Zephyr Power (Pvt) Limited

November 18, 2014

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

Subject: **Conversion of the Revised Generation License Application for 50 MW Wind Power Project at Gharo of Zephyr Power (Pvt.) Limited**

Dear Sir,

This is with Reference to our letter dated November 08, 2014 regarding the Revised Generation License Application (the "**Application**"). The Application was filed by us and received by National Electric Power Regulatory Authority ("NEPRA") on November 14, 2014.

It may be noted that NEPRA had granted Zephyr Power (Private) Limited (the "**Company**") a Generation License No. WPGL/17/2012 dated July 27, 2012 based on Sinovel SL 82 1.5MW wind turbines.

Through this letter we humbly request that the Application is treated as a License Proposed Modification (the "**LPM**")under regulation 10 (2) of the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations, 1999.

It may be further noted that the Company has procured the consent of the Alternative energy DevelopmentBoard in the matter.

In satisfaction of the LPM and requirements of regulation 10 (2) please find below the information which is further elaborated in the Application as already submitted.

Text of Proposed Modification

The Generation License No. WPGL/17/2014 dated July 27, 2012 was granted by NEPRA to the Company based on Sinovel SL 82 1.5 MW wind turbines, however now the Company is changing the technology to Vestas V100 2.0 MW wind turbines.

Statement of Reasons in Support of the Modification

The statements in the Application shall be treated as Statement of Reason in Support of the Modification.

We have submitted the Application to NEPRA based on Vestas V100 2.0 MW turbines for Zephyr Power 50 MW project and therefore request the LPM is granted in light thereof.

Impact on Tariff

We have concurrently along with the submission of the Application have further submitted the revised Tariff Petition to NEPRA on November 14, 2014 wherein the impact on tariff has been

68-B, Sindhi Muslim Housing Society, Karachi-74400, Pakistan.
Tel: 021-4315646, Fax: 021-4315647-48, E-mail: director@zephyrpowerltd.com

Zephyr Power (Pvt) Limited

discussed in detail. We look forward to positive response from NEPRA in respect to the modification of the Company's generation license.

Thanking you

For and on behalf of Zephyr Power (Pvt.) Limited

Zia Khaleeli
Director / CEO
Zephyr Power (Pvt.) Limited

68-B, Sindhi Muslim Housing Society, Karachi-74400, Pakistan.
Tel: 021-4315646, Fax: 021-4315647-48, E-mail: director@zephyrpowerltd.com

4.0 Basis of Revised Generation License

Under the "Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of) 1997, hereinafter referred to as the NEPRA Act, National Electric Power Regulatory Authority("NEPRA") is responsible, interalia, for determining tariffs, awards of Generation License and other terms and conditions for the supply of electricity by the generation, transmission and distribution companies and to recommend these to the Federal Government, subject to the need to comply with guidelines, not inconsistent with the provisions of the NEPRA Act, laid down by the Federal Government. NEPRA is also responsible for determining the process and procedures for reviewing tariff and recommending tariff adjustments.

Zephyr Power (Pvt.) Limited ("ZPL", "the Company") is a private limited company registered under the Companies Ordinance 1984. ZPL has been setup as a Special Purpose Company to setup and operate power projects.

The Company is seeking to develop, own and operate a 50 MW wind farm Independent Power Producer ("IPP") Project ("the Project") in the province of Sindh.

The Alternative Energy Development Board ("AEDB") issued us a Letter of Intent ("LOI") in February 2005.

In July 27, 2012, ZPL had received the Generation License ("GL") based on Sinovel SL 82 1.5 MW wind turbines by NEPRA. In May 24, 2012 ZPL had received the Tariff Award for the aforementioned technology.

Sinovel due to own financial crisis was unable to deliver the project to ZPL.

Hence ZPL is required to resubmit its revised Generation License based on a different technology and price quote.

This Revised Generation License is based on the Vestas Wind Systems ("Vestas") V 100, 2.0 MW Turbine, and with Vestas also serving as the Engineering, Procurement & Construction ("EPC") and long-term Operations & Maintenance ("O&M") Contractor.

This is first such contract with single point of responsibility to be signed for a wind power project in Pakistan.

This development approach is consistent with the guidelines in the Renewable Policy for the Government of Pakistan ("GoP", "Government").

The Policy is under the purview of the AEDB. The AEDB Policy for Power Generation through Renewable Energy ("RE") has taken into account the relevant provisions of the RE Power Policy 2006.

5.0 History

Omega (Pvt.) Ltd. ("Omega"), the predecessor and sister company of ZPL, and Zond Corporation ("Zond"), the predecessor of Enron Wind Systems and GE Wind, signed a Memorandum of Understanding ("MOU") on 17th December, 1994 with the GoPto develop a 150 MW Gharo Creek Wind IPP in Taluka Mirpur Sakro, District. Bhambore, Sind.

An area of 56 square kilometers was allocated for exclusive wind mapping in Taluka Mirpur Sakro. A copy of letter from Ministry of Petroleum and Natural Resources, Director General of New & Renewable Energy Resources, to Chief Secretary, Government of Sind, dated November 29, 1994 has been noted in the Appendix 7.5.

For the first time in Pakistan's history, private sector undertook wind analysis and wind mapping. During 1995 to 1997 Omega installed eight anemometers with close proximity of Gharo. The anemometers were at 10 meter and 20 meter heights.

Due to absence at the time of a renewable energy policy the Project could not be developed and, accordingly, the MOU lapsed.

In 2004, a 50 meter height wind mast was installed by Omega at the same site where wind data had been gathered nine years ago. This is the first wind mast at this height in Pakistan, and this fresh study built upon that extensive data already gathered nine years ago. The data gathered was being processed by our wind consultants in USA.

Correlation of all available wind data with site specific data being monitored at 20, 30 and 50m was sent to Global Energy Concepts ("GEC"), of USA.

Omega entered into an agreement with GEC of USA to determine the energy output of the wind farm based on the latest available wind data.

GEC analyzed the energy output at the site. They have provided an assessment of wind at the specific site based on 17 months wind data.

The following is the timeline for development of ZPL

2005

- Awarded Letter of Intent ("LOI") by AEDB

2006

- AEDB awarded initial allocation of land in Gharo

2008

- Signed Agreement to Lease with AEDB for 2,540 acres of land in Gharo

2011

- Conducted Initial Environmental Examination ("IEE") Study and approved by Environmental Protection Agency ("EPA") Government of Sind
- Submitted USD 250,000 Bank Guarantee ("BG")
- Signed EPC and O&M Contracts with Sinovel
- Received approval of FS from AEDB
- Applied a Tariff Application and Generation License Application to NEPRA

2012

- Received Tariff Determination and Generation License from NEPRA
- Submitted USD 125,000 as a Performance Guarantee ("PG") to AEDB

2013

- Awarded Letter of Support ("LOS") by AEDB
- Sinovel unable to develop project; ZPL initiated negotiation with Vestas

2014

- Selected Vestas as single-point vendor to develop Wind IPP
- Conducted Grid Study ("GIS") on Vestas2.0 MW, V100 Turbine
- Received EPC and O&M Contracts from Vestas
- Conducted verification of production estimates from RISOE

6.0 Revival- Current Status

Tehsil Gharo is considered to be the area of greatest wind in Pakistan. It is also proximate to the power generation and grids of KESC, Port Qasim and the National Highway system.

In 2004 we installed a 50 meter height wind mast at the same site where we gathered wind data. This we have done with our own funds.

We were the first in 1995 with a 20m mast and are the first with a 50 m mast. Wind analysis equipment of highest quality has been imported from USA. Through a fresh study of the wind we are building upon the extensive data already gathered by us nine years ago.

The Power Policy on Renewable has reaffirmed support for wind farms in Pakistan and Renewable in general.

To use renewable in place of fossil fuels with a view to substantially reduce green house gases and other pollutants. Broadly, to support local and global environment protection.

- Encourage private and public sector participation in the development of indigenous energy technology and resources.

We would request all concerned to bear in mind that electrical power from wind energy farms is an alternate energy which displaces conventional sources of energy when available. It is not to be construed as a regular source of power 24 hours a day, 7 days a week and 365 days a year like conventional energy sources.

1. Technology, size of the plant, number of units.

Wind Turbine Generator.

- Total installed capacity: 50 MW
- Size of Unit: Vestas V100 2.0 MW
- Number of Units: 25 wind turbines

V100 2.0 MW is a three bladed, horizontal-shaft wind energy converter (WEC) by adopting variable speed, pitch control, active yaw system and double fed generating technology, which is especially developed for utilizing inland wind energy in high efficiency. The rotation speed is variable and the wind turbine can

operate in best efficiency as the wind speed varying from 3.0m/s to 12.5 m/s. It will achieve the 2000 kW rated power at 12.5 m/s and keep constant power output from 12.5 m/s to 20.0m/s.

For achieving a constant power output at different wind speed and wind direction, V100 2.0 MW can one side adjust the respective blade, the other side yaw the nacelle according to wind direction.

