National Electric Power Regulatory Authority
Islamic Republic of Pakistan

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Registrar

No. NEPRA/R/LAG-394/ 18698-04 October 07, 2019

Mr. Saleem M. Bandukda,
Chief Operating Officer,
Indus Wind Energy Limited,
5th Floor, Office No. 508, Beaumont Plaza, Beaumont Road,
Civil Lines Quarters, Karachi.

Subject: **Grant of Generation Licence No. WPGL/50/2017**
Licence Application No. LAG-394
Indus Wind Energy Limited (IWEL)

Reference: *IWEL's LPM submitted vide letter dated March 29, 2019 (received on April 01, 2019)*

It is intimated that the Authority has approved Modification in Generation Licence No. WPGL/50/2017 dated August 16, 2017 in respect of Indus Wind Energy Limited (IWEL), pursuant to Regulation 10(11) of the NEPRA Licensing (Application and Modification Procedure) Regulations 1999.

2. Enclosed please find herewith determination of the Authority in the matter of Licensee Proposed Modification in the Generation Licence of IWEL along with Modification-I in the Generation Licence No. WPGL/50/2017 as approved by the Authority.

Encl: As above

REGISTRAR

07 X 19

(Syed Safeer Hussain)

Copy to:

1. Secretary, Power Division, Ministry of Energy, A-Block, Pak Secretariat, Islamabad.
2. Managing Director, NTDC, 414-WAPDA House, Lahore.
3. Chief Executive Officer, CPPA-G, ENERCON Building, Sector G-5/2, Islamabad.
4. Chief Executive Officer, Alternative Energy Development Board (AEDB), 2nd Floor, OPF Building, G-5/2, Islamabad
5. Chief Executive Officer, Hyderabad Electric Supply Company Limited (HESCO), WAPDA Offices Complex, Hussainabad, Hyderabad
6. Director General, Environment Protection Department, Government of Sindh, Complex Plot No. ST-2/1, Korangi Industrial Area, Karachi.

National Electric Power Regulatory Authority
(NEPRA)

Determination of the Authority in the Matter of Licensee Proposed Modification in the Generation Licence of Indus Wind Energy Limited

October 07, 2019
Case No. LAG-394

(A). Background

(i). In terms of Section-15 (now Section-14B) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (the "NEPRA Act"), the Authority granted a generation licence (No. WPGL/50/2017 dated August 16, 2017) to Indus Wind Energy Limited (IWEL)

(ii). According to the generation licence, the 50.00 MW generation facility/Wind Power Plant (WPP) proposed to be located at Jhimpir wind corridor, district Thatta, in the province of Sindh, is based on twenty five (25) wind turbine generators of Gamesa (G114-2.0 MW), with a hub height of 80m.

(B). Communication of Modification

(i). IWEL in accordance with Regulation-10(2) of the NEPRA Licensing (Application & Modification Procedure) Regulations, 1999 (the Licensing Regulations), communicated a Licensee Proposed Modification (LPM) in its above mentioned generation licence on April 01, 2019.

(ii). In the "text of the proposed modification", IWEL proposed to change the Wind Turbine Generators (WTG) of its WPP from Gamesa G114-2.0 with hub height of 80m to General Electric (GE)116-2.0, with hub height of 94m and to extend the lifespan of the WPP from 20 years to 25 years.

(iii). Regarding the "statement of the reasons in support of the modification, IWEL submitted that Gamesa G114-2.0 WTGs with hub height of 80m have been revised to WTGs of GE116-2.0, having hub height of 94m. This change is to ensure more efficient and effective wind turbine with respect to site selection and the choice offers a combination of scale and maximum performance. Furthermore, this is in-line with the tariff that was applied by the Company and determined by NEPRA. The 94m hub height is a

standard product range and is backed by the Type Certificate, which was not available at the time when the Company had originally applied for the generation licence. Regarding change in term of licence, IWEL submitted that the envisaged wind farm will be in operation for a period of up to 25 years. The updated operational life is to ensure lower levelized cost of energy and is in congruence with the cost-plus tariff awarded to the Project Company by NEPRA.

(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", IWEL submitted that there would be no adverse impact on the tariff, quality of service and obligations of the licensee under the 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, by IWEL, the Registrar published the communicated LPM on April 12, 2019, in one (01) Urdu (Daily Express) and one (01) English (the News) newspaper, informing the general public about the communicated LPM and inviting their comments within a period of fourteen (14) days from the date of the said publication.

