8 MVAR at 22 kV bus bar is supplying 5.3 MVAR at (22.6 kV) voltage and, after VAR loss across 132/22 kV transformers, supplying about 5.2 MVAR at 132 kV bus i.e. fulfilling the Grid Code criteria at the point of interconnection. The voltage profile on all the bus bars of 132 kV of HESCO grid are well within the normal operating criteria of ± 5 % off the nominal.

6.3.2 Contingency cases and evolving of reliable scheme

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

Exhibit-6.1	Thatta to BWEPL-G 132 kV Single Circuit Out
Exhibit-6.2	FWEL-I to BWEPL-Gujju 132 kV Single Circuit Out
Exhibit-6.3	Thatta to Sujawal 132 kV Single Circuit Out
Exhibit-6.4	Thatta to jhimpir 132 kV Single Circuit Out
Exhibit-6.5	Jhimpir to Kotri-GTPS 132 kV Single Circuit Out
Exhibit-6.6	Sapphire to Jhimpir 132 kV Single Circuit Out
Exhibit-6.7	Zorlu to Jhimpir 132 kV Single Circuit Out
Exhibit-6.8	Zorlu to FFC to 132 kV Single Circuit Out
Exhibit-6.9	FFC to Nooriabad 132 kV Single Circuit Out
Exhibit-6.10	TGF to Nooriabad 132 kV Single Circuit Out
Exhibit-6.11	Nooriabad to Jamshoro-New 132 kV Single Circuit Out

The results show that power flows on intact 132 kV circuits in all the outages remain within their rated limits. The results show that under all events of outages, the bus voltages also remain within the permissible limits.

The switched shunt capacitor banks at 22 kV bus regulates the voltage under all events. The reactive power being supplied by the 8 MVAR switched shunt capacitor banks connected at 22 kV bus, maintains the supply of VARS to the grid under all contingencies adjusting its output according to the system requirement. Therefore to cover the steady state, normal and outage conditions, the suitable size of switched shunt capacitor bank at 22 kV bus is 8 MVAR which would be installed as two banks i.e. 2x4 MVAR in each bus section of 22 kV.

6.4 Conclusion of Load Flow results

The proposed interconnection scheme would require looping in-out one circuit of the 132 kV Double Circuit from Thatta towards FWEL-I & FWEL-II at the Farm Substation of BWEPL-Gujju WPP. Greeley conductor will be used with the capacity of 184 MVA per circuit. In the load flow simulation, however, the MVA capacity is assumed to be 202.4 MVA taking into account the increase in thermal rating of the conductors at high wind speed during high wind season. The distance of the looping point from the farm substation is 4-5 km.

The load flow results of the proposed scheme of interconnection of BWEPL-Gujju WPP show that under the operating conditions that the scheme is enough to absorb the output of BWEPL-Gujju WPP under normal as well as contingency conditions under the conditions simulated in the study.

References:

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

2- *Ibid.* p.3.1

7. Short Circuit Analysis for the Year 2014-15

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 1.10 PU i.e. 10 % above the nominal as per IEC909. For calculations of minimum fault levels the bus voltage has been assumed as 0.9 PU i.e. 10% below the nominal. That covers the entire ± 10 % range of the ratings of the equipments.

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 year 2014-15.

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-Gujju 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.

For minimum short circuit levels we have considered off- peak conditions of 2014-15 to simulate the minimum short circuit strength of southern grid. For BWEPL-Gujju

WPP we have assumed dispatch of 33 % of its capacity for the minimum short circuit calculations i.e. just one collector group with partial output of 4.5 MW is on bar.

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

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

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

7.2 Fault Currents Calculations

7.2.1 Maximum short circuit levels

The short circuit levels have been calculated and plotted on the bus bars of 220 kV and 132 kV of substations lying in the electrical vicinity of our area of interest i.e. Thatta, Gharo and Jhimpir area, and are shown plotted in the Exhibit 7.1 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 detail for each faulted bus bar.

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

The fault levels of BWEPL-Gujju 132 kV are 3.92 kA and 3.11 kA for 3-phase and single phase faults respectively. This is much less than the switchgear rating of 40 kA

recommended for BWEPL-Gujju Farm Substation as per NTDC requirements for 132 kV.

The fault levels for BWEPL-Gujju 22 kV are 8.53 kA and 7.84 kA for 3-phase and single-phase faults respectively. Therefore the short circuit rating recommended for 22 kV switchgear is recommended as 25 kA.

Table-7.1

Maximum Short Circuit Levels with BWEPL-Gujju-WPP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
BWEPL MV 22kV	8.53	7.84
BWEPL Gujju 132 kV	3.92	3.11
Jhimpir New 132 kV	4.09	2.65
Jhimpir 132 kV	7.82	6.04
Thatta 132 kV	4.84	4.16
Sujawal 132 kV	4.06	3.00
T.M Khan 132 kV	10.74	8.51
Hyd TMRD 132 kV	14.23	12.62
Jamshoro-O 132 kV	18.69	17.58
Nooriabad 132 kV	9.10	7.81
Kotri GTPS 132 kV	17.49	17.40
FWEL-I 132kV	4.84	4.16
FWEL-II 132kV	2.96	2.16
Pirpatho 132kV	3.02	2.22
Jamshoro 220 kV	23.41	24.45
T.M. Khan Road 220 kV	15.18	12.64

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 7.2. 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 i.e. the substations connecting in the three branches of 132 kV running South of Hyderabad up to Southern Sind coast line. The tabular output is the detailed output showing the contribution to the fault current from the adjoining sources i.e. the lines and transformers connected to that bus. The phase currents, the sequence currents and the sequence impedances are shown in detail for each faulted bus bar.

The total 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-Gujju-WPP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
BWEPL MV 22 kV	6.36	5.56
BWEPL Gujju 132 kV	2.67	1.95
Jhimpir New 132 kV	2.99	2.01
Jhimpir 132 kV	5.03	3.94
Thatta 132 kV	3.17	2.42
Sujawal 132 kV	2.88	2.08
T.M Khan 132 kV	6.88	5.79
Hyd TMRD 132 kV	8.44	7.88
Jamshoro-O 132 kV	10.27	9.97
Nooriabad 132 kV	5.59	4.67
Kotri GTPS 132 kV	9.28	9.09
FWEL-I 132kV	2.10	1.46
FWEL-II 132kV	2.10	1.46
Pirpatho 132kV	2.16	1.51
Jamshoro 220 kV	10.79	10.88
T.M. Khan Road 220 kV	8.29	7.36

7.3 Conclusions of Short Circuit Analysis

In order to see how much the BWEPL-Gujju WPP has contributed to increase the fault levels of the substations in its electrical vicinity, we compare the maximum fault levels with the fault levels of the same bus bars in Table 3.1 (Chapter-3) evaluated without BWEPL-Gujju WPP but inclusive of other Wind Farms such as FWEL-I and FWEL-II in the Gharo cluster and FFC, Zorlu, TGF, Sapphire, Tapal, Sachal, Metro, Yunus and UEP in the Jhimpir Cluster and. We find that the fault levels at Thatta and FWEL-I Substation have increased due to direct interconnection with BWEPL-Gujju WPP, but on farther substations, the increase is insignificant. As a whole 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-Gujju 132 kV are 3.92 kA and 3.11 kA for 3-phase and single phase faults respectively. This is much less than the switchgear rating of 40 kA recommended for BWEPL-Gujju Farm Substation as per NTDC requirements for 132 kV.

The fault levels for BWEPL-Gujju 22 kV are 8.53 kA and 7.84 kA for 3-phase and single-phase faults respectively. Therefore the recommended short circuit rating for the 22 kV switchgear is 25 kA.

Comparing the minimum short circuit levels of the 132 kV substations of HESCO near the Wind Farms, we find that in terms of short circuit strength, the levels at Thatta and Jhimpir 132 kV get slightly better and the short circuit strength is improved. The short circuit strength is very important for Power Quality issues like flicker, harmonics and voltage unbalance. Exhibit 7.2.1 and 7.2.2 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 good on the basis of short circuit analysis as well.

8. Transient Stability Analysis

The objective of transient stability study is to see:

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

8.1 Assumptions & Methodology

8.1.1 Type-3 WTG Dynamic Model

BWEPL-Gujju is considering Dongfang DEC FD89 1.5 MW as the WTG to be installed in BWEPL-Gujju WPP. It is a Doubly Fed Induction Generator which is designated as Type-3 WTG. 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 Three Phase Faults, Normal Clearing Time of 5 Cycles & Trip of Circuits

The system disturbances have been simulated for this model as follows;

Three- phase fault applied at BWEPL-Gujju 132 kV bus bar, cleared in 5 cycles as normal clearing time i.e. 100 m seconds, followed by trip of 132 kV single circuit between BWEPL-Gujju-WPP and Thatta, which was significantly loaded in the pre-fault normal load flow case and its outage may cause severe impact.

Fig 8.1.1 indicates the bus voltages in pre and post fault conditions at 132 kV substations in the vicinity of BWEPL-Gujju WPP. We find that the voltages recover smoothly and quickly to their pre-disturbance values.

The system frequency indicated in Fig. 8.1.2 shows very nominal excursions of frequency that damps down very quickly and smoothly

The MW and MVAR output of equivalent WTG get back to normal quickly after the fault clearance as shown in Fig 8.1.3.

The dynamic response of generator is shown in Figs 8.1.4 showing the recovery of speed and mechanical power. We find that the WTG is robust enough to damp down transients in the generator speed and Pmech.

Fig 8.1.5 shows that the aerodynamic torque that dips down after fault is recovered by pitch angle control which responds quickly and restores the aerodynamic torque to normal with good damping of oscillations after fault clearance.

Fig. 8.1.6 shows no impact on shaft twist angle and quick damping of transients in aerodynamic power (Paero) on the rotor blade side.

Fig. 8.1.7 indicates no impact on turbine rotor speed and quick recovery of generator speed.

Fig 8.1.8 shows the generator rotor angle deviation that shifts from its pre-fault value to a new value very smoothly.

Fig. 8.1.9 shows the dynamic response of pitch control and pitch compensation that acts quickly to stabilize the WTG.

The outage of 132 kV single circuit between BWEPL-Gujju to Thatta causes the entire output of BWEPL-Gujju to shift to the intact circuit between BWEPL-Gujju to FWEL-I which is then combined with the power from FWEL-I and FWEL-II WPPs to cause significant loading on the FWEL-II to Thatta 132 kV Single Circuit.

Fig. 8.1.10 shows the transients of MW and MVAR flows on FWEL-II to Thatta 132 kV circuit which settles the transients quickly and acquire new steady state levels soon.

The response of the adjoining power plant of FWEL-II is shown in Fig 8.1.11, where the MW outputs of the generators recover to almost their pre-fault output levels.

The angular stability of other conventional generators of the system can be seen in Fig. 8.1.12. The relative rotor angles of Kotri 132 kV, Lakhra 132 kV, Nooriabad 132 kV, Thatta 132 kV and Jamshoro 220 kV are plotted w.r.t. Hub 500 kV. The results show that they remain in synchronism with the system generators and stay stable. The angular swings are also nominal and damp quickly.

8.2.2 Three Phase Faults, Clearing Time of 9 Cycles (Stuck Breaker): LVRT Test

The worst-case fault on system may be the failure of breaker (stuck-breaker) and fault clearing with backup protection in 9 cycles. It may also be termed as testing the ride through capability (LVRT) of Wind Power Plant for clearing time of 9 cycles i.e. 180 ms which is a criterion set out in the Grid Code to be fulfilled.

Three- phase fault applied at BWEPL-Gujju 132 kV bus bar, cleared in 9 cycles as normal clearing time i.e. 180 m seconds, followed by trip of 132 kV single circuit between BWEPL-Gujju-WPP and Thatta, which was significantly loaded in the pre-fault normal load flow case and its outage may cause severe impact.

Fig 8.2.1 indicates the bus voltages in pre and post fault conditions at 132 kV substations in the vicinity of BWEPL-Gujju WPP. We find that the voltages recover smoothly and quickly to their pre-disturbance values.

The system frequency indicated in Fig. 8.2.2 shows very nominal excursions of frequency that damps down very quickly and smoothly

The MW and MVAR output of equivalent WTG get back to normal quickly after the fault clearance as shown in Fig 8.2.3.

The dynamic response of generator is shown in Figs 8.2.4 showing the recovery of speed and mechanical power. We find that the WTG is robust enough to damp down transients in the generator speed and Pmech.

Fig 8.2.5 shows that the aerodynamic torque that dips down after fault is recovered by pitch angle control which responds quickly and restores the aerodynamic torque to normal with good damping of oscillations after fault clearance.

Fig. 8.2.6 shows no impact on shaft twist angle and quick damping of transients in aerodynamic power (Paero) on the rotor blade side.

Fig. 8.2.7 indicates no impact on turbine rotor speed and quick recovery of generator speed.

Fig 8.2.8 shows the generator rotor angle deviation that shifts from its pre-fault value to a new value very smoothly.

Fig. 8.2.9 shows the dynamic response of pitch control and pitch compensation that acts quickly to stabilize the WTG.

The outage of 132 kV single circuit between BWEPL-Gujju to Thatta causes the entire output of BWEPL-Gujju to shift to the intact circuit between BWEPL-Gujju to FWEL-I which is then combined with the power from FWEL-I and FWEL-II WPPs to cause significant loading on the FWEL-II to Thatta 132 kV Single Circuit.

Fig. 8.2.10 shows the transients of MW and MVAR flows on FWEL-II to Thatta 132 kV circuit which settles the transients quickly and acquire new steady state levels soon.

The response of the adjoining power plant of FWEL-II is shown in Fig 8.2.11, where the MW outputs of the generators recover to almost their pre-fault output levels.

The angular stability of other conventional generators of the system can be seen in Fig. 8.2.12. The relative rotor angles of Ketri 132 kV, Lakhra 132 kV, Nooriabad 132 kV, Thatta 132 kV and Jamshoro 220 kV are plotted w.r.t. Hub 500 kV. The results show that they remain in synchronism with the system generators and stay stable. The angular swings are also nominal and damp quickly.

8.3 Dynamic Impact of Wind Farm Disturbances

8.3.1 Sudden Loss of a group of WTGs

We have simulated the sudden loss of a group of WTGs, i.e. loss of one equivalent WTG of 6 MW representing a collector group. This happens due to 3-phase fault on the MV bus of BWEPL-Gujju Farm substation and cleared by tripping of a collector double circuit. The fault clearing at 22 kV is assumed as 10 cycles (200 ms). The following variables are monitored:

Fig 8.3.1 indicates the bus voltages in pre and post fault conditions at 132 kV substations in the vicinity of BWEPL-Gujju WPP. We find that the voltages recover smoothly and quickly to their pre-disturbance values.

The system frequency indicated in Fig. 8.3.2 shows very nominal excursions of frequency that damps down very quickly and smoothly

The MW and MVAR output of equivalent WTG get back to normal quickly after the fault clearance as shown in Fig 8.3.3.

The dynamic response of generator is shown in Figs 8.3.4 showing the recovery of speed and mechanical power. We find that the WTG is robust enough to damp down transients in the generator speed and Pmech.

Fig 8.3.5 shows that the aerodynamic torque that dips down after fault is recovered by pitch angle control which responds quickly and restores the aerodynamic torque to normal with good damping of oscillations after fault clearance.

Fig. 8.3.6 shows no impact on shaft twist angle and quick damping of transients in aerodynamic power (Paero) on the rotor blade side.

Fig. 8.3.7 indicates no impact on turbine rotor speed and quick recovery of generator speed.

Fig 8.3.8 shows the generator rotor angle deviation that shifts from its pre-fault value to a new value very smoothly.

Fig. 8.3.9 shows the dynamic response of pitch control and pitch compensation that acts quickly to stabilize the WTG.

The outage of one 132/22 kV transformer at BWEPL-Gujju WPP Substation causes the entire output of BWEPL-Gujju WPP to shift to the intact transformer at BWEPL-Gujju WPP Substation. Fig. 8.3.10 shows the transients of MW and MVAR flows on the 132/22 kV BWEPL-Gujju WPP transformer which settles the transients quickly and acquire new steady state levels soon.

The response of the adjoining power plant of FWEL-II is shown in Fig 8.3.11, where the MW outputs of the generators recover to almost their pre-fault output levels.

The angular stability of other conventional generators of the system can be seen in Fig. 8.3.12. The relative rotor angles of Kotri 132 kV, Lakhra 132 kV, Nooriabad 132 kV, Thatta 132 kV and Jamshoro 220 kV are plotted w.r.t. Hub 500 kV. The results show that they remain in synchronism with the system generators and stay stable. The angular swings are also nominal and damp quickly.

8.3.2 Sudden Loss of one of 132/22 kV Transformer in the Farm Substation

The sudden trip of 132/22 kV transformer in the BWEPL-Gujju Farm is caused with the clearing of 3-phase fault on MV bus of Farm substation.

Fig 8.4.1 indicates the bus voltages in pre and post fault conditions at 132 kV substations in the vicinity of BWEPL-Gujju WPP. We find that the voltages recover smoothly and quickly to their pre-disturbance values.

The system frequency indicated in Fig. 8.4.2 shows very nominal excursions of frequency that damps down very quickly and smoothly

The MW and MVAR output of equivalent WTG get back to normal quickly after the fault clearance as shown in Fig 8.4.3.

The dynamic response of generator is shown in Figs 8.4.4 showing the recovery of speed and mechanical power. We find that the WTG is robust enough to damp down transients in the generator speed and Pmech.

Fig 8.4.5 shows that the aerodynamic torque that dips down after fault is recovered by pitch angle control which responds quickly and restores the aerodynamic torque to normal with good damping of oscillations after fault clearance.

Fig. 8.4.6 shows no impact on shaft twist angle and quick damping of transients in aerodynamic power (Paero) on the rotor blade side.

Fig. 8.4.7 indicates no impact on turbine rotor speed and quick recovery of generator speed.

Fig 8.4.8 shows the generator rotor angle deviation that shifts from its pre-fault value to a new value very smoothly.

Fig. 8.4.9 shows the dynamic response of pitch control and pitch compensation that acts quickly to stabilize the WTG.

The outage of one 132/22 kV transformer at BWEPL-Gujju WPP Substation causes the entire output of BWEPL-Gujju WPP to shift to the intact transformer at BWEPL-Gujju WPP Substation. Fig. 8.4.10 shows the transients of MW and MVAR flows on the 132/22 kV BWEPL-Gujju WPP transformer which settles the transients quickly and acquire new steady state levels soon.

