National Electric Power Regulatory Authority
Islamic Republic of Pakistan

Registrar

NEPRA Tower, Ataturk Avenue(East), G-5/1, Islamabad
Ph: +92-51-9206500, Fax: +92-51-2600026
Web: www.nepra.org.pk, E-mail: registrar@nepra.org.pk

No. NEPRA/R/LAG-260/ 10745-50

September 16, 2014

Lt General (Rtd) Hamid Rab Nawaz
Chief Executive Officer
NBT Wind Power Pakistan III (Pvt.) Limited
D-94, B-Street, 5th Avenue,
Block 5, Kehkashan, Clifton
Karachi

Subject: **Generation Licence No. WPGL/27/2014**
Licence Application No. LAG-260
NBT Wind Power Pakistan III (Pvt.) Limited (NBTWPPPL-III)

Reference: Your letter No. nil dated April 22, 2014 (received on 24.04.2014).

Enclosed please find herewith Determination of the Authority in the matter of Generation Licence Application of NBTWPPPL-III along with Generation Licence No. WPGL/27/2014 annexed to this determination granted by the National Electric Power Regulatory Authority to NBTWPPPL-III for its 249.60 MW Wind Power Plant located at Deh Kohistan 7/1, Tappo Jhampir, District Thatta, Sindh, pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997).

2. Please quote above mentioned Generation Licence No. for future correspondence.

Enclosure: **Generation Licence (WPGL/27/2014)**

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

16/09/14

(Naweed Illahi Sheikh)

Copy to:

1. Chief Executive Officer, Alternative Energy Development Board (AEDB), 2nd Floor, OPF Building, G-5/2, Islamabad.
2. Chief Executive Officer, NTDC, 414-WAPDA House, Lahore
3. Chief Operating Officer, CPPA, 107-WAPDA House, Lahore
4. Chief Executive Officer, Hyderabad Electric Supply Company (HESCO), WAPDA Water Wing Complex, Hussainabad, Hyderabad
5. Director General, Pakistan Environmental Protection Agency, Plot No. 41, Street No. 6, H-8/2, Islamabad.

National Electric Power Regulatory Authority (NEPRA)

Determination of the Authority in the Matter of Generation Licence Application of NBT Wind Power Pakistan III (Pvt.) Limited

September 12, 2014
Application No. LAG-260

(A). Background

(i). Government of Pakistan has set up Alternative Energy Development Board (AEDB) for harnessing the Renewable Energy (RE) resources in the Country. AEDB has issued Letter of Intent (LoI) to various RE developers for setting up projects in the country.

(ii). Apart from AEDB, the Provincial Governments are also authorized to issue LoI to prospective private investors. Govt. of Sindh (GoS) issued an LoI in favor of a consortium of Norwegian and Malaysian investors/sponsors for setting up an approximately 250.00 MW Wind Power Plant (WPP)/Wind Farm (WF)/Generation Facility in the Jhampir Wind Corridor of the Province of Sindh. For the purpose of the implementation of the projects, the Sponsor(s) incorporated special Purpose Vehicle in Pakistan in the name of NBT Wind Power Pakistan III (Pvt.) Limited (NBTWPPPL-III) under the Companies Ordinance 1984.

(iii). The Authority through its Determination No. NEPRA/TRF-WPT/2013/3942-3944 dated April 24, 2013 announced an Upfront Tariff for setting up WPP/WF in the Country. NBTWPPPL-III decided to unconditionally accept the above mentioned Up-Front Tariff on the standard terms and conditions as given in the said Determination.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ★ NEPRA ★ REGISTRAR

(B). Filing of Generation Licence Application

(i). In accordance with Section 15 of Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (the NEPRA Act), NBTWPPPL-III filed an application on April 24, 2014, requesting for the grant of Generation Licence.

(ii). The Registrar examined the submitted application to confirm its compliance with the NEPRA Licensing (Application and Modification Procedure) Regulations, 1999 (the "Regulations") and found the same compliant with the Regulations. The Registrar placed the matter before the Authority for admission or otherwise? The Authority admitted the same under Regulation 7 of the Regulations on June 19, 2014 for consideration of grant of a Generation Licence and approved the Notice of Admission (NoA) to be published in daily newspapers, seeking comments of the general public as stipulated in Regulation 8 of the Regulations. The Authority also approved the list of interested/affected parties for inviting comments or otherwise assisting the Authority in the matter as stipulated in Regulation 9 of the Regulations.

(iii). Accordingly, the NoA was published in one Urdu and one English National Newspaper on June 26, 2014. Further, separate notices were also sent to Individual Experts/Government Ministries/Representative Organizations etc. on June 27, 2014 for submitting their views/comments in the matter.

(C). Comments of Stakeholders

(i). In reply to the above, the Authority received comments from five (05) stakeholders. These included Central Power Purchasing Agency (CPPA) of National Transmission and Despatch Company Limited (NTDC), Pakistan Counsel of Renewable Energy Technologies (PCoRET), Ministry of Science and Technology (MoST), Ministry of Water and Power (MoW&P) and Energy Department Government of Balochistan (EDGoB).