(ii). Apart from the above, separate letters were also sent to other stakeholders including Government Ministries and their attached departments, various representative organization, individual experts and others, on April 12, 2019. Through the said letters, the stakeholders were informed about the communicated LPM and publication of its notice in the press. Further, the said entities were invited 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 two (02) stakeholders including Engineering Development Board (EDB) and Ministry of Science and Technology (MoST). The comments offered by the said stakeholders are summarized in the following paragraphs:-

(a). EDB submitted that none of the clauses of the LPM are related to it however, it is recommended that efforts should be made to utilize indigenous potential available for the project; and

REGISTRAR

(b). MoST submitted that the change in hub height from 80m to 94m will help in increasing the capacity factor of the WPP with increased output, due to increase in wind speed with increasing height. The change in life span from 20 years to 25 years is supported. Equipment to be used in the plant must be of top quality, manufactured by internationally reputed OEMs. Furthermore, MoST cannot comment on the financials and other TORs of the project.

(ii). The Authority examined the above comments of stakeholders and considered it appropriate to seek perspective of IWEL on the observations of the stakeholders. Regarding comments of the EDB, the Licensee/IWEL submitted that:-

(a). Incorporation of indigenous potential for the project would be its top priority. However, in doing so IWEL has to ascertain that integrity of the project is not compromised as well as project costs are within the limits of the parameters set out by NEPRA in the cost-plus tariff to IWEL;

(b). In Pakistan the scope of indigenous potential of wind projects is very limited. So far, only towers and transformers are being manufactured locally but that too are very expensive than imports. At most, presently the potential of the country lies in providing Engineering Services and O&M services which IWEL aims to utilize in its project as sub-contractors;

(c). Only one local company came forward to bid for the EPC contract for IWEL's project. However its Bid for EPC contract was high comparable to another bid received. They were given chance to revise their offer but chose to bow out giving reason that they are unfavourably placed viz a viz the other foreign bidder due to our Governments Tax policies as they have to charge 7% on all supplies and services while the foreign bidder is getting 12.5% tax credit in their country on supply. To mitigate such situation, other countries are giving extra tariff benefits to project sponsors specifically to utilize and promote the local resources; and

(d). Finally, foreign lenders comfort is also a very important consideration for the success of the Project. The local EPC Companies do not have enough financial strength to warrant the risk of the whole project on a stand-alone

basis. Hence, this acts as a dampener in utilizing the indigenous potential. However, for the sector, IWEL is very hopeful as the wind energy sector progresses, the economies of scale and learning curve will set which will kick off investments in the downstream and upstream industries leading to availability of local resources. In short. IWEL will use all its efforts to utilize available indigenous potential to the extent it does not compromise the integrity of project, to supply cheap and affordable power to consumers and at the same time manage to keep project costs within the parameters fixed by NEPRA in its tariff.

(iii). On the observations of the MoST, in its reply IWEL inter alia submitted that:-

(a). MoST has in clear terms supported our application request with a very intuitive and pragmatic reasoning. The ultimate objective is to pass on maximum benefits to the end consumers as well as to bring down the aggregate cost of energy;

(b). The hub heights of turbines have been increased from 80m to 94m to take advantage of wind shear that will result in higher energy numbers. The practical evidence of this has been witnessed recently when WPPs of Artistic, Hartford and Jhimpir Power were commissioned with 91 meters hub height compared to similar WTGs of Sapphire and Master WPP with 80 meters hub height. The results have been in favor of former projects with tremendous boost in energy produced. Hence, translating into lower cost of energy and benefit to country as such.

(c). Moreover, the requested increase in the validity period of generation is to make it in line with conditions of the tariff awarded by NEPRA. IWEL understands that this precondition by NEPRA is primarily to bring down the Levelized Cost of Energy of the Project for its dampening effect on aggregate energy purchase cost of the country. However, in order to align the project for 25 years life span necessitates that top quality and highly efficient turbines are used which have proven track record globally as well as domestically in Pakistan. Therefore, IWEL requested the change in turbine from Gamesa 2.0 MW to GE 2.0 MW in its LPM; and

(d). Although, GE turbines are more expensive than other comparable

turbines offered in Pakistan market, these machines backed by GE guarantees are more robust and efficient to outlast the project life span. Furthermore, GE operations is more entrenched in our market with local offices, spare parts warehouses and round the clock service to cater to project needs in real time. All these factors contribute exponentially in augmenting efficiencies which translates into lower costs much to the benefit of end consumers and our country in entirety.

