National Electric Power Regulatory Authority
Islamic Republic of Pakistan

Registrar

NEPRA Tower, Attaturk 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-315/ 4726-32

April 04, 2017

Mr. Rafique Khanani
Chief Financial Officer
Hartford Alternative Energy (Private) Limited,
Plot 4 & 8, Sector 25, Korangi Industrial Area,
Karachi, Pakistan.
Tel: +92-21-111 016 016

Subject: **Modification-I in Generation Licence No: WPGL/30/2016**
Licence Application No. LAG-315
Hartford Alternative Energy (Private) Limited (HAEPL)

Reference: *Your application vide letter No. HAEPL/OUT/NEPRA/37-2016, dated December 27, 2016 (received on December 28, 2016).*

It is intimated that the Authority has approved "Licensee Proposed Modification" in Generation Licence No. WPGL/30/2016 (issued on April 26, 2016) in respect of Hartford Alternative Energy (Private) Limited (HAEPL), pursuant to Regulation 10(11)(a) of the NEPRA Licensing (Application and Modification Procedure) Regulations 1999.

2. Enclosed please find herewith Modification-I in the Generation Licence No. WPGL/30/2016, as approved by the Authority. Further, the determination of the Authority in the matter is also attached.

Encl:/As above

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04.04.17

(Syed Safeer Hussain)

Copy to:

1. Secretary Ministry of Water & Power, 'A' Block, Pak Secretariat, Islamabad.
2. Chief Executive Officer, Alternative Energy Development Board (AEDB), 2nd Floor, OPF Building, G-5/2, Islamabad.
3. Chief Executive Officer, NTDC, 414-WAPDA House, Lahore.
4. Chief Executive Officer, CPPA-G, 6th Floor, Shaheed-e-Millat Sectariat, Jinnah Avenue, Blue Area, Islamabad.
5. Chief Executive Officer, Hyderabad Electric Supply Company Limited (HESCO), WAPDA Offices Complex, Hussainabad, Hyderabad.
6. Director General, Environment Protection Agency, Government of Sindh, Complex Plot No. ST-2/1, Korangi Industrial Area, Karachi.

National Electric Power Regulatory Authority
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Determination of the Authority in the Matter of Licensee Proposed Modification in the Generation Licence of Hartford Alternative Energy (Private) Limited

March 22, 2017
Case No. LAG-315

(A). Background

(i). The Authority in terms of Section-15 of Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 ("the NEPRA Act") granted a Generation Licence No. WPGL/30/2016 dated April 26, 2016 to Hartford Alternative Energy (Private) Limited (HAEPL).

(ii). The abovementioned Generation Licence envisaged setting up a Wind Power Plant/Wind Farm with accumulative installed capacity of 49.30 MW, to be located in the Jhimpir wind corridor, District Thatta, in the Province of Sindh. In order to achieve the said capacity HAEPL proposed 29x1.7 MW Wind Turbine Generators (WTGs) of General Electric (G.E. 1.7–103).

(B). Communication of Modification

(i). HAEPL in accordance with Regulation-10(2) of the NEPRA Licensing (Application & Modification Procedure) Regulations, 1999 ("the Licensing Regulations"), communicated on December 28, 2016 a Licensee Proposed Modification (LPM) in the above mentioned Generation Licence.

(ii). In the "text of the proposed modification", HAEPL submitted that it plans to install the WTGs with hub height of 91 instead of 80 meters, as communicated earlier. HAEPL clarified that except the said change in hub height, there will no change in any project parameters (i.e. power curves, net capacity, make/model etc.).

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(iii). Regarding the "statement of the reasons in support of the modification", HAEPL submitted that the proposed WTG (i.e. G.E. 1.7-103) is now available with higher hub height, which will result in better energy yield of the project.

(iv). About the "statement of the impact on the tariff, quality of service and the performance by the licensee of its obligations under the licence", HAEPL submitted that the proposed modification in the Generation Licence will not have any adverse impact on its existing tariff, quality of service and its performance under the above mentioned Generation Licence.

(C). Processing of LPM

(i). After completion of all the required information as stipulated under the Regulation-10(2) and 10(3) of the Licensing Regulations, the Registrar published the communicated LPM on January 07, 2017, in one (01) Urdu ("Daily Jang") and one (01) English ("Business Recorder") newspapers, to inform the general public about the communicated LPM and inviting their comments.

(ii). Apart from the above, separate letters were also sent to other stakeholders including government ministries and their attached departments, various representative organization and individual experts etc., on January 09, 2017, inviting them to submit their views and comments in the matter, for assistance of the Authority.

(D). Comments of Stakeholders

(i). In reply to the above, the Authority received comments from four (04) stakeholder including Board of Investment (BoI), Engineering Development Board (EDB), Alternative Energy Development Board (AEDB) and Ministry of Water and Power (MoW&P). The comments offered by the said stakeholders are summarized in the following paragraphs:-

(a). BoI supported the LPM subject to reasonable tariff and fulfilment of all codal and technical formalities;

(b). EDB did not raise any objection regarding the LPM but proposed that indigenous potential available may be utilized for execution of

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the project;

(c). AEDB confirmed that the proposed WTG is internationally certified and supported the proposed modification;

(d). MoW&P in its comments submitted that the LPM involves selection of different hub height of WTG, therefore the Authority may confirm the long term efficiency of the same. Further, the ministry expressed that the Authority may process the LPM as per provisions of the NEPRA Act, relevant rules and regulations there under.

(ii). The Authority considered the above comments of the stakeholders and found the same in support of the communicated modification. Accordingly, the Authority decided to proceed further with the communicated LPM as stipulated in the Licensing Regulations and the NEPRA Licensing (Generation) Rules, 2000 ("the Generation Rules").

(E). Evaluation of the Case

(i). The Authority has examined the entire case in detail including the already granted Generation Licence, the communicated LPM, Up-Front Tariff granted to HAEPL, the provisions of the Policy for Development of Renewable Energy for Power Generation 2006 ("the RE Policy"), comments of the stakeholders and relevant rules & regulations.

(ii). In this regard, the Authority observes that in terms of Regulation-10(5) of the Licensing Regulations, it is entitled to modify a licence subject to and in accordance with such further changes as it may deem fit if, in the opinion of the Authority such modification (a). does not adversely affect the performance by the licensee of its obligations; (b). does not cause the Authority to act or acquiesce in any act or omission of the licensee in a manner contrary to the provisions of the NEPRA Act or the rules or regulations made pursuant to it; (c). is or is likely to be beneficial to the consumers; (d). is reasonably necessary for the licensee to effectively and efficiently perform its obligations under the licence; and (e). is reasonably necessary to ensure the continuous, safe and reliable supply of electric

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power to the consumers keeping in view the financial and technical viability of the licensee.

(iii). The main features of the LPM under consideration are that the Authority originally granted a Generation Licence (No. WPGL/30/2016 dated April 26, 2016) to HAEPL with an installed capacity of 49.30 MW based on twenty nine (29) WTGs of General Electric (G.E-1.7–103) of 1.7 MW each. In the Generation Licence, the hub height of the tower was considered as 80 meters. However, now HAEPL intends to install the WTGs with hub height of 91 meters.

(iv). In consideration of the above, the Authority has observed that the proposed WTGs (i.e. G.E. 1.7–103) are based on latest technology and offer higher annual energy production. The G.E. 1.7-103 WTGs, which were initially available for the hub height of 80-meters, are now available with a hub height of 91-meters, resulting further increase in the efficiency of the said WTGs. With the proposed hub height, the net capacity factor of the Wind Power Plant/Wind Farm of HAEPL will increase from 35% to 35.3% (i.e. the net annual generation will increase from 151.15 GWh to 152.45 GWh) without changing the installed capacity of the Wind Power Plant/Wind Farm.

(v). The Authority has also examined the impact of the communicated LPM on the tariff and observes that HAEPL has already been granted Up-Front Tariff (through determination No. NEPRA/TRF-352/HAEPL/4142-4144, dated March 31, 2016). The Authority is of the considered view that the communicated LPM of HAEPL will not have no impact on its existing Up-Front Tariff.

(vi). In consideration of the above, the Authority is of the considered opinion that the proposed LPM will not have any adverse effect on the performance of the Licensee/HAEPL of its obligations, instead its performance will be improved with the enhance capacity factor of the Wind Power Plant/Wind Farm. Further, the LPM will not cause the Authority to act or acquiesce in any act or omission of HAEPL in a manner contrary to the provisions of the NEPRA Act or the rules or regulations made pursuant to the NEPRA Act. The LPM will be beneficial to the consumers as more renewable energy will be available to the power purchaser with the proposed hub height. The Authority is of the considered opinion that the LPM is reasonably necessary for HAEPL to effectively and efficiently perform its obligations under the

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Licence. The LPM is necessary to ensure the continuous, safe and reliable supply of electric power to the consumers keeping in view the financial and technical viability of HAEPL.

(F). Approval of LPM

(i). In view of the above, the Authority is satisfied that HAEPL has complied with all the requirements of the Licensing Regulations pertaining to the modification. Therefore, the Authority in terms of Regulation-10(11)(a) of the Licensing Regulations approves the communicated LPM without any changes.

(ii). Accordingly, the already granted Generation Licence (No. WPGL/30/2016 dated October 21, 2016) is hereby modified. The changes made in the Generation Licence are attached as annexure to this determination. The approval of the LPM will be subject to the provisions contained in the NEPRA Act, relevant rules framed there under, terms & conditions of the Generation Licence and other applicable documents.

Authority

Maj. (R) Haroon Rashid
(Member)

Syed Masood-ul-Hassan Naqvi
(Member)

Himayat Ullah Khan
(Member/Vice Chairman)

Tariq Saddozai
(Chairman)

04.04.17

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National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan

GENERATION LICENCE
No. WPGL/30/2016

In exercise of the powers conferred upon the National Electric Power Regulatory Authority (NEPRA) under Section-26 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997, the Authority hereby modifies the Generation Licence granted to **HARTFORD ALTERNATIVE ENERGY (PRIVATE) LIMITED** (issued on April 26, 2016 and expiring on June 29, 2037), to the extent of changes mentioned as here under:-

(i). Changes in Articles are attached as Revised/Modified Articles;

(ii). Changes in Schedule-I are attached as Revised/Modified Schedule-I; and

(iii). Changes in Schedule-II are attached as Revised/Modified Schedule-II.

This **Modification-I** is given under my hand on 04th **day** of **April Two Thousand & Seventeen.**

04.04.17

Registrar

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Article-1
Definitions

1.1 In this Licence

(a). "Act" means the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 as amended or replaced from time to time;

(b). "AEDB" means the Alternate Energy Development Board or any other entity created for the like purpose established by the GOP to facilitate, promote and encourage development of renewable energy in the country;

(c). "Applicable Documents" mean the Act, the rules and regulations framed by the Authority under the Act, any documents or instruments issued or determinations made by the Authority under any of the foregoing or pursuant to the exercise of its powers under the Act, the Grid Code, the applicable Distribution Code, if any, or the documents or instruments made by the Licensee pursuant to its generation licence, in each case of a binding nature applicable to the Licensee or, where applicable, to its affiliates and to which the Licensee or any of its affiliates may be subject;

(d). "Applicable Law" means all the Applicable Documents;

(e). "Authority" means "the National Electric Power Regulatory Authority constituted under Section-3 of the Act";

(f). "Bus Bar" means a system of conductors in the generation facility/Wind Power Plant/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;

(g). "Carbon Credits" mean the amount of Carbon Dioxide (CO_2) and

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other greenhouse gases not produced as a result of generation of energy by the generation facility/ Wind Power Plant/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 Power Plant/Wind Farm, which are available or can be obtained in relation to the generation facility/ Wind Power Plant/Wind Farm after the COD;

(h). "Commercial Operations Date (COD)" means the day immediately following the date on which the generation facility/Wind Power Plant/Wind Farm of the Licensee is commissioned;

(i). "CPPA-G" means Central Power Purchasing Agency (Guarantee) Limited or any other entity created for the like purpose;

(j). "Distribution Code" means the distribution code prepared by the concerned XW-DISCO and approved by the Authority, as it may be revised from time to time with necessary approval of the Authority;

(k). "Energy Purchase Agreement (EPA)" 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 Power Plant/Wind Farm, as may be amended by the parties thereto from time to time;

(l). "Grid Code" means the grid code prepared and revised from time to time by NTDC with necessary approval of the Authority;

(m). "GoP" means the Government of Pakistan acting through the AEDB which has issued or will be issuing to the Licensee a LoS for the design, engineering, construction, insuring, commissioning, operation and maintenance of the generation facility/Wind Power

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Plant/Wind Farm;

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

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

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

(q). "Implementation Agreement (IA)" means the implementation agreement signed or to be signed between the GoP and the Licensee in relation to this particular generation facility/Wind Power Plant/Wind Farm, as may be amended from time to time;

(r). "Letter of Support (LoS)" means the letter of support issued or to be issued by the GoP through the AEDB to the Licensee;

(s). "Licensee" means **Hartford Alternative Energy (Private) Limited** and its successors or permitted assigns;

(t). "Net Delivered Energy" means the net electric energy expressed in kWh generated by the generation facility/Wind Power Plant/Wind Farm of the Licensee at its outgoing Bus Bar and delivered to the Power Purchaser;

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

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

(w). "Power Purchaser" means CPPA-G which will be purchasing electric energy from the Licensee either on behalf of all XW-DISCOs or any single XW-DISCO, pursuant to an EPA for procurement of electric

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energy;

(x). "SCADA System" means the supervisory control and data acquisition system for gathering of data in real time from remote locations to control equipment and conditions;

(y). "Licensing Regulations" mean the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations, 1999 as amended or replaced from time to time;

(z). "Generation Rules" mean the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000 as amended or replaced from time to time;

(aa). "Wind Power Plant/Wind Farm" means a cluster of WTGs situated in the same location of a generation facility used for production of electric energy;

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

(cc). "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 Generation Rules and Licensing Regulations issued under the Act.

Article-2
Applicability of Law

This licence is issued subject to the provisions of the Applicable Law, as amended from time to time.

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Article-3
Generation Facilities

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

3.2 The net capacity/Net Delivered Energy of the generation facility/Wind Power Plant/Wind Farm of the Licensee is set out in Schedule-II of this licence. The Licensee shall provide the final arrangement, technical and financial specifications and other specific details pertaining to its generation facility/Wind Power Plant/Wind Farm before its COD.

Article-4
Term of Licence

4.1 This licence is effective from the date of its issuance (i.e. April 26, 2016) and will have a term of twenty (20) years from the COD of the generation facility/Wind Power Plant/Wind Farm of the Licensee.

4.2 Unless suspended or revoked earlier, the Licensee may apply for renewal of this Licence ninety (90) days prior to the expiry of the above term, as stipulated in the Licensing Regulations.

Article-5
Licence fee

The Licensee shall pay to the Authority the licence fee as stipulated in the National Electric Power Regulatory Authority (Fees) Rules, 2002 as amended or replaced from time to time.

Article-6
Tariff

The Licensee shall charge only such tariff from the Power Purchaser which has been determined, approved or specified by the Authority.

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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 Generation 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

10.1 The generation facility/Wind Power Plant/Wind Farm of the Licensee shall comply with the environmental and safety standards as may be prescribed by the relevant competent authority from time to time.

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10.2 The Licensee shall provide a certificate on a bi-annual basis, confirming that the operation of its generation facility/Wind Power Plant/Wind Farm is in conformity with required environmental standards as prescribed by the relevant competent authority.

Article-11
Power off take Point and Voltage

The Licensee shall deliver the electric energy to the Power Purchaser at the outgoing Bus Bar of its generation facility/Wind Power Plant/Wind Farm. The Licensee shall be responsible for the up-gradation (step up) of generation voltage up to the required dispersal voltage level.

Article-12
Performance Data

12.1 The Licensee shall install monitoring mast with properly calibrated automatic computerized wind speed recording meters at the same height as that of the WTG.

12.2 The Licensee shall install SCADA System or compatible communication system at its generation facility/Wind Power Plant/Wind Farm as well as at the side of the Power Purchaser.

12.3 The Licensee shall transmit the wind speed and power output data of its generation facility/Wind Power Plant/Wind Farm to the control room of the Power Purchaser.

Article-13
Provision of Information

In accordance with provisions of Section-44 of the Act, the Licensee shall be obligated to provide the required information in any form as desired by the Authority without any exception.

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Article-14
Emissions Trading /Carbon Credits

The Licensee shall process and obtain expeditiously the Carbon Credits admissible to the generation facility/Wind Power Plant/Wind Farm. The Licensee shall share the said proceeds with the Power Purchaser as per the Policy.

Article-15
Design & Manufacturing Standards

The WTGs and other associated equipment of the generation facility/Wind Power Plant/Wind Farm shall be designed, manufactured and tested according to the latest IEC, IEEE standards or any other equivalent standard in the matter. All the plant and equipment of the generation facility/Wind Power Plant/Wind Farm shall be unused and brand new.

Article-16
Power Curve

The power curve for the 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 Power Plant/Wind Farm.

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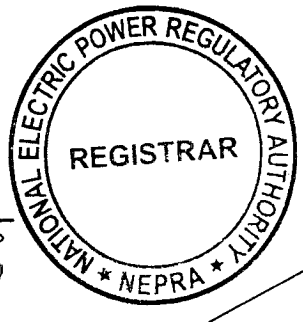
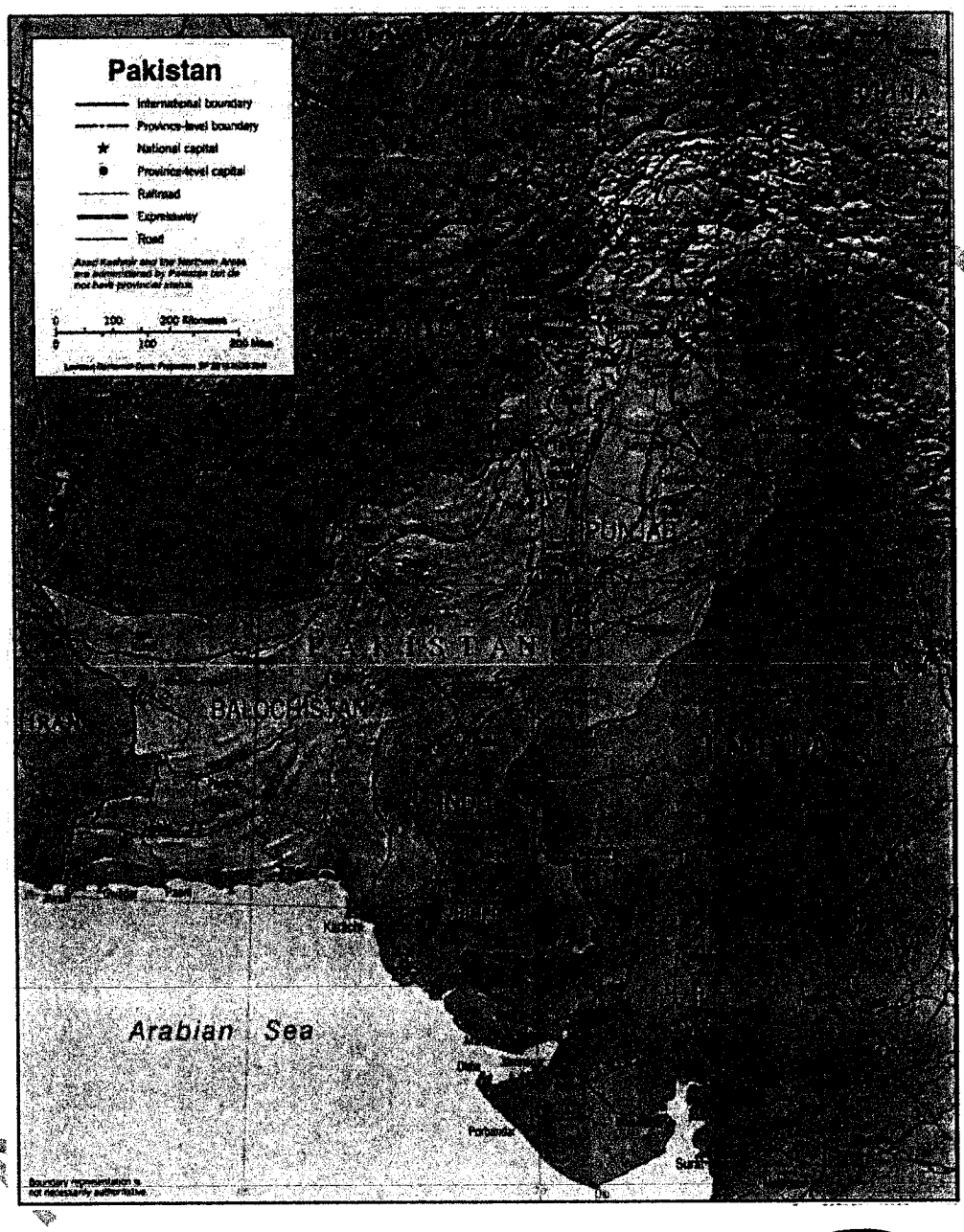
SCHEDULE-I
(Revised/Modified)
Modification-I

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 Facility/Wind Power Plant/Wind Farm of the Licensee are described in this Schedule.