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ★ NEPRA ★ REGISTRAR

(ii). The salient points of the comments offered by the above stakeholders are summarized in the following paragraphs: -

(a). CPPA in its comments submitted that NBTWPPPL-III selected Wind Turbine Generator (WTG) of 1.6 MW capacity whereas higher capacity WTG (like 2.5 MW) could be installed at the same hub height. As per NTDC vetted Grid Interconnection Study the proposed Interconnection Scheme NBTWPPPL-III would require (a) Development of collector substation of 220/33 KV for interface with Grid of NTDC after internally collecting the output of WPP/WF (b) Connect collector substation of 220/33 KV for WPP/WF by looping in-out (and having a looping distance of about 10 KM) with of the existing 220 KV circuit from Jamshoro to KDA-33 at NBTWPPPL-III. CPPA would like to highlight that NBTWPPPL-III must ensure that its proposed WPP/WF complies with the provisions of the Grid Code, approved by NEPRA, as amended in April 2010 for Grid Integration of WPP/WF already enforced within the National Grid;

(b). PCoRET expressed its no reservation to the grant of Generation Licence to NBTWPPPL-III;

(c). MoST endorsed the comments of PCoRET;

(d). MoW&P submitted that since policy of the GoP allows installing the project of NBTWPPPL-III therefore, the Authority may process the request of the applicant as stipulated in the NEPRA Act and relevant rules; and

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(e). EDGoB supported the request of NBTWPPPL-III for the grant of Generation Licence.

(iii). The comments of the above stakeholders were examined and found to be supportive except the observation of CPPA on the selection of the WTG and its compliance with Grid Code. The perspective of NBTWPPPL-III on the aforesaid position of CPPA was sought. In its rejoinder, NBTWPPPL-III submitted that the WTG selection was done based on Wind Data and Micro-siting for overall yield of WPP/WF and is the choice of the WF developer(s). The 220/33KV Collection Substation would be constructed by NBTWPPPL-III whereas the 220 KV line for looping In-Out the existing 220 KV Jamshoro to KDA-33 Transmission Line at the 220/33 KV substation of NBTWPPPL-III would be constructed by NTDC. It was confirmed that NBTWPPPL-III would comply with the provisions of the Grid Code.

(iv). The Authority considered the comments of the stakeholders and the rejoinder of NBTWPPPL-III and found the same satisfactory. In view of the said, the Authority considered it appropriate to process the application of NBTWPPPL-III for the grant of Generation Licence as stipulated in the Regulations and NEPRA Licensing (Generation) Rules, 2000 (the Rules).

(D). Grant of Generation Licence

(i). The sustainable and affordable energy/electricity is a key prerequisite for socio-economic development of any country. In fact, the Economic Growth of any country is directly linked with the availability of safe, secure, reliable and cheaper supply of energy/electricity. In view of the said reasons, the Authority is of the considered opinion that for sustainable development, all indigenous power generation resources including RE must be developed on priority basis.

(ii). The existing energy mix of the country is heavily skewed towards the costlier thermal power plants, mainly operating on imported furnace oil. The

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

continuously increasing trend in fuel prices is not only creating pressure on the precious foreign exchange reserves of the country but is also an environmental concern. Therefore, in order to achieve sustainable development it is imperative that indigenous RE resources are given priority for power generation and their development is encouraged. The Energy Security Action Plan 2005 (ESAP) approved by the Government of Pakistan, duly recognizes this very aspect of power generation through RE and envisages that at least 5% of total national power generation capacity (i.e. 9700 MW) to be met through RE resources by 2030. The Authority considers that the proposed project of NBTWPPPL-III is consistent with the provisions of ESAP. The project will help in diversifying the energy portfolio of the country. Further, it will not only enhance the energy security of the country by reducing the dependence on imported furnace oil but will also help reduction in carbon emission by generating clean electricity, thus improving the environment.

(iii). The term of a Generation Licence under the Rules is to be commensurate with the maximum expected useful life of the units comprised in a generating facility. According to the information provided, the Commercial Operation Date (COD) of the proposed Generation Facility/WPP/WF of NBTWPPPL-III will be by January 31, 2017 and will have a useful life of about twenty (20) years from its COD. NBTWPPPL-III has also submitted that the Energy Purchase Agreement (EPA) will be based and negotiated in terms of twenty (20) years useful life of the WGT. Further, NBTWPPPL-III also submitted that the term of its Generation Licence may be set accordingly. The Authority considers that the information provided by NBTWPPPL-III on useful life is consistent with other similar cases. In view of this, the Authority fixes the term of the Generation Licence to twenty (20) years from COD.

(iv). Regarding the Tariff, it is hereby clarified that under Section 7(3)(a) of the NEPRA Act, the determining of tariff, rate and charges etc. is the sole responsibility of the Authority. NBTWPPPL-III has already applied for the acceptance of the Up-front Tariff in accordance with the Determination of the Authority No. NEPRA/TRF-WPT/2013/3942-3944, dated April 24, 2013

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

however, the same is still under consideration of the Authority. In view of the said, the Authority directs NBTWPPPL-III to charge only such tariff from the Power Purchaser which has been determined, approved or specified by the Authority in terms of Rule-6 of the Rules.

(v). The proposed Generation Facility of NBTWPPPL-III will be using RE Resource for Generation of Electric Power. Therefore, the project may qualify for the Carbon Credit under the Kyoto Protocol (for RE projects coming into operation upto 2020). In view of the said, the Authority directs NBTWPPPL-III to initiate the process in this regard at the earliest so that proceeds for the Carbon Credits are materialized. NBTWPPPL-III shall be required to share the proceeds of the Carbon Credits with the Power Purchaser as stipulated in Article-14 of its Generation Licence.

(vi). In view of this, the Authority hereby decides to approve the grant of Generation Licence to NBTWPPPL-III on the terms set out in the Generation Licence annexed to this determination. The grant of Generation Licence will be subject to the provisions contained in the NEPRA Act, relevant rules, regulations framed and the applicable documents.