(iv). The Authority examined the above submissions/response of IWEL on the observations of the stakeholders and found the same plausible. Foregoing in view, the Authority considered it appropriate to proceed further with the communicated LPM as stipulated in the Licensing Regulations and the NEPRA Licensing (Generation) Rules, 2000 ("the Generation Rules").

(E). Finding/Evaluation

(i). The Authority examined the entire case in detail including the already granted generation licence, the communicated LPM, granted cost-plus tariff of IWEL, the provisions of the Policy for Development of Renewable Energy for Power Generation 2006 ("the RE Policy"), comments of the stakeholder and relevant rules & regulations.

(ii). In this regard, the Authority observed that in terms of Regulation-10(5) of the Licensing Regulations, the Authority is entitled to modify a licence subject to and in accordance with such further changes as the Authority 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 power to the consumers keeping in view the financial and technical viability of the licensee.

(iii). Regarding the main features of the case under consideration the Authority has noted that originally it had granted a generation licence (No. WPGL/50/2017 dated August 16, 2017) to IWEL with an installed capacity of 50 MW based on 25 WTGs of Gamesa (G114-2.0MW). In the said generation licence the hub height of the tower for

installation of the WTGs was mentioned as 80m. Further, Article-4 of the generation licence stipulates that the licence shall become effective from the date of its issuance and will have a term of twenty (20) years from the COD of the WPP of the Licensee.

(iv). Now, through the communicated LPM, IWEL has proposed (a). to change the WTG technology its WPP from Gamesa G114-2.0 to General Electric (GE) 116-2.0 with a hub height of 94 m and (b). to extend the lifespan of wind farm from 20 years to 25 years. IWEL proposed the change of WTG technology from Gamesa to GE to ensure more efficient and effective wind turbine with respect to site selection and the choice offers a combination of scale and maximum performance. The 94m hub height is a standard product range and is backed by the Type Certificate, which was not available at the time when the Company had originally applied for the generation licence. With the proposed changes, the WPP will be in operation for a period of up to 25 years instead of 20 years. The updated/extended operational life will result in lower levelized cost of energy. Furthermore, the proposed amendments are in-line with the cost-plus tariff awarded to IWEL by the Authority.

(v). Regarding the proposed change in the WTG technology, the Authority has observed that the proposed WTGs (i.e. G.E. 116-2.0) are based on latest technology and offer higher annual energy production. With the proposed hub height, the net capacity factor of the WPP of IWEL will increase from 35% to 38% (i.e. the net annual generation will increase from 153.30 GWh to 166.44 GWh) without changing the installed capacity of the Wind Power Plant/Wind Farm.

(vi). Regarding changes in hub height of towers, it is relevant to mention that worldwide wind turbine tower heights have experienced a steady increase in the last 20 years. The average tower height in Belgium, France and the Netherlands has increased from approximately 60m in 2000 to 100-120m in the last years. In 2013, 75% of the installed capacity in Belgium and 70% in France has a tower height equal or taller than 100m. The main reason behind this tendency is the potential increase of the expected production yield due to higher wind speeds at greater heights.

(vii). Regarding the impact of the communicated LPM on the tariff, the Authority considers that it has already granted cost-plus tariff to IWEL (through determination (No. NEPRA/TRF-427/IWEL-2018/18042-18044 November 19, 2018). In this regard, the

Authority considers that the communicated LPM of IWEL will not have any adverse impact on its existing tariff.

(viii). Regarding the proposed extension in operational span of the facility from twenty (20) years to twenty five (25) years, the Authority has observed that under Rule-5(1) of the Generation Rules the term of generation licence is to commensurate with the maximum expected useful life of the units comprised in a generation facility, except where an applicant for a generation licence consents to a shorter term. The Authority has noted that as per international benchmark, the useful life of wind turbine generators is normally considered as 20 to 25 years. Further, the WTGs selected by IWEL for its WPP are type certified, more robust, efficient and backed by GE guarantees of 25 years. In this regard, it is relevant to mentioned that the cost plus tariff granted to IWEL also envisages a control period of 25 years. Further, the proposed extension in the term of licence is in line with other similar projects. Therefore, the Authority is of the view that the proposed extension in the term of licence is in-line with the said standards for useful life of WTGs and control period of tariff.

(ix). Foregoing in view, the Authority is of the considered opinion that the proposed LPM will not have any adverse effect on the performance of the Licensee/IWEL of its obligations, instead its performance will be improved. Further, the LPM will 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 the NEPRA Act. The LPM will be beneficial to the consumers in general as more electricity will be available to the power purchaser and that too without installing any additional wind turbine generator. The LPM is reasonably necessary for the Licensee to effectively and efficiently perform its obligations under the 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 the Licensee.

(F). Approval of LPM

(i). In view of the above, the Authority is satisfied that the Licensee has complied with all the requirements of the Licensing Regulations pertaining to the modification. Therefore, the Authority in terms of Regulation-10(11) of the Licensing Regulations approves the communicated LPM.

(ii). Accordingly, the already granted generation licence (No. WPGL/50/2017 dated August 16, 2017) is hereby modified. The changes made in the generation licence are attached as annexure to this determination. The approval of the LPM is 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

Rafique Ahmed Shaikh
(Member)

Rehmatullah Baloch
(Member)

Saif Ullah Chattha
(Member)

(Did not Attend the meeting-Away)

Engr. Bahadur Shah
(Member/Vice Chairman)

Tauseef H. Farooqi
(Chairman)

National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan

GENERATION LICENCE

No. WPGL/50/2017

In exercise of the Powers conferred under Section-26 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997, the Authority hereby modifies the Generation Licence (No. WPGL/50/2017 dated August 16, 2017 granted to Indus Wind Energy Limited, to the extent of changes mentioned hereunder:

(a). Changes made in **Articles of the Generation Licence** regarding term of the generation facility/wind power plant are attached as **Revised/Modified Articles**;

(b). Changes made in **Schedule-I** of the generation licence are attached as **Revised/Modified Schedule-I**.

(c). Changes made in **Schedule-II** of the generation licence are attached as **Revised/Modified Schedule-II**.

This **Modification-I** is given under my hand on this 07th day of **October Two Thousand & Nineteen**

01/X/19

Registrar

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 Alternative 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 NEPRA rules and regulations, 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 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 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 XW-DISCO(s) and approved by the Authority, as it may be revised from time to time with necessary approval of the Authority;

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

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

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

(n). "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 Plant/Wind Farm;

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

(p). "IEC" means the International Electro-technical Commission and its successors or permitted assigns;

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

(r). "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;

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

(t). "Licensee" means **Indus Wind Energy Limited** or its successors or permitted assigns;

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

(v). "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;

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

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

(y). "Power Purchaser" means the CPPA-G purchasing electric power on behalf of XW-DISCO(s) from the Licensee, pursuant to an Energy Purchase Agreement for procurement of electricity;

(z). "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;

(aa). "Wind Power Plant/Wind Farm" means a cluster of WTGs situated in the same location of a generation facility/Wind Power Plant/Wind Farm 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 rules and 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.

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 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 shall become effective from the date of its issuance and will have a term of twenty five (25) years from the COD of the generation facility/Wind Power Plant/Wind Farm of the Licensee, subject to provisions of Section-14B of the Act.

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 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.

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 & Safety 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.

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 of Wind Power Plant

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.

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.

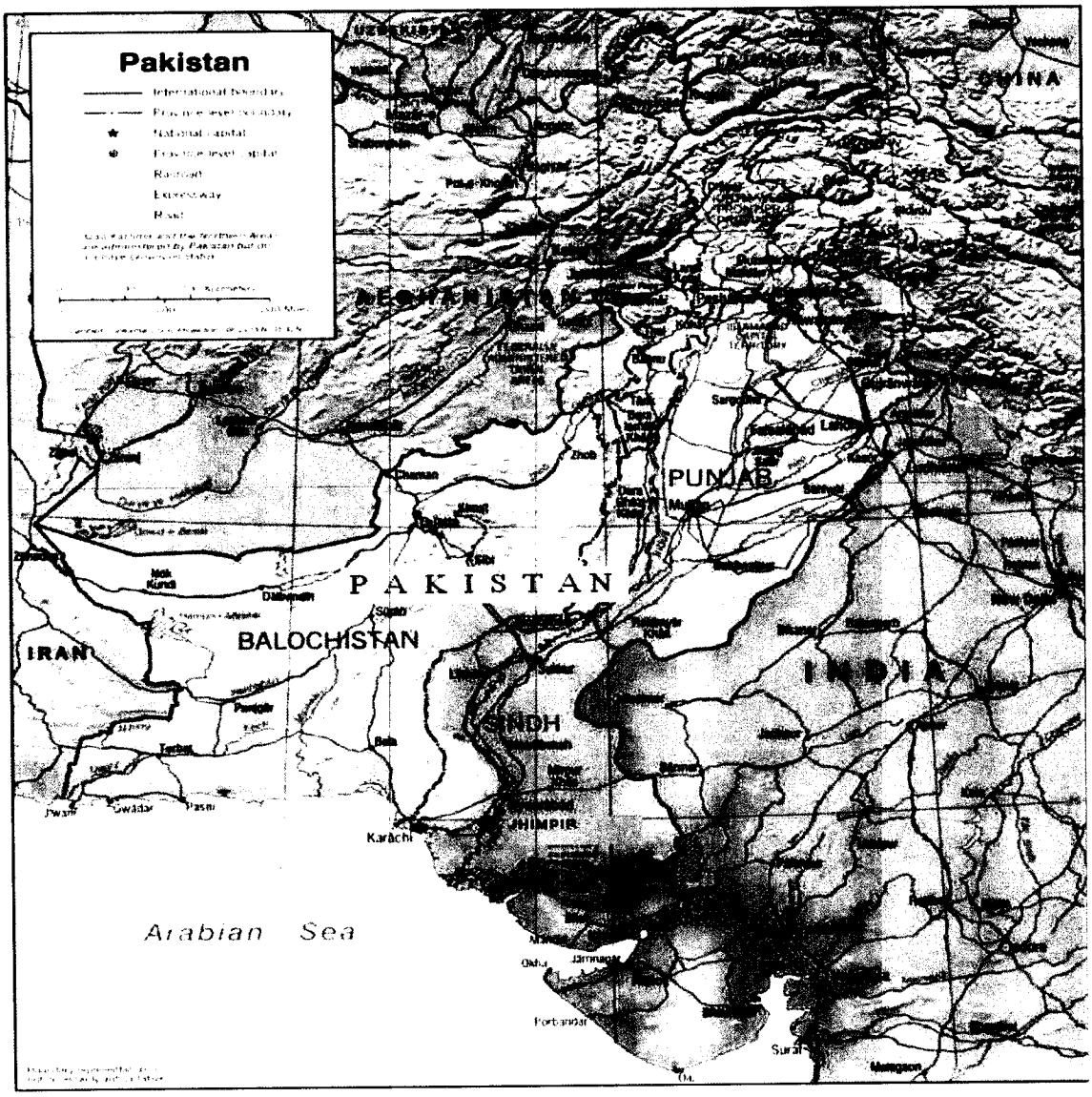
Article-16
Power Curve

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.

SCHEDULE-I
(Revised/Modified)

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 Farm of the Licensee are described in this Schedule.

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



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

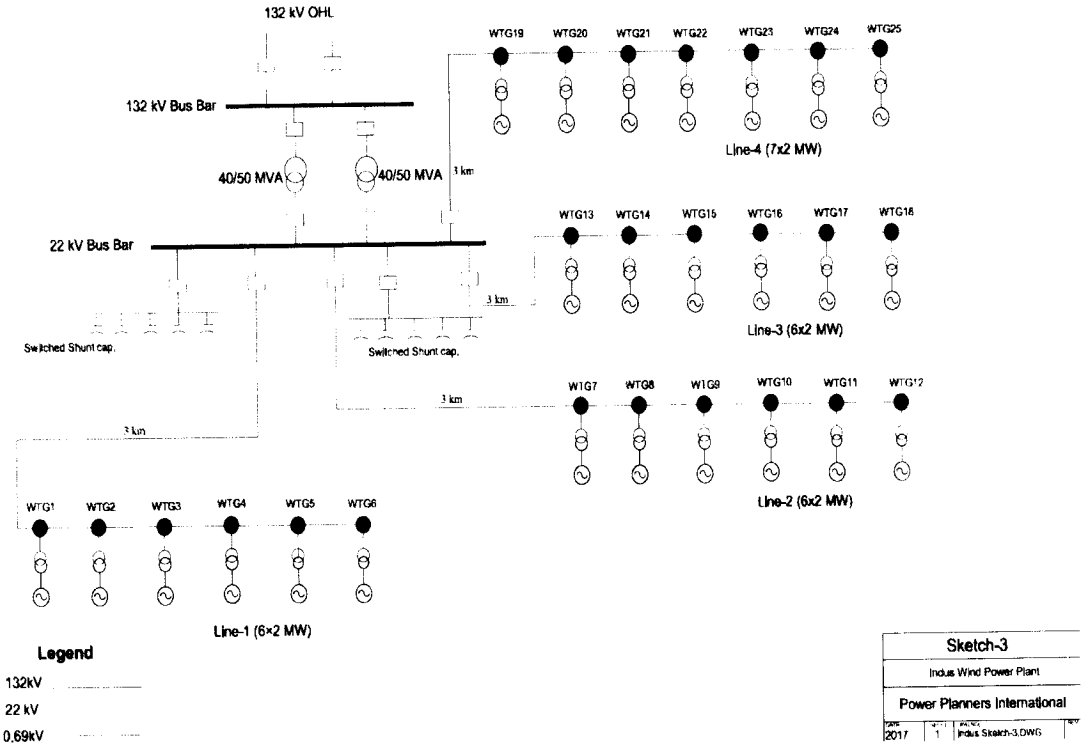
Land Coordinates and Micro-Sitting of the Generation Facility/Wind Power Plant/Wind Farm of the Licensee

Sr. No.	Latitude	Longitude
1	67°42'46.74"E	24°56'8.88"N
2	67°42'43.74"E	24°56'4.79"N
3	67°45'39.24"E	24°54'30.83"N
4	67°45'36.19"E	24°54'26.81"N
5	67°45'21.35"E	24°54'2.70"N
6	67°45'19.21"E	24°53'58.21"N
7	67°42'23.95"E	24°55'39.73"N
8	67°42'21.00"E	24°55'33.94"N

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

Turbine No.	Coordinates (UTM Z42 WGS84)	
	Easting [m]	Northing [m]
INDUS_G01	369463.469	2757410.658
INDUS_G02	369755.738	2757233.054
INDUS_G03	370106.823	2758335.359
INDUS_G04	370394.94	2758151.097
INDUS_G05	370683.057	2757966.835
INDUS_G06	370924.813	2756522.64
INDUS_G07	370971.174	2757782.573
INDUS_G08	371259.291	2757598.31
INDUS_G09	371801.619	2755989.83
INDUS_G10	372093.888	2755812.226
INDUS_G11	372123.642	2757045.524
INDUS_G12	372386.156	2755634.623
INDUS_G13	372411.759	2756861.261
INDUS_G14	372678.425	2755457.019
INDUS_G15	372699.876	2756676.999
INDUS_G16	372987.993	2756492.737
INDUS_G17	373276.11	2756308.475
INDUS_G18	373555.231	2754924.209
INDUS_G19	373564.228	2756124.212
INDUS_G20	373847.5	2754746.605
INDUS_G21	373852.345	2755939.95
INDUS_G22	374139.768	2754569.002
INDUS_G23	374140.462	2755755.688
INDUS_G24	374428.579	2755571.426
INDUS_G25	374716.696	2755387.163

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



Interconnection Arrangement for Dispersal of Power from the Generation Facility/Wind Power Plant/Wind Farm of the Licensee

The electric power generated from the Generation Facility/Wind Power Plant/Wind Farm of the Licensee i.e. Indus Wind Energy Limited (IWEL) shall be dispersed to the National Grid through the load center of HESCO.

(2). The proposed Interconnection Arrangement/Transmission Facilities for dispersal of power from Generation Facility/Wind Power Plant/Wind Farm of IWEL will consist of the following:-

(i). A total of two 220 kV D/C transmission lines (measuring approx. 5km long each on twin bundled AASC Greeley conductor) for making double In/out of existing 220 kV Double Circuit (D/C) Jamshoro—KDA-33 transmission lines at the proposed 220/132kV Jhimpir-2 grid station/substation;

(ii). Addition of 4th power transformer (of 250 MVA) at the newly proposed 220/132kV Jhimpir-2 grid station/substation;

(iii). A 132kV D/C transmission line (approx. 135 km long on twin bundled AASC Greeley conductor) for connecting eight (08) Wind Power Plants (WPPs) in the first loop[1] to newly proposed 220/132kV Jhimpir-2 grid station/ substation;

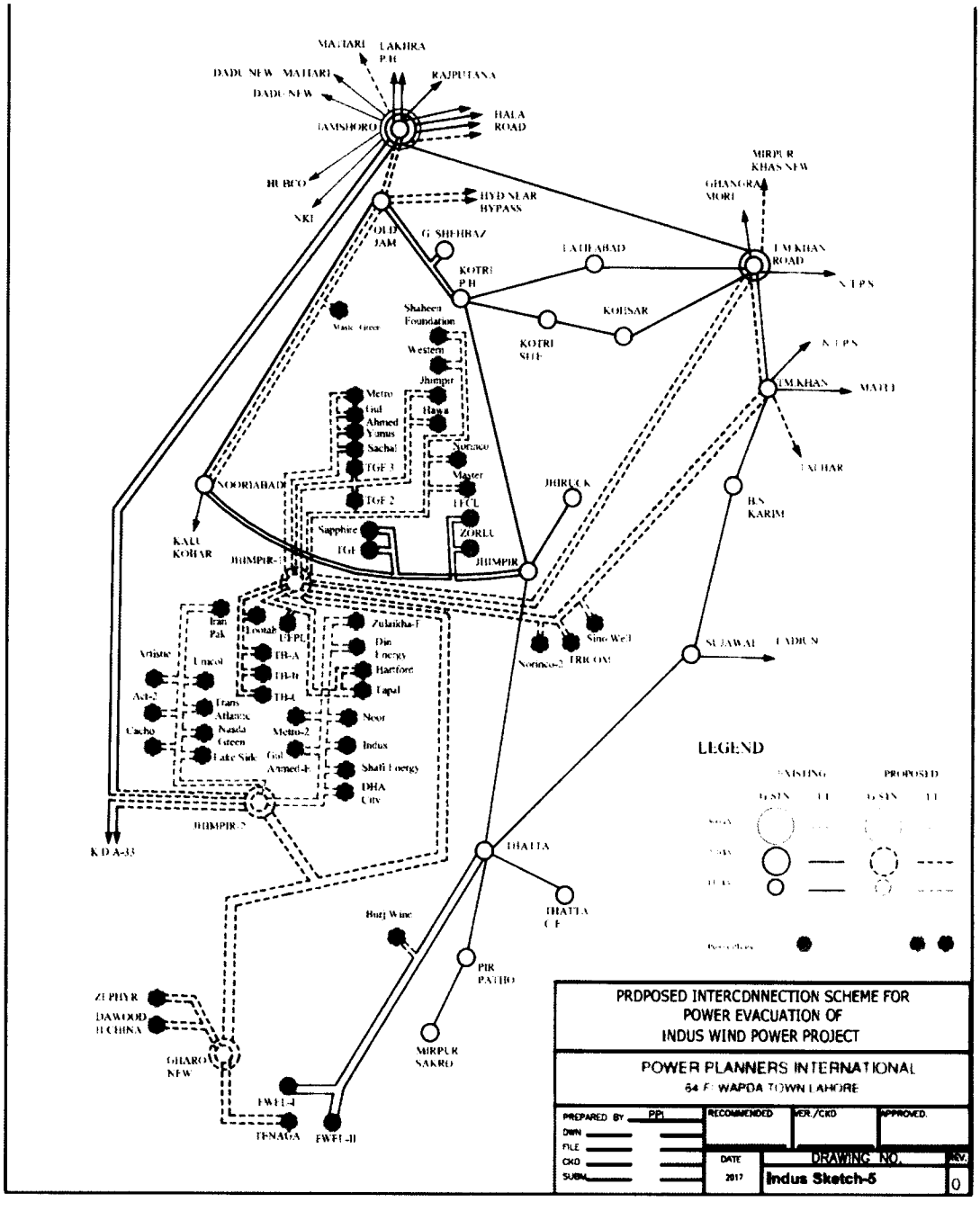
(iv). 132kV D/C transmission line (approx. 168 km long on twin bundled AASC Greeley conductor) for connecting eight (08) WPPs in the second loop2 to newly proposed 220/132 kV Jhimpir-2 grid station/substation.

[1] Lakeside, Nasda, Trans-Atlantic, Uni-Energy, Iran-Pak, Artistic, Act-2 and Cachoo WPPs

(3). In the above scheme the interconnection for the generation facility/Wind Power Plant/Wind Farm of IWEL (which is placed in second loop) includes a 132 kV D/C transmission line (measuring approx. 0.80 km in length, on twin bundled AASC Greeley conductor) for making in/out of 132kV single circuit transmission line connecting the WPP of Noor and Shafi Energy to the newly proposed 220/132 kV Jhimpir-2 grid station/substation.

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

Schematic Diagram for Interconnection Arrangement for Dispersal of Power from the Generation Facility/Wind Power Plant/Wind Farm of the Licensee



Detail of Generation Facility/Wind Power Plant/ Wind Farm

(A). General Information

(i).	Name of the Company/Licensee	Indus Wind Energy Limited
(ii).	Registered/Business Office	Office No. 508, 5th Floor, Beaumont Plaza, Beaumont Road, Civil Lines Quarter, PIDC, Karachi.
(iii).	Plant Location	Deh Kohistan 7/3 & 7/4, Tapo Jungshahi, Taluka & 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	General Electric (GE 116-2.0MW)
(ii).	Installed Capacity of Wind Farm (MW)	50.00 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (MW)	25x2.0 MW

(C). Wind Turbine Details

(a).	**Rotor**	
(i).	Number of blades	3
(ii).	Rotor diameter	116 m
(iii).	Swept area	10568 m^2
(iv).	Power regulation	Combination of blade pitch angle adjustment and generator/converter torque control.
(v).	Cut-in wind speed	3 m/s

(vi).	Cut-out wind speed	25 m/s
(vii)	Survival wind speed	25 m/s average in a 600-second time interval 28 m/s average in a 30-second time interval 30 m/s average in a 3-second time interval
(viii)	Pitch regulation	Electric motor drives a ring gear mounted to the inner race of the blade pitch bearing.
(b).	**Blades**	
(i).	Blade length	56.9 m
(ii).	Material	Glass Fiber Reinforced Epoxy Resin
(c).	**Gearbox**	
(i).	Type	Multi-stage planetary/helical gear design
(ii).	Gear Ratio	104.3 (60 Hz), 130.4 (50 Hz)
(iii).	Main Shaft	Roller Bearing Mounted in a bearing cap arrangement
(d).	**Generator**	
(i).	Nominal Power	2.0 MW
(ii).	Voltage	690 V
(iii).	Type	Doubly Fed Induction Type
(iv).	Degree of Protection	IP34
(v).	Coupling	Flexible coupling
(vi).	Power factor	0.95
(e).	**Control System**	
(i).	Type	Automatic or manually controlled

128

(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
(f).	**Brake**	
(i).	Design	Mechanical Breaks
(ii).	Operational brake	Aerodynamic Brake achieved by feathering blades
(iii).	Secondary brake	Mechanical Breaks on (high speed) Shaft of Gearbox
(g).	**Tower**	
(i).	Type	Tabular tower
(ii).	Hub height	94 m
(h).	**Yaw System**	
(i).	Yaw Bearing	Ball Bearing attached between the nacelle and tower controller activates the yaw drives to align the nacelle
(ii).	Brake	Planetary Yaw drives with brakes (passive)
(iii).	Yaw Drive	Motor Drive
(iv).	Speed	0.5°/s

(D). Other Details

(i).	Project Commissioning Date (Anticipated)	December 31, 2021
(ii).	Expected Life of the Project from Commercial Operation Date (COD)	25 Years

Power Curve of Wind Turbine Generator of General Electric (GE 116-2.0MW) (Tabular)

Wind Speed at Hub Height [m/s]	Normal Turbulence Intensities at 15 m/s 10% < TI < 15%	Low Turbulence intensities at 15 m/s TI < 10%	High Turbulence Intensities at 15 m/s 15% < TI < 20%	$C_{p,e}$ Normal Turbulence Intensities
3.0	[illegible]	0	0	-
3.5	[illegible]	61	[illegible]	[illegible]
4.0	[illegible]	135	[illegible]	[illegible]
4.5	[illegible]	226	[illegible]	0,39
5.0	[illegible]	335	[illegible]	0,42
[illegible]	[illegible]	466	494	[illegible]
6.0	[illegible]	617	652	0,45
6.5	804	792	836	[illegible]
[illegible]	[illegible]	994	1045	[illegible]
[illegible]	[illegible]	1225	[illegible]	0,45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8.5	[illegible]	1742	[illegible]	[illegible]
[illegible]	[illegible]	1906	[illegible]	[illegible]
9.5	[illegible]	2000	[illegible]	0,36
[illegible]	[illegible]	2000	1992	[illegible]
[illegible]	[illegible]	2000	2000	-

[illegible]

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SCHEDULE-II
(Revised/Modified)

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

SCHEDULE-II

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (in MW)	50.00
(2).	Total Annual Full Load Hours	3328.80
(3).	Average Wind Turbine Generator (WTG) Availability	98.0 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	186.88
(5).	Array & Miscellaneous Losses (in GWh)	12.58
(6).	Availability Losses (in GWh)	04.72
(7).	Balance of Plant Losses (in GWh)	03.14
(8).	Annual Energy Generation (25 years equivalent Net AEP) (in GWh)	166.44
(9).	Net Capacity Factor	38 %

Note

All the above figures are indicative as provided by the Licensee/IWEL. The net energy available to power purchaser for dispatch will be determined through procedures contained in the energy purchase agreement.

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