



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-261/12469-74

October 02, 2014

Mr. Dilshad Nabi Khan Lodhi
General Manager
Titan Energy Pakistan (Pvt.) Limited
FL-2/1, Block-6, Gulshan-e-Iqbal,
Karachi-75300

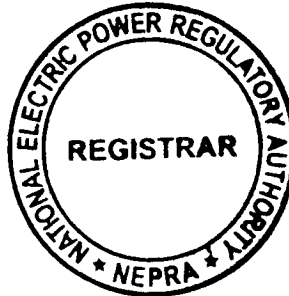
Subject: **Generation Licence No. WPGL/28/2014**
Licence Application No. LAG-261
Titan Energy Pakistan (Pvt.) Limited (TEPPL)


Reference: Your letter No. TEPPL/Gen-License/NEPRA/6 dated May 08, 2014.

Enclosed please find herewith Determination of the Authority in the matter of Generation Licence Application of TEPPL along with Generation Licence No. WPGL/28/2014 annexed to this determination granted by the National Electric Power Regulatory Authority to TEPPL for its 09.00 MW Wind Power Plant located at Jhampir, near Nooriabad, Taluka and 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/28/2014)




(Naweed Illahi Sheikh) 02/10/14

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
Titan Energy Pakistan (Pvt) Limited

September 29, 2014
Application No. LAG-261

(A). Background

(i). Government of Pakistan has set up Alternative Energy Development Board (AEDB) for development of Renewable Energy (RE) resources in the Country. AEDB had issued Letter of Intent (LoI) to different Private Entrepreneurs.

(ii). One of such LoI was issued to Titan Energy Pakistan (Pvt.) Limited (TEPPL) on August 18, 2010 for setting up a Wind Power Project (WPP)/Wind Farm (WF) in Ghara/Jhampir Wind Corridor(s), in District Thatta in the Province of Sindh.

(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. TEPPL decided to unconditionally accept the above mentioned Up-Front Tariff on the standard terms and conditions as given in the said Determination.

(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), TEPPL filed an application on May 09, 2014, requesting for the grant of Generation Licence.

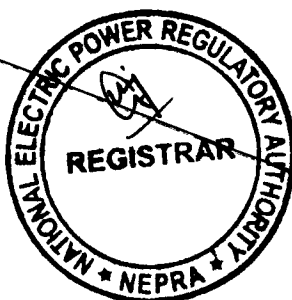


(ii). The Registrar examined the submitted application to confirm its compliance with the NEPRA Licensing (Application and Modification Procedure) Regulations, 1999 (the "Regulations"). It was observed that some of required information/documentation was missing. Accordingly, Registrar directed TEPPL for submitting the missing information/documentation. TEPPL completed the missing information/documentation on June 19, 2014. The Authority admitted the same under Regulation 7 of the Regulations on June 26, 2014 for consideration of grant of a Generation Licence and approved the advertisement about 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.

(iii). 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. Accordingly, NoA was published in one Urdu and one English National Newspaper on July 03-04, 2014. Further, separate notices were also sent to Individual Experts/Government Ministries/Representative Organizations etc. on July 04, 2014 for submitting their views/comments in the matter.

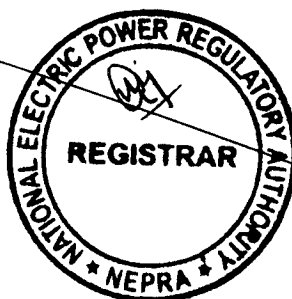
(C). Comments of Stakeholders

(i). In reply to the above, the Authority received comments from seven (07) stakeholders. This included Energy & Power Department of Govt. of Kyber Pakhtunkhwa (E&PDGoKPK), Central Power Purchasing Agency (CPPA) of National Transmission and Despatch Company Limited (NTDC), Board of Investment Govt. of Pakistan (BoI), Pakistan Counsel of Renewable Energy Technologies (PCoRET), Ministry of Science and Technology (MoST), Energy Department Govt. of Balochistan (EDGoB) and Ministry of Water and Power (MoW&P).



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

- (a). E&PDGoKPK submitted that the issue of shortage of Fossil fuels in the future and the increasing demand of electrical energy has made the world to consider the production of electrical energy from RE Resources including Wind and Solar. In order to meet the growing demand of energy, use of Wind Energy is increasing all over the world. In view of the said, the proposed Project of TEPPL will be beneficial for the country;
- (b). CPPA in its comments supported the request of TEPPL for the grant of Generation Licence subject to the fulfillment of the requirements of the Regulations and NEPRA Licensing (Generation) Rules, 2000 (the Rules). However, CPPA highlighted that TEPPL 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;
- (c). BoI commented that affordable and smooth supply of energy is backbone for industrial growth as well as for attracting FDI in the country. Therefore, the grant of Generation Licence to TEPPL is supported;
- (d). PCoRET expressed its no reservation to the grant of Generation Licence to TEPPL; and
- (e). MoST endorsed the comments of PCoRET;



(f). EDGoB supported the request of TEPPL for the grant of Generation Licence; and

(g). MoW&P submitted that the Authority may process the Generation Licence application of FSPL as per provisions of NEPRA Act, relevant rules and Policy Guidelines of Govt. of Pakistan in the matter.

(iii). The Authority considered the above comments of the stakeholders and generally found the same supportive except to the observations of CPPA that the Project of TEPPL must comply with the requirements of Grid Code. In view of the said, the Authority considered it appropriate seeking prospective of TEPPL on the comments of CPPA through a rejoinder in the matter.