Authority

Maj. (R) Haroon Rashid
Member

Khawaja Muhammad Naeem
Member

Habibullah Khilji
Member/Vice Chairman

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan

GENERATION LICENCE

No. WPGL/27/2014

In exercise of the Powers conferred upon the National Electric Power Regulatory Authority (NEPRA) under Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997, the Authority hereby grants a Generation Licence to:

NBT WIND POWER PAKISTAN III (PVT.) LIMITED

Incorporated under the Companies Ordinance, 1984
Cooperate Universal Identification No. 0080094, dated June 06, 2012

for its Generation Facility/Wind Power Plant/Wind Farm Located at Deh Kohistan 7/1 Tappo Jhampir, District Thatta, in the Province of Sindh

(Installed Capacity: 249.60 MW Gross ISO)

to engage in generation business subject to and in accordance with the Articles of this Licence.

Given under my hand this 16th day of September Two Thousand & Fourteen and expires on 30th day of January Two Thousand & Thirty Seven.

Registrar 16/09/14

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Article-1
Definitions

1.1 In this Licence

(a). "Act" means "the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 ";

(b). "Authority" means "the National Electric Power Regulatory Authority constituted under section 3 of the Act";

(c). "Bus Bar" means a system of conductors in the generation facility/Wind Farm of the Licensee on which the electric power of all the Wind Turbine Generators or WTGs is collected for supplying to the Power Purchaser;

(d). "Carbon Credits" mean the amount of carbon dioxide (CO_2) and other greenhouse gases not produced as a result of generation of energy by the generation facility/Wind Farm, and other environmental air quality credits and related emissions reduction credits or benefits (economic or otherwise) related to the generation of energy by the generation facility/Wind Farm, which are available or can be obtained in relation to the generation facility/Wind Farm after the COD;

(e). "Commercial Operations Date (COD)" means the day immediately following the date on which the generation facility of the Licensee is Commissioned;

(f). "CPPA" means the Central Power Purchasing Agency of NTDC or any other entity created for the like purpose;

(g). "Energy Purchase Agreement" means the energy purchase agreement, entered or to be entered into by and between the Power Purchaser and the Licensee, for the purchase and sale of electric

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

energy generated by the generation facility/Wind Farm, as may be amended by the parties thereto from time to time

(h). "Grid Code" means the grid code prepared by NTDC and approved by the Authority, as it may be revised from time to time by NTDC with any necessary approval by the Authority;

(i). "HESCO" means Hyderabad Electric Supply Company Limited and its successors or permitted assigns;

(j). "IEC" means "the International Electrotechnical Commission and its successors or permitted assigns;

(k). "IEEE" means the Institute of Electrical and Electronics Engineers and its successors or permitted assigns;

(l). "Licensee" means **NBT Wind Power Pakistan III (Pvt.) Limited** and its successors or permitted assigns;

(m). "NTDC" means National Transmission and Despatch Company Limited and its successors or permitted assigns;

(n). "Policy" means "the Policy for Development of Renewable Energy for Power Generation, 2006" of Government of Pakistan as amended from time to time;

(o). "Power Purchaser" means NTDC (through CPPA) on behalf of XW-DISCOs which purchases electricity from the Licensee, pursuant to an Energy Purchase Agreement for procurement of electricity;

(p). "Rules" mean "the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000";

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(q). "Wind Farm" means "a cluster of Wind Turbines in the same location used for production of electric power";

(r). "Wind Turbine Generator" or "WTG" means the machines installed at the generation facility/Wind Farm with generators for conversion of wind energy into electric power/energy;

(s). "XW DISCO" means "an Ex-WAPDA distribution company engaged in the distribution of electric power"

1.2 Words and expressions used but not defined herein bear the meaning given thereto in the Act or in the Rules.

Article-2
Application of Rules

This Licence is issued subject to the provisions of the Rules, as amended from time to time.

Article-3
Generation Facilities

3.1 The location, size (capacity in MW), technology, interconnection arrangements, technical limits, technical and functional specifications and other details specific to the generation facility/Wind Farm of the Licensee are set out in Schedule-I of this Licence.

3.2 The net capacity of the generation facility/Wind Farm of the Licensee is set out in Schedule-II hereto.

3.3 The Licensee shall provide the final arrangement, technical and financial specifications and other specific details pertaining to its generation facility/Wind Farm before its COD.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Article-4
Term of Licence

4.1 The Licence is granted for a term of twenty (20) years after the COD of the generation facility/Wind Farm.

4.2 Unless suspended or revoked earlier, the Licensee may within ninety (90) days prior to the expiry of the term of the Licence, apply for renewal of the Licence under the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations, 1999 as amended or replaced from time to time.

Article-5
Licence fee

After the grant of the Generation Licence, the Licensee shall pay to the Authority the Licence fee, in the amount, manner and at the time set out in the National Electric Power Regulatory Authority (Fees) Rules, 2002.

Article-6
Tariff

The Licensee shall charge only such tariff which has been determined, approved or specified by the Authority in terms of Rule-6 of the Rules.

Article-7
Competitive Trading Arrangement

7.1 The Licensee shall participate in such manner as may be directed by the Authority from time to time for development of a Competitive Trading Arrangement. The Licensee shall in good faith work towards implementation and operation of the aforesaid Competitive Trading Arrangement in the manner and time period specified by the Authority. Provided that any such participation shall be subject to any contract entered into between the Licensee and another party with the approval of the Authority.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

7.2 Any variation or modification in the above-mentioned contracts for allowing the parties thereto to participate wholly or partially in the Competitive Trading Arrangement shall be subject to mutual agreement of the parties thereto and such terms and conditions as may be approved by the Authority.

Article-8
Maintenance of Records

For the purpose of sub-rule (1) of Rule 19 of the Rules, copies of records and data shall be retained in standard and electronic form and all such records and data shall, subject to just claims of confidentiality, be accessible by authorized officers of the Authority.

Article-9
Compliance with Performance Standards

The Licensee shall comply with the relevant provisions of the National Electric Power Regulatory Authority Performance Standards (Generation) Rules 2009 as amended from time to time.