Location of the Generation Facility/Wind Power Plant/ Wind Farm of the Licensee



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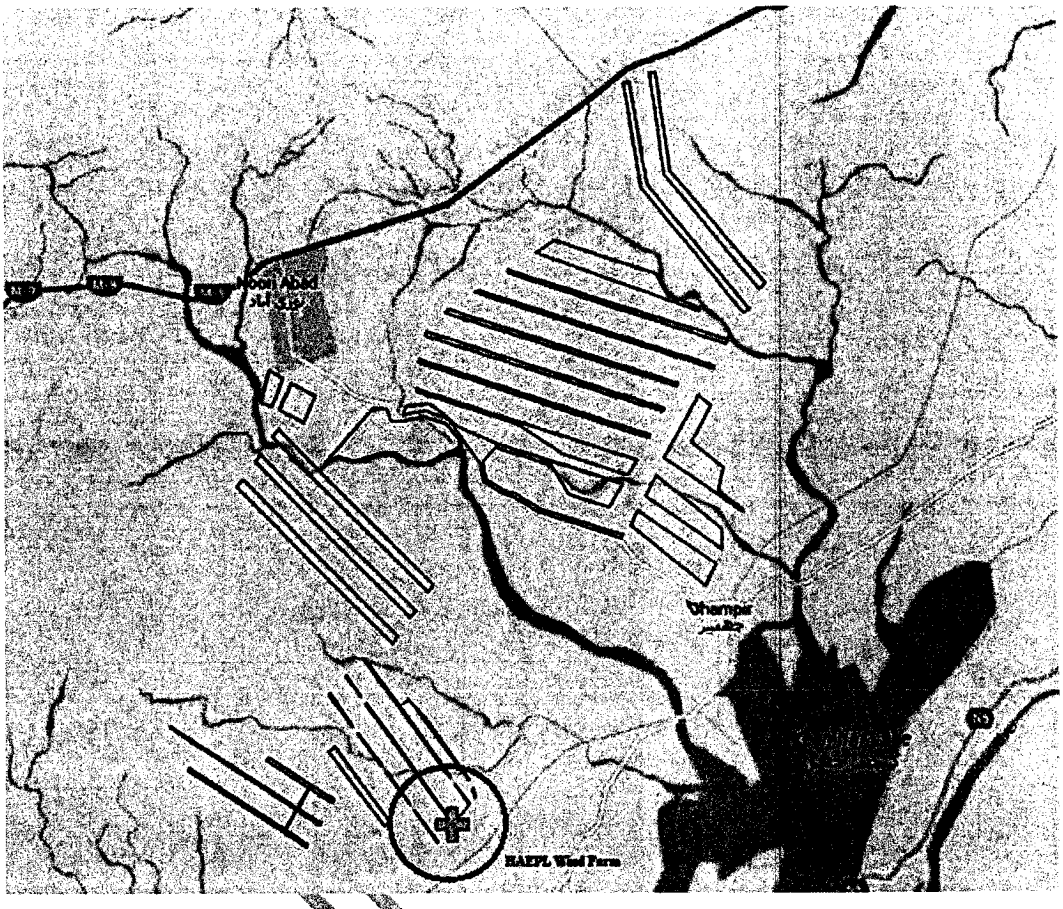
Layout of the Generation Facility/Wind Power Plant/ Wind Farm of the Licensee



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Land Coordinates of the Generation Facility/Wind Power Plant/ Wind Farm of the Licensee

Hartford Alternative Energy-50 MW Wind Farm					
	Area	Easting [m]	Northing [m]	Latitude	Longitude
1	320 acres	382854.5155	2764212.807	24.9888338	67.83926222
2		382736.1238	2764120.619	24.9879922	67.83809715
3		386914.331	2758456.441	24.9371658	67.87995335
4		387806.0191	2759437.569	24.946091	67.8887042
5		387065.5745	2760441.351	24.9550996	67.88128921
6		386942.5175	2760354.051	24.9543022	67.88007754
7		387672.8388	2759365.371	24.9454292	67.88739108
8		386986.9481	2758610.683	24.9385639	67.88065988

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Micro-Sitting of the Generation Facility/Wind Power Plant/ Wind Farm of the Licensee

Turbine No.	Easting (m)	Northing (m)
1	382,834	2,764,113
2	382,985	2,763,914
3	383,134	2,763,713
4	383,279	2,763,509
5	383,433	2,763,312
6	383,579	2,763,109
7	383,876	2,762,707
8	384,024	2,762,505
9	384,172	2,762,304
10	384,321	2,762,103
11	384,471	2,761,903
12	384,616	2,761,700
13	384,767	2,761,500
14	385,064	2,761,098
15	385,212	2,760,897
16	385,361	2,760,695
17	385,509	2,760,494
18	385,656	2,760,292
19	385,803	2,760,090
20	385,951	2,759,888
21	386,098	2,759,686
22	386,248	2,759,486
23	386,694	2,758,883
24	386,843	2,758,682
25	387,045	2,760,344
26	387,193	2,760,142
27	387,341	2,759,940
28	387,489	2,759,739
29	387,637	2,759,537

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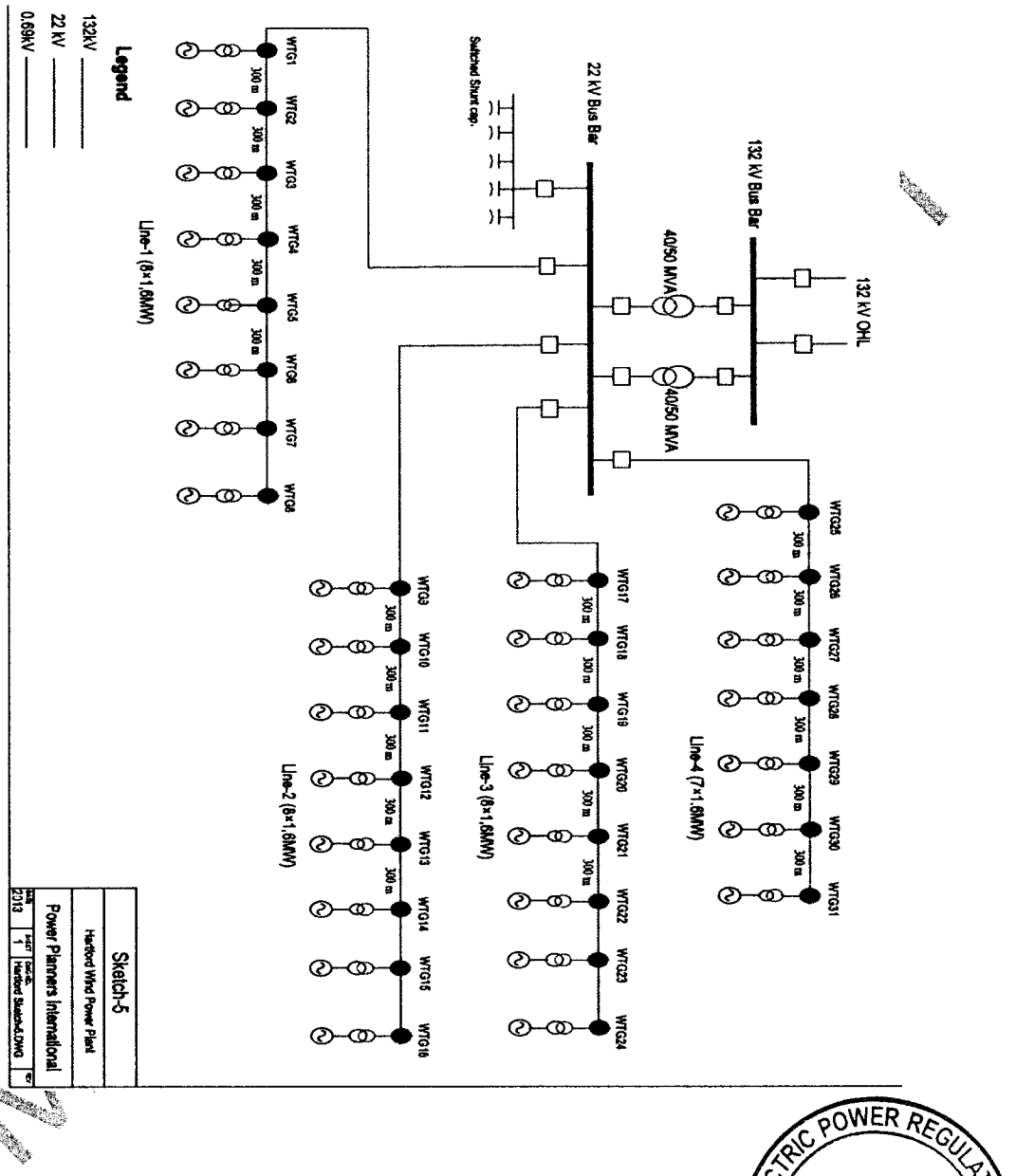
Single Line Diagram (Electrical) of the Generation Facility/Wind Power Plant/ Wind Farm of the Licensee



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Interconnection Arrangement/Transmission Facilities for Dispersal of Power from Generation Facility/Wind Power Plant/Wind Farm

The electric power generated from the Generation Facility/Wind Power Plant/Wind Farm of the Licensee/Hartford Alternative Energy (Private) Limited shall be dispersed to the national grid through load center of HESCO. The proposed Interconnection Arrangement/Transmission Facilities for dispersal will be consisting of the following:-

(a). The Generation Facility//Wind Power Plant/Wind Farm of the Licensee will be connected by a 132 KV D/C Transmission Line by making In-Out arrangement with a sub cluster also connecting Fina, Tapal, Titan and Sunec Wind Power Plants (WPPs) to Jhimpir-New 132 KV collector substation;

(2). The above mentioned scheme of Interconnection Arrangement/Transmission Facilities of the Licensee supposes that the following reinforcement will be in place in Jhimpir and Gharo clusters by end of 2016 including as follows:-

(a). 220/132 KV Jhimpir-New Substation at suitable location in Jhimpir cluster;

(b). A 220 KV D/C Transmission Line (measuring about 80 KM in length) from Jhimpir-New 220 KV Substation to the existing T.M. Khan Road 220 KV Substation;

(c). A 132KV D/C Transmission Line (Measuring about 82 KM using Greeley conductor) connecting Jhimpir-New 220/132 KV Substation with T.M. Khan Substation in HESCO network;

(d). 220/132 KV Gharo-New substation at suitable location in Gharo cluster;

(e). A 220 KV D/C Transmission Line (Measuring about 65 KM long) from Gharo-New 220 KV Substation to Jhimpir-New 220 kV Substation;

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(f). Five sub-collectors groups will be connected to Jhimpir 220/132 KV collector substation through 132 KV double circuits;

(g). FFC and Zorlu looped In-Out with Jhimpir-Nooriabad 132 KV circuit;

(h). Four WPPs in the collector system of Gharo 220/132 KV substation;

(i). FWEL-I and FWEL-II through a 64 KM long 132 KV D/C on Greeley conductor connected to Thatta;

(j). Rehabilitation of the exiting 132 KV lines in the vicinity of WPPs clusters, i.e. Jhimpir-Kotri, Jhimpir-Thatta, Thatta-Sujawal and Nooriabad-Jamshoro Old.

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

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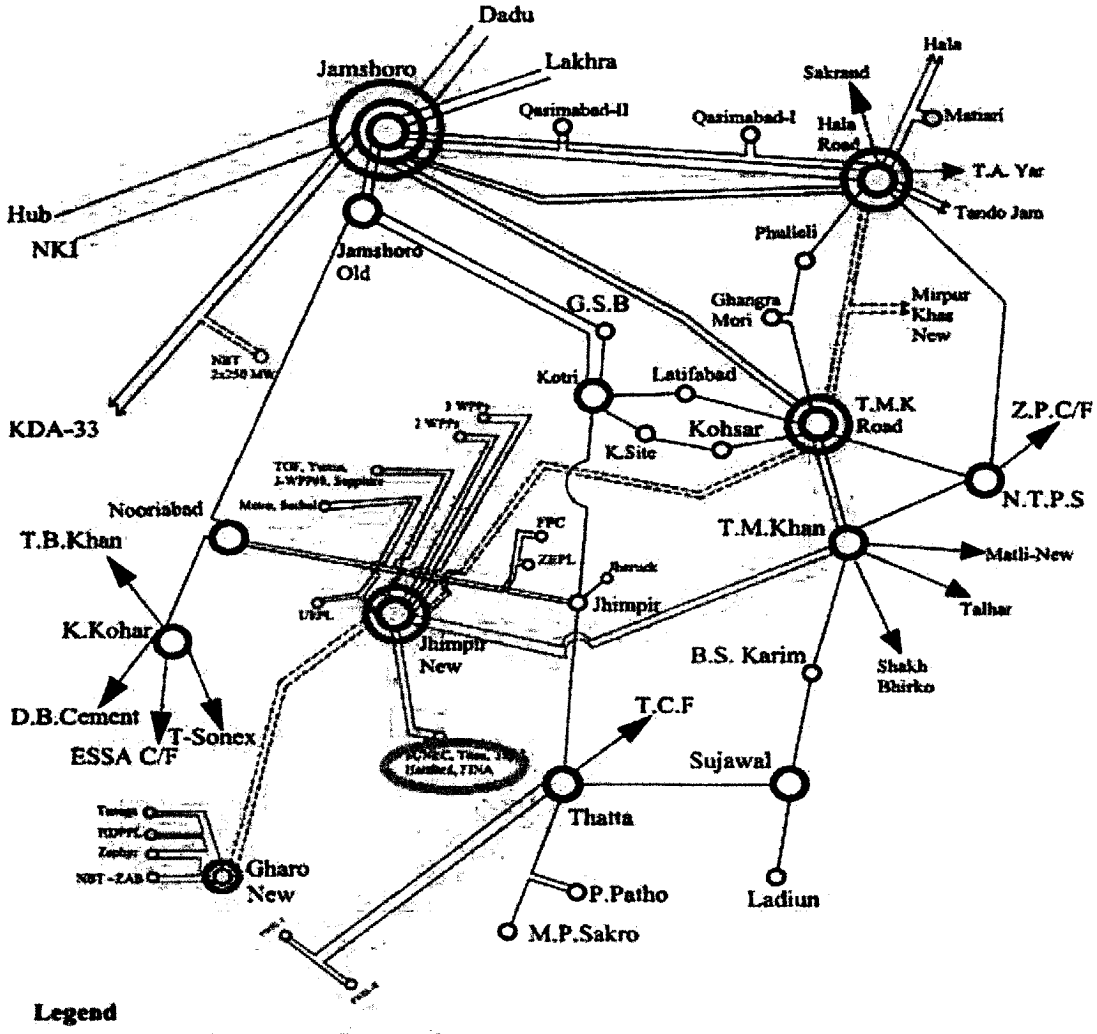
Schematic Diagram of Interconnection Arrangement/Transmission Facilities for Dispersal of Electric Power



Legend

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

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Details of Generation Facility/Wind Power Plant/ Wind Farm

(A). General Information

(i).	Name of the Company/Licensee	Hartford Alternate Energy (Private) Limited
(ii).	Registered/Business Office	Plot No. 4 & 8, Korangi Industrial Area, Karachi.
(iii).	Plant Location	Deh Kohistan, 7/1, Tapo Jhimpir, Taluka & District Thatta, in the Province of Sindh
(iv).	Type of Generation Facility	Wind Power Plant/Wind Farm

(B). Wind Farm Capacity & Configuration

(i).	Wind Turbine Type, Make & Model	General Electric (GE) 1.7-103m
(ii).	Installed Capacity of Wind Farm (MW)	49.30 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	29 x 1700KW

(C). Wind Turbine Details

(a).	**Rotor**	
(i).	Number of Blades	3
(ii).	Rotor Diameter	103 m
(iii).	Swept Area	8,332 m^2
(iv).	Power Regulation	Combinations of blade pitch angle adjustment, and generator/converter torque control.
(v).	Cut-in wind speed	3 m/sec

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(vi).	Cut-out wind speed	20 m/sec
(vii).	Survival wind speed	20m/s (10-minute average), 23/25 m/s (30/3 second average)
(viii).	Pitch regulation	Electric motor drives a ring gear mounted to the inner race of the blade pitch bearing.
(b). Blades		
(i).	Blade Length	50.2 m
(ii).	Material	Glass fiber reinforced epoxy resin
(c). Gear Box		
(i).	Type	Multi-stage planetary/helical gear design
(ii).	Gear ratio	1:107
(iii).	Main shaft bearing	Double row spherical roller bearing
(d). Generator		
(i).	Power	1,700 kW
(ii).	Voltage	690
(iii).	Type	Double-fed induction type
(iv).	Enclosure class	IP54
(v).	Coupling	Flexible coupling
(vi).	Power Factor	+0.95 to -0.95
(e). Yaw System		
(i).	Yaw Bearing	Roller bearing

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(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
(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	91 m

(D). Other Details

(i).	Expected COD of the Generation Facility	June 30, 2017 (Anticipated)
(ii).	Expected Life of the Generation Facility from COD	20 years

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Power Curve (Tabular) of the WTG-G.E. 1.7–103

Wind Speed at Hub height [m/s]	Power [kW]
3	3
3.5	57
4	119
4.5	194
5	288
5.5	406
6	539
6.5	692
7	861
7.5	1056
8	1258
8.5	1427
9	1536
9.5	1640
10	1682
10.5	1700
11	1714
11.5 to Cut-out wind speed	1715

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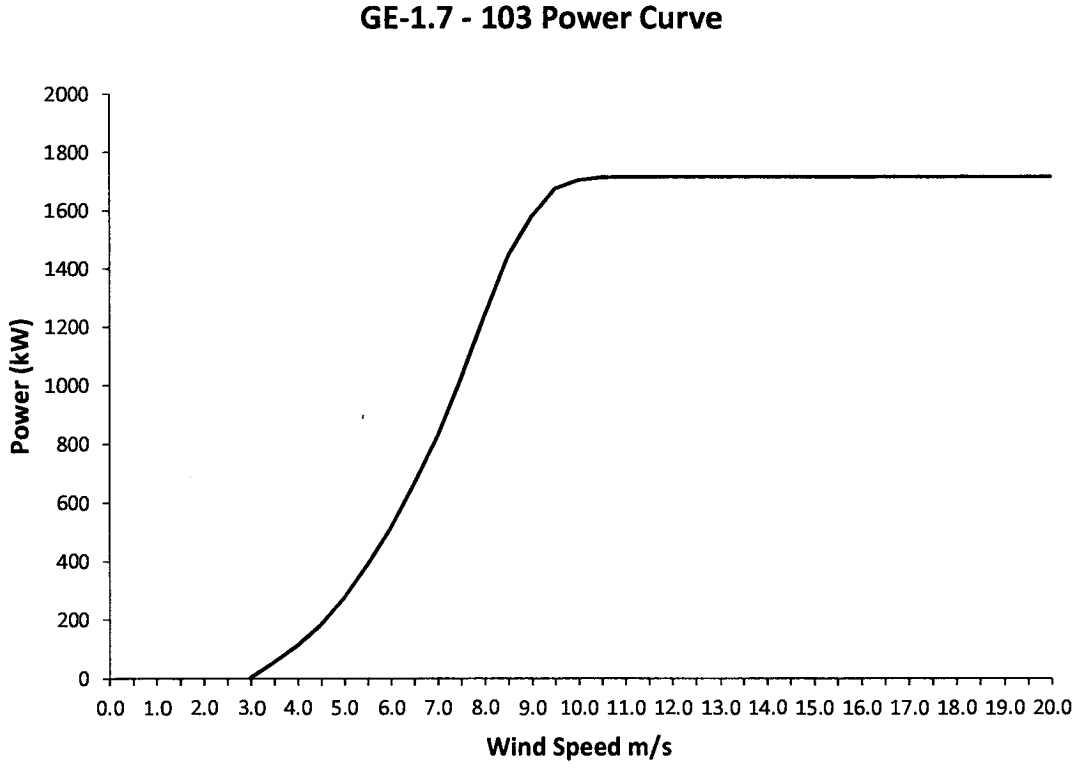
Power Curve (Graphical) of the WTG-G.E. 1.7–103 (Graphical)



MODIF

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SCHEDULE-II
(Revised/Modified)
Modification-I

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

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SCHEDULE-II

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	49.30 MW
(2).	Total Annual Full Load Hours	3066 Hrs
(3).	Average Wind Turbine Generator (WTG) Availability	98.0 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	181.12 GWh
(5).	Array & Miscellaneous Losses GWh	20.81 GWh
(6).	Availability Losses GWh	3.47 GWh
(7).	Balance of Plant Losses GWh	4.33 GWh
(8).	Annual Energy Generation (20 years equivalent Net AEP) GWh	152.45 GWh
(9).	Net Capacity Factor	35.30 %

Note

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

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