The response of the adjoining power plant of FWEL-II is shown in Fig 8.4.11, where the MW outputs of the generators recover to almost their pre-fault output levels.

The angular stability of other conventional generators of the system can be seen in Fig. 8.4.12. The relative rotor angles of Kotri 132 kV, Lakhra 132 kV, Nooriabad 132 kV, Thatta 132 kV and Jamshoro 220 kV are plotted w.r.t. Hub 500 kV. The results show that they remain in synchronism with the system generators and stay stable. The angular swings are also nominal and damp quickly.

8.4 Conclusion of Stability Study

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

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

9- Power Quality

The issues of power quality are of particular importance to wind turbines that may cause flicker and distortions in the power supply due to harmonics and unbalance. These issues are more significant for weak systems of low short circuit strength. Therefore we have investigated these issues for the case of minimum short circuit of 2014 for the proposed scheme of interconnection. The same case has been re-evaluated with per unit MVA values and plotted for 3-phase faults in Exhibits 7.2.1 and 7.2.2 in Appendix-7

9.1 Flicker

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

9.1.1 Continuous Operation

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

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

where

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

S_n is the rated apparent power of the wind turbine;

S_k is the short-circuit apparent power at the PCC

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

PCC is the point of common coupling of WTGs that is MV bus of BWEPL-Gujju Farm substation.

For minimum short circuit case we have assumed the same case as discussed in paragraph 7.2.1 of Chapter 7 in which output of BWEPL-Gujju Wind farm reduced as low as 33 % of its rated capacity. Therefore taking one collector group as one equivalent generator of 3 x 1.5 MW we have calculated as follows;

S_n= 1.58 MVA at 0.95 PF

N_{WT} = 3

S_k for MV bus = 610 MVA

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

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

where

S_n is the rated apparent power of the wind turbine;

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

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

Putting this data in the above Equation, we find

$$P_{St\Sigma} = P_{lt\Sigma} = 0.0114 = 1.14\ \%$$

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-Gujju Wind farm would not cause any flicker problem during steady state operation even in the weakest system conditions of minimum short circuit level.

9.1.2 Switching Operation

The most common switching operations would be as follows;

a. Wind turbine start-up at cut-in speed

b. Wind turbine start-up at rated wind speed

c. The worst case of switching between the WTGs

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

$$P_{st\Sigma} = \frac{18}{S_k} \left(\sum_{i=1}^{N_{wt}} N_{10i} \cdot (k_{f,i}(\psi_k) \cdot S_{n,i})^{3.2} \right)^{0.31}$$

$$P_{lt\Sigma} = \frac{8}{S_k} \left(\sum_{i=1}^{N_{wt}} N_{120i} \cdot (k_{f,i}(\psi_k) \cdot S_{n,i})^{3.2} \right)^{0.31}$$

where

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

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

For switching conditions of (a) and (b)

$$N_{10} = 10$$

$$N_{120} = 120$$

For switching conditions of (c)

$$N_{10} = 1$$

$$N_{120} = 12$$

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

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

$$P_{St\Sigma} = 0.303$$

$$P_{lt\Sigma} = 0.291$$

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

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

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

9.2 Voltage Unbalance

9.2.1 Voltage Step-Change

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

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

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

Where

S_{WKA} = MVA rating of the WTG

S_{KE} = Short circuit MVA at connection point

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

For the minimum short circuit case, we have calculated minimum fault levels in MVA as shown in Exhibit 7.2.2

S_{WKA} = 1.58 MVA for the equivalent WTG of a collector group for the minimum case

S_{KE} for one WTG in collector group = 220 MVA (Exhibit 7.2.2)

S_{KSS} = 240 MVA (Exhibit 7.2.2)

Substituting these values we get

$$\Delta V = 0.000598 = 0.0598\ \%$$

Which is much less than the limit of 3 %

9.2.2 Voltage Fluctuation

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

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

Where

P_{WKA} = MW rating of the WTG

S_{KE} = Short circuit MVA at connection point

Punching all the numbers in this equation, we get

Voltage Fluctuation = 0.0682 = 0.682 %

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

9.3 Harmonics

Regarding harmonics, IEC61400-21 states as follows [1]:

"A wind turbine with induction generator directly connected to the electrical system (i.e. without a power electronic converter) is not expected to cause any significant harmonic distortion. Hence this standard does not require any further assessment of these.

"For a wind turbine with a directly connected synchronous generator (without a power electronic converter)....the wind turbine will only give a very limited emission of harmonic currents, and hence this standard does not require any further assessment of these."

Therefore we have to look into the harmonic phenomena for a wind turbine with a power electronic converter. The important thing would be to see if the resonance of harmonics generated from the WTG occurs at or near odd-harmonic frequency or not. For this purpose we carried out frequency scan by employing a state of art software PSCAD / EMTDC. The system upto Kotri, Jamshoro-old and Thatta has been modeled in detail however the system behind these nodes has been represented by an equivalent voltage source. These equivalents have been developed from the Short Circuit cases of PSS/E discussed earlier in Chapter 7.

The frequency has been scanned through a spectrum of impedance values of this equivalent circuit at the node of BWEPL-Gujju-WPP 22 kV, which is the medium voltage bus of the Wind Farm substation. If harmonic resonance is controlled at this node then all the emissions of harmonics are well contained within the Farm itself. The switched shunt capacitor banks installed at MV bus bar for voltage regulation would play an important role in causing or avoiding harmonic resonance. So we have carried out the frequency scan with and without the switched shunt capacitor banks at MV bus of 22 kV for a range of 0 to 2000 Hz i.e. from fundamental frequency to 40th

harmonic. However, the results have been plotted in the figures for a frequency range up to 750 Hz i.e. upto 15th harmonic, because the frequencies beyond that value are of less importance, and once the resonant point occurs at some frequency up to that range, then it would normally not recur after that.

9.3.1 Without Switched Shunt Capacitor Banks

The frequency versus positive and zero sequence resistance and reactance i.e., R_+, R_0, X_+, X_0, are shown plotted in Figures 9.1.1, 9.1.2, 9.1.3 and 9.1.4.

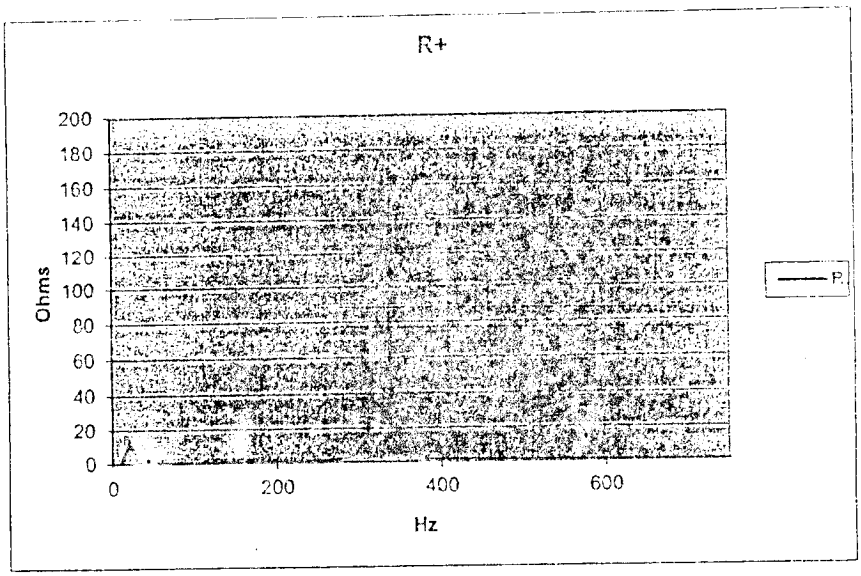

Fig 9.1.1

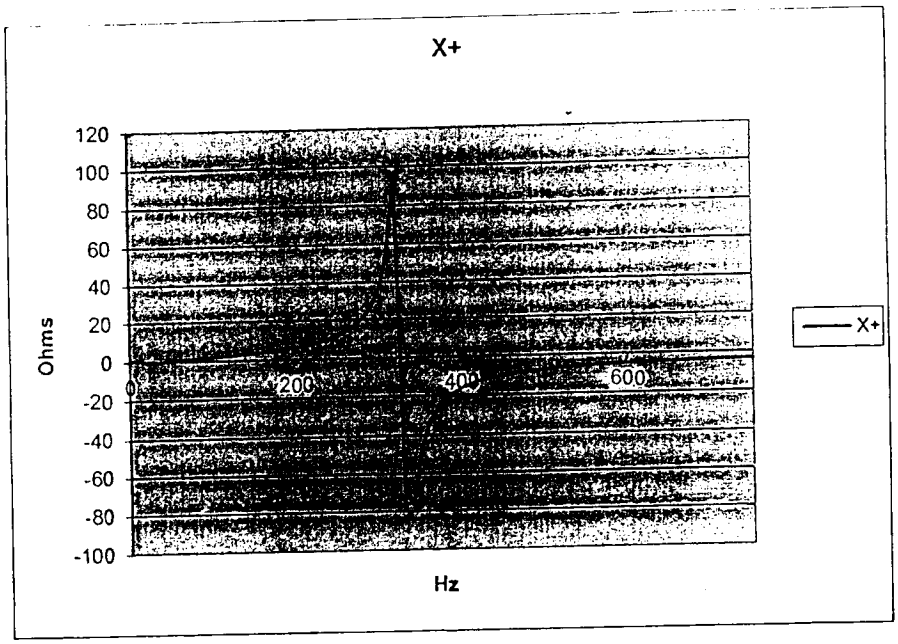

Fig 9.1.2

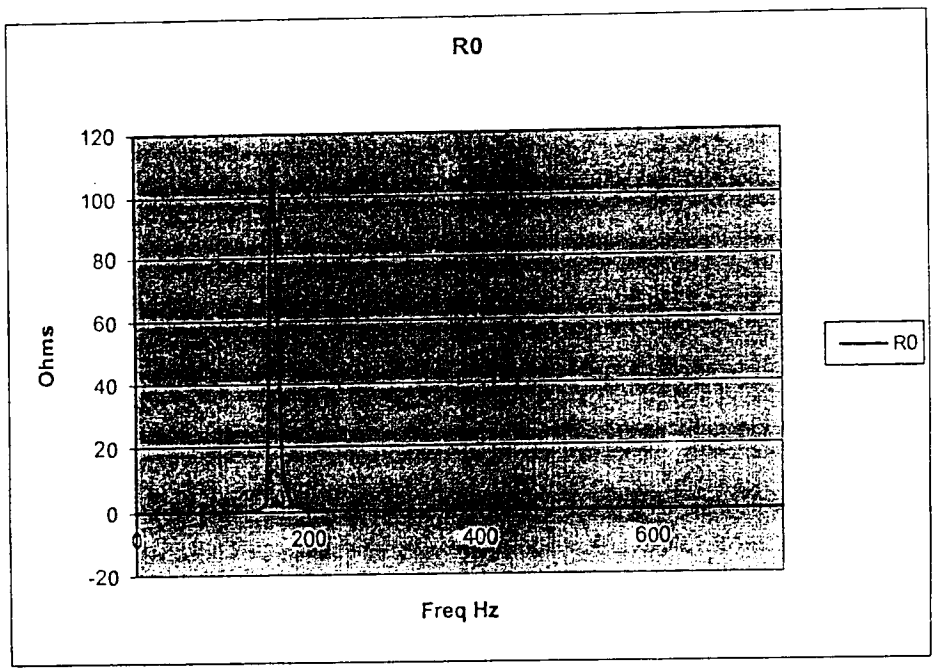

Fig 9.1.3

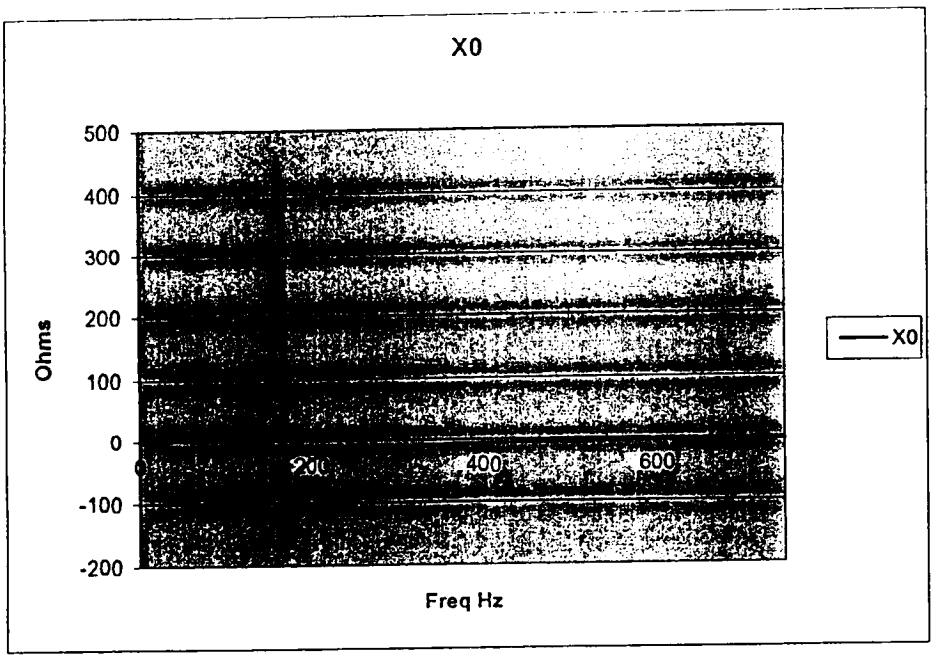

Fig 9.1.4

The curves of resistance $R_+ R_0$ show their highest value to occur at the resonance point whereas the reactance curves show the point of resonance where the curve crosses zero i.e. it changes sign from positive to negative and its value becomes zero. Resonance is a phenomenon when inductive reactance X_L and the capacitive reactance X_C becomes equal and cancels each other giving net reactance as zero. We find from the figures that the point of resonance for positive sequence occurs at 330 Hz, which is quite close to 7th harmonic i.e. 350 Hz; whereas for zero sequence the resonance occurs at 170 Hz which is close to 3rd harmonic i.e. 150 Hz. We see that both the 7th and the 3rd harmonic are odd harmonics and resonance at these points should be avoided.

9.3.2 With Switched Shunt Capacitor Banks

As we know that already we have proposed a switched shunt capacitor bank of 8 MVAR at MV bus of 22 kV for voltage regulation and reactive power compensation of the WTG consuming VARs. Therefore, we now see the impact of this capacitor bank on harmonic resonance. The PSCAD simulation has been run for frequency

scanning and the results are shown plotted in Figs 9.2.1, 9.2.2, 9.2.3 and 9.2.4 respectively for positive and zero sequence resistance and reactance.