Article-10
Compliance with Environmental Standards

The Licensee shall comply with the environmental standards as may be prescribed by the relevant competent authority from time to time.

Article-11
Power off take Point and Voltage

The Licensee shall deliver electric power to the Power Purchaser at the outgoing Bus Bar of its 220 KV grid station. The up-gradation (step up) of generation voltage up to 220 KV will be the responsibility of the Licensee.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Article-12
Performance Data of Wind Farm

The Licensee shall install monitoring mast with properly calibrated automatic computerized wind speed recording meters at the same height as that of the wind turbine generators and a compatible communication/SCADA system both at its Wind Farm and control room of the Power Purchaser for transmission of wind speed and power output data to the control room of the Power Purchaser for record of data.

Article-13
Provision of Information

13.1 The obligation of the Licensee to provide information to the Authority shall be in accordance with Section 44 of the Act.

13.2 The Licensee shall in addition to 13.1 above, supply information to the Power Purchaser regarding the wind data specific to the site of the Licensee and other related information on a regular basis and in a manner required by it.

13.3 The Licensee shall be subject to such penalties as may be specified in the relevant rules made by the Authority for failure to furnish such information as may be required from time to time by the Authority and which is or ought to be or has been in the control or possession of the Licensee.

Article-14
Carbon Credits

The Licensee shall process and obtain Carbon Credits expeditiously and credit the proceeds to the Power Purchaser as per the Policy.

Article-15
Design & Manufacturing Standards

15.1 The Wind Turbine Generator or WTG and other associated equipments of the generation facility/Wind Farm shall be designed, manufactured and tested according to the latest IEC, IEEE standards or other equivalent standards in the matter.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

15.2 All the plant and equipment of the generation facility/Wind Farm shall be unused and brand new.

Article-16
Power Curve

The power curve for the individual Wind Turbine Generator or WTG provided by the manufacturer and as mentioned in Schedule-I of this Generation Licence, shall form the basis in determining the cumulative Power Curve of the generation facility/Wind Farm.

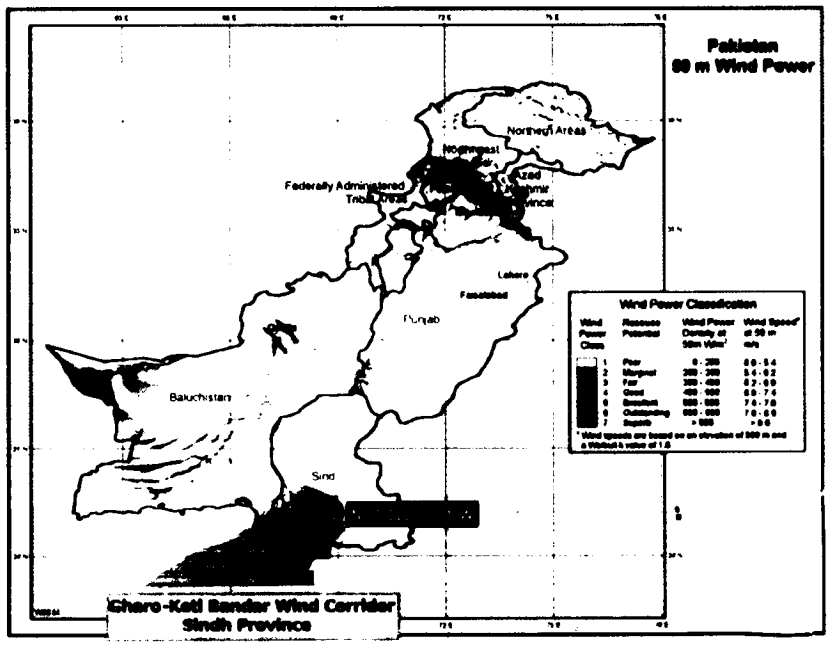
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

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.

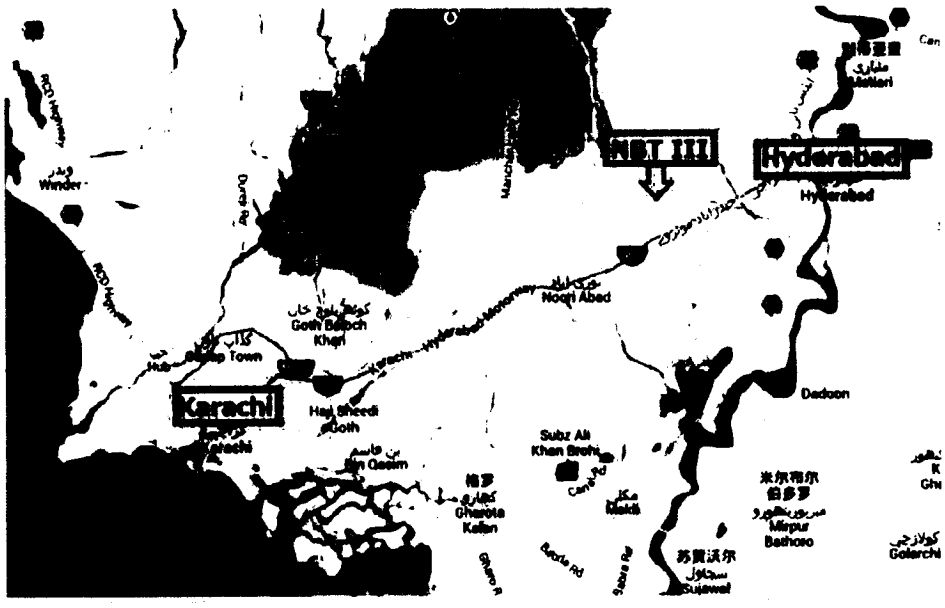
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ★ NEPRA ★ REGISTRAR

