



## **WESTERN ENERGY (PRIVATE) LIMITED**

**Registered Office:** F-25 • Block 5 • Rojhan Street  
Kehkashan • Clifton • Karachi - 75600 • Pakistan  
**Tel** : +92-21-35876994 - 7  
**Fax** : +92-21-35876991 & 35876993

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

Date: 12<sup>th</sup> January, 2023  
Ref.: WEL/NEPRA/001/23

**Subject: Western Energy (Private) Limited ("Company") - Licensee Proposed Modification of the Generation License**

Dear Sir,

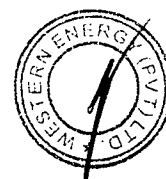
The Company was granted Generation License No. WPGL/37/2017 on 5<sup>th</sup> January 2017 (the "**Generation License**") by NEPRA, under Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997, for its wind power generation facility at Jhimpir, Taluka & District Thatta, Sindh (the "Project").

As mentioned in the Generation License, the Project was designed with a capacity of 50 MW based on 25 Wind Turbine Generators ("WTG") of Haizhuang Windpower H111-2.0 MW with a hub height of 80m. However, due to reasons provided in the attached LPM, the Project has selected Goldwind GW140 – 3.4 MW as the WTG for the Project with a hub height of 80m.

The Company, pursuant to Regulation 10(2) of the NEPRA Licensing (Application, Modification, Extension and Cancellation) Procedure Regulations 2021 ("**Regulations**"), hereby seeks to apply for a modification of the Generation License granted to the Company to cater for the aforementioned change of WTG to Goldwind GW140 – 3.4 MW. The said change of WTG requires modification in Generation License with respect to revision of Project installed capacity and capacity factor. The LPM also seeks change in expected life of the generation facility.

In relation hereto, we certify that the documents-in-support attached with this modification application are prepared and submitted in conformity with the provisions of Regulation 10(2) of the Regulations, and we undertake to abide by the terms and provisions of the above-said Regulations. We further undertake and confirm that the information provided in the attached documents-in-support is true and correct to the best of our knowledge and belief.

Bank drafts in the sum of PKR 669,306/- (Pakistan Rupees Six Hundred Sixty-Nine Thousand Three Hundred Six) and PKR 8,400/- (Pakistan Rupees Eight Thousand Four Hundred) drawn in favor of National Electric Power Regulatory Authority, being the applicable fee in accordance with Schedule II of the Regulations are also attached herewith.





In light of the submissions set out in this application and the information attached to the same, NEPRA is kindly requested to process the Licensee Proposed Modification of the Company's Generation License at the earliest, thereby enabling the Company to proceed further with the development of the Project.

Yours sincerely,  
For & On behalf of  
Western Energy (Private) Limited

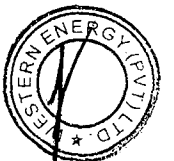
  
Tabish Tapal  
Chief Executive Officer



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# BOARD RESOLUTION

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## **WESTERN ENERGY (PRIVATE) LIMITED**

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Kehkashan • Clifton • Karachi - 75600 • Pakistan

**Tel :** +92-21-35876994 - 7

**Fax :** +92-21-35876991 & 35876993

### **CERTIFIED TRUE COPY OF RESOLUTION OF THE BOARD OF DIRECTORS OF WESTERN ENERGY (PRIVATE) LIMITED**

**“RESOLVED THAT** Western Energy (Private) Limited (**“Company”**) be and is hereby authorized to file a Licensee Proposed Modification of Generation (the **“LPM Application”**) to be initiated in respect of generation license issued by NEPRA License No. WPGL/37/2017 on 5<sup>th</sup> January 2017 and in relation thereto, enter into and execute all require documents, make all fillings, attend all hearings, provide all required information and pay all applicable fees, in each case, of any nature whatsoever.”

**“FURTHER RESOLVED THAT** in respect of LPM application, **Mr. Tabish Tapal**, being the Chief Executive Officer of the Company, be and hereby authorized and empowered for and on behalf of Company to:

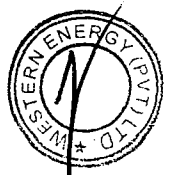
- (i) Review, execute, submit, and deliver the LPM and any related documentation required by National Electric Power Regulator Authority for award of modified Generation, including any contact, documents, power of attorney, affidavits, statements, letters, forms, applications, deeds, guarantees, undertakings, approvals, memoranda, amendments, letters, communications, notices, certificates, requests, statements and any other instruments of any nature whatsoever;
- (ii) Represent the Company in all negotiations. Representations, presentations, hearings, conferences and /or meetings of any nature whatsoever with any entity (including, but in no manner limited to National Electric Power Regulatory Authority, any private parties, companies, partnerships, individuals, governmental and/or semi-governmental authorities and agencies, ministries, boards, departments, regulatory authorities and/or any other entity if any nature whatsoever);
- (iii) Sign and execute the necessary documentation, pay the necessary fees, appear before the National Electric Power Regulatory Authority as needed, and do all acts necessary for completion and processing of the award of Modified Generation License of the Company from National Electric Power Regulatory Authority;
- (iv) Appoint or nominate any one or more officers of the Company or any other person or persons, singly or jointly, in their discretion to communicate with, make presentations to and attend any hearings in connection with the LPM of Company’s Generation License;
- (v) Do all such acts, matters and things as may be necessary for carrying out the purposes aforesaid and giving full effect to the above resolutions.”

  
Tabish Tapal  
Chief Executive Officer

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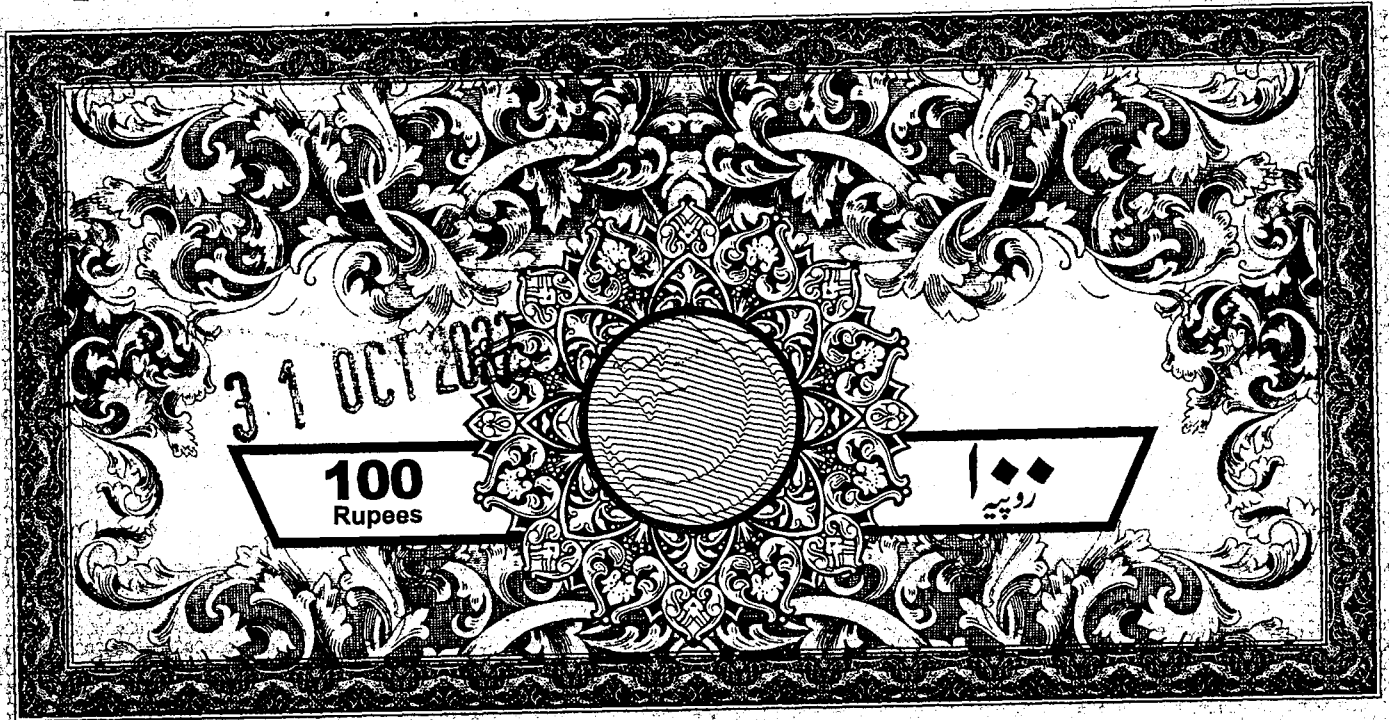
# AFFIDAVIT

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Licensee Proposed Modification Application  
Western Energy (Private) Limited



Mr. ABDUL KALEEM STAMP VENDOR  
LICENSE # 16,

Plot No: 217, Shop No: 02, Near 100 Bed  
Hospital, Steel Town Karachi

SR. NO. 526 DATE 31 OCT 2022

ISSUED TO WITH ADDRESS MR. Western Energy (Pvt) Ltd.

THROUGH WITH ADDRESS MR.

PURPOSE

VALUE RS. ATTACHED

STAMP VENDOR'S SIGNATURE

BEFORE

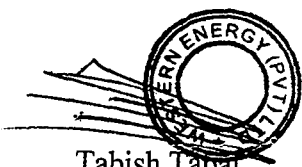
THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

### AFFIDAVIT

I, Tabish Tapal s/o Moiz Ali Tapal, the Chief Executive Officer of Western Energy (Private) Limited, bearing CNIC No 42301-2385059-9, do hereby solemnly affirm and declare on oath as under:

1. The Licensee Proposed Modification (the "LPM Application") in respect of NEPRA's Generation License No. WPGL/37/2017 on 5<sup>th</sup> January 2017 has been filed before the National Electric Power Regulatory Authority and the contents of the same may kindly be read as an integral part of this affidavit.
2. That the contents of the accompanying LPM Application are true and correct to the best of my knowledge and belief and nothing has been concealed or misstated therein.

DEPONENT

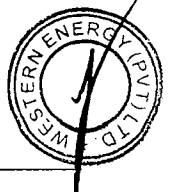


Tabish Tapal  
Chief Executive Officer  
Western Energy (Private) Limited

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# **LICENSEE PROPOSED MODIFICATION**

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## 1. TEXT OF THE PROPOSED MODIFICATION

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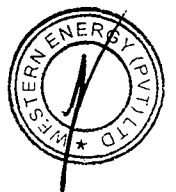
Western Energy (Private) Limited ("Company") was granted Generation License No. WPGL/37/2017 on 5<sup>th</sup> January 2017 (the "**Generation License**") by NEPRA.

Haizhuang Windpower H111-2.0 MW was selected by the Company as Wind Turbine Generators ("**WTG**") for its proposed 50 MW wind power project to be located in Jhimpir, Thatta, Sindh, Pakistan ("**Project**").

The Company desires to modify its Generation License with respect to following;

1. **Change in WTG:** WTG stated in Generation License from Haizhuang Windpower H111-2.0 MW to Goldwind GW140 – 3.4 MW.
2. **Change in Capacity Factor:** Capacity factor stated in Generation License from 40.47% to 38%.
3. **Change in Project Capacity:** Project installed Capacity stated in Generation License from 50 MW to 47.6 MW.
4. **Change in Expected Life of the Generation Facility:** Expected life of the generation facility stated in Generation License from 20 years to 25 years from Commercial Operations Date.

In relation hereto, please find the proposed modifications to Schedule 1 and Schedule 2 of the Generation License attached herewith as *Annexure 1* and *Annexure 2* respectively.





## **2. STATEMENT OF REASONS IN SUPPORT OF MODIFICATIONS**

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### **1. Change in WTG:**

The Company applied for Generation License on 08<sup>th</sup> June 2016 with CSIC (Chongqing) Haizhuang Windpower H111-2.0 MW as WTGs to be installed at Project at a hub height of 80 m.

The Chinese Partner CSIC was also the WTG supplier and as per the yield assessment, the H111-2.0 was not able to achieve capacity of 38% as allowed by NEPRA. Hence, the Chinese partner (CSIC) decided to withdrawal from the Project as equity investors, WTG supplier and EPC contractor. Thereafter, the Company undertook new wind resource assessment study based on which Goldwind GW140 – 3.4 MW is determined as most suitable WTG for its Project site.

### **2. Change in Capacity Factor**

As the land allocated is in close vicinity of the PAF Bholari Base, selection and micro sighting of the wind turbines are effected due to a height restriction perimeters declared by PAF Bholari Base.

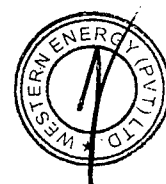
The change in WTG from CSIC (Chongqing) Haizhuang Windpower H111-2.0 MW to Goldwind GW140 – 3.4 MW will change the capacity factor to 38% as determined by NEPRA in the previous tariff determination.

### **3. Change in Project Capacity**

The change in WTG from Haizhuang Windpower H111-2.0 MW to a bigger but fewer in numbers WTG Goldwind GW140 – 3.4 MW will change the Project installed capacity from 50 MW to 47.6 MW.

### **4. Change in Expected Life of the Generation Facility**

The Generation License is based on the expected project operating life of 20 years. However, in the tariff determination of the Company and other recent wind power tariff determinations, the Authority has determined project life and tariff period of 25 years.



### 3. STATEMENT OF IMPACT ON THE TARIFF, QUALITY OF SERVICE AND THE PERFORMANCE BY THE LICENSEE OF ITS OBLIGATION UNDER THE GENERATION LICENSE

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#### *Impact on Tariff*

- a. The proposed change of WTGs from Haizhuang Windpower H111-2.0 MW to Goldwind GW140 – 3.4 MW is based on the latest wind resource and energy yield assessment study. The change of WTGs has no direct impact on tariff, however, since the revised WTG is of larger size and will reduce the total number of WTGs to be installed at site, which will result in achieving a comparatively lower construction cost and consequential reduction in tariff.
- b. The change of WTGs from Haizhuang Windpower H111-2.0 MW to Goldwind GW140 – 3.4 MW is because of the fact that the H111-2.0 was not able to achieve the approved capacity factor due to height restrictions at Project Site. The revised capacity factor requested in this Modification is same as determined by NEPRA so it has no impact on tariff.
- c. The proposed change in Project installed capacity from 50 MW to 47.6 MW has no impact of tariff.
- d. The increased operation life from 20 years to 25 years will result in reduction of levelized cost of energy.

#### *Impact on Services and Performance*

Goldwind is a global leader of clean energy, energy conservation and environmental protection. Goldwind is a key player in promoting energy transformation to attain access to affordable, reliable and sustainable energy for all, and to drive a renewable future. Specializing in wind power, internet of energy and environmental protection, Goldwind leverage strong scientific research innovation and best business practices to take renewable energy utilization efficiency to new heights.

Goldwind has a strong presence globally as well as in Pakistan with following stats:

- 86,134 MW (45,186 WTGs) installed globally.
- 477 MW (278 WTGs) installed in Pakistan.

The proposed WTGs have a proven track record with 459 installations worldwide with a total capacity of 1514 MW.

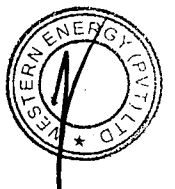
In view of the foregoing, the Company hereby requests NEPRA to approve the proposed modification to the Generation License as such modification would allow the Company to proceed further with the Project and achieve financial close in a timely manner.



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# **ANNEXURE 1 – REVISED SCHEDULE 1 TO THE GENERATION LICENSE**

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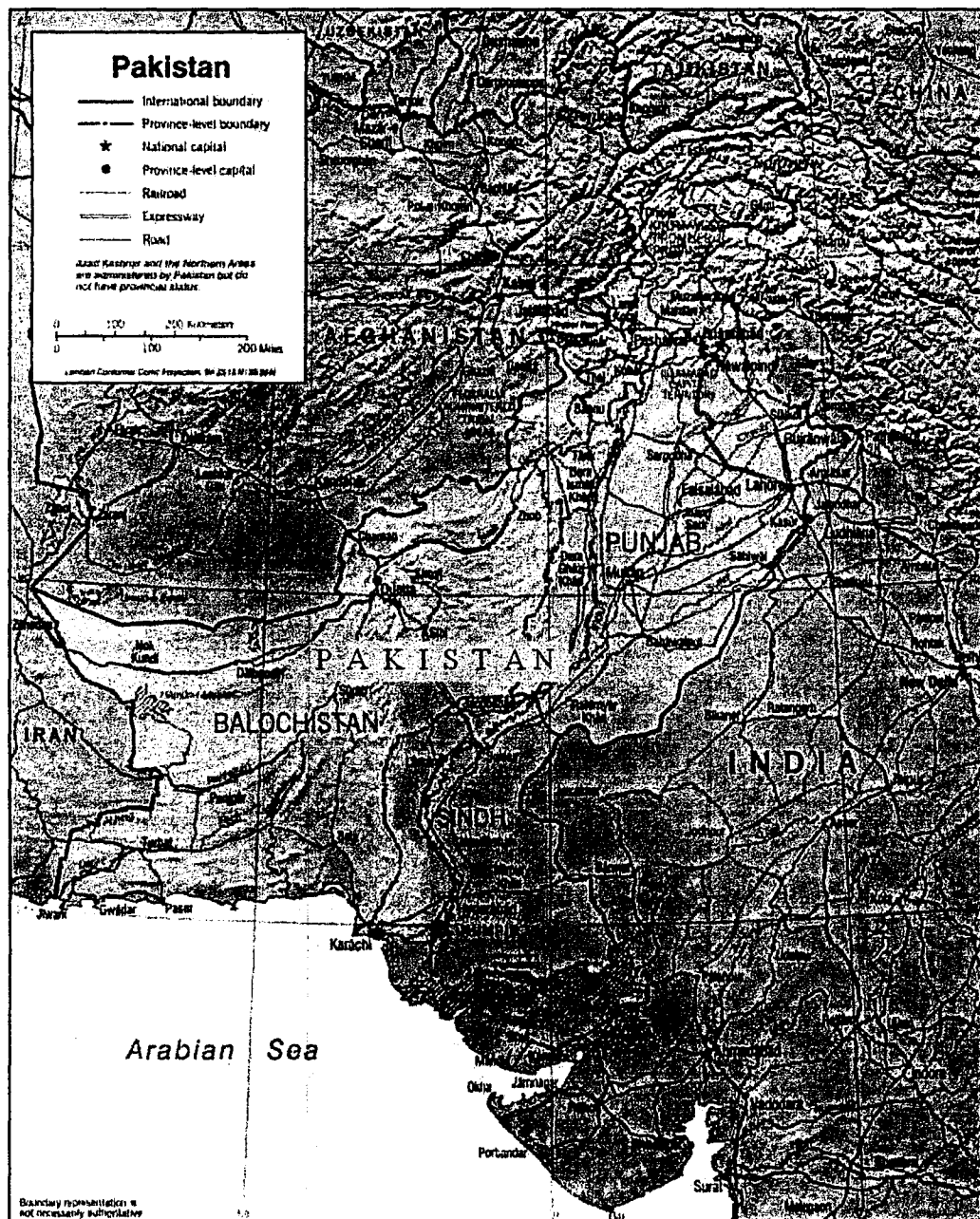
## **SCHEDULE-I**

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.



## Location of Generation Facility/ Wind Farm

The wind farm Project is located in Jhimpir, which is located approximately 109 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 428 acres of land, which has been acquired by the Project Company. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site. The Jhimpir wind corridor is identified as potential area for the development of wind power projects. The geographical location of the project is shown in figure below.

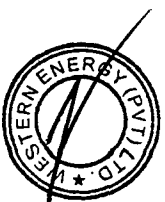


## Project Size

The Project Site has flat terrain with sparse vegetation, consisting of small shrubby bushes. The map is given in Figure below: WEPL Project site is shown in Red.

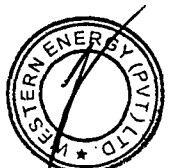
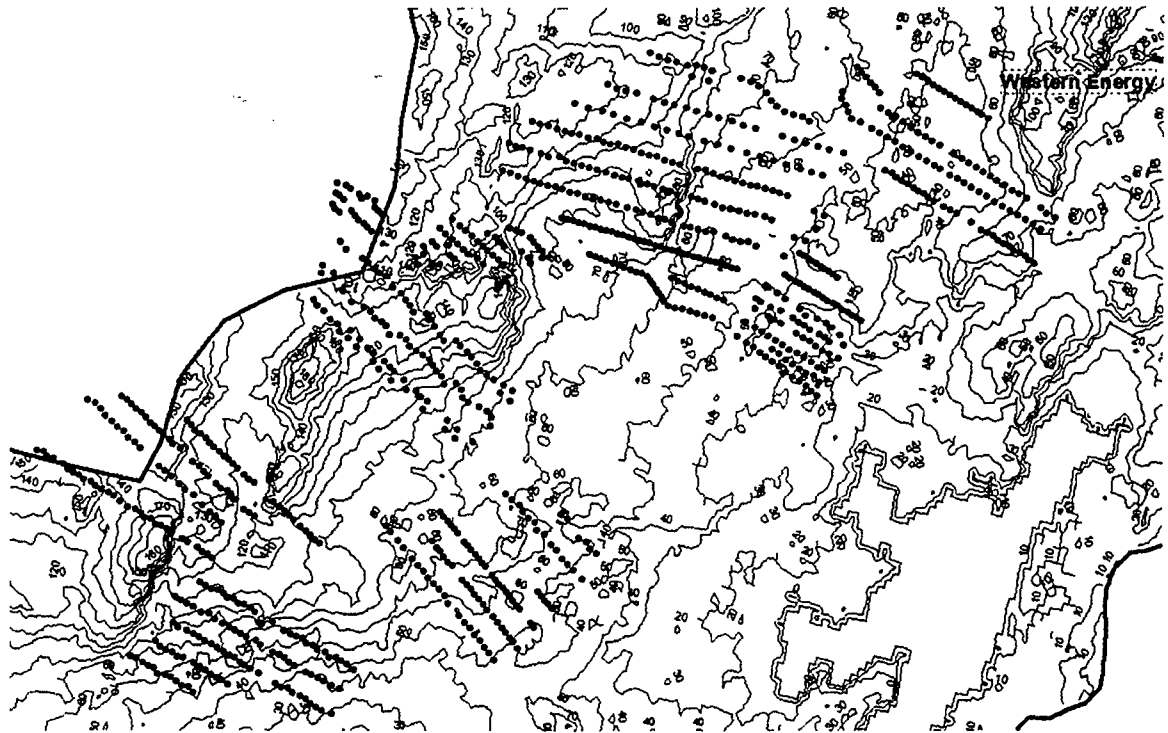


The Project shall have an installed capacity of 47.6 MW rated power. The number of WTGs are 14 with capacity of 3.4 MW each.



## Layout of Generation Facility/ Wind Farm

The general layout along with neighboring Wind Farms of 47.6 MW WEPL is shown in figure below. WEPL turbine are shown in Red color.

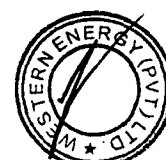


## Land Coordinates of Generation Facility/Wind Farm

Location: Jhimpir – Sindh, Pakistan

The Site coordinates are given in Table below.

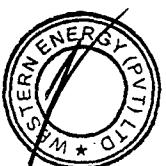
Total Land Area: 428 Acres		
Geodetic Coordinates		
Point No.	Latitude (N)	Longitude (E)
Boundary 1	25° 11' 12.32"	68° 02' 44.02"
Boundary 2	25° 11' 7.61"	68° 02' 40.98"
Boundary 3	25° 10' 0.35"	68° 04' 29.78"
Boundary 4	25° 09' 59.66"	68° 04' 30.91"
Boundary 5	25° 09' 42.21"	68° 05' 8.50"
Boundary 6	25° 09' 38.41"	68° 05' 5.14"
Boundary 7	25° 09' 0.13"	68° 05' 4.99"
Boundary 8	25° 08' 55.40"	68° 05' 1.84"
Boundary 9	25° 09' 33.30"	68° 04' 11.44"
Boundary 10	25° 09' 33.99"	68° 04' 10.28"
Boundary 11	25° 10' 39.92"	68° 02' 23.60"
Boundary 12	25° 10' 35.90"	68° 02' 20.53"





## Micro-Sitting of Generation Facility/Wind Farm

The micro-siting of Wind Farm with 14 WTGs is given in figure below.



The coordinates are WTGs are given in table below.

Wind Turbine	Easting [m]	Northing [m]	Z [m]	HH [m]
GW_01	403538	2784604	49.1	80
GW_02	403770	2784435	50.4	80
GW_03	404013	2784279	50	80
GW_04	404249	2784113	50	80
GW_05	404484	2783950	48.1	80
GW_06	404717	2783784	46.6	80
GW_07	404950	2783620	46	80
GW_08	405191	2783461	46	80
GW_09	405428	2783296	46	80
GW_10	405661	2783132	46	80
GW_11	405898	2782978	46	80
GW_12	406133	2782811	48.2	80
GW_13	406365	2782649	50	80
GW_14	406645	2782488	51.4	80



[illegible]

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

The electric power generated from the Generation Facility/Wind Power Plant of WEPL 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 of WEPL will consist of the following:-

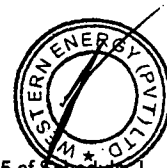
(a). A 3 KM 132-KV double circuit transmission line looping in-out with the sub-cluster connecting the Master Wind Energy (Private) Limited to Jhimpir-1 220/132KV collector substation.

(3). The scheme of interconnection of Wind Power Plant of WEPL also proposes the following reinforcement that is already in place in Jhimpir cluster:-

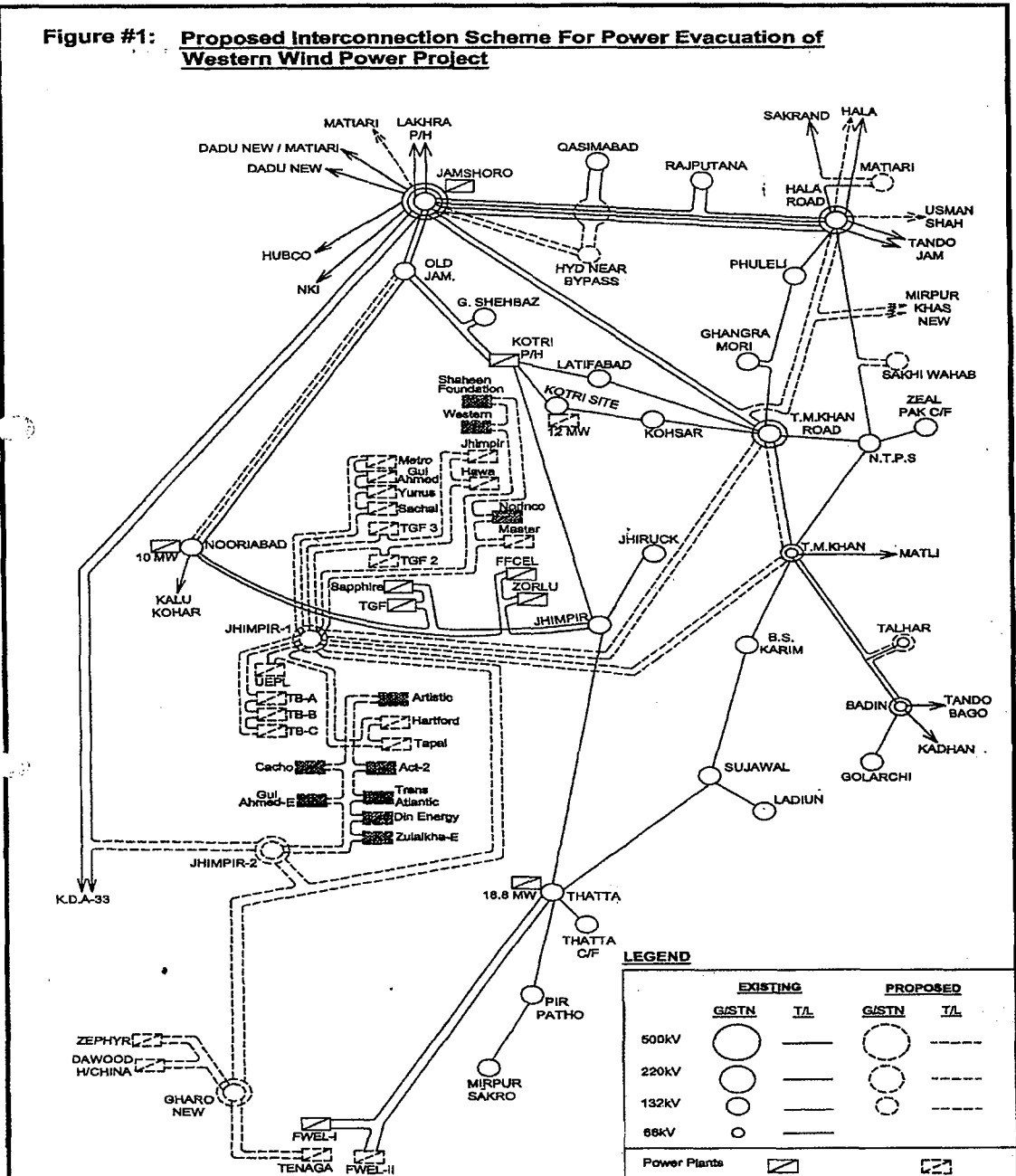
(a). 220 kV D/C transmission line, approximately 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro-KDA-33 D/C transmission line at Jhimpir-2.

(b). 220 kV D/C transmission line, approximately 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.

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



# Schematic Diagram of Interconnection Arrangement/Transmission Facilities for Dispersal of Power from Generation Facility/Wind Power Plant



## Detail of Generation Facility/Power Plant/ Wind Farm

### **(A). General Information**

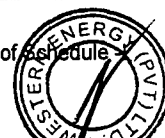
(i).	Name of Applicant/Company	Western Energy Private Limited
(ii).	Registered/Business Office	F -25, Block-5, Rojhan Street, Kehkashan, Clifton, Karachi, Pakistan
(iii).	Plant Location	Jhampir, Nooriabad, District Thatta, Sindh
(iv).	Type of Generation Facility	Wind Power

### **(B). Wind Farm Capacity & Configuration**

(i).	Wind Turbine Type, Make & Model	Goldwind, GW140-3.4 x 14 (HH = 80 m)
(ii).	Installed Capacity of Wind Farm (MW)	47.6 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (kW)	14 x 3400

### **(C). Wind Turbine Details**

<b>(a). <u>Rotor</u></b>		
(i).	Number of blades	3
(ii).	Rotor diameter	140 m
(iii).	Swept area	15482 m <sup>2</sup>
(iv).	Power regulation	Combination of blade pitch angle adjustment, and generator / converter torque control.
(v).	Cut-in wind speed	2.5 m/s
(vi).	Cut-out wind speed	20 m/s
(vii).	Survival wind speed	37.5 m/s (V ref)



(viii)	Pitch regulation	Independent electromechanical pitch system for each blade, rotary drives, 3-stage planetary gearbox
<b>(b). <u>Blades</u></b>		
(i).	Blade length	68.5 m
(ii).	Material	GFRP fiber reinforced resin
<b>(c). <u>Gearbox</u></b>		
(i).	Type	Direct Drive / Gearless
(ii).	Gear ratio	N/A
(iii).	Main shaft	N/A
<b>(d). <u>Generator</u></b>		
(i).	Nominal Power	3400 (kW)
(ii).	Voltage	720 V
(iii).	Type	Synchronous Permanent
(iv).	Degree of Protection	IP54 Generator – IP23 Ring Body
(v).	Coupling	Friction Clutch
(vi).	Power factor	Capacitive 0.925 – Inductive 0.925
<b>(e). <u>Control System</u></b>		
(i).	Type	PLC Control System
(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, trip logs
<b>(f). <u>Brake</u></b>		
(i).	Design	Aerodynamic Brake
(ii).	Operational brake	Aerodynamic brake achieved by feathering blades.

(iii).	Secondary brake	Hydraulic brake
<b>(g). <u>Tower</u></b>		
(i).	Type	Tubular Steel Tower
(ii).	Hub heights	80 m
<b>(h). <u>Yaw System</u></b>		
(i).	Yaw bearing	Ball bearing slewing ring Hydraulic System
(ii).	Brake	Hydraulic and Electromagnetic Braking System
(iii).	Yaw drive	4 Stage Planetary Gearbox
(iv).	Speed	0.5°/s Controlling speed

**(D). Other Details**

(i).	Project Commissioning Date (Anticipated)	2023-2024
(ii).	Expected Life of the Project from Commercial Operation Date (COD)	25 Years

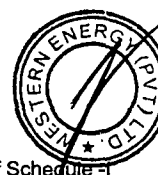


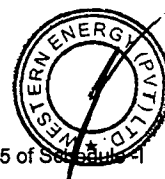
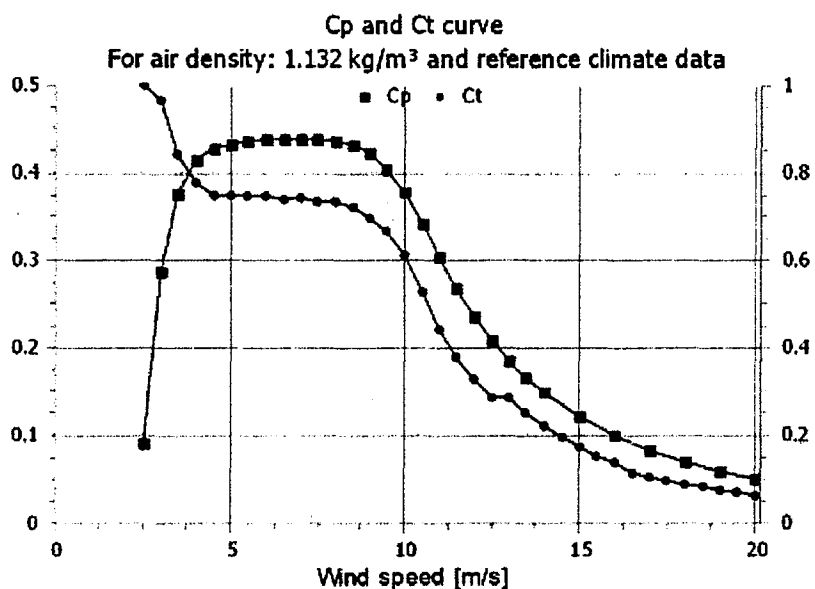
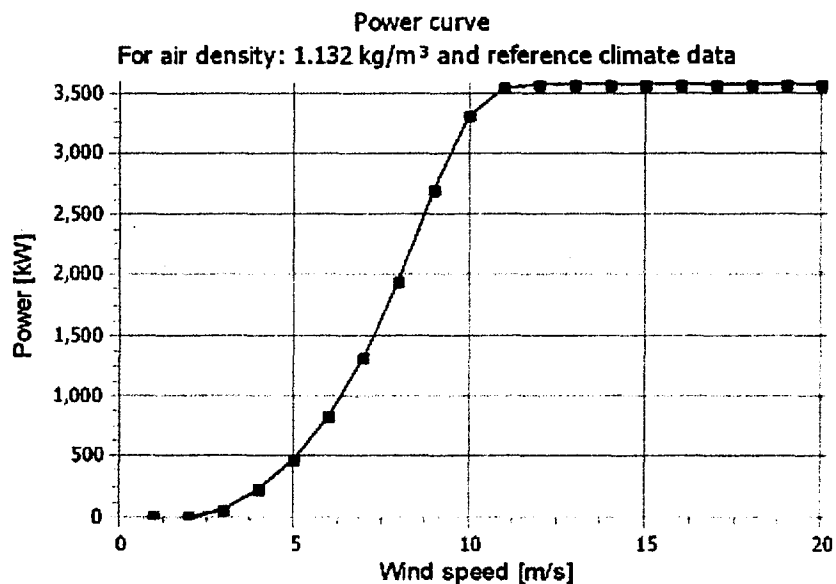


## Power Curve of Goldwind GW140-3.4 WTG

The tabular and graphical values of Power curve are shown below:

Wind speed [m/s]	Power [kW]
2.5	13.22
3	68.67
3.5	142.15
4	233.32
4.5	343.42
5	475.29
5.5	636.88
6	830.91
6.5	1058
7	1323
7.5	1626
8	1963
8.5	2333
9	2709
9.5	3053
10	3318
10.5	3467
11	3551
11.5	3570
12	3570
12.5	3570
13	3570
13.5	3570
14	3570
14.5	3570
15	3570
15.5	3570
16	3570
16.5	3570
17	3570
17.5	3570
18	3570
18.5	3570
19	3570
19.5	3570
20	3570
20.5	0

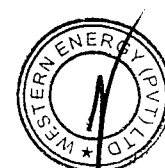




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# **ANNEXURE 2 – REVISED SCHEDULE 2 TO THE GENERATION LICENSE**

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## **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) Annual Energy Generation (GWh) and Net Capacity Factor of the Generation Facility /Wind Farm of Licensee are given in this Schedule.

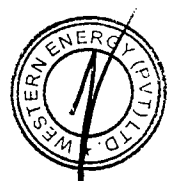


## **SCHEDULE-II**

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	47.6 MW
(2).	Total Annual Full Load Hours	3,329 Hrs.
(3).	Average Wind Turbine Generator (WTG) Availability	97.0 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	216.3
(5).	Array & Miscellaneous Losses (GWh)	45.97
(6).	Availability Losses (GWh)	6.48
(7).	Balance of Plant Losses (GWh)	5.4
(8).	Annual Energy Generation (25 years equivalent Net AEP in GWh)	158.45
(9).	Net Capacity Factor	38%

### **Note**

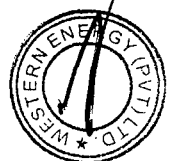
All the above figures are indicative as provided by the Licensee. The net energy available to power purchaser for dispatch will be determined through procedures contained in the energy purchase agreement.



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# **ANNEXURE 3 – TYPE TEST CERTIFICATE OF GOLDWIND GW140 – 3.4 MW**

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# TYPE CERTIFICATE

Certificate No.:  
TC-DNVGL-SE-0074-05925-1

Issued:  
2021-07-01

Valid until:  
2025-06-30

Issued for:

## GW140/3400 Wind Turbine

Specified in Annex 1

Issued to:

## Xinjiang Goldwind Science & Technology Co. Ltd.

No.107 Shanghai Road, Economic & Technological Development Zone, Urumqi, Xinjiang, P. R. China

According to:

## DNVGL-SE-0074:2018-01 Type and component certification of wind turbines according to IEC 61400-22

Based on the document:

FER-TC-DNVGL-SE-0074-05925-1

Final Evaluation Report, dated 2021-06-30

Additional references according to above report are given in Annex 2.

Changes of the system design, the production and erection or the manufacturer's quality system are to be approved by DNV.

Hellerup, 2021-07-01

For DNV Renewables Certification

**Bente Vestergaard**  
Service Line Leader

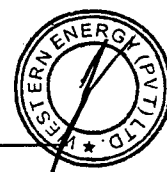


By DAKKS according DIN EN IEC/ISO 17065 accredited Certification Body for products. The accreditation is valid for the fields of certification listed in the certificate.

Shanghai, 2021-07-01

For DNV Renewables Certification

**Tao Ni**  
Project Manager





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## General

Wind turbine class	IIIB (IEC 61400-1 ed.3 + A1)
Power regulation	Variable speed, pitch-controlled
Rotor orientation	Upwind
Rotor tilt	6°
Cone angle	3°
Rated power	3400 kW
Rated wind speed $v_r$	10.0 m/s (HH100) 10.3 m/s (HH80)
Rotor diameter	140 m
Hub height(s)	100 m / 80 m
Hub height operating wind speed range $v_{in}$ - $v_{out}$	2.5 m/s–20 m/s
Design lifetime	20 years
Software version	3000S_E_V161020

## Wind conditions

Turbulence intensity $I_{ref}$ at $v_{hub} = 15$ m/s	0.14
Annual average wind speed at hub height $v_{ave}$	7.5 m/s
Reference wind speed $v_{ref}$	37.5 m/s
Mean flow inclination	8°
Hub height extreme wind speed $v_{e50}$	52.5 m/s

## Electrical network conditions

Normal supply voltage and range	690V±10%
Normal supply frequency and range	50Hz±5%
Voltage imbalance	< 2%
Maximum duration of electrical power network outages	6 hours in Normal condition 1 week in Extreme condition
Number of electrical network outages	20 times per year

## Other environmental conditions

Corrosion Environment	C4 acc. to ISO 12944-2
Normal and extreme temperature ranges	Normal: -10°C to +40°C Extreme: -20°C to +50°C
Relative humidity of the air	Up to 100%
Air density	1.225 kg/m <sup>3</sup>
Solar radiation	1000 W/m <sup>2</sup>
Description of lightning protection system	Designed acc. to IEC 61400-24, Protection Level I







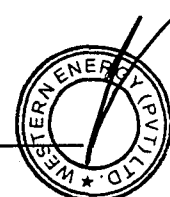
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## Major components

<b>Blade</b>	Type	Sinoma68.6A
	Manufacturer	Sinoma
	Material	Fibre-reinforced plastic (Epoxy / Glass), PVC foam and Balsa
	Blade length	68.6 m
<b>Blade bearing</b>	Number of blades	3
	Drawing / Data sheet / Part no.	SIYP68.6A-00(YJ), Rev. 00
	Type	3 x 2 rows, ball slewing bearing
	Manufacturer 1	Rollix Defontaine Qingdao
<b>Blade bearing</b>	Drawing / Data sheet / Part no.	13-2650-01, Rev. A
	Type	3 x 2 rows, ball slewing bearing
	Manufacturer 2	TMB
	Drawing / Data sheet / Part no.	B030.76.2650K, Rev. 3
<b>Hub</b>	Type	Spheroidal graphite cast iron
	Material	QT400-18AL
	Drawing / Data sheet / Part no.	00037333, Rev. A
<b>Base frame</b>	Type	Spheroidal graphite cast iron
	Material	QT450-18AL
	Drawing / Data sheet / Part no.	00032112, Rev. A
<b>Axle</b>	Type	Spheroidal graphite cast iron
	Material	QT400-18AL
	Drawing / Data sheet / Part no.	00000163, Rev. E
<b>Shaft</b>	Type	Spheroidal graphite cast iron
	Material	QT400-18AL
	Drawing / Data sheet / Part no.	00000164, Rev. C
<b>Rotor</b>	Type	Structural steel, Welded
	Material	Q355 C/D or S355 J0/J2
	Drawing / Data sheet / Part no.	00042361, Rev. B
<b>Stator</b>	Type	Structural steel, Welded
	Material	Q355 C/D or S355 J0/J2
	Drawing / Data sheet / Part no.	00036804, Rev. B
<b>Pitch gear</b>	Type	3 x 3 stages planetary spur teeth gearbox, i = 172.5
	Manufacturer 1	Chongqing Gearbox Co., Ltd.
	Drawing / Data sheet / Part no.	BJ3000JA-WX, Rev.00
	Type	3 x 3 stages planetary spur teeth gearbox, i = 172
	Manufacturer 2	Bonfiglioli
	Drawing / Data sheet / Part no.	531134100, Rev. A (311 L3 FZB)
<b>Pitch gear</b>	Type	3 x 3 stages planetary spur teeth gearbox, i = 172.45
	Manufacturer 3	NGC
	Drawing / Data sheet / Part no.	FDX105F-02-00R1, Rev. D
<b>Pitch motor</b>	Type	3 x 11.78 kW 3-phase AC motor, inverter operated
	Manufacturer 1	Schwarz Elektromotoren GmbH
	Drawing / Data sheet / Part no.	MAKOF 160.5.2.100010





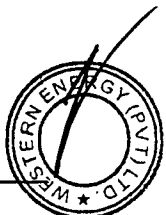
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	Type Manufacturer 2 Drawing / Data sheet / Part no.:	3 x 11.78 kW 3-phase AC motor, inverter operated Suzhou Lego Motors Co., Ltd. MSVF160M-4 (50Hz C3-H corrosion class) MSVF160M-4A(FD) (50Hz C4-H corrosion class)
Pitch belt	Type Manufacturer 1 Drawing / Data sheet / Part no.	3 x TP PU, steel cord reinforced, 200 mm wide Continental 187/16/07/14
	Type Manufacturer 2 Drawing / Data sheet / Part no.:	3 x TP PU, steel cord reinforced, 200 mm wide Mitsuboshi FS-0270
Main bearing	Type Manufacturer 1 Drawing / Data sheet / Part no.	Single row tapered roller bearing Schaeffler-FAG F-620724.TR1- WPOS, Rev. AB – Front bearing F-620723.TR1- WPOS, Rev. AC – Rear bearing
	Type Manufacturer 2 Drawing / Data sheet / Part no.	Single row tapered roller bearing NTN 16-03165-B (CR-37001S30) – Front bearing 16-03166-B (CR-26402S30) – Rear bearing
	Type Manufacturer 3 Drawing / Data sheet / Part no.	Single row tapered roller bearing SKF 20.09.00621, Rev. A (BT1-8173) – Front bearing 20.09.00622, Rev. A (BT1-8174) – Rear bearing
	Type Manufacturer 4 Drawing / Data sheet / Part no.	Single row tapered roller bearing TIMKEN E-55949, Rev. D (NP523309-90WA1) – Rear bearing E-55950, Rev. D (NP348905-90WA1) – Front bearing E-57445, Rev. A (NP348905-90WA2) – Front bearing
Yaw gear	Type Manufacturer 1 Drawing / Data sheet / Part no.	6 x 4 stages planetary spur teeth gearbox, i = 1744.46 Chongqing Gearbox Co., Ltd. PH3000JA-WX, dated 2016-06-25
	Type Manufacturer 2 Drawing / Data sheet / Part no.	6 x 4 stages planetary spur teeth gearbox, i = 1745 Bonfiglioli I7120T022500, Rev.- (MT712T114)
	Type Manufacturer 3 Drawing / Data sheet / Part no.	6 x 4 stages planetary spur teeth gearbox, i = 1744 NGC FDX207F-02-00R1, Rev. A
Yaw motor	Type Manufacturer 1 Drawing / Data sheet / Part no.	6 x 3 kW active drives, 3-phase asynchronous, DOL starter Siemens Standard Motors Ltd. 1LE0001-1CC03-4GB4-Z
	Type Manufacturer 2 Drawing / Data sheet / Part no.	6 x 3 kW electrical motor Bonfiglioli CD00002557, Rev. 02 (BN132S)
	Type Manufacturer 3 Drawing / Data sheet / Part no.	6 x 3 kW electrical motor Jiangxi Special Electric Motor Co., Ltd. YEJ132S-6



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<b>Yaw bearing</b>	Type	2 rows, ball slewing bearing
	Manufacturer 1 Drawing / Data sheet / Part no.	Rollix Defontaine Qingdao 11-2980-01
	Type	2 rows, ball slewing bearing
	Manufacturer 2 Drawing / Data sheet / Part no.	TMB Y032.60.2980K, Rev. A
<b>Yaw brake</b>	Type	8 x YBG-2 CB120 double pad disc brake, hydraulically activated
	Manufacturer 1 Drawing / Data sheet / Part no.	GKN Stromag 381-01217, Rev. A
	Type	8 x 2 calliper disc brake, hydraulically activated
	Manufacturer 2 Drawing / Data sheet / Part no.	Jiangxi Huawu Brake Co., Ltd. SB01540A, Rev. B
	Type	8 x 2 calliper disc brake, hydraulically activated
	Manufacturer 3 Drawing / Data sheet / Part no.	Jiaozuo Rethel Disc Brakes Co., Ltd. DADH120-B I-00, Rev.-
	Type	8 x 2 calliper disc brake, hydraulically activated
	Manufacturer 4 Drawing / Data sheet / Part no.	Jiaozuo City Brakes Development Co., Ltd. GWAB 3-120-B-00, dated 2019-01-25
	Type	8 x 2 calliper disc brake, hydraulically activated
	Manufacturer 5 Drawing / Data sheet / Part no.	Svendborg 590-0135-018, Rev. C (BSAB 120-S-551)
<b>Generator</b>	Type	GW3.0MW(S)-TFY (G0808)
	Manufacturer	Permanent Magnet Synchronous Generator Beijing Goldwind Science & Creation Windpower Equipment Co., Ltd.
	Rated power	3630 kW
	Rated frequency	8.4 Hz
	Rated speed	12 rpm
	Rated voltage	720 V
	Number of phases	6
	Rated current	1706 A
	Insulation class	F
	Degree of protection Drawing / Data sheet / Part no.	IP54 Generator Unit, 00044455, Rev. B
<b>Converter</b>	Type	GW PCS05-CVT01, IGBT full power converter
	Manufacturer	Beijing Etechwin Electric Co., Ltd.
	Rated voltage	690 V
	Rated frequency	50 Hz
	Rated current	2845 A
	Degree of protection Electrical diagram	IP54 5.2003.1022DL01, Rev. B
<b>HH100 Tower</b>	Type	Tubular steel tower
	Number of sections	5
	Length	97.760 m
	Drawing / Data sheet / Part no.	60.00.00282, Rev. D 60.00.00354, Rev. B

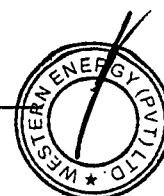


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<b>HH80 Tower</b>	Type	Tubular steel tower
	Number of sections	4
	Length	77.760 m
	Drawing / Data sheet / Part no.	60.00.01530, Rev. A
<b>Manuals</b>	O&M manual	GW-08FW.0207, Rev. C
	Transport manual	GW-08BY.0009, Rev. A1
		GW-08BY.0010, Rev. A1
		GW-08BY.0011, Rev. B1
	Installation / Commissioning manual	GW-08FW.0206, Rev. D
		GW-08FW.0217, Rev. A
		GW-08FW.0418, Rev. A





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The certification is based on the following documents, in addition to the document(s) listed on the front page of this certificate:

DB-DNVGL-SE-0074-02670-3	Design Basis Conformity Statement, dated 2020-09-11
DE-DNVGL-SE-0074-05349-3	Design Evaluation Conformity Statement, dated 2021-06-30
ME-DNVGL-SE-0074-02672-6	Manufacturing Evaluation Conformity Statement, dated 2021-06-30
TT-DNVGL-SE-0074-02673-6	Type Test Conformity Statement, dated 2021-06-30
CC-DNVGL-SE-0074-05688-0	Component Certificate issued by DNV for Sinoma68.6A Rotor Blade, dated 2020-06-17