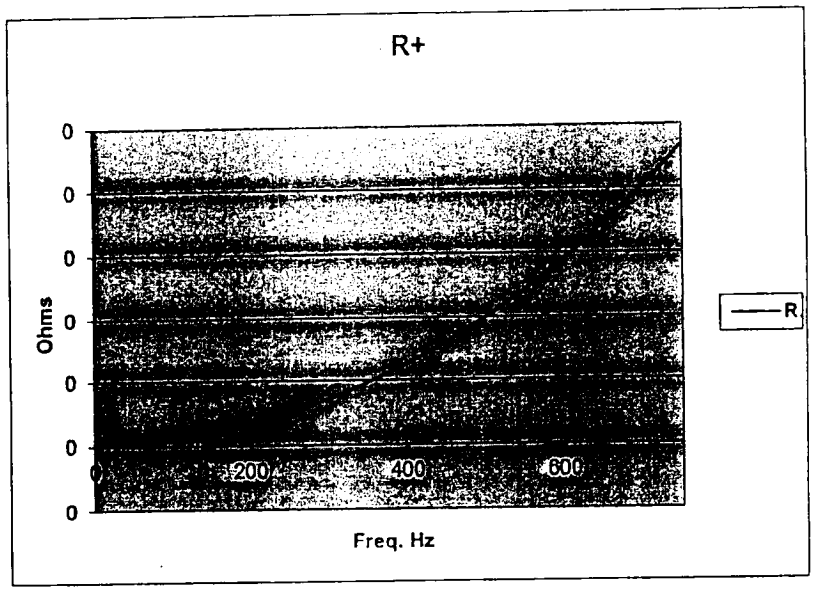

Fig 9.2.1

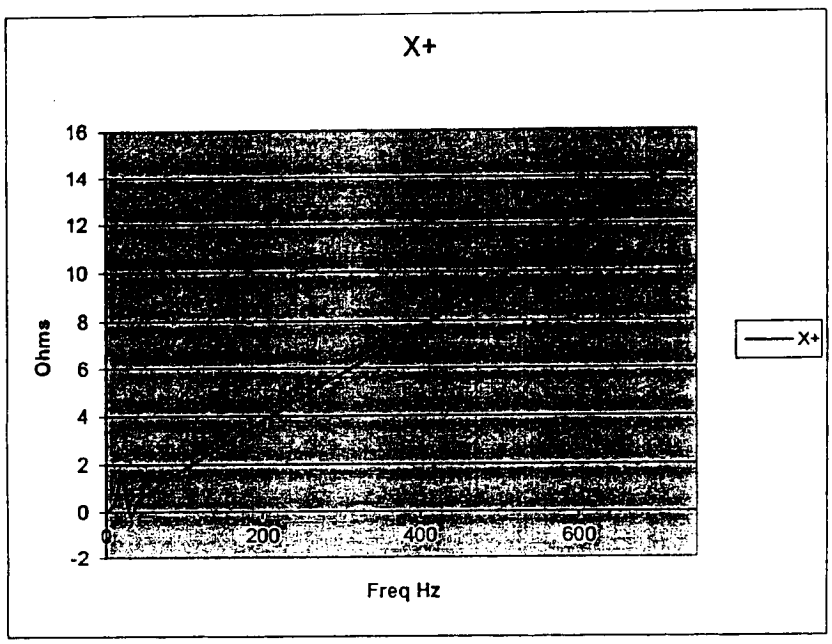

Fig 9.2.2

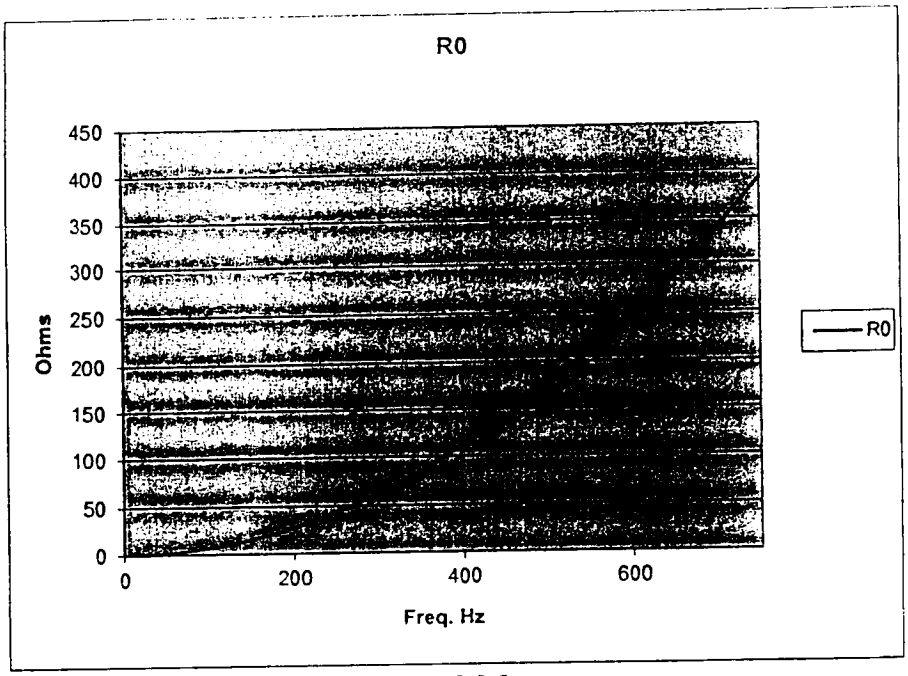

Fig 9.2.3

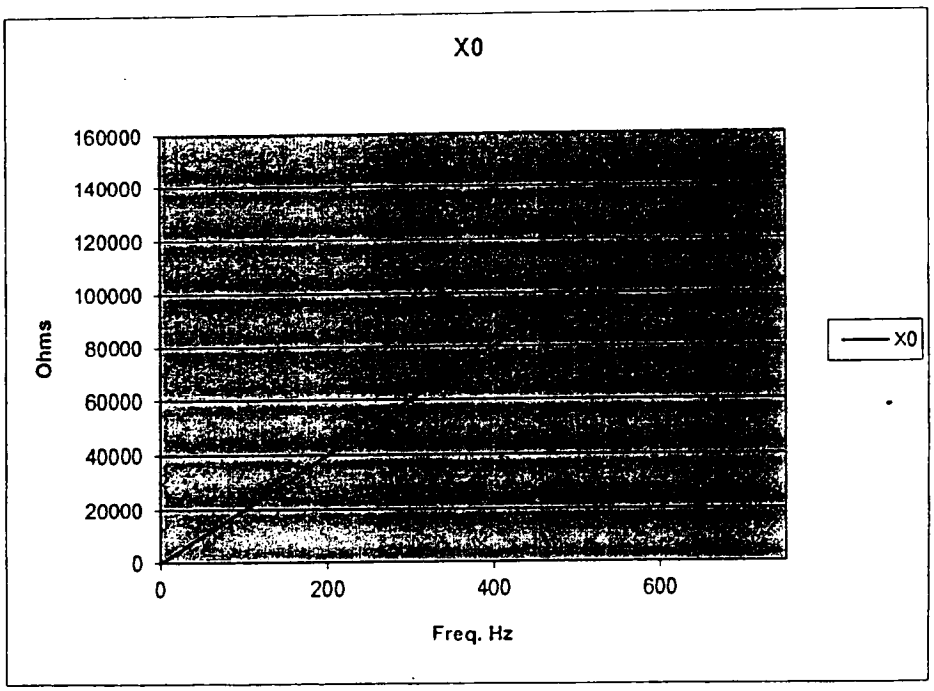

Fig 9.2.4

The results show that there is no zero crossing or change of signs of reactance or a maxima-minima of resistance showing no resonance i.e. the resonance point is detuned permanently not to occur at all. This role of capacitor banks to filter all the harmonics well within the farm field is an additional benefit of this capacitor bank.

References

1- *Wind Turbine Generator Systems*, IEC61400-21 First edition 2001-12; Part 21; Chapters 6, 7 and 8.

2- *Wind Energy Handbook*; John Wiley & Sons Ltd. 2001, Chapter 10.

10- Conclusions & Recommendations

1. BWEPL-Gujju Wind Energy Wind Power Plant would be connected looping in-out one circuit of the 132 kV Double Circuit from Thatta towards FWEL-I & FWEL-II at the farm substation of BWEPL-Gujju WPP. The distance of the looping point from the farm substation would be 4-5 km. The conductor used would be 132 kV Greeley conductor.
2. The scheme of interconnection of BWEPL-Gujju WPP presupposes the following reinforcement already in place in Jhimpir and Gharo clusters by 2015:
   - A 132 kV double circuit T/Line, 64 km long from FWEL-I & FWEL-II WPPs to the existing Thatta 132 kV substation as shown in Sketch-2 & 3.
   - Rehabilitation of the exiting 132 kV lines in the vicinity of WPP clusters, i.e. Jhimpir-Kotri, Jhimpir-Thatta, Thatta-Sujawal and Nooriabad-Jamshoro Old
   - Partial construction of collector station at 132 kV level at Jhimpir, a 132kV double circuit of 82 km using Greeley conductor would be constructed to connect this collector station with T.M. Khan in HESCO network. This collector substation at Jhimpir has been assumed to be completed in two stages, first at 132 kV and second to complete 220/132 kV at later stage.
   - Development of two sub-clusters of 132 kV. One sub-cluster will comprise FFC, Zorlu, TGF and Sapphire whereas the other would evacuate power from the WPPs in the sub-cluster connected to the newly developed Jhimpir-New 132 kV Substation.
   - An interim arrangement of diverting one of existing 220 kV Jamshoro-KDA-33 circuits to Nooriabad to operate at 132 kV as follows:
     - 132 kV S/C T/Line, approx. 4 km from Nooriabad to the nearby exiting 220 kV D/C Jamshoro – KDA T/Line.
     - One of the two 220 kV circuits of Jamshoro -KDA (D/C T/Line) to be energized at 132kV connected with Nooriabad on one end through the arrangement mentioned above and Jamshoro 132 kV bus on the other end.
3. The existing grid system of HESCO and NTDC in the vicinity of BWEPL-Gujju WPP has been studied in detail by performing load flow, short circuit and

dynamic analysis for the conditions prior to commissioning of Dewan WPP and no bottlenecks or constraints have been found in the grid system:

4. Wind Farm of BWEPL-Gujju has been modeled considering Dongfang DEC FD89 WTG with capacity of 1.5 MW. It is a Doubly Fed Induction Generator which is designated as Type-3 WTG. Its 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.
5. A conceptual design of scheme of 132/22 kV substation of BWEPL-Gujju Wind Farm has been laid down as follows

   iv. For 22 kV;

      a. Two single bus-sections of 22 kV with a bus sectionalizer
      b. Two breaker bays to connect two collector circuits from two collector groups of WTGs
      c. Two breaker bays to connect two 132/22 kV transformers
      d. Two breaker bays to connect two switched shunt capacitor banks of 2 x (2x2) MVAR, one in each bus section
      e. One breaker bay to connect station auxiliary transformer 22/0.4 kV, 300 kVA

   v. For 132 kV;

      e. Double Bus with Coupler as Farm substation is GIS
      f. Two breaker bays to connect two 132/22 kV transformers
      g. The protection scheme would be designed in compliance of NTDC requirements sent by Chief Engineer Protection, vide letter No.3416-19/CE/SP/MN/50MW CWE WPP Jhimpir dated 23/07/2010
      h. The telecommunication scheme would be designed in compliance of NTDC requirements sent by Chief Engineer Telecommunication, vide letter No. CE (Tel)/NTDC/232/4372 dated 27/08/2010.

   vi. Other Equipment:

a. Two 132/22 kV, 13.5 MVA OLTC transformers, 140±8×1.25%/22 kV, to fulfill N-1 criteria of Grid Code

b. One station auxiliary transformer of 22/0.4 kV, 300 kVA

c. Two switched shunt capacitor banks each of the size of 4 MVAR (2 x 2 MVAR) to provide 8 MVAR at 22 kV with contactors and PLC (Programmable Logic Controller).

d. Energy meters would be installed on HV side (132 kV) of the 132/22 kV transformers.

6. Load flow analysis has been carried out for June 2015 considering the Mid 2015 COD targeted by BWEPL-Gujju as September falls in the upcoming high wind season and thus will allow us the judge the maximum impact of the plant on the grid, for the dispersal of load from BWEPL-Gujju WPP into HESCO Grid at 132 kV level using the latest load forecast, generation and transmission expansion plans of NTDC and HESCO. The above mentioned interconnection scheme (item-1) 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. The grid facilities of HESCO are found adequate to absorb output power of BWEPL-Gujju WPP.

7. Maximum and minimum short circuit levels for three-phase faults and single-phase faults have been evaluated for the year 2015, and it has been found that the proposed scheme provides maximum SC strength for the evacuation of BWEPL-Gujju WPP power to the grid.

The switchgear ratings for BWEPL-Gujju 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

8. Transient Stability analysis has been carried out for BWEPL-Gujju 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-Gujju WTG unit's dynamic characteristics and the grid connectivity is strong enough to maintain stability under all disturbances. In turn, any disturbance from BWEPL-Gujju WPP side did not cause any stress on the main grid or the power plants in HESCO area viz. Kotri, Lakhra or Jamshoro such that the whole system remained stable under all events.
9. 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.
10. 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.
11. There are no technical constraints whatsoever in the way of bringing in the 13.5 MW of Gujju 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.

BURJ Capital

BURJ WIND ENERGY (PRIVATE) LIMITED
(A Project of Burj Capital)

PROJECT FEASIBILITY STUDY

(Volume I)

14MW WIND POWER PROJECT

at

GUJJU, SINDH, PAKISTAN

BURJ Power

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TABLE OF CONTENTS – VOLUME II

GLOSSARY

ADB	Asian Development Bank
AEDB	Alternative Energy Development Board
AEP	Annual Energy Production
BC	Burj Capital
BOO	Build-own-operate
BP	Burj Power
BW	Burj Wind Energy (Private) Limited
CAA	Civil Aviation Authority of Pakistan
CEO	Chief Executive Officer
CMS	Condition Monitoring System
COD	Commercial Operation Date
ECO	Economic Cooperation Organization
EOD	Economic Order of Dispatch
EPA	Energy Purchase Agreement
EPC	Engineering Procurement Construction
ESS	Electrically Simplified System
EWS	Extreme Wind Speed
GOP	Government of Pakistan
GoS	Government of Sindh
GPS	Global Positioning System
GUI	Graphical user interface
IA	Implementation Agreement
IDC	Interest During Construction
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IPPs	Independent Power Producers
KIBOR	Karachi Inter Bank Offer Rate
Km	Kilometer
LOI	Letter of Interest
LOS	Letter of Support
m/s	Meter per second
MCP	Measure-Correlate-Predict
MV	medium voltage
NEPRA	National Electric Power Regulatory Authority
NEQS	National Environment Quality Standards
NEQs	National Environmental Quality Standards
NEQSAA	National Environmental Quality Standards for Ambient Air
NEQSDW	National Environmental Quality Standards for Drinking Water Quality
NEQSN	National Environmental Quality Standards for Noise
NOC	No Objection Certificate
NPCC	National Power Control Center

NTDC	National Transmission and Dispatch Company Limited
O&M	Operations and Maintenance
ODBC	Open Data Base Connectivity
OPEC	Organization of the Petroleum Exporting Countries
OPIC	Overseas Private Investment Corporation
PEPA	Pakistan Environmental Protection Act
PPI	Power Planners International
PSLF	Power System Load Flow
PSS/ E	Power System Simulation for Engineering
RE Policy	Policy for Development of Renewable Energy for Power Generation 2006
RfP	Request for Proposal
ROE	Return on equity
RPM	Revolutions per minute
SBP	State Bank of Pakistan
SCADA	Supervisory Control and Data Acquisition System
SCR	Short circuit ratio
SECP	Securities and Exchange Commission of Pakistan
SIDS	Sindh Infrastructure Development Surcharge
SPV	Special Purpose Vehicle
US CPI	United States Consumer Price Index
US D /$	United States Dollar
WPI	Wholesale Price Index
WTG	Wind Turbine Generator

SECTION-1

EXECUTIVE SUMMARY

Although Pakistan's economy has been growing at a modest rate of about 3 percent for the last four years, the demand for energy both at production and consumer end is increasing rapidly. The country has been facing an unprecedented energy crisis since the last several years. Pakistan meets almost 65% of its power needs by thermal means, which is fueled mainly by heavy fuel oil. Realizing the cost and environmental fallout of thermal power, the Government of Pakistan ("GoP") is taking all possible measures to diversify its energy mix on a fast track basis to ensure energy affordability and security in the long run. In this regard the government is focusing on the fast track development of renewable energy resources in the country.

The Alternative Energy Development Board ("AEDB") was established to promote and facilitate renewable energy development in Pakistan. The GoP has set a target of at least 5% of the total national power generation capacity (i.e. renewable capacity of 20,000 MW) to be generated through renewable energy technologies, especially through wind energy by the year 2030. Pakistan has good wind resources. The Gharo Jhimpir - Keti Bander Wind Corridor, spreading approximately 60 Km along the coastline of Sindh Province and more than 170 Km deep into the hinterland alone has a potential to generate over 60,000 MW of electricity.

Burj Wind Energy (Private) Limited (the "**Project Company**") is a Pakistan based company with the sole objective of developing, financing , building and operating a 14 MW wind power project in Pakistan. The Project is being pursued under the terms of a Letter of Intent ("**LOI**") issued by the Alternative Energy Development Board ("**AEDB**") to Project Company and is being developed under the build-own-operate ("**BOO**") scheme, with non- recourse financing.

Burj Capital will contribute 100% of the required equity. Sponsors of the Company will provide equity commitments towards the development cost and other fees payable at the Financial Closing.

An area covering approximately 250 acres for establishing 13.5 MW wind farm in Gujju, Thatta, Sindh, Pakistan is arranged by the Project Company on lease from the Private Owners. The site was selected after going through various technical studies of terrain and assessment of wind. Topographically the area is flat, stony, and barren; majority of the terrain is 55-145m above the sea level.

Geo-technical study has been carried out on the Project Site. Soil conditions are also favorable for road construction and for installing underground facilities such as wind turbine foundations, fiber-optic communication lines, and electrical conductors. The bearing capacity is high and stable. Foundation system will be designed to prevent excessive settlement or shear failure of soil due to structural loads. Therefore, turbine foundations will be placed on pile foundations after considering ground conditions and the size of structure. A comprehensive geotechnical study will be conducted under the supervision of EPC Contractor.

Project Company circulated a Request for Proposal ("**RfP**") to various equipment suppliers and EPC Contractors for wind power plants soliciting EPC proposals. In response, only the following two companies showed serious interest and submitted their proposals.

1. Dongfang Electric International Corporation, China; and
2. HydroChina Huadong Engineering Corporation with GoldWind as wind turbine supplier.

Dongfang offered the latest model of FD89-1500 kW that is more reliable and has an international footprint whereas HydroChina offered GW77 model WTGs' of 1.5MW. Project Company engaged Lahmeyer International for thorough evaluation of EPC proposals besides reviewing proposals internally and selected Dongfang because of better output and performance.

Project Company has signed the EPC Contract with Dongfang, China. The Project is comprised of installation of up to nine (09) wind turbine generators. The Project will be constructed under the terms of a fixed price, turnkey contract and construction will be completed in a continuous period of 12 months.
Assessment of the wind resource is a complex process involving several stages of data collection, modeling and statistical analysis. Project Company has engaged Lahmeyer International to carry out wind resource assessment and estimation of Annual Energy Production ("AEP") for the Project. Project Company has installed its own wind mast with a height of 80 meters. Wind data for the period from December 05, 2012 to December 04, 2013 from Project Company's 80m met mast was evaluated to determine the wind resources at the Project Site.

The wind flow in this natural wind corridor is unidirectional for most of the year, blowing from the sea towards the land. This phenomenon is due to the natural geographical setting of the region, with sea in the south and desert area in the northern part of the province. Wind is abundant in the summer months with peak winds during May to July and lower winds in the winter months from November to January. Assessment of wind data clearly indicates that the Gujju site is located within the vicinity of one of the best wind corridors in the country i.e. Gharo ~ Kati Bander Wind Corridor.

In order to assess the impact of the Project and the National Grid on each other, a detailed grid interconnection study has been carried out. It was concluded that there are no technical constraints whatsoever in the way of bringing in the Project at the proposed Site and at the scheduled time of commissioning, in respect of steady state (load flow) or short circuit or dynamic performance (stability) or power quality issues related to this plant. The power from the Project will be delivered to the grid at an approved interconnection point.

As per the requirements of Section 12 of Pakistan Environmental Protection Act (PEPA), 1997, Project Company has completed the Initial Environmental Examination ("**IEE**") report for the Project. The proposed Project is not likely to have any significant adverse environmental impacts, which could be irreversible or could affect sensitive eco-system, requires involuntary resettlement, or has an unprecedented impact. The Project has no gaseous and other emissions. Sewerage will be treated and reused at the Project Site for sprinkling on the unpaved site to reduce fugitive dust. The Project is also not located in the vicinity of sensitive location of national importance. Therefore, Project falls under Category "B" according to "Pakistan Environmental Protection Agency, Review of IEE & EIA Regulations 1997/2000 (revised)". Project has submitted IEE to Sindh Environmental Protection Agency and will get No Objection Certificate ("NOC") in due course.

Project Company always regards corporate social responsibility as an important force in building a harmonious society. It also believes in paying full attention to human factors, exercising environmental protections and conservation, increasing employment, and helping build the community. Every year it supports numerous educational, sporting, and charity programs designed to help a wide range of people. Operations of the Plant will also provide job opportunities especially to the local people. Poverty alleviation, though at minor scale, will be another benefit besides meeting power shortage in Pakistan.