Location of the Generation Facility/Wind Farm



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Location of the Generation Facility/Wind Farm

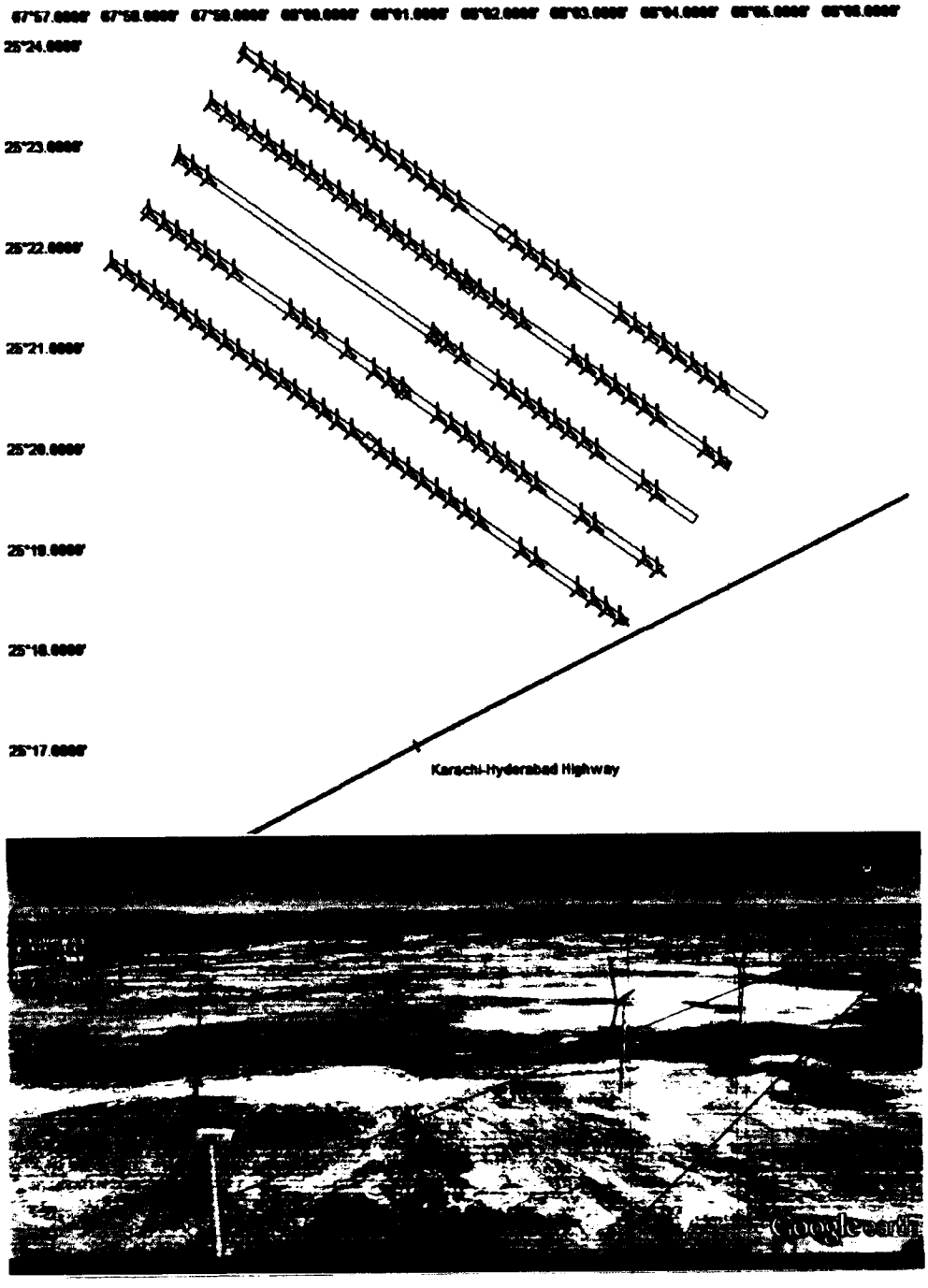


NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Location of the Generation Facility/Wind Farm

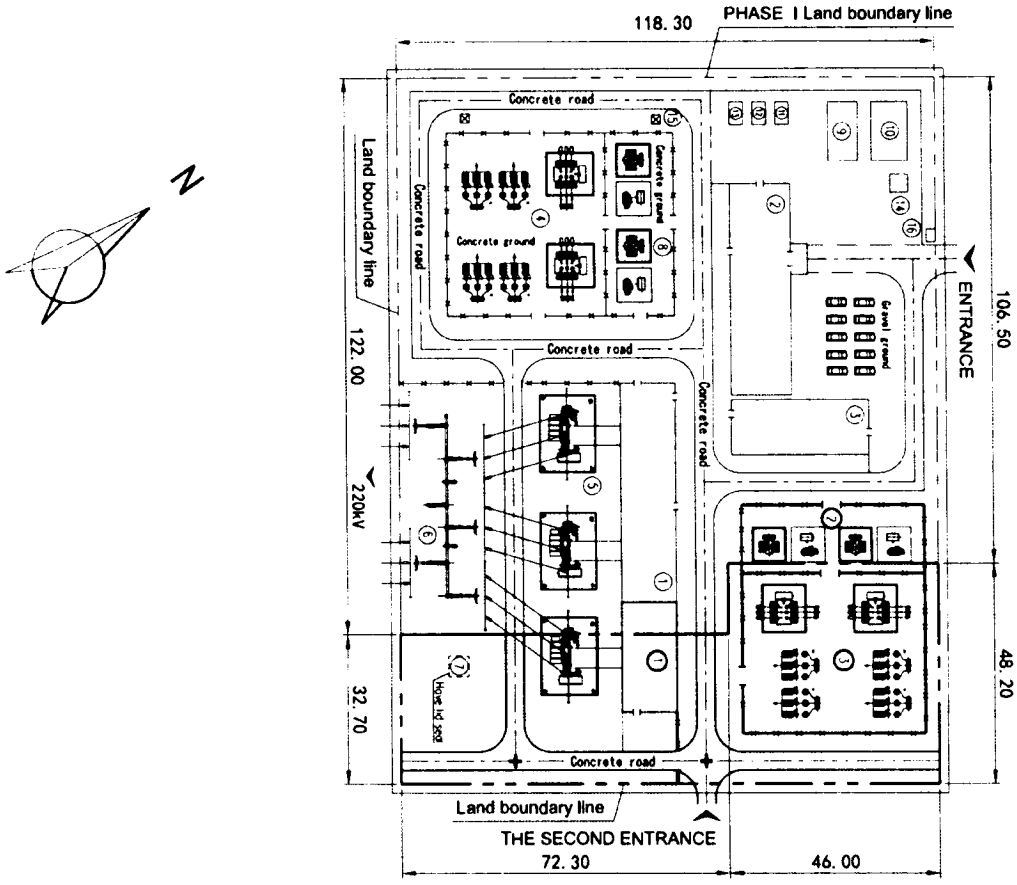
NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Layout of the Generation Facility/Wind Farm (With Coordinates)