(iv). In its rejoinder, TEPPL confirmed that its project would comply with the provisions of the Grid Code approved by NEPRA, as amended in April 2010 for Grid Integration of WPP/WF. The Authority considered the comments of the stakeholders and the rejoinder of TEPPL and found the same adequate. In view of the above, the Authority considered it appropriate to process the application of TEPPL for the grant of Generation Licence as stipulated in the Regulations and 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 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% (i.e. 9700 MW) of total national power generation capacity to be met through RE resources by 2030. The Authority considers that the proposed project of TEPPL 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). TEPPL is setting up the proposed WPP/WF at 13-KM off Thatta-Thano Bulla Khan road in Taluka and District Thatta in the Province of Sindh in the Wind Corridor of Jhampir. The proposed Generation Facility/WPP/WF will have a Total Installed Capacity of 09.00MW consisting 6 x 1.50 MW WTG's. Further, TEPPL has informed that in terms of the conditions of the Lol, it carried out an Interconnection and System Stability Study for dispersal of electric power from the above mentioned Generation Facility/WPP/WF. According to the said study carried out by Power Planner International U.K. the dispersal/interconnection arrangement will be consisting of In-out Arrangement of one circuit of 132 KV Double Circuit (D/C) Transmission Line emanating from Jhampir cluster of WF's to 220/132 kV Jhampir Substation. This circuit will also include the Generation Facility/WPP/WF of Tapal Wind Energy (Pvt.) Limited and Hawa Energy (Pvt.) Limited. The study confirmed that proposed WTG will be in conformity with the required stability and reliability standards of NTDC as stipulated in the Grid Code. The Authority has observed that although TEPPL

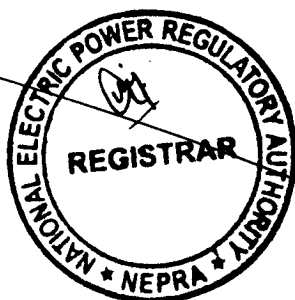


submitted the study with NTDC however, approval of the same from the Planning Department of NTDC is still awaited. Therefore, the Authority directs TEPPL for taking up the matter with NTDC for expediting the approval of the said study within three (03) months of this Determination.

(iv). 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 TEPPL will be June 30, 2015 and will have a useful life of about twenty (20) years from its COD. TEPPL has also submitted that the Energy Purchase Agreement (EPA) will be based and negotiated in terms of twenty (20) years useful life of the WTG/equipment. TEPPL has submitted that the term of its Generation Licence may be set accordingly. The Authority considers that the information provided by TEPPL 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.

(v). 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. TEPPL 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 however, the same is still under consideration of the Authority. In view of the said, the Authority directs TEPPL 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.

(vi). The proposed Generation Facility of TEPPL 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 TEPPL to initiate

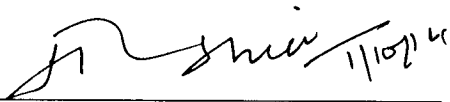


the process in this regard at the earliest so that proceeds for the Carbon Credits are materialized. TEPPL shall be required to share the proceeds of the Carbon Credits with the Power Purchaser as stipulated in Article-14 of its Generation Licence.

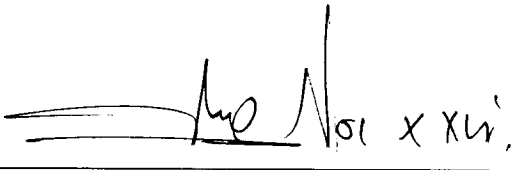
(vii). In view of this, the Authority hereby decides to approve the grant of Generation Licence to TEPPL on the terms set out in the Generation Licence annexed to this determination. The grant of Generation Licence will be subject to the provisions contained in the NEPRA Act, relevant rules, regulations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

Authority

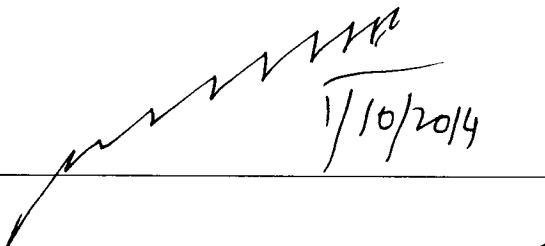
Maj. (R) Haroon Rashid
Member

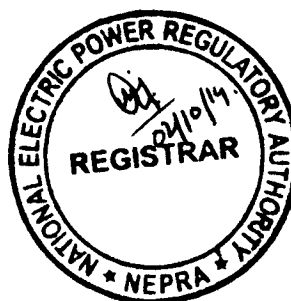


Khawaja Muhammad Naeem
Member



Habibullah Khilji
Member/Vice Chairman





**National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan**

GENERATION LICENCE

No. WPGL/28/2014

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:

TITAN ENERGY PAKISTAN (PRIVATE) LIMITED

Incorporated under the Companies Ordinance, 1984
Cooperate Universal Identification No. 0067040, dated July 28, 2008

**for its Generation Facility/Wind Power Plant/Wind Farm Located at Jhampir, Near
Nooriabad, Taluka and District Thatta, in the Province of Sindh**

(Installed Capacity: 09.00 MW Gross ISO)

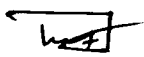
to engage in generation business subject to and in accordance with the Articles of this Licence.

Given under my hand this 02nd day of October Two Thousand & Fourteen and expires on 29th day of June Two Thousand & Thirty Five.


Registrar

02/10/14.



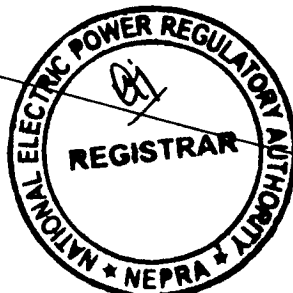




Article-1
Definitions

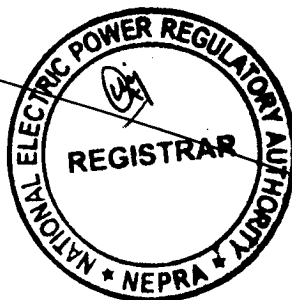
1.1 In this Licence

- (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 (CO₂) 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



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 Titan Energy Pakistan (Private) 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";



- (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.



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.

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

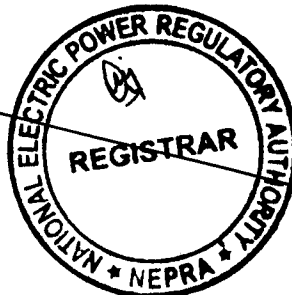
The Licensee shall comply with the environmental standards as may be prescribed by the relevant competent authority from time to time.

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 132 KV grid station. The up-gradation (step up) of generation voltage up to 132 KV will be the responsibility of the Licensee.

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.

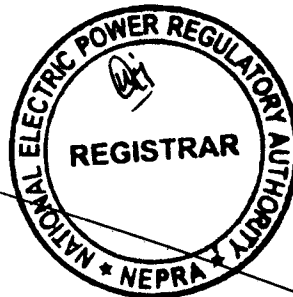
Article-14
Carbon Credits

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.

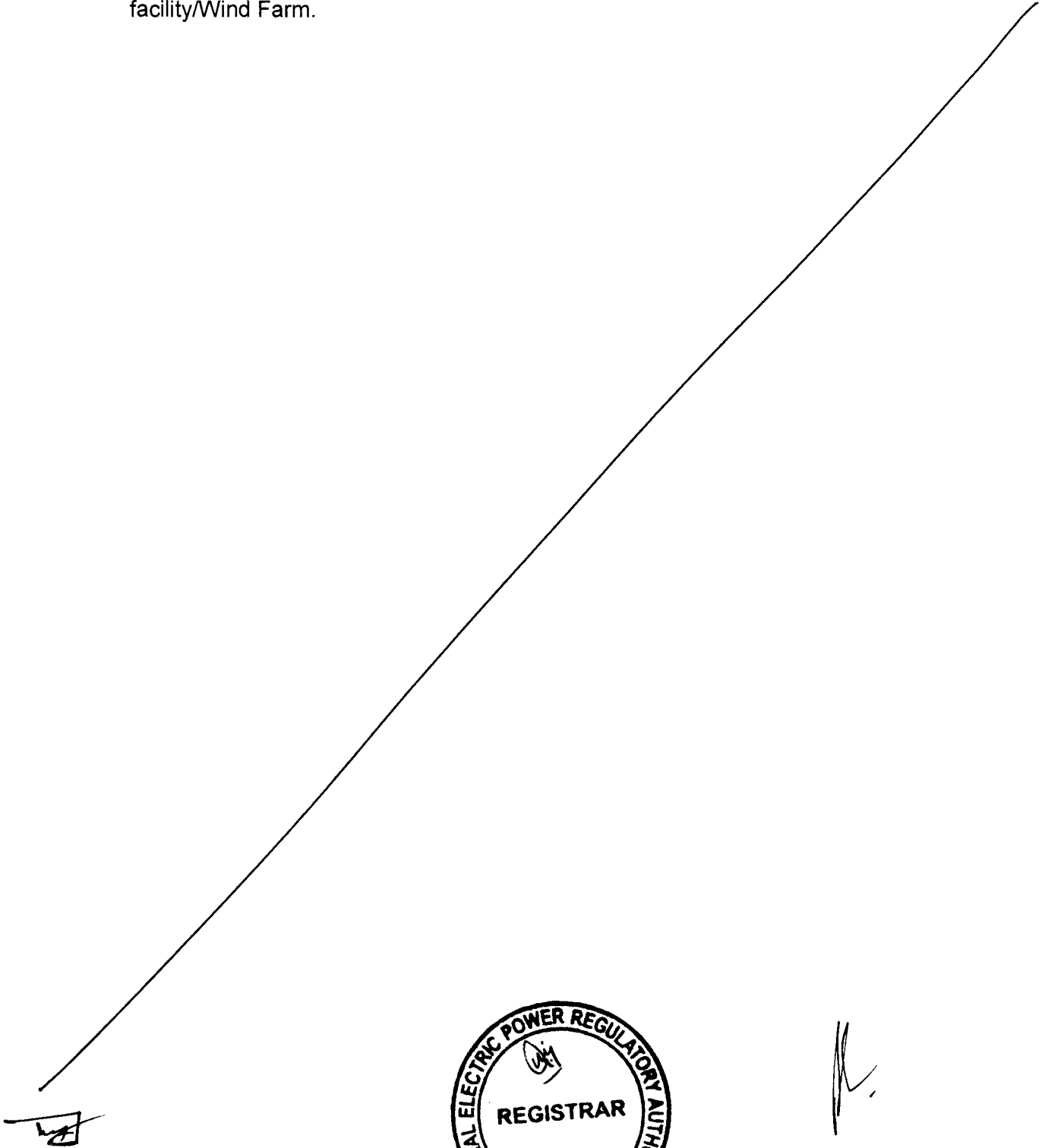
15.2 All the plant and equipment of the generation facility/Wind Farm shall be unused and brand new.



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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.



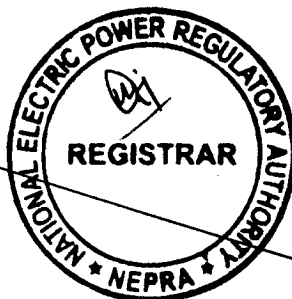
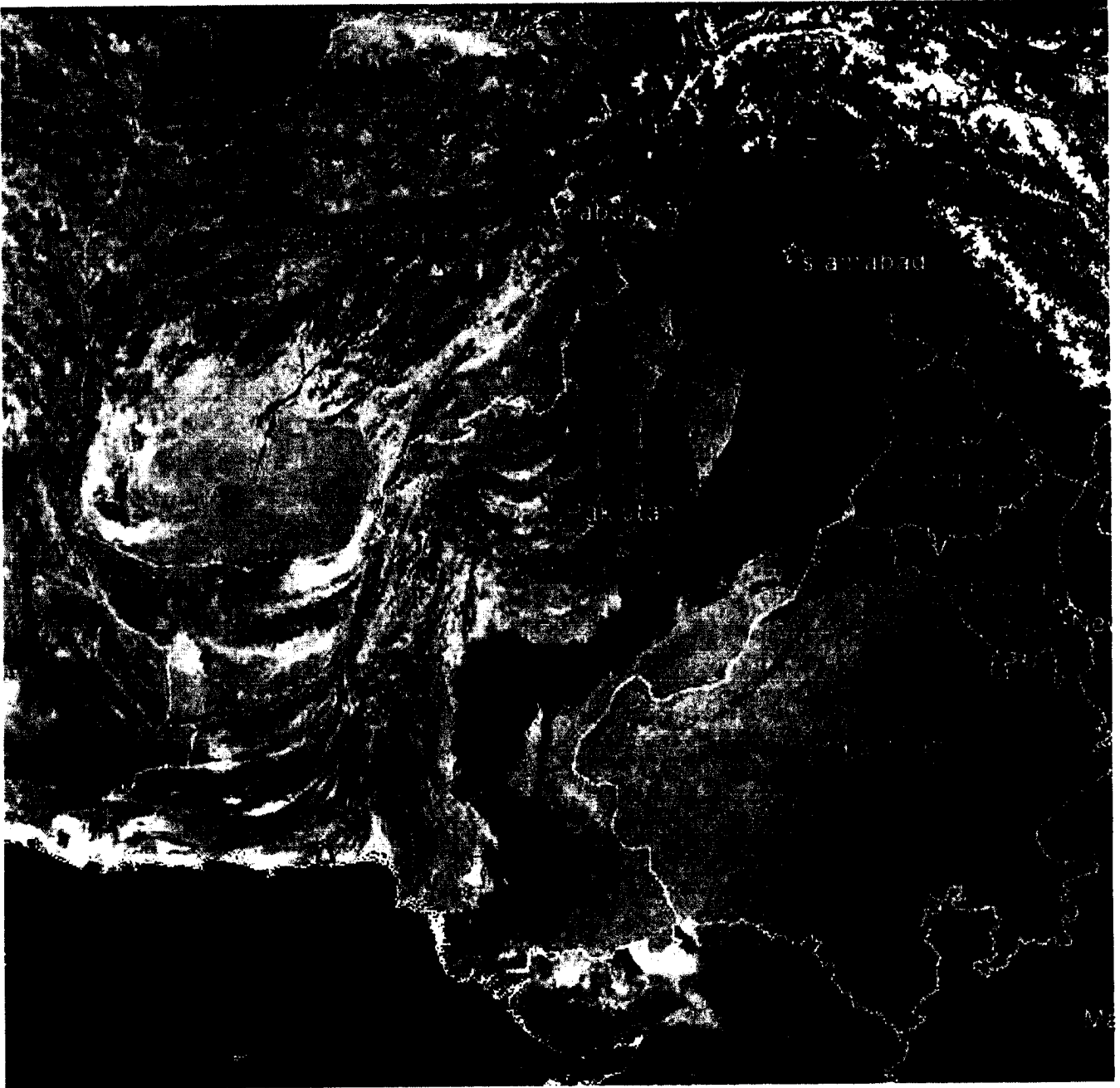
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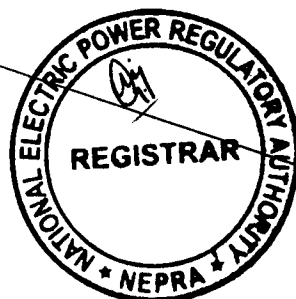
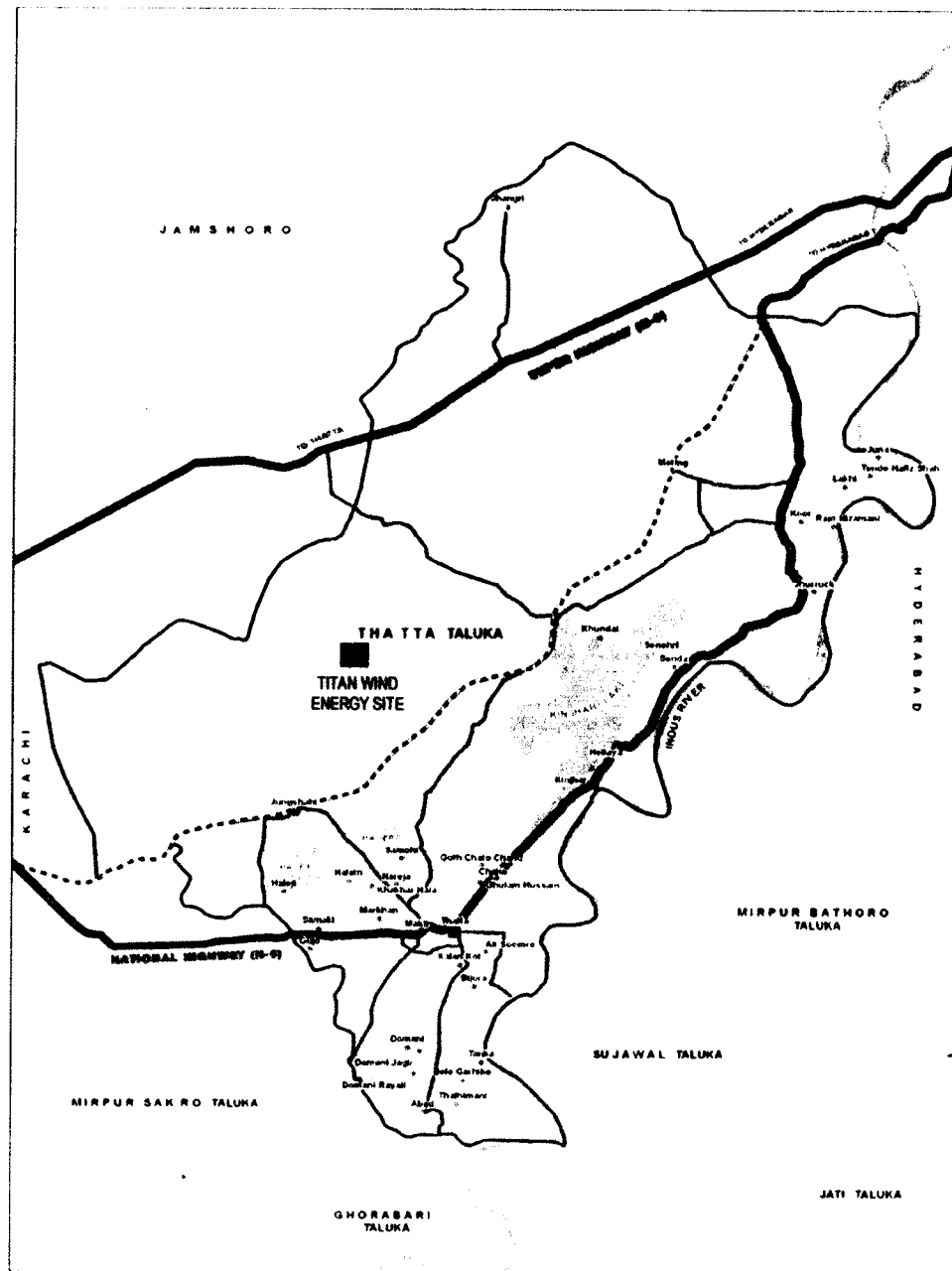
SCHEDULE-I

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.

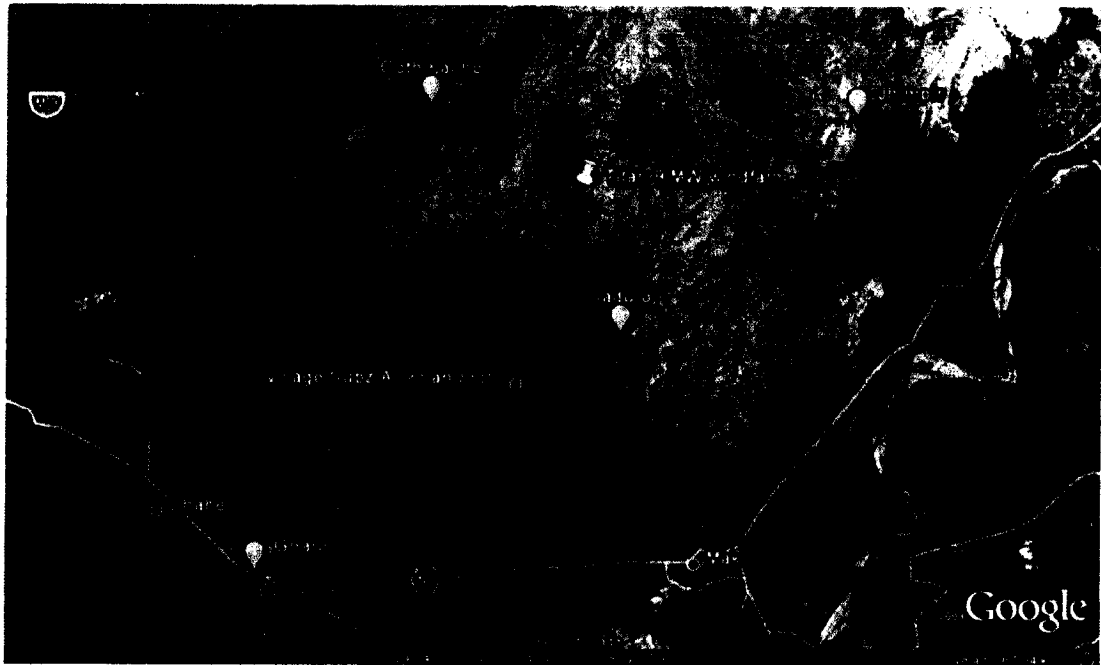


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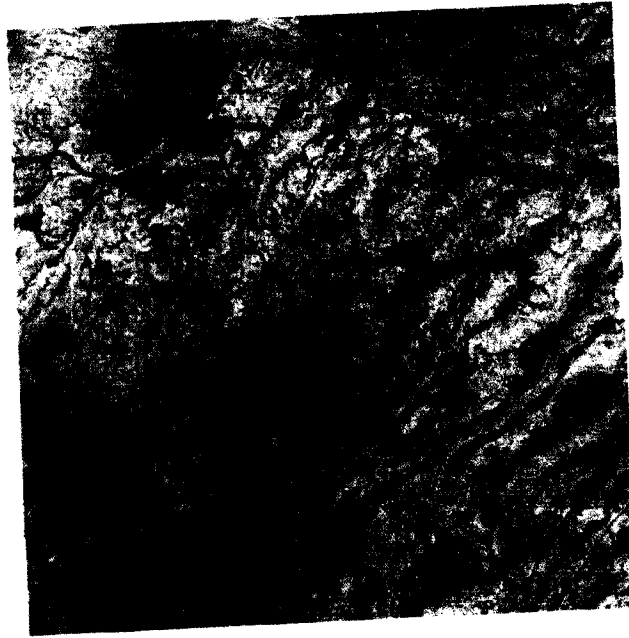


Generation Licence
Titan Energy Pakistan (Private) Limited
Jhampir, Near Nooriabad
Taluka and District Thatta
in the Province of Sindh



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W4



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E 2120446.32 (67.82171507)
N 817688.34 (24.98283878)

AREA LIMIT
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AREA LIMIT
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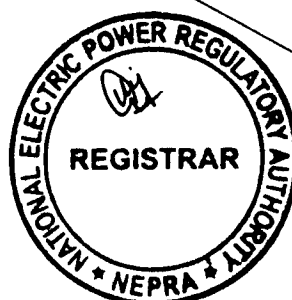
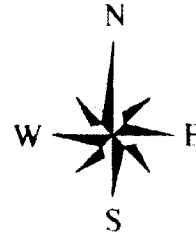
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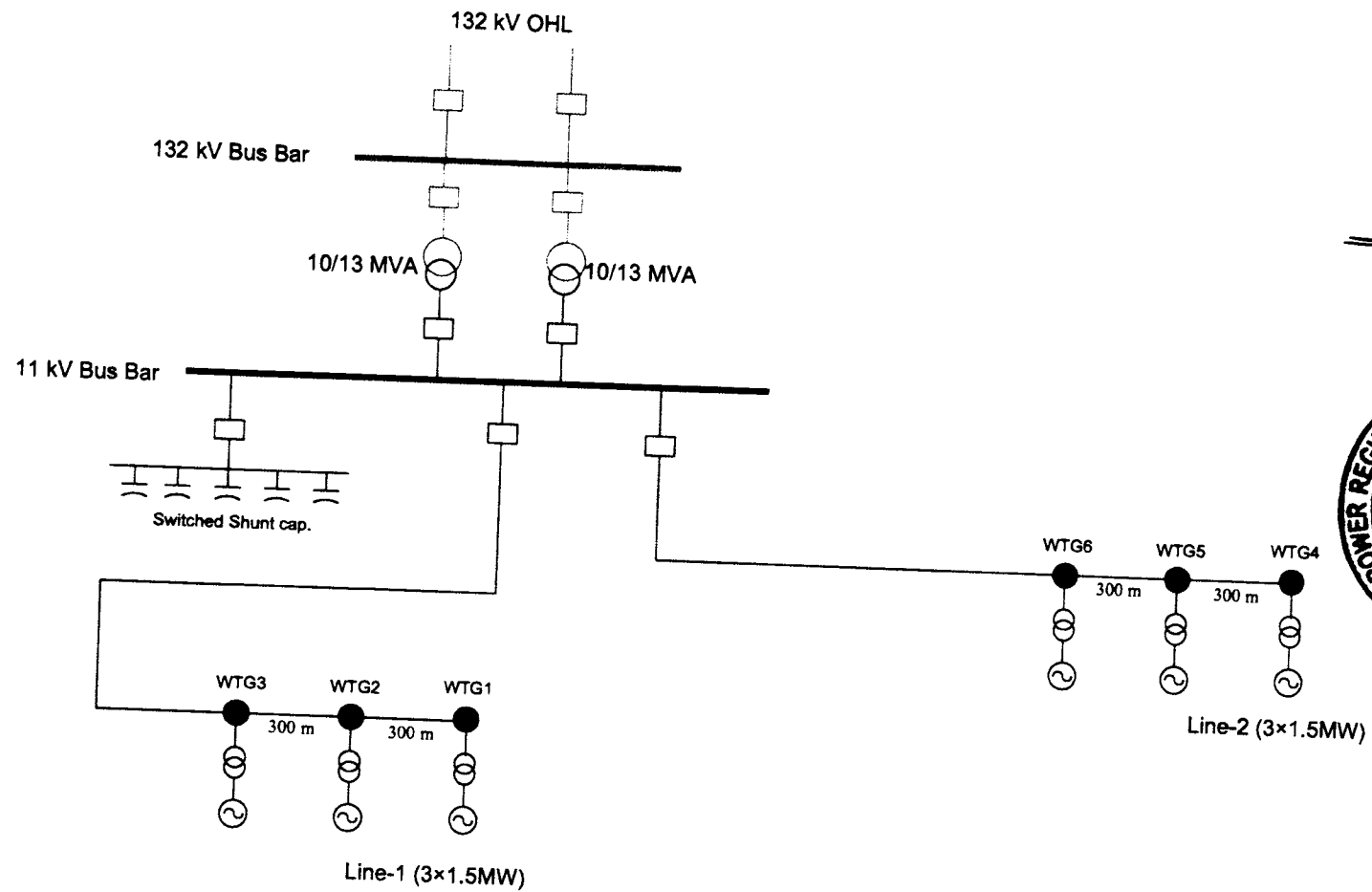
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N 816076

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Legend

132kV _____

11 kV _____

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Interconnection
Arrangement/Transmission Facilities for Dispersal of
Power from the Generation Facility/Wind Power
Plant/Wind Farm of Titan Energy Pakistan (Private)
Limited (TEPPL)

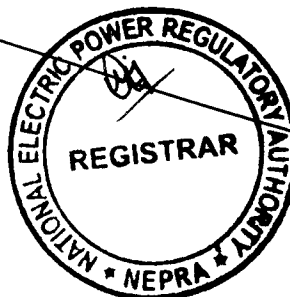
The power generated from the Generation Facility/Wind Power Plant/Wind Farm of TEPPL shall be dispersed to the load center of HESCO.

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

(a). The Generation facility of TEPPL would be connected by looping in-out Jhampir-Finergy (Private) Limited-Thatta 132KV circuit at substation of TEPPL. In this arrangement, TEPPL would be connected to Thatta on one end and Finergy (Private) Limited Wind Power Plant/WPP at the other end. The nearby 30.00MW WPP of Tapal Wind Energy will also be using the same 132/20 KV substation as that of TEPPL to connect to the grid.

(3). The scheme of interconnection of TEPPL proposes the following reinforcement already in place in Jhampir cluster by 2014:

- (a). 220/132 kV Jhampir-New collector substation at suitable location in Jhampir cluster;
- (b). 75 Km Long 132 KV Double Circuit from Jhampir-New collector substation to T.M Khan 132 KV Substation.
- (c). 120 Km long 220 KV Double Circuit from NTDC Gharo to T.M. Khan Road 220 kV substation in Hyderabad, which is in-out at Jhampir-New 220/132 KV substation.

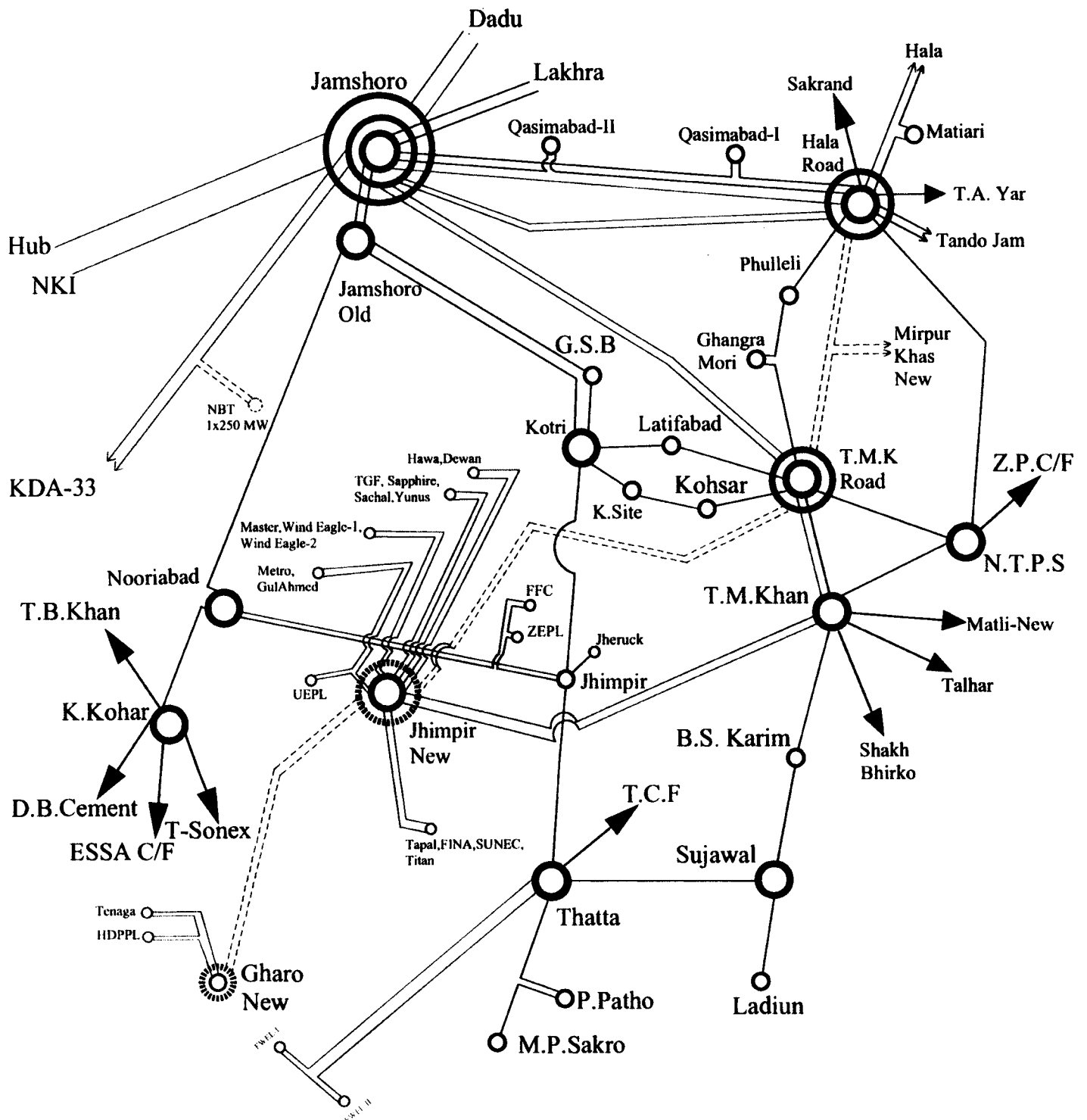


- (d). 132 KV D/C from Gharo cluster to Thatta (55 Km) using Greeley conductor constructed from the first wind farm in Gharo cluster.
- (e). 220/132KV NTDC Gharo substation at suitable location in Gharo cluster that may be constructed in stages for 132 KV and 220 KV levels depending on the respective quantum of wind power going to be added in this cluster.
- (f). Reconductoring of Nooriabad - Jamshoro Old 132 KV single circuit with Greeley Conductor.

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



Generation Licence
Titan Energy Pakistan (Private) Limited
Jhampir, Near Nooriabad
Taluka and District Thatta
in the Province of Sindh



Legend

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



Detail of
Generation Facility/Wind Power Plant/
Wind Farm

(A). General Information

(i).	Name of Licensee/Company	Titan Energy Pakistan (Private) Limited
(ii).	Registered/Business Office	FL-2/1, Block-6, Gulshan-e-Iqbal, Karachi in the Province of Sindh
(iii).	Plant Location	Jhampir, Near Nooriabad, Taluka and District Thatta, in the Province of Sindh
(iv).	Type of Generation Facility	Wind Power

(B). Wind Farm Capacity & Configuration

(i).	Wind Turbine Type, Make & Model	Sinovel SL 82 /1.5 MW
(ii).	Installed Capacity of Wind Farm (MW)	9.00 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (MW)	6 x 1.50 MW

(C). Wind Turbine Details

(a). <u>Rotor</u>		
(i).	Number of blades	3
(ii).	Rotor speed	9.7-19 r.p.m.
(iii).	Rotor diameter	82.9 m
(iv).	Swept area	5398 m ²
(v).	Power regulation	Active Single Blade Adjustment
(vi).	Rated power	1500 KW
(vii).	Cut-in wind speed	3 m/s



(viii).	Cut-out wind speed	20 m/s
(ix).	Survival wind speed	52.5 m/s
(x).	Pitch regulation	Electric drive pitch control
(b). <u>Blades</u>		
(i).	Blade length	40.25 m
(ii).	Material	Glass fiber/epoxide resin
(iii).	Weight	3 x 6.4 ton
(c). <u>Gearbox</u>		
(i).	Type	Multi-stage planetary + one stage spur gear or linkage with differential gears
(ii).	Gear ratio	1/104.5
(iii).	Weight	25.6 ton
(iv).	Main shaft bearing	Self-aligning roller bearing
(d). <u>Generator</u>		
(i).	Power	1,500 kW
(ii).	Voltage	690 V
(iii).	Type	Doubly-fed Asynchronous Induction type
(iv).	Speed	1000 - 2000 r.p.m.
(v).	Enclosure class	IP 54
(vi).	Coupling	Cone coupling
(vii).	Efficiency	Efficiency 95 % at full load, (electrical system overall)
(viii).	Weight	6 Tons
(ix).	Power factor	+ 0.90 to -0.95
(e). <u>Yaw System</u>		
(i).	Yaw bearing	Ball Bearing
(ii).	Brake	Disk brake with hydraulic brake calipers



(iii).	Yaw drive	Asynchronous motor
(iv).	Range of Yaw Speed	18.3-23.2 °/min
(v).	Speed	0.5 degree/s
(f). <u>Control System</u>		
(i).	Type	Remote field controller/PLC Sinovel control 2
(ii).	Grid connection	Via IGBT 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). <u>Brake</u>		
(i).	Design	Three independent systems, fail safe (individual pitch)
(ii).	Operational brake	Electromechanical
(iii).	Secondary brake	Actively actuated Disc brake
(h). <u>Tower</u>		
(i).	Type	Cylindrical Tubular Steel Tower
(ii).	Hub heights	80 m

(D). Other Details

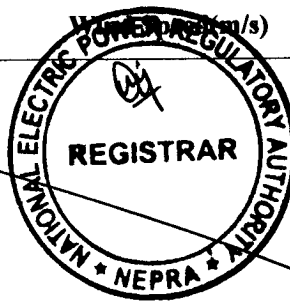
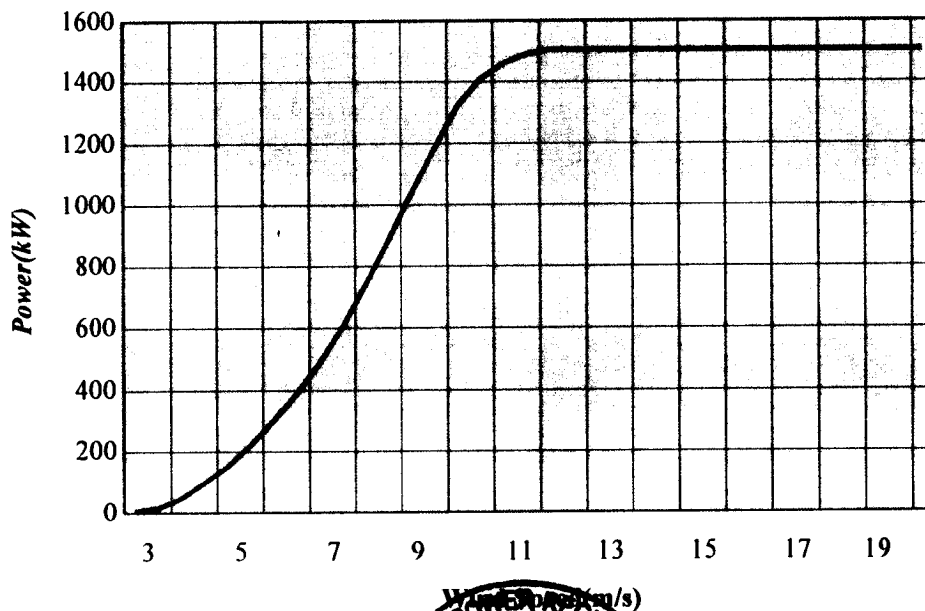
(i).	COD of the Generation Facility/ Wind Power Plant/Wind Farm	June 30, 2015
(ii).	Expected Life of the Generation Facility/ Wind Power Plant/Wind Farm from COD	20 Years



Power curve at the density 1.225 kg/m³

Wind speed [m/s]	Power(kW)	Wind speed [m/s]	Power(kW)
3	3.9951059	12	1500
3.5	15.406999	12.5	1500
4	46.561256	13	1500
4.5	95.728628	13.5	1500
5	149.37969	14	1500
5.5	218.10323	14.5	1500
6	295.031	15	1500
6.5	381.404	15.5	1500
7	482.685	16	1500
7.5	600.193	16.5	1500
8	736.01	17	1500
8.5	882.016	17.5	1500
9	1033.26	18	1500
9.5	1177.88	18.5	1500
10	1316.13	19	1500
10.5	1403.81	19.5	1500
11	1455.89	20	1500
11.5	1485.67		

SL1500/82 estimated power curve at standard air density



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)	09.00 MW
(2).	Total Annual Full Load Hours	2823 Hrs
(3).	Average Wind Turbine Generator (WTG) Availability	95.00%
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	35.60 GWh
(5).	Array & Miscellaneous Losses (GWh)	04.39 GWh
(6).	Availability Losses (GWh)	02.69 GWh
(7).	Balance of Plant Losses (GWh)	07.10 GWh
(8).	Annual Energy Generation (20 year equivalent Net Annual Energy Production-AEP) GWh	29.70 GWh
(9).	Net Capacity Factor	32.23%

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.