The turbine V100 2.0 MW is commercially available and running smoothly in Denmark.

2. Fuel: type, imported / indigenous, supplier, logistics, pipeline etc.

The monthly benchmark average wind speed of 80 m calculated by AEDB of the area is given below.

Monthly Benchmark Wind Speeds for Khuttikun and Bhambore (Gharo) sites

Month	**Hub Height 80 m Wind Speed (m/s)**
January	5.4
February	5.7
March	5.9
April	7.6
May	9.8
June	11.3
July	9.2
August	10.3
September	8.4
October	4.8
November	4.4
December	5.3
Annual Benchmark Wind Speed	**7.3**

3. Emission values

Zero emission values. There will be reduction of CO2 emissions in the country due to use of wind energy. The carbon intensity of the grid would also reduce with the use of wind energy.

7.0 Interconnection Scheme (Single Line Diagram)

Zephyr Power's consultants M/s Power Planners International (PPI) have performed the detailed Grid Interconnection Studies based on Vestas 2.0MW wind turbines. Copy attached. The final report was submitted to NTDC for approval in April 2014. Copy attached

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

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

In case of ZPL, the nearest substation is the collector substation of Gharo New 220/132 kV whose 220kV stage would be completed by December 2015 which corresponds with the Commercial Operation Date ("COD") of ZPL.

7.1 Proposed Interconnection Scheme

Three wind IPPs' including ZPL are to be developed in Gharo, and fourteen in Jhimpir.

The grid scheme development would be a pre-requisite before connecting ZPL project to the grid as shown in the following diagram.

- 220/132 kV Gharo at suitable location in Gharo cluster
- 75 km, 220 kV double circuit, from Gharo to Jhimpir
- Connection of wind farm projects in the collector systems of Gharo 220/132 kV substation via a 132 kV double circuit emanating from Gharo 220/132 kV substation
- Fauji Foundation I & II through 64 km long 132 kV D/C on Greeley conductor connected to Thatta
- 220/132 kV Jhimpir
- 70 km double circuit from Jhimpir to the existing T.M. Khan Road 220 kV
- 132 kV double circuit of 82 km using Greeley conductor connecting Jhimpir T.M. Khan in HESCO network

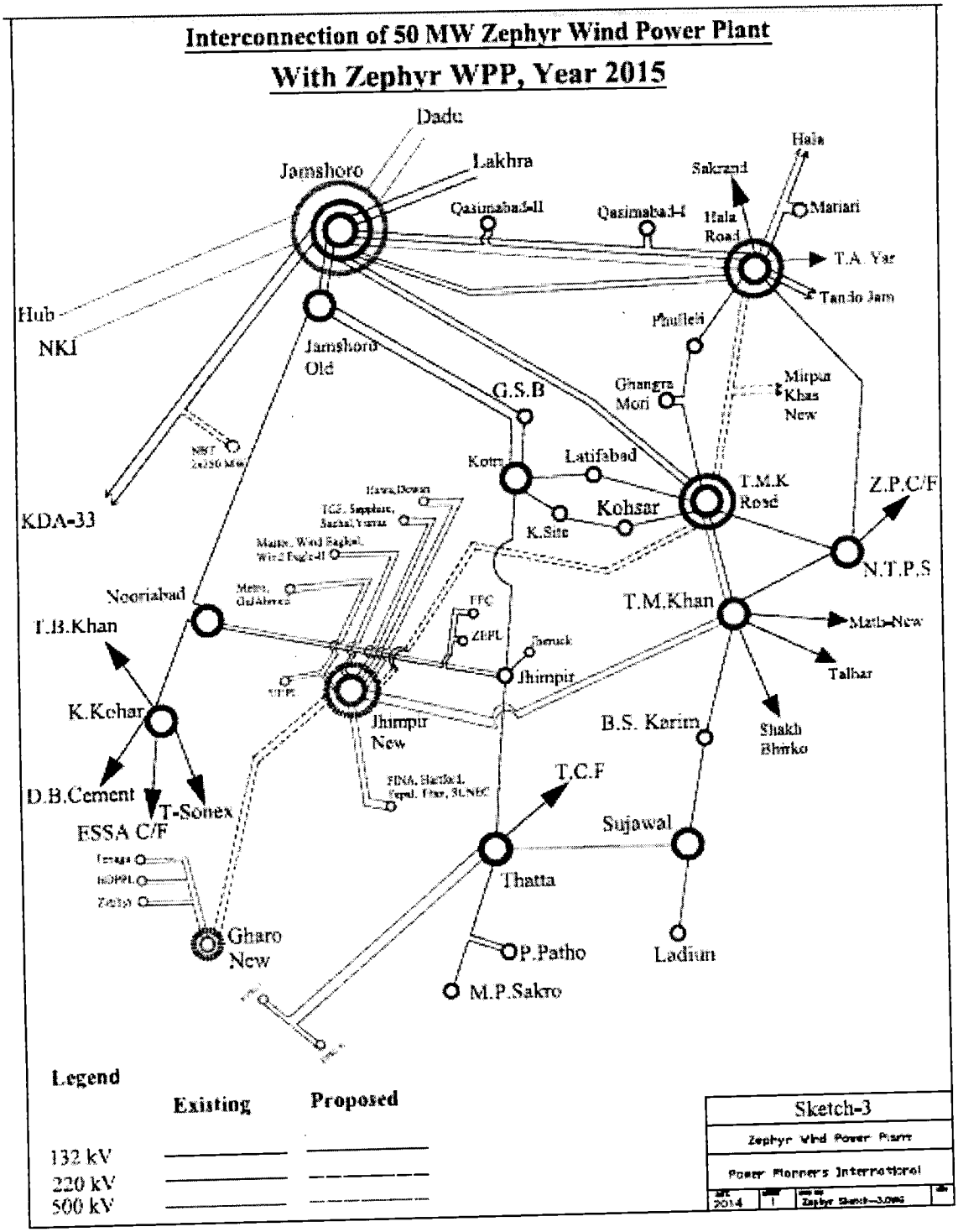
- Five sub collectors groups will be connected to Jhimpir 220/132 kV through 132 kV double circuits
- FFC and Zorlu looped in-out with Jhimpir-Nooriabad 132 kV circuit

Rehabilitation of the existing 132 kV lines in the vicinity of wind power project clusters i.e. Jhimpir-Kotri, Jhimpir-Thatta, Thatta-Sujawal and Nooriabad-Jamshoro Old.

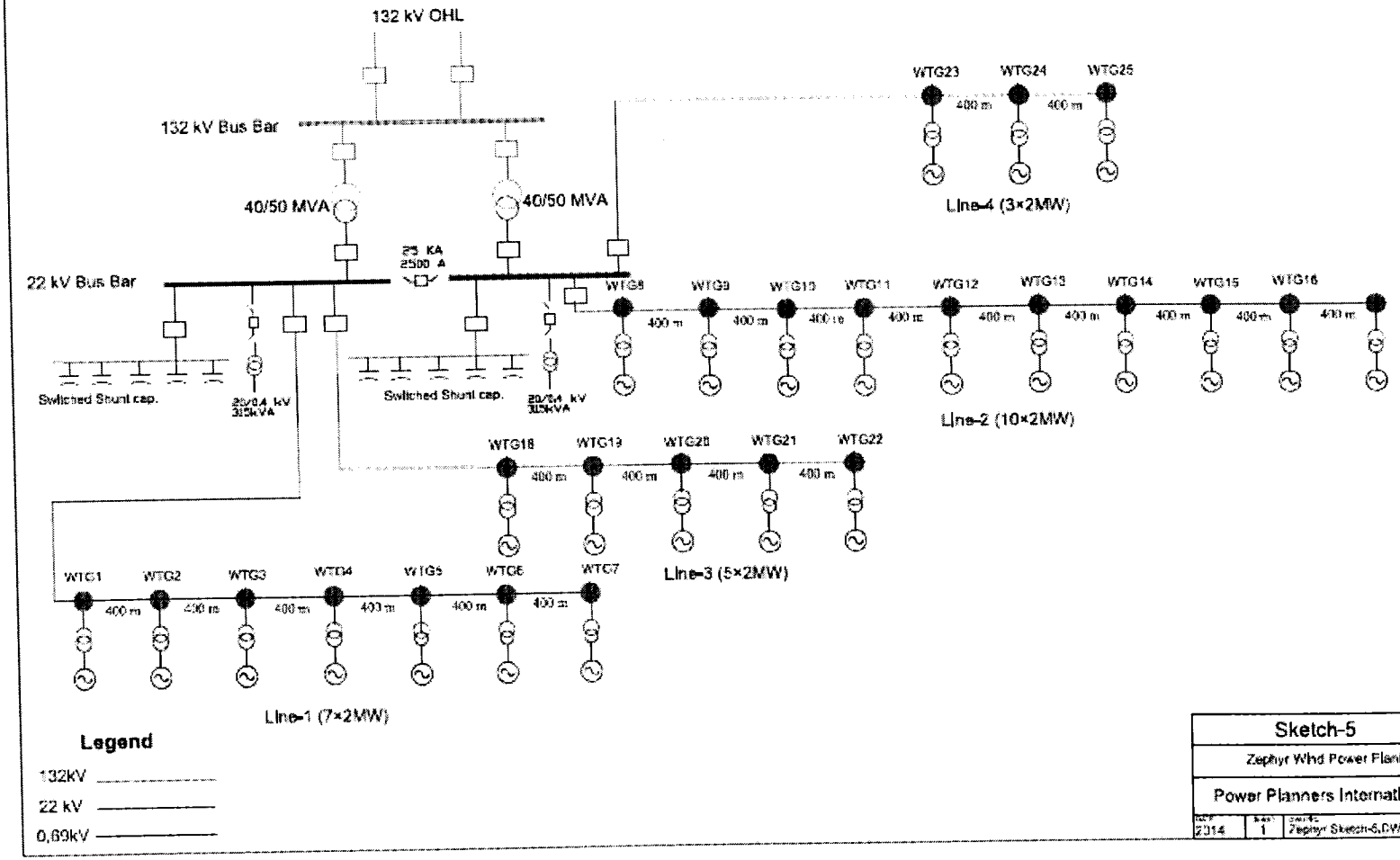
The connection scheme of Zephyr Power project for the scenario of December 2015 in the following diagram:

- ZPL would be connected by a double circuit of 132 kV looping in-out with a sub cluster already connecting Tenaga and HDPPL wind power project to Gharo-New collector substation.
- The grid facilities at 132 kV for a testing of individual turbines at ZPL should be made available by June 2015 whereas the grid facilities for evacuating the full output of ZPL should be made available by 2016 when the 220 kV part of the Gharo-New 220/132 kV substation will be commissioned.

The point of purchase envisaged in the AEDB Renewable Policy is that the NTDC will install the 132 KV transmission line to the wind farm. This will help the wind farm to reduce their initial capital costs and put all wind farms on a more equal footing with each other.


Interconnection of 50 MW Zephyr Wind Power Plant
With Zephyr WPP, Year 2015
Dadu
Jamshoro
Lakhra
Qasimabad-II
Qasimabad-I
Hala
Sakrand
Hala Road
Mariari
T.A. Yar
Tando Jam
Hub
NKI
Jamshoro Old
Phuleli
G.S.B
Ghangra Mori
Mirpur Khas New
KDA-33
Kotri
Latifabad
T.M.K Road
Kohsar
K.Site
Z.P.C/F
N.T.P.S
Noorjabad
T.B.Khan
T.M.Khan
Matli-New
Talhar
Jhimpir
K.Kohar
Jhimpir New
B.S. Karim
Shakh Bhirko
D.B.Cement
T-Sonex
ESSA C/F
T.C.F
Sujawal
Thatta
Gharo New
P.Patho
Ladium
M.P.Sakro
Legend
Existing
Proposed
132 kV
220 kV
500 kV
Sketch-3
Zephyr Wind Power Plant
Power Planners International

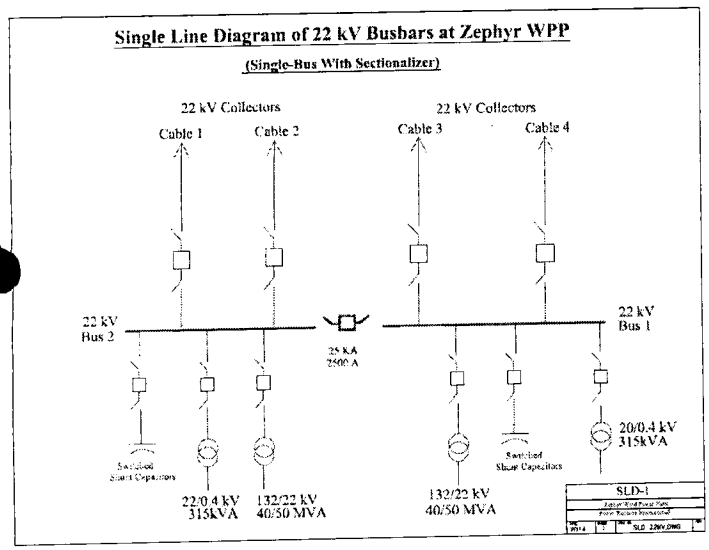
Zephyr 50MW Wind Farm
25x2 MW WTGs

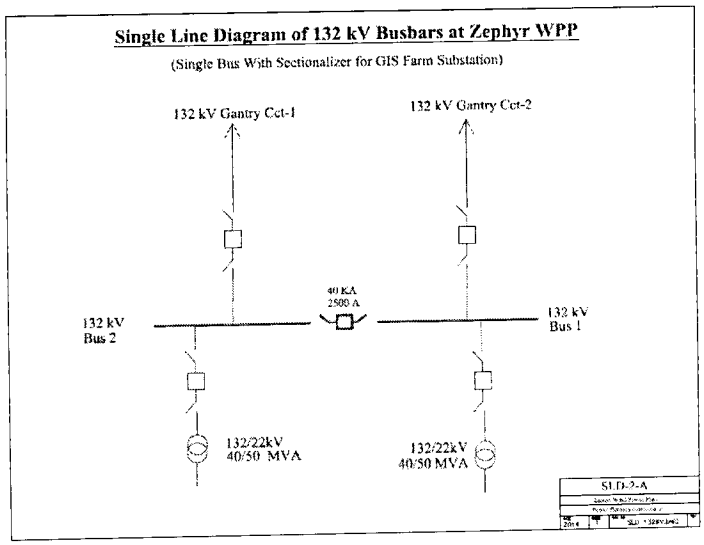


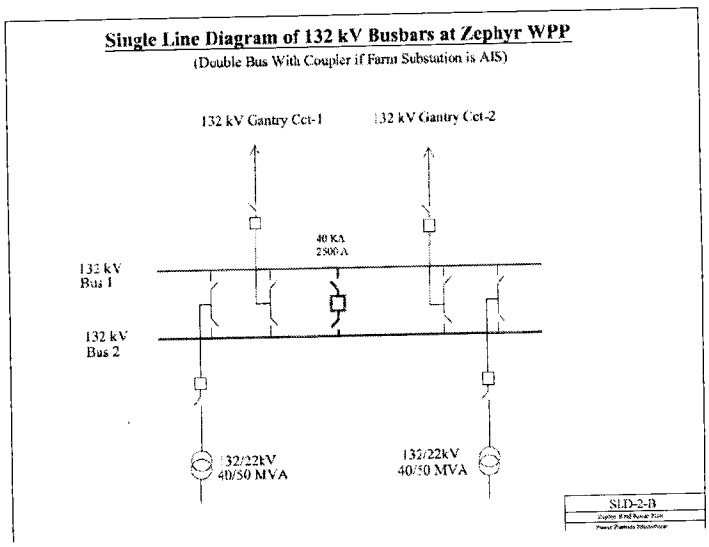
7.3 Wind Farm Substation 132/22 kV

A substation would be built within ZPL to collect all the power from the wind turbines at medium voltage (MV) level of 22 kV and step-up this power to high voltage (HV) level of 132 kV so that the farm's output may be evacuated to the main grid HESCO/NTDC.

The single line diagrams of the substation, as a conceptual design, are shown below in Single Line Diagrams for 22 kV and 132 kV respectively.







7.4 Internal Distribution system

The internal power distributions system shall be based on 22 KV cables. There will be separate distribution transformer of 0.69 / 22 KV, at each wind turbine. The transformer is located in the nacelle of the turbine. The power system will be arranged in separate feeder loops and each loop will contain 2-3 turbines as per utility practices. The different loops would be connected at a point to make a bus bar of 22 KV.

The transformer is a three phase dry-type transformer, which is self-extinguishing. The windings are connected in star on the low voltage side (690V and 480V). The 690V and the 480V system in the nacelle is a TN-system, which means that the star point is connected to earth. In the transformer area lightning arresters are mounted on the medium voltage side of the transformer.

The electrical system within the farm for grouping of wind energy converters has yet to be provided by Vestas.

8.0 Infrastructure

The ZPL project is nearest to Karachi as compared to wind farms in Jhimpir. It is located in Tehsil Gharo which is 60 km from Karachi and one hour by car. Infrastructure is proximate. The national railway passes through Dhabeji. The National Highway passes through Gharo. A good metal road connects Gharo to Mirpur Sakro to Keti Bunder. Coastal Highway passes 4 Km from ZPL land. The site is 2.5 km from the end of the metalled road moving across the Kutcha. Residential accommodation and amenities are available at these towns. Daily commuting is feasible.

Project cost, information regarding sources and amounts of equity and debt.

The proposed investment is US$ 150.672 million.

Equity: 25 %.

Debt : 75 %.

Equity will come from the following sources:

Mr. Zia Khaleeli	20%
Investors	80%
	100%

Both local and foreign institutional investors, as well as high net worth individuals, will be our investors. Local and international financial institutions have been contacted for private placements. All have shown considerable positive interest.

Equity

Mr. Zia Khaleeli, family and friends would hold the Sponsor's share of the equity in the company.

Debt

United Bank Limited has shown interest in financing the project. Letter from the bank is enclosed. See third party Annexure.

Project commencement and completion schedule with milestones.

We include the chart for the actual erection and commissioning of the project.

See Vestas Schedule.

	Months								
	1	2	3	4	5	6	7	8	9
Activities									
Re-engineering									
Mobilization of Equip / Manpower									
Infrastructure Development									
Production, Planning, Supply of Equip									
Erection & Commissioning									

Detailed Standard Project Gant Chart for completion of project will be made after confirmation of tariff by NEPRA.

9.0 Environmental Impact Assessment and Social Acceptability

9.1 Developmental Impact

There are many advantages of developing Renewable energy, particularly wind energy.

- Transfer of the latest technology to Pakistan as it is pioneering efforts to have wind farms in Pakistan.
- Employment to the local people during the construction phase and during operational life of the project.
- Building of approach roads to the site.
- Interconnections to the grid.

Trickle down effect on the area. With improved communications, education and health etc facilities would be accessible to the local population.

9.2 Environmental Impacts and Mitigation

An environmental impact is assessed by first identifying the potential impact, followed by evaluating and quantifying (where possible) the impact before interpreting its significance. Environmental screening is a process through which the range of potential effects is evaluated to identify those that merit detailed assessment. For the proposed wind farm, the impacts that were screened out as not requiring a detailed assessment are visual intrusion (the wind farm is located outside towns); shadow flicker and reflected (no dwellings within a kilometer of the wind farm); construction and turbine noise (no dwellings within a kilometer of the wind farm); archeological disturbance (no archeological sites in the vicinity of the wind farm); hydrological interference (no natural water courses in the vicinity of the wind farm); dust (it will be generated mostly within the project area during the construction phase well away from dwellings); public safety (no dwellings or regular human activity in the vicinity of the wind farm); and cultural conflict (very short-term duration, that is, during the construction phase). A more detailed and thorough assessment was, however, carried out for the impacts described below.

9.3 Loss of Habitat

No rare or threatened vegetation species grow along the proposed site or access road. Most of the plants found here have a wide ecological aptitude and populations large enough to ensure their genetic diversity. There is no vegetation and will not harm the diversity of plant communities in the area. Only raptors use the proposed site as a hunting ground and for soaring overhead. Burrowing taxa, such as rodents and reptiles, will face some loss of habitat because of site preparation and access road construction.

The disturbance to wild life will be minimized through management controls such as reducing the size of the fenced area to the extent possible; training project staff to avoid killing or chasing wild animals; and minimizing noise generated by project activities.

9.4 Disturbance to Birds

Though not a significant impact, wind turbines affect birds' staging or roosting because of the noise they create, or because their location forces birds to change their migration paths. Studies indicate that wind turbines affect staging or roosting birds up to a distance of 500 m. Coastal birds settle along the shoreline and passerine and other resident birds nest in forest areas.

The wind farm would be located more than 500 m from the shoreline.

9.5 Avian Collisions

It has been estimated that between 100 million to well over 1 billion birds are killed annually in the United States because of collisions with human-made structures. However, wind generation facilities account for only 10,000 to 40,000 of these fatalities. This indicates that avian collision mortality attributed to wind turbines is the lowest when compared to other sources of mortality, and does not appear to cause any significant population impact. Auditory and visual stimuli will be used to warn birds of the turbines' presence.

While birds tend to collide with man-made structures such as electrical power lines, masts, or buildings, they are very rarely affected directly by wind turbines.

9.6 Disturbance to Marine Life

The presence of humans during the construction phase, and the expected further influx of people because of infrastructural development in the area during the later stages of the project, may pose no threat to the area's marine life.

9.7 Waste Disposal

The main types of waste that will be generated during the construction phase of the project are waste oil, camp waste, medical waste, demolition waste, packing waste, and excess construction material. Every effort will be made to minimize the waste generated while construction is in progress, and a special waste-minimization program will be initiated. In addition, project management will be responsible for all waste generated by the project until its final disposal. A waste disposal site will also be developed, containing a lined landfill and a burn pit. Furthermore, an inventory of all waste generated during the project will be maintained.

9.8 Sand Dune Stability

The coastal sand dunes act as barriers that absorb wave attack during storms, protecting both the beach in front of them and the land behind. The dunes are a complex, flexible, and often fragile ecosystem. Any large-scale construction project on the sand dunes runs the risk of affecting the stability of the dunes in an unpredictable manner unless precautionary measures are undertaken to minimize the disturbance and steps are taken to stabilize the dunes immediately after construction work has been completed. The project site is far from the sand dunes of the shore line.

9.9 Aircraft Safety

Although wind turbines can pose a safety hazard for low-flying aircraft, the Civil Aviation Authority (CAA) has a detailed code that specifies the maximum height of structures that are allowed in the vicinity of commercial airports. The proposed wind turbines will meet CAA safety standards and will not interfere with aircraft using the Karachi airport.

9.10 Interference with Telecommunication Systems

The moving blades of a wind turbine can distort electromagnetic signals. In the Gharo area, four different sources of electromagnetic signals may be affected: the microwave communication link between cities and other towns of Sind, the television rebroadcast tower, the VHF omni-directional radio (VOR) communication link at the airport, and the military radar of the airport.

There are no such installations in the area. The wind turbines are not expected to interfere with any of these sources of electromagnetic signals because they are situated too far away from these facilities.

9.11 Land Use Conflict

The whole land is barren and there is no conflict of interest.

9.12 Employment Opportunities

There is a high expectation among the local population that the project will generate significant local employment opportunities.

Accordingly, the local population will be given preference when hiring unskilled, semiskilled and skilled workers. If suitably skilled labor is not available locally, then residents of the district will be given preference. Wherever feasible, local laborers will be trained to enhance their skills. No person under the age of 15 will be employed on the project.

9.13 Tourism Potential

There is no tourism potential at site since it is barren and uninhabited

9.14 Environmental Benefits

Given that wind power is a 'clean' source of energy, its key environmental benefit is in terms of the emission offsets it provides. The wind farm will offset carbon dioxide depending on the efficiency of the power plant that it will replace. Over a twenty-year time horizon, i.e., the assumed life of this project, the wind farm has the potential to offset of million tons of CO_2 equivalent.

It will also offset sulfur dioxide of the thermal plants. The local benefits of this are obvious in the sense that the ingestion of SO_2 and particulates is harmful for human health. Sulfur dioxide also contributes to acid rain. Therefore, if a thermal power station option was exercised as opposed to the wind farm, the additional cost of mitigating the SO2 and particulate emissions would have to be borne.

9.15 Social Benefits

As the use of wind energy for electricity generation does not cause pollution, the air quality around wind farms is unaffected. There is therefore a health benefit from this technology compared to other more traditional forms of power generation.

Innovations in wind power in world significantly reduce the amount of greenhouse gas emissions. Global warming and climate change pose extreme problems for the social well being of people all over the world. It has been predicted to:

- increase the incidence of natural disasters including floods, droughts and hurricanes;
- increase the spread of infectious diseases;

9.16 Wind Turbines Whisper Quietly

Large, modern wind turbines have become very quiet. At distances above 200 meters, the swishing sound of rotor blades is usually masked completely by wind noise in the leaves of trees or shrubs.

There are two potential sources of noise from a wind turbine:
Mechanical noise from the gearbox or generator, and aerodynamic noise from the rotor blades.

Mechanical noise has virtually disappeared from modern wind turbines. This is due to better engineering with more concern about avoiding vibrations. Other technical improvements include elastically dampened fastenings and couplings of the major components in the nacelle, and to a certain extent sound insulation. Finally, the basic components themselves, including gearboxes, have developed considerably over the years. Modern wind turbine gearboxes use "soft" gearwheels, i.e. toothed wheels with hardened surfaces and relatively elastic interiors.

Aerodynamic noise i.e. the "swish" sound of the rotor blades passing the tower of a wind turbine primarily arises at the tip and the back edge of the rotor blade. The higher the rotational speed, the louder the sound. Aerodynamic noise has been cut dramatically during the past ten years due to better design of rotor blades (particularly blade tips and back edges).

Pure tones can be very annoying to a listener, while "white noise" is hardly noticed at all. Rotor blade manufacturers take extreme care to ensure a smooth surface which is important to avoid pure tones. Likewise, manufacturers who install wind turbines take great care to ensure that the rotor blades are not damaged when a wind turbine is being installed.

9.17 Wind Energy Clean and Saves Energy

Wind turbines use only the energy from the moving air to generate electricity. A modern 1,000 kW wind turbine in an average location will annually displace 2,000 tons of carbon dioxide from other electricity sources, i.e. usually coal fired

power stations. The energy produced by a wind turbine throughout its 20 year lifetime (in an average location) is eighty times larger than the amount of energy used to build, maintain, operate, dismantle, and scrapping it again.
In other words, on average it takes only two to three months for a wind turbine to recover all the energy required to build and operate it.

9.18 Wind Projects Minimize Ecological Impact

Wind turbine manufacturers and wind farm developers have by now substantial experience in minimizing the ecological impact of construction work in sensitive areas such as moors, or mountains, or when building wind farms in offshore locations.

After the useful life of a wind farm has elapsed, foundations can be reused or removed completely. The scrap value of a wind turbine can normally cover the costs of restoring its site to its initial state.

The IEE for the Project as per GOP guidelines has been conducted and approved by Sindh EPA. The NOC letter is attached

9.19 Safety Plans and Emergency plans

These have been developed as per Wind Energy Farm requirements of international standards by Vestas.

The Safety Manual and Emergency Plans to be prepared by the major equipment supplier for the project would cover all aspects from unloading of equipment at the port, to transportation to storage area, erection of equipment, commissioning and normal plant operation, shutdowns and emergency stoppages both for equipment, structures, vehicles, personnel, etc.

Some of the topics to be covered are:

- Safety and Health Policy Statement
- Safety Education and Training Program
- Safety Committee
- MSDS Responsibilities
- Supervisor Responsibilities
- Employee Responsibilities
- First Aid OSHA Safety and Health Program Manuals!
- Safety Inspection Responsibilities and Checklists
- Orientation & Training Responsibilities
- Employee Safety Handbook
- Machinery Tag Out Program
- Hazard Prevention and Control
- Hazard Communication (HAZCOM) Program
- Property Maintenance
- Personal Protective Equipment

- Blood borne Pathogens
- Liability Reporting
- Accident Investigation
- Emergency Action Plans
- Hazardous Material Spill Response
- OSHA Inspection
- OSHA Record Keeping and Posting Requirement

Other areas would be-

Back and Lifting Safety	Electrical Safety	Forklift and Motorized Truck	Landscape and Grounds Maintenance	Respiratory Protection Program
Bloodborne Pathogens	Ergonomics	General Shop/Work Area and Tool Safety	Machinery & Machine Guarding Safety	Roof Labor Safety
Carpentry and Lumber Handling	Excavation and Trenching	Hearing Conservation Program	Motor Vehicle Safety	Safety & Health Signs and Tags
Chemical Safety-HAZCOM for Non-Laboratories	Fall Protection	Heating Systems and Boiler	Office Safety	Scaffold Safety
Concrete and Masonry Construction	Fire Prevention	Housekeeping and Material Storage	Painting Operations	Temporary and Contract Workers
Confined Space	Flammable Liquids	Laboratory Health and Safety	Personal Protective Equipment	Tool Box Talks/ Work Group Safety Meetings
Corridors and Outside Walkways	Fleet Motor Vehicle Safety Program	Laboratory HAZCOM Chemical Safety Plan	Plumbing Operations	Welding, Hot Work, and Metal Fabrication
Cranes and Hoists	Food Service	Ladder Safety	Refrigeration and Air Conditioning	Workplace Hazards and Workplace Violence

10.0 Sensors

Some sensors discussed here- Several sensors are used in the wind turbine to measure important safety related parameters. The details of important sensors are as under:-

1. **Shake Sensor:** To sense the shaking/displacement of component by physical contact with the component

2. **Anemometer:** To measure the wind speed at specified heights

3. **Wind Vane:** To measure the wind direction

4. **Rotor Speed Sensor:** A proximity type sensor, which records rotor speed rpm and displays on the FR1 display module.

5. **Generator Speed Sensor:** A proximity type sensor that records and displays generator rpm on the screen

6. **Vibration analyzers:** These are accelerometer type sensors that record and display the displacement in various planes.

7. **Twist Stop Sensor:** These are limit switch type sensors, that display error message when cable twist exceeds set value

8. **Temperature Sensors** RTD type sensors, provide the temperature status at Generators (G1/ G2), Bearing DE/ NDE, hub bearing, Nacelle, fluid coupling, gear oil sump, gear bearing HSS inner, HSS outer,

The sensors are connected to the control system; WTG cuts off if sensors record abnormal values. Values recorded can also be stored, recalled and analyzed.

11.0 Grid Interconnection

Main Transformer, Frequency Tolerance, Voltage Tolerance and Fault Ride Through

See Annexure. See Electrical data of Vestas item.

12.0 Plant Characteristics

Generation voltage, frequency, power factor, automatic generation control, ramping rate, alternative fuel, auxiliary consumption, time(s) required to synchronize to grid.

There is no requirement of alternative fuel. Auxiliary consumption required would be from the grid operator in case of emergencies when no wind is available or when due to high winds the turbines have been shutdown for safety reasons.

Generation Voltage
690 V, please see enclosed electrical data document.

Medium Voltage
It is recommended 20 KV, I believe it has been calculated based on the wind and annual loss in the cables/transformer and then choose the right voltage level.

Frequency 50Hz.
50 Hz, please see enclosed electrical data document

Reactive Power Capability
The Vestas wind turbine has a standard reactive power capability corresponding to a power factor of 0.95 lagging to 0.95 leading.

With reactive power support from the line-side/rotor-side converters and the selection of the appropriate generator, Vestas offers an expanded reactive power capability option: 0.90 lagging to 0.90 leading.

Wind Power Free Reactive Power
As an optional feature, Vestas V100 can supply or consume reactive power (+/-150 kVAR) even when there is no active power generation (i.e. wind below cut-in speed). This is achieved by utilizing capabilities of the line side converter in the rotor circuit.

Automatic Generation Control

The turbine operates completely autonomous and the generation is controlled from each turbine controller, based on the wind conditions at each turbine, for further information please see electrical data document.

Ramping Rate
The turbine will during starting and stopping (not emergency stop) increase and decrease the active power with 50 kW/s. During normal production the active power production will follow the wind speed variation. For the complete wind farm the output power will be quite smooth and without any large change short time.

Time required to synchronize to internal farm grid. Each turbine will synchronize autonomous depending on the wind at each turbine. The synchronization of the generator takes approximately 1 second

13.0 Control, Metering, Instrumentation and Protection.

See Electrical data of Vestas.

14.0 Training & Development

Vestas informed that they will conduct intramural training of lead group of Project personnel in Denmark. A detailed training programme has been developed. The company will also develop an in-house training programme for all new employees.

Feasibility Study Report Enclosed.

15.0 Prospectus

15.1 Introduction of Applicant

Mr. Zia Khaleeli studied at St. Paul's School, London, and then did his BA (Jurisprudence) at Oxford. He is Vice President of the International Chamber of Commerce (ICC Pakistan), Chairman of the Oxford & Cambridge Society, Karachi, Educational Trust, an active member of the Petroleum Institute of Pakistan (PIP) and served as Director of the State Bank of Pakistan from January 2001 to 2004. He also serves as Director of ACE, Pakistan's leading Engineering Consultants.

Chief Executive of Omega Ltd. whose core business is representation of international companies on petroleum, ethanol and bulk commodities.

Chief Executive of Chemical Synergies Ltd. (certified ISO 9001:2000 Company) which has its manufacturing facility in Winder, Baluchistan.

Mr. Zia Khaleeli, has been involved in the development of a wind farm project since 1994, and pioneered the wind data gathering exercise in the private sector of Pakistan. Zephyr Power (Pvt.) Ltd., the project company was formed in 2005 to set-up a 50 MW wind farm project located in district Thatta, Sindh. Mr. Zia Khaleeli is responsible for effective implementation and development of the project.

15.2 Salient Features of the Facility

Name of Project : Zephyr Power Pvt Limited
Location : Bhambore

Installed Capacity: 50 MW.

The wind farm would be connected to NTDC / WAPDA systems. According to Renewable Energy Policy it is mandatory for the CPPA (Central Power Purchasing Agency) to purchase all electricity offered to them by the renewable energy projects.

We contacted four wind turbine manufacturers to undertake the Engineering Procurement and Construction contract and Operation and Maintenance of the wind farm.

Supply of Wind Energy Turbines was discussed and quotations received from Vestas – Denmark and Goldwind – China. Both offered their latest versions of wind turbines.

Subsequent to detailed discussions with Vestas – Denmark, the largest manufacturer of Wind Energy Converters in the world. We have finalised and signed the EPC contract and O & M contract with Vestas.

Authorization from Board resolution enclosed.

Certificate of Incorporation enclosed.

Memorandum and Articles of Association enclosed.

Vestas - The wind energy converter and substation equipment will be provided under a turnkey EPC Contract. See attached

Operations and maintenance contract for 10 years also with Vestas. See O & M Contract attached.

Verified references with experience of applicant and sub-contractors.

Our general consultant is M/s Associated Consulting Engineers Pvt. Limited (ACE) have carried detailed work on a number of power projects developments in Pakistan and abroad.

M/s F&W Management conducted the soil investigation of various locations on ZPL land. Soil Investigation report is enclosed.

M/s Renewable Resource (Pvt.) Limited and M/s Lahmeyer International GmbH, Bad Viberl Germany are the Technical Consultants for Engineering Procurement

and Construction contract, Operation and Maintenance contract, Energy Purchase Agreement and Implementation Agreement.

M/s RIAA Law are Legal Consultant for Engineering Procurement and Construction contract, Operation and Maintenance Contract, Energy Purchase Agreement and Implementation Agreement.

Feasibility Report Enclosed.

Information

for

Schedule-I

Schedule-I

Wind Farm Coordinates

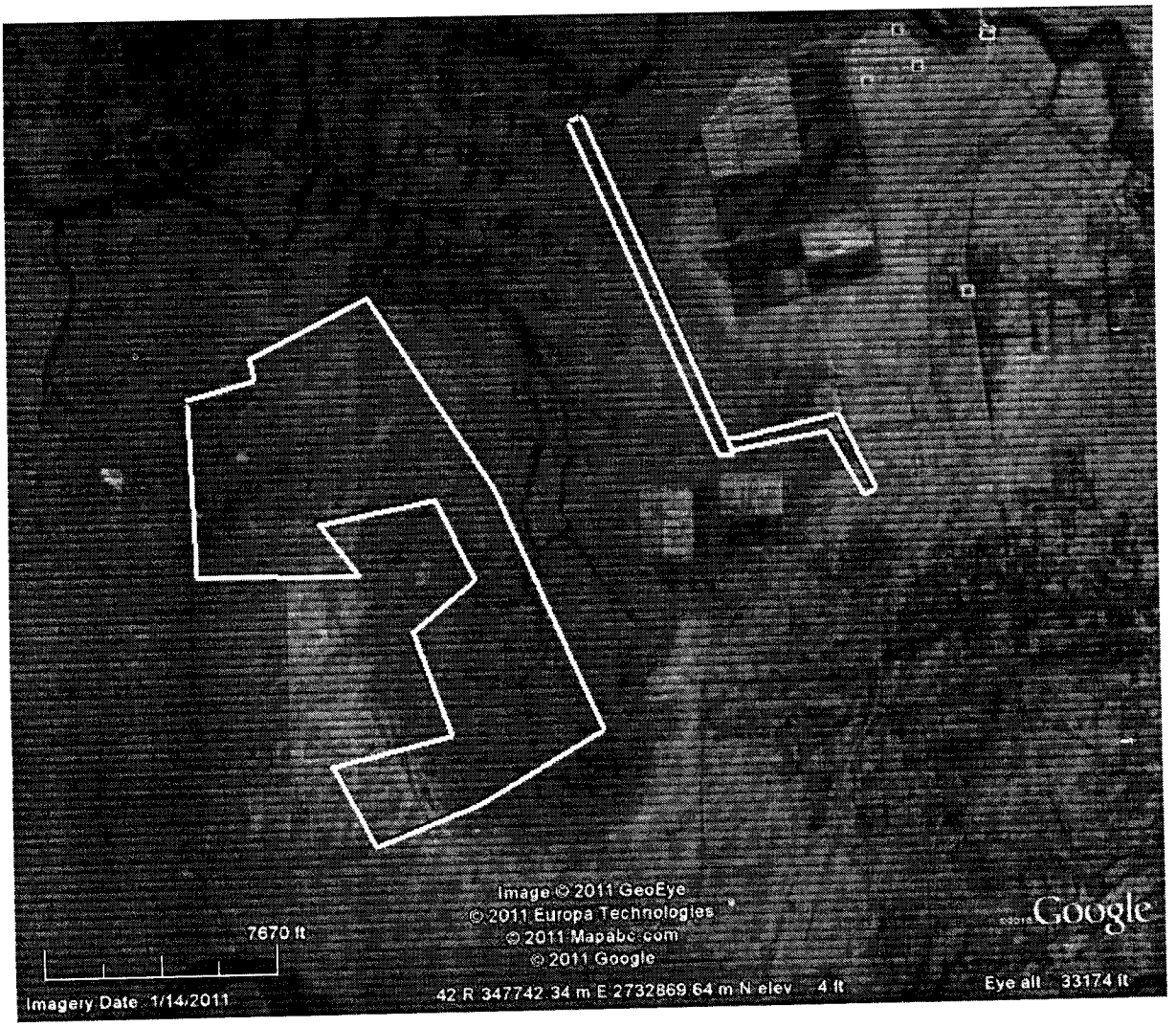
Western Land

1	24°42'49.74"N	67°27'19.04"E
2	24°42'54.93"N	67°27'43.69"E
3	24°43'2.69"N	67°27'42.35"E
4	24°43'21.21"N	67°28'22.33"E
5	24°42'18.11"N	67°29'7.55"E
6	24°41'55.33"N	67°29'20.16"E
7	24°40'57.86"N	67°29'45.52"E
8	24°40'35.32"N	67°29'0.93"E
9	24°40'22.48"N	67°28'22.78"E
10	24°40'48.45"N	67°28'9.91"E
11	24°40'56.33"N	67°28'51.73"E
12	24°41'30.47"N	67°28'36.86"E
13	24°41'48.12"N	67°29'2.22"E
14	24°42'15.21"N	67°28'47.19"E
15	24°42'9.05"N	67°28'3.96"E
16	24°41'50.73"N	67°28'19.58"E
17	24°41'52.56"N	67°27'22.05"E

Eastern Land

18	24°42'13.04"N	67°31'21.79"E
19	24°42'14.08"N	67°31'25.48"E
20	24°42'34.48"N	67°31'10.91"E
21	24°42'38.43"N	67°31'13.05"E
22	24°42'28.00"N	67°30'35.46"E
23	24°42'31.15"N	67°30'34.07"E
24	24°43'48.23"N	67°29'59.78"E
25	24°44'19.57"N	67°29'43.39"E
26	24°44'16.87"N	67°29'35.88"E
27	24°42'26.29"N	67°30'28.02"E

Wind Farm Lay Out



Wind Farm Micro-Sitting

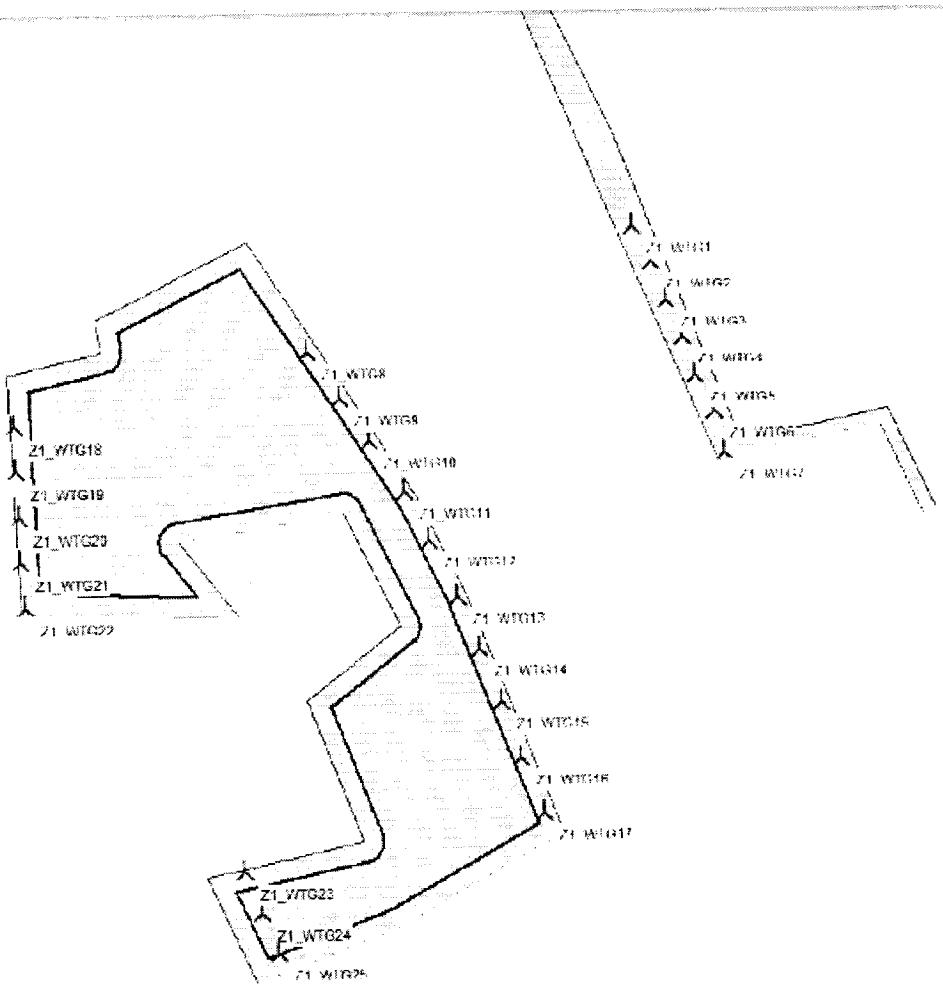
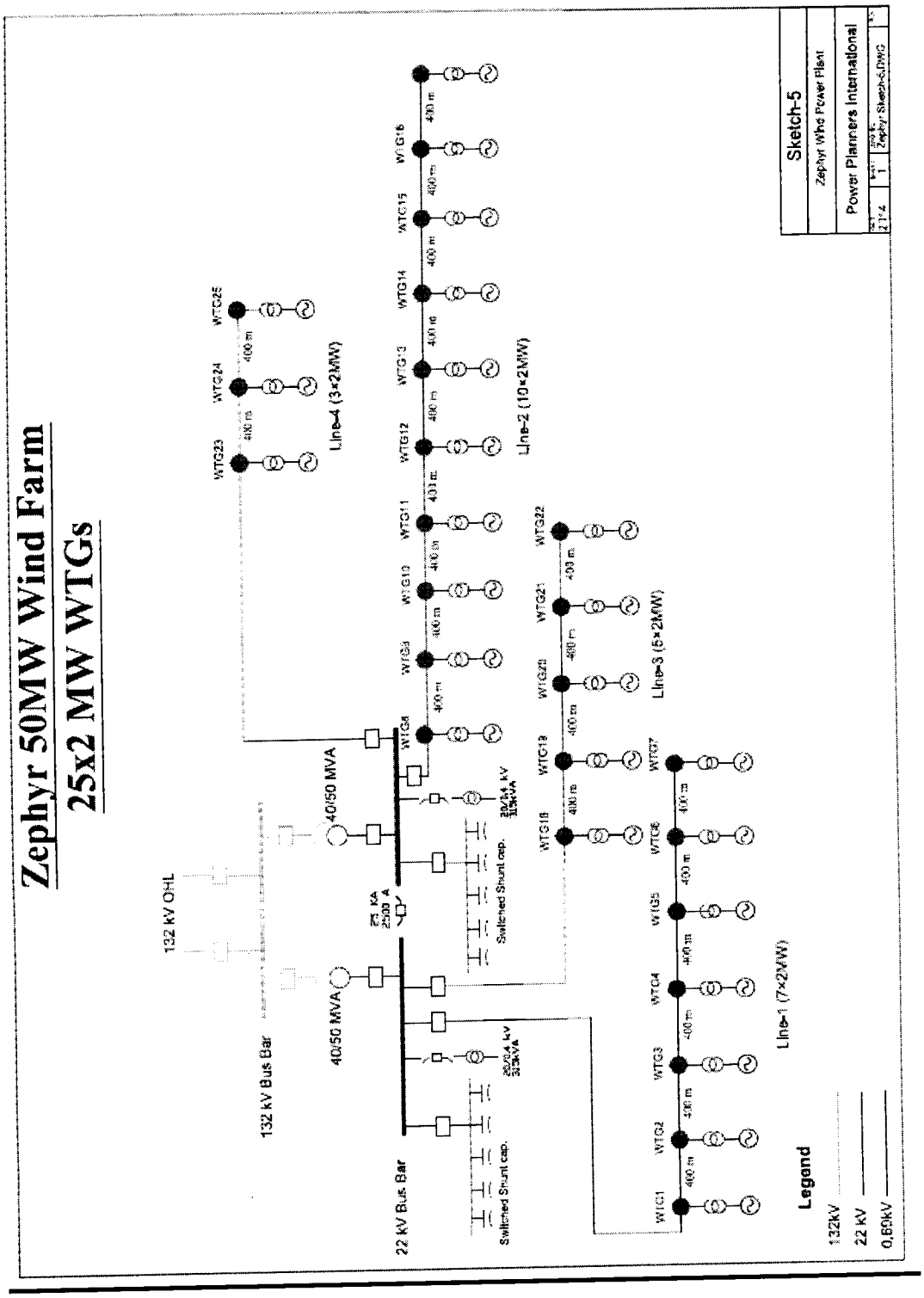


Figure Site layout, 25xV100-2MW-80mHH.

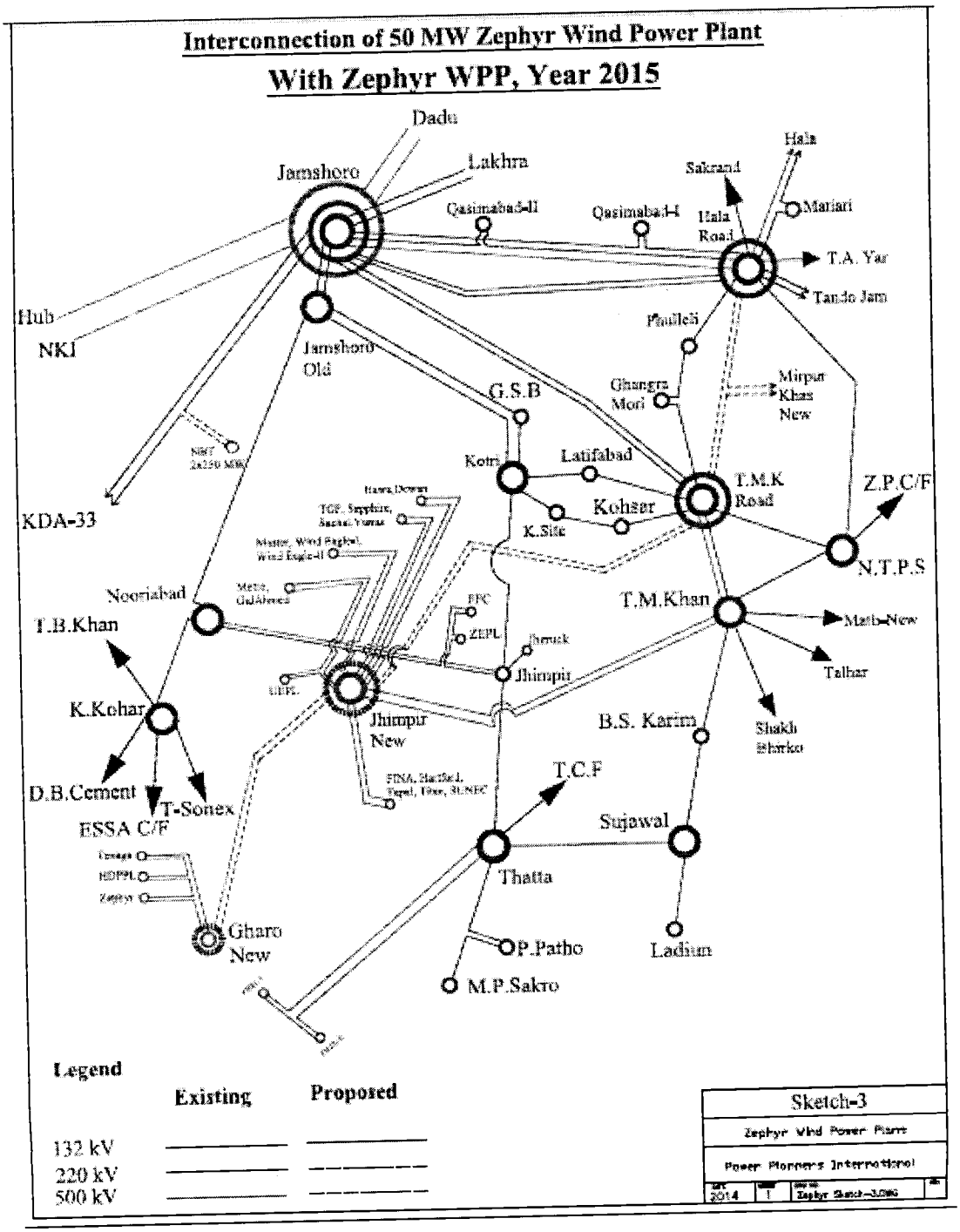
Single Line Diagram
Electrical System of the Wind Farm



INTERCONNECTION ARRANGEMENT FOR DISPERSAL OF POWER FROM THE WIND FARM

The connection scheme for Zephyr Power wind farm would be loop in-out of one of the 132 kV double circuits from NTDC-Gharo 220/132 kV grid station to Thatta.

Schematic Diagram
For Interconnection/Transmission Arrangement for Dispersal of Power from Zephyr Power Limited



Wind Farm Details*

(A). General Information

(i).	Name of Applicant/Company	Zephyr Power Pvt. Limited
(ii).	Registered/Business Office	68-B, S.M.C.H.S., Karachi.
(iii).	Plant Location	Deh Kalra Sarkari (Bhambore), Taluka Mir Pur Sakro, District Thatta, Sindh.
(iv).	Type of Generation Facility	Wind Power

(B). Wind Farm Capacity & Configuration

(i).	Wind Turbine type, Make & Model	Vestas V100 / 2.0 MW
(ii).	Installed Capacity of Wind Farm (MW)	50 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	25 x 2.0 MW

(C). Wind Turbine Details

(a).	**Rotor**	
(i).	Number of blades	3
(ii).	Rotor speed	14.9 rpm
(iii).	Rotor diameter	100 m
(iv).	Swept area	9503 m^2
(v).	Rotational direction	Clockwise (front view)
(vi).	Rated power	2000 KW

* As provided by Three Gorges First Wind Farm Pakistan (Private) Limited

(v).	Cut-in wind speed (10 min. avg.)	3 m/s
(vi).	Cut-out wind speed (10 min. avg.)	22 m/s
(vii)	Survival wind speed (3 second gust)	59.5 m/s
(viii)	Pitch regulation	OptiTip®
(b).	**Blades**	
(i).	Blade length	54000 mm
(ii).	Material	Fibre glass reinforced epoxy and carbon fibres
(iii).	Weight	8300 kg
(c).	**Gearbox**	
(i).	Type	1 planetary stage + 2 helical stages
(ii).	Weight	16000 kg
(iv)	Main shaft bearing	Type: Trumpet shaft Material: Forged Steel 42 CrMo4 / QT / EN 10083
(d).	**Generator**	
(i).	Power	2000 kW
(ii).	Voltage	690 V
(iii).	Type	Three phase asynchronous generator, air-cooled
(iv).	Speed	2600 rpm
(v).	Protection Level	IP 54
(vi).	Coupling	Composite coupling
(vii).	Efficiency	Efficiency c. 95 % at full load, (electrical system overall)
(viii).	Weight	6 110 kg
(ix).	Power factor	0.87 (Cos phi Unit)

(e).	**Yaw System**	
(i).	Yaw bearing	Plain bearing
(ii).	Brake	Disk brake with hydraulic brake and aerodynamic brakes
(iii).	Electric Motor Specs	1.5kW for 50Hz & 1.75kW for 60Hz, 6 pole/690 V
(iv).	Type Worm gear	W75
(v).	Ratio/planetary stages	1: 107.9
(vi).	Ratio/Worm gear	1:10
(vii).	Ratio total	1:1080
(viii).	Yaw Gear Weight	230 kg
(f).	**Control System**	
(i).	Type	Remote Control System
(ii).	Grid connection	Fiber optical converter
(iii).	Scope of monitoring	Remote monitoring of more than 300 different parameters, e.g. temperature sensors, hydraulic sensors, pitch parameters, vibration, speed, generator torque, wind speed and direction, etc.
(iv).	Recording	Production data, event list, long and short-term trends
(g).	**Mechanical Brake**	
(i).	Manufacturer	Eurotobi STILFRENI
(ii).	Type, side mounted	20.2802.01-4 PR771401000
(iii).	Type, top mounted	20.3100.03 PR771301000
(iv).	Piston diameter	ø75 mm
(v).	Weight	16 kg
(vi).	Maximum pressure	150 bar

(h).	**Tower**	
(i).	Type	cylindrical tubular steel tower
(ii).	Hub heights	Tubular tower 80 m

(D). Other Details

(i).	Project Commissioning date (Anticipated)	October 31, 2016
(ii).	Expected Life of the Project from Commercial Operation date (COD)	20 Years

Power Curve With Graphic
Vestas V100 / 2.0 MW

Air density 1.171 kg/m^3 adjusted Power Curve. V100-2.0 MW 50 Hz VCS, Noise Mode 0

Wind Speed [m/s]	Power [kW]
3.0	15
3.5	52
4.0	107
4.5	173
5.0	249
5.5	339
6.0	427
6.5	558
7.0	707
7.5	877
8.0	1069
8.5	1283
9.0	1513
9.5	1722
10.0	1868
10.5	1948
11.0	1980
11.5	1994
12.0	1999
12.5	2000
13.0	2000
13.5	2000
14.0	2000
14.5	2000
15.0	2000
15.5	2000
16.0	2000
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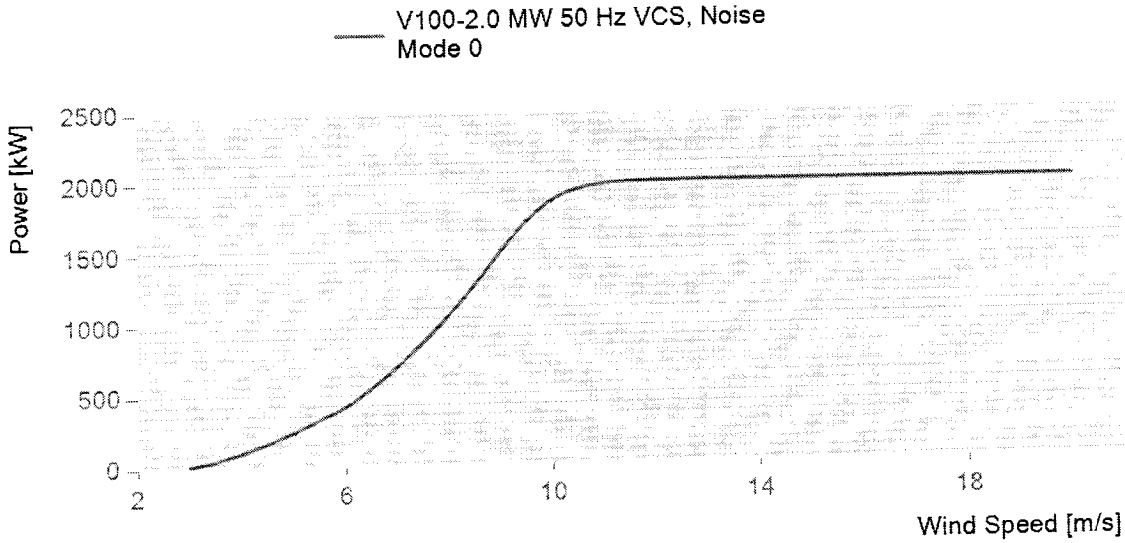
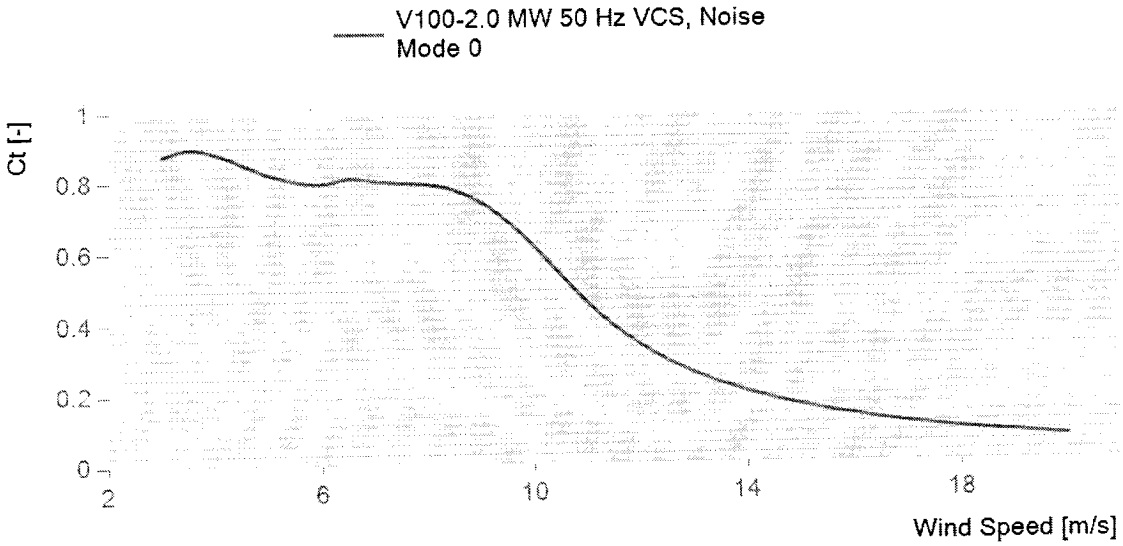
18.5	2000
19.0	2000
19.5	2000
20.0	2000



Air Density Adjusted Power Curve

Air density 1.171 kg/m^3 adjusted Ct Curve. V100-2.0 MW 50 Hz VCS, Noise Mode 0

Wind Speed [m/s]	Ct [-]
3.0	0.878
3.5	0.896
4.0	0.884
4.5	0.854
5.0	0.824
5.5	0.804
6.0	0.798
6.5	0.812
7.0	0.804
7.5	0.799
8.0	0.794
8.5	0.777
9.0	0.742
9.5	0.686
10.0	0.615
10.5	0.535
11.0	0.457
11.5	0.391
12.0	0.337
12.5	0.293
13.0	0.257
13.5	0.228
14.0	0.203
14.5	0.182
15.0	0.164
15.5	0.148
16.0	0.134
16.5	0.122
17.0	0.112
17.5	0.102
18.0	0.094
18.5	0.087
19.0	0.081
19.5	0.075
20.0	0.070



Air Density Adjusted Ct Curve

Information

for

Schedule-II

SCHEDULE-II

1.	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	50 MW
2.	Total Gross Generation of the Generation Facility/Wind Farm at P 50	188.2 GWh/yr
3.	Efficiency	96.3%
4.	Capacity Factor	41.4%
5.	Air Density	1.170 kg/m^3
6.	Wake Effects	3.6%
7.	Net Energy Generation at P50	181.3 GW/yr
8.	Net Energy Generation at P90	139.4 GWh/yr

Note

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