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Layout of the Generation Facility/Wind Farm (Electrical System)



A LIST OF BUILDINGS & STRUCTURES

PHASE I

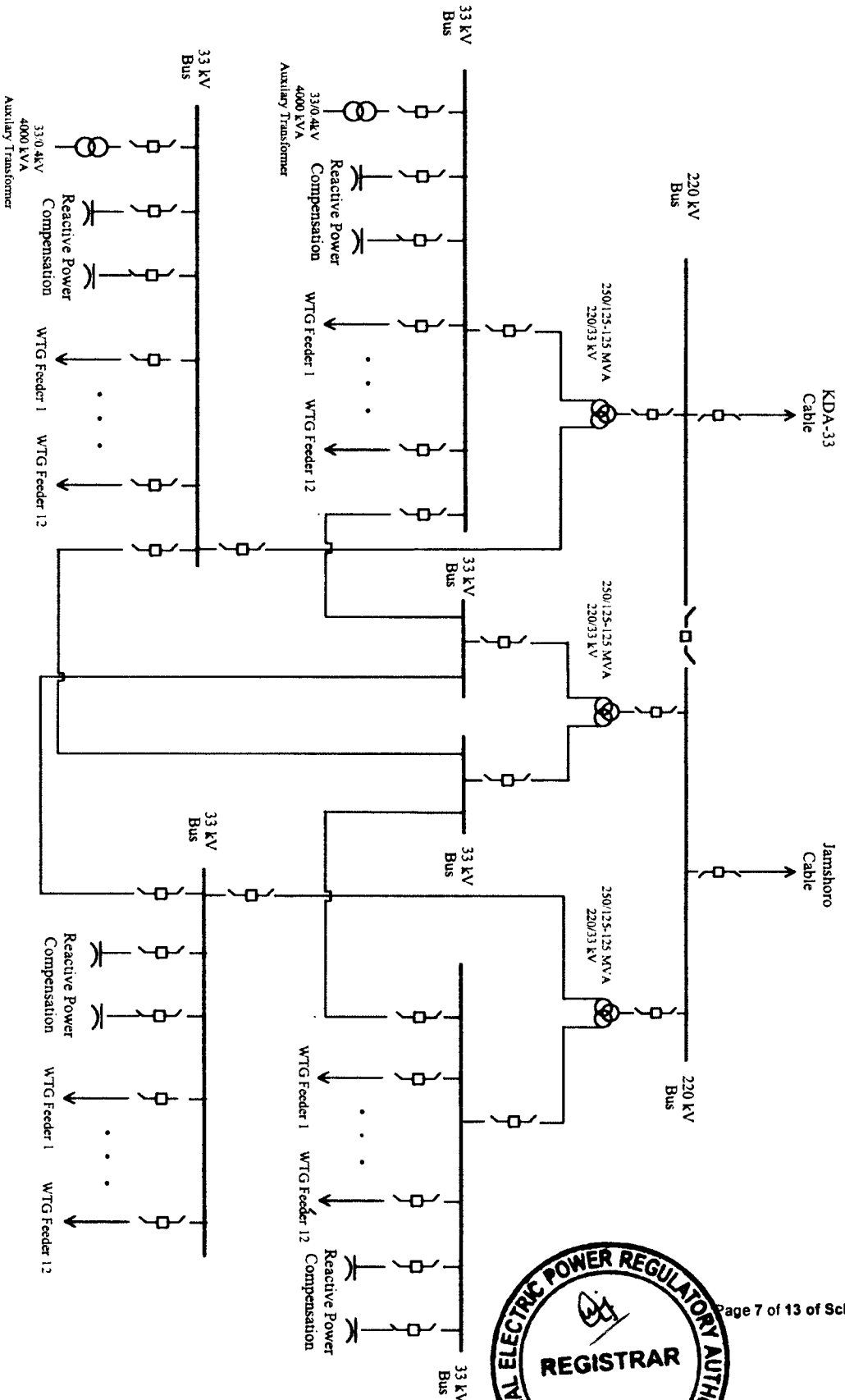
①	MAIN CONTROL BUILDING
②	SERVICE BUILDING
③	CONTROL BUILDING
④	REACTIVE POWER COMPENSATION
⑤	MAIN TRANSFORMER
⑥	220KV GIS
⑦	TRANSFORMER EMERGENCY OIL PIT
⑧	PETERSEN-COIL
⑨	FIRE PUMP ROOM
⑩	FIRE PUMP TANK
⑪	SEPTIC TANK
⑫	REGULATING POOL
⑬	DOMESTIC WASTE TREATMENT DEVICE
⑭	DEEP WELL PUMP ROOM
⑮	LIGHTNING ROD
⑯	GUARD