The contractual framework of the Project follows a structure similar to that of Independent Power Producers ("IPP"s) being setup under previous power policies in Pakistan.

The AEDB will sign an Implementation Agreement ("IA") on behalf of GoP with the Project Company. The IA grants the right to the Project Company to implement the Project, extends certain concessions and defines each party's responsibility during the construction and operational phases of the Project. Availability of foreign currency is guaranteed by GoP and the Company is also adequately protected from changes in law.

GoP is also providing a Sovereign Guarantee to the Project which covers the performance and payment obligations of the Power Purchaser and Ministry of Finance under the project agreements.

The Company will enter into a long term Energy Purchase Agreement ("EPA") with National Transmission and Dispatch Company Limited ("NTDC") under which NTDC undertakes to purchase the capacity output of the Company for a continuous period of 20 years.

Total Capital Cost of the Project is estimated to be approximately USD 40,529,423 inclusive of IDC. The Project cost will be financed by a combination of Loan and equity. The capital structure of the Company is envisaged at a Loan~Equity ratio of 75:25 thus resulting in USD 30,397,068 and USD 10,132,423 as Loan and equity respectively.

Sources of Funds are as follows;

Sources of Funds	% of Project Cost	USD
Loan	75%	30,397,068
Equity	25%	10,132,356
Total Project Cost with IDC	**100%**	40,529,423

Entire loan will come from local banks in Pak Rupees. The Project will utilize a mix of available financing options.

Project Company has decided to avail the loan facility for renewable projects of SBP. Loan under SBP Facility is hereby referred as **Loan-I, SBP Facility**. Under the terms and conditions of SBP Facility, this financing is only available for the purchase of new imported and locally manufactured plant, machinery and equipment. As project cost not only comprises of imported and locally manufactured plant, machinery and equipment but also includes civil work, land and site preparation costs, duties and taxes, insurance costs and Interest cost and related financing charges during construction, etc. therefore, in addition to the SBP Facility, Project Company is also arranging a certain portion of loan from the Commercial Banks. Loan under Commercial Banks facility is hereby referred as **Loan-II, Commercial Banks** and is being arranged to cover the gap as mentioned above.

The breakdown of loan is given below;

Description	USD	Pak Rupee
Loan-I, SBP Facility	23,500,000	2,293,600,000
Loan-II, Commercial Banks	6,897,068	673,153,794
	30,397,068	2,966,753,794

GoP is offering a number of fiscal incentives under the policy framework. These fiscal incentives include exempting private power companies from corporate income tax, relief from import duties on plant and equipment, and guaranteed repatriation of equity and dividends derived from the power plant. There is no restriction on repatriation of equity and dividends. Withholding tax on dividend is 7.5% payable at the time of payment of dividend. Profit of the Project Company is exempt from corporate tax. Thus the key market risks are minimal as an off-take price is guaranteed by the GoP through a regulated tariff structure while other project risks including financial risk, performance risk, regulatory risk and political risk are adequately covered through insurance, performance bonds, financial and operation contracts.

Feasibility Study is based on estimated tariff, which will be filed with the NEPRA for approval in due course. Levelized Tariff of Rs. 15.7711 per kWh (US Cents 16.1589 per kWh) is calculated on the bases of certain assumptions. Return on Equity of 17% p.a. is assumed in the calculation of tariff.

Sponsors are targeting Financial Close of the Project by March 31, 2015. It is expected that total construction period for the wind farm will be approximately 15 months and tentative Commercial Operations Date ("**COD**") is July 31, 2016.

* * *

SECTION-2

KEY PROJECT STRENGTHS

The key strengths of the Project are proposed below:

a) Executed EPC and O&M Contracts with a global leader in wind technology
Project Company has been able to execute its EPC Contract with Dongfang Electric International Corporation, China. Project Company is negotiating O&M Contract with Dongfang. The Project Company had undergone discussions with the leading wind turbine manufacturers of the world including Nordex, General Electric, HydroChina Huadong Engineering Corporation with GoldWind as wind turbine supplier. Based on the technical evaluation of the proposals, Project Company selected Dongfang Electric International Corporation as the EPC Contractor and O&M Operator.

b) Definitive contracts
i. Lump sum, fixed price and date certain.
ii. Full scope of work covering both EPC and O&M phases.
iii. Sufficient contractor security/performance warranties to ensure completion and performance.

c) Improved Technology
i. FD89-1500 kW being the latest technology on offer based on successful predecessor versions that have already been running around the world and featuring important improvements;
ii. Better energy production.

d) Strong Project Management Team
The Project is being managed by a team of professionals, who derive experience of commissioning various projects worldwide.

BWE has employed a team of leading and most reputable foreign and local names to act as the consultants to-the Project Company for the development of the Project. The team of consultants brings with it knowledge of the global wind energy market and practices, experience of transaction structuring, strong grasp of concessionary framework in Pakistan and transaction execution capability. Brief profiles of the same are provided below:

RIAA Law - Project's Legal Counsel
The firm, RIAA Law was established in 1989. The-firm is among the largest and most reputed law firms in Pakistan. While offering its clients the whole gamut of legal services, the firm has particular expertise in areas of project finance, mergers and acquisitions, privatizations, power projects, oil and gas projects, infrastructure projects, banking and finance, intellectual property, international trade, anti-dumping, telecommunication, construction, mining and pharmaceutical sectors. The firm is recognized as the leading Project Finance law firm of Pakistan. Its partners have been involved for more than 20 years in more than 90% of all project finance transactions undertaken in the private sector.

Lahmeyer International GmbH - Project's Technical Consultant
Lahmeyer International is the project's owner's engineer. As an independent company of consulting engineers, Lahmeyer offers a wide range of planning and consultancy services. Positioned as an international market leader in the engineering consulting business, the Lahmeyer Group employs more than 1,500 people from over 30 specialist fields worldwide. Lahmeyer has executed projects

in 165 countries all around the globe. Lahmeyer has long-standing worldwide experience in the fields of power generation and energy supply and is a competent partner for the realization of wind energy plants with a decade of experience on projects all over the globe.

Burj Capital Pakistan Private Limited – Lead Arranger

Burj Capital offers its services on a regional basis by a team of investment banking professionals with an unrivaled depth of experience in conventional and Islamic banking, having led transactions for clients in the growing economies around the world, the Middle East to the Sub Continent and Asia to Africa. Its investment banking professionals have in-country, hands on investment, operating and transaction execution experience throughout Europe, Eastern Europe, Africa, the Far East Asia, and the Middle East.

Burj Power - Lead Project Developer

The Project is being developed by Burj Power. Burj Power ("BP") is a power project advisory and management company, headquartered in Dubai, UAE with an objective to develop, build, and operate power projects in the Africa and Asia region. It was organized by a strong team of industry veterans with a successful track record of developing, operating and managing large power assets globally, including Pakistan, both as a part of the global power company, The AES Corporation as well as on their own. The team has a proven track record of developing sustainable and profitable projects both in AES and outside.

Project Company has engaged a team of professionals to assist in developing the project. A brief description of the team is given below;

Organization	Role
Burj Wind Energy (Private) Limited	Project Company
Burj Capital	Sponsors
Burj Power	Lead Project Developer
Dongfang Electric International Corporation	EPC Contractor
Dongfang Electric International Corporation	O&M Operator
Lahmeyer International GmbH	Owner's Engineer
Lahmeyer International GmbH	Wind Consultant
Soil Testing Services	Geo Technical Studies
ECTECH Environment Consultants (Dr. Hanif)	Environmental Studies
Power Planners International	Grid Study
Jehangir Services (Private) Limited	Route Access Report
Al-Husnain Enterprises	Topographical survey
RIAA Law Islamabad	Legal Counsel

SECTION-3

SPONSORS PROFILE

Burj Capital is an international investment firm focused on developing and managing renewable power generation and retailing. Burj Capital aims to create a lasting value for its investors and partners by identifying opportunities where it can either build or unlock value by utilizing its team of industry and business experts who have a proven track record of investing across a variety of sectors and combining them with access to capital. The firm's world class and multi-disciplined professionals have a successful track record of identifying high quality assets and advancing them from development to operations.

Burj Capital's business objective is to achieve long term capital appreciation for its shareholders by developing Greenfield initiatives or investing in companies requiring expansion or growth capital. The company's target markets are Pakistan, the Middle East and Africa. Burj Capital is also evaluating select opportunities of acquiring and developing renewable energy generation companies and projects in Europe.

Headquartered in Dubai, United Arab Emirates, Burj Capital maintains presence in Singapore Karachi and Islamabad through its own and its representatives' offices.

Business Verticals

- Renewable Power: Burj Capital is developing the following projects:

  Projects under advanced stage of development:

  Pakistan:
  50 MW Jhimpir wind power project, in Jhimpir, Sindh
  15 MW Gujju wind power Project, Gujju, Sindh
  15 MW Gharo wind power project Gharo, Sindh

  Projects pipeline:

  Pakistan:
  200 MW wind power project in Sindh
  11 MW waste to power generation project in Karachi

  UAE:
  4 MW landfill waste gas to power project in Ras Al Khaimah UAE

  Kenya:
  2 x 40 MW wind power projects in Meru and Lambwe Valley
  20 MW solar power project in Meru

  West Africa:
  5 x 20 MW solar power projects in UEMOA countries in West Africa

  Europe:
  100 MW wind

- Oil & Gas: Burj Capital owns Gray Mackenzie Oilfield Services ("GMOS"), a UK based oil & gas services company with a 13-year track record in the Middle East. GMOS provides E&P companies end-to-end services including procurement, human resources, turnkey project development, and operations management. GMOS is currently underway expanding its operations to Pakistan.

- Retailing: Burj Capital holds franchise for Nine West in Pakistan. It operates three flagship stores in Karachi, Lahore and Islamabad. Nine West is a leading international brand for ladies footwear, handbags and other fashion accessories. Two additional stores are now being planned for Karachi and Lahore along with franchise opportunities under review for other main cities of Pakistan. Burj Capital is also planning diversification into fast food, men's fashion, and supermarkets.

- Investment Banking: Operating under the brand name "Burj Capital", it is offering its services on a regional basis by a team of investment banking professionals with an unrivalled depth of experience in conventional and Islamic banking, having led transactions for clients in Middle East, Pakistan and Africa. Its investment banking professionals have in-country, hands on global investment, operating and transaction execution experience. By combining corporate advisory with access to a diverse capital base, regional knowledge and proven execution, the investment banking vertical is strategically positioned to address the diverse needs of conventional and Islamic clients in the target region. Firm's investment banking platforms include Burj Capital Pakistan, Burj Partners, UAE and joint ventures in Zambia and Ghana. Deal execution is carried out from Karachi and Dubai.

- Waste Management: In 2013, Burj Capital partnered with a leading waste management company in the Middle East, Ceres Associates Gulf ("Ceres"). Ceres, with offices in the UAE, KSA and Pakistan, has been responsible for design, development, construction and operation of entire waste management systems across seven major cities in the Middle East which include cities of Medina, Jeddah, Ras Al Khaimah and Umm Al Quwain. Total value of waste management facilities delivered by Ceres is over AED 200 million and it handles more than 13,000 tons of solid municipal waste daily. Ceres is currently constructing a state-of-the-art zero waste system for Qaseem municipality in Saudi Arabia. Burj Capital is expanding Ceres' operations in the UAE, Pakistan and Oman.

SECTION-4

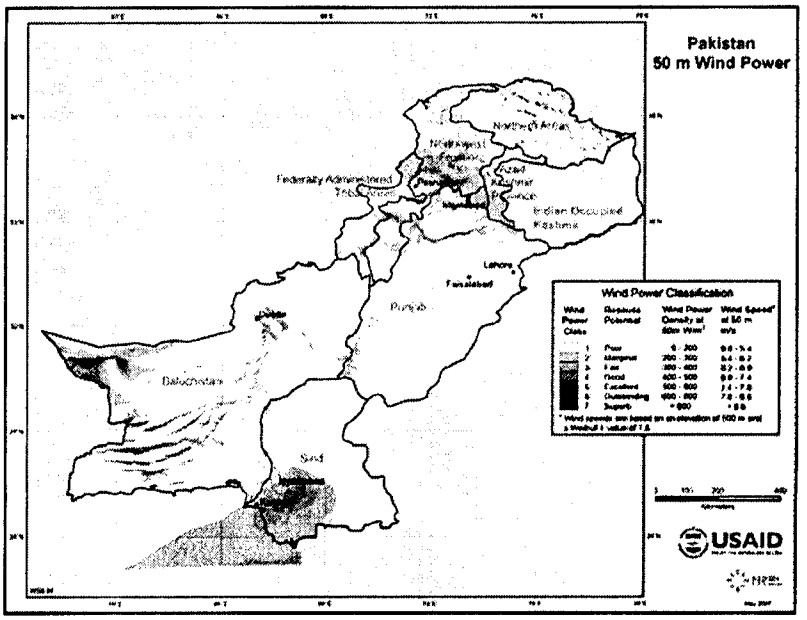
PROJECT SITE

4.1 Introduction

Project is located in Gharo-Jhimpir Keti Bander wind corridor; a wind corridor identified and approved by AEDB as one of the areas with high wind speeds. An area covering approximately 250 acres for establishing 13.5 MW wind farm in Gujju, Thatta, Sindh, Pakistan is arranged by the Project Company on lease from the Private Owners.

Pakistan has a considerable potential of wind energy in the coastal belt of Sindh, Balochistan and in the desert areas of Punjab and Sindh. This renewable source of energy has however, not been utilized significantly in the country. Wind data of Pakistan has been collected by the Pakistan Metrological Department and has been analyzed by AEDB. Over a dozen wind masts have also been installed in various different locations by private companies pursuing wind power projects in the area. As per the collected data, the coastal belt of Pakistan has a wind corridor that is 60 km wide (Gharo ~ Kati Bandar) and 180 km long (up to Hyderabad). This corridor has the exploitable potential of 50,000 MW of electricity generation through wind energy.

The map of Pakistan shown below, developed by USAID, shows the country's wind power corridors along with their classification according to the wind speed.



USAID Wind Map

4.2 The Land

Gujju is situated about 80 km away on National Highway from Karachi (Pakistan's biggest metropolitan city) to Hyderabad and is a small town of approximately 30,000 inhabitants in Thatta District, Sindh, Pakistan. Gujju wind corridor falls within the Gharo-Keti Bandar wind corridor, which is amongst the best wind corridors of the country.

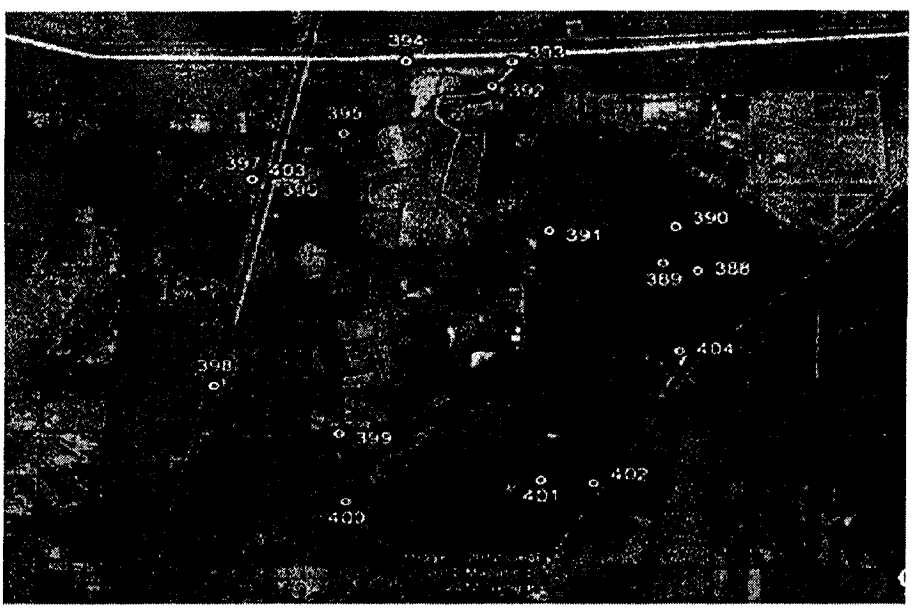
The Project Company has the possession of the land and installed its own wind data collection mast in October 2012.

4.3 Land Coordinates

The Project Site coordinates are given below;

S. No.	Longitude	Latitude
A	67°49'03.54"East	24°44'05.43"North
B	67°48'59.84"East	24°44'06.34"North
C	67°49'01.17"East	24°44'10.74"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
H	67°48'25.81"East	24°44'22.08"North
I	67°48'21.20"East	24°44'17.21"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°44'16.54"North
Q	67°49'01.65"East	24°43'55.70"North

Technical layout of the Project is shown below;



Source: WindRose Consultancy

4.4 Land Surroundings

The Site is situated at a distance of 3 km from the population of local villages, decreasing any chances of potential threat to local dwellers. There are no nesting habitats for any large or significant avian populations located in the project area of influence.

Topographically the area is flat with sporadic vegetation like wild grass etc. The land is generally flat; majority of the terrain is 55-145m above sea level. Terrain conditions can be classified as regular in general. There is a seasonal rain drain in the area, which is discharged during monsoon season. The ground and soil conditions are stable for turbine foundations and crane pads.

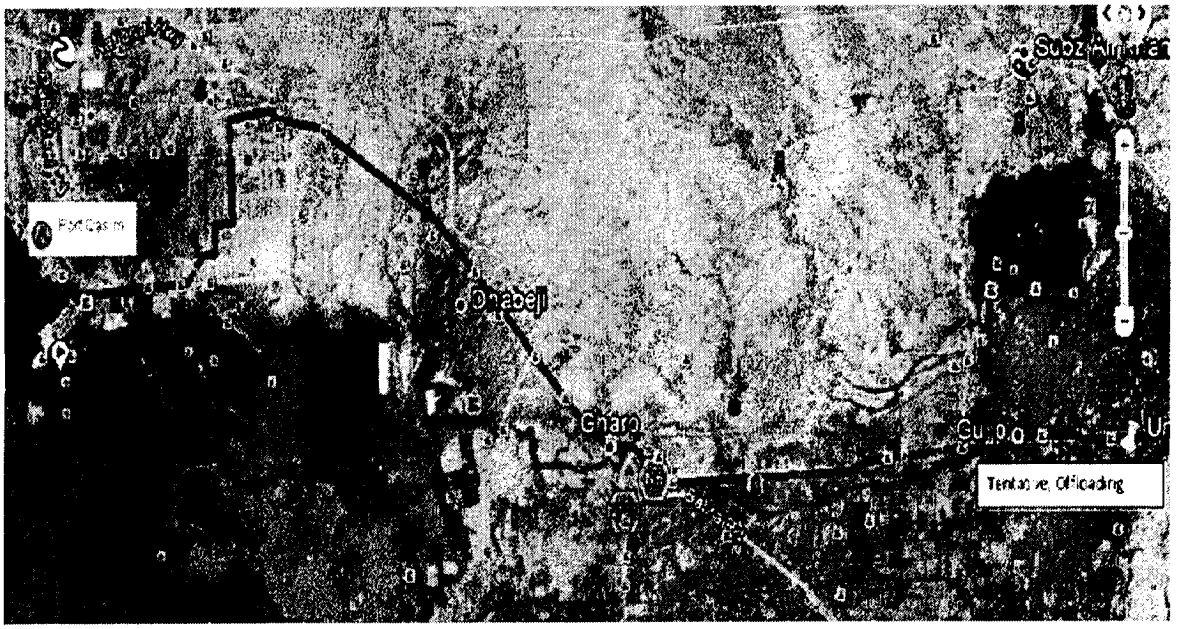
Due to its close location to Arabian Sea, the area is hot and humid with very low precipitation. This has made the area barren. Since basic amenities were not available in the area hence most of the local population residing in the area migrated to nearby villages which are more than 03 km from the Project Site.

4.5 Logistic

The delivery of equipment and construction of wind project also requires that the terrain be accessible by heavy-duty vehicles (e.g., tractor trailers, cement trucks) and cranes. As there are no steep slopes or deep gullies therefore it will not be difficult to assess and mitigate unacceptable safety risks.

Components of the wind turbine will require transportation to the Site from the delivery point i.e. Port Qasim via National Highway. Project Site is approximately 73~75 km from the Port Qasim, Karachi. The Project Site is located in a small town not more than about 12km from Thatta and is connected to Karachi through N5 via Karachi-Hyderabad SuperHighway-Motorway (M-9). The access route to the Project Site has been reviewed for the delivery of blades, tower, and other components. Route access report is completed by M/s Jehangir Services (Private) Limited.

The route was surveyed from Port Qasim, Karachi to the Project Site, Gujju, Thatta along the road to the site entrance. The route on the Google map is shown below;

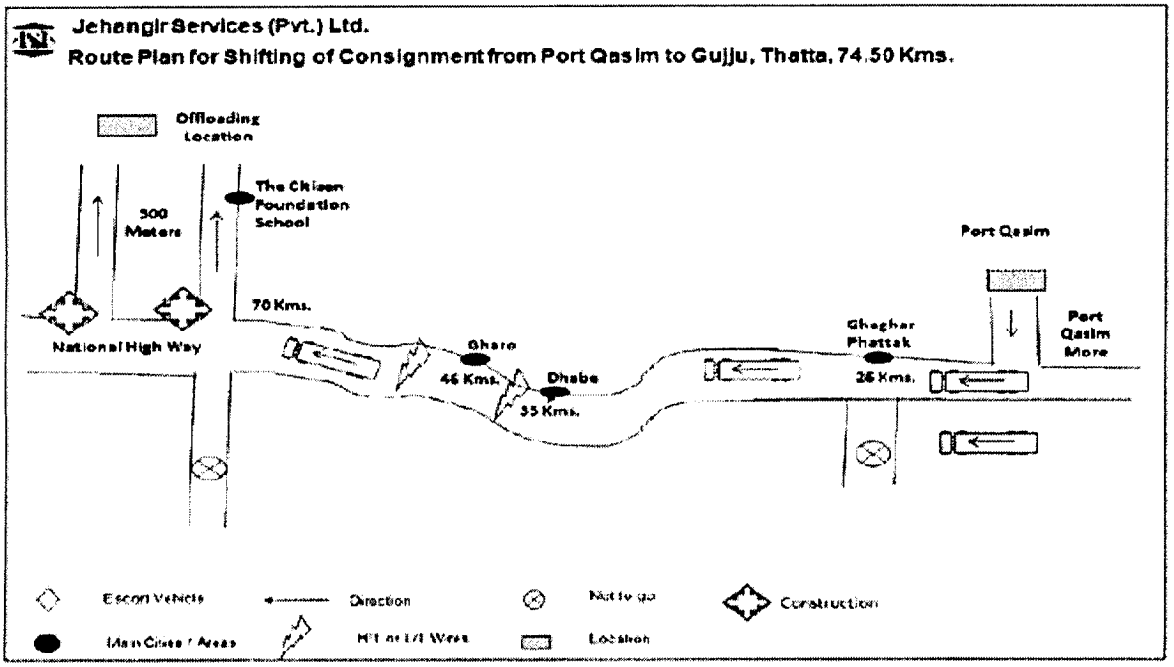


Route map
Source: Jehangir Services (Private) Limited

Based on the report, no special precautions would be required in respect of vehicle movements other than adequate traffic management and vehicle supervision by escort vehicle. On the basis of information provided by the EPC Contractor, standard allowable weights would not be exceeded, removing any issues associated with the abnormal load damage. However, existing roads may need to be widened to provide larger turning radii so that vehicles carrying oversized components (blades, tower sections) can move more easily.

Project Company will ensure that adequate warning signs be implemented to warn other road users at critical points along the route.

Route plan highlighting junctions & vehicle paths is given below;



Road Map
Source: Jehangir Services (Private) Limited

4.6 Soil Condition

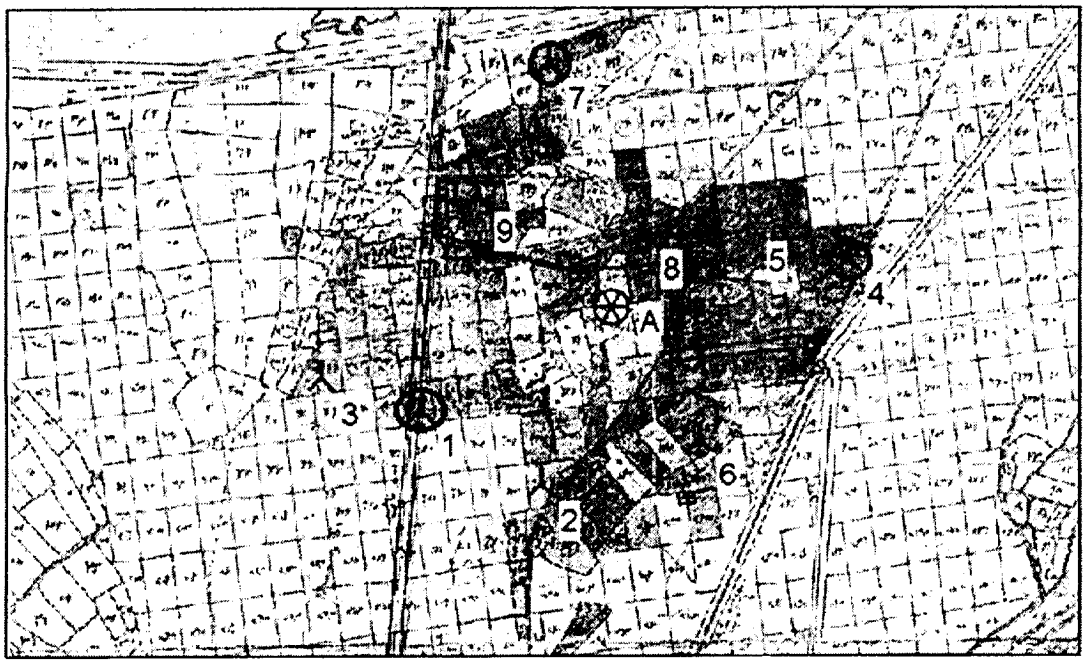
Soil conditions are also favorable for road construction and for installing underground facilities such as wind turbine foundations, fiber-optic communication lines, and electrical conductors.

M/s Soil Testing Services (STS) conducted geo-technical investigation of the Project Site. Its scope of work included drilling of boreholes, carrying out field tests to obtain adequate subsurface information, collections of soil samples, laboratory testing and preparation of report including recommendations for foundation design. . The boring work at the Site was accomplished by Rotary Wash Drilling Method, in which the borehole is advanced by constant rotation of the bit and it cuts the material loose. Bentonite was used as drilling fluid. The returning drilling fluid brings up the soil cuttings, which are preserved as disturbed samples for visual identification of the soil. Core samples were collected by using NX core barrel. Stratigraphy of various soil layers at the Site has also been assessed through information / data from drilling, field testing and laboratory test results. In addition to field testing, a number of laboratory tests were also conducted on selected soil samples.

Borehole locations were planned in a manner to obtain fair amount of information about subsoil conditions up to a considerable depth. A total of three (03) boreholes were drilled at the Site. Depth of each borehole was 40.0 meters below the existing ground level.

Geotechnical investigation for wind turbine foundations at Gujjo was carried out in November, 2012. Three (03) boreholes were drilled as part of the field investigation. Soil and rock samples were also collected during the field investigation. The boreholes were drilled at locations 1, 4 and 7 in the boreholes location plan shown below.

Following picture shows the location of the three bore holes (Blue circles);



The ground conditions at Site indicated 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. These rock deposits were classified in very weak to weak category of BS 5930 classification of rocks.

Mudstone deposits have also been encountered in all the boreholes drilled at the Site. The values of the recovered cores vary from very poor to fair. According to the strength characteristics the rock was classified as very weak.

Limestone deposits were encountered at the Site. The values of the recovered cores vary from very poor to poor. According to the strength characteristics this rock is classified as weak.

In designing the foundations, it is primarily important that soil is capable of carrying loads of all sorts of engineering structure placed upon it without causing any hazard and trouble. Based on the findings of the study, it was decided to use sulphate resistant cement for all concrete work below the ground level. Foundation system will be designed to prevent excessive settlement or shear failure of soil due to structural loads. Therefore, turbine foundations will be placed on pile foundations after considering ground conditions and the size of structure. It was also identified that sub-soil consists of layers of limestone, sandy shale, and conglomerate. Ground water was encountered in all three boreholes up to the end of each boring.

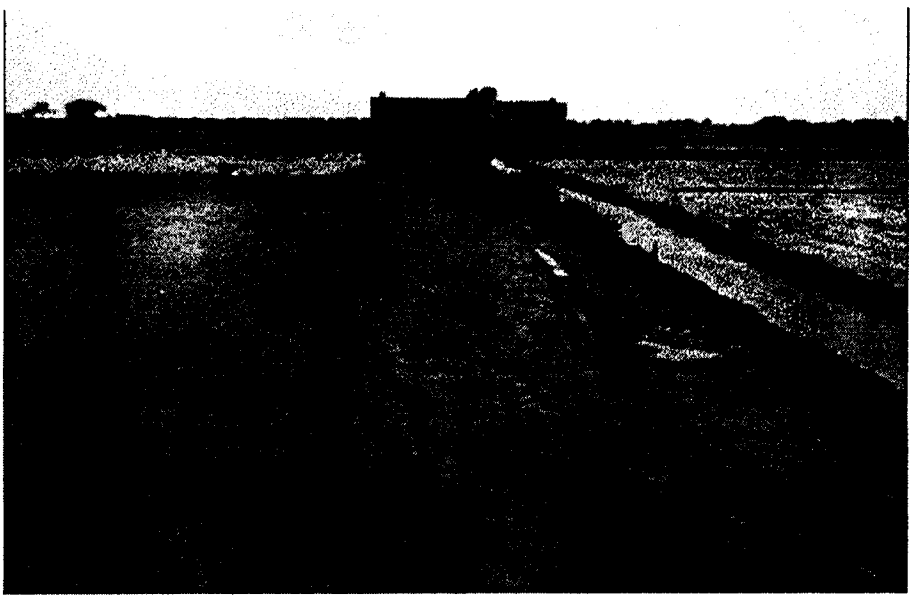
Al-Husnain Enterprises conducted the site topographical survey of the Site. The survey was conducted in order to give the EPC contractor a better understanding about the site conditions and to avoid any unforeseen surprises that could hamper the Project or increase Project cost.

The site pictures are given below;

Location Picture No 1

Location Picture No 2

Location Picture No 3



Location Picture No 4

SECTION-5

SELECTION OF EPC CONTRACTOR

BWE circulated a Request for Proposal ("**RfP**") to various equipment suppliers and EPC Contractors of wind power plant soliciting EPC proposals. In response, only following two companies showed serious interest and submitted their proposals.

3. Dongfang Electric International Corporation; and
4. HydroChina Huadong Engineering Corporation with GoldWind as wind turbine supplier.

The Project Company engaged Lahmeyer International for thorough evaluation of EPC proposals besides reviewing proposals internally.

Negotiations were carried out with both the parties after proposal evaluation. Technology and other technical parameters were sorted out. Due consideration was also given to the financial strength and market acceptability of the equipment suppliers and EPC Contractors.

The following Table displays the statistics of Dongfang and GoldWind/HydroChina machines based on an independent WRA conducted by Lahmeyer International for the Project;

Wind Farm Energy	Dongfang	GoldWind/ HydroChina
Type of Turbine	FD89-1500 kW	GW77
Turbine Capacity [kW]	1,500	1,500
IEC Wind Turbine Class [-]	IEC IIIB	IEC IIA
Number of WTG [-]	9	9
Installed Park Capacity [kW]	13,500	13,500
Hub Height [m]	85	85
Rotor Diameter [m]	89	77
Gross Energy Production (free-stream) [MWh/y]	46,138	42,381
Wake Losses [%]	5.11	4.93
Wake Reduced Energy Production [MWh/y]	43,780	40,292
Park Efficiency [%]	94.9	95.1
Capacity Factor [%]	37	34
Mean WTG Result [MWh/y]	4,864.5	4,476.9
Full Load Hours [Hours/year]	3,243	2,985

Based on Lahmeyer International's WRA, Dongfang with turbine type FD89 is producing 7.9% more energy as compared with the Goldwind/HydroChina with turbine type GW77. Total production of the total wind power plant (sum of all turbines) of Dongfang is higher than GoldWind/HydroChina. Dongfang provides lowest cost per kWh due to its superior production numbers at the same wind speed.

Project Company and Burj Capital respect both the esteemed equipment suppliers/ EPC Contractors. Based on the detailed evaluation covering all aspects, it was decided to select Dongfang as EPC Contractor for the Project.

SECTION-6

CONTRACTUAL FRAMEWORK

The contractual framework of the Project follows a structure similar to that of Independent Power Producers ("**IPP**"s) being setup under previous power policies in Pakistan.

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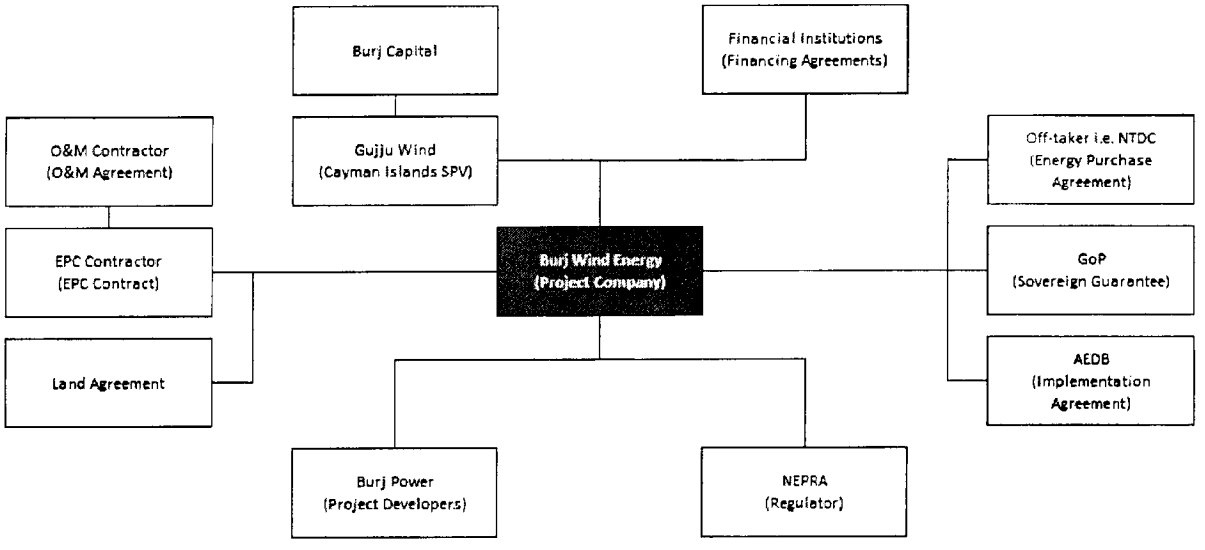

Image: I.1. Contractual Framework

The key terms of the relevant project agreements are summarized below.

6.1 Implementation Agreement (IA) -IA grants the right to the Project Company to implement the Project, extends certain concessions and defines each party's responsibility during the construction and operational phases of the Project. AEDB will sign an IA on behalf of GoP. IA also provides general support of the government for obtaining necessary GoP authorizations/consents. The Company is permitted to import, freely and without taxes, all items necessary for the Project. Availability of foreign currency is guaranteed by GoP and the Company is also adequately protected from changes in law. This agreement also sets out the rules, terms and conditions of the GoP Guarantee, which provides a sovereign guarantee covering the payment obligations of the Off-taker under the Energy Purchase Agreement (EPA).

6.2 GoP Guarantee - GoP is providing a Sovereign Guarantee to the Project which covers the payment obligations of the Power Purchaser and Ministry of Finance under the project agreements.

6.3 Energy Purchase Agreement - The Company will enter into a long term Energy Purchase Agreement ("**EPA**") with National Transmission and Dispatch Company Limited ("**NTDC**") under which NTDC undertakes to purchase the capacity output of the Company for a continuous period of 20 years. The EPA describes the terms and conditions, instructions and procedures for the operations of the power plant. Under the agreement, the off-taker will take the wind risk, which means that the Off-taker will pay fixed monthly energy payments to the Project Company

6.4 Wind Risk – The proposed tariff is designed keeping in view the fact that the wind risk is assumed by the Power Purchaser. Monthly payments will be made by NTDC for the benchmark energy produced by the Project. Further, bonus payments are also applied on any energy produced over and above the benchmark energy. Standard EPA approved by GOP provides payment mechanism of the bonus energy.

6.5 Environment - Burj Wind carried out the initial environmental examination (IEE), which was submitted to the Environmental Protection Agency (EPA), Government of Sindh. There is no significant environmental impact that would prevent or adversely affect the construction of the Project. EPA Sindh has accorded approval to the Project. Copy of EPA, Sindh's IEE approval is appended herewith as **Annex-D.**

SECTION-7

PROJECT CAPITAL COST

7.1 Introduction

The Project will comprise of installation of up to nine (9) wind turbine generators. Project will be constructed under the terms of a fixed-price, turnkey contract whereas construction will be completed in a continuous period of 12 months.

Total Project Cost of US$40,529,423, expressed in United States Dollars, has been calculated after thorough analyses, evaluation and understanding of the dynamics that affects the development, construction and operations of a wind farm in Pakistan.

The estimated total Capital Cost includes the following;

i) All turnkey engineering, procurement, and construction costs;
ii) Construction management cost and Project development cost;
iii) Land and site preparation costs;
iv) Duties and taxes;
v) Insurance costs; and
vi) Interest cost and related financing charges during construction.

Withholding tax on dividend is 7.5% payable at the time of payment of dividend. Profit of the Project Company is exempt from corporate tax. The Project cost will be financed by a combination of Loan and equity.

Break up of Project Cost is given below;

PROJECT COST	US$	Rs.
EPC Cost	31,166,667	3,041,866,699
Land	102,800	10,033,280
Pre-COD insurance	420,750	41,065,200
Non-EPC cost	795,230	77,614,448
Project development cost	3,557,701	347,231,586
Project cost BEFORE IDC & Financing Charges	**36,043,148**	**3,517,811,214**
Financial fees and charges	2,170,183	211,809,867
Project Cost Excluding IDC	**38,213,331**	**3,729,621,081**
Interest during construction (IDC)	2,316,093	226,050,644
Project Cost Including IDC	**40,529,423**	**3,955,671,726**

7.2 EPC Cost

EPC Contracts are executed on a fixed price, lump sum, date certain basis. With respect to the cost overruns and additional costs incurred following Force Majeure Events, the Company's reasonable restoration costs caused by Pakistan Political Force Majeure Events or a Change in Law will be recovered through supplemental tariff under the Energy Purchase Agreement.

EPC of the Project will be managed through two (02) separate and independent contracts (collectively called "**EPC Contracts**").

The Project Company has signed legally binding and executable contracts with Dongfang Electric International Corporation ("**Dangfong**").

The consideration payable to Dangfong for supply of equipment is inclusive of all taxes and duties levied in China. Project Company is to provide revolving (automatic) letter of credit to EPC Contractors after advance payment.

7.3 Land

Project will be constructed on private agriculture survey lands of around 250 acres.

7.4 Duties and Taxes

Customs Duty, Special Excise Duty, Sales Tax, Income Tax, Sindh Infrastructure Development Surcharge (SIDS), Service Tax, other direct and indirect taxes and surcharge what so ever which is imposed by the Government of Pakistan and/or the Government of Sindh at the time of filing of Tariff application are not being considered in the calculation of Tariff and the same shall be claimed under Tariff as and when paid before COD.

7.5 Pre-COD Insurance

Pre-COD insurance cost covers the insurance cost of Project Company's assets during construction as well as the cost incurred prior to COD. These cost estimates have been developed based on recent tariff determinations of various wind power project by NEPRA. NEPRA allows 1.35% of the EPC Cost as Pre-COD Insurance Cost.

Project Company will solicit offers from leading local insurance companies and international leading insurance companies in due course.

The Project Company, in view of the practices set by the other IPPs in Pakistan and in accordance with the requirements set out by the lenders funding the project, intends to procure following insurances during the construction phase of the Project;

- Construction, erection all risk insurance (CEAR)/ Third party liability
- Marine cargo – delay – in startup insurances
- Terrorism insurance
- Workmen's compensation insurance
- Group personal accident
- Motor comprehensive insurance

Pre-COD Insurance is assumed as 1.35% of EPC Cost.

7.6 Non-EPC Cost

The Non-EPC Cost includes the cost of items that are not part of the EPC Contractor's scope of work pursuant to the executed EPC Contracts.

A) Fixed Assets

This includes cost of various instruments, equipment, and other assets (excluding such assets that are supplied under On-shore and Off-shore Contracts) and comprises of:

a) vehicles, office equipment, furniture, electrical appliances;
b) wind measurement mast (instruments, lattice tower, calibration, security, maintenance, and insurance) as required under EPA; and
c) Telecommunication equipment

B) Residential facility

Being a foreign owned company coming into Pakistan, Project Company requires rented accommodation in Karachi for the permanently resident officers and staff. Since the Project Site is not too far from Karachi hence there is no intention to build a full-fledged residential colony at the site except a few rooms hostel.

C) Security Arrangement Cost

Pakistan is going through a tough time with respect to security situation in the country. This is one of the major impediments to attracting foreign investments. The Project Company is also concerned about the security of its personnel. Therefore, security arrangement cost becomes one of the important components of the Project Cost. This represents the costs associated with providing security at offices, accommodation, and site; and also including for expatriates engaged by Sponsors, lenders, and contractors for the Project. The Project Company has hired the services of a dedicated security manager to oversee and monitor the security related matters along with other security staff.

D) Optic Fiber / Communication Link Cost with WAPDA

In accordance with the requirements of EPA, the Project Company is required to provide connectivity to the Power Purchaser through fiber optic. Total installment cost (including equipment, materials, and installation) has been included under this head. This communication link is essential as the Project is bound to transmit wind speed and power output data to the Power Purchaser for record of data in line with EPA requirements.

Break Up of Non-EPC Cost is given below;

Non-EPC cost		US$
A) Fixed Assets		
	Wind measurement masts	70,230
	Recalibration of wind mast	25,000
	Vehicles	150,000
	Furniture and Electronic Equipment	20,000
	Telecommunication equipment	15,000
	Misc	50,000
		330,230
B) Residential facility		100,000
C) Access road		65,000
D) Security Arrangement Cost		100,000
E) Optic fiber/Communication link with WAPDA		200,000
TOTAL NON-EPC COST		**795,230**

7.7 Project Development Cost

The Project Development Cost includes the costs incurred for the purpose of project development and includes all cost, fees, and expenses incurred or to be incurred for such purpose. These costs mainly include the following;

- Feasibility study costs
- Government permits and licenses fees
- Costs related to the guarantees which have been furnished or to be furnished to AEDB
- Costs incurred or to be incurred for Project Company incorporation and capitalization
- Consultants fees
- Human resources cost
- Cost of travel

Feasibility study	:	It includes wind measuring mast, technical feasibility, electrical and grid inter-connection studies, and geo-technical, & topographical studies. It also includes construction supervision engineer during pre-COD period.
Government permits and licenses fee	:	It includes various fees to AEDB, NEPRA, NTDC, and Environment Protection Agency (EPA) of Government of Sindh. It also includes bank guarantee charges for obtaining LOI from AEDB, performance guarantee charges for issuance of LOS, and seller's L/C to NTDC charges under EPA.
Project Company incorporation and capitalization fee to SECP	:	The fees relating to Project Company incorporation and capitalization incurred on registration of authorized capital of the Project Company with the Securities and Exchange Commission of Pakistan (SECP) are included in this cost head.
Project consulting and advisory fees	:	The technical, financial and legal consultants, and advisors costs to be incurred by the Project Company during the project development phase are included in this cost head
HR Cost	:	The HR costs include salaries, wages, and benefits of all staff as follows; ▪ Management executives ▪ Technical and operations department ▪ Commercial and legal affairs department ▪ Mt department ▪ Finance department ▪ Training and human resource department ▪ Supply and logistic departments These staff members will be employed by the Project Company at the site and in Karachi office.
Travel and related cost	:	The Project Company is incurring and will also incur domestic and international travelling expenses including

accommodation cost during development and construction phases of the Project.

Break up of Project Development Cost is given below;

Project development cost	US$
i) Feasibility cost	
Topographic survey	6,130
Soil study	5,400
Detailed Geo-technical & Seismic studies	40,000
Environmental impact assessment	10,000
Logistic studies	1,000
Grid study (Load Flow Study)	10,000
Wind assessment - Riso	20,000
Wind resource assessment	30,000
Technical Consultant	120,000
CDM Consultant	50,000
Lawyer	200,000
Owners Engineer	800,000
Financial Consultant	952,941
Lenders – Advisors	400,000
Miscellaneous	50,000
i) TOTAL Feasibility cost	**2,695,471**
ii) Permits/License	
Generation license	2,156
Tariff application fee	2,874
Annual license fee	10,000
Fee for LOI	7,100
Fee for LOS	50,000
Environmental Protection Agency (GoS) fee	100
ii) TOTAL Permits/License COST	**72,230**
iii) Company formation fee	
Registration of authorized capital	20,000
Audit fee yearly	20,000
iii) TOTAL Company formation fee	**40,000**
iv) Project consultants - Developers fee	200,000
v) Project administration costs	200,000
vi) HR costs	200,000
vii) Travelling expenses	150,000
TOTAL PROJECT DEVELOPMENT COST	**3,557,701**

SECTION-8

PROJECT FUNDING

8.1 Introduction

Total Capital Cost of the Project is estimated to be approximately USD 40,529,423 inclusive of IDC. The Project cost will be financed by a combination of Loan and equity.

The capital structure of the Company is envisaged at a Loan~Equity ratio of 75:25 thus resulting in USD 30,397,068 and USD 10,132,423 as Loan and equity respectively.

Sources of Funds are as follows;

Sources of Funds	% of Project Cost	USD
Loan	75%	30,397,068
Equity	25%	10,132,356
Total Project Cost with IDC	**100%**	40,529,423

8.2 Loan Structure

Under the proposed financing structure, Loan will account for 75% i.e. approximately USD 30.397 million, of the total Project Cost including Interest During Construction ("**IDC**"). Loan disbursements are dependent on actual payments to be made to the EPC Contractor.

a) Local Currency Loan

Entire loan will come from local banks in Pak Rupees. The Project will utilize a mix of available financing options. Note that the recommended financing structure and associated terms in this application/proposal are based on preliminary responses received recently by the Project Company from the financial markets. In current volatile environment, it is critical to recognize that the financing structure and associated terms are subject to adverse changes in the financial markets and Project parameters.

In order to promote renewable energy projects in the country, State Bank of Pakistan ("**SBP**") is providing financing for the establishment of new power projects using renewable energy. SBP vide its circular no. SMEFD Circular No. 19 of 2009 dated December 01, 2009 and IH&SMEFD Circular Letter No. 11 of 2012 dated July 30, 2012 issued a scheme for financing power plants using renewable energy.

Project Company has decided to avail the loan facility for renewable projects of SBP. Loan under SBP Facility is hereby referred as **Loan-I, SBP Facility**. Under the terms and conditions of SBP Facility, this financing is only available for the purchase of new imported and locally manufactured plant, machinery and equipment. As project cost not only comprises of imported and locally manufactured plant, machinery and equipment but also includes civil work, land and site preparation costs, duties and taxes, insurance costs and Interest cost and related financing charges during construction, etc. therefore, in addition to the SBP Facility, Project Company is also arranging a certain portion of loan from the Commercial Banks. Loan under Commercial Banks facility is hereby referred as **Loan-II, Commercial Banks** and is being arranged to cover the gap as mentioned above.

The breakdown of loan is given below;

Description	USD	Pak Rupee
Loan-I, SBP Facility	23,500,000	2,293,600,000
Loan-II, Commercial Banks	6,897,068	673,153,794
	30,397,068	2,966,753,794

b) Interest on Loan

Interest payments will start after the commencement of operations of the wind farm and will be made on quarterly basis. Interest will be calculated on the basis of actual number of days elapsed in a year of 365 days on the outstanding principal amount of the Facility.

i) Loan-I SBP Facility:

Under the terms and conditions of SBP Facility, the rate of service charges once fixed will remain locked-in for the entire duration of the loan.

Project Company has taken 11.40% (i.e. fixed rate of interest) on SBP Facility for calculating interest during construction and interest payments after the end of the grace period.

Fixed Interest Rate is given below;

SBP Rate	:	8.40%
Spread	:	3.00%
Fixed Interest rate	:	11.40%

NOTE: i) *Since interest rate of Loan-I, SBP Facility is fixed throughout the term of Loan-I, therefore no adjustment is and will be claimed on account of variation of SBP rate during the term of the Loan-I, SBP Facility.*

ii) Entire benefit will be passed on to the power purchaser, in case final interest rate is lower than the rate used for the calculation of tariff.

iii) Fixed Interest rate will be finalized at the time of Financial Closure.

ii) Loan-II, Commercial Banks:

Interest rate of Commercial Banks will be linked with KIBOR thus it will vary as and when there is a change in KIBOR. Project Company has taken 13.21% interest rate on Commercial Banks facility for calculating interest during construction and interest payments after the end of the grace period.

Interest Rate is given below;

KIBOR	:	10.21% (3months - Offer dated October 01, 2014)
Spread	:	3.00%
Interest rate	:	13.21%

NOTE: *Interest rate is KIBOR based thus interest rate will change as and when there is a change in KIBOR.*

c) Grace Period and Loan Term

i) Grace Period

Grace period starts from the date banks first disburse the funds to the Project Company. The loans will be obtained with a grace period of 2 years i.e. 24 months (covering 15 months of construction) and first year of operations.

IDC is an estimated figure, however, IDC is subject to change depending on the fluctuations in KIBOR and exchange rate, drawdown schedule and changes in the Project Cost. IDC will be calculated for the period starting from the first drawdown of loan after the financial closure based on accrued interest for the outstanding loan on monthly basis.

As mentioned above, grace period is of 24 months, out of which 15 months will be utilized during construction of the wind farm and remaining 9 months will fall in the first year of operations (hereby referred as "**Post-COD grace period**"). Interest on loans (Loan-I, SBP Facility, Loan-II, Commercial Banks) will not be paid during the construction period and will be part of the Total Project Cost (that is referred as IDC in this application) however, interest will be paid to banks on quarterly basis during the first year of operations i.e. Post-COD grace period whereas repayment of Principal will start once grace period of 24 months ends i.e. from 2 year of operations along with the interest on loans (Loan-I, SBP Facility, Loan-II, Commercial Banks).

Interest to be paid to banks during the Post-COD grace period is part of the tariff.

ii) Loan Term

Repayment period of both Loan-I and Loan-II will be eight (08) years starting from the end of the grace period.

d) Hedging Cost

One of the terms and conditions of SBP Facility is that SBP will not consider the request of bank(s)/DFI(s) to enhance the amount of funding of the project due to depreciation of Pak Rupee during the availability period of the facility.

SBP Facility says that the risk of enhanced financing requirements would either be borne by the borrower or by the bank on same terms upon which refinance has been obtained. Due to this, Lenders require that borrower hedges changes in US Dollar and Pak Rupee exchange rate from financial closure date till the date of commencement of commercial operations (COD).

The tariff model has assumed cost of hedging against the movements in exchange rate between US Dollar and Pak Rupee prior to COD on the purchase of plant and equipment.

Project Company will not claim adjustment in the Off-shore EPC Cost component and resultant tariff due to the movements in the foreign exchange rate at the time of COD. However, all other foreign currency costs will be adjusted accordingly at the time of COD due to changes in exchange rates.

5.36% of Total Loan-I is assumed as hedging cost in the tariff and will be finalized at Financial Close. This cost is a part of the financial charges.

e) Terms and Conditions

A summary of key terms and conditions is given below;

Terms and conditions	Loan-I, SBP Facility	Loan-II, Commercial Banks
Base Currency	Pak Rupees	Pak Rupees
Amount (in Pak Rs.)	2,293,600,000/-	673,153,794/-
Total Tenor	2+ 8 Years	2+ 8 Years
Nature of Interest Rate	Fixed	Variable
Benchmark Rate	SBP rate	KIBOR
Margin over Benchmark Rate	300 bps	300 bps
Total Interest Rate	11.40%	13.21%
Upfront/ Arrangement Fee	2%	2%
Commitment Fee	0.5%	0.5%
Hedging Cost	5.36%	Not required

f) Financial Charges

Financial charges cover the costs related to the financing of the Project. Such costs include lenders' up-front/Arrangement fee, commitment fee, hedging cost and other related costs.

Landers take one time upfront/arrangement fee before the first disbursement.

Commitment fee is charged by the lenders on the undrawn balance of the loan facility. The commitment fee is calculated according to the loan schedule of the Project Company.

The financial charges will be negotiated with the lenders at the time of issuance of term sheet by the lenders.

Financial fees and charges	Rs.	
Arrangement Fee	59,335,076	Calculated as per loan amount
Commitment fee	8,065,862	Calculated as per loan schedule
LC commission	21,472,000	Estimated amount ($220,000)
TOTAL - Financial fees and charges	**88,872,938**	
Hedging Cost	122,936,960	For details, refer to 10.2 (d)

g) Loan Schedule

Loan schedules of Loan-I and Loan-II are given in Schedule 13.

8.3 Equity Structure

It is estimated that 25% of the total capital cost of the Project i.e. approximately Rs. 988,917,931 (i.e. USD 10.13 million) will be funded by the Sponsors in the form of equity.

Sponsors of the Company are funding the development cost and will pay other fees payable on or before the Financial Closure.

Risk perceptions are high in investing in Pakistan's energy sector not only because of the security situation of the country but also considering the issue of the circular debt. Considering the above, Project Company is filing tariff petition with NEPRA under the Cost-plus regime at a fixed IRR of 17%.

Sponsors reserve the right to sell certain percentage of shares of the Project Company to other investors in future, subject to the requirements of the Lenders.

SECTION-9

O&M COST INCLUDING INSURANCE

9.1 O&M Cost

NEPRA issued wind upfront tariff in April 2013 and allowed O&M Cost of Rs. 1.6040 per kWh, which is also being assumed in the tariff by the Project Company.

O&M expenses are one of the major unknowns for the wind developers in Pakistan. It is imperative to note that O&M costs are not as low in wind projects as perceived by many. Today's modern wind turbines are built from over 8,000 different components. Furthermore, unexpected components failure, especially electronic controls, generators, rotor blades etc have driven up operations and maintenance costs. This is even more critical in Pakistan where the temperatures in the windy months are also very high and machines have to work in almost full capacity in extreme weathers. Yet these maintenance costs are lesser as compared to overhauling and fuel costs of thermal generators.

9.2 Outsource of O&M during Operations

Project Company is in discussion with WTG supplier of the Project to provide O&M services during the operations under an O&M Contract. The O&M price includes the costs associated with daily operation, scheduled maintenance, routine maintenance, services required for unscheduled maintenance, and any spare parts and consumables required for carrying out the scheduled and routine maintenance.

9.3 Other operating cost

O&M Cost also includes the following;

i) **Fixed Assets:** This includes cost of vehicles, office equipment, furniture, electrical appliances, and tools required at site.

ii) **Payroll and Allied Expenses:** Payroll costs include salaries and benefits of corporate office (CEO, CFO, COO etc...). These staff members will be employed by the Project Company at the site and in Karachi office.

iii) **Security Arrangement Cost:** Due to volatile law and order situation, security arrangements are very important and a vital subject. The Project will depute a full time security team at its site office. The foreign staff of manufacturers and investors who visits or will visit the Project Site for work will also be provided security cover during their stay in Pakistan.

iv) **Vehicle Fuel and Maintenance:** This component includes the costs associated with running and maintenance of vehicles at the Karachi and site offices of the Project Company. The vehicles include vehicles required by the security personnel for securing the site; vehicles required for supervision and coordination of O&M activities, vehicles for administration needs. The vehicles purchased during the construction period will be used for first 5 years of the O&M period. At the start of the 6th year, the old vehicles will retire and new vehicles will be procured by the Project Company in each year as depreciated and worn off vehicles will be laid off.

v) **Administration Costs:** This portion of the O&M cost includes costs associated with rents, utilities, travelling, entertainment, audit, legal and financial consultants, technical consultation, generation license fees, and other allied expenses of running the offices during operations.

9.4 Insurance

Project has assumed 1.35% of the EPC Price as insurance cost. Insurance cost component of tariff will be adjusted only on account of US $/PKR exchange rate variation annually, not exceeding the insurance cost actually incurred.

SECTION-10

INDEXATIONS, ESCALATIONS AND ADJUSTMENT

10.1 Indexation

Various components of tariff are adjusted on pre-determined formula and reference parameters. IPPs are not required to approach NEPRA for tariff indexation. The purpose of indexation is to remove any exposure of investors to cost escalations, over the life of the Project, over which they have no direct control. With that principle in mind, the following sections discuss the proposed indexation for various components of the tariff. Indexation formulae have been prepared taking into account the guidelines presented in the Ministry of Water and Power/ Alternative Energy Development Board's, guidelines for determination of tariff for wind power generation 2006", NEPRA's recent determinations and the provisions of the standard drafts of the implementation agreement and the energy purchase agreement.

10.1.a Foreign Exchange

A foreign exchange indexation is applied to those cost elements that are dominated in foreign currency (US $). For these items, the investors have no control over cost changes caused by exchange rate fluctuations, and these are therefore passed through to power purchaser. The proposed tariff structure for the Project implies that the following components will be indexed to variations in foreign exchange rate (Rs./ US$);

- O&M component;
- The insurance component as discussed previously will provide cover on a replacement cost basis, which will be incurred in US dollars. Premium will therefore be constructed on that basis, and insurance cost will therefore fluctuate with exchange rate movements;
- The ROE and ROEDC component that reflects the equity investment in foreign currency (USD).

Indexation for these components will be applied quarterly, on January 1, April 1, July 1, and October 1 on the basis of the TT & OD selling rate as notified by the National Bank of Pakistan (in Rs/ US $). In the event of discontinuation of TT&OD selling rate by the NBP or introduction of another regime by the State Bank of Pakistan (SBP) for determination of the exchange rate, NEPRA will be asked to substitute the mechanism with another mechanism thus it does not place the Project Company in a worse position.

10.1.b KIBOR

The wind farm investors have no control over changes in interest rates. Appropriate indexation will be applied.

Since Interest Rate of Loan-I is fixed throughout the term of Loan-I, therefore no adjustment will be claimed on account of variation of SBP rate during the term of the Loan-I.

Loan-II will be adjusted with the changes in Karachi Interbank Offer Rate (KIBOR). This portion will be adjusted bi-annually for variations in the 6 month KIBOR.

10.1.c Foreign Inflation

O&M component is denominated in US Dollars thus will be adjusted with changes in US inflation, United States Consumer Price Index (US CPI), as published monthly by the department of Labor, United States Government.

A summary of indexation requested is given below; Different components of the tariff are escalated/ indexed on the following basis;

Energy Payment	Variation in...
Fixed O&M	US CPI & USD
Insurance	USD
Return On Equity & Return on Equity During Construction	USD
Loan-II Commercial Banks	KIBOR

10.2 Indexation and Adjustment Factors

Indexations and adjustment factors will be determined by NEPRA from time to time (for each Quarter, Semi-Annual Period or the year, as applicable) and notified in the official gazette by government of Pakistan.

From and after the Commercial Operations Date, indexation formulas as given in the standardized Energy Purchase Agreement (EPA) duly issued by AEDB will be applied.

10.3 Fiscal Incentives

GoP is offering a number of fiscal incentives under the policy framework. These fiscal incentives include exempting private power companies from corporate income tax, relief from import duties on plant and equipment, and guaranteed repatriation of equity and dividends derived from the power plant.

SECTION-11

PROJECT TARIFF

Based on certain assumptions, below tariff is calculated @ P50.

Year	O&M Rs/kwh	Insurance Rs/kwh	RoE Rs/kwh	RoE-DC Rs/kwh	Loan-I Rs/kwh	Loan-II Rs/kwh	Tariff Rs/kwh
1	1.6040	0.9628	4.1203	0.7005	4.5980	1.5637	13.5493
2	1.6040	0.9628	4.1203	0.7005	10.3361	3.2253	20.9490
3	1.6040	0.9628	4.1203	0.7005	10.3361	3.2253	20.9490
4	1.6040	0.9628	4.1203	0.7005	10.3361	3.2253	20.9490
5	1.6040	0.9628	4.1203	0.7005	10.3361	3.2253	20.9490
6	1.6040	0.9628	4.1203	0.7005	10.3361	3.2253	20.9490
7	1.6040	0.9628	4.1203	0.7005	10.3361	3.2253	20.9490
8	1.6040	0.9628	4.1203	0.7005	10.3361	3.2253	20.9490
9	1.6040	0.9628	4.1203	0.7005	10.3361	3.2253	20.9490
10	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
11	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
12	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
13	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
14	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
15	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
16	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
17	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
18	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
19	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
20	1.6040	0.9628	4.1203	0.7005	-	-	7.3876
Levelized Tariff (Rs)	1.6040	0.9628	4.1203	0.7005	6.3792	2.0043	15.7711
Levelized Tariff (US Cents)	1.6434	0.9865	4.2216	0.7177	6.5360	2.0536	16.1589

1US Dollar = 97.60 Pak Rupees

Project Company has calculated for a Levelized Tariff of Rs. 15.7711 per kWh (US Cents 16.1589 per kWh), whereas NEPRA issued Levelized wind upfront tariff of Rs. 16.2926 per kWh (US Cents 16.6932 per kWh) in April 2013 on 100% rupee financing. Project Company's tariff is lower than the last issued wind upfront tariff.

Key parameters are given below:

Capacity (MW)	13.50
Plant specific plant factor	36.1%
Units produced in a year (GWh)	42.65
Dollar rate	97.60
Total Project cost (US$)	40,529,423

Total Project cost (Rs.)	3,955,671,726
Debt %	75%
Equity %	25%
Loan-I (SBP Facility) (for equipment only) (Rs.)	2,293,600,000
Interest Rate	11.40%
Debt Term (Years)	8
No of payments in a year	4
Installment (Rs.)	95,978,300
Loan-II (C-Banks) (Rs.)	673,153,794
Interest Rate	13.21%
Debt Term (Years)	8
No of payments in a year	4
Installment (Rs.)	31,648,612

Repayment Schedule of Loan-I, SBP Facility is given below;

Quarters	Opening Principle	Principle	Interest	Installment	Closing Principle
Grace Period	2,293,600,000		65,367,600		2,293,600,000
Grace Period	2,293,600,000		65,367,600		2,293,600,000
Grace Period	2,293,600,000		65,367,600		2,293,600,000
1	2,293,600,000	44,841,474	65,367,600	110,209,074	2,248,758,526
2	2,248,758,526	46,119,456	64,089,618	110,209,074	2,202,639,070
3	2,202,639,070	47,433,861	62,775,213	110,209,074	2,155,205,209
4	2,155,205,209	48,785,726	61,423,348	110,209,074	2,106,419,484
5	2,106,419,484	50,176,119	60,032,955	110,209,074	2,056,243,365
6	2,056,243,365	51,606,138	58,602,936	110,209,074	2,004,637,227
7	2,004,637,227	53,076,913	57,132,161	110,209,074	1,951,560,314
8	1,951,560,314	54,589,605	55,619,469	110,209,074	1,896,970,708
9	1,896,970,708	56,145,409	54,063,665	110,209,074	1,840,825,300
10	1,840,825,300	57,745,553	52,463,521	110,209,074	1,783,079,747
11	1,783,079,747	59,391,301	50,817,773	110,209,074	1,723,688,445
12	1,723,688,445	61,083,953	49,125,121	110,209,074	1,662,604,492
13	1,662,604,492	62,824,846	47,384,228	110,209,074	1,599,779,646
14	1,599,779,646	64,615,354	45,593,720	110,209,074	1,535,164,292
15	1,535,164,292	66,456,892	43,752,182	110,209,074	1,468,707,400
16	1,468,707,400	68,350,913	41,858,161	110,209,074	1,400,356,487
17	1,400,356,487	70,298,914	39,910,160	110,209,074	1,330,057,573
18	1,330,057,573	72,302,433	37,906,641	110,209,074	1,257,755,139
19	1,257,755,139	74,363,053	35,846,021	110,209,074	1,183,392,087
20	1,183,392,087	76,482,400	33,726,674	110,209,074	1,106,909,687
21	1,106,909,687	78,662,148	31,546,926	110,209,074	1,028,247,539
22	1,028,247,539	80,904,019	29,305,055	110,209,074	947,343,520

23	947,343,520	83,209,784	26,999,290	110,209,074	864,133,736
24	864,133,736	85,581,263	24,627,811	110,209,074	778,552,474
25	778,552,474	88,020,329	22,188,745	110,209,074	690,532,145
26	690,532,145	90,528,908	19,680,166	110,209,074	600,003,237
27	600,003,237	93,108,982	17,100,092	110,209,074	506,894,255
28	506,894,255	95,762,588	14,446,486	110,209,074	411,131,668
29	411,131,668	98,491,822	11,717,253	110,209,074	312,639,846
30	312,639,846	101,298,838	8,910,236	110,209,074	211,341,008
31	211,341,008	104,185,855	6,023,219	110,209,074	107,155,152
32	107,155,152	107,155,152	3,053,922	110,209,074	(0)

Repayment Schedule of Loan-II, Commercial Banks is given below;

Quarters	Opening Principle	Principle	Interest	Installment	Closing Principle
Grace Period	673,153,794		22,230,904		673,153,794
Grace Period	673,153,794		22,230,904		673,153,794
Grace Period	673,153,794		22,230,904		673,153,794
1	673,153,794	12,158,415	22,230,904	34,389,319	660,995,379
2	660,995,379	12,559,946	21,829,372	34,389,319	648,435,433
3	648,435,433	12,974,739	21,414,580	34,389,319	635,460,695
4	635,460,695	13,403,229	20,986,089	34,389,319	622,057,465
5	622,057,465	13,845,871	20,543,448	34,389,319	608,211,594
6	608,211,594	14,303,131	20,086,188	34,389,319	593,908,464
7	593,908,464	14,775,492	19,613,827	34,389,319	579,132,972
8	579,132,972	15,263,452	19,125,866	34,389,319	563,869,520
9	563,869,520	15,767,528	18,621,791	34,389,319	548,101,992
10	548,101,992	16,288,250	18,101,068	34,389,319	531,813,741
11	531,813,741	16,826,170	17,563,149	34,389,319	514,987,571
12	514,987,571	17,381,854	17,007,465	34,389,319	497,605,717
13	497,605,717	17,955,890	16,433,429	34,389,319	479,649,827
14	479,649,827	18,548,883	15,840,436	34,389,319	461,100,944
15	461,100,944	19,161,460	15,227,859	34,389,319	441,939,484
16	441,939,484	19,794,267	14,595,051	34,389,319	422,145,217
17	422,145,217	20,447,973	13,941,346	34,389,319	401,697,244
18	401,697,244	21,123,267	13,266,051	34,389,319	380,573,977
19	380,573,977	21,820,863	12,568,456	34,389,319	358,753,113
20	358,753,113	22,541,497	11,847,822	34,389,319	336,211,616
21	336,211,616	23,285,930	11,103,389	34,389,319	312,925,686
22	312,925,686	24,054,948	10,334,371	34,389,319	288,870,738
23	288,870,738	24,849,363	9,539,956	34,389,319	264,021,376
24	264,021,376	25,670,013	8,719,306	34,389,319	238,351,363
25	238,351,363	26,517,765	7,871,554	34,389,319	211,833,598
26	211,833,598	27,393,514	6,995,805	34,389,319	184,440,084
27	184,440,084	28,298,185	6,091,134	34,389,319	156,141,899
28	156,141,899	29,232,733	5,156,586	34,389,319	126,909,166
29	126,909,166	30,198,144	4,191,175	34,389,319	96,711,023

30	96,711,023	31,195,437	3,193,882	34,389,319	65,515,586
31	65,515,586	32,225,667	2,163,652	34,389,319	33,289,919
32	33,289,919	33,289,919	1,099,400	34,389,319	(0)

Calculation of Equity IRR is given below;

IRR=	17.00%
-1	(988,917,931)
1	175,730,716
2	175,730,716
3	175,730,716
4	175,730,716
5	175,730,716
6	175,730,716
7	175,730,716
8	175,730,716
9	175,730,716
10	175,730,716
11	175,730,716
12	175,730,716
13	175,730,716
14	175,730,716
15	175,730,716
16	175,730,716
17	175,730,716
18	175,730,716
19	175,730,716
20	175,730,716

ADJUSTMENTS AT COD

NEPRA will be requested to allow the adjustments (as set out in this Section (Adjustments at COD)) to the Reference Generation Tariff at the time of true up at COD;

ADJUSTMENTS TO PROJECT COST

It is expected that the Project Cost will be adjusted at COD for the following assumptions. The adjustments to the Project Cost to be reflected in the relevant tariff components (Return on Equity and Loan Servicing):

a. US$ / PKR exchange rate variations during the construction period;
b) All such Project Cost, which are subject to be adjusted, as per actual
c) All local Duties and Taxes paid or withheld;
d) Arrangement and commitment fee charges and any other fees/charges by the Lenders of the Project;
e) Interest during Construction for increase in Project Cost, change in interest base rate (KIBOR), variation in loan & equity drawdowns;

f) Return on Equity during Construction (ROEDC; IRR based) based on actual equity drawdown.

Pass-Through Items

In addition to the pass-through items stipulated in the standardized EPA (with its Schedules) and in the Tariff Petition, any taxes, duties and levies etc. not factored in the tariff calculation will be treated as part of the Project cost at the time of COD. Any direct and indirect taxes (federal and provincial) taxes currently applicable or impose before and after COD of the Project on the O&M Operator will be considered as Pass Through Item as per the terms of EPA.

Power Purchase Prior to COD

It is standard practice for wind power projects internationally to come online one WTG at a time, thereby, enabling the wind farm to commence dispatching energy to the grid as soon as a WTG is capable of power generation. Commissioning of a WTG cannot be completed without the substation being completed, tested and commissioned, therefore, all protection and safety equipment required to ensure smooth, safe operation of the wind farm (and the grid) would already be in place prior to commissioning of the WTGs. As soon as a WTG has been commissioned, it is ready to supply energy to the grid. It is requested that compensation from NTDC be allowed for the supply of electricity prior to achievement of COD.

NEPRA is therefore requested to allow the Project to claim compensation from the Power Purchaser for all electricity supplied into the grid system prior to achievement of COD at the tariff rate applicable for the first year of operation minus the Loan servicing components of the tariff.

In case the Project is not allowed to claim compensation, there will be no motivation for the Project to supply energy into the grid, which could otherwise assist in reducing the demand-supply gap.

General Assumptions

The tentative tariff has been worked on the basis of following non-exhaustive list of assumptions - any change in relation thereto will require an appropriate adjustment in the tentative tariff:

1. Project cost of $40,529,423 and Loan~Equity ratio of 75~25.
2. Annual energy yields are calculated for exceeding probability levels @ P50 and units produced in a year are 42,651MWh.
3. The Power Purchaser will assume wind risk and will pay at least benchmark energy on a monthly basis. Bonus on energy over and above the benchmark energy by the Project will be shared between the Project Company and Off-taker as per the RE Policy of 2006.
4. Insurance during construction is 1.35% of EPC Cost.
5. 100% of Loan has been assumed to be financed through local banks and financial institutions.
6. Fixed interest rate of 11.40% on Loan-I, SBP Facility.
7. Interest rate for Loan-II-Commercial Banks is assumed at 13.21%.
8. IRR of 17% is assumed (exclusive of 7.5% withholding tax on dividends) over 20 years. The ROEDC will be accrued at the time of COD according to the actual schedule of equity injection.
9. Return on Equity for the construction and commissioning period, will be adjusted on IRR basis at the time of COD according to the actual Equity disbursement during such period
10. Exchange Rate (PKR/US$) is taken @ PKR 97.60 per US$.

11. Taxes (Federal, Provincial, Local or district), stamp duties and levies etc. are not factored in the tariff calculation and will be claimed separately under Tariff thereafter project cost in the tariff will be adjusted accordingly or will be treated as Pass-Through items in term of EPA.
12. No customs duties, FED sales tax, income tax and Sindh Infrastructure tax have been considered for imports. Similarly, customs duties on spare parts after COD will be considered "Pass-Through" to the Power Purchaser.
13. Sindh Infrastructure Development Surcharge on the import for the Project has not been assumed, however, it will be adjusted at the time of actual shipment and thereafter project cost in the tariff will be adjusted accordingly.
14. Federal Excise Duty has not been assumed as part of the Project Cost; in case the same is required to be paid by the Project, the same should be treated as pass through under the tariff.
15. Deduction of withholding tax is assumed only in On-Shore Contract. No withholding tax has been considered in the Off-Shore Contract. Any additional tax, if levied, will be "pass through" to the Power Purchaser.
16. 7.5% withholding tax on dividend is assumed. Tariff doesn't include withholding tax of 7.5% and will be claimed to Off-taker as and when dividend is paid. Any changes in the aforesaid withholding tax regime will be "Pass-Through" to the Power Purchaser. General Sales Tax and all other taxes will also be treated as a "Pass-Through "
17. The Zakat deduction on dividends (currently 2.5%), if levied, will be considered as "Pass-Through".
18. The Power Purchaser will exclusively be responsible for the financing of construction, operation and maintenance of the Interconnection and Transmission Lines as per the prevailing policy at the time of tariff determination.
19. Financing Terms are as yet based on the initial discussion with the financial institutions and hence are subject to final negotiations once tariff is determined by NEPRA and the EPA / IA are signed. This will include mainly the debt-equity ratio, Grace Period and loan repayment term, benchmark index (KIBOR), SBP rate and the spread margin of the financial institution.
20. Main Energy meter and electronic recorder for continuous recording of readings will be provided by NTDC at its own cost.
21. Any other assumptions that are not expressly stated herein but are identified at the time of finalization of EPA between Project Company and the Power Purchaser may lead to changes in the Reference Generation Tariff.
22. The payments to Workers Welfare Fund and Workers Profit Participation Fund have not been accounted for in the Project budget and have been assumed to be reimbursed at actual by the Power Purchaser.
23. Bonus will be shared between the power seller and buyer as per the RE Policy.
24. In the tariff no adjustment for certified emission reductions has been accounted for. However, upon actual realization of carbon credits, the same will be distributed between the power purchaser and the power producer in accordance with the government policy, as amended from time to time;
25. The tariff will be applicable for a period of twenty years (20) from the commencement of commercial operations;

SECTION-12

BENCHMARK ENERGY TABLE

The Benchmark Energy Table and Complex Power Curve are used by the Power Purchaser as a means of estimating the performance of the Project. These provide a benchmark for the energy to be produced by the Project at a given wind speed. The payments to the Project Company for the energy produced as well as the coverage provided to the Project against wind speed variability risk will be based on these tables and the same will be attached as schedules of the EPA. The said tables also form the basis of payment to the Project Company against Non-Project Missed Volume (as defined under the EPA). NEPRA is therefore requested to approve the Benchmark Energy Table and Complex Power Curve provided here in order for the same to be appended as schedules of the EPA.

Monthly net energy yield at actual wind conditions with energy losses is shown in below Table;

Months	Wake Reduced Energy [MWh]	Availability	Turbine Performance	Electrical	Environmental	Curtailment	Total Loss	Net Energy [MWh]
Jan	2,190	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	2,017
Feb	2,700	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	2,486
Mar	3,132	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	2,884
Apr	3,584	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	3,300
May	7,693	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	7,084
Jun	4,622	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	4,256
Jul	6,351	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	5,848
Aug	5,055	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	4,655
Sep	3,617	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	3,331
Oct	2,107	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	1,940
Nov	2,282	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	2,101
Dec	2,987	5.0%	0.5%	2.0%	0.6%	0.0%	7.9%	2,750
	46,320	**5.0%**	**0.5%**	**2.0%**	**0.6%**	**0.0%**	**7.9%**	**42,651**

Monthly energy yield (Actual wind condition)
Source: WRA

Monthly net energy yield at P50, P75, P90 and P99 for actual wind condition is shown in below Table;

Month	Uncertainty [%]	PoE [MWh/a] 50%	75%	90%	99%
Jan	15.5%	2,017	1,806	1,617	1,291
Feb	15.5%	2,486	2,227	1,993	1,591
Mar	15.5%	2,884	2,583	2,312	1,846
Apr	15.5%	3,300	2,956	2,646	2,112
May	15.5%	7,084	6,344	5,679	4,534
Jun	15.5%	4,256	3,812	3,412	2,724
Jul	15.5%	5,848	5,238	4,688	3,743
Aug	15.5%	4,655	4,169	3,732	2,979
Sep	15.5%	3,331	2,983	2,670	2,132
Oct	15.5%	1,940	1,738	1,555	1,242
Nov	15.5%	2,101	1,882	1,685	1,345
Dec	15.5%	2,750	2,463	2,205	1,760
		42,651	**38,200**	**34,194**	**27,300**

PoE - Monthly net yield (Actual wind condition)
Source: WRA

Monthly net energy yield at benchmark wind conditions with energy losses is shown in below Table;

Months	Wake Reduced Energy [MWh]	Availability	Turbine Performance	Electrical	Environmental	Curtailment	Total Loss	Net Energy [MWh]
Jan	2,211	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	2,033
Feb	2,141	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	1,969
Mar	2,605	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	2,395
Apr	4,514	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	4,150
May	7,272	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	6,686
Jun	7,877	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	7,243
Jul	6,575	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	6,045
Aug	7,205	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	6,625
Sep	4,482	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	4,121
Oct	1,351	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	1,242
Nov	1,173	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	1,079
Dec	2,018	5.0%	0.6%	2.0%	0.6%	0.0%	8.1%	1,855
	49,424	**5.0%**	**0.6%**	**2.0%**	**0.6%**	**0.0%**	**8.1%**	**45,443**

Monthly energy yield (Benchmark)
Source: WRA

Monthly net energy yield at P50, P75, P90 and P99 for benchmark wind condition is shown in below Table;

Month	Uncertainty [%]	PoE [MWh/a] 50%	75%	90%	99%
Jan	13.0%	2032.93	1854.69	1694.28	1418.20
Feb	13.0%	1968.56	1795.98	1640.64	1373.30
Mar	13.0%	2395.19	2185.20	1996.20	1670.92
Apr	13.0%	4150.44	3786.56	3459.06	2895.41
May	13.0%	6686.31	6100.11	5572.51	4664.47
Jun	13.0%	7242.58	6607.61	6036.12	5052.54
Jul	13.0%	6045.45	5515.43	5038.40	4217.40
Aug	13.0%	6624.71	6043.91	5521.17	4621.50
Sep	13.0%	4121.02	3759.72	3434.54	2874.89
Oct	13.0%	1242.19	1133.28	1035.27	866.57
Nov	13.0%	1078.53	983.97	898.87	752.40
Dec	13.0%	1855.47	1692.80	1546.39	1294.40
		45,443	41,459	37,873	31,702

PoE - Monthly net yield (Benchmark)
Source: WRA

SECTION-13

Environment and Social Responsibility

13.1 GENERAL

As per the requirements of Section 12 of Pakistan Environmental Protection Act (PEPA), 1997, Burj Wind Energy (Private) Limited (the "**Project Company**" or "BWE") has completed the Initial Environmental Examination ("**IEE**") report for 14MW wind power project (the "**Project**") in Gujju (the "**Project Site**"). In order to determine the impact on environment due to installation of a wind farm in the area, a detailed and thorough assessment was carried out. BWE engaged ECTECH Environment Consultants for a review of environment related issues of the Project.

The comprehensive IEE report also highlights the policy, legal, and administrative framework applicable on the Project. The methodology for anticipating environmental impacts during construction and operational phases was also evaluated. In addition, potential (Unmitigated) environmental, health, and safety impacts were also studied thoroughly.

The Project Site for the proposed wind farm is located at a distance of approximately 80 km along the National Highway from Karachi to Hyderabad. Thus it is located well away from the main populated areas of Karachi, where development infrastructure is not available and population density is low.

Although wind turbines can pose a safety hazard for low-flying aircraft, the Civil Aviation Authority of Pakistan ("**CAA**") has a detailed code that specifies the maximum height of structures that are allowed in the vicinity of commercial airports. The proposed wind turbines meet the CAA safety standards and will not interfere with aircraft using the Karachi airport.

The key environment related issues identified for detailed evaluation were;

- Collisions of migratory birds /avian impact
- Noise
- Health and safety
- Shadow
- Visibility
- Atmospheric emissions
- Clearing of land for road and building construction
- Delivery of equipment 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
- Solid waste management

Based on the study, it was concluded that the intensity of all possible impacts varies between minor to medium, and Project activity has no probable environmental degradation in the Project area.

13.2 THE SITE

13.2.1 General

The Project Site is a barren tract of land with small scanty bushes scattered here and there. Human settlements in the form of small villages (Goths) are situated far off from the Project Site. There is no industry near or around the Project Site. The Site is barren whereas some small bushes are also found. There are no endangered habitats, parks, forests, wildlife, estuaries, historical or cultural resources within the area of influence of the Project. There is no industry and commercial activity around the Project Site, neither any resettlement nor any land acquirement is involved.

Topographically, Sindh is 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. All the wetlands including Mancher Lake, Keenjhar (Kalri) Lake, Drig Lake, Haleji Lake, Jubho Lagoon, Nurri Lagoon, and Deh Akro, are situated far beyond from the area of influence of the Project Site, hence Project has absolutely no influence on these wetlands.

13.2.3 Geological Setting

The prevailing geological conditions in the region are the result of extensive inundation, depositions, coastal movements, and erosions over a long period of time in the geological ages. Most of the Sindh is covered either by recent alluvium or wind-borne sand. 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 Karachi-Jati-Allah Bund Fault. The main faults between Karachi and Rann of Kutch are generally easterly oriented 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 year 1668 at Pipri near Steel Mill, which is only 60 km away from Karachi and 50 km away from the Project Site. Project Site doesn't fall under the fault line hence it is safe from earthquake effects.

13.2.4 Soils

The land in this area consists of 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.

13.2.5 Temperatures

The Province of Sindh is situated in a subtropical region; it is hot in 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, centered on Jacobabad), Wicholo (the middle region, centered on Hyderabad), and Lar (the lower region, centered on Karachi). The thermal equator passes through upper Sindh. The highest temperature ever recorded in Mohenjodaro (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 34 C and 21 C.

13.2.6 Humidity

July, August and September are the most humid months in the area, whereas May and June are the least humid months.

13.2.7 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.

13.2.8 Ambient Air Quality on the Project Site

Environmental monitoring on site ambient was carried out to assess the state of environment on the Project Site. Environmental monitoring was carried out for gases including Sulphur Dioxide (SO2), Nitrogen Oxides (NOx) and Carbon Monoxide (CO); Particulate Matter (PM) and Noise levels. Since there are no sources of common air pollutants including mainly Sulphur Dioxide (SO2), Nitrogen Oxides (NOx), and Carbon Monoxide (CO), therefore there is no possibility of pollutants to be present in the ambient air.

13.3 POLLUTION

The Project will save a lot of Green House Gases emissions as compared to power plants based on fossil fuels and Project qualifies for earning Carbon Credits. Since the Project will be clean from the environmental 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**"), Pakistan; under the Pakistan Environmental Protection Act-1997 therefore, it also provides safeguard against pollution from the Project activity.

It is expected that during construction and operations, there will be some environmental pollution. Sponsors are determined to take all the necessary measures according to the guidelines of 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, and National Environmental Quality Standards for Noise ("**NEQSN**") 2010 to handle such specific environmental pollutants. It is also expected that solid wastes and sewage will also be generated especially during construction, which will be disposed off in an environmentally sustainable manner as this has been specified in the EPC contract.

13.4 COLLISIONS OF MIGRATORY BIRDS /AVIAN IMPACT

One of the significant issues for installing wind masts can be related to the migratory birds' and their collision with the wind turbines and associated infrastructure. According to a survey conducted by WWF in 2009; the quantum of birds in and around Keenjhar Lake and Lake Haleji has reduced drastically. By nature, local birds avoid wind turbines by flying around them, and migrating birds tend to fly well above the height of wind turbine. These birds have tendency to fly at an altitude of 400 to 500 meters and turbine blades will be at around 80 meter height from the ground

level, hence, there is no chance of collision with the wind towers & turbine blades at the Project Site. No special bird species or nests are reported in the Project area.

Usually birds make their nest in the vacuums and holes in towers. Checking of vacuums and holes in the towers will be carried out regularly so as to avoid nesting facility of any birds, whereas underground power and communication cables will be installed to further reduce the chances of avian collision. In order to provide birds a safe passage to the Project Site and avoiding avian collision, distance between two wind turbines will be about 300 meters.

There are no known wild reserves in the area of influence of the Project so the chances of wildlife fatalities are very limited. However, cattle can safely and conveniently graze around. Therefore the severity is categorized as low.

13.5 NOISE

Noise of wind turbine and background noise level increases with the increase in wind speed. However, noise level is at a low level when wind turbines cut-in. Noise generation from most of the wind turbines (running at full swing) is estimated to be less than 45dB(A). With the increase in distance between the source and receptor, the noise level decreases. No potential threat was established. Noise of wind turbines will be kept within the parameters given in NEQSN.

13.6 SHADOW/FLICKERING EFFECT

Rotating rotor blades make moving shadows during sun shine and normally affect the visibility close to the turbine, whereas shadow may spread over long distance on a sunny day, which may be inconvenient for the people around. Correct positioning of wind turbines, and distance from dwellings will suffice to avoid this problem. The distance between the proposed wind farm Site and the nearest population village (Goth) is about 3 km. Therefore, this issue will not require any special attention.

13.7 VISIBILITY

Wind turbines comprise of large structure machines. Surveys conducted indicate that by and large, majority of the people were in favor of development of wind energy. The proposed wind farm will change the landscape of the area. The residents of small villages (Goths) scattered remotely around the Project Site often pass by un-noticed. Local residents are used to the visibility of tall tower as Project Company has already installed its 80meter tall wind mast at the Site. Therefore, the new wind farm will not create unpleasant situation for them. Under the given situation severity of this issue is categorized as low.

13.8 ATMOSPHERIC EMISSIONS

Air emissions will increase during construction due to movements of vehicles and disturbance of soil during construction work including construction of roads and foundations. Dust suppression methods will be employed to keep the atmospheric emissions under control. Therefore, air emissions will not pose any danger to the environment. 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. In addition, speed limit of vehicles in the Project Site will also help to keep the dust emissions under control. Therefore, severity of this factor is categorized low.

13.9 LAND CLEARING FOR ROADS AND BUILDING CONSTRUCTION

Clearing of the Site from bushes and shrubs will be restricted to the foundation sites and along the surveyed right-of-way. In order to avoid potential destruction of flora mostly shrubs and bushes, wide roads will be developed during construction, which will accommodate heavy traffic that is expected for the delivery of equipment. Moreover, indiscriminate removal of bushes and shrubs will be avoided and will only be restricted to those areas where civil work is required. The severity of this issue is categorized as low.

The main types of waste that will be generated during construction of the Project are waste oil, camp waste, medical waste, demolition waste, packing waste, and excess construction material; hence every effort will be made to minimize the waste generated during construction. A waste disposal site will also be developed, containing a lined landfill and a burn pit. Furthermore, an inventory of all waste generated during the construction will be maintained. Project will initiate waste-minimization program as well. In addition, project management team would be made responsible for all waste generated by the Project until its final disposal.

13.10 TRANSPORTATION ROUTE OF EQUIPMENTS AT SITE

The imported equipment will be transported from Port Qasim to the Project Site. Of the two different modes of transporting the equipment from Port Qasim to site (rail and road), the road route is preferable on the basis of technical limitations. It is also expected that during construction of the Project, there will be an increase in the vehicle movements on public roads. Presently available roads have stable infrastructure in place to accommodate the expected traffic. The severity of this issue can be categorized as moderate to low.

13.11 FOUNDATION CONSTRUCTION -TOWER AND CRANES PLATEFORM

Approximately 20m x 30m area will be required to level and compact for the cranes at each turbine site. Heavy duty cranes will be used to lift the approximately 40-45 tons of wind turbine generator. During construction of foundation for towers and crane platform, there will be soil disturbance and relocation. Topsoil will be stripped off and stored separately whereas subsoil will be kept separate during excavation for wind turbines foundation. After completion of the installation of wind turbines, the subsoil will be used as backfill and later stripped off topsoil will be put back, which completes the rehabilitation work regarding backfilling of the site.

It is also expected that there will be some damage to vegetation and increase in heavy traffic like heavy duty trucks and heavy earth moving machines. The best use of displaced soil will be its usage as road surfacing material. Soil admixing can also 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 will be implemented. The severity can be categorized as moderate to minimal.

13.12 HISTORICAL HERITAGE

There is no site of historical importance in the vicinity of the Project Site. Since there is no such site, therefore there is no need for any mitigation measure.

13.13 CONCLUSION

The proposed Project is not likely to have any significant adverse environmental impacts, which could be irreversible or could affect sensitive eco-system, requires involuntary resettlement, or has an unprecedented impact. The Project has no gaseous and other emissions. Sewerage will be treated and reused at the Project Site for sprinkling on the unpaved site to reduce fugitive dust. The Project is also not located in the vicinity of sensitive location of national importance. Therefore, Project falls under Category "B" according to "Pakistan Environmental Protection Agency, Review of IEE & EIA Regulations 1997/2000 (revised)".

Project has submitted IEE to Sindh Environmental Protection Agency and will get No Objection Certificate ("NOC") in due course.

13.14 SOCIAL RESPONSIBILITY

Project Company always regards corporate social responsibility as an important force in building a harmonious society. It also believes in paying full attention to human factors, exercising environmental protections and conservation, increasing employment, and helping build the community.

Being a responsible corporate citizen, Project Company firmly believes in giving back to the communities it operates in and provides support and encouragement to the people who need it the most. Every year it supports numerous educational, sporting, and charity programs designed to help a wide range of people. Sponsors have always shown commitment and support for public health and education and have participated in awareness initiatives.

The people of the area believe that installation of the power plant in their area will open up numerous employment opportunities, especially during construction, which in turn follows a chain of indirect socio-economic benefits. Either directly or indirectly, a reasonable number of local people will get employment and business from the installation of the Plant, e.g. shop keepers, traders, suppliers, contractors, transporters, technicians etc. Operations of the Plant will also provide job opportunities especially to the local people. Poverty alleviation, though at minor scale, will be another benefit besides meeting power shortage in Pakistan.

Project Company is committed to develop a Corporate Social Responsibility Plan to ensure that its daily activities adhere to a set of morals and respect for people and the environment. Project Company seeks to implement paperless environment by trying to print what is strictly necessary.

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