BEFORE
THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
(NEPRA)

APPLICATION FOR A GENERATION LICENSE FOR WIND POWER GENERATION FACILITY

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

ON BEHALF OF

ARTISTIC WIND POWER (PRIVATE) LIMITED

FOR NEPRA'S GRANT OF GENERATION LICENSE FOR
ARTISTIC WIND POWER (PRIVATE) LIMITED

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

AT

JHIMPIR, DISTRICT THATTA, PROVINCE OF SINDH, PAKISTAN

DATED: May 24, 2016

ARTISTIC WIND POWER (PRIVATE) LIMITED

ADDRESS : PLOT NO. 4 & 8, KORANGI INDUSTRIAL AREA, KARACHI, PAKISTAN
PHONE # : +92 (21) 111 263 646
FAX # : +92 (21) 3570 5446

Statement of Authorized Representative

ARTISTIC WIND POWER (PVT) LTD.

Registered office : Plot 4 & 8, Sector-25, Korangi Industrial Area, Karachi-74400 Pakistan
Phone : 92-21-111 016 016 Fax : 92-21-35075446 Email : energy@artisticmilliners.com

May 24, 2016

THE REGISTRAR

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

SUBJECT: **APPLICATION FOR THE GRANT OF GENERATION LICENSE ON BEHALF OF ARTISTIC WIND POWER (PRIVATE) LIMITED IN RELATION TO ITS 50MW WIND POWER GENERATION PROJECT TO BE LOCATED AT JHIMPIR, DISTRICT THATTA, PROVINCE OF SINDH**

I, **RAFIQUE KHANANI,** being the duly authorized representative of ARTISTIC WIND POWER (PRIVATE) LIMITED (a company incorporated under the laws of Pakistan with its registered office located at Plot No. 4 & 8, Korangi Industrial Area, Karachi, Pakistan) hereby, pursuant to Rule 3 of the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, apply to the National Electric Power Regulatory Authority (**NEPRA**) for the grant of the Generation License to ARTISTIC WIND POWER (PRIVATE) LIMITED.

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

We are submitting with this Generation License Application the required generation license fee through a non-refundable pay order in the amount of PKR 286,640/- (Pakistani Rupees Two Hundred Eighty Six Thousand Six Hundred and Forty) dated May 24, 2016 drawn in favor of NEPRA.

Sincerely,

For and on behalf of ARTISTIC WIND POWER (PRIVATE) LIMITED

.....

RAFIQUE KHANANI

AUTHORISED REPRESENTATIVE

Bank Draft/ Pay Order

Executive Summary

Executive Summary

This application is for *Grant of Generation License* filed by *Artistic Wind Power (Pvt.) Ltd* (the "Project Company") for its 50 MW Wind Power Project (the "Project") in Jhimpir Sindh Pakistan.

Artistic Wind Power (Pvt.) Ltd (AWPPL) is a local (Pakistani) organization having planned a 50 MW wind power project in Jhimpir. The land has been allocated by Government of Sindh in the wind corridor of Jhimpir, Pakistan.

This application document is a package of information as per Section-5 of Article-3 of NEPRA Licensing (Application & Modification Procedure) Regulation, 1999 notified by National Electric Power Regulatory Authority (NEPRA).

The document is comprised of following Annexure:

Annexure – 01:	Prospectus
Annexure – 02:	Applicant Experience
Annexure – 03:	Board Resolution
Annexure – 04:	Certificate of Incorporation
Annexure – 05:	Article of Association
Annexure – 05:	Memorandum of Association
Annexure – 06:	GW/HC Certificate of Confirmation
Annexure – 07:	Lender's Expression of Interest (ADB, IFC & Bank Al-Habib)
Annexure – 08:	Profile of EPC Contractor
Annexure – 09:	Feasibility Study
Annexure – 10:	Correspondence with NTDC in respect of Grid Interconnection Study
Annexure – 11:	Approval for Initial Environmental Examination
Annexure – 12:	CV of Senior Management
Annexure – 13:	Information for Schedule-I of License
Annexure – 14:	Information for Schedule-II of License
Annexure – 15:	Cash Balances of AWPPL

Back Ground

Generation License Application

BACKGROUND TO GENERATION LICENSE APPLICATION

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

a. Issuance of "Letter of Intent"

ARTISTIC WIND POWER (PRIVATE) LIMITED (a company duly organized and existing under the laws of Pakistan, with its office located at Plot No. 4 & 8, Korangi Industrial Area, Karachi) (the **Project Company**), was issued a LETTER OF INTENT by the Directorate of Alternative Energy, Energy Department Govt. of Sindh, (DAE, GOS) on September 01, 2015 vide its letter No; DAE/Wind/94/2015 (the **LOI**) to develop and establish an approximately 50 MW wind farm project to be located at Jhimpir, Thatta (**Project**). The Project Company has also submitted a bank guarantee for an amount equal to US$ 25,000. The LOI is valid until February 28, 2017.

b. Submission of the Feasibility Study

Pursuant to the relevant provisions of the Policy for Development of Renewable Energy for Power Generation 2006 (the **RE Policy 2006**) and the LOI, the Project Company completed the detailed technical feasibility study for the Project and the Project Company submitted the same to DAE, GOS on February 22, 2016. A copy of Project Feasibility Study is attached hereto as ANNEXURE 09 for NEPRA's perusal.

c. Submission of Initial Environmental Examination

The Project Company hired consultants, Renewable Resources (Pvt.) Limited, who completed the initial environmental examination for the Project (the **Initial Environmental Examination**) and the Project Company submitted the same to the Sindh Environmental Protection Agency (the **SEPA**) on January 11, 2016.

After careful review and analysis of the Initial Environmental Examination, the SEPA accorded its approval for the Project through its decision Ref: EPA/2016/01/19/IEE/021 dated March 17, 2016 (the **IEE Approval Decision**). A copy of the IEE Approval Decision is attached hereto at ANNEXURE 11 for NEPRA's perusal.

d. Grid Interconnection Studies

Grid Interconnection Study is being carried out by National Transmission and Despatch Company (NTDC). As the study is being undertaken by NTDC itself, there is no requirement of an approval of the Grid Interconnection Study. The Project Company has already shared the relevant technical data with NTDC in order to assist NTDC in carrying out the relevant studies

(refer to Annexure 10 for Project Company's correspondence with NTDC in respect of the Grid Interconnection Study).

Grid Interconnection Studies shall be provided to NEPRA, once it is finalized by NTDC.

e. **Location of Project & Lease of Land**

The Project site is located near the Village Jhimpir, District Thatta, Karachi; a city of the southern province Sindh. The aerial distance between the Project site and Port Qasim is about 59.1 km and the road distance of site from Port Qasim is 122 km. The distance between Project site and the coastal line of Arabian Sea is approximately 80 km. The size of the whole wind farm is 462 acres. The north latitude of the site is 24.98 N, and the east longitude is 67.88 E. The altitude of the site is 40m~70m above sea level. The monsoon from the Indian Ocean, which is stable in its direction and high in quality, brings rich wind energy resource to the site. Project land has been allocated to company by Land Utilization Department, Government of Sindh (the GoS) through letter no; 01-46-2015/S0-VII/29 dated 15-01-2016.

f. **Brief Technical Synopsis of the Project**

The Project shall have an installed capacity of 50 MW with 20 wind turbine generators (WTG) of 2.5 MW each. There shall be a substation of 132 KV, which shall dispatch electricity as per Interconnection Grid Scheme, finalized by NTDC.

g. **Tariff**

DAE, GOS has issued its recommendation to NEPRA for the award of upfront tariff to the AWPPL. Upon issuance of the Generation License and award of the upfront tariff, the Project Company would execute the Energy Purchase Agreement with the power purchaser and aims to achieve financial close for the Project within 12 months of granting of tariff. The expected commercial operations date of the Project is to be 18 month from the financial close.

Request for grant of a generation license

Based on the matters provided in Sections a, b, c, d, e, f and g above whereby the Project Company, on its part, has undertaken and completed all activities required for procurement of approvals of the relevant matters from various stakeholders, it is submitted that the requirements of the regulatory process for applying to NEPRA for grant of a generation license to the Project Company are complete.

Annexure 01 – Prospectus

PROSPECTUS

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

Brief of prospectus including salient features of Artistic Wind Power (Private) Limited is as under.

Applicant – Artistic Wind Power (Pvt.) Limited

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

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

Sponsor – Artistic Milliners (Pvt.) Limited

The primary sponsor financing the Project is Artistic Milliners (Private) Limited (which is one of the leading textile sector undertakings of Pakistan having a variety of business divisions e.g. spinning, weaving, denim, garments etc.).

Artistic Milliners group of companies was established in 1949, and is today one of Pakistan's leading business houses and one of the largest premium quality denim cloth and finished products mills in the country. The company is engaged in the manufacturing and trading of denim, garments and fabrics and has the distinct privilege of being one of the few mills that are completely export oriented.

The group has its roots in textile trading and has since expanded to become a complete vertically integrated textile set up with the aim of providing high-end customers with premium quality of denim fabrics and garments.

Operating on an area of 165,922 sq. m and employing 7,650 people, Artistic Milliners has the ability to cater to specific client needs with package deals such as product development at source,

design support, shorter lead times, on-time deliveries and warehousing facilities. Artistic's latest undertaking is the new state of the art denim mill AM-5 which will take the production capacity to 36 million meters per annum.

Today Artistic Milliners has total assets of over PKR 22.07 billion (US$ 218 million: 2015) with an annual turnover of over PKR 25.04 billion (US$ 246.9 million: 2015).

Renewable Power: Artistic Milliners is developing another Wind Power Project of 49.3MW, which is under advanced stage of development, named as 'Hartford Alternative Energy (Pvt.) Limited'.

Environmental Impact

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. Wind Power Project is a green energy Project and, therefore, there is no major long lasting social or environment impact foreseen. 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 Area does not fall under any sensitive, protected area. No threatened / Near-Threatened species of wildlife was recorded in the Project Area. There are no settlements in and around the project area. Other settlements are outside from the wind farm site at distance of approximately 10 Kilometers therefore no disturbance to the inhabitants is foreseen. 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. Regarding bird mortality due to collision, it is found that birds landing area is around 10 km away from the wind farm and the migratory birds are not seen in the wind farm area and there are minimal to zero chance of bird collision from these wind turbines. Noise impacts will be less than 70 DB (A) which is within the range as per National Environmental Quality Standards (NEQs) of Pakistan.

After careful review and analysis of the Initial Environmental Examination, the SEPA accorded its approval for the Project through its decision (Ref: EPA/2016/01/19/IEE/021) dated March 17, 2016 (the IEE Approval Decision). A copy of the IEE Approval Decision is attached for NEPRA's perusal.

Social Impact

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.

Proposed Investment

The Total Project Cost of US$ 109 Million (United States Dollars One Hundred and Nine Million) is to be financed in a debt to equity ratio of 75:25, which is in accordance with the RE Policy 2006.

DEBT

With regards to debt financing for the Project, the Project Company has already signed financing term sheets/ Expression of Interest with a consortium of leading local banks (same as for the previous project) along with International Finance Corporation & Asian Development Bank for the foreign portion of the debt financing.

EQUITY

Based on the Debt to Equity ratio of 75:25, the equity required to be injected by Artistic Milliners (the **Equity**), being the primary sponsor, amounts to USD 27 Million. The Sponsor has already committed the equity in respect of the Project and such arrangements have been agreed with the Mandated Lead Arrangers.

Salient Features of the Facility

Project Information

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

Project Site

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

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

The Site is located in Jhimpir, District Thatta, Sindh, which is one of the most promising areas where wind power projects can be viably installed. The Project's wind farm site is located 122 km from Port Qasim Karachi in the East direction with easy road access. Nooriabad Industrial

Estate (situated on the M9 motorway connecting Karachi and Hyderabad) is 35 Km from the Wind Farm.

Land Description of the Project Site:

Total Land Area: 462 Acres		
	Latitude (N)	
	24.997024	
	24.958109	
	24.968220	
	24.988781	
	24.995899	
	24.959917	
	24.966988	
	24.990102	

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

The proposed wind farms lies on a flat inland area with hard and rocky ground conditions. The site would be categorized as inland wind development as opposed to offshore/coastal wind project development (which is more difficult to develop due to tides and soft subsoil clay). The general terrain at the site can be described as simple and flat terrain. Internal access roads are the roads connecting the single wind turbine locations with each other and the external access roads and grid station would be constructed during the civil works of the wind farm.

Wind Farms Layout at Project Site

The wind farms site is in long and narrow in shape, the topography is relatively flat and the elevation above sea level is approximately 40-70m. There is little vegetation at the wind farm site.

Topographical and Geological Conditions at Project Site

Topographical conditions:

The Site is on a plain area at an elevation of 40-70m, which is generally flat, but a bit higher on the west and lower on the east. The landform at wind farm sites is mainly of pediment and the vegetation there is less developed.

Geological conditions:

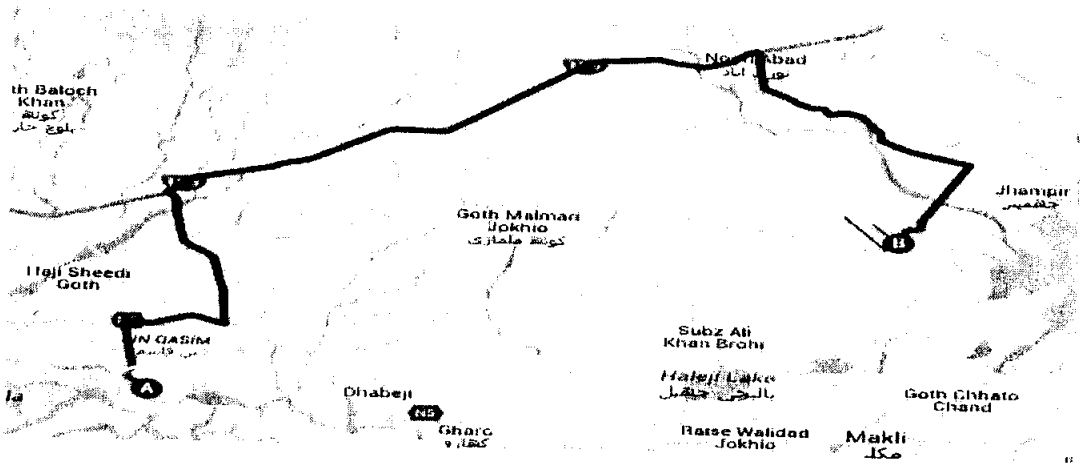
The planned wind farm sites are covered mainly by marine alluvium of Holocene and recent weathered deposit, and underlain mainly by Tertiary limestone. The bedrock in the site is generally outcropped. As the WTG is a high-rise structure, it has a high gravity center and should sustain high loads, large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

Hydrology:

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

Site Accessibility

The Project is located on Thatta-Bannu Khan Road heading towards Jhimpir from M-9 Khi-Hyd highway. The machinery for the Project will be routed from Port Qasim Karachi which is on the eastern edge of the city and closer to the Project site, for which the transporter has to travel to Jhimpir from Karachi port through populated areas. The distance of Project site from Karachi is 130 km. The proposed route to the Project site is given in the below Illustration.



Telecommunication at project site

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

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

Availability of Semi-Skilled and Skilled Labor

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

General Information

(i).	Name of Applicant/Company	Artistic Wind Power (Pvt.) Limited
(ii).	Registered/Business Office	Plot No. 4 & 8, Korangi Industrial Area, Karachi, Pakistan
(iii).	Plant Location	Jhampir, Nooriabad, District Thatta, Sindh
(iv).	Type of Generation Facility	Wind Power

Wind Farm Capacity & Configuration

(i).	Wind Turbine Type, Make & Model	GOLDWIND GW 121/2500
(ii).	Installed Capacity of Wind Farm (MW)	50 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	20 x 2500 KW
(iv).	Capacity Factor	Upto 35%
(v).	Debt to Equity Ratio	75:25
(vi).	Total Power Purchaser	US$ 109,177,771 (United States Dollars One Hundred Nine Million One Hundred Seventy Seven Thousand Seven Hundred and Seventy One)
(vii).	Dispatch / Power Purchaser	Central Power Purchasing Agency (Guarantee) Limited

Wind Turbine Details

(i).	Wind Turbine Type, Make & Model	GOLDWIND GW 121/2500
(ii).	Installed Capacity of Wind Farm (MW)	50 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	20 x 2.5 MW
(iv).	Number of blades	3
(v).	Rotor diameter	121 m
(vi).	Hub Height	90 m
(vii).	Generator Voltage	690 V
(viii).	Cut-in wind speed	3 m/s
(ix).	Cut-out wind speed	22 m/s
(x).	Survival wind speed	52.5 m/s

Expected Date of Financial Close:
Within 12 months of granting of tariff
Expected COD:
18 month from the financial close

Annexure 02 – Applicant Experience

Experience of the Applicant

Introduction

Artistic Milliners (Private) Limited is the Sponsor of the Project Company (the **Sponsors**) with complete shareholding in the Project Company. ***The current Project is the second wind power project being set up by the same Sponsor simultaneously along with their first 49.3 MW wind power project i.e. Hartford Alternative Energy (Private) Limited, which is expected to achieve Financial Close in July, 2016.***

Artistic Milliners (Private) Limited

Artistic Milliners (Private) Limited is a vertically integrated composite textile company established since 1949. The manufacturing facilities of Artistic Milliners include spinning, dyeing, denim, weaving, finishing and garment manufacturing. \

The Spinning unit is equipped with state of the art machinery from Germany and Switzerland and is capable of producing high quality yarn to assure the production of premium denim fabrics. Product range includes ring spun, open end, core spun lycra and multi count and multi twist yarn.

The Denim unit produces approx 76 million meter of denim fabric per annum from 358 looms being the largest Denim manufacturing facility in Pakistan. The Garment unit has capacity of 16 Million pieces per annum.

Artistic Milliners maintains ISO 9001 quality policy and operates in accordance with International and Pakistani laws and maintain strict compliance for health & safety.

The company has 11 units situated at three different locations and exports 100% of the output.

Unit	Installed Capacity
Spinning	56,760 Spindles
Weaving	380 looms including Air Jet Looms with capacity up to 76 Mn meters p.a.
Stitching	Approx. 16 Mn pcs p.a.

Artistic Milliners produces denim fabrics and garments for the following global brands:

Levi's ESPRIT

MANGO PACIFIC JEANS

INDITEX MARKS SPENCER

Bershka

GAP H&M

Key Financials
Financial Strength of the Sponsor is shown below (refer to **Annexure 08** for detailed financials of the Artistic Milliners (Private) Limited).

Artistic Milliners	2015	2014	2013
Key Financials	PKR (000)	PKR (000)	PKR (000)
Turnover	25,037,058	21,345,314	14,829,513
Net Profit	3,389,408	2,589,549	1,850,582
Assets	22,335,691	20,790,377	13,803,525
Net Worth	12,084,838	8,844,420	6,416,007

Sponsor's Power Sector Experience
Artistic Milliners is already undertaking a 50 MW Wind Project under the name of Hartford Alternative Energy (Private) Limited for which financial close is expected in July 2016. The EPC & O&M contracts after a competitive bidding process have been signed with Hydro China & GE.

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

In addition, the curriculum vitae of the following individuals currently engaged by the Project Company are attached as **Annexure 12**:

S. No.	Name of Individuals	Position
1.	Mr. Yaqoob Ahmed	Chief Executive
2.	Mr. M. Rafique Khannai	Chief Financial Officer & Company Secretary
3.	Brig. M. Naeem	Project Director
4.	Mr. Irfan Bashir	Senior Manager Finance
5.	Mr. M. Asad Ullah	Deputy Project Manager

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

Technical Advisors and Owner's Engineers
The Project Company has appointed Renewable Resources – RE2 Pakistan, as technical advisors and 'Owner's Engineers' in respect of the Project.

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

Legal Adviser
HAIDERMOTABNR & CO. has been selected by the Project Company to provide legal support on all legal aspects of the Project including Project documentation, regulation and financing matters. HaidermotaBNR & Co. has been actively involved in the power sector and other projects and has advised various project companies / sponsors, lenders and the Government of Pakistan on various transactions and matters. It is ranked by Chamber & Partners as a "*Band 1*" firm in Pakistan for Projects, Banking & Finance and Corporate & Commercial.

Annexure 03 – Board Resolution

ARTISTIC WIND POWER (PVT) LTD.

Registered office : Plot 4 & 8, Sector-25, Korangi Industrial Area, Karachi-74400 Pakistan
Phone : 92-21-111 016 016 Fax : 92-21-35075446 Email : energy@artisticmilliners.com

EXTRACT OF THE MINUTES OF THE MEETING OF THE BOARD OF DIRECTORS OF THE COMPANY HELD ON MAY 23, 2016

"**RESOLVED THAT** the Company do file an application to the National Electric Power Regulatory Authority for seeking a generation license for the 50 MW wind power project to be constructed at Jhimpir, pursuant to and under Sections 7(2)(a) and 15 of the NEPRA Act read with other enabling provisions of the NEPRA Act, the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations 1999, National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, and in accordance with the Policy for Development of Renewable Energy for Power Generation 2006 and to enter into any subsequent modifications, and in relation to the foregoing, enter into and execute all required documents, make all filings and pay all applicable fees, in each case, of any nature whatsoever, as required."

"**FURTHER RESOLVED THAT** in respect of filing of application for Generation License (including any subsequent modifications) for submission to National Electric Power Regulatory Authority, **MR. YAQOOB AHMED** (Director) and **MR. RAFIQUE KHANANI** (Chief Financial Officer and Company Secretary) be empowered and authorized for and on behalf of the Company to:

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

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

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

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

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

"**AND FURTHER RESOLVED THAT MR. YAQOOB AHMED (Director) and MR. RAFIQUE KHANANI (Chief Financial Officer and Company Secretary),** be and are hereby authorized to delegate all or any of the above powers in respect of the forgoing to any other officials of the Company as deemed appropriate.

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

Rafique Khanani
Company Secretary

ARTISTIC WIND POWER (PVT) LTD.

Annexure 04 – Certificate of Incorporation

A011217

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

SECP

COMPANY REGISTRATION OFFICE, KARACHI

Company Registration Office Karachi

CERTIFICATE OF INCORPORATION

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

Corporate Universal Identification No. **0095853**

I hereby certify that **ARTISTIC WIND POWER (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 **Twenty Sixth** day of **October,** Two **Thousand** and **Fifteen.**

Incorporation fee Rs. **2,500/=** only

(Sidney Custodio Pereira)
Joint Registrar of Companies
Karachi

2/11/15

Annexure 05 – Article of Association

The Companies Ordinance, 1984
Private Company Limited by Shares

ARTICLES OF ASSOCIATION
OF

ARTISTIC WIND POWER (PRIVATE) LIMITED

PRELIMINARY

1. Subject as hereinafter provided, the regulations contained in Table 'A' in the First Schedule to the Companies Ordinance 1984, and other provisions in the Companies Ordinance 1984, shall apply to the Company so far those are applicable to private companies. In case of conflict between the provisions herein contained and the provisions contained in Table A, the provision herein contained shall apply.

DEFINITIONS AND INTERPRETATIONS

2. In these Articles unless there be something in the subject or context inconsistent therewith, words signifying the singular number only, shall include the plural and vice versa and words signifying males only shall extend to and include females and words signifying persons, shall apply mutatis mutandis to bodies corporate.

(a) "Articles" means the Articles of Association as originally framed or as altered from time to time.

(b) "Capital" shall mean the capital of the Company for the time being raised or authorised to be raised for the purpose of the Company.

(c) "Company" means "ARTISTIC WIND POWER (PRIVATE) LIMITED"

(d) "Dividend" includes bonus shares.

(e) "Member" means the member of the Company within the meaning of the provisions of Section 2(1)(21).

(f) "Month and year" shall mean the English calendar month and English calendar year respectively.

(g) "Office" means the registered office of the Company for the time being.

(h) "Ordinance" means the Companies Ordinance, 1984.

(i) "Register" means the register of members to be kept pursuant to Section 147 of the Ordinance.

(j) "Section" means Section of the Ordinance.

(k) "Seal" in relation to a Company means the Common Seal of the Company.

(l) "Shares" shall mean the shares in the capital of the Company.

(m) "Writing" includes printed, lithographed and typewritten or other modes of representing words in visible and legible form.

PRIVATE COMPANY

3. The Company is a Private Limited Company within the meaning of Clause (28) of Sub-section (1) of Section 2 and accordingly:-

   (a) No invitation shall be issued to the public to subscribe for any shares, debentures or debenture-stock of the Company.

   (b) The number of the members of the Company (exclusive of the persons in the employment of the Company) shall be limited to fifty; provided that for purposes of this provisions, where two or more persons hold one or more shares jointly in the Company, they shall be treated as a single member; and

   (c) The right of transfer of shares in the Company is restricted.

CAPITAL

4. The authorised share capital of the Company is such amount divided into such number of ordinary or other kinds / classes of shares as are set out in clause V of the Memorandum of association of the company.

SHARES

5. No shares shall be offered for subscription except upon the terms that the amount payable on application shall be full amount of the nominal value.

6. The shares in the capital of the Company may be issued or allotted in payment or part payment of any property, land, building, machinery, goodwill or goods supplied or any service rendered to the Company and any shares so allotted may be issued as fully paid up and not otherwise.

7. The shares shall be under the control of the Directors who may allot or otherwise dispose of the same as they may think fit.

8. The certificates of title to shares and duplicates thereof when necessary, shall be issued under the seal of the Company, and signed by any two Directors or officers of the Company duly authorised by the 8oard of Directors.

9. Every member shall be entitled to one certificate for all the shares registered in his name or to as many certificates as the Directors may from time to time decide. Every certificate of the shares shall specify the number and denote the number of the shares in respect of which it is issued and the amount paid up thereon.

10. A new certificate in lieu of one defaced, lost or destroyed on proof thereof to the satisfaction of the Directors and on such indemnity as the Directors may deem adequate shall be issued on payment of such fee, not exceeding Rs. 10/- as the directors think fit.

INCREASE, REDUCTION AND RE-ORGANIZATION OF SHARE CAPITAL

11. The Company may from time to time, by ordinary resolution, increase the shares capital by creation of new shares or consolidate, sub-divide or reorganize its capital in such manner as may be provided by law and as may be directed by the resolution passed at such meeting.

12. Subject to the provisions of the Ordinance, all new shares shall, before issue, be offered to such persons as at the date of the offer are entitled to receive notices from the Company of general meetings in proportion, as nearly as the circumstances admit, to the amount of the existing shares to which they are entitled. The offer shall be made by notice specifying the number of shares offered, and limiting a time within which the offer, if not accepted, will

deemed to be declined, and after the expiration of that time, or on the receipt of an intimation from the person to whom the offer is made that he declines to accept the shares offered, the Directors may dispose off the same in such manner as they think most beneficial to the Company. The Directors may likewise so dispose off any new shares which (by reason of the ratio which the new shares bear or shares held by persons entitled to an offer of new shares) cannot, in the opinion of the Directors, be conveniently offered under this regulation.

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

14. The Company may, by special resolution, reduce its share capital in any manner and with, and subject to, any incident authorised and consent required, by law.

TRANSFER OF SHARES

15. No shares can be sold, mortgaged, or otherwise disposed off by any member to a non-member without previous sanction of the Directors.

16. No transfer of any share shall be made or registered without the previous sanction of the Directors.

17. Any member desiring to sell any of his shares must notify to the Directors the number of shares, the name, address and description of the proposed transferee, and if the Directors approve the desired transfer, an entry shall be made in the Register of members on payment of prescribed fee by the transferee and then the transfer shall be deemed to be duly effected.

18. The instrument of transfer of any share in the Company shall be executed both by the transferor and transferee, and the transferor shall be deemed to remain holder of the share until the name of the transferee is entered in the register of members in respect thereof.

19. Shares in the Company shall be transferred in the form prescribed by Table 'A' in First Schedule or in any usual or common form which the Directors shall approve.

20. The transfer books and register of members may be closed during such time as the Directors think fit.

TRANSMISSION OF SHARES

21. The executors, administrators, heirs or nominees, as the case may be, of a deceased sole holder of a share shall be the only persons recognised by the Company as having any title to the share. In the case of a share registered in the name of two or more holders the survivors or survivor, or the executors or administrators of the deceased survivor, shall be the only persons recognised by the Company as having any title to the shares.

22. Any person becoming entitled to a share in consequence of the death or insolvency of a member shall, upon such evidence being produced as may from time to time be required by the Directors, have the right, either to be registered as a member in respect of the share or, instead of being registered himself, to make such transfer of the share as the deceased or insolvent person could have made; but the Directors shall, in either case, have the same right to decline or suspend registration as they would have had in the case of transfer of share by the deceased or insolvent person before the death or insolvency.

23. A person becoming entitled to a share by reason of the death or insolvency of the holder shall be entitled to the same dividends and other advantages to which he would be entitled if he was the registered holder of the share, except that he shall not, before being registered as a member in respect of the share, be entitled in respect thereof to exercise any right conferred by membership in relation to meetings of the Company.

GENERAL MEETING

24. The first Annual General Meeting, shall be held within eighteen months from the date of incorporation of the Company and thereafter once at least in every calendar year and 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.

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25. All general meetings of the Company other than annual general meetings shall be called extraordinary general meetings.

NOTICE AND PROCEEDINGS OF GENERAL MEETINGS

26. Atleast twenty-one day's notice, specifying the place and the day and hour of the meeting along with a statement of the business to be transacted at the meeting, and in case of special resolution, the general nature of that business, shall be sent to (a) every member of the Company (b) any person entitled to a share in consequence of death of a member and (c) to the auditors of the Company in accordance with the provisions of Section 50. Accidental omission to give such notice to or non-receipt of such notice by any member shall not invalidate the proceedings of the general meeting.

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

28. No business shall be transacted at any general meeting unless a quorum of members is present. The quorum of the meeting(s) shall be governed according to the provisions of the Ordinance as applicable to this company.

29. At any general meeting, unless a poll is demanded, a resolution other than relating to appointment or removal of Directors, put to the vote of the meeting shall be decided by a show of hands and an entry under the proceedings of the Company shall be conclusive evidence of the fact.

30. Before or on the declaration of the result of the voting on any resolution on a show of hands, a poll may be ordered to be taken by the Chairman of the meeting of his own motion, and shall be ordered to be taken in accordance with the provisions of Section 167.

31. A poll demanded on the election of a Chairman or on a question of adjournment of a meeting shall be taken forthwith, and a poll demanded on any other question shall be taken at such time not more than fourteen days from the day on which it is demanded as the Chairman of the meeting may direct.

32. The result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.

VOTES OF MEMBERS

33. 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 shall apply. On a poll every member shall have voting rights as laid down in Section 160.

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

35. 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 poll, vote by proxy.

36. On a poll, votes may be given either personally or by proxy; provided that no body corporate shall vote by proxy as long as a resolution of its Directors in accordance with the provisions of Section 162 is in force.

37. (1) The instrument appointing a proxy shall be in writing under the hands of the appointer or of his attorney duly authorised 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.

38. An instrument appointing a proxy may be in the common form and shall be in writing.

39. A vote given in accordance with the terms of an instrument of proxy shall be valid notwithstanding the previous death or insanity of the principal or revocation of the proxy or the authority under which the proxy was executed, for the transfer of the share in respect of which the proxy is given, provided that no intimation in writing of such death, insanity, revocation or transfer as aforesaid shall have been received by the Company at the office before the commencement of the meeting or adjourned meeting at which the proxy is used.

40. The Chairman of any meeting shall be the sole judge of validity of every vote tendered at such meeting and at taking of poll he shall be the sole judge of validity of every vote tendered at such poll.

DIRECTORS

41. There shall be not less than two Directors of the Company. The Directors of the Company shall fix the number of elected Directors of the Company not later than 35 days before convening of the general meeting at which Directors are to be elected and the number so fixed shall not be changed except with the prior approval of the general meeting of the Company.

42. The following are the first Directors of the Company.

1. Mr. Yaqoob Ahmed
2. Mr. Muhammad Omer Ahmed
3. Mr. Muhammad Murtaza Ahmed

43. The Directors of the Company shall, unless the number of persons who offer themselves to be elected is not more than the number of Directors fixed under Article 41 be elected by the members of the Company in general meeting in the following manner namely:-

a) a member shall have such number of votes as is equal to the product of the number of voting shares or securities held by him and number of Directors to be elected;

b) a member may give all his votes to a single candidate or divide them between more than one of the candidates in such manner as he may choose; and

c) the candidate who gets the highest number of votes shall be declared elected as Director and then the candidate who gets the next highest number of votes shall be so declared and so on until the total number of Directors to be elected has been so elected.

44. First Directors shall stand retired at the First Annual General Meeting of the Company and the Directors elected at the first Annual General Meeting or thereafter shall hold office for three years after their election. A retiring Director shall continue to perform his functions until his successor is appointed. The retiring Directors shall be eligible for re-election.

45. Save as provided in Section 187, no person shall be appointed as a Director unless he is member of the Company.

46. The Directors of the Company elected under Article 43 shall hold office for three years except the Directors appointed against casual vacancy who shall be subject to retirement in terms of Article 49 hereof.

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

48. Subject to the provisions of the Ordinance, the Company may from time to time in general meeting increase or decrease the number of Directors.

CASUAL VACANCY

49. Any casual vacancy occurring amongst the Directors may be filled up by the Directors, and the person so appointed shall hold office for the remainder of the term of the Director in whose place he is appointed.

REMOVAL OF DIRECTOR

50. A Director elected may only be removed by a resolution of the Company in General Meeting but such a resolution shall not be deemed to have been passed if the number of votes against it equals to, or exceeds, the number of votes that would have been necessary for the election of a Director at the immediately preceding election of Directors.

51. A Director may retire from office upon giving prior notice in writing to the Company of his intention to do so, and such resignation shall take effect upon the expiration of such notice or its earlier acceptance.

REMUNERATION OF DIRECTORS

52. Each Director shall be paid out of the funds of the Company remuneration for attending the meetings of the Directors or a committee of Directors according to the scale as may from time to time be approved by the Board of Directors subject to the provisions of the Ordinance.

53. If a Director shall be called upon to perform any extra service, or make any special exertion, or to go out of the place of his ordinary residence for any purpose of the Company, or be actively engaged in the conduct and management of the business of the Company, he shall be paid such remuneration as may be determined by the Board of Directors.

POWERS AND DUTIES OF DIRECTORS

54. The business of the Company shall be managed by the Directors who may pay all such expenses preliminary and incidental to the promotion, formation, establishment and registration of the Company as they may think fit, and may exercise all such powers of the Company and do on behalf of the Company all such acts as may be exercised and done by the Company, and as are not by the statutes or by these Articles required to be exercised or done by the Company in general meeting, subject nevertheless to any regulations in these Articles, to the provisions of the statues and such regulations as may from time to time be prescribed by the Company in general meeting, but no regulation made by the Company in general meeting shall invalidate any prior act of the Directors, which would have been valid if such regulation had not been made.

BORROWING POWERS

55. Subject to the provisions of the Ordinance, the Board of Directors shall have the powers to raise or borrow any sums of money for and on behalf of the Company from firms, companies, commercial banks, or financing institutions or the Directors may themselves advance money to the Company upon such terms and conditions as they may approve from time to time.

56. The Directors may from time to time secure the payment of such money in such manner and upon such terms and conditions in all respects as they may think fit and in particular by the issue of debentures or bonds of the Company or by mortgage or charge of all or any part of the property or assets of the Company.

PROCEEDINGS OF DIRECTORS

57. The quorum necessary for the meeting of the Board of Directors shall be the majority of the Directors present in person, not being less than two.

58. A resolution in writing signed by all the Directors shall be as effective for all purposes as a resolution passed at meeting of Directors duly called, held and constituted.

59. All acts done by any meeting of the Directors, shall notwithstanding that it shall afterwards be discovered that there was some defect in the appointment of any such Director or person acting as aforesaid, or that they or any of them were disqualified be as valid as if every such person has been duly appointed and was qualified to be Director.

DISQUALIFICATION OF DIRECTORS

60. A Director shall immediately cease to hold office on happening of any of the following events, that is to say:

(a) On his becoming in-eligible to be appointed a Director on any one or more of the grounds enumerated in Clauses (a) to (h) of Section 187;

(b) On his resignation from office by notice in writing to the Company;

(c) On his removal by the Company in general meeting;

(d) On his being absent from three consecutive meetings of the Directors or from all meetings of Directors for a continuous period of three months, whichever is the longer, without leave of absence from the Board of Directors.

NOMINEE DIRECTOR

61. In addition to the elected Directors, the Financial Institutions shall be entitled, during the currency of their respective loan(s) to the Company, to appoint one person on the Board of Directors of the Company to be called Nominee Director and to recall and/or replace such a person from time to time. Such Nominee Director on the Board of Directors of the Company may not be holder of Shares in the Capital of the Company and other regulations and/or rules pertaining to the election, retirement, qualification and/or disqualification of the Director shall not apply to him.

MANAGEMENT

62. The business of the Company shall be managed and run by the Board of Directors who shall exercise such powers as are necessary and expedient to conduct and run the business of the Company, including the powers to make purchases and sales, appoint the officers and

employees of the Company, correspond with the suppliers, clients and other customers, to make and sign all contracts and to draw, accept, endorse and negotiate on behalf of the Company all bills of exchange, promissory notes, drafts, to institute, conduct or defend any proceedings for or against the Company before any Court, Government or Semi-Government authority; to operate bank accounts of the Company including the power to sub-delegate any of their powers to any Director or Directors or shareholder or other officer, employee or attorney of the Company and generally to exercise all such powers as are exercisable by the Board of Directors under the provisions of the Ordinance, or may be specifically delegated to them by the Company in general meeting from time to time.

CHAIRMAN

63. The Directors may elect one of their members to be the Chairman of the Company. He shall preside over all the meetings of Directors and shareholders. He shall conduct and supervise election of Directors. He shall exercise and perform all other powers and functions as may from time to time be delegated and assigned to him by the Board of Directors.

CHIEF EXECUTIVE

64. (a) Within 14 days from the day of each election of Directors, a Chief Executive will be appointed by the Directors for a period of not exceeding three years and on the expiry of the said period he will retire but he shall continue to act till the appointment of his successor. However, the first Chief Executive of the Company will hold office upto the conclusion of first Annual General Meeting.

(b) A retiring Chief Executive will at all times be eligible for reappointment. The Chief Executive shall, if he is not already a Director be deemed to be a Director of the Company and be entitled to all the rights and privileges and be subject to all the liabilities of a Director. An elected Director is eligible for appointment as a Chief Executive.

(c) A Chief Executive shall be paid such salary and allowances and enjoy such fringe benefits and facilities as may from time to time be fixed and allowed by the Board of Directors.

(d) The chief executive of the company can be removed in accordance with the provisions of section 202 of the Ordinance.

THE SEAL

65. The Directors shall provide a common seal for purposes of the Company and shall have power from time to time to destroy the same and substitute a new Seal in lieu thereof and they shall provide for the safe custody of the Seal. The seal of the Company shall not be affixed to any instrument except by authority of a resolution of the Board of Directors and save as provided in Article 8, in the presence of at least one Director or officer and such Director or officer shall sign every instrument to which the seal shall be affixed in his presence, such signature shall be conclusive evidence of the fact that the seal has been properly affixed.

ACCOUNTS

66. The Directors shall from time to time determine whether and to what extent and at what time and places and under what conditions or regulations the accounts and books or papers of the Company or any of them shall be open to the inspection of members not being Directors, and no member (not being a Director) shall have any right of inspecting any account and books or papers of the Company except as conferred by law or authorised by the Directors or by the Company in general meeting.

67. The Directors shall in all respects comply with the provisions of Sections 230 to 236.

AUDIT

68. The auditors of the Company shall be appointed and their duties regulated in accordance with Sections 252 to 255.

INDEMNITY

69. Every officer or agent for the time being of the Company may be indemnified out of the assets of the Company against any liability incurred by him in defending any proceedings, whether civil or criminal, arising out of his dealings in relation to the affairs of the Company except those brought by the Company against him, in which judgment is given in his favour or in which he is acquitted, or in connection with any application under Section 488 in which relief is granted to him by the Court.

SECRECY

70. No member shall be entitled to visit or inspect any works of the Company without the permission of the Directors or the Chief Executive or to require discovery of any matter or information regarding any details of the Company's business or any matter which may be in the nature of a trade secret, or secret process which may relate to the conduct of business of the Company and which in the opinion of the Directors or the Chief Executive will not be in the interest of the members of the Company to communicate to the public.

RECONSTRUCTION

71. On any sale of the undertaking of the Company, the Directors or the liquidator in a winding-up may, if authorised by a Special Resolution, accept shares, debentures or securities of any other Company, whether incorporated in Pakistan or not, either then existing or to be formed for the purchase in whole or in part of the property of the Company, and the Directors (if the profits of the Company permit), or the Liquidator (in winding-up), may distribute such shares, debentures or securities, or any other property of the Company amongst the members without realisation, or vest the same in trustees for them, and any resolution may provide for the distribution or appropriation of the cash, shares, debentures, benefits or property otherwise than in accordance with the strict legal rights of the members or contributories of the Company, and for the valuation of any such securities or property at such price and in such manner as the meeting may approve, and all holders of shares shall be bound to accept and shall be bound by any valuation or distribution so authorised, and waive all rights in relation thereto, save only in case the Company is proposed to be or is in the course of being wound up, such statutory rights (if any) under the law, as are incapable of being varied or excluded by these Articles.

WINDING UP

72 If the Company is wound up, the liquidator may, with the sanction of a special resolution of the Company and any other sanction required by the Ordinance, divide amongst the members, in specie or kind, the whole or any part of the assets of the Company, whether they consist of property of the same kind or not.

73. For the purpose aforesaid, the liquidator may set such value as he deems fair upon any property to be divided as aforesaid and may determine how such division shall be carried out as between the members or different class of members.

74. The liquidator may, with the like sanction, vest the whole or any part of such assets in trustees upon such trusts for the benefit of the contributories as the liquidator, with the like sanction, thinks fit, but so that no member shall be compelled to accept any shares or other securities whereon there is any liability.

DISPUTE RESOLUTION

75 In the event that a dispute, claim or controversy arises between the company, its management or its shareholders, or between the shareholders inter-se, or the directors inter-se, all steps may be taken to settle the dispute and resolve the issue through mediation by an accredited mediator before taking recourse to formal dispute resolution such as arbitrage or litigation.

We, the several persons, whose names and addresses and descriptions are subscribed below, are desirous of being formed into a company in pursuance of these Articles of Association and we respectively agree to take the number of shares in the capital of the company set opposite our respective names:

Name and surname (Present and former) in full (In block letters) / Fathers Name / Nationality / NIC #	**Occupation**	**Residential Address in Full**	**Number of shares taken by each subscriber**	**Signature**
MR. YAQOOB AHMED S/O. AHMED OMER PAKISTANI CNIC # 42201-4651073-5	BUSINESS	HOUSE NO. 35, STREET # 10, KHAYABAN-E-MUHAFIZ, PHASE VI, DHA, KARACHI	= 100 = (One hundred shares)	
MR. MUHAMMAD OMER AHMED S/O. YAQOOB AHMED PAKISTANI CNIC # 42201-4652023-5	BUSINESS	HOUSE NO. 35, STREET # 10, KHAYABAN-E-MUHAFIZ, PHASE VI, DHA, KARACHI	= 100 = (One hundred shares)	
MR. MUHAMMAD MURTAZA AHMED S/O. YAQOOB AHMED PAKISTANI CNIC # 42201-8075257-7	BUSINESS	HOUSE NO. 35, STREET # 10, KHAYABAN-E-MUHAFIZ, PHASE VI, DHA, KARACHI	= 100 = (One hundred shares)	
		TOTAL	=300 = (Three hundred shares)	

Dated this 12TH day of September, 2015

Witness to the above signatures:

Full Name, Fathers' name in Block Letters	National Institutional Facilitation Technologies (Private) Limited
Occupation	
Full Address	5th Floor, AWT Plaza, I.I. Chundrigar Road, Karachi
Signature	

2/11/15

Annexure 05 – Memorandum of Association

The Companies Ordinance, 1984
(Private Company Limited by Shares)

MEMORANDUM OF ASSOCIATION

OF

ARTISTIC WIND POWER (PRIVATE) LIMITED

NAME

I. The name of the Company is ARTISTIC WIND POWER (PRIVATE) LIMITED

REGISTERED OFFICE

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

OBJECTS

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

1. To carry on the business of power generation, operation and management of power generation projects anywhere in Pakistan or other countries of the world, and to develop, design, finance, engineer, negotiate, purchase properties etc. in regard to the development, installation, commissioning and operation of power projects.

2. To acquire on lease, construct new complex(s), design, insure, own, operate and maintain power generation complex(s) and to carry on the business of electricity generation, power transmission and distribution services, refurbishment and re-powering of power plants and to work generate, accumulate, distribute and supply electricity for the purpose for which electrical energy can be employed.

3. To carry on the business of manufacture and supplies of all apparatuses and things required for or capable of being used in connection with power generation, distribution, supply, accumulation and employment of electricity, and as supplier of electrical power produced through wind, coal, fuel, steam, gas, diesel, hydro-thermal power, solar, atomic power, and to buy, sell, manufacture, repair, convert, alter, let on hire, and deal in machinery used for the manufacturing and supply of electricity.

4. To enter into negotiation and agreements with government authorities / agencies, semi-government bodies or any other private associations, persons, corporations and companies to establish their own and acquire on lease power complex(s) and for the sale and purchase of fuel and / or electricity in any mode.

5. To acquire consultancy services and to enter into any power plant operations and maintenance (O&M) agreements or any other contract with regards to the power plants.

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

7. To acquire by concession, grant, purchase, exchange, barter, licence either absolutely or conditionally and either solely or jointly with other any lands, buildings, easements, machinery, plants, equipments, privileges rights, licences, trade marks, patent design, copyright, licence, concession, convenience, innovation 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.

8. To act as representative, for any person, firm or company and to undertake and perform subcontracts, and also act in the business of the company through 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-contractor or otherwise.

9. To acquire and carry on all or any part of the business or property of any person, firm, association suitable for any of the purpose of the Company or carrying on any business this Company is authorized to carry on and in consideration for the same to pay cash or to issue shares of the Company, and to undertake the liabilities of associated undertakings.

10. To enter into arrangements with the government or authority (supreme, municipal, local or otherwise) or any corporation, company or persons that may seem conductive to the company's objects or any of them and to obtain from any such governments, authority, corporation, company or person any charters, rights, privileges and commission which the Company may think desirable and to carry on exercise and comply with any such charters, contracts, decrees, rights, privileges and concessions.

11. To carry on joint venture agreements, enter into partnership, to amalgamate or merge with other companies and / or to buy, 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 authorised to carry on or which is capable of being conducted so as directly or indirectly to benefit his company and to have foreign collaborations and to pay royalties / technical fees to collaborators, subject to the provisions of the Companies Ordinance, 1984.

12. To invest the funds of the Company not immediately required in the manner the company deems fit.

13. To Capitalize such portion of the profits of the Company as are not distributed among shareholders of the Company in the form of dividends as the Board of Directors of the Company may think fit, and to issue bonus shares, as fully paid-up in favor of the shareholders of the Company.

14. To grant pensions, allowances, gratuities and bonuses to the employees, officers, ex-employees and ex-officers of the Company or its predecessors in business or the dependents of such persons, and to take over, fund, establish, develop, endow or contribute to any plan, scheme or project or fund for any such purposes, or to any other welfare fund as super-annuation, sickness, provident, accident fund or scheme, and to support or subscribe to any charitable or other useful institutions, societies, clubs, organizations, associations, funds, and to subscribe or guarantee, money for or towards any national, charitable, benevolent, publicly beneficial or otherwise useful purpose, object, scheme, plan, fund or for any exhibition.

15. To ratify agreements or contracts executed by the promoters of this Company with various individuals, firms, corporations or government agencies in the interest of the Company prior to its incorporation.

16. To borrow, raise or secure the payment of money for the purpose of business of the Company in such manner as the Board of Directors of the Company may think fit and in particular by the issue of debentures or debenture-stock, whether perpetual or terminable or upon the whole or any part of the Company's assets both present and future and to purchase, redeem or pay off or discharge any such securities.

17. To mortgage and charge the undertaking and all or any of the moveable and immovable property (present and future) for the time being of the Company.

18. To borrow money for the purpose of business of the Company with or without giving any security thereof and upon such terms as to priority or otherwise as the Board of Directors shall think fit.

19. To distribute in specie or otherwise any assets of the Company amongst its members in the event of winding up and for such purpose to distinguish and separate capital from profits but so that no distribution involving a reduction of capital be made except with the sanction (if any) for the time being required by law.

20. To draw, make, accept, endorse, and negotiate negotiable instruments such as Bills of Exchange, promissory Notes, Cheques in connection with business of the Company.

21. To do all or any of the above things anywhere in Pakistan or in any place outside Pakistan and to employ agent (other than managing agent / agencies) and employees for the same.

22. Generally to do, carry out all such other things as may be considered necessary, incidental or conducive to the fulfillment of the objects or any of the objects above mentioned in this Memorandum of Association of the Company.

23. To do all or any of the things herein before authorized in any part of the world either alone or in conjunction with others as agents for others residing in any part of the world or by or through agents appointed in any part of the world.

24. To carry on any business, which may seem to the Company capable of being conveniently carried on in connection with any or calculated directly or indirectly, to enhance the value of or render profitable any of the Company's property or rights.

25. To enter into partnerships, or into any arrangement for sharing profits and losses, or for any union of interests, joint venture, reciprocal concession or co-operation with any person or persons, or companies carrying on, or engaged in or about to carry on, or engaged in or being authorized to carry on, or engaged in any business or transaction which this Company is authorized to carry on or engaged in, or in any business or transaction capable of being conducted, so as directly to benefit this Company.

26. To take, amalgamate or otherwise acquire and hold shares and/or other securities of any other Company having objects altogether or in part similar to

those of this Company, or carrying on any business capable of being conducted so as directly or indirectly to benefit this Company.

27. To remunerate any person, firm or Company rendering services to this Company, whether by the payment of cash or by the allotment of shares or securities of the Company.

28. To sell or otherwise dispose of the whole or any part of the undertaking of the Company for such consideration as the Company may think fit, and in particular for shares, debentures or securities of any company purchasing the same.

29. To have, keep, maintain and float subsidiary companies with objects similar to its own and to have branches all over Pakistan or elsewhere.

30. To open any current, overdraft, cash-credit account or fixed account with any bankers, or merchants, of the Company and to pay money into and draw money out of such account.

31. To pay all the costs, charges and expenses preliminary and incidental to the promotion, formation, establishment and incorporation of the Company.

32. To distribute any of the property of the Company among its members in specie or otherwise in the event of winding up.

33. To act and / or undertake and / or carry on the office or offices so as to become, supervisors, promoters, executors, committee, delegates, substitutes, receivers, liquidators or agents (except managing agents) or any other office or situation of trust or confidence of any Company, firm or person either independently or jointly with any other company, firm or person and to perform and discharge the duties and functions incidental thereto, either gratuitously or otherwise.

34. To carry out the business of setting up retail or wholesale shops so as to be able to dispose off the various products this Company owns.

35. To operate, conduct, accomplish and establish service for and relating to the activities of the Company in any aspect of trade, business or commerce and otherwise relating to the same in Pakistan and abroad.

36. And generally to do and perform all such other acts as may be incidental or conducive to the attainment of the above objects or any of them.

It is, hereby, undertaken that the Company shall not engage in banking business or Forex, illegal brokerage, or any business of investment company or non-banking finance company or insurance or leasing or business of managing agency or in any unlawful business and that nothing contained in the object clauses shall be so construed to entitle it to engage in such business directly or indirectly and the Company shall not launch multi-level marketing (MLM), Pyramid and Ponzi schemes.

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

LIMITED LIABILITY OF MEMBERS

IV. The liability of the members is limited.

CAPITAL

V. The Authorized Capital of the Company is Rs. 100,000/- (Rupees One hundred thousand only) divided into 10,000 (Ten thousand) Ordinary shares of Rs.10/- (Rupees ten only) each. The Company shall have power by special resolution from time to time to increase, consolidate, sub-divide, and reduce, to divide the shares into several classes or other-wise re-organise the share capital of the company subject to the provisions of the Companies Ordinance, 1984.

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

Name and surname (Present and former) in full (In block letters) / Fathers Name / Nationality / NIC #	**Occupation**	**Residential Address in Full**	**Number of shares taken by each subscriber**	**Signature**
MR. YAQOOB AHMED S/O. AHMED OMER PAKISTANI CNIC # 42201-4651073-5	BUSINESS	HOUSE NO. 35, STREET # 10, KHAYABAN-E-MUHAFIZ, PHASE VI, DHA, KARACHI	= 100 = (One hundred shares)	
MR. MUHAMMAD OMER AHMED S/O. YAQOOB AHMED PAKISTANI CNIC # 42201-4652023-5	BUSINESS	HOUSE NO. 35, STREET # 10, KHAYABAN-E-MUHAFIZ, PHASE VI, DHA, KARACHI	= 100 = (One hundred shares)	
MR. MUHAMMAD MURTAZA AHMED S/O. YAQOOB AHMED PAKISTANI CNIC # 42201-8075257-7	BUSINESS	HOUSE NO. 35, STREET # 10, KHAYABAN-E-MUHAFIZ, PHASE VI, DHA, KARACHI	= 100 = (One hundred shares)	
		TOTAL	=300 = (Three hundred shares)	

Dated this 12TH day of September, 2015

Witness to the above signatures:

Full Name, Fathers' name in Block Letters	National Institutional Facilitation Technologies (Private) Limited
Occupation	
Full Address	5th Floor, AWT Plaza, I.I. Chundrigar Road, Karachi
Signature	

2/11/15

Annexure 06 – GW/HC Certificate of Confirmation

中国电建 POWERCHINA | 中国水电 HYDROCHINA
中国水电工程顾问集团有限公司
HYDROCHINA CORPORATION
中国 北京 西城区 六铺炕 北小街 2 号 100010

May 21, 2016

ATTN:
MR. AGHA WASIF
SECRETARY ENERGY,
ENGERGY DEPARTMENT, GOVERNMENT OF SINDH,
3RD FLOOR, STATE LIFE BUILDING,
KARACHI, PAKISTAN.

SUBJECT: **UNDERTAKING REGARDING WTGS PROPOSED TO BE SUPPLIED TO ARTISTIC WIND POWER (PRIVATE) LIMITED**

Dear Sir,

We, Hydrochina Corporation, the selected EPC Contractor for Artistic Wind Power (Private) Limited's proposed 50MW wind power project to be located at Jhimpir, Sindh (the **Project**), hereby confirm the following:

1. The plant and machinery, including WTGs that will be supplied to the Project will be brand new and will comply with the latest IEC and NTDC standards/specifications/grid code; and

2. The plant and machinery, in particular WTGs to be installed has a proven track record of 2000 WTG installations worldwide with a total capacity of 5000 MW.

Very truly yours,

.....

Liu Minghua
Representative of Hydrochina Corporation

电话：+86-10-51975899 传真：+86-1051975890 网址：www.hydrochina.com.cn

GOLDWIND

May 21, 2016

MR. AGHA WASIF
SECRETARY ENERGY
ENERGY DEPARTMENT, GOVERNMENT OF SINDH,
3RD FLOOR, STATE LIFE BUILDING,
KARACHI, PAKISTAN.

SUBJECT: **UNDERTAKING REGARDING WTGS PROPOSED TO BE SUPPLIED TO ARTISTIC WIND POWER (PRIVATE)LIMITED**

Dear Sir,

We, Beijing Goldwind New Energy Trade Co., Ltd, a fully owned subsidiary of Xinjiang Goldwind Science & Technology Co., Ltd, the original equipment manufacturers of GW121/2500 (**WTG**) hereby confirm the following:

1. The model of the WTGs selected by Artistic Wind Power (Private) Limited in respect of its proposed 50MW wind power project to be located in Jhimpir, Sindh, are part of our current range of production and the WTGs that will be supplied to the project commenced production in the year 2017/2018; and

2. The WTGs are of state of the art design and quality and will be delivered to Artistic Wind Power (Private) Limited brand new in accordance with the terms finalized in our contracts.

We trust that the above information satisfies your requirements.

Very truly yours,

.....

Ma Xiaobui
Director, West Asia and North Africa

Annexure 07 – Lender's Expression of Interest (ADB, IFC & Bank Al-Habib)

IFC | International Finance Corporation
WORLD BANK GROUP

May 23, 2016

Artistic Milliners (Pvt) Ltd.
Plot No. 4&8, Sector 25,
Korangi Industrial Area, Karachi
Pakistan

Attention: Mr. Rafique Khanani, Chief Financial Officer, Artistic Milliners (Pvt) Ltd.

Dear Mr. Khanani:

We refer to your discussions with International Finance Corporation ("IFC") concerning the development of a 50 MW wind power project being developed by Artistic Milliners (Pvt) Ltd. at Jhimpir, District Thatta in the province of Sindh in Pakistan (the "Project"). We understand that you are interested in seeking IFC financing for the Project, which will be developed through a separate project company (the "Project Company") owned and controlled by Artistic Milliners (Pvt) Ltd. as the sponsor.

We are pleased to inform you that IFC would be interested in principle in participating in the financing of the Project, as well as assisting in the mobilization of additional funds from other sources to complete the financial plan. We would consider an investment in the Project, after IFC's regular comprehensive appraisal process, design of a satisfactory security package and support arrangements, confirmation of the viability of the Project, approval by IFC's management and Board of Directors and execution of definitive documentation in form and substance satisfactory to IFC.

IFC's investment is typically limited to 25% of project cost and can consist of an A loan and mobilizing of B loans and/or parallel loans (on a best efforts basis) based on the indicative terms set out in Annex A. Please note that IFC has not carried out a due diligence review of the proposed Project, and that neither this letter nor Annex A constitute an offer or commitment by IFC. Accordingly the terms in Annex A are indicative only and are subject to change following IFC's appraisal.

You will appreciate that our statement of interest to consider financing this Project does not constitute a binding obligation of IFC to pursue further appraisal or financing for the Project. Please also note that this is a non-exclusive letter of interest. IFC may provide similar letters to other other potential developers of wind projects in Pakistan.

We look forward to the opportunity of working with you on this Project.

Sincerely,

Erik Becker
Manager

Accepted and Agreed:
Artistic Milliners (Pvt) Ltd.

By: _____

Name:

10th Floor West Side, The Gate, D.I.F.C. - P. O. Box 118071, Dubai, United Arab Emirates
Tel: +(971-4) 360 1000 Fax: +(971-4) 360 1010

Title:
Date:

ANNEX A

PROPOSED IFC INVESTMENT

SUMMARY OF INDICATIVE FINANCIAL TERMS

This is not an offer or commitment to provide any financing for the Project or the Project Company. All terms are subject to change following the appraisal and/or as a result of material changes in the international loan syndication, financial or capital markets.

The term sheet, as well as any final agreements evidencing the IFC investment, will also contain terms and conditions customary for international financing transactions, including representations and warranties; conditions of disbursement; affirmative, negative and reporting covenants; events of default, (e.g., non-payment, cross-default provisions, insolvency and nationalization); provisions for the payment of additional costs and fees (e.g., late payment charges, legal costs, tax gross-up, increased cost of funding, prepayment fees); and governing law and jurisdiction provisions.

A Loan

(a) Amount: Up to US$[15.3] million representing 12.5% of the total project cost;

(b) Interest Rate: [4.50%-5.00%] over six-month US$ LIBOR (the final loan spread will depend on IFC's assessment of the investment risk, and support/security arrangements);

(c) Maturities: Up to [12] years, including [2] year[s] grace period (only for repayments of principal);

(d) Fees:
(i) a one-time front-end fee of 1.75% of the principal amount of the loan;
(ii) a commitment fee of 1.5% per annum on the undisbursed principal amount of the loan;
(iii) an annual supervision fee of US$25,000;

(e) Security: (i) A first ranking mortgage on the movable and immovable assets of the Project Company, acceptable to IFC.

(ii) Assignment of all project documents and concessions, including the land lease and to the extent permitted under relevant laws, all licences, consents, permits, etc. associated with the Project.

(iii) A first ranking share pledge of all the shares in the Company.

(iv) Any other security as is customary and appropriate for a project finance transaction of this nature.

B Loan/Parallel Loan

(a) Amount: Up to US$[15.3] million representing 12.5% of the total project cost on a best efforts basis;

(b) Interest Rate: [4.50%-5.00%] over six-month US$ LIBOR (the final loan spread will depend on IFC's assessment of the investment risk, and support/security arrangements);

(c) Maturities: Up to [12] years, including [2] year[s] grace period (only for repayments of principal);

(d) Fees:
- (i) a one-time front-end fee of 1.75% of the principal amount of the loan;
- (ii) a commitment fee of 1.5% per annum on the undisbursed principal amount of the loan;
- (iii) a B Loan administration fee of US$10,000 per annum per Participant (for IFC's account); and
- (iv) Fees and expenses in connection with a secure web-based syndication system to syndicate the B Loan.

(e) Security: Same as A Loan

Bank AL Habib Limited

25 YEARS SILVER JUBILEE 1991-2016

February 22, 2016

Chief Executive Officer,
Artistic Milliners (Pvt) Ltd.
Karachi.

Dear Sir,

Expression of Interest – Setting up of a 50 MW Wind Power Project at Jhimpir, District Thatta by Artistic Milliners (Pvt) Limited ("AMPL")

This is with reference to your request for arrangement of financing for a 50 MW wind power project to be set up by Artistic Milliners (Pvt) Limited in Jhimpir, Sindh (the "Project"). In this regards, we are pleased to express Bank AL Habib Limited's ("BAHL") in-principal interest in providing financial advisory and debt arrangement services for the complete Project Debt in the capacity of Lead Advisor & Arranger ("LAA"), including but not limited to participation in the said Project Debt, subject to internal approvals.

We understand that AMPL intends to set up a 50 MW wind power Project at Jhimpir, District Thatta, Sindh pursuant to the issuance of a Letter of Intent by the Government of Sindh. We further understand that the capital cost of the Project is currently estimated at US$ 125 million and is expected to be funded at a debt: equity ratio of 75:25, resulting in debt requirement of US$ 94 Million, equivalent to PKR 10,600[1] million ("Project Debt"). A comprehensive term sheet is enclosed.

Please note that our interest in assisting AML for debt arrangement and participation in Project Debt is based on our best assessment of the Project, given the currently available limited information and may not be construed as commitment on part of BAHL or any of its subsidiaries or affiliates to arrange the required financing, or any part thereof, at this point of time. Our final decision to arrange the project Debt, will amongst other things, be subject to: a) satisfactory due diligence of the Project, key stakeholders and the Project, including feasibility and b) the execution of definitive agreement(s) between BAHL (along with other participants) and the Project pertaining to the provision of debt arrangement services.

For and on behalf of Bank AL Habib Limited

Arsalan Ullah Khan
Senior Manager

Imad Riaz
Head – Syndications & DCM

[1] At an exchange rate of PKR 113 per US$

Bank AL Habib Limited

25 YEARS SILVER JUBILEE 1991-2016

ARTISTIC WIND POWER (PRIVATE) LIMITED: EXPRESSION OF INTEREST FOR THE PROPOSED FINANCING OF 50 MW WIND POWER PROJECT TO BE LOCATED IN JHIMPIR, SINDH PROVINCE, PAKISTAN

This document is provided by BAHL purely as an expression of our interest to act as the Mandated Lead Arranger for the financing of this Project.

All terms and conditions contained in this document are drafted for discussion purposes only and are not legally binding nor are they a comprehensive statement of all terms and conditions and are subject to award of a bankable tariff, prevalent market conditions, completion of detailed due diligence and receipt of internal and regulatory approvals.

1.	**Obligor**	Artistic Wind Power (Private) Limited, a private limited unlisted company incorporated under the laws of Pakistan (the "Obligor" or "Project Company"). ("**Obligor**").
2.	**Sponsor**	Artistic Milliners (Private) Limited ("referred to herein as the Sponsor"), committing 100% of all equity contributions required in relation to the Project. ("**the Sponsor**").
3.	**Project**	50 MW wind power project, to be located in Jhimpir, Sindh Province, Pakistan ("the **Project**").
4.	**Mandated Lead Arranger**	Bank AL Habib Limited ("BAHL") (hereinafter referred to as the "MLA").
5.	**Lenders**	A consortium of local & International financial institutions including the MLA (hereinafter collectively referred to as "**Lenders**").
6.	**Tariff Regime**	NEPRA 2015 Wind Power Feed-in Tariff ("**Upfront Tariff**") Regime.
7.	**Facilities**	Project Finance Facility ("**PF Facility**") and Letter of Credit Facility ("**LC Facility**"), collectively ("the **Facilities**").
8.	**PF Facility Amount**	Up to a maximum of PKR 10,600 Million, subject to the terms and conditions agreed with the Lenders, ("the **Commitment**"). The determination of PF Facility Amount would also be subject to the results of due diligence, award of the Upfront Tariff and internal approvals of the MLA and other project lenders.
9.	**Purpose of**	The proceeds of the financing will be used for the development, construction,

PRINCIPAL OFFICE: 2nd FLOOR MACKINNONS BUILDING, I.I. CHUNDRIGAR ROAD, KARACHI-PAKISTAN
PHONES : (92-21) 32412421-32412986 & 111-786-110 FAX : (92-21) 32419752 & 32401171
EMAIL: info@bankalhabib.com WEBSITE: www.bankalhabib.com
REGISTERED OFFICE: 126-C, OLD BAHAWALPUR ROAD, MULTAN

	Facilities	commissioning, operation and maintenance of the Project.
10.	**Commitment Period**	Period from and including the signing date of the finance documents and satisfaction of all conditions precedent ("**Facilities Effective Date**") to and including the date which is the earliest of: (a) eighteen (18) months from Facilities Effective Date; (b) the required commercial operations date as per Energy Purchase Agreement ("**EPA**"); and (c) Commercial Operations Date.
11.	**PF Facility Term and repayments**	The tenor of the PF Facility shall not exceed eleven and half years (11.5) years (inclusive of the Commitment Period) with principal and profit repayments (on annuity basis) over twenty (20) installments, commencing after the expiry of the Commitment Period.
12.	**Fees and Charges**	The Obligor will be responsible for the payment of arrangement fees and annual administrative fees, including but not limited to, agency fee, project monitoring fee, shariah structuring fee and trustee fees. Obligor will also be responsible for payment of commitment fees, LC charges and any other charges imposed by the bank pursuant to the financing documents.
13.	**Mark-up / Profit Rate**	3 Month KIBOR plus 3.00% per annum.
14.	**Mark-up / Profit payment Date**	1st day in the months of January and July of each calendar year after the first disbursement.
15.	**Debt-to-Equity Ratio**	Not higher than 75:25.
16.	**Security**	The Obligor's obligations to the Lenders shall be secured by collateral satisfactory to the Lenders pursuant to documentation satisfactory to the Lenders and their Legal Counsel, including at a minimum the following (the "**Security Documents**"): *a) Claims on Project Assets:* i. Exclusive first ranking, hypothecation charge over all present and future movable assets of the Obligor with 25% margin. For abundant clarity, charge amount will be calculated by dividing the PF Facility amount by 75%; ii. Exclusive equitable mortgage over the unencumbered leasehold rights in immovable property on which the Project will be established, with 25% margin. For abundant clarity, charge amount will be calculated by dividing the PF Facility Amount by 75%; *b) Claims on Project Cash flows:* i. First-ranking exclusive assignment/mortgage over receivables from Central Power Purchasing Agency (Guarantee) Limited ("**CPPA-G**") and/or any of their successors, assigns and transferees, due under the Energy Purchase Agreement ("EPA"). ii. First ranking exclusive assignment/mortgage over receivables under the Emissions Reduction Purchase Agreement (s), or any other arrangement for sale of Certified Emissions Reduction units, if applicable; iii. Lien over and set-off rights in respect of all Accounts

c) *Assignments of Rights and Benefits:*

i. Exclusive assignment/mortgage over the Obligor's rights and benefits under all Project Documents, and any performance bonds, warranty bonds, advance payment guarantees etc issued thereunder and any amendments thereto. In addition, direct agreements between Lenders and counterparties to the Project Documents will be required.

ii. Assignment over all rights and benefits of the Obligor under any and all Project insurances and reinsurances;

d) Pledge of shares held by the Sponsor's in the Obligor (**"Sponsor Shares"**) along with executed Transfer Deeds and Power of Attorneys in form and substance acceptable to the Lenders' Legal Counsel.

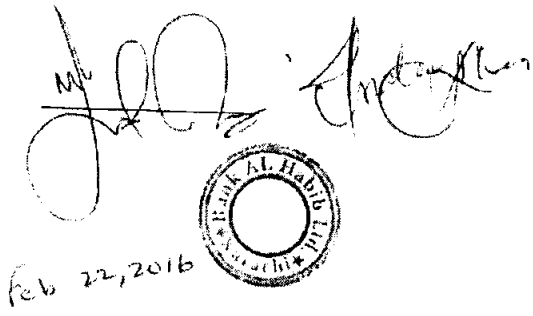
17.	**Sponsor Support**	In addition to the initial equity required to fund the project costs, Sponsor will undertake to provide to the Obligor additional funds on agreed terms.
18.	**Covenants and Events of Default**	To be set out in the finance documents.
19.	**Conditions Precedent**	To be set out in the finance documents.
20.	**Other Payments**	Obligor to pay or reimburse the Lenders in respect of: (a) increased costs resulting from a change of law or regulations; (b) unwinding/breakage costs; (c) withholding taxes, if any (tax gross-up); (d) all taxes (including stamp taxes) or other charges payable on any of the finance documents; (e) legal fees and expenses relating to finalization of documents and security structure; (f) amounts (to be agreed with the Obligor at the time) to compensate the Lenders for additional work required in connection with any restructuring; (g) fees for legal, technical, insurance and other consultants; (h) All out of pocket expenses including but not limited to travelling expenses, accommodation, utilities, printing, advertisements, etc and all other amounts incurred in connection with all matters related to the PF Facility.
21.	**Mandatory / Voluntary Prepayment**	Mandatory and voluntary prepayments permitted in whole or in part subject to terms and conditions agreed with the Lenders.
22.	**Representations and Warranties**	Customary and appropriate for the Obligor and Sponsor, as to be agreed in the final documentation.
23.	**Other Terms and Conditions**	i. Arrangement of the Facilities by BAHL is subject to the execution of a detailed mandate term sheet between BAHL and the Obligor; ii. The Obligor shall comply with State Bank of Pakistan's Prudential Regulations throughout the tenor of the Facility and any waivers / approvals required from SBP from time to time are procured; ii. The Obligor shall restrain from actions that could prejudice the rights and security of the Lenders; v. The Facilities are subject to the Lenders internal credit approval and satisfactory Financial and Legal documentation review;

v. Facilities to be arranged on a best efforts basis;

vi. CIB clearance to be obtained such that the Sponsor/ Company are not defaulters of any Bank/ DFI;

24.	**Governing Law**	Pakistan law.
25.	**Submission to Jurisdiction**	Obligor and Sponsor to submit to non-exclusive jurisdiction of the courts in Karachi, Pakistan.

For and on behalf of Bank AL Habib Limited



ADB

17 March 2016

To: Artistic Milliners Private Limited
Plot 4 & 8 Sector 25, Korangi Industrial Area
Karachi, Pakistan
Attn.: Mr. Yaqoob Ahmed

Re: Artistic Milliner Wind Project (the "Project")

Dear Mr. Ahmed:

1. We refer to our recent discussions regarding the Project. We understand from you that Artistic Milliners Private Limited (the "**Sponsor**") is expected to receive by June 2016 the revised upfront feed-in tariff for wind power projects (approved in December 2015) from the National Electric Power Regulatory Authority ("**NEPRA**"). We have been requested by the Sponsor to provide indicative financing terms for the financing of the Project. This summary has been prepared solely for the purpose of discussions between the Sponsor and the Asian Development Bank ("**ADB**") and is subject to change depending on the outcome of due diligence.

2 Based on the limited information provided to date, there does seem to be a conceptually sound environmental and economic rationale for developing the Project and, therefore, we consider that this is a project ADB could possibly support from its private sector operations. However, please note that any support ADB might consider will be fully dependent upon a number of factors, including, but not limited to, our full satisfaction with the Project's financial, economic, environmental, social, procurement, structural and documentary elements as well as the receipt of all requisite internal approvals and compliance with other guidelines set by ADB.

3. The indicative terms herein do not constitute an offer or commitment from ADB to provide financing, and are without any legal effect whatsoever. The terms and conditions are subject to the final approval by ADB's Management and Board of Directors, which may include different or additional provisions and which may contain provisions that deviate from the corresponding provisions contained herein. The closing of any financial transaction would be subject to various conditions precedent and covenants, including, without limitation, financial covenants.

4. Based on our discussion, ADB's financing would most likely be in the form of a direct Shari'ah compliant facility to the project company, for which preliminary indicative terms are provided in the following table:

ADB Shari'ah Compliant Facility (the "Facility")	
Facility Tenor	Up to 12 years door-to-door amortizing facility (up to 2 years grace period on principal repayments)
Facility Amount	The lesser of (i) 25% of the total project cost, such cost to be determined in consultation with lenders advisors, and (ii) US$31 million.*
Profit margin/Mark-up	In line with the market pricing or feed-in-tariff for foreign debt pricing as notified by NEPRA, whichever is higher

ASIAN DEVELOPMENT BANK
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
Tel: +63 2 632 4444
Fax: +63 2 636 2444

Upfront premium	1.50% on the Facility Amount.
Commitment premium	0.50% on the undisbursed and uncancelled portion of the Facility.
Representations, warranties, covenants	Customary representations, warranties and covenants for transactions of this nature and amount.
Security	The Facility will be secured by all project assets and assignment of contracts, in line with market precedents for transactions of this nature and amount.
Other	Out of pocket due diligence and travel expenses will be for the account of the borrower.

*Note: The assumption used for the indicative terms provided above is a total project cost of US$124 million.

5. We look forward to further discussing ADB's financing for the Project with you. If you have any questions or clarifications, please do not hesitate to contact Mohammed Azim Hashimi (phone: +63-2-683-1430 / email: mhashimi@adb.org) or David Urbaneja-Furelos (phone: +63-2-683-1926 / email: durbanejafurelos@adb.org).

Yours sincerely,

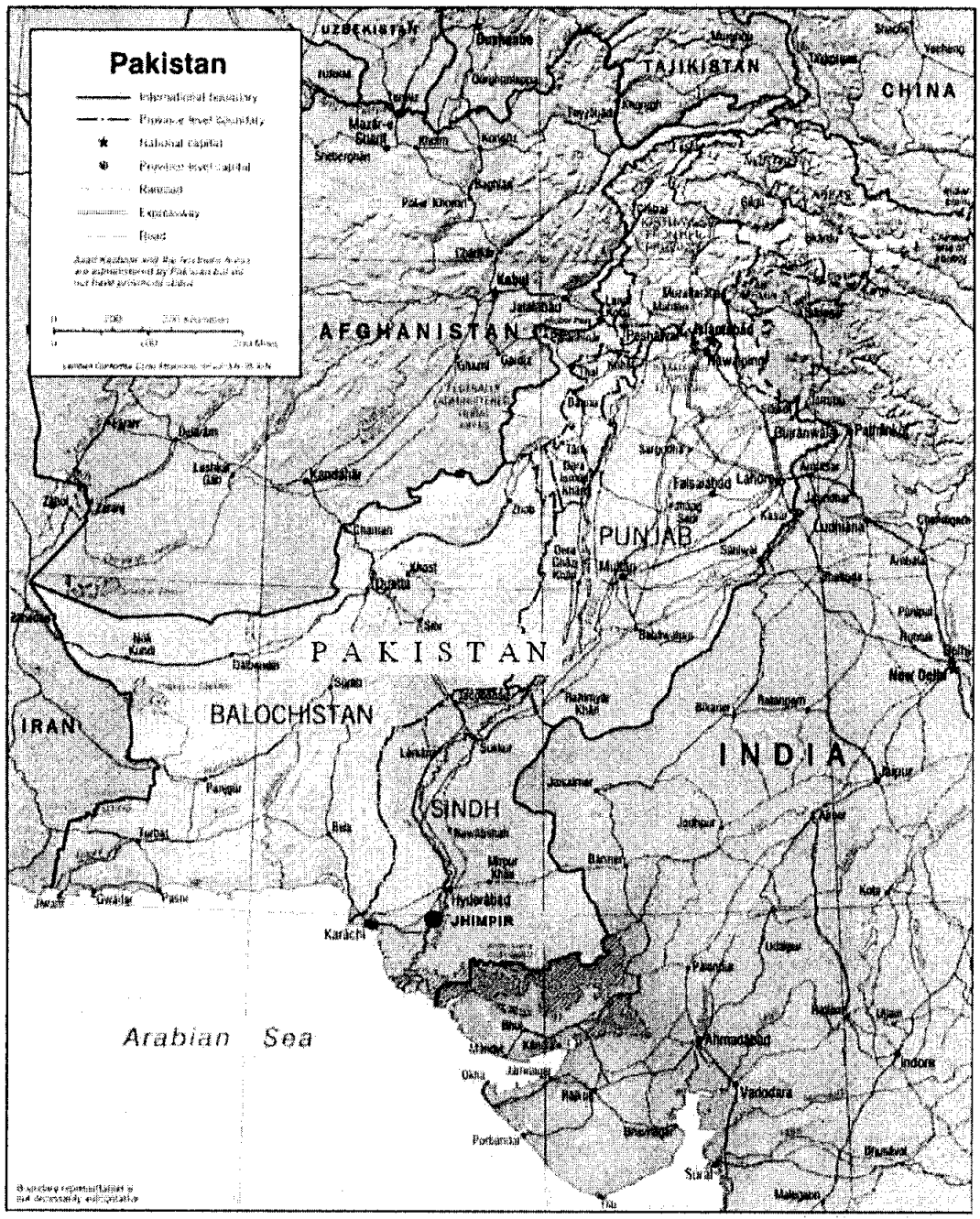
Michael Barrow
Deputy Director General
Private Sector Operations Department

SCHEDULE-I

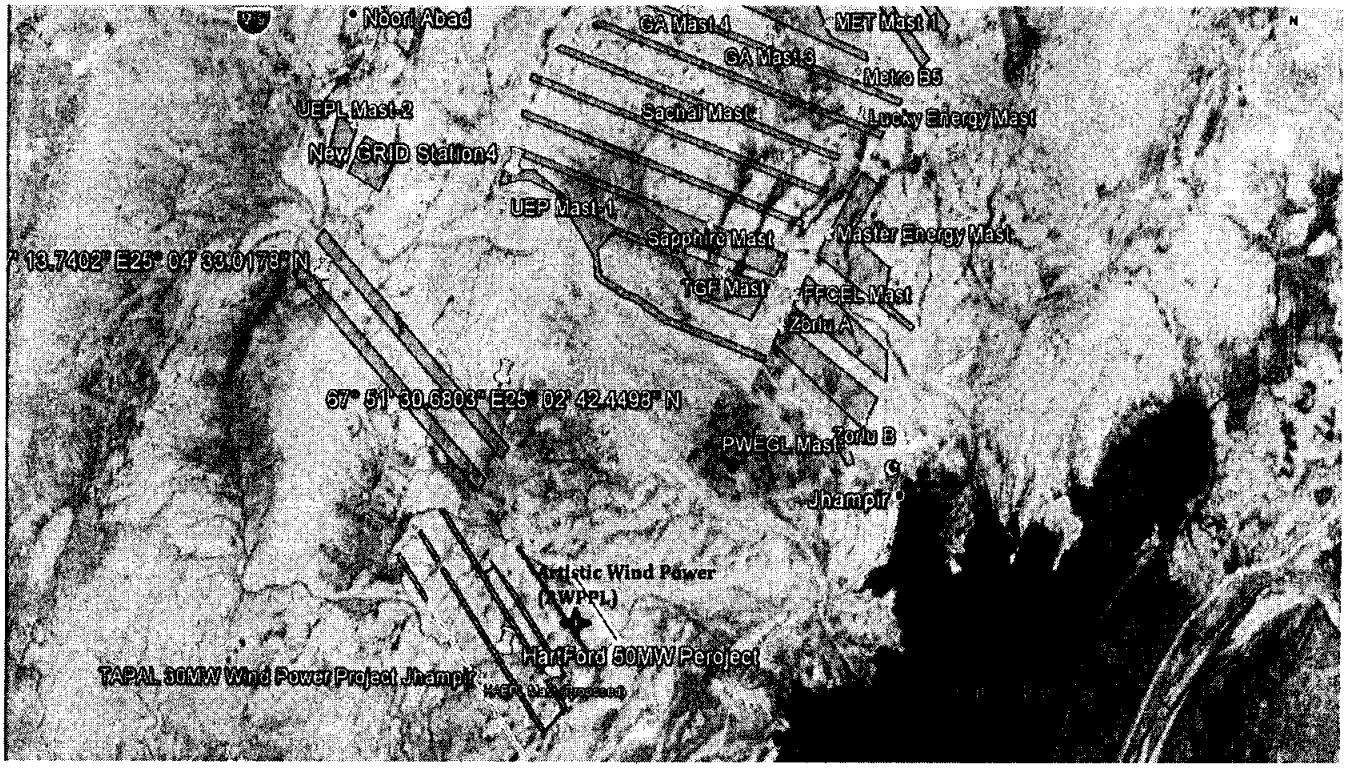
The Location, Size (i.e. Capacity in MW), Type of Technology, Interconnection Arrangements, Technical Limits, Technical/Functional Specifications and other details specific to the Generation Facilities of the Licensee are described in this Schedule.

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

Location of Generation Facility/ Wind Farm



Layout of Generation Facility/ Wind Farm

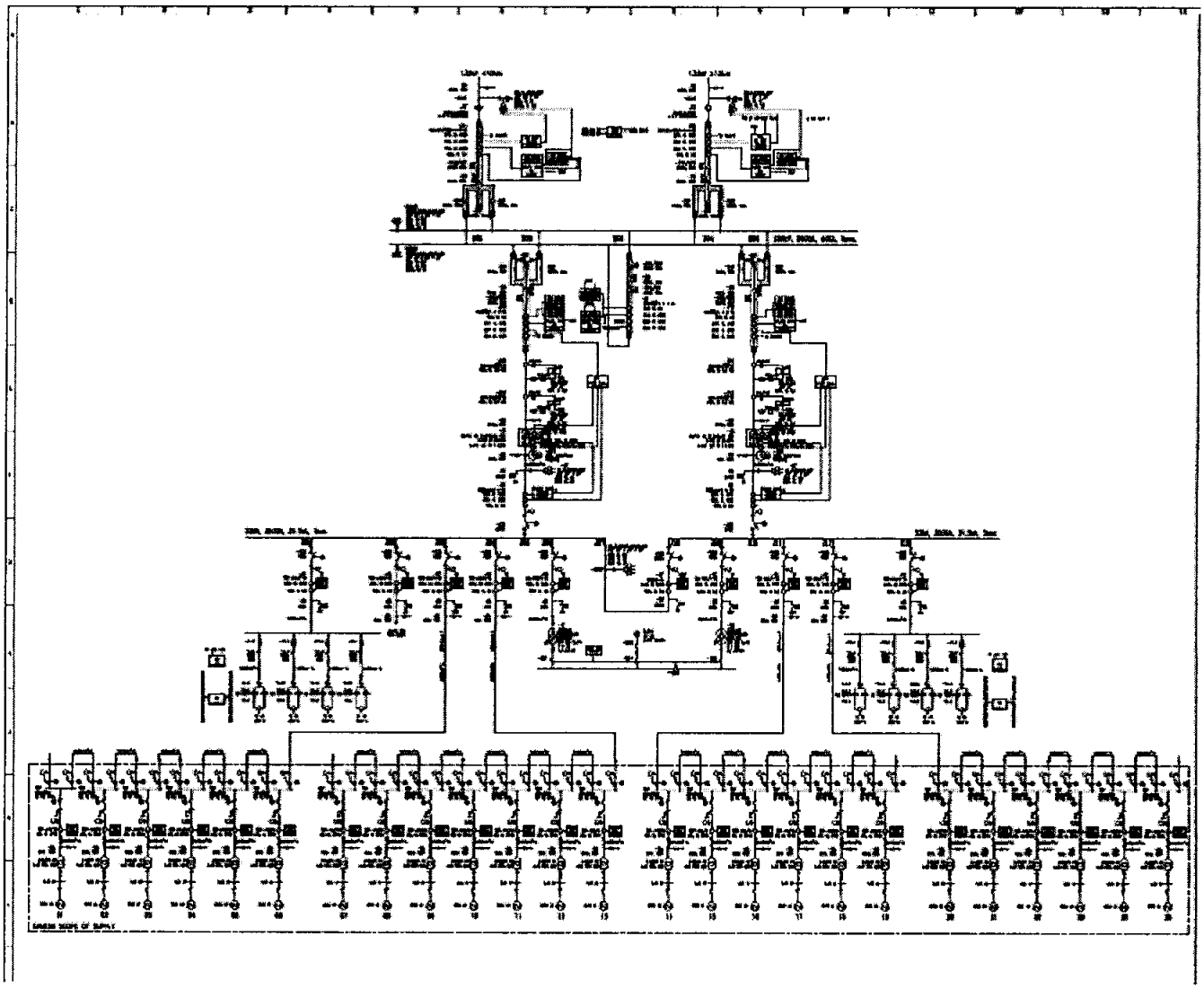


Land Coordinates of Generation Facility/ Wind Farm

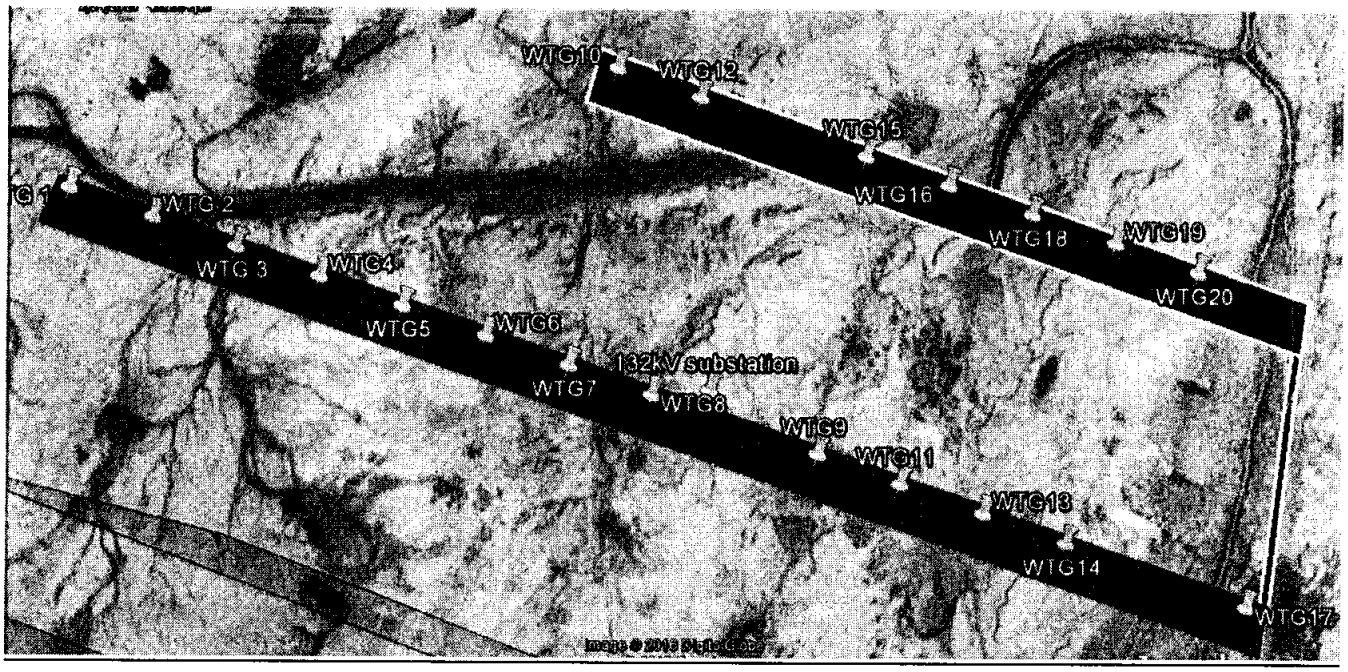
	Coordinates (UTM z42, WGS84)	
	Easting [m]	Northing [m]
1	385814.82	2765094.70
2	385631.01	2764971.64
3	388926.70	2760759.29
4	389049.67	2760958.53
5	389878.12	2761871.39
6	389708.84	2761736.31
7	387807.57	2764165.30
8	387969.55	2764310.28

Electrical System Single Line Diagram of Generation Facility/Wind Farm

The project will install 20 WTGs GOLDWIND GW 121/2500. There shall be four (04) WTG collector group. Each collector group shall consist of 5 WTGs.



Micro-Sitting of Generation Facility/ Wind Farm



Micro-siting arrangement of WTGs

	Coordinates (UTM Z42 WGS84)	
WTG #	Easting (m)	Northing (m)
WTG01	385,771	2,764,982
WTG02	385,994	2,764,696
WTG03	386,218	2,764,410
WTG04	386,441	2,764,124
WTG05	386,665	2,763,838
WTG06	386,889	2,763,552
WTG07	387,112	2,763,266
WTG08	387,336	2,762,980
WTG09	387,783	2,762,408
WTG10	387,935	2,764,170
WTG11	388,006	2,762,122
WTG12	388,159	2,763,885
WTG13	388,230	2,761,836
WTG14	388,453	2,761,550
WTG15	388,609	2,763,316
WTG16	388,834	2,763,031
WTG17	388,938	2,760,926
WTG18	389,059	2,762,746
WTG19	389,284	2,762,461
WTG20	389,509	2,762,176

Interconnection Arrangement/Transmission Facilities for Dispersal of Power from the Generation Facility/Power Plant/Wind Farm of Artistic Wind Power (Pvt.) Limited (AWPPL)

Grid Interconnection Study is being carried out by National Transmission and Despatch Company (NTDC). As the study is being undertaken by NTDC itself, there is no requirement of an approval of the Grid Interconnection Study. The Project Company has already shared the relevant technical data with NTDC in order to assist NTDC in carrying out the relevant studies (refer to Annexure-14 for Project Company's correspondence with NTDC in respect of the Grid Interconnection Study).

Interconnection Arrangement shall be provided to NEPRA, once it is finalized by NTDC.

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

Grid Interconnection Study is being carried out by National Transmission and Despatch Company (NTDC). As the study is being undertaken by NTDC itself, there is no requirement of an approval of the Grid Interconnection Study. The Project Company has already shared the relevant technical data with NTDC in order to assist NTDC in carrying out the relevant studies (refer to Annexure-14 for Project Company's correspondence with NTDC in respect of the Grid Interconnection Study).

Schematic for Interconnection Arrangement shall be provided to NEPRA, once it is finalized by NTDC.

Detail of Generation Facility/Power Plant/ Wind Farm

(A). General Information

(i).	Name of Applicant/Company	Artistic Wind Power (Pvt.) Limited (AWPPL)
(ii).	Registered/Business Office	Plot No. 4 & 8, Korangi Industrial Area, Karachi, Pakistan
(iii).	Plant Location	Jhampir, Nooriabad, District Thatta, Sindh
(iv).	Type of Generation Facility	Wind Power

(B). Wind Farm Capacity & Configuration

(i).	Wind Turbine Type, Make & Model	GOLDWIND GW 121/2500
(ii).	Installed Capacity of Wind Farm (MW)	50 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	20 x 2500 KW

(C). Wind Turbine Details

(a).	Rotor	
(i).	Number of blades	3
(ii).	Rotor diameter	121 m
(iii).	Swept area	11,595 m^2
(iv).	Power regulation	blade pitch angle adjustment
(v).	Cut-in wind speed	3 m/s

(vi).	Cut-out wind speed	22 m/s
(vii)	Survival wind speed	52.m/s
(viii)	Pitch regulation	Independent electrical pitch control system, belt transmission, one for each blade
(b).	**Blades**	
(i).	Blade length	59.5 m
(ii).	Material	Glass fiber reinforced plastic
(c).	**Converter**	
(i).	Type	Full load power converter, double PWM IGBT technology
(ii).	Rated Voltage	690 V
(iii).	Rated Current	2200 A
(d).	**Generator**	
(i).	Power	2,500 kW
(ii).	Voltage	690 V
(iii).	Type	Permanent Magnet Direct Drive Synchronous Generator
(iv).	Enclosure class	IP 54
(vi).	Power factor	+0.95 to -0.95
(e).	**Yaw System**	
(i).	Yaw bearing	4 points-contact, double row ball slewing ring
(ii).	Brake	Hydraulic Disc Brakes
(iii).	Yaw drive	4 x electrical asynchronous Motors with 4 x planetary gears, 4 stages
(iv).	Speed	0.5 degree/s
(f).	**Control System**	
(i).	Type	Microprocessor Controlled, DFU (SCADA)

(ii).	Scope of monitoring	Remote monitoring of different parameters, e.g. temperature sensors, pitch parameters, speed, generator torque, wind speed and direction, etc.
(iii).	Recording	Production data, event list, long and 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	Hydraulic rotor brake for generator
(h).	**Tower**	
(i).	Type	Tubular steel tower
(ii).	Hub heights	90 m

(D). Other Details

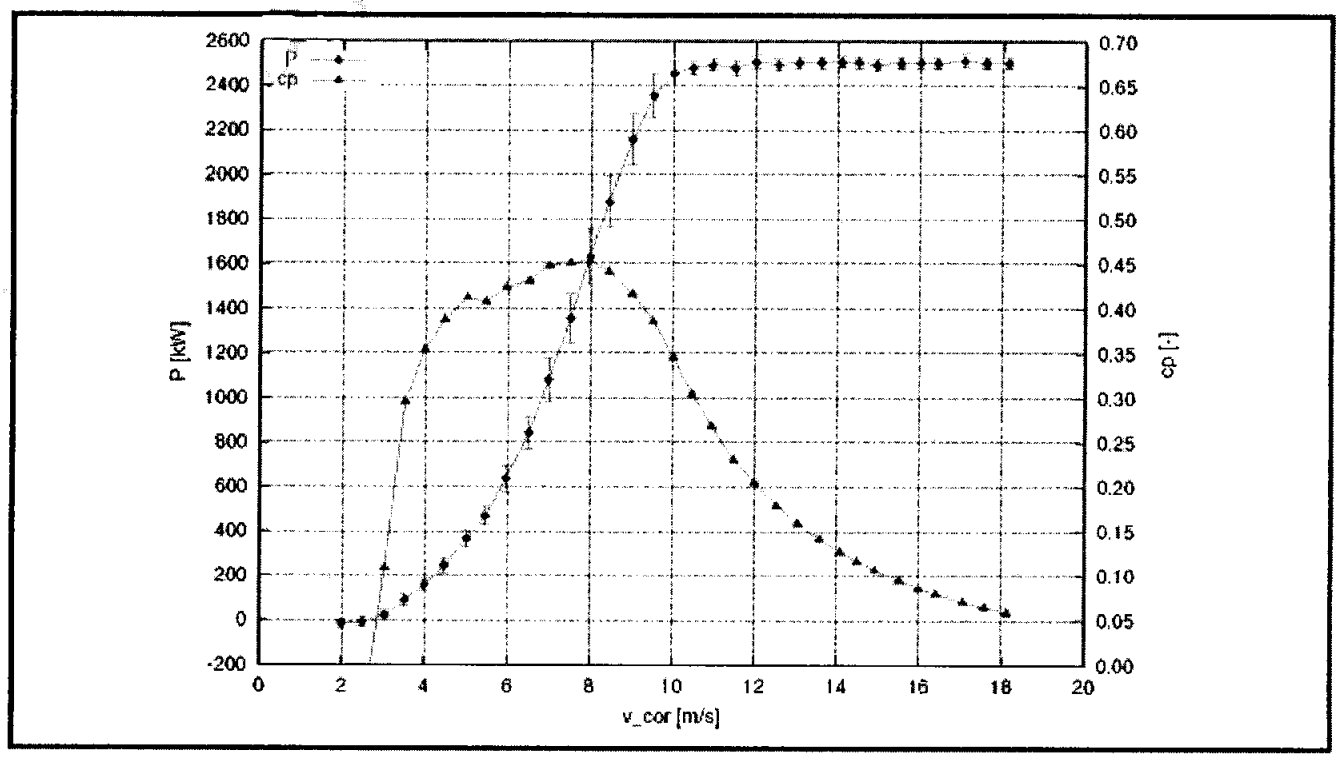
(i).	Project Commissioning Date (Anticipated)	2018
(ii).	Expected Life of the Project from Commercial Operation Date (COD)	20 Years

Power Curve of GOLDWIND GW 121/2500 Wind Turbine Generator (WTG) will be added at the time of Final Generation License

3	63
3.5	113
4	188
4.5	279
5	384
5.5	513
6	666
6.5	876
7	1114
7.5	1365
8	1640
8.5	1904
9	2181
9.5	2428
10	2494
10.5	2520
11	2530
11.5	2538
12	2545
12.5	2550
13	2550
13.5	2550
14	2550
14.5	2550
15	2550
15.5	2550
16	2550
16.5	2550
17	2550

Graphical Power Curve of GW 121/2500

Power Curve according to IEC 61400-12-1



Annexure 14 – Information for Schedule-II

SCHEDULE-II

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

SCHEDULE-II

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	50 MW
(2).	Total Annual Full Load Hours	3066.0 Hrs
(3).	Average Wind Turbine Generator (WTG) Availability	98.0 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	173.74 GWh
(5).	Array & Miscellaneous Losses GWh	13.62 GWh
(6).	Availability Losses GWh	3.41 GWh
(7).	Balance of Plant Losses GWh	3.41 GWh
(8).	Annual Energy Generation (20 year equivalent Net AEP) GWh	153.30 GWh
(9).	Net Capacity Factor	35.00 %

Note

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

Annexure 15 – Cash Balances of AWPPL

RENEWABLE
RESOURCES

February, 2016

Power (Pvt.) Limited

Resources (Pvt.) Ltd

APPROVAL SHEET

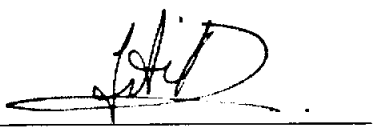
TITLE	:	Feasibility Study Report for 50 MW Wind Power Project in Jhimpir-Sindh, Pakistan	
DOCUMENT NUMBER	:	RE2-141-175-002	Issue: 02
CLASSIFICATION	:	**CONTROLLED**	

SYNOPSIS

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

DATE : February, 16

PREPARED BY :



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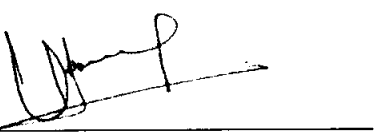

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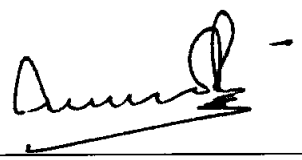

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Chief Technical Officer

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LIST OF ABBREVIATIONS

AC	Alternate Current
AEDB	Alternative Energy Development Board
ASL	Associated Surveyors (Pvt.) Ltd
C.R	Core Recovery
CDM	Clean Development Mechanism
CFCs	Chlorofluoro Carbons
CH_4	Methane
Cm	Centimeter
CMA	Certified Management Accountant
CNG	Compressed Natural Gas
CNOOC	China National Offshore Oil Corporation
CO_2	Carbon dioxide
CoP	Conference of the Parties
CPPA	Central Power Purchasing Agency
DAE GoS	Department of Alternate Energy, Government of Sindh
DC	Direct Current
DGPS	Dual Global Positioning System
DISCOs	Distribution Companies
EE	Energy Efficiency

EMC	Electromagnetic Compatibility
EMP	Environment Management Plan
EPA	Energy Purchase Agreement
EPC	Engineering Procurement Construction
EU	European Union
GDP	Gross Domestic Product
GENCOs	Generation Companies
GHG	Green House Gas
GIS	Geographic Information System
GoP	Government of Pakistan
GPS	Global Positioning System
GW	Gold Wind
HAWT	Horizontal Axis Wind Turbine
HESCO	Hyderabad Electric Supply Corporation
Hz	Hertz
IEE	Initial Environmental Examination
IPPs	Independent Power Producers
JI	Joint Implementation
KANUPP	Karachi Atomic Nuclear Power Plant
KESC	Karachi Electric Supply Company
Km	Kilometer

kV	Kilovolt
KW	Kilowatt
LNG	Liquefied Natural Gas
LOI	Letter of Intent
LPG	Liquefied Petroleum Gas
LOS	Letter of Support
LUC	Local Control Unit
m^2	Meter square
m^3/h	Meter cube per hour
MTDF	Medium Term Development Framework
MVA	Million Volt-Ampere
MW	Megawatt
N_2O	Nitrous Oxide
NAPWD	Northern Areas Public Works Department
NCS	National Conservation Strategy
NEPRA	National Electricity Power Regulatory Authority
NEQS	National Environmental Quality Standards
NOCs	No Objection Certificates
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
O & M	Operation & Management

OECD	Organization for Economic Cooperation and Development
OHL	Overhead Lines
OLTC	On-Load Tap Changer
PAEC	Pakistan Atomic Energy Commission
PCM	Pulse Code Modulation
PEPA	Pakistan Environment Protection Act
PLC	Programmable Logic Control
PMD	Pakistan Meteorological Department
PPIB	Private Power Infrastructure Board
PVC	Poly Vinyl Carbonate
QC	Quality Control
R & D	Research and Development
RE	Renewable Energy
RE2	Renewable Resources (Pvt.) Ltd
RQD	Rock Quality Designation
SEC/SCECO	Saudi Electricity Company
SF_6	Sulfur Hexafluoride
SHYDO	Sarhad Hydro Development Organization
SPT	Standard Penetration Test
UPS	Uninterruptible Power Supply
USA	United States of America

VAWT	Vertical Axis Wind Turbine
VRLA	Valve Regulated Lead Acid
WAPDA	Water And Power Development Authority
WAsP	Wind Atlas and Application Programme
WMO	World Metrological Organization
WTG	Wind Turbine Generator

ACKNOWLEDGEMENTS

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

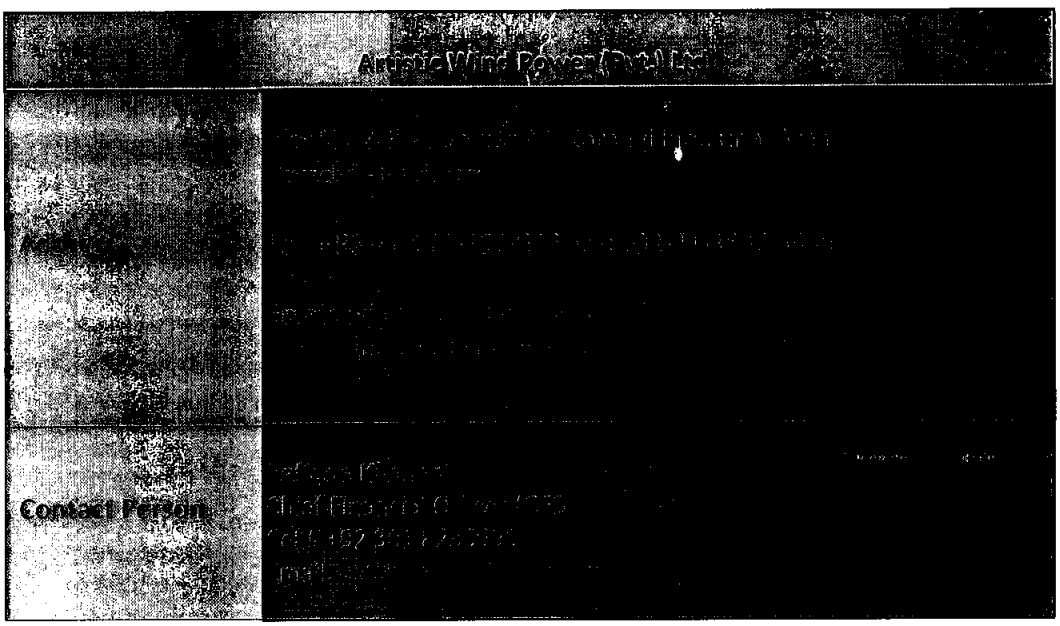
The management of Artistic Wind Power (Pvt.) Ltd also recognizes the kind cooperation of concerned Government departments (NEPRA, NTDC, and HESCO).

DISCLAIMERS

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

COPY RIGHT NOTICE

COMPANY CONTACT INFORMATION



CONSULTANT CONTACT INFORMATION

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Contact Person	Irfan Afzal Mirza, CEO
Email	irfanmirza@renewableresources.com.pk

DOCUMENT INFORMATION

Purpose and Scope:

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

1 EXECUTIVE SUMMARY

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

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

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

Artistic Wind Power (Pvt.) Limited (AWPPL) is an SPV formed for developing 50MW Wind Power Project. AWPPL is a subsidiary of Artistic Milliners (Pvt.) Limited (Pakistan Largest Integrated composite textile unit established in 1949).

AML also has another project of 50 MW, which in financial close phase by the name of Hartford Alternative Energy (Pvt.) Limited (HAEPL) in the Jhimpir region. The distance between the two sites is 1.7 km approx. The group now plans to install a Wind Power Project of 50 MW installed capacity and plans to accept the upfront tariff .In this regard, AML has an LOI for 50 MW from Government of Sindh (GOS).

AWPPL has land available having area of approximately 462 Acres. In order to identify the land for the wind farm within the same area, preliminary site assessment has been carried out. This document is the complete technical feasibility study of the project including but not limited to soil investigations, topographic studies, wind resource assessment, energy yield estimates, environmental impact assessment, electrical and grid interconnection studies.

1.1 PROJECT OVERVIEW AND SITE

The wind farm Project is located in Jhimpir, which is located approximately 135 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 462 acres of land, which is leased by GoS. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site. The Jhimpir wind corridor is identified as potential area for the development of wind power projects. The overview of the project site is shown in ***Figure 1***.

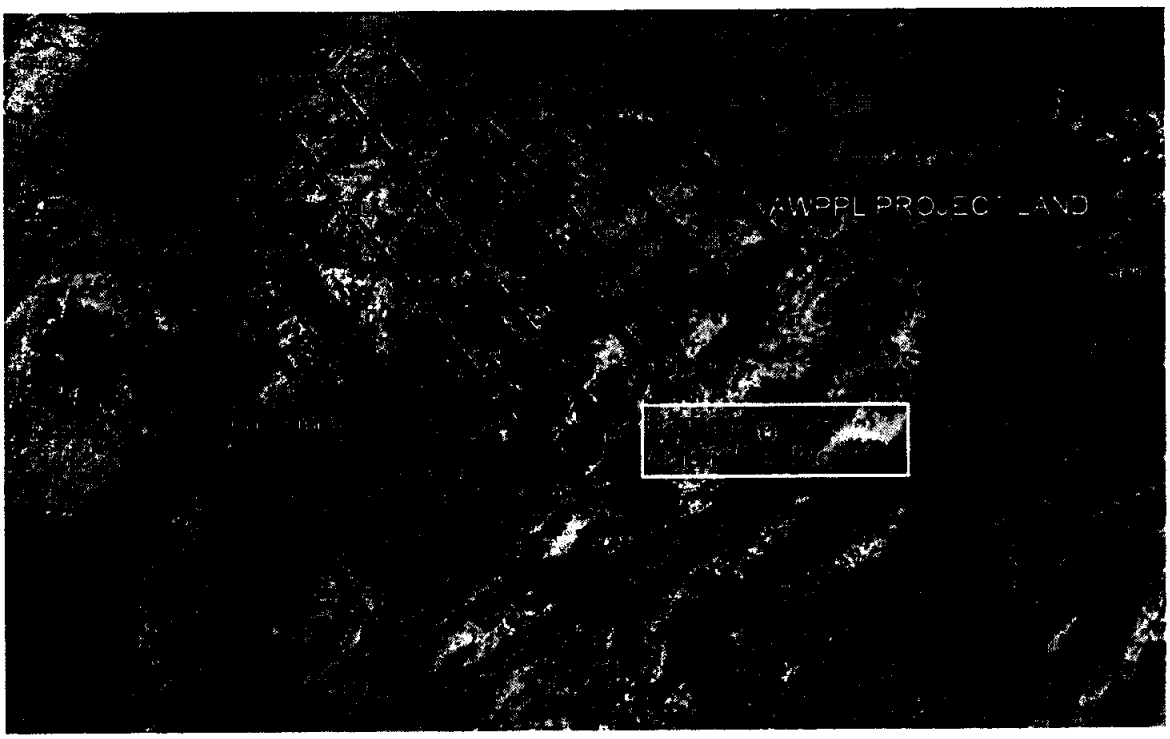


Figure 1: AWPPL Site overview

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

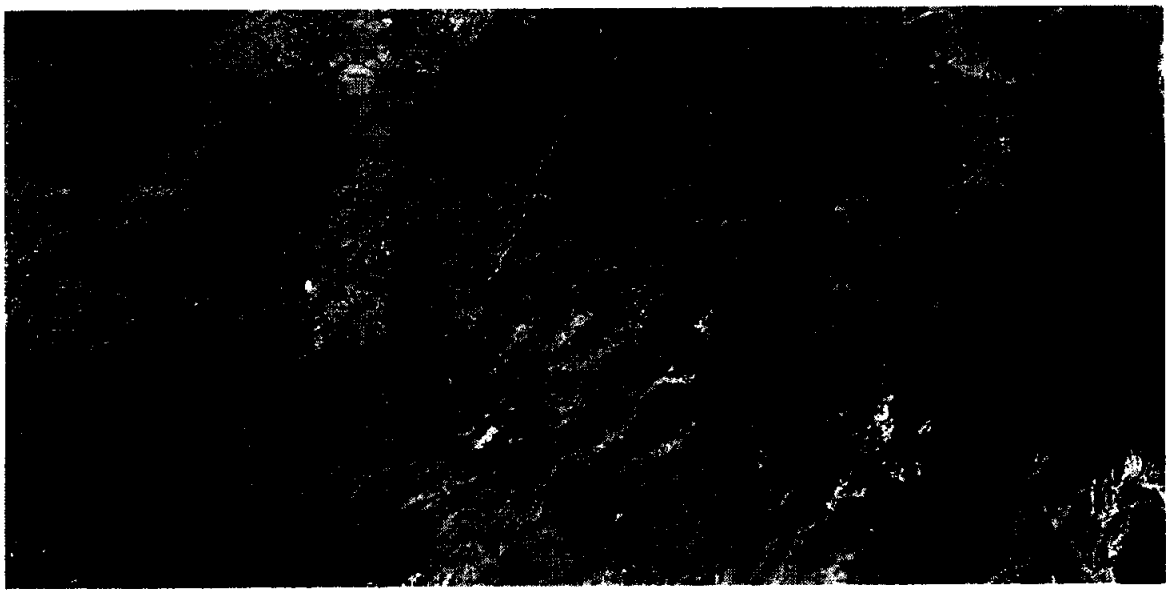


Figure 2: Satellite map of the Site

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

1.1.1 Project Size

The Project shall have an installed capacity of 50 MW, having area of 462 Acres.

1.1.2 Project Status and Calendar

The project calendar is given below:

Table 1: Project Planned Milestones

Activity / Milestone	2015	2016				2017				2018	
	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR
Time consumed in Land arrangement and Grid Data											
Preparation of Feasibility											
Submission of Feasibility Study											
Recommendation for Tariff											
Generation License											
Upfront Tariff											
Signing of IA											
Project Construction											

Document Title: Feasibility Study Report for 50 MW Wind Power Project in Jhimpir, Sindh-Pakistan	Consultant Name: Renewable Resources (Pvt.) Ltd	Document No RE2-141-175-001	Date of Approval Feb, 16
	Project Company: Artistic Wind Power (Pvt.) Ltd.	Document Issue 01	Page 22

The project construction shall take 18 months from the date of financial close till the COD.

Table 2: Project Construction Scheduling

[illegible] Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
[illegible]																		
Construction of Temporary Establishment																		
[illegible]																		
Construction of Substation																		
[illegible]																		
Cables and Interconnection																		
[illegible]																		
Testing and Commissioning of EBOP																		
[illegible]																		
EPA Tests and Reliability Run Test																		

1.1.3 Geological Conditions

The information related to geological conditions is given in Section 09. The detailed Geotechnical Investigation Report is attached as Annex III.

There were 06 bore holes with depth up to 15 meters.

The Sub-surface conditions disclosed by this investigation show the deposition of the area mainly consists of 'very weak to medium strong' limestone. Karstcaves and deposits of karstic limestone were encountered in some of bore holes. Ground water table was not encountered up to the explore depth of 15meters.

1.1.4 Design of Civil Works

Information related to the civil works is given in Section 10.

1.1.5 Design of Electrical Works

Information related to the electrical works is given in Section 11.

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

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

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

1.1.6 Construction Management

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

1.1.7 O & M Management

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

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

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

1.1.8 Environmental Management

Information related to the environmental management works is given in Section 13.

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

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

1.1.9 Health and Safety

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

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

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

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

1.1.10 CDM Aspect

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

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

1.2 LIST OF ANNEXURE

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

ANNEX – II: Transportation and Access Study Report

ANNEX – III: Geo Technical Investigation Report

ANNEX – IV: Electrical Grid Interconnection Study Report

ANNEX – V: Initial Environmental Examination (IEE) Report

1.3 PROJECT TEAM

1.3.1 Project Company: Artistic Wind Power (Pvt.) Limited (AWPPL)

Artistic Wind Power (Pvt.) Limited is subsidiary of Artistic Milliners Private Limited. AML got the LOI to establish a 50MW wind power plant on August 25, 2015 from DAE Sindh. AML has also acquired 462 acres of land from GoS for the project in Jhimpir region. Following are the key members of the AWPPL project team and their accomplishments.

Muhammad Rafique Khanani – CFO & Company Secretary

A Fellow Chartered Accountant (FCA) with a vast experience (30 years) in the field of Finance, Accounts, Treasury, Corporate Law and Tax Planning. Working for Artistic Group since 2012 and pioneer and key team member of Artistic Wind Farms. Actively engaged from inception of Hartford (first wind farm) and also engaged with second wind project and solar power project. Working in the capacity of Senior Management and responsible to supervise the entire team of Artistic Wind Farms during development and implementation phase of the Project.

Brig. (R) Muhammad Naeem – Project Director

A Mechanical Engineer from University of Engineering and Technology Lahore, with a vast experience (31 years) of providing engineering services to Pakistan Army. Worked for 2 years as a Project Director of FFC Energy Ltd, Pakistan's First Ever Wind Power Plant located at Jhampir, Sindh. He joined Artistic in 2015 and responsible for proactive dealing with Project Regulators like NEPRA, NTDC, CPPA, AEDB and GOS etc. to achieve Project milestones in a timely manner. Furthermore, he will be responsible to supervise Project Site during execution phase of the Project.

Irfan Bashir – Senior Manger Finance / Contract / Planning

A Chartered Accountant with a vast experience (14 years) of Investment banking, Project Finance, Risk Management and Audit at local and overseas market. Worked for 1.5 years as Manager Finance of Metro Power / Gul Ahmed Wind Power, dealt with Local & Foreign Financiers, EPC Contractors, Technical Consultants, Lawyers and Insurance Advisors and successfully achieved Financial Close for both Projects. He joined Artistic in August 2015 and responsible for Project planning & development, financing and management of the Project.

Muhammad Asad Ullah - Deputy Project Manager

Holds a Bachelor's degree in Electrical Engineering and having an experience of 06 years in the field of Energy including 04 years in Three Gorgeous First Wind Farm Pakistan where he was responsible for project management, technical due diligence, procurement support, construction supervision (installation, testing and commissioning of power plants), O&M supervision assignments and technical aspects of the EPA and EPC. He joined Artistic in October 2015 and responsible for engineering management, project development, systems design, project planning, contractual negotiations & management.

1.3.2 Project Sponsor: Artistic Milliners (Pvt.) Limited (AML)

The primary sponsor financing the Project is Artistic Milliners (Private) Limited (which is one of the leading textile sector undertakings of Pakistan having a variety of business divisions e.g. spinning, weaving, denim, garments etc.).

Artistic Milliners group of companies was established in 1949, and is today one of Pakistan's leading business houses and one of the largest premium quality denim cloth and finished products mills in the country. The company is engaged in the manufacturing and trading of denim, garments and fabrics and has the distinct privilege of being one of the few mills that are completely export oriented.

The group has its roots in textile trading and has since expanded to become a complete vertically integrated textile set up with the aim of providing high-end customers with premium quality of denim fabrics and garments.

Operating on an area of 165,922 sq. m and employing 7,650 people, Artistic Milliners has the ability to cater to specific client needs with package deals such as product development at source, design support, shorter lead times, on-time deliveries and warehousing facilities. Artistic's latest undertaking is the new state of the art denim mill AM-5 which will take the production capacity to 36 million meters per annum. Currently Artistic Milliners have an annual turnover in excess of US$ 250 million.

The sponsor is already undertaking a 50 MW wind power project under the name of Hartford Alternative Energy which is currently in advanced stages and financial close for the same is expected in April 2016.

1.3.3 Renewable Resources (Pvt.) Ltd – Project Consultant

www.renewableresources.com.pk

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

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

2 COUNTRY AND INDUSTRY OVERVIEW

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

Pakistan currently has 24.375 GW of installed capacity for electricity generation. Conventional thermal plants (oil, natural gas, coal) account for 67% of Pakistan's capacity, with hydroelectricity making up 29%, whereas nuclear and wind make up the remaining 3% and 1%, respectively. It is expected that by the end of next year, wind power will surpass nuclear energy in the overall composition of Power Sector Generation Pattern. The current supply, however, is unable to satisfy the electricity demand of the local market resulting in an acute shortage, which peaked at 5,384 MW in summer of 2014. The current installed capacity translates into a deliverable capacity of only 18,121 MW. The Government of Pakistan (GOP) estimates that by 2016, Pakistan's demand for electricity will reach 26,940 MW and the country will have to increase its generating capacity by almost 50% to meet the increasing demand.

Major reasons for the energy crises include:

(i) Lack of investment in power sector.
(ii) Depleting gas reserves.
(iii) Increasing reliance on foreign fuel based power generation sources.

The GOP has identified wind as one of the most feasible renewable energy resources for power generation in the short term. Although the technology is new in Pakistan, it has a globally proven track record, recognized commercial viability and an installed base of over 369,597 MW around the globe (over 137,074 MW of which is installed in India and China alone), making the case for development of wind energy in Pakistan very strong.

The Alternate Energy Development Board (AEDB) has identified the Gharo – Keti Bander – Hyderabad wind corridor (Wind Corridor) as being economically feasible for development of wind power projects. Based on an average wind speed of 7.5 m/s prevalent in the Wind Corridor the power generation potential for the area has been estimated to equal 50,000 MW.

Pursuant to the "Policy for Development of Renewable Energy for Power Generation 2006" the Energy Department Government of Sindh ("EDGOS") issued a Letter of Intent to Artistic Wind Power (Private) Limited ("AWPPL" or the "Employer"), a company incorporated under the laws of Pakistan and owned by Artistic Milliners (Private) Limited (the "Sponsors"), for developing 50

MW wind power project. In this regard, AWPPL has been allocated land at Jhimpir, District Thatta by the Government of Sindh.

AWPPL intends to develop a 50 MW wind power project located at Jhimpir, District Thatta, Sindh. In relation hereto, AWPPL wishes to invite and receive bids for *inter alia*, the engineering, procurement and construction of the wind power projects.

3 REGULATORY REGIME

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

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

3.1 MINISTRY OF WATER AND POWER

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

3.2 NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

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

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

3.3 NATIONAL TRANSMISSION AND DISPATCH COMPANY (NTDC)

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

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

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

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

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

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

3.6 Alternate Energy Development Board (AEDB)

Alternative Energy Development Board (AEDB) is the sole representing agency of the Federal Government that was established in May 2003 with the main objective to facilitate, promote and encourage development of Renewable Energy in Pakistan and with a mission to introduce Alternative and Renewable Energies (AREs) at an accelerated rate. The administrative control of AEDB was transferred to Ministry of Water and Power in 2006.

The Government of Pakistan has tasked the AEDB to ensure 5% of total national power generation capacity to be generated through renewable energy technologies by the year 2030. In addition, under the remote village electrification program, AEDB has been directed to electrify 7,874 remote villages in Sindh and Baluchistan provinces through ARE technologies.

4 CARBON CREDITS

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

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

Each country's emissions target must be achieved by the period 2008 - 2012. It will be calculated as an average over the five years. "Demonstrable progress" must be made by 2005. Cuts in the three most important gases carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) will be measured against a base year of 1990 (with exceptions for some countries with economies in transition). Cuts in three long-lived industrial gases – hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), and sulfur hexafluoride (SF6) - can be measured against either a 1990 or 1995 baseline. A major group of industrial gases, chlorofluorocarbons, or CFCs, are dealt with under the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.

Actual emission reductions will be much larger than 5%. Compared to emissions levels projected for the year 2000, the richest industrialized countries (OECD members) will need to reduce their collective output by about 10%. This is because many of these countries will not succeed in meeting their earlier non-binding aim of returning emissions to 1990 levels by the year 2000, and their emissions have in fact risen since 1990. While the countries with economies in transition

have experienced falling emissions since 1990, this trend is now reversing. Therefore, for the developed countries as a whole, the 5% Protocol target represents an actual cut of around 20% when compared to the emissions levels that are projected for 2010 if no emissions-control measures are adopted.

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

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

4.1 EMISSION REDUCTION MECHANISMS

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

4.1.1 Emissions Trading

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

4.1.2 Clean Development Mechanism (CDM)

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

4.1.3 Joint Implementation (JI)

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

4.2 ROLE OF CDM IN AWPPL PROJECT

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

5 WIND INDUSTRY IN PAKISTAN

5.1 CURRENT STATUS OF WIND IPPs IN PAKISTAN

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

Initially very few suppliers wanted to come to new market like Pakistan. But now most of the suppliers are keen for the Pakistani market. One factor could be the Pakistani market getting matured. Now GE, Nordex, Vestas and Goldwind are all active in the market.

5.1.1 Letter of Intent (LOI)

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

5.1.2 Land Allocation by AEDB / GOS

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

5.1.3 Projects at Advanced Stages

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

Table 3: Wind Projects with CODs

No.	Company	Capacity (MW)	COD
[redacted]	[redacted]	[redacted]	[redacted]
	Zorlu Energy	56.4	2nd Quarter 2013
[redacted]	[redacted]	[redacted]	[redacted]
	Foundation Wind Energy II	50.0	4th Quarter 2014
[redacted]	[redacted]	[redacted]	[redacted]
	Sapphire Wind Energy Ltd	52.8	4th Quarter 2015.

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

Table 4: Wind Projects in Construction Phase

No.	Company	Capacity (MW)
[redacted]	[redacted]	[redacted]
	Metro Power Company Ltd	50.0
[redacted]	[redacted]	[redacted]
	UEP Wind (Pvt) Ltd	99.0
[redacted]	[redacted]	[redacted]
	Tapal Wind (Pvt) Ltd	30.0
[redacted]	[redacted]	[redacted]
	Tenega Genarsi	49.5
[redacted]	[redacted]	[redacted]

5.1.4 Projects at Advanced Development Stages

Following projects have reached the Generation License / Tariff stage:

Table 5: Projects at advanced Development Stages

No.	Company	Capacity (MW)
	[redacted]	
	Jhimpir Power Ltd	49.3
	[redacted]	
	Tricon Boston 1	49.3
	[redacted]	
	Tricon Boston 3	49.3
	[redacted]	
	Three Gorges Third Wind Farm Ltd	49.5
	[redacted]	

5.1.5 Projects at Initial Development Stages

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

Table 6: Projects at Initial Development Stages

No.	Company	Capacity (MW)
	[redacted]	
	Metro Wind Power Ltd	60.0
	[redacted]	
	ACT2 Wind (Pvt) Ltd	50.0
	[redacted]	
	Uni Energy Ltd	50.0
	[redacted]	
	Liberty Group	50.0
	[redacted]	

5.2 TARIFF REGIME IN PAKISTAN

5.2.1 Negotiated Tariff for Wind IPPs

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

5.2.2 Upfront Tariff for Wind IPPs

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

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

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

6 PROJECT IN TERMS OF POLICY FRAMEWORK

6.1 LETTER OF INTENT (LOI)

First step was to obtain Letter of Intent from DAE, GoS which was accomplished on September 01, 2015. This letter entitled the Project Company to start working on wind power project at official level and get support from DAE GoS and other government departments in the preparation of feasibility study and acquisition of land for the project. The feasibility is being submitted before expiration of LOI but after the dead line given in the LOI for the feasibility.

6.2 ACQUISITION OF LAND

462 acres of land has been allocated for AWPPL by Government of Sindh in the Jhimpir region. The following are the land coordinates.

Table 7: Land Coordinates

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
2.	**24° 57.488'N**	**67° 53.982'E**
[redacted]	[redacted]	[redacted]
4.	**24° 59.404'N**	**67° 53.396'E**
[redacted]	[redacted]	[redacted]
6.	**24° 58.019'N**	**67° 54.441'E**
[redacted]	[redacted]	[redacted]
8.	**24° 59.821'N**	**67° 52.111'E**

6.3 FEASIBILITY STUDY

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

6.4 GENERATION LICENSE

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

6.5 TARIFF DETERMINATION

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

6.6 LETTER OF SUPPORT (LOS)

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

6.7 ENERGY PURCHASE AGREEMENT (EPA)

Agreement between the Power Purchaser (CPPA) and the Project Company is called Energy Purchase Agreement (EPA). This agreement lists terms and conditions for the sale and purchase of electricity between the two companies. As soon as the feasibility study is submitted and upfront tariff is filed, the Project Company shall enter into the discussions of EPA. This is going to be a significant step in the project development because no other project has negotiated an EPA with upfront tariff.

6.8 IMPLEMENTATION AGREEMENT (IA)

The Implementation Agreement (IA) provides security to the sponsors and lenders against the performance of the power purchases through guarantees from Government of Pakistan. Implementation Agreement will be signed by AEDB on the behalf of GoP. Its discussions shall start alongside the EPA.

6.9 FINANCIAL CLOSE

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

7 PROJECT SITE

7.1 WIND CORRIDOR OF PAKISTAN

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

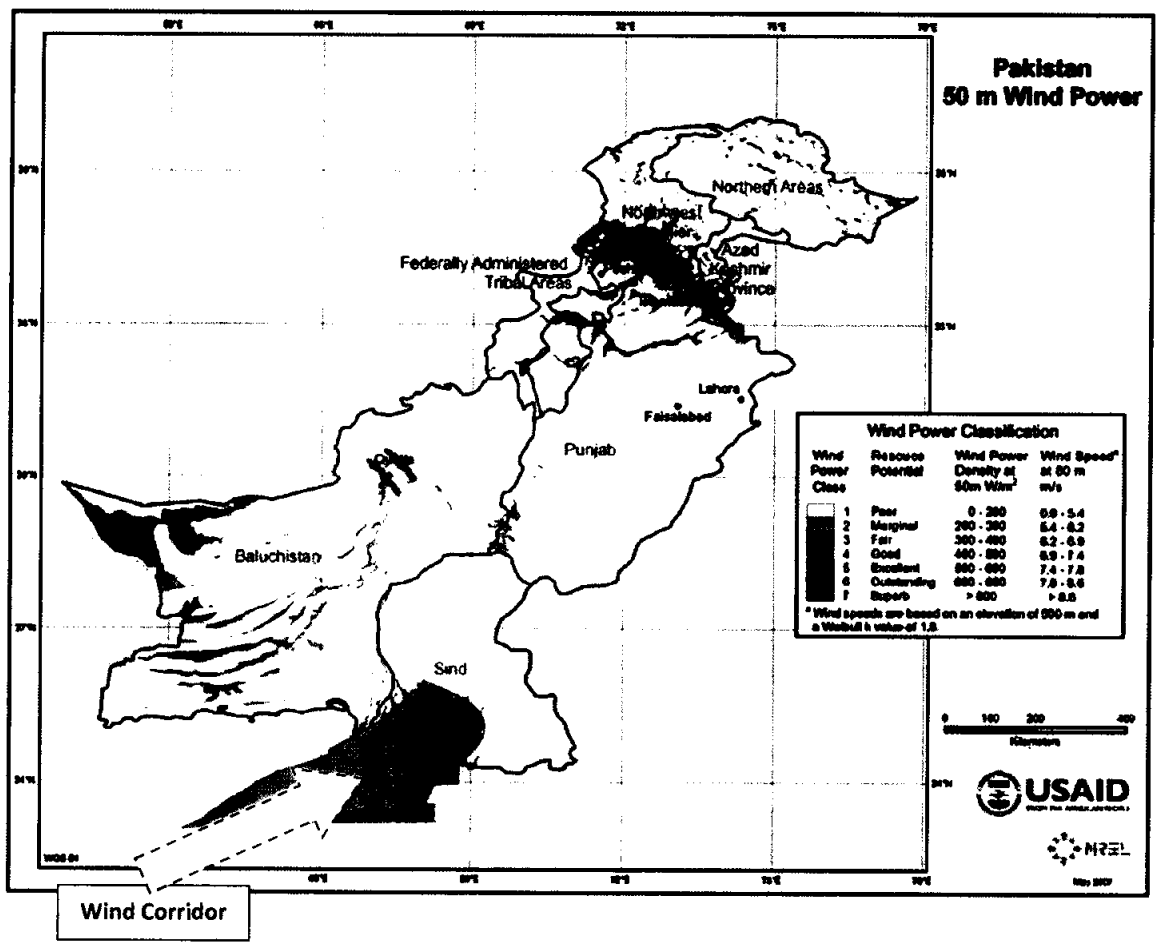


Figure 3: Wind Map of Pakistan by NREL

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

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

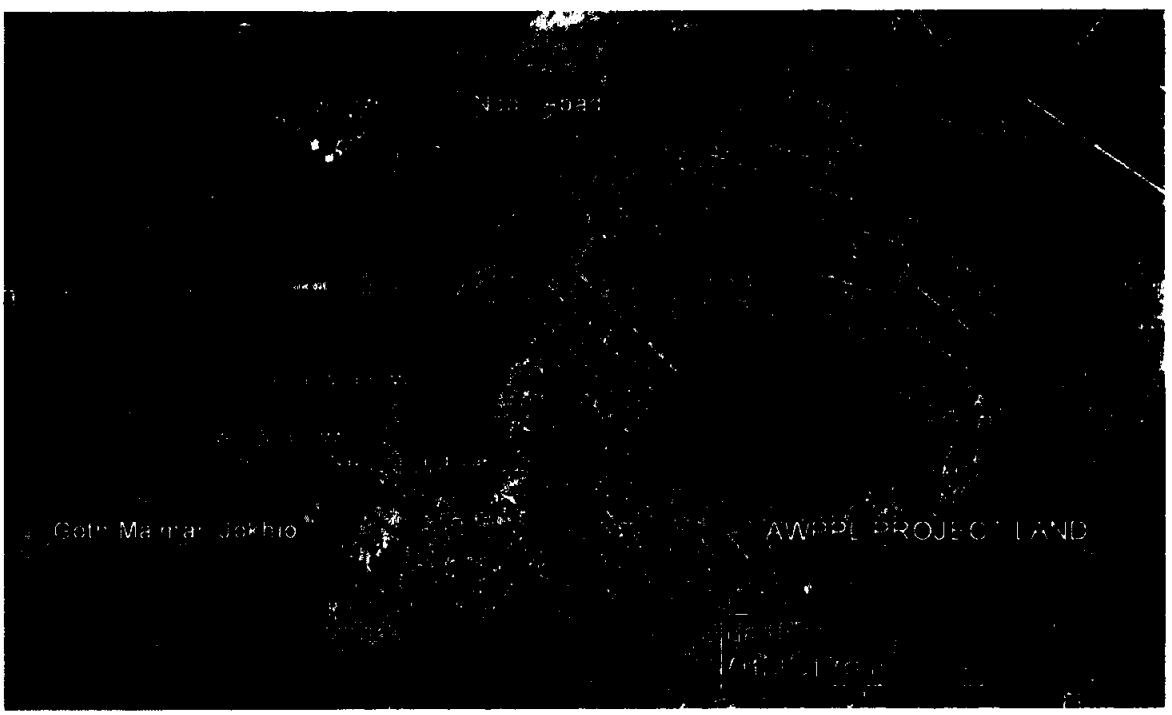


Figure 4: Overview of AWPPL Site

7.2 SITE DETAILS

The site is located in Jhimpir Sindh which is towards the North East of Karachi as shown in ***Figure 5***.

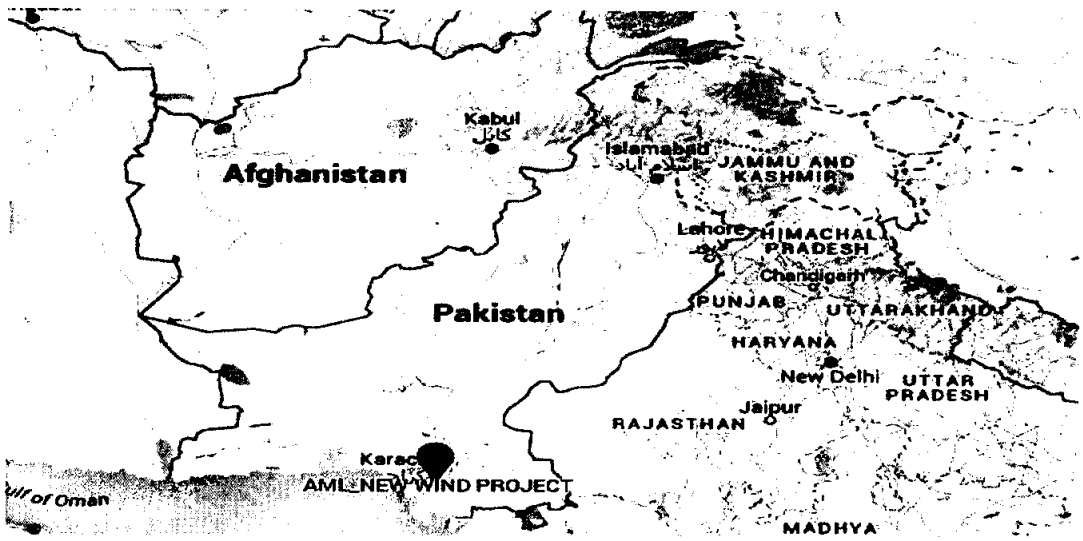


Figure 5: AWPPL Site Location

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

Hyderabad Electrical Supply Company 132/11 kV grid station is DISCO in Jhimpir. Nearest Grid is New Jhimpir Grid. The distance of the grid station from the Project site is approximately seventeen (19) kilometers.

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

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

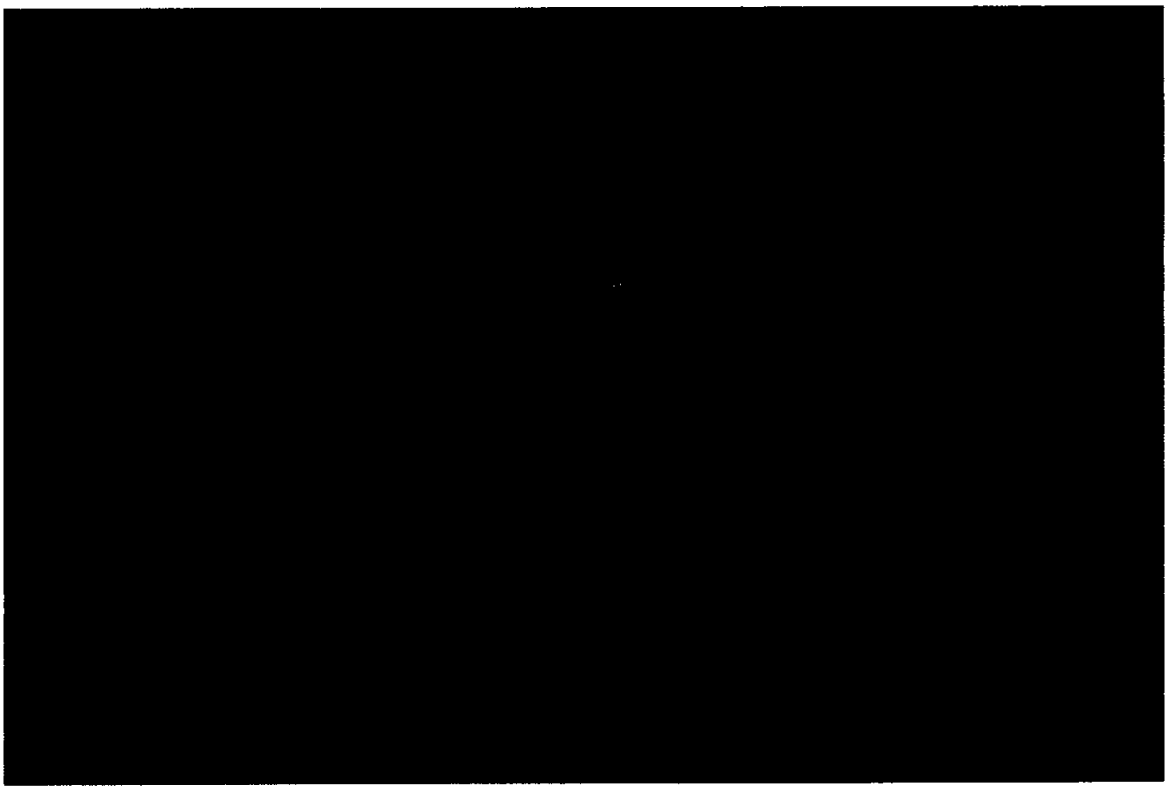


Figure 6: View of Project Site

7.3 TRANSPORTATION AND ACCESS NETWORK

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

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

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

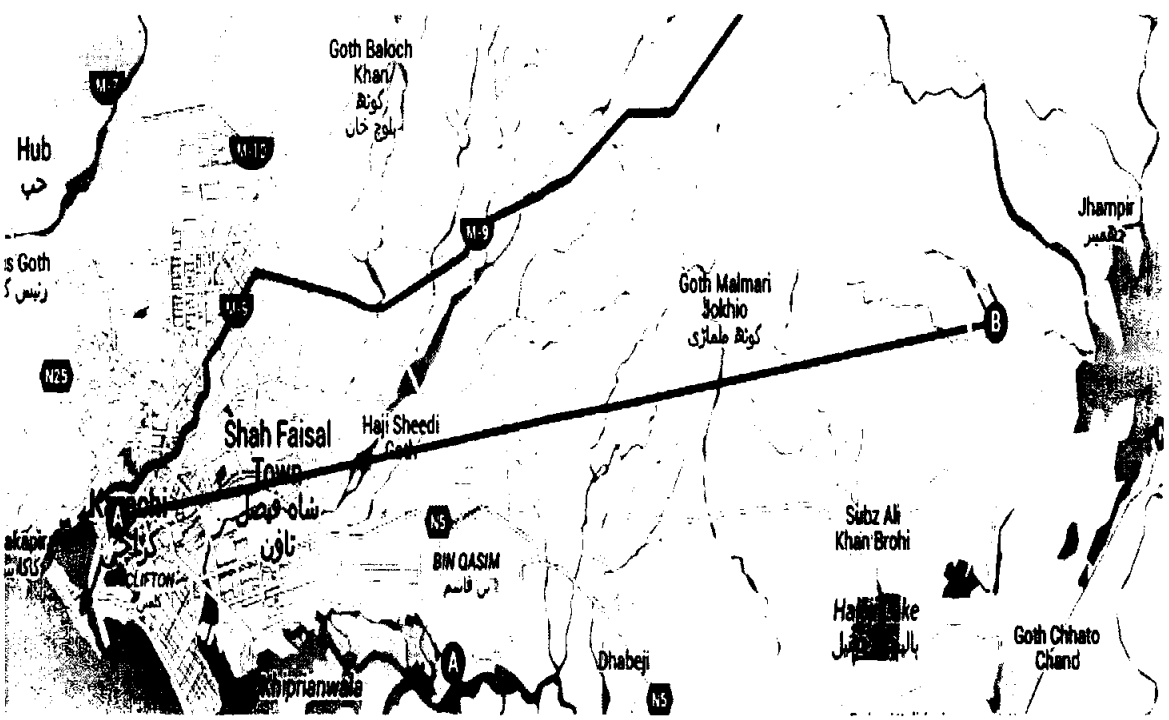


Figure 7: Access to the Site

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

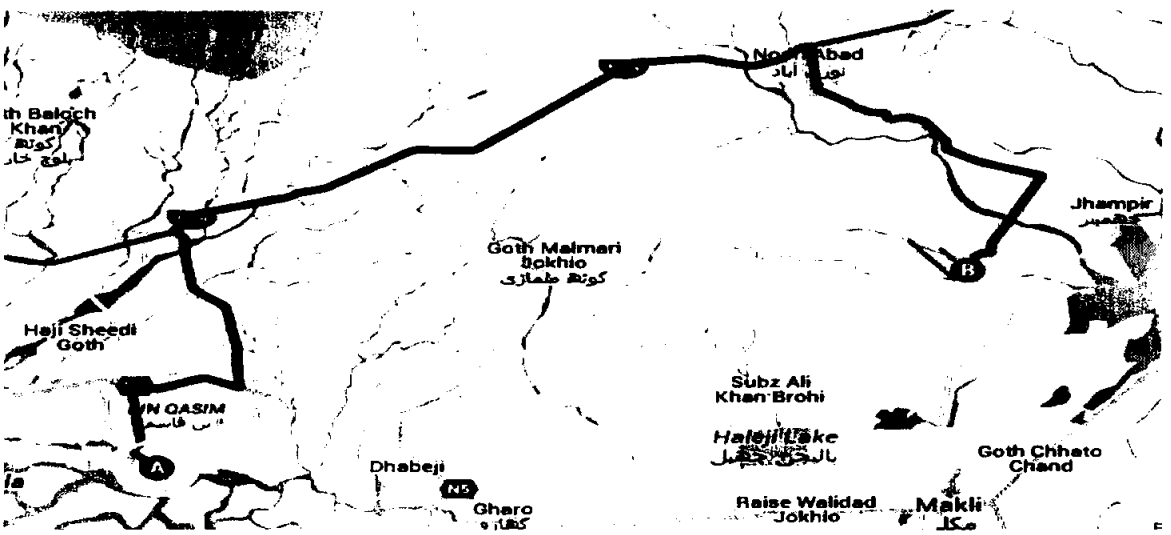


Figure 8: Detailed Access to the Site

7.4 CLIMATIC CONDITIONS

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

Table 8: Maximum & Minimum Temperatures in Jhimpir Region

[redacted]						
[redacted]	[illegible]	(°C)	(°C)	(°C)	(°C)	[illegible]
[redacted]	Jan	20.6	20	10.3	34.5	5.7
[redacted]	Feb	22.9	22.3	12.9	33.3	[illegible]
[redacted]	Mar	26.7	25.9	14.7	42.6	5
[redacted]	Apr	29.8	28.9	20.4	41.9	[illegible]
[redacted]	May	31.6	30.2	25.2	42.8	4.3
[redacted]	Jun	31.1	30.3	25.9	38.2	[illegible]
[redacted]	Jul	29.4	28.7	25.7	35.8	2.2
[redacted]	Aug	28.5	27.8	24.7	34.6	[illegible]
[redacted]	Sep	28.6	27.8	23.6	38.5	3.5
[redacted]	Oct	[illegible]	28.4	21.6	[illegible]	[illegible]
[redacted]	Nov	25.8	25	17.9	35.9	4.4
[redacted]	Dec	21.8	21.6	9.9	34.8	[illegible]

Table 9: Average Precipitation and Rainfall Days in Jhimpir Region

[redacted]											
[redacted]	[illegible]	[illegible]	6mm	5mm	12mm	21mm	50mm	14mm	[illegible]	[illegible]	[illegible]
[redacted]	1	0	1	0	1	3	4	1	0	0	1

7.5 TELECOMMUNICATION

The wire based land line telecommunication is available in the nearby towns but not at project site. All major mobile phone suppliers including Mobilink, Telenor, Warid, Ufone and Zong have coverage on the site area.

7.6 EARTHQUAKES

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

8 SELECTION OF WTG AND EPC CONTRACTOR

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

Table 10: EPC bidders

Power China	• General Electric GE 1.7-103 • General Electric GE 2.75 • Gold Wind GW 121-2.5 • Gamesa G114-2.0 • Gamesa G114-2.5	• 1.7 MW • 2.75 MW • 2.5 MW • 2.0 MW • 2.5 MW
Vestas	• Vestas V126-3.3	• 3.3 MW

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

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

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

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

9 GEOLOGICAL CONDITIONS

In order to collect detailed regional geological information, AWPPL hired professional services of Soil Testing Services–Pakistan Alternative Engineering Services (Pvt.) Ltd: a Pakistani local prospecting agency to conduct field exploration drilling often (06) bore holes on the Site during December, 2015. The average drilling depth is 15 m. The complete Geotechnical Investigation Report is report is attached as Annex-III.

9.1 OBJECTIVES OF GEOTECHNICAL STUDIES

- To execute 06 boreholes with 15m in depth.
- To execute field and laboratory geotechnical testing.
- To investigate the surface and sub-surface soil condition, to evaluate foundation design parameters.
- To provide shallow and deep foundation recommendations.

9.2 GEOLOGY OF KARACHI REGION AND SURROUNDINGS

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

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

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

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

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

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

Figure 9: Tectonic Map of Pakistan

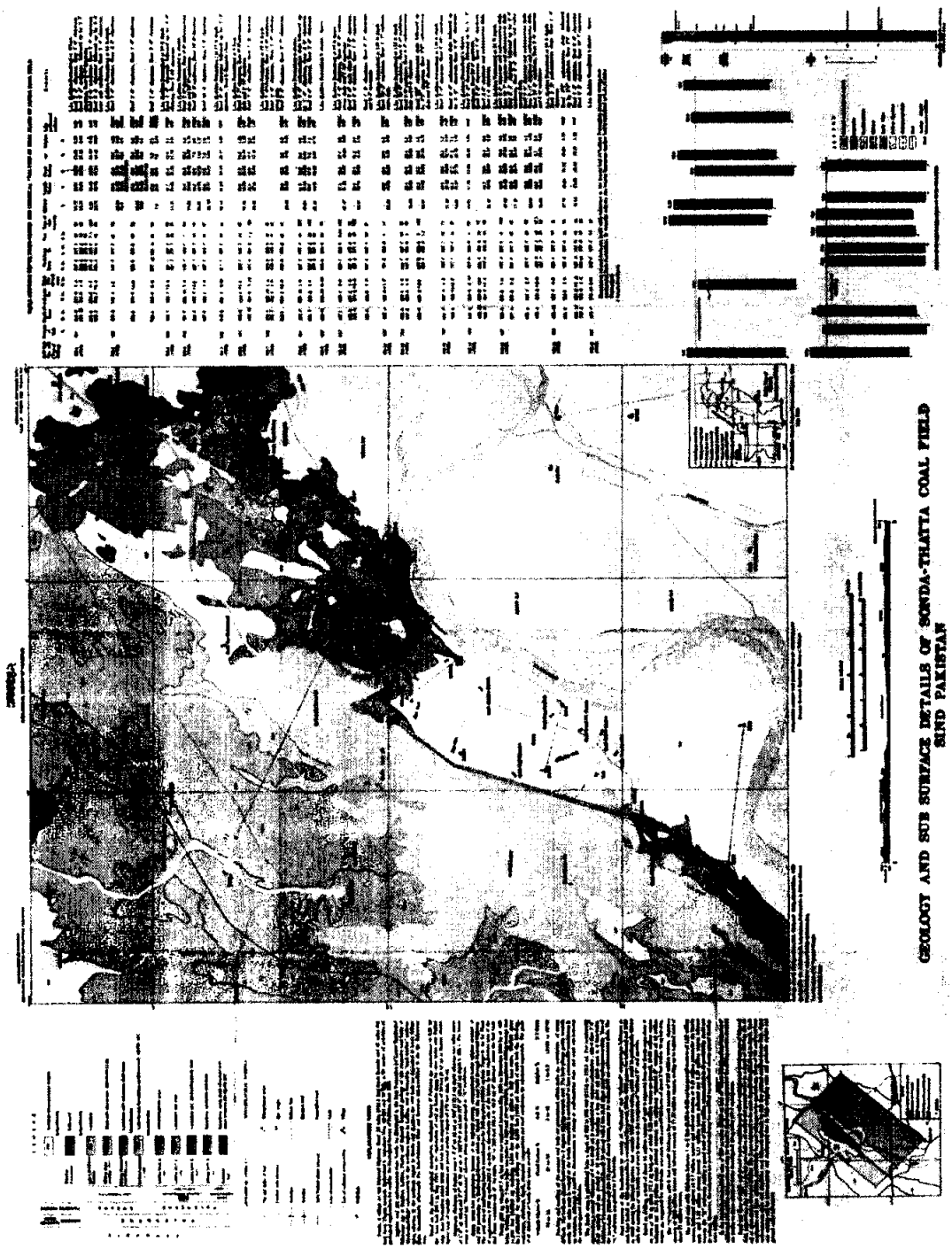


Figure 10: Geological and Sub Surface details of Jhimpir

9.3 SEISMOLOGY OF KARACHI REGION

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

Table 11: Earthquake Records around Karachi

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

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

Table 12: Seismic Parameters of Karachi

UBC Zone	[illegible]
Max Peak Ground Acceleration	16% - 20% of 'g' ($g = 9.8\ m/s^2$)
[illegible]	[illegible]
Magnitude (Richter Scale)	5.5 to 6.5
Intensity (MM Scale)	VI - VII

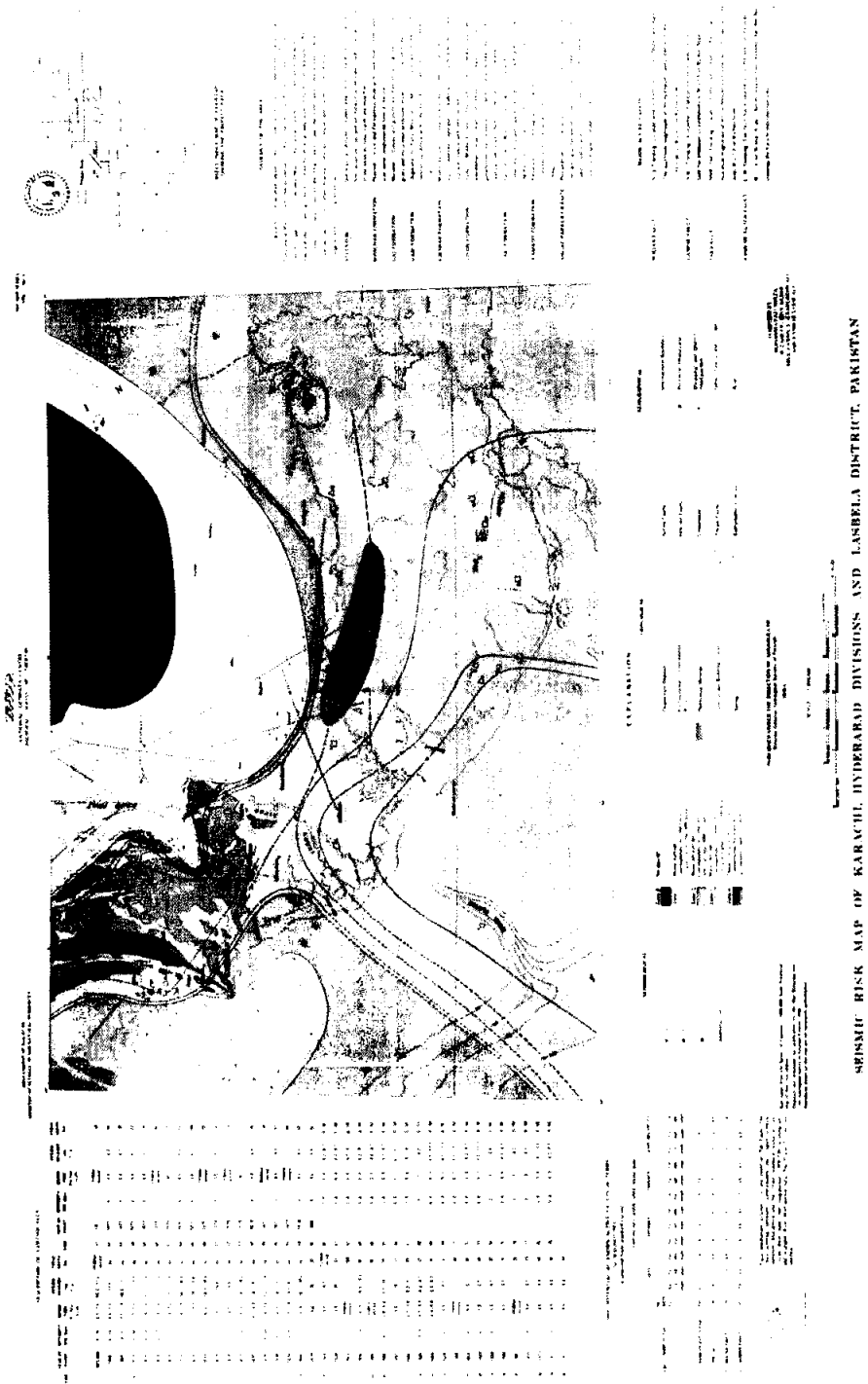


Figure 11: Seismic Map of Pakistan

9.4 FIELD WORK

9.4.1 Borehole Drilling

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

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

9.4.2 Rock Core Drilling

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

9.4.3 Location of Boreholes

Table 13: Location of Boreholes during Geo Technical Investigations (UTM zone 42R)

B1	[illegible]	[illegible]
B2	386601	2763958
B3	[illegible]	[illegible]
B4	388492	2761533
B5	[illegible]	[illegible]
B6	388069	2763967

9.4.4 List of Field and Lab Tests

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

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

9.5 CONCLUSIONS OF GEOTECHNICAL STUDIES

Geo technical Investigation for Artistic Wind Power Pvt Ltd Wind Power Project Jhimpir, Sindh was carried out in Dec, 2015. Scope of work included drilling of (06) bore holes up to 15.0 meters depth. Soil ERS was also conducted at 06 location across the site. Soil and rock samples were also collected during the field investigation. Laboratory testing of soil and rock samples has been carried out in STS lab and includes natural moisture content, specific gravity, water absorption, density, unconfined compressive strength etc. Chemical characteristics of soil and ground water samples have also been assessed through determination of total dissolved solids, sulphate content, chloride content and pH. Keeping in view, the results from field, and laboratory tests and the expected loads being transferred to the founding stratum, allowable bearing pressures for shallow foundations at depth of 1.5meters. Exposure to chloride and sulphate salts is 'negligible 'for soil; therefore, Ordinary Portland Cement (OPC) should be used for underground concreting.

10 CIVIL ENGINEERING DESIGN

The civil engineering design mainly includes following structures:

- Foundation of WTG Towers
- Foundation of substation and grid interconnection apparatus, i.e. transformer, switchgear.
- Construction of permanent buildings (residence and offices) of O&M staff.

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

11 ELECTRICAL ENGINEERING DESIGN

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

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

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

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

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

The 132 kV substation shall consist of two bus sections of a single bus bar with a coupler and two breaker bays to connect main transformers with the 132 kV double circuit overhead lines (OHL). The Main Transformers shall meet the N-1 grid code criteria and thus may be two (02) in number (31.5/40/50 MVA each). The instrumentation transformers (CTs, VTs and CVTs) for all purposes shall be sized according to requirement.

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

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

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

12 CONSTRUCTION MANAGEMENT

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

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

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

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

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

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

Table 14: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Engineering and Mobilization																		
Construction of Temporary Establishment																		
Civil Works and Foundations																		
Construction of Substation																		
Supply of WTGs and Towers																		
Cables and Interconnection																		
Electrical Installation																		
Testing and Commissioning of EBOP																		
Erection and Commissioning																		
EPA Tests and Reliability Run Test																		

13 Initial Environment Examination (IEE)

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

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

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

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

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

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

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

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

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

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

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

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

Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor will be carefully selected after undergoing an

options assessment. This enabled the right of way alignment to bypass villages and important water supplies and resources. The main Project impacts are associated with clearing of shrub vegetation, waste management and excavation and movement of soils.

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

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

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. Mitigation measures related to Construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed Project has Ltd adverse environmental and social impact which can be mitigated following the EMP & shall be pollution free Renewable source of Power generation with low Environmental foot prints.

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

environmental and social impact which can be mitigated following the EMP& shall be pollution free Renewable source of Power generation with low Environmental foot prints.

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

14 CONCLUSIONS OF FEASIBILITY STUDY

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

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

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

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

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

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

From here onwards, the Project may enter into getting licenses and permits and into negotiation of security documents. The next steps after submission of feasibility is to get recommendation for Tariff, which is necessary for the application of Generation License and Tariff, and after that to begin negotiations for EPA and IA. The Project may also enter into discussions with lenders at some stage.

It is expected that the Project will achieve financial close by 1st quarter of year 2017 and construction will be completed by 2nd quarter of year 2018. It is anticipated that the Project of

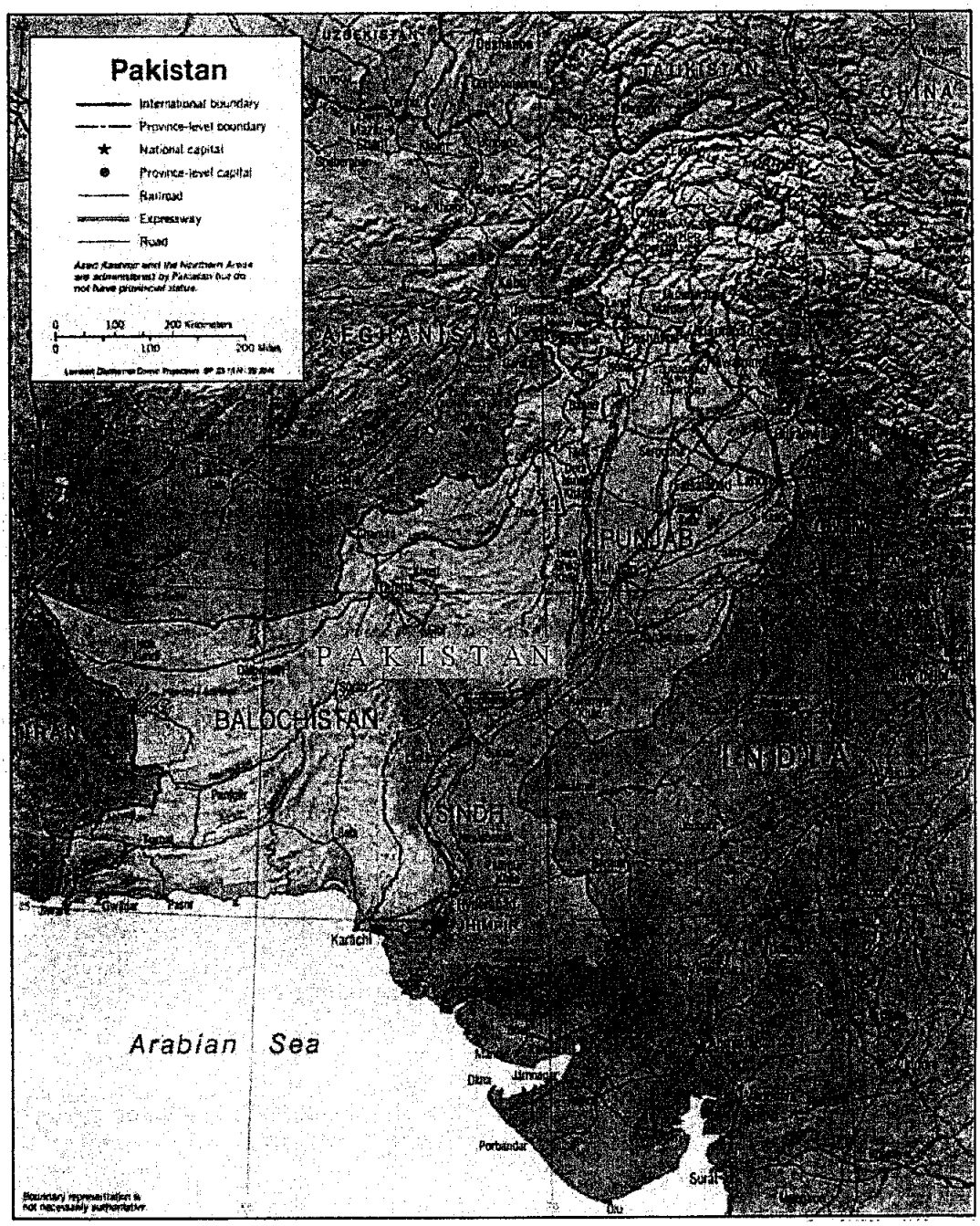
AWPPL would be a valuable addition to the National Grid for generating electricity and contribute to overcome the current energy crises of the Pakistan.

SCHEDULE-I

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

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

Location of Generation Facility/ Wind Farm



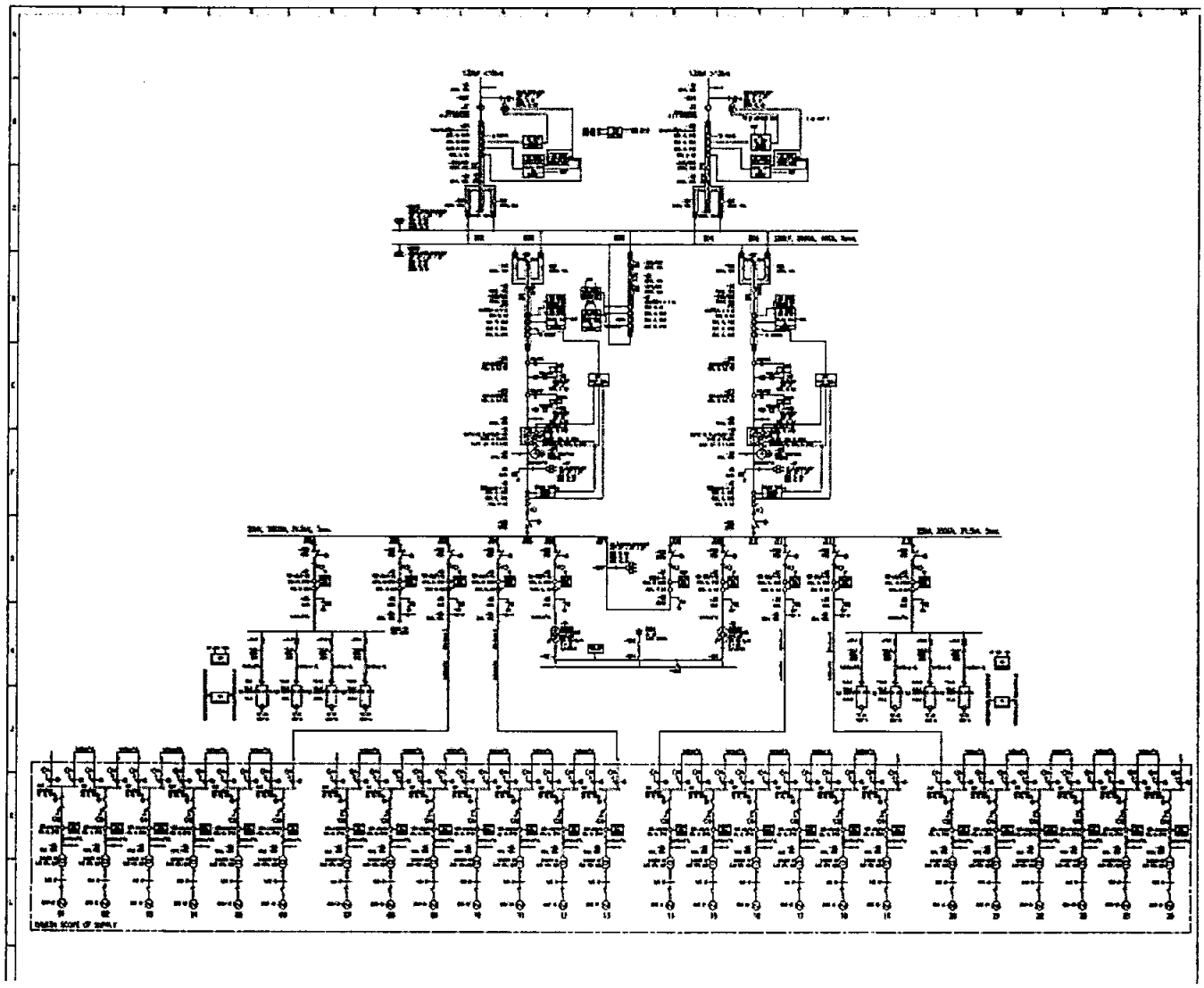
Layout of Generation Facility/ Wind Farm

Land Coordinates of Generation Facility/ Wind Farm

	Coordinates (UTM z42, WGS84)	
	Easting [m]	Northing [m]
1	385814.82	2765094.70
2	385631.01	2764971.64
3	388926.70	2760759.29
4	389049.67	2760958.53
5	389878.12	2761871.39
6	389708.84	2761736.31
7	387807.57	2764165.30
8	387969.55	2764310.28

Electrical System Single Line Diagram of Generation Facility/Wind Farm

The project will install 20 WTGs GOLDWIND GW 121/2500. There shall be four (04) WTG collector group. Each collector group shall consist of 5 WTGs.



Micro-Sitting of Generation Facility/ Wind Farm

Micro-siting arrangement of WTGs

	Coordinates (UTM Z42 WGS84)	
WTG #	Easting (m)	Northing (m)
WTG01	385,771	2,764,982
WTG02	385,994	2,764,696
WTG03	386,218	2,764,410
WTG04	386,441	2,764,124
WTG05	386,665	2,763,838
WTG06	386,889	2,763,552
WTG07	387,112	2,763,266
WTG08	387,336	2,762,980
WTG09	387,783	2,762,408
WTG10	387,935	2,764,170
WTG11	388,006	2,762,122
WTG12	388,159	2,763,885
WTG13	388,230	2,761,836
WTG14	388,453	2,761,550
WTG15	388,609	2,763,316
WTG16	388,834	2,763,031
WTG17	388,938	2,760,926
WTG18	389,059	2,762,746
WTG19	389,284	2,762,461
WTG20	389,509	2,762,176

Interconnection Arrangement/Transmission Facilities for Dispersal of Power from the Generation Facility/Power Plant/Wind Farm of Artistic Wind Power (Pvt.) Limited (AWPPL)

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

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

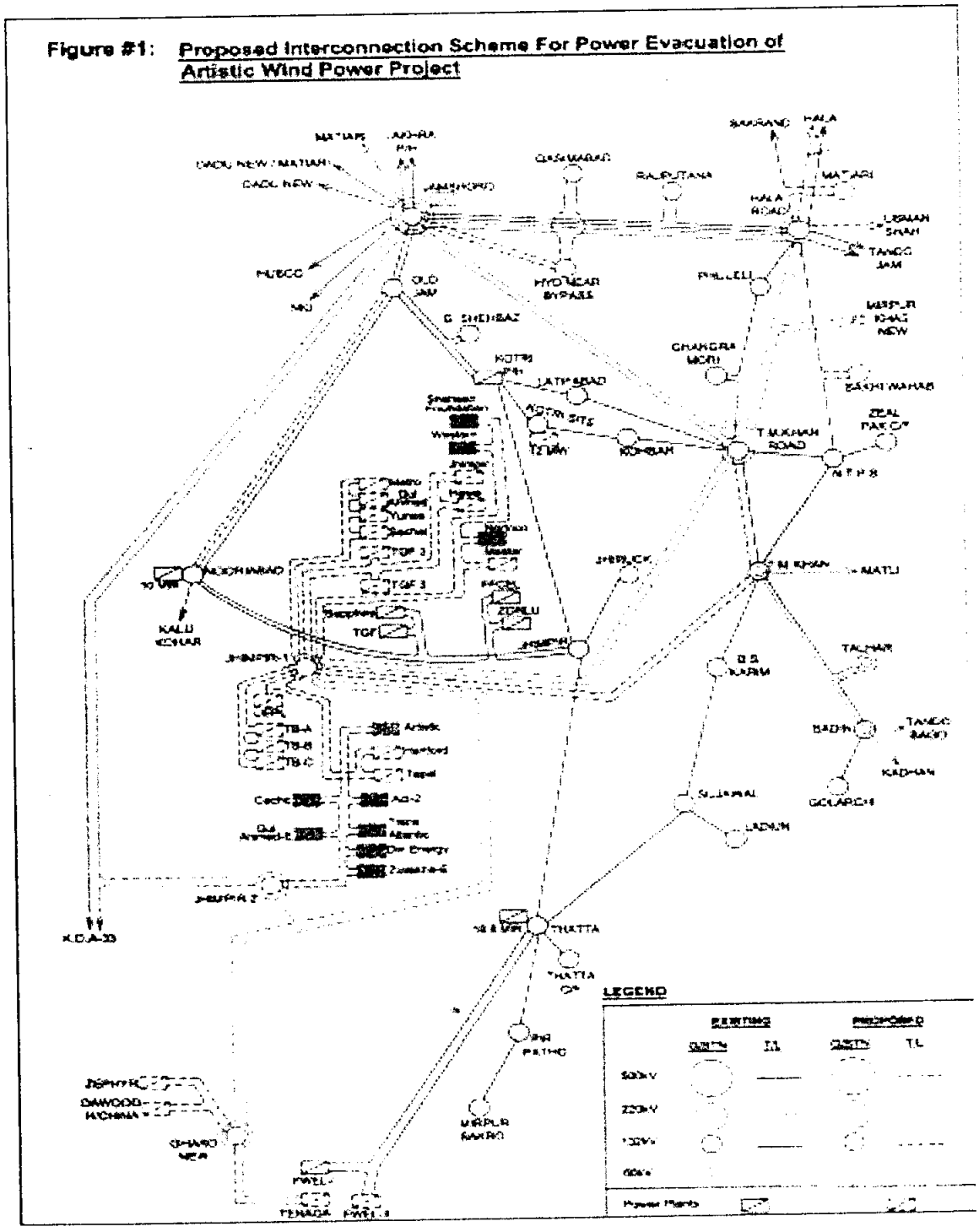
- 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro - KDA33 D/C transmission line at Jhimpir-2.

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

- 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Artistic WPP with Jhimpir-2. In this scheme, the interconnection of Artistic WPP includes 132kV D/C transmission line, approx. 14 km long, on twin-bundled Greeley conductor for looping In/Out from Artistic WPP on the 132 kV single circuit from Cacho WPP to ACT-2 WPP.

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

Figure #1: **Proposed Interconnection Scheme For Power Evacuation of Artistic Wind Power Project**



Detail of Generation Facility/Power Plant/ Wind Farm

(A). General Information

(i).	Name of Applicant/Company	Artistic Wind Power (Pvt.) Limited (AWPPL)
(ii).	Registered/Business Office	Plot No. 4 & 8, Korangi Industrial Area, Karachi, Pakistan
(iii).	Plant Location	Jhampir, Nooriabad, District Thatta, Sindh
(iv).	Type of Generation Facility	Wind Power

(B). Wind Farm Capacity & Configuration

(i).	Wind Turbine Type, Make & Model	GOLDWIND GW 121/2500
(ii).	Installed Capacity of Wind Farm (MW)	50 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	20 x 2500 KW

(C). Wind Turbine Details

(a).	Rotor	
(i).	Number of blades	3
(ii).	Rotor diameter	121 m
(iii).	Swept area	11,595 m^2
(iv).	Power regulation	blade pitch angle adjustment
(v).	Cut-in wind speed	3 m/s
(vi).	Cut-out wind speed	22 m/s
(vii)	Survival wind speed	52.m/s

(viii)	Pitch regulation	Independent electrical pitch control system, belt transmission, one for each blade
(b).	**Blades**	
(i).	Blade length	59.5 m
(ii).	Material	Glass fiber reinforced plastic
(c).	**Converter**	
(i).	Type	Full load power converter, double PWM IGBT technology
(ii).	Rated Voltage	690 V
(iii).	Rated Current	2200 A
(d).	**Generator**	
(i).	Power	2,500 kW
(ii).	Voltage	690 V
(iii).	Type	Permanent Magnet Direct Drive Synchronous Generator
(iv).	Enclosure class	IP 54
(vi).	Power factor	+0.95 to -0.95
(e).	**Yaw System**	
(i).	Yaw bearing	4 points-contact, double row ball slewing ring
(ii).	Brake	Hydraulic Disc Brakes
(iii).	Yaw drive	4 x electrical asynchronous Motors with 4 x planetary gears, 4 stages
(iv).	Speed	0.5 degree/s
(f).	**Control System**	
(i).	Type	Microprocessor Controlled, DFU (SCADA)
(ii).	Scope of monitoring	Remote monitoring of different parameters, e.g. temperature sensors, pitch parameters, speed, generator torque, wind speed and direction, etc.

(iii).	Recording	Production data, event list, long and 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	Hydraulic rotor brake for generator
(h).	**Tower**	
(i).	Type	Tubular steel tower
(ii).	Hub heights	90 m

(D). Other Details

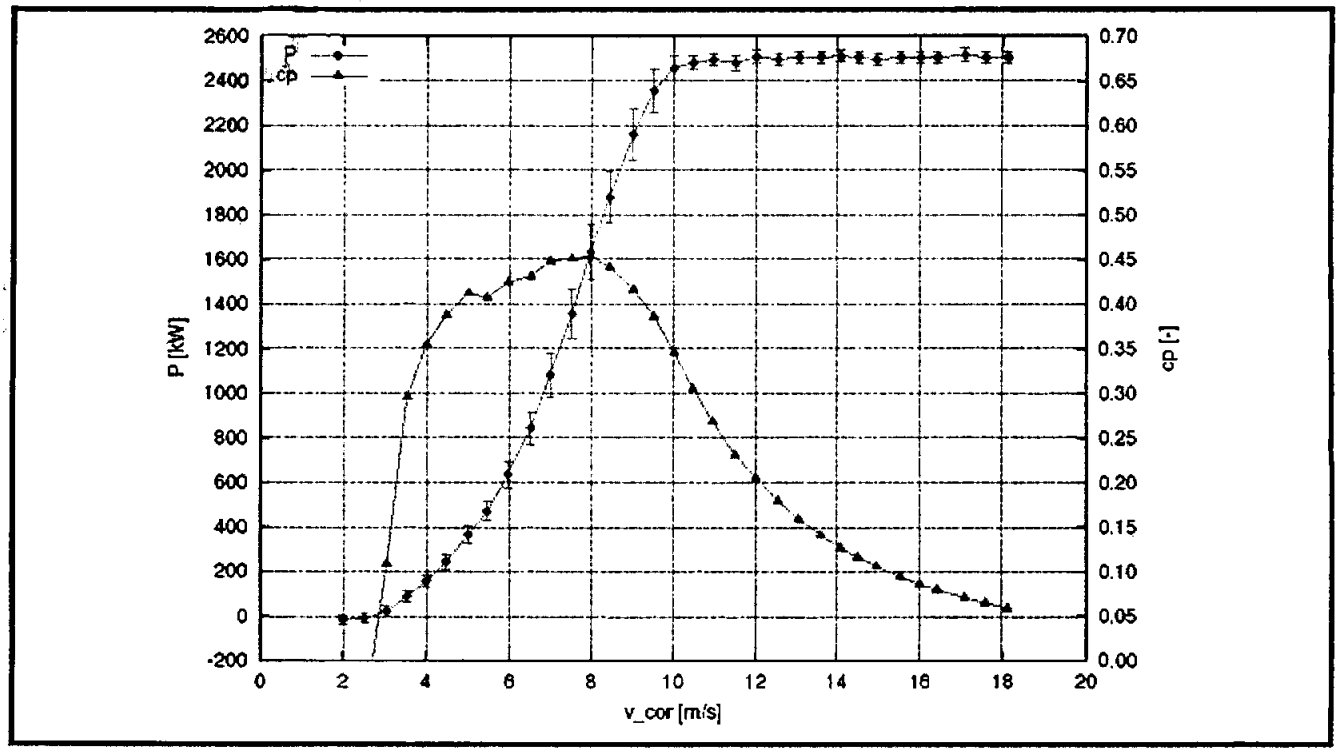
(i).	Project Commissioning Date (Anticipated)	2018
(ii).	Expected Life of the Project from Commercial Operation Date (COD)	20 Years

Power Curve of GOLDWIND GW 121/2500 Wind Turbine Generator (WTG) will be added at the time of Final Generation License

3	63
3.5	113
4	188
4.5	279
5	384
5.5	513
6	666
6.5	876
7	1114
7.5	1365
8	1640
8.5	1904
9	2181
9.5	2428
10	2494
10.5	2520
11	2530
11.5	2538
12	2545
12.5	2550
13	2550
13.5	2550
14	2550
14.5	2550
15	2550
15.5	2550
16	2550
16.5	2550
17	2550

Graphical Power Curve of GW 121/2500

Power Curve according to IEC 61400-12-1



NATIONAL TRANSMISSION & DESPATCH CO. LTD

General Manager Planning Power, NTDCL

No. GMPP/CEMP/TRP- 380/2894-98 Dated: 03-06-2016

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

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

Ref: M/s Artistic Wind Power (Pvt) Ltd. letter dated 26-04-2016.

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

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

DA/As Above

(Maqsood Ahmed Qureshi)
General Manager Planning (Power)

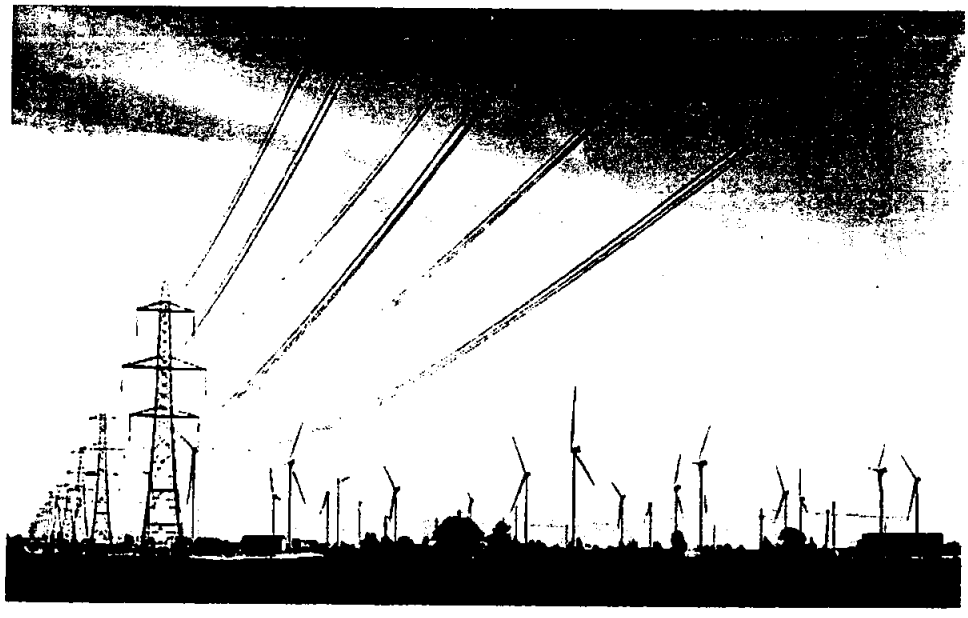
CC:

- Managing Director (NTDC), 414-WAPDA House, Lahore for information.
- Chief Executive Officer (CPPA-G) Ltd., 6th Floor, Shaheed-e-Millat Secretariat, Jinnah Avenue, Blue Area, Islamabad.
- General Manager Services Division (NTDCL) 414-WAPDA House, Lahore for information.
- Chief Executive Officer, M/s Artistic Wind Power (Pvt) Limited, Plot 4 & 8, Sector-25, Korangi Industrial Area, Karachi-74400, along with a copy of the subject interconnection study report.

- *Master File (MP)*

National Transmission and Despatch Company Limited
(NTDCL)

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



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

May 2016

Table of Contents

Appendices

Executive Summary

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

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

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

4. As per information provided by the project sponsor Artistic WPP comprises of 20 No. WTGs and each WTG is of Goldwind make, Type-4 with 2.5 MW gross capacity. The total gross generation capacity of Artistic WPP is 50 MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 47.9 MW.

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

with the proposed interconnection scheme for evacuation of power from Artistic WPP to the National Grid in the light of NEPRA Grid Code.

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

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

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

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

   iv) 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Artistic WPP with Jhimpir-2. In this scheme, the interconnection of Artistic WPP includes 132 kV D/C transmission line, approx. 14 km long, on twin-bundled Greeley conductor for looping In/Out from Artistic on the 132kV single circuit from Cacho WPP to ACT-2 WPP.

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

8. The above proposed interconnection scheme is expected to be completed in Dec. 2019. It is added that the expected timeline of the proposed interconnection scheme may be extended depending on variation in completion of the related activities, i.e., preparation and approval of PC-1, funding

arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.

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

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

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

12. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Artistic WPP are 7.19 kA and 4.58 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Artistic WPP.

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

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

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

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

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

1 Introduction

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

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

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

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

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

rating of transformers; single line diagram; switchyard voltage levels & equipment rating etc., have been provided by its sponsor and is attached in Appendix-1.
As per information provided by the project sponsor Artistic WPP comprises of 29 No. WTGs and each WTG is of General Electric GE1.7-103 make, Type-3 with 1.7 MW gross capacity. The total gross generation capacity of Artistic WPP is 49.3 MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 47.2 MW.

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

2 Technical Data of Artistic WPP

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

a) **WTG Generator Data**:

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

b) **WTG Arrangement in Wind Farm**

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

c) **Total Wind Farm Capacity:**

- Total gross capacity= 50 MW
- EBOP Losses = 1.35 MW
- Auxiliary Consumption = 0.8 MW
- Total net output capacity that will flow to the Grid = 47.9 MW

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

- No. of step-up transformers = 20
- Voltage ratio = 0.69/33 kV
- MVA rating = 3 MVA
- Percentage Impedance = 10%

e) Proposed Switchyard of Wind Power Project:

- High Voltage (HV) Level = 132 kV
- Medium Voltage (MV) Level = 33 kV
- Bus Bar Scheme = Double bus single breaker
- Bus Bar capacity = 3150 Amp
- Power (HV/MV) transformer:
  - No. of transformers = 2
  - Voltage ratio = 132/33 kV
  - MVA rating = 31.5/40/50 MVA
  - Percentage Impedance = 10-12%
- Switchgear data, single line diagram and layout of switchyard attached in Appendix-1.

f) Proposed Reactive Power Compensation

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

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

3 Study Objectives, Assumptions and Criteria

3.1 Study Objectives

The objectives of the interconnection study are given as under:

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

3.2 Study Assumptions

The system studies are based on the following assumptions:

- Latest load forecast.
- Latest generation expansion plan.
- Latest transmission expansion plans of NTDC and DISCOs, especially HESCO.
- Export of power from NTDC to K-Electric is assumed as 650 MW.
- Interconnected transmission system has been assumed, however, split bus has been assumed at 132 kV bus bars of Hala Road and T.M. Khan Road 220/132 kV substations as per system requirements.
- The existing, under-construction and already planned WPPs at Jhimpir and Gharo clusters with their interconnection arrangements. The under-construction 220/132 kV substations, i.e., Jhimpir New (Jhimpir-1) and Gharo New, with their allied transmission lines are assumed to be commissioned.
- As per information provided by project sponsor, the total gross & net capacity of Artistic WPP have been assumed as 50 MW & 47.9 MW respectively. The modeling of Artistic WPP in PSS/E software has been made as under:

- There are a total number of 20 WTGs and four collector groups in the wind farm with each WTG having gross capacity of 2.5 MW and generating power at 0.69 kV which has been stepped up to 33 kV through 3 MVA transformer.
- The four collector groups comprising of 5 WTGs each have been modeled separately with equivalent gross capacity of 4x2.5=12.5 MW and equivalent 0.69/33 kV transformers.
- Each of the four collector groups have been connected through individual 33 kV cables with 33 kV bus bar of the 132/33 kV substation.
- The SVC has been represented at 33 kV bus bar.
- At 132/22 kV substation, 2 No. 132/33 kV transformers have been modeled separately. The percentage impedance of 132/33 kV transformer has been assumed as 12% each.

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

3.3 Study Criteria

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

Voltage Limits	±5% under normal and ±10% under contingency conditions. However, voltages at some generation buses and some substations may be kept upto +8% under normal operating conditions as per network configuration and/or system requirements.

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

4 Proposed Interconnection Scheme

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

- A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
- 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.
- 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir New (Jhimpir-1) – Gharo New D/C transmission line at Jhimpir-2.
- 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Artistic WPP with Jhimpir-2. In this scheme, the interconnection of Artistic WPP includes 132kV D/C transmission line, approx. 14 km long, on twin-bundled Greeley conductor for looping In/Out from Artistic WPP on the 132 kV single circuit from Cacho WPP to ACT-2 WPP.

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

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

5 Load Flow Studies

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

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

5.1 Peak Load 2019 Scenario

Load flow study for the peak load scenario in 2019 under normal system condition has been carried out with net output of 47.9 MW from Artistic WPP and is attached as Exhibit #1.0 & 1.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Artistic WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Artistic WPP – Act-2 WPP 132 kV S/C	15.2
Artistic WPP – Cacho WPP 132 kV S/C	32.7
Act-2 WPP – Trans Atlantic WPP 132 kV S/C	62.9
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7

Transmission Line/Transformers	Power Flow (MW)
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Jhimpir-1 – Jhimpir-2 220 kV S/C	167.1
Gharo New – Jhimpir-2 220 kV S/C	118.1
Jhimpir-2 – Jamshoro 220 kV S/C	237.6
Jhimpir-2 – KDA-33 220 KV S/C	377.3
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504.0
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

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

a. N-1 Contingency Analysis

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

Exhibit #	Contingency Conditions	Remarks
1.1	Artistic WPP – Act-2 WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
1.2	Artistic WPP – Cacho WPP 132 kV S/C out	-do-
1.3	1x50 MVA, 132/33 kV transformer at Artistic WPP out	-do-
1.4	One collector group (5 WTGs) at	-do-

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

b. Comments on Normal and N-1 Contingency Analysis

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

5.2 Off-peak Load 2019 Scenario

Load flow study for the off-peak load scenario in 2019 under normal system condition has been carried out with net output of 47.9 MW from Artistic WPP and is attached as Exhibit #2.0 & 2.0A. As per load flow study, the power flows on the

transmission lines/transformers at/around Artistic WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Artistic WPP – Act-2 WPP 132 kV S/C	15.2
Artistic WPP – Cacho WPP 132 kV S/C	32.7
Act-2 WPP – Trans Atlantic WPP 132 kV S/C	62.9
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Jhimpir-1 – Jhimpir-2 220 kV S/C	183.9
Gharo New – Jhimpir-2 220 kV S/C	122.0
Jhimpir-2 – Jamshoro 220 kV S/C	251.4
Jhimpir-2 – KDA-33 220 kV S/C	383.9
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504.8
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

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

a. N-1 Contingency Analysis

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

Exhibit #	Contingency Conditions	Remarks

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

b. Comments on Normal and N-1 Contingency Analysis

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

5.3 Peak Load 2021 Scenario

Load flow study for the peak load scenario in 2021 under normal system condition has been carried out with net output of 47.9 MW from Artistic WPP and is attached as Exhibit #3.0 & 3.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Artistic WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Artistic WPP – Act-2 WPP 132 kV S/C	15.2
Artistic WPP – Cacho WPP 132 kV S/C	32.7
Act-2 WPP – Trans Atlantic WPP 132 kV S/C	62.9
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Jhimpir-1 – Jhimpir-2 220 kV S/C	111.4
Gharo New – Jhimpir-2 220 kV S/C	105.3
Jhimpir-2 – Jamshoro 220 kV S/C	247.4
Jhimpir-2 – KDA-33 220 kV S/C	299.4
Jhimpir-1 – T.M.Khan Road 220 kV D/C	533.4
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

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

a. N-1 Contingency Analysis

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

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

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

b. Comments on Normal and N-1 Contingency Analysis

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

5.4 Conclusions of Load Flow Analysis

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

6 Short Circuit Studies

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

6.1 Methodology and Assumptions

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

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

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

6.2 Short Circuit Study Results

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

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

Maximum Short Circuit Levels

Name of Faulted Bus Bars	Maximum Short Circuit Levels	
	Three Phase (kA)	Single Phase (kA)
Artistic WPP 132 kV	7.19	4.58
Cacho WPP 132 kV	7.58	4.85
ACT-2 WPP 132 kV	7.84	5.09
Jhimpir-2 220 kV	18.96	11.47
Jhimpir-2 132 kV	15.48	12.01
Jhimpir-1 220 kV	19.89	11.66
Jhimpir-1 132 kV	27.59	13.56

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

Minimum Short Circuit Levels at Artistic 132 kV Bus

WTGs in Operation at Artistic WPP	Minimum Short Circuit Levels	
	Three Phase (kA)	Single Phase (kA)
All WTGs	5.98	3.64
One WTG	5.84	3.55

6.3 Conclusions of Short Circuit Analysis

It is evident from the short circuit analysis that the induction of Artistic WPP has no adverse impact on the existing and proposed substations in its vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Artistic WPP are 7.19 kA and 4.58 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Artistic WPP.

7. Transient Stability Studies

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

7.1 Study Methodology

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

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

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

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

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

- Running simulation up to 10 seconds after fault clearance.

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

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

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

Bus Number	Bus Name / Voltage
81113	Artistic / 132kV
811131	Artistic MV / 33kV
811136, 811137 811138, 811139	Artistic LV / 0.69 kV
81114	Act-2 / 132 kV
81112	Cacho / 132 kV
8111	Jhimpir-2 / 132 kV
811	Jhimpir-2 / 220kV
9429	Jhimpir-1 / 220kV
800	Jamshoro / 220 kV
900	KDA-33 / 220 kV
530	M.Garh / 220 kV
90	Hub / 500 kV

7.2 Transient Stability Analysis Results

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

(i) For Normal Clearing Time (100 ms)

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

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

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

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

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

(ii) For Delayed Clearing Time (180 ms)

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

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

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

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

7.3 Conclusions of Transient Stability Analysis

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

substations in its vicinity. The stability simulations also proved that Artistic WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

8 Power Quality Analysis

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

8.1 Flicker

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

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

Where

S_n is the rated apparent power of the WTG

S_k is the short-circuit apparent power at PCC

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

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

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

S_n = 2.632 MVA

N_{WT} = 20

S_k = 1367.18 MVA

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

$$P_{St\Sigma} = P_{lt\Sigma} = 0.008609 = 0.86\ \%$$

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

8.2 Voltage Unbalance

(i) Voltage Step-Change

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

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

Where

S_{wka} is the MVA rating of the inverter

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

S_{kss} is the Short circuit MVA at PCC

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

S_{wka} = 2.632 MVA

S_{ke} = 429.08 MVA

S_{kss} = 1335.49 MVA

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

$$\Delta V = 0.004163 = 0.42\ \%$$

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

(ii) Voltage Fluctuation

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

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

Where

P_{wka} is the MW rating of WTG

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

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

P_{wka} = 2.5 MW

S_{ke} = 429.08 MVA

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

Voltage Fluctuation = 0.005826 = 0.58 %

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

8.3 Conclusions of Power Quality Analysis

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

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

9 Overall Conclusions and Recommendations

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

- A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
- 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.
- 220 kV D/C transmission line, approx. [illegible]m long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.
- 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Artistic WPP with Jhimpir-2. In this scheme, the interconnection of Artistic WPP includes 132 kV D/C transmission line, approx. 14 km long, on twin-bundled Greeley conductor for looping In/Out from Artistic WPP on the 132 kV single circuit from ACT-2 WPP to Cacho WPP.

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

iii) The results of detailed load flow studies for various operating scenarios indicate that the power from Artistic WPP can be dispersed to the National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints. The voltage profile, line loading, frequency and active/reactive power flow etc. from Artistic WPP and on the grid are within the NEPRA Grid Code criteria.

iv) The normal rated current for switchgear equipment in the 132 kV switchyard of Zulaikha WPP is recommended as 2500 Amperes.

v) The results of short circuit studies indicate that Artistic WPP and its surrounding WPPs have no adverse impact on the existing and proposed substations in their vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Artistic WPP are 7.19 kA and 4.58 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Artistic WPP.

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

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

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

ix) It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of Artistic WPP will be required to follow/implement the requirements/recommendations given in the revised

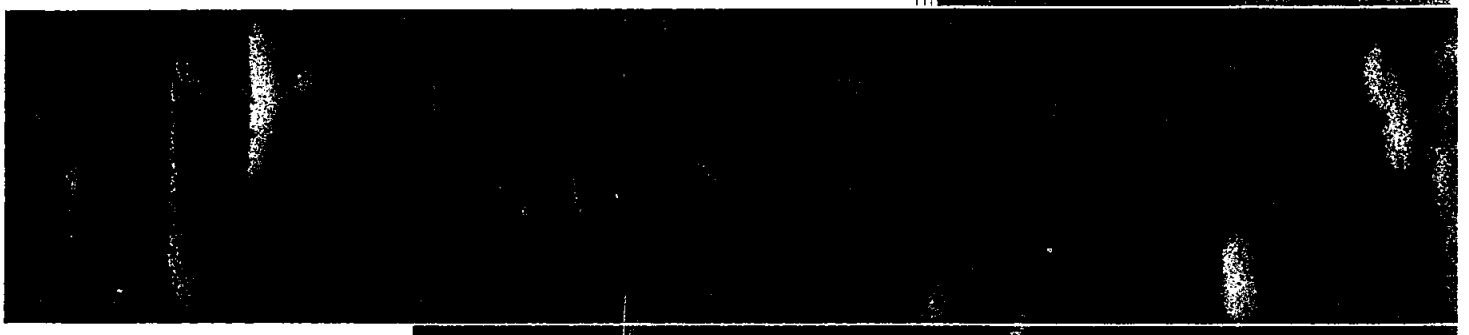
Grid Code, after its approval from NEPRA and make necessary additions/modifications in the equipment/substation of Artistic WPP, if any, in this regard.

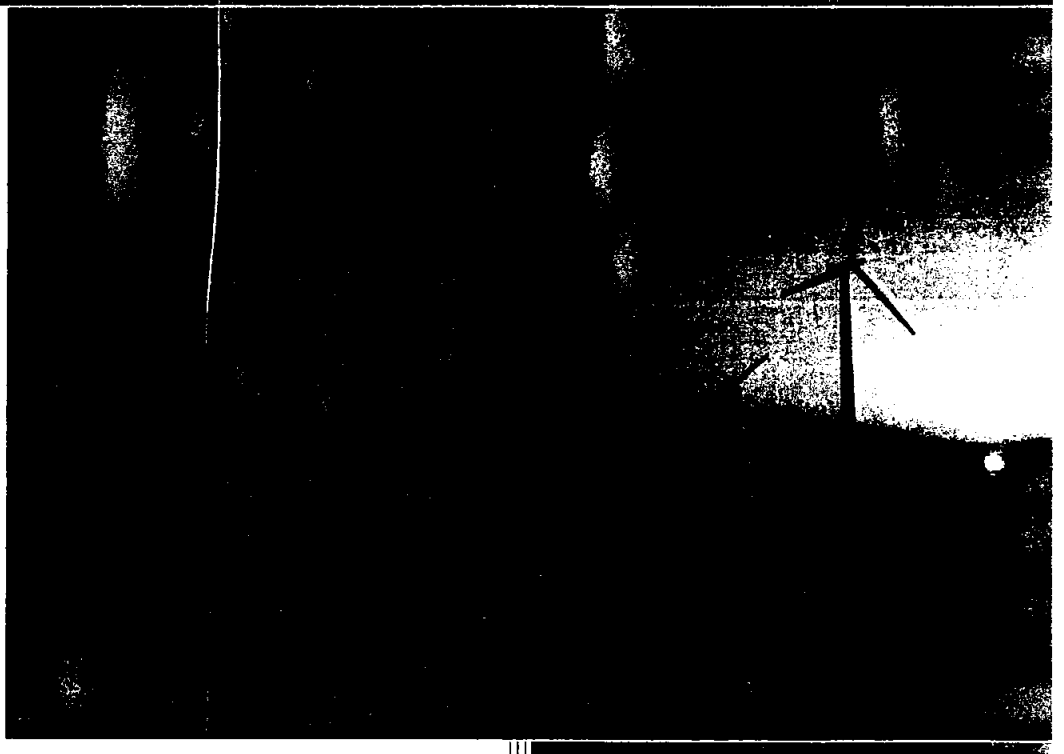
x) In view of the huge wind potential at Jhimpir and in its surrounding areas, the power system network around Artistic WPP will be developed in future. Therefore, there may be possibility of modification in the interconnection arrangement of Artistic WPP in future, if needed necessary as per system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

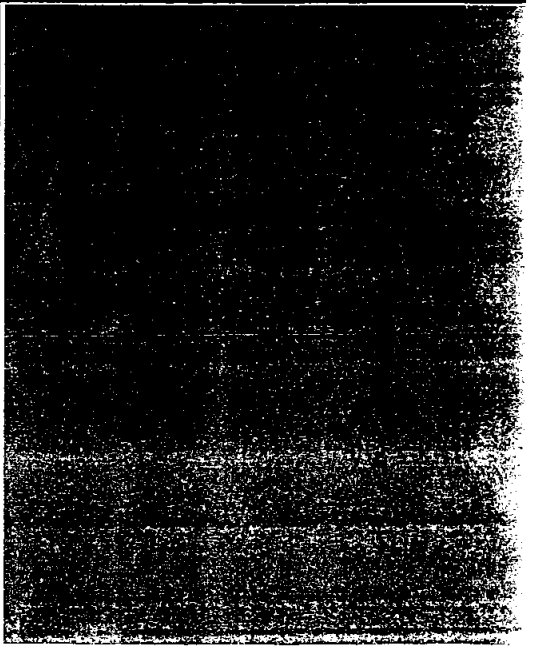
Appendix-1

Artistic WPP Data Received from Project sponsor

Artistic Wind Power







Artistic Wind Power

DATA/INFORMATION REQUIRED FOR INTERCONNECTION STUDY OF WIND POWER PROJECT (WPP)(TO BE SUPPLIED BY THE PROJECT DEVELOPER)

1. SUMMARY & INTRODUCTION

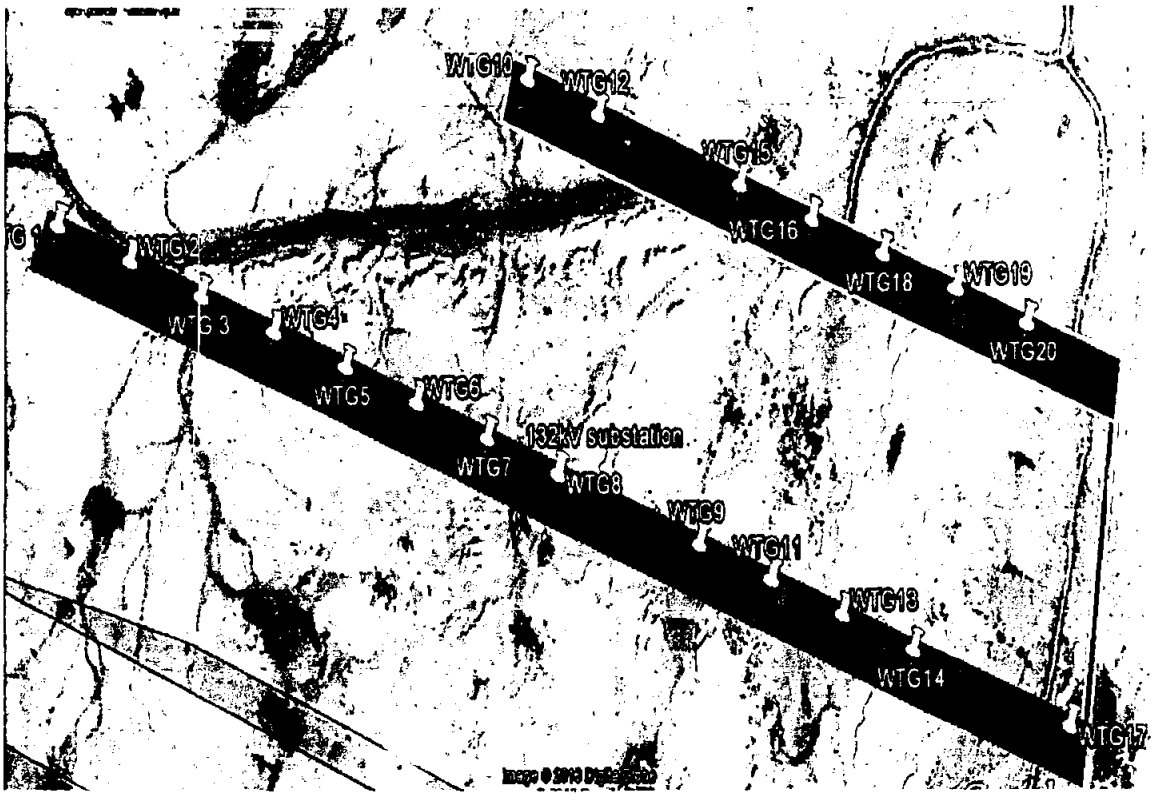
This document presents technical information for the purposes of performing the grid inter-connection studies of 50 MW Artistic Wind Power (Pvt.) Ltd (the "Project"). The requirement is in response to the template received from NTDC Planning Power. The Project has completed all development steps and has been shortlisted for a grid slot amongst ten in total for evacuation of 500MW capacity in the existing plans of NTDC. It has been conveyed that NTDC Planning Power shall develop the Grid Interconnection Studies for the Project by 25th May, 16.

2. LOCATION, SITE COORDINATES AND PROPOSED SKETCH OF THE WPP

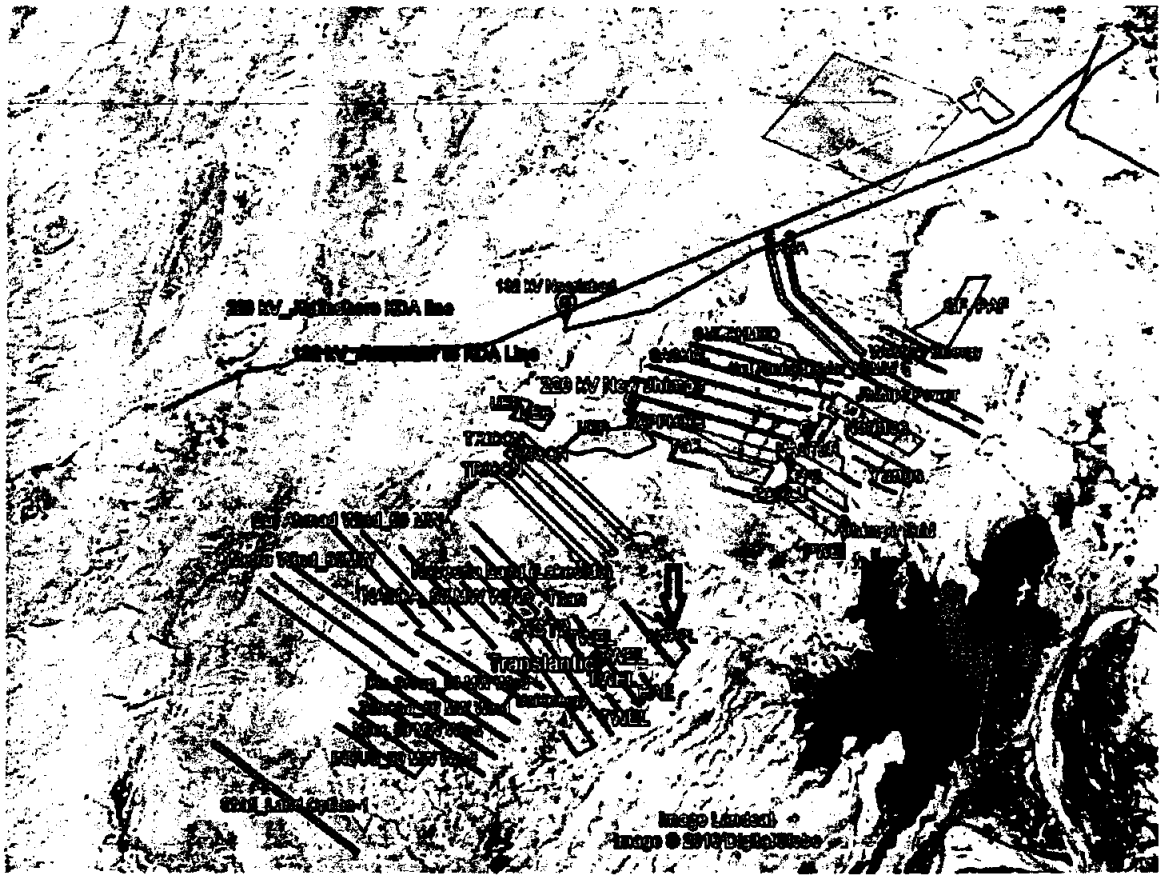
Location:DEH KOHISTAN 7/3 TAPO JUNGSHAHI TALUKA, JHIMPIR, DISTRICTTHATTA.
Site Coordinates:

	Coordinates (UTM z42, WGS84)	
	Easting [m]	Northing [m]
1	385814.82	2765094.70
2	385631.01	2764971.64
3	388926.70	2760759.29
4	389049.67	2760958.53
5	389878.12	2761871.39
6	389708.84	2761736.31
7	387807.57	2764165.30
8	387969.55	2764310.28

Wind Power Plant Sketch:



3. GEOGRAPHICAL DIAGRAM INDICATING APPROX. DISTANCE OF THE WPP WITH THE SURROUNDING WPPS AND GRID STATIONS/TRANSMISSION LINES.



4. Manufacturer and Type of WTG

GOLDWIND Science & Technology Co., Ltd. is the manufacturer

Type – IV, Permanent Magnet Direct Drive (PMDD)GW 121-2.5

5. WTG GENERATOR DATA

- Number of WTGs

  20 Nos. of WTGs

- Voltage, Gross capacity [MVA, MW], Power factor (Lagging/Leading),

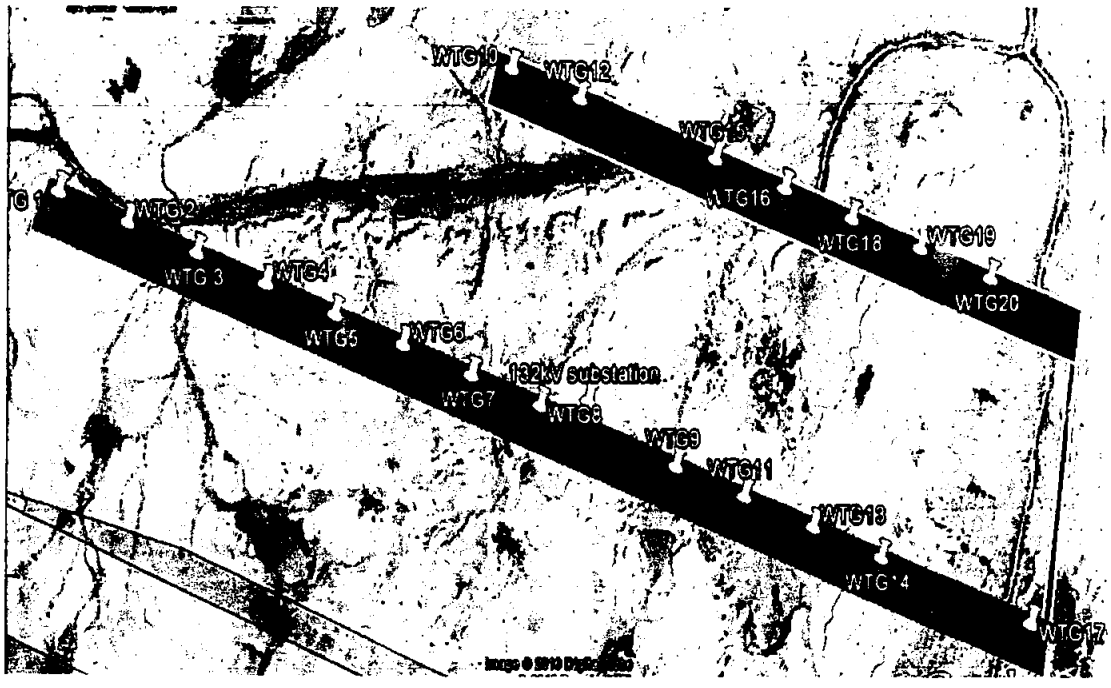
  Voltage = 690V

  Gross Capacity = 2.5MW

  Power Factor = 0.95 Inductive~0.95 capacitive

6. WTG ARRANGEMENT IN WIND FARM

- Micro-siting arrangement of WTGs



Coordinates (UTM Z42 WGS84)

WTG #	Easting (m)	Northing (m)
WTG01	385,771	2,764,982
WTG02	385,994	2,764,696
WTG03	386,218	2,764,410
WTG04	386,441	2,764,124
WTG05	386,665	2,763,838
WTG06	386,889	2,763,552
WTG07	387,112	2,763,266
WTG08	387,336	2,762,980
WTG09	387,783	2,762,408
WTG10	387,935	2,764,170
WTG11	388,006	2,762,122
WTG12	388,159	2,763,885
WTG13	388,230	2,761,836
WTG14	388,453	2,761,550
WTG15	388,609	2,763,316
WTG16	388,834	2,763,031
WTG17	388,938	2,760,926
WTG18	389,059	2,762,746

WTG19	389,284	2,762,461
WTG20	389,509	2,762,176

- Proposed Substation Coordinates:
  Coordinates (UTM Z42 WGS84)

	Easting (m)	Northing (m)
Substation	388081.32	2762108.05

- No. of Collector group
  There shall be 04 collector groups

- WTGs connection in each Collector group
  Each collector group shall consist of 05 WTGs

- Length of each Collector group with the switchyard
  Approximately 04-05 Km for each collector group

- Type of conductor or cable for collector group
  Medium-voltage XLPE (cross- linked polyethylene) armored each core separate metallic cables (Al) suitable for laying in ground for interconnection between WTGs.

7. TOTAL WIND FARM CAPACITY:

- Total Gross Capacity (MW)
  50MW

- Wake Losses, EBOP Losses, Auxiliary Consumption
  Wake Losses: 11.6 %
  EBOP Losses: 1350kW
  Auxiliary consumption: 800kW

- Total Net Output Capacity (MW) that will flow towards Grid
  47.9MW

8. Generator Step-up Transformer Data:

- No. of step-up transformers
  20 Nos. step-up transformers

- Voltage ratio
  0.69/33kV

- MVA rating
  3000 kVA

- Percentage Impedances
  +/-10%

- Number of Generators connected to each step-up transformer.
  One WTG will be connected with One Step-up transformers.

9. **PROPOSED SWITCHYARD OF WIND POWER PROJECT**

- Single line diagram
  Single Line Diagram is attached. Appendix 1
  Major equipment planned for the project includes the following:
  Two 132/33kV, 31.5/40/50 MVA, Power Transformers, HV Switch Gear 132 kV has following bays:

  i. Two bays for OHTL
  ii. Two bays for power transformers
  iii. One bay for Bus Coupler

  They comprise of following:
  - 132kV circuit breakers
  - Dis-connectors / Isolators
  - Earthing Isolators
  - Voltage transformers
  - Current transformers
  - 132 kV Surge arrestors
  - 132 kV Coupling Capacitor Voltage transformers
  - Protection system with relays

- Layout of Switchyard of Proposed Power Project indicating plant and switchyard equipment.
  Layout of Switchyard is attached. Appendix 2

- High Voltage (HV)
  132kV

- Medium Voltage (MV) Level
  33kV

- HV/MV transformer: No. of transformers, Voltage ratio, MVA rating, Percentage Impedances
  02 Nos. of Transformers with (N-1) contingency, 33/132kV, 31.5/40/50MVA,10-12%

- Bus Bar Scheme: One-and-a-half breaker or Double Bus Single Breaker
  Bus Bar Scheme: Double Bus Bar

- Switchgear (circuit breaker, disconnectors etc.) data: Rated Voltage, Normal Current Rating, Short Circuit Rating.
  Circuit Breaker = 145kV rated, 2000A, 40kA 3sec, 50Hz
  Disconnector = Motor operated, three poles, 145kV rated, 2000A, 40kA, 3 sec, 50Hz

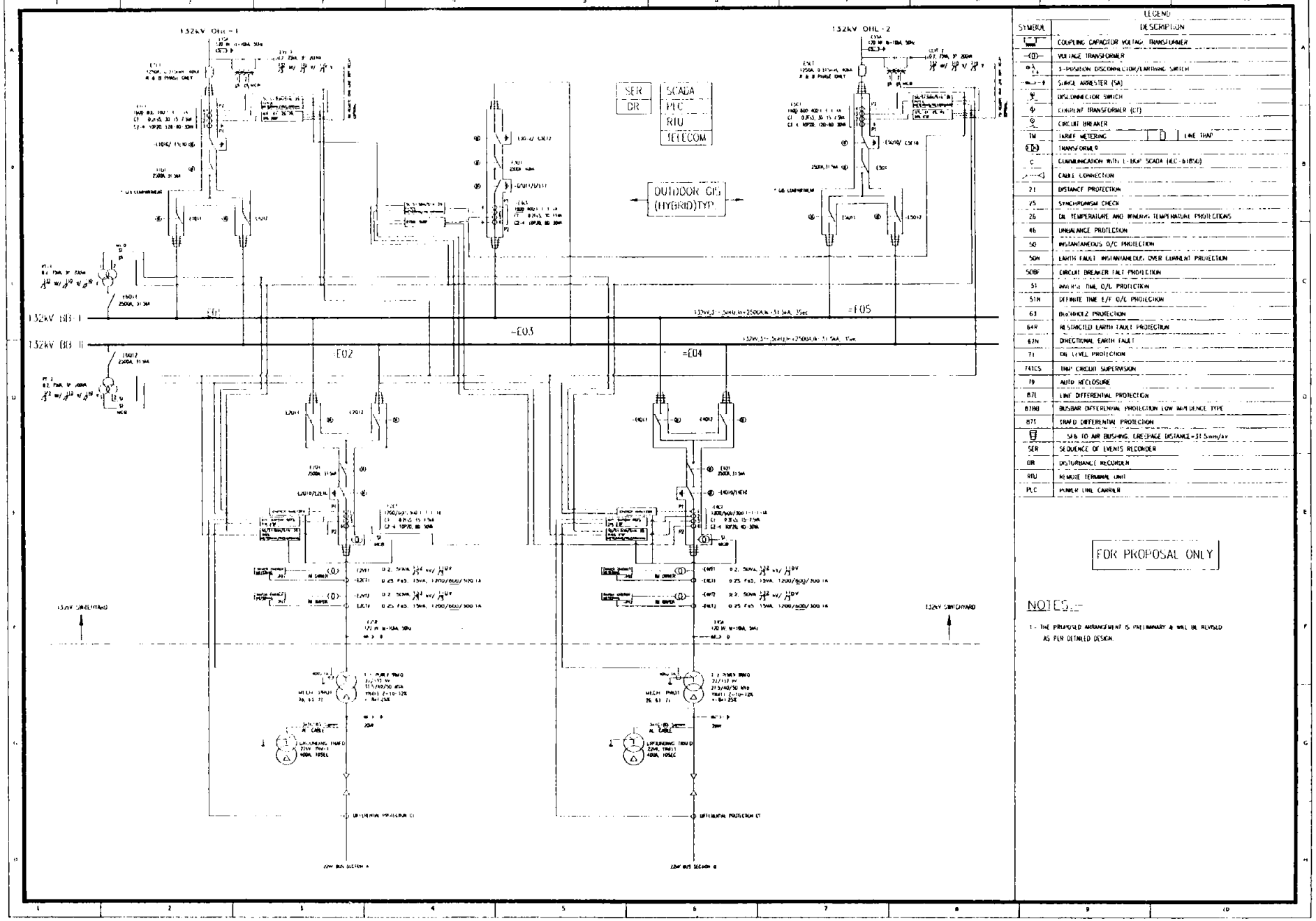
- Bus Bar: Type/conductor name, maximum current rating
  Aluminum Alloy LDRE, 3150 Ampere

10. PROPOSED REACTIVE POWER COMPENSATION

- Type of Reactive Compensation device at MV level (SVC or Switched Capacitor)
  Reactive Compensation System, whether capacitor bank based or SVC, to be decided in detailed design stage.

- MVAR Rating
  MVAR Rating : 2 x 10 MVAR

11. Expected COD
2018-2019



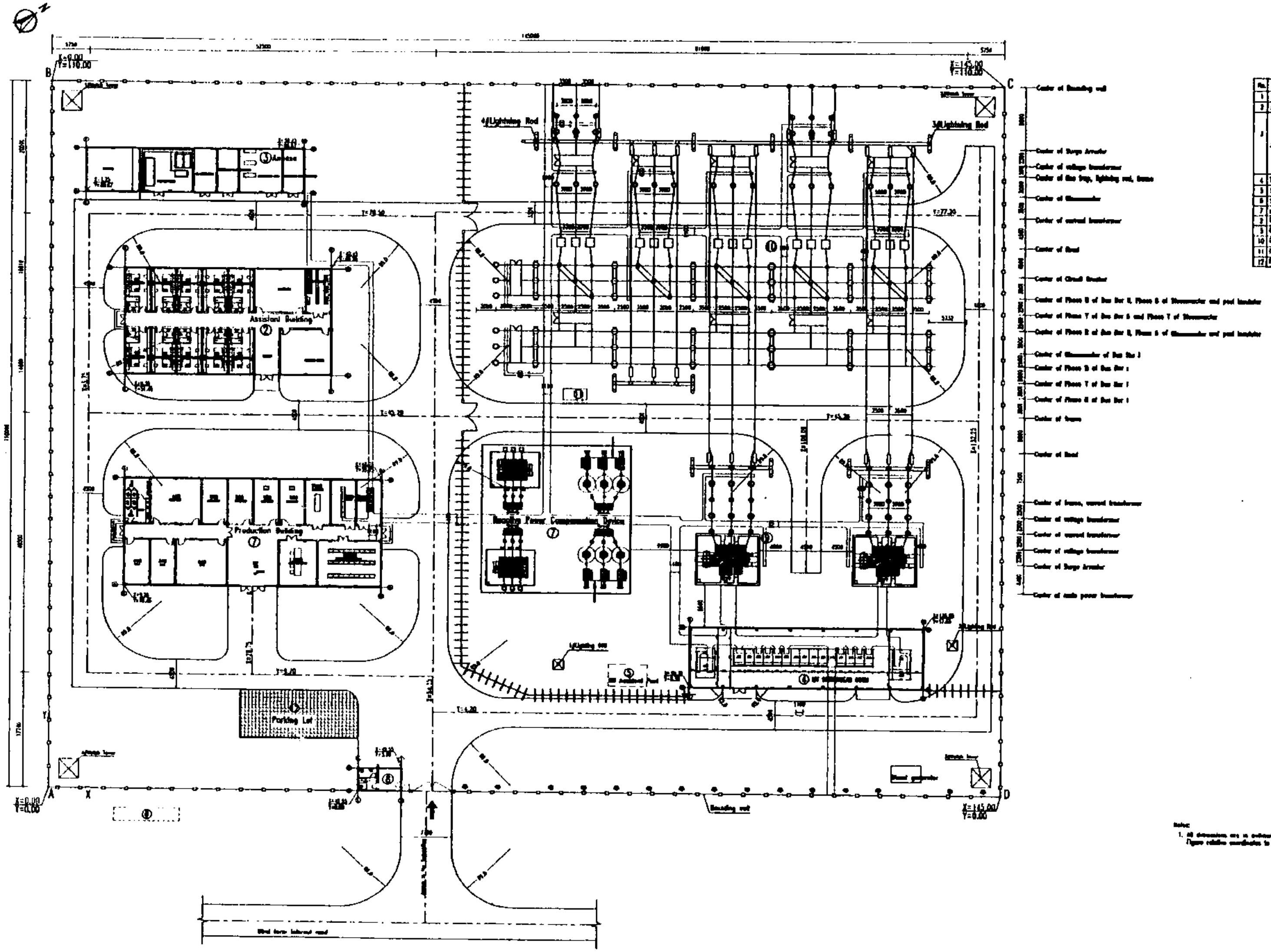
LEGEND

SYMBOL	DESCRIPTION
	COUPLING CAPACITOR VOLTAG. TRANSFORMER
	VOLTAGE TRANSFORMER
	3-POSITION DISCONNECTOR/EARTHING SWITCH
	SURGE ARRESTER (SA)
	DISCONNECTOR SWITCH
	CURRENT TRANSFORMER (CT)
	CIRCUIT BREAKER
TM	TARIFF METERING
	TRANSFORMER
C	COMMUNICATION WITH E-BOP SCADA (IEC-61850)
	CABLE CONNECTION
21	DISTANCE PROTECTION
25	SYNCHRONISM CHECK
26	OIL TEMPERATURE AND WINDING TEMPERATURE PROTECTIONS
46	UNBALANCE PROTECTION
50	INSTANTANEOUS O/C PROTECTION
50N	EARTH FAULT INSTANTANEOUS OVER CURRENT PROTECTION
50BF	CIRCUIT BREAKER FAILT PROTECTION
51	INVERSE TIME O/C PROTECTION
51N	DEFINITE TIME E/F O/C PROTECTION
63	BUCHHOLZ PROTECTION
64R	RESTRICTED EARTH FAULT PROTECTION
67N	DIRECTIONAL EARTH FAULT
71	OIL LEVEL PROTECTION
74CS	TRIP CIRCUIT SUPERVISION
79	AUTO RECLOSURE
87L	LINE DIFFERENTIAL PROTECTION
87BB	BUSBAR DIFFERENTIAL PROTECTION LOW IMPEDENCE TYPE
87T	TRAFO DIFFERENTIAL PROTECTION
	SF6 TO AIR BUSHING CREEPAGE DISTANCE = 31.5mm/kv
SER	SEQUENCE OF EVENTS RECORDER
DR	DISTURBANCE RECORDER
RTU	REMOTE TERMINAL UNIT
PLC	POWER LINE CARRIER

FOR PROPOSAL ONLY

NOTES :-

1 - THE PROPOSED ARRANGEMENT IS PRELIMINARY & WILL BE REVISED AS PER DETAILED DESIGN.



Substation Building List

No.	Building Name		Construction area/Area
1	Production Building		Construction area:[illegible]
2	Assistant Building		Construction area:[illegible]
3	Annexes	Fire Pool	Construction area:[illegible]
		Fire Pump Room	
		Oil Storehouse	
		Lubricating Oil Placing Area	
		Spare Parts Area	
		Insulation Equipment Room	
4	kV Switchgear Room		Construction area:[illegible]
5	The Oil Accident Pool		Capacity:[illegible]
6	Sewage Treatment Equipment		Area:[illegible]
7	Reactive Power Compensation Device		[illegible]
8	Guard Room		[illegible]
9	Outdoor [illegible]		[illegible]
10	Outdoor [illegible]		[illegible]
11	[illegible]		[illegible]
12	Parking Lot		[illegible]

Notes:
1. All dimensions are in millimeters.
Figure relative coordinates to the wall centerline corner point A is the origin.

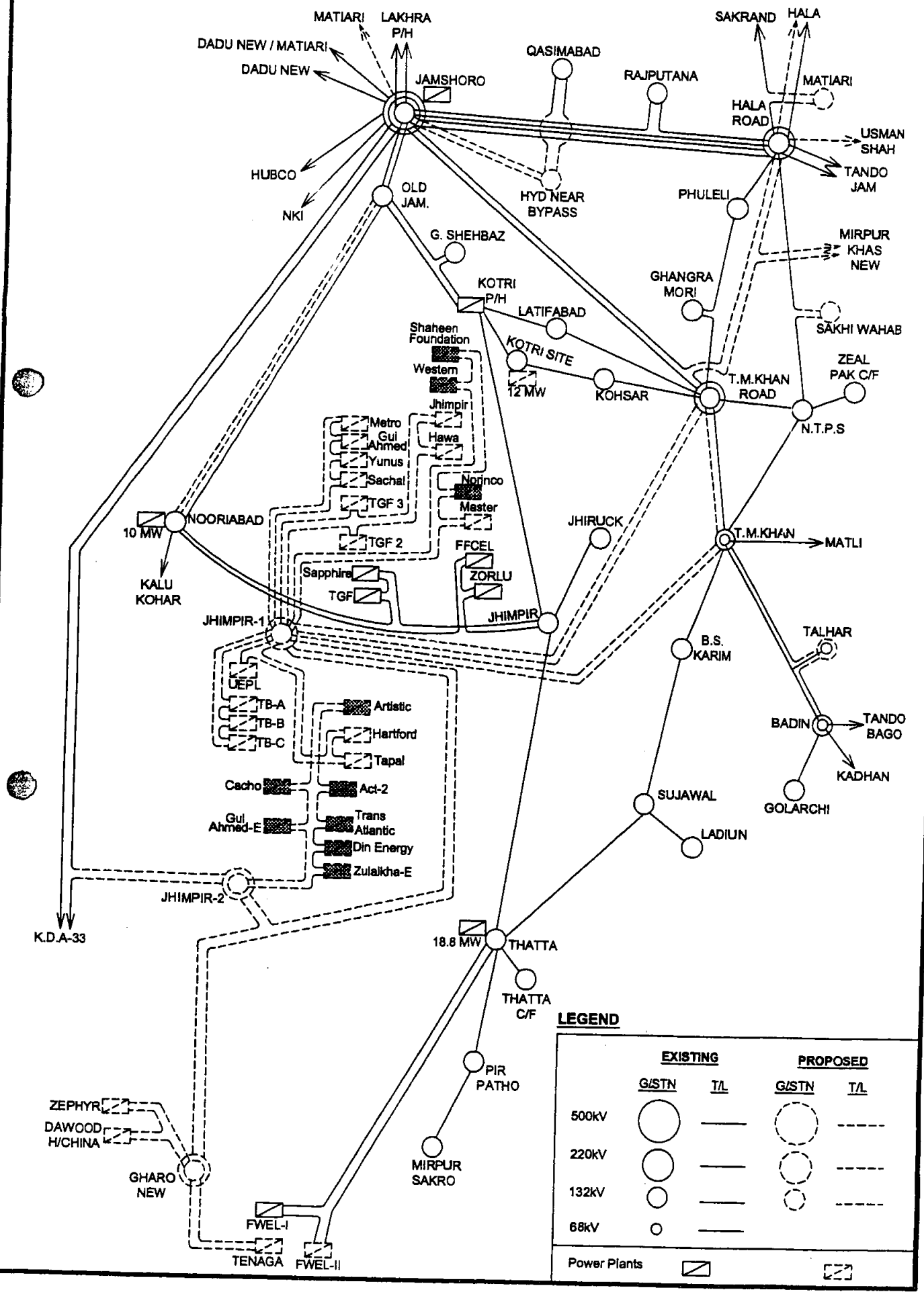
The General Arrangement Of The 132kV Substation

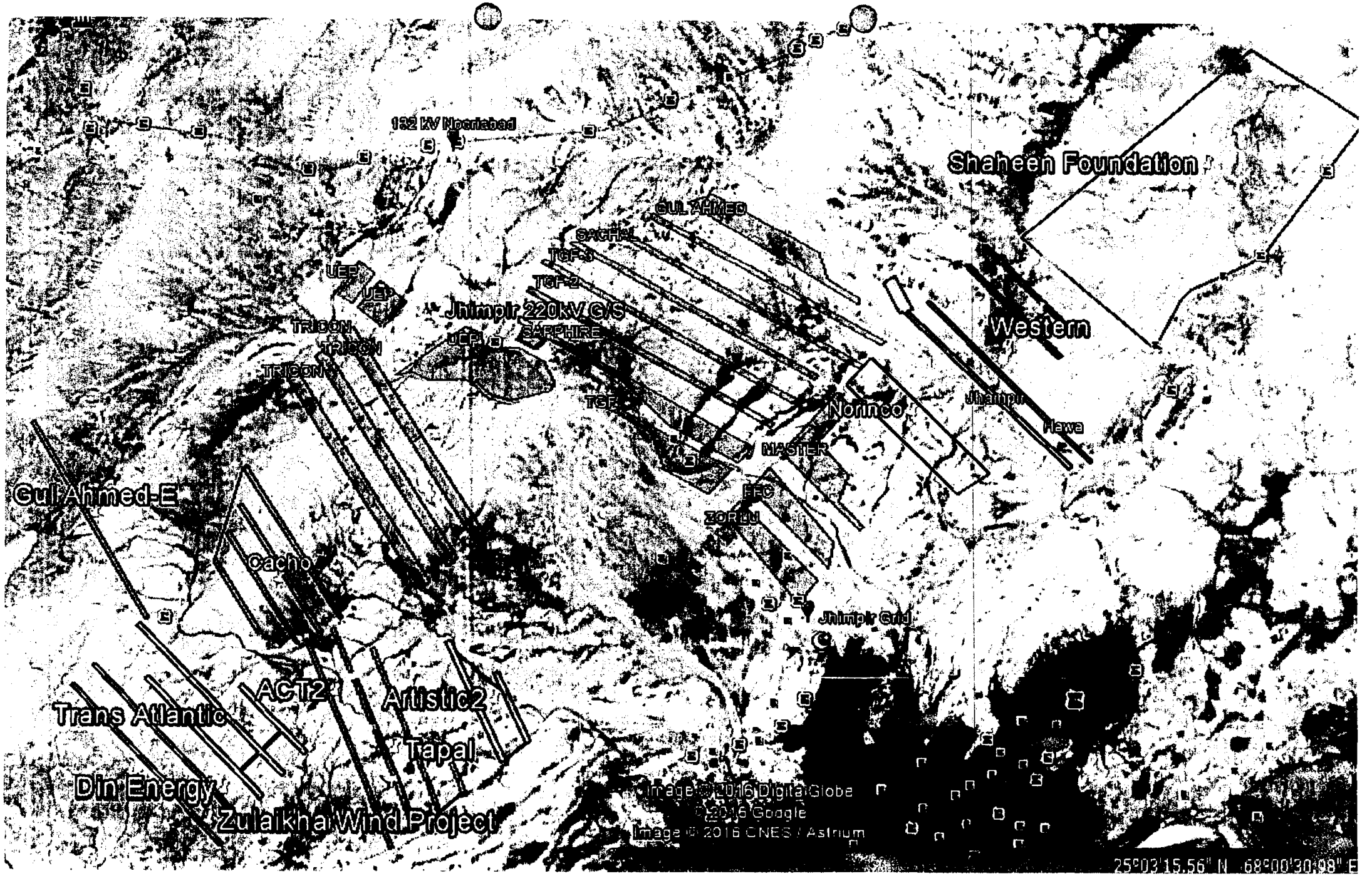
1:500

Appendix-2

Proposed Interconnection Diagram for Artistic WPP

Figure #1: Proposed Interconnection Scheme For Power Evacuation of Artistic Wind Power Project




132 kV Nooriabad
Shaheen Foundation
GUL AHMED
SAPPHIRE
TGF-3
TGF-2
UEP
UEP
Jhimpir 220kV G/S
TRIDON
TRIDON
TRIDON
SAPPHIRE
UEP
TGF
Western
Jhimpir
Hawa
Nornico
MASTER
FFC
ZORLU
Gul Ahmed-E
Cacho
Jhimpir Grid
ACT2
Artistic2
Trans Atlantic
Tapal
Din Energy
Zulaikha Wind Project
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25°02'15.56" N 68°00'30.08" E