PHASE II

①	MAIN CONTROL BUILDING
②	PETERSEN-COIL
③	REACTIVE POWER COMPENSATION

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Single Line Diagram (Electrical) of the Generation Facility/ Wind Farm



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ★ NEPRA ★ REGISTRAR

Interconnection Arrangement/Transmission Facilities for Dispersal of Power from the Generation Facility/Wind Power Plant/Wind Farm of NBT Wind Power Pakistan III (Pvt.) Limited (NBTWPPPL-III)

The power generated from the Generation Facility/Wind Power Plant/Wind Farm of NBTWPPPL-III shall be dispersed to the load center of HESCO.

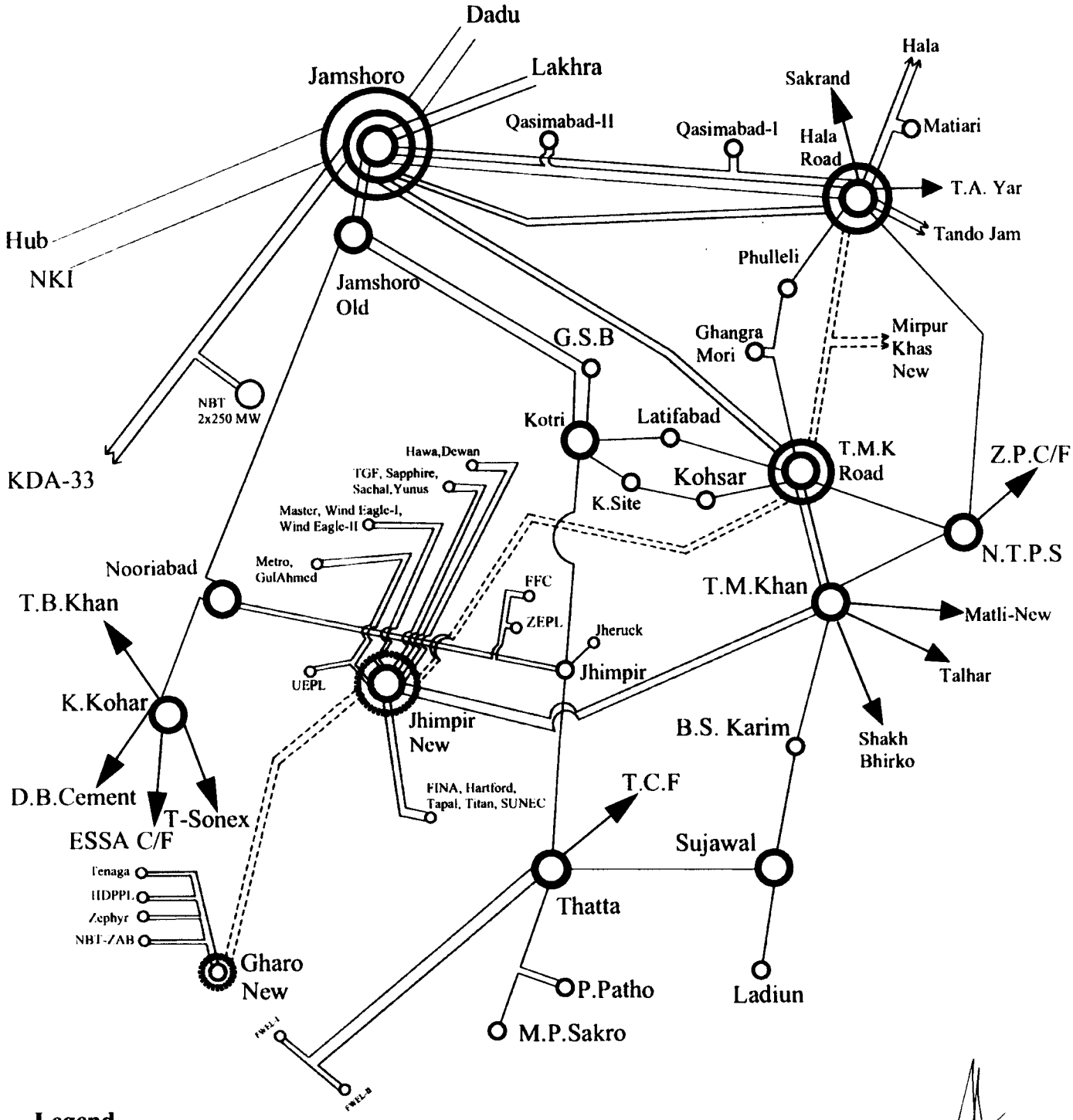
(2). The proposed Interconnection Arrangement/Transmission Facilities for dispersal of will consist of the following:-

(a). The Generation facility of NBTWPPPL-III will be connected by Making an In-Out of one circuit of 220 kV Double Circuit Jamshoro–KDA-33 Transmission Line;

(3). Any change in the above mentioned Interconnection Arrangement/Transmission Facilities duly agreed by NBTWPPPL-III, NTDC and HESCO, shall be communicated to the Authority in due course of time.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Schematic Diagram
for Interconnection Arrangement/Transmission Facilities for Dispersal of Power from NBTWPPPL-III



Legend

	Existing	Proposed
132 kV	———	———
220 kV	———	- - - -
500 kV	———	- - - -

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ★ NEPRA ★ REGISTRAR

Detail of Generation Facility/Wind Power Plant/ Wind Farm

(A). General Information

(i).	Name of Company/Licensee	NBT Pakistan III (Pvt.) Limited
(ii).	Registered/Business Office	D-94, B Street, 5th Avenue, Block 5, Kehkashan Clifton, Karachi
(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	General Electric (G.E.) 1.6 – 82.5m
(ii).	Installed Capacity of Wind Farm (MW)	249.6 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	156 x 1.60 MW

(C). Wind Turbine Details

(a).	Rotor	
(i).	Number of blades	3
(ii).	Rotor speed	9.8 – 18.7 rpm
(iii).	Rotor diameter	82.5 m
(iv).	Swept area	5346 m^2
(v).	Power regulation	Combination of blade pitch angle adjustment, and generator / converter torque control.
(vi).	Cut-in wind speed	3 m/s

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(vii).	Cut-out wind speed	25 m/s
(viii)	Survival wind speed	40 m/s, 3s average (40 m/s, 10min ave; 56 m/s, 3s ave)
(ix)	Pitch regulation	Electric motor drives a ring gear mounted to the inner race of the blade pitch bearing.
(b).	**Blades**	
(i).	Blade length	40.3 m (GE has not yet defined what the blade variant will be for this project.)
(ii).	Material	Fiberglass polyester resin
(c).	**Gearbox**	
(i).	Type	Multi-stage planetary/helical gear design
(ii).	Gear ratio	1:107.1
(iii).	Main shaft bearing	Roller bearing mounted in a pillow-block housing arrangement.
(d).	**Generator**	
(i).	Power	1,600 kW
(ii).	Voltage	690 V
(iii).	Type	Doubly-fed induction type
(iv).	Enclosure class	IP 54
(v).	Coupling	Flexible coupling
(vi).	Power factor	+0.95 to -0.95
(e).	**Yaw System**	
(i).	Yaw bearing	Roller bearing
(ii).	Brake	Planetary yaw drives (with brakes that engage when the drive is disabled)
(iii).	Yaw drive	4 planetary yaw drives.
(iv).	Speed	0.5 degree/s
(f).	**Control System**	
(i).	Type	Automatic or manually controlled.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

(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	Mechanical brake on (high speed) shaft of gearbox.
(h).	**Tower**	
(i).	Type	Tubular steel tower
(ii).	Hub heights	80 m

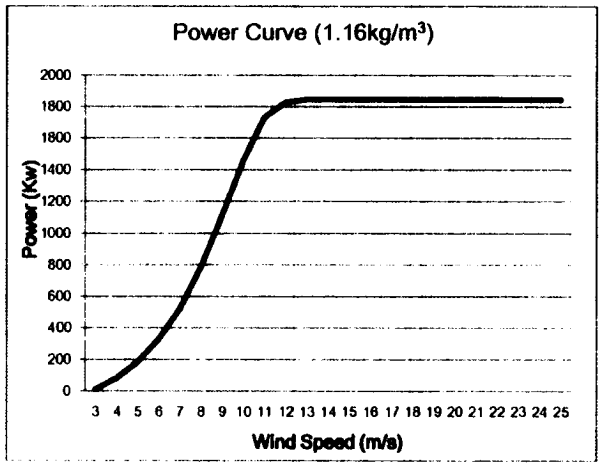
(D). Other Details

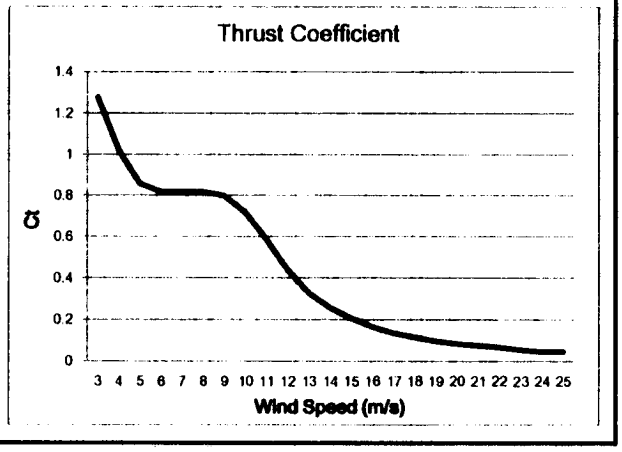
(i).	Project Commissioning date (Anticipated)	January 31, 2017
(ii).	Expected Life of the Project from Commercial Operation date (COD)	20 Years

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Power Curve of Wind Turbine Generator (GE 1.6-82.5)

Wind speed [m/s]	P [kW]	C_t
3	17	1.28
4	87	1.02
5	192	0.86
6	334	0.82
7	531	0.82
8	790	0.82
9	1119	0.8
10	1463	0.72
11	1737	0.59
12	1833	0.44
13	1850	0.33
14	1850	0.26
15	1850	0.21
16	1850	0.17
17	1850	0.14
18	1850	0.12
19	1850	0.1
20	1850	0.09
21	1850	0.08
22	1850	0.07
23	1850	0.06
24	1850	0.05
25	1850	0.05





NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

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

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

SCHEDULE-II

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	249.6MW
(2).	Total Annual Full Load Hours	2875 Hrs
(3).	Average Wind Turbine Generator (WTG) Availability	97.0 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	896.0 GWh
(5).	Array & Miscellaneous Losses GWh	96.64 GWh
(6).	Availability Losses GWh	26.88 GWh
(7).	Balance of Plant Losses GWh	54.66GWh
(8).	Annual Energy Generation (20 year equivalent Net AEP) GWh	717.5 GWh
(9).	Net Capacity Factor	32.8%

Note

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

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA