LICENSEE PROPOSED MODIFICATION OF GENERATION LICENSE

OF

TRANS ATLANTIC ENERGY (PVT.) LIMITED

49.5 MW WIND POWER PROJECT AT JHIMPIR, DISTRICT THATTA, SINDH PAKISTAN

12TH OCTOBER 2022

TRANS ATLANTIC ENERGY

Letter No. TAEL/NEPRA/12102022/001
Dated: 12th October, 2022

The Registrar,
National Electric Power Regulatory Authority,
NEPRA Tower, Ataturk Avenue, G-5, Islamabad.

Subject: Trans-Atlantic Energy (Private) Limited - Application for Modification of the Generation License

Dear Sir

Trans-Atlantic Energy (Private) Limited ("Company) was granted Generation License No. WPGL/43/2017 on 18th April 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"). The Generation License was later modified on request of the Company on 16th August 2022.

As mentioned in the Generation License, the Project was designed with a capacity of 48.3 MW based on 14 Wind Turbine Generators ("WTG") of Vestas (V126-3.45) with a hub height of 87m. However, in view of current market dynamics, the Project has decided to opt for GoldWind GW155-4.5 with hub height of 95m. This turbine is a 4.5MW turbine which is line with the evolution of wind turbines globally. The turbine is technologically advanced, efficient and one of the largest wind turbines in the industry, with an energy yield suitable for the wind conditions in Jhimpir.

The Company, pursuant to Regulation 10(2) of the NEPRA Licensing (Application and Modification Procedure) Regulations, 1999 ("Regulations"), hereby seeks to apply for a modification of the Generation License granted to the Company to cater the change of WTG from Vestas (V126-3.45) to Goldwind 155-4.5. The aforementioned modification in Generation License with respect to change of WTG requires change of Schedule I and Schedule II (an updated version of Sch I and Sch II are attached with this application).

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 National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, 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.

A BANK DRAFT dated 12th October, 2022 in the sum of PKR 639,218 (Six lacs thirty-nine thousands two hundred eighteen rupees) drawn in favor of National Electric Power Regulatory Authority, being the applicable fee in accordance with Licensing (Application and Modification Procedure) Regulations, 1999 is also attached herewith.

Transatlantic Energy Private Limited
Office No. 1002 10th Floor, Emerald Tower Near 2 Talwar, Clifton, Karachi
Ph# 35147573 - 35147574

TRANS ATLANTIC ENERGY Private Limited

TRANSATLANTIC ENERGY
Private Limited

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.

Sincerely,

Trans Atlantic Energy Private Limited

Adnaan Tapal
General Manager - Operations

Transatlantic Energy Private Limited
Office No. 1002 10th Floor, Emerald Tower Near 2 Talwar, Clifton, Karachi
Ph# 35147573 - 35147574

Trans Atlantic Energy Private Limited

BOARD RESOLUTION

TRANS ATLANTIC ENERGY Private Limited

Dated: 07/10/2022

Board Resolution

"RESOLVED THAT Trans Atlantic 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/43/2017 dated 18th April 2017 and Modification – I dated 16th August 2022 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. Adnaan Tapal, GM Operations, of Company, be and hereby single 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."

Mustafa Tapal
GM Regulatory Affairs
Transatlantic Energy Private Limited

RESOLUTIONS BY CIRCULATION PASSED BY THE BOARD OF DIRECTORS OF TRANS ATLANTIC ENERGY (PRIVATE) LIMITED ON 07 SEPTEMBER 2022

BACKGROUND:

Corporate matters related to Trans Atlantic Energy (Private) Limited (the "**Company**"), including

(i) Authorizing individuals to discuss, negotiate, sign and execute all documents with third parties, regulatory authorities and / or local authorities in relation to the Company developing a 50 MW wind power project located at Jhimpir, District Thatta, Sindh ("**Project**").

BOARD RESOLUTION:

The following resolution is hereby approved by the Board of Directors (the "**Board**")

RESOLVED THAT, Mr Mustafa Tapal, Mr Adnaan Tapal, Mr Fawad Jawed and Mr Farhad Shaikh Mohammad are each hereby singly authorized and empowered to act on behalf of the Company to take all necessary steps and actions for the implementation of the Project and to discuss, negotiate, sign and execute all documents, seek all necessary consents and approvals and (where required) file all necessary documents, declarations, applications and undertakings (and make any amendments thereto) with the relevant regulatory authorities in relation to the Project. Further, the Chief Executive and the authorized representatives are hereby authorized to pay and incur all necessary fees and expenses and to appear and make representations before any regulatory or other authority, as may be necessary or conducive for and in connection with the Project.

TRANS ATLANTIC ENERGY
Private Limited

First Floor, Bahria Complex-III, Karachi, Pakistan
Direct: +92 21 3520 29[illegible] Fax: +92 21 3563 5388

TRANS ATLANTIC ENERGY Private Limited

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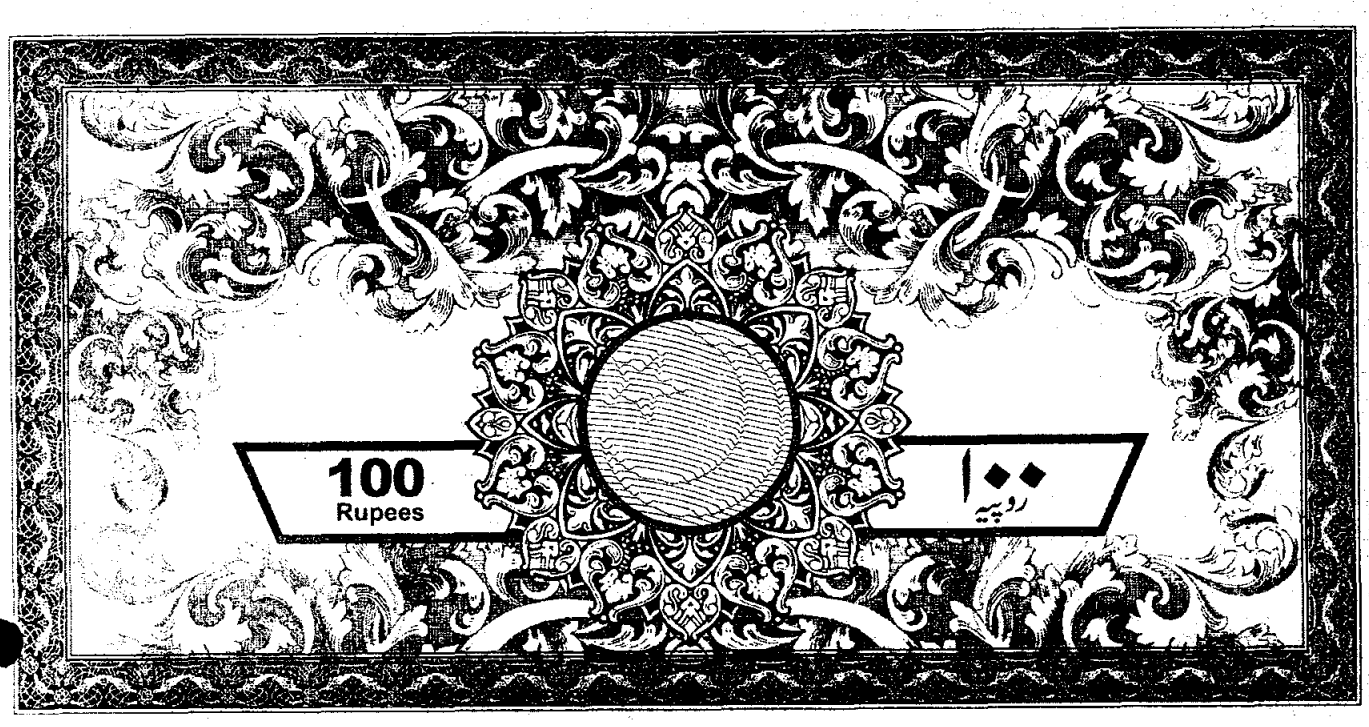
Signature Sheet

Sr. No.	Name of Director	Signature	Date
1	Mr. Pervez Anwer Qureshi		07th September 2022
2	Mr. Waqas Anwer Qureshi		07th September 2022
3	Mr. Ali Maskatiya		07th September 2022
4	Mr. Shahreyar Nawabi		07th September 2022
5	Mr. Barkat Anwer Qureshi		07th September 2022

TRANS ATLANTIC ENERGY Private Limited

AFFIDAVIT

X509150



SYED ALI FARAZ STAMP VENDOR
Shop No. 16, Rizvi Centre, Tariq Road, Boultan Market, Karachi
13950 DATE
ISSUED TO WITH ADDRESS MR. Muhammad Javed Tapoli
ATTORNEY WITH ADDRESS MR. Advocate L.No.8539/92/KHI.
(ATTACHED)
SIGNATURE
NOT RESPONSIBLE FOR ANY FAKE DOCUMENTATIONS
FOR COURT TYPED PAPERS FOR DIVORCE DEED WILL PURPOSE

06 AUG 2022

BEFORE

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

AFFIDAVIT

I Adnaan Tapal s/o Zafar A Tapal, General Manager Operations of Trans Atlantic Energy (Private) Limited, bearing CNIC No 42301-5123339-3, 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/43/2017 by NEPRA on 15th September 2022 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

ADNAAN TAPAL
GM Operations
Trans Atlantic Energy Private Limited

TRANS ATLANTIC ENERGY Private Limited

LICENSEE PROPOSED MODIFICATION

1. TEXT OF THE PROPOSED MODIFICATION

Trans Atlantic Energy (Private) Limited ("**Company**") was granted Generation License No. WPGL/43/2017 on 18th April 2017 (the "**Generation License**") by NEPRA with 20 years of expected life from Commercial Operation date (COD). Later the Company applied a Licensee Proposed Modification (LPM) in its existing Generation License on 18th February 2021 upon which NEPRA granted Modification on Generation License No. WPGL/43/2017 ("**Modification-I**") on 16th August 2022.

Vestas (V126 – 3.45 MW) was selected by the Company as Wind Turbine Generators ("**WTG**") for its proposed 48.3 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 approved in Generation License from Vestas (V126 – 3.45 MW) to Goldwind GW155 - 4.5.

2. ***Change in Hub Height:*** Hub height provided in Generation License from 87m to 95m.

3. ***Change in Capacity Factor:*** Capacity factor stated in Generation License from 37.10% to 38.5%.

4. ***Change in Project Capacity:*** Project installed Capacity stated in Generation License from 48.3 MW to 49.5 MW.

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

1. Change in WTG:

The Company applied for Generation License on 10th June 2016 with Vestas (V126 – 3.45 MW) as WTGs to be installed at Project at a hub height of 137 m. Later the Company applied for LPM on 18th February 2021, upon which NEPRA through Modification – I to the Generation license approved Vestas (V126 – 3.45 MW) at hub height of 87m for the Project.

The Company has now decided to choose a technologically advanced, larger and more efficient WTG for the Project, in line with latest market dynamics. The Company has therefore selected Goldwind GW 155-4.5 MW at hub height of 95m.

2. Change in Hub Height

The earlier selected WTG, i.e. Vestas (V126 – 3.45 MW) has a hub height of 87m, whereas the proposed Goldwind (GW155 – 4.5 MW) has a hub height of 95m. Hence, the change of WTG in Generation License also requires a change in the hub height of WTGs from 87m to 95m.

3. Change in Capacity Factor

The change in WTG from Vestas (V126 – 3.45 MW) to Goldwind GW155- 4.5 MW and hub height (from 87m to 95m) will change the capacity factor from 37.10% to 38.5%.

4. Change in Project Capacity

The change in WTG from Vestas (V126 – 3.45 MW) to a bigger WTG Goldwind (GW155- 4.5 MW) will change the Project installed capacity from 48.3 MW to 49.5 MW.

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

Impact on Tariff

a. The proposed change of WTGs from Vestas (V126 – 3.45 MW) to Goldwind 155 - 4.5 MW will ensure achievement of a higher capacity factor which will result in a lower cost of energy.

b. The proposed change in hub height from 87m to 95m will ensure achievement of a higher capacity factor which will result in a lower cost of energy.

c. The proposed change in capacity factor from 37.10% to 38.5%, will result in a lower cost of energy.

d. The proposed change in Project installed capacity from 48.3 MW to 49.5 MW, will result in a lower 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 and environmental protection, Goldwind leverages strong scientific research, innovation and best business practices to take renewable energy utilization efficiency to new heights.

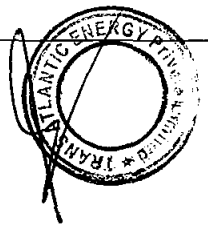
Goldwind has a strong presence globally as well as in Pakistan with following stats:

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

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.

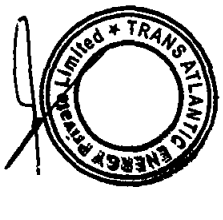
ANNEXURE 1 - MODIFICATION IN SCHEDULE 01 OF THE GENERATION LICENSE

An updated Schedule 01 is attached herewith;



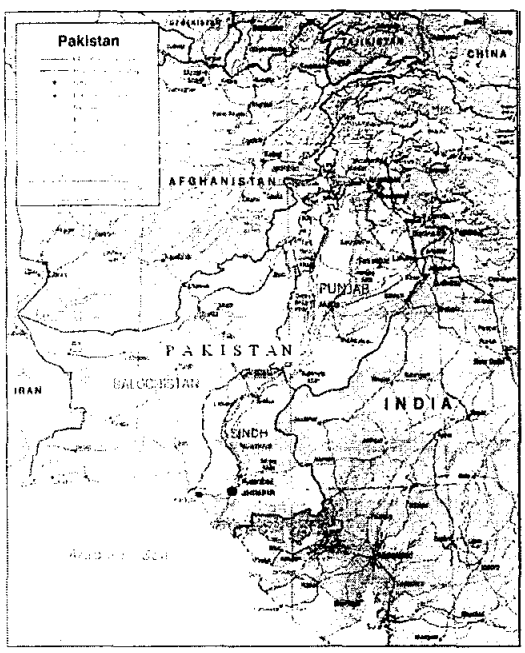
SCHEDULE-I

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 land 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.



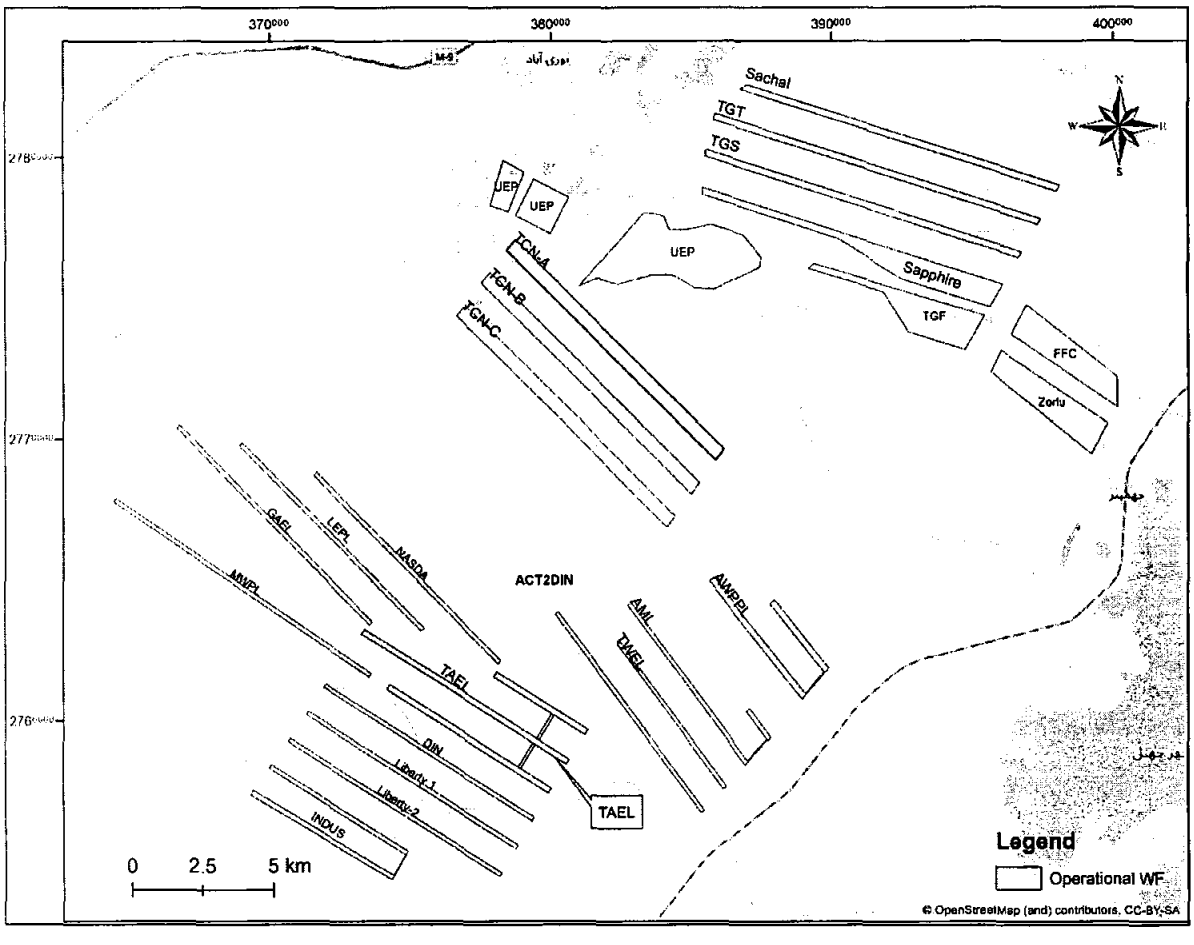
Project Size

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

The Project shall have an installed capacity of approx. 49.5 MW rated power. The number of WTGs are 11 with capacity of 4.5 MW each.

Layout of Generation Facility/ Wind Farm

The general layout along with neighboring Wind Farms of 49.5 MW TAEL is shown in figure below. TAEL Project site is shown in Blue color.



Land Coordinates of Generation Facility/Wind Farm

Location: Jhimpir – Sindh, Pakistan

The Site coordinates are given in Table below.

S.No	Coordinates (UTM Z42, WGS84)	
	Easting	Northing
TA-1	377927.222	2761530.165
TA-2	379980.705	2760223.761
TA-3	379443.934	27593680.033
TA-4	373348.717	2763257.745
TA-5	373241.363	2763088.99·9
TA-6	379336.580	2759211.287
TA-7	378799.809	2758367.559
TA-8	374231.685	2761273.751
TA-9	374124.331	2761105.005
TA-10	379864.266	2757453.320
TA-11	379971.620	2757622.066
TA-12	378884.182	2758313.882
TA-13	379420.953	2759157.610
TA-14	380508.391	2758465.794
TA-15	380615.745	2758634.539
TA-16	379528.307	2759326.356
TA-17	380065.077	2760170.084
TA-18	381152.516	2759478.267
TA-19	381259.870	2759647.013
TA-20	378034.576	2761698.911

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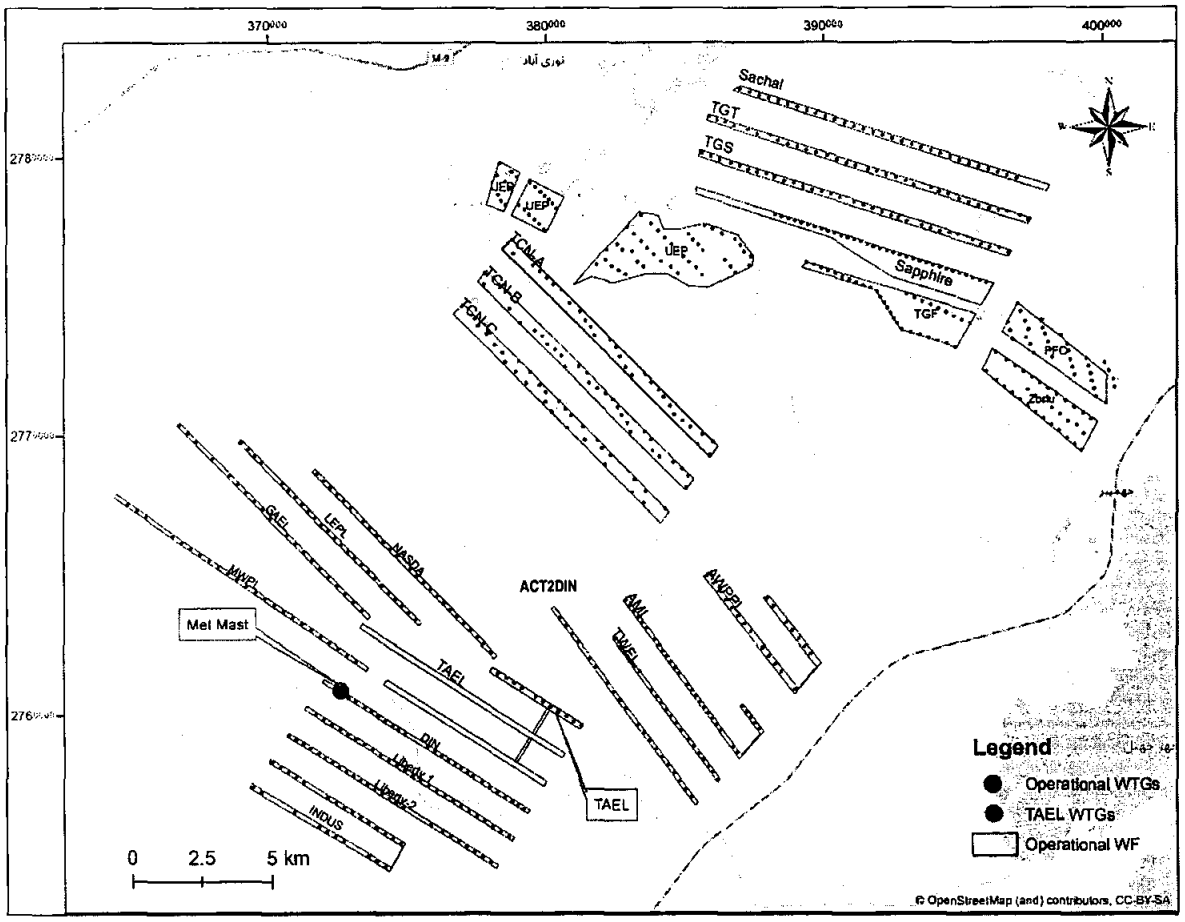
Micro-Sitting of Generation Facility/Wind Farm

The micrositing of Wind Farm with 11 WTGs is given in figure below.



The coordinates are WTGs are given in table below.

Wind Turbine	Easting [m]	Northing [m]
1	378,008	2,761,619
2	378,310	2,761,409
3	378,620	2,761,204
4	378,939	2,761,005
5	379,258	2,760,804
6	379,573	2,760,602
7	379,898	2,760,402
8	380,214	2,760,192
9	380,542	2,759,991
10	380,859	2,759,786
11	381,160	2,759,565

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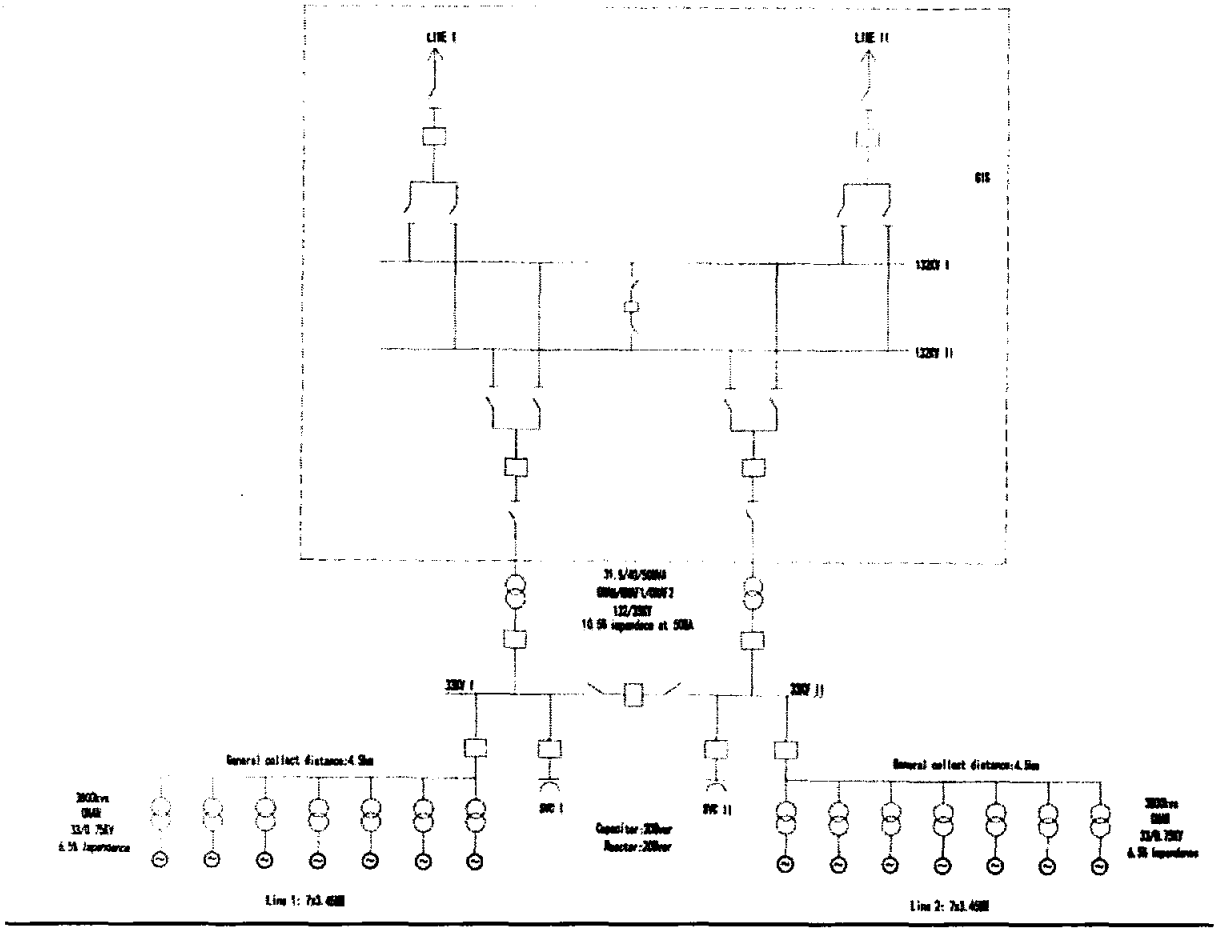
Electrical System Single Line Diagram of Generation Facility/Wind Farm

The project will install 11 WTGs (Goldwind 155-4.5). There shall be four (04) WTG collector group.



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 TAEL shall be dispersed to the National Grid through the load center of HESCO.

(1). The scheme of interconnection of Wind Power Plant of TAEL also proposes the following reinforcement already in place in Jhimpir cluster. The Grid interconnection study has concluded the following:-

(a). A new 220/132 kV Jhimpir-2 substation 3x250 MVA 220/132 kV transformers.

(b). 220 kV double circuit (D/C) transmission line, approx. 18 km long, on twin-bundled Greely conductor for looping In/Out of One circuit of the existing Jamshoro – KDA D/C transmission line at Jhimpir-2.

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

(d). 132 kV transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Trans-Atlantic WPP with Jhimpir-2. In this Scheme, the interconnection of Trans-Atlantic WPP includes 132 kV D/C transmission line, approx. 2 km long, on twin bundled Greeley conductor for looping In/Out from Trans-Atlantic WPP on the 132 kV single circuit from ACT2DIN WPP to DIN WPP.

(2). After conducting the design activity, NTDC has finalized and built two 132kV D/C transmission lines to connect various WPPs (including TAEL) with 220/132 kV Jhimpir-2 substation. Both of the 132kV D/C transmission lines have been

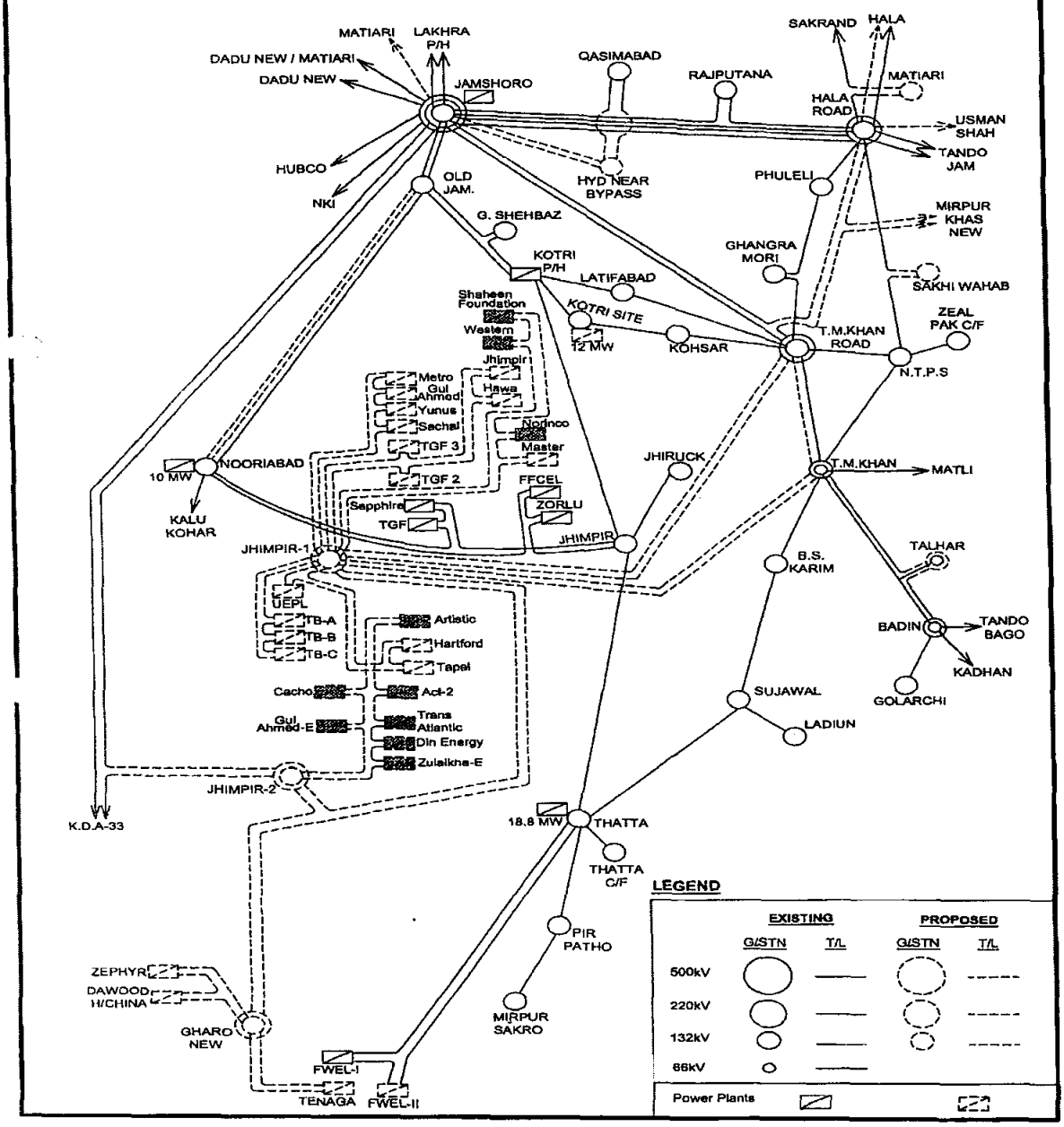
Trans Atlantic Energy Private Limited

constructed. The in and out D/C circuit of about 2km is to be constructed to connect TAEL WPP.

(3). Any change in the above mentioned Interconnection Arrangement/Transmission Facilities duly agreed by TAEL, 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

Figure #1: Proposed Interconnection Scheme For Power Evacuation of Western Wind Power Project



Detail of Generation Facility/Power Plant/ Wind Farm

(A). General Information

(i).	Name of Applicant/Company	Tans Atlantic Energy Private Limited
(ii).	Registered/Business Office	10th Floor, Emerald Tower, Clifton, Block 5, Karachi 75600
(iii).	Plant Location	Deh Kohistan, Jhimpir, District Thatta, Sindh
(iv).	Type of Generation Facility	Wind Power Plant

(B). Wind Farm Capacity & Configuration

(i).	Wind Turbine Type, Make & Model	Goldwind GW155-4.5MW
(ii).	Installed Capacity of Wind Farm (MW)	49.5 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (kW)	11 x 4500 kW

(C). Wind Turbine Details

(a).	**Rotor**	
(i).	Number of blades	3
(ii).	Rotor Speed	5.5-9.5 rpm
(iii).	Roater Diameter	155 m
(iv).	Swept Area	18,869 m^2
(v).	Power Regulation	Variable speed and pitch regulation
(vi).	Cut- in wind speed	2.5 m/s
(vii)	Rate power wind speed	10.8 m/s for standard air density1.225kg/m^3

(viii)	Cut-out wind speed	24 m/s
(viii)	Survival wind speed	52.5m/s
(ix)	Pitch regulation	Hydraulic pitch cylinder drives a ring gear mounted to the inner race of the blade pitch bearing
(b).	**Blades**	
(i).	Blade length	76 m
(ii).	Material	Glass fiber reinforced epoxy resin composite
(c).	**Gearbox**	
(i).	Type	N/A
(ii).	Gear ratio	N/A
(iii).	Weight	N/A
(iv).	Oil Quantity	N/A
(v).	Main shaft	N/A
(d).	**Converter**	
(i).	Type	Full power converter
(ii).	Rated Voltage	690 V
(iii).	Rated Current	4800 A
(e).	**Generator**	
(i).	Power	4800kW
(ii).	Voltage	760 V
(iii).	Type	Permanent magnet synchronous generator
(iv).	Speed	9.5 rpm
(v).	Enclosure class	F
(vi).	Coupling	Friction coupling
(vii).	Efficiency	≥ 97%

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(viii).	Weight	8,050 kg
(ix).	Power factor	0.95
(f).	**Yaw System**	
(i).	Yaw bearing	Double-row ball bearing slewing ring
(ii).	Brake	Friction brake, motor brake
(iii).	Yaw drive	Multiple stages geared
(iv).	Speed	0.46°/s
(g).	**Control System**	
(i).	Type	CX51 30
(ii).	Scope of monitoring	Remote monitoring of more than 500 different parameters, e.g., temperature sensors, pitch parameters, generator torque, wind speed and direction, etc.
(iii).	Recording	Production data, event list, long and short-term trends
(h).	**Brake**	
(i).	Design	Aerodynamic Brake
(ii).	Operational brake	Aerodynamic brake achieved by feathering blades.
(iii).	Secondary brake	Hydraulic brake
(i).	**Tower**	
(i).	Type	Tapered steel tower
(ii).	Hub heights	95 m

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(D). Other Details

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

Power Curve
of Wind Turbine Generator (WTG) of
Goldwind 155 – 4.5 MW
(Tabular)

Table 1 Dynamic PC (Air density 1.225kg/m^3, Turbulence intensity 10%)

Wind speed (m/s)	Power (kW)	Wind speed (m/s)	Power (kW)
2.5	11.06	13.5	4500.00
3	88.08	14	4500.00
3.5	191.55	14.5	4500.00
4	317.60	15	4500.00
4.5	469.88	15.5	4500.00
5	653.02	16	4500.00
5.5	877.23	16.5	4500.00
6	1142.83	17	4500.00
6.5	1459.88	17.5	4500.00
7	1821.08	18	4500.00
7.5	2232.89	18.5	4486.81
8	2675.07	19	4442.83
8.5	3146.57	19.5	4350.96
9	3602.48	20	4186.87
9.5	3998.21	20.5	3915.98
10	4279.55	21	3586.00
10.5	4416.45	21.5	3226.43
11	4486.16	22	2864.70
11.5	4498.97	22.5	2517.18
12	4500.00	23	2192.42
12.5	4500.00	23.5	1958.49
13	4500.00	24	1767.13

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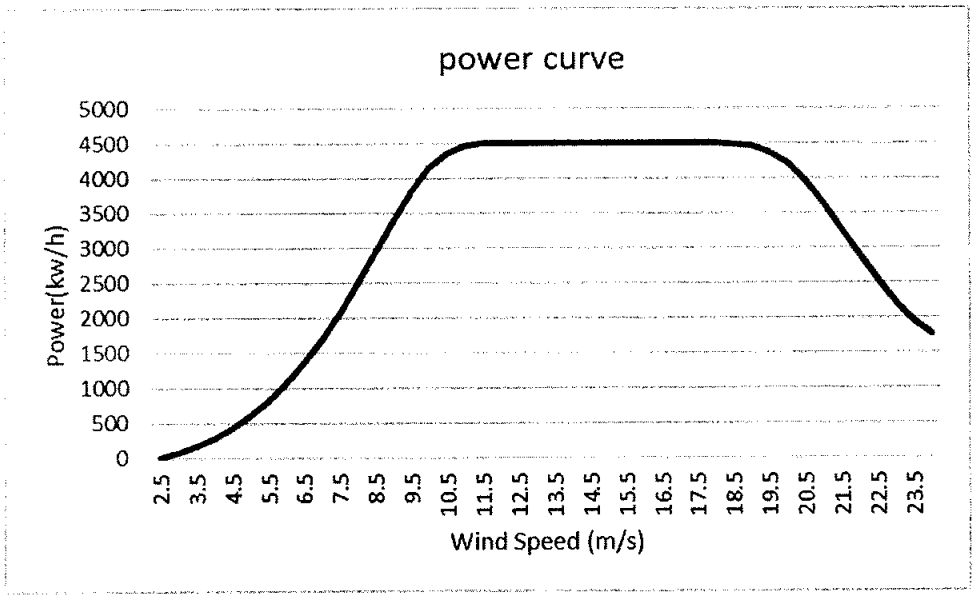
Power Curve
of Wind Turbine Generator (WTG) of
Goldwind 155 – 4.5 MW
(Graphical)



ANNEXURE 2 - MODIFICATION IN SCHEDULE 02 OF THE GENERATION LICENSE

An updated Schedule 02 is attached herewith;

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)	49.5 MW
(2).	Total Annual Full Load Hours	3,373 Hrs
(3).	Average Wind Turbine Generator (WTG) Availability	97.0 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	236.8
(5).	Array & Miscellaneous Losses (GWh)	56.84
(6).	Availability Losses (GWh)	7.10
(7).	Balance of Plant Losses (GWh)	5.92
(8).	Annual Energy Generation (25 years equivalent Net AEP in GWh)	166.94
(9).	Net Capacity Factor	38.5%

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.

ANNEXURE 3 – TYPE TEST CERTIFICATE OF GOLDWIND GW155 – 4.5 MW

鉴衡认证
CHINA GENERAL CERTIFICATION

Type Certificate

Type Certificate No.: CGCTC2021461130131 Valid until: 2025-06-14

This certificate is issued to

Xinjiang Goldwind Science & Technology Co., Ltd.

107 Shanghai Road, Economic & Technological Development Zone, Urumqi,

Xinjiang 830026, China

for the wind turbine designed for cold climate

GW155-4.5

With Blade Type GW76 and Hub Height 95m

This certificate attests compliance with IEC 61400-1 "Wind turbines – Part 1: Design requirements", Third edition, 2005-08 and Amendment 1, 2010-10, Class S, GB/T 29543-2013 "Wind turbine generator systems for cold environments" concerning the design and manufacture.

Reference documents:

Design Basis Evaluation Conformity Statement	No. CGCSZ202046113078	2021-10-12
Design Evaluation Conformity Statement	No. CGCSP202046113078	2021-10-12
Type Test Conformity Statement	No. CGCXS202046113078	2021-10-12
Manufacturing Conformity Statement	No. CGCZN202046113078	2021-10-12
Final Evaluation Report	No. CGCTC202046113078	2021-10-12

Conformity evaluation was carried out according to GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT).

The wind turbine type is specified in the Annex (9 pages total).

Any change in the system design or the manufacturer's quality system is to be approved by CGC. Without approval, the certificate loses its validity. Regular surveillance is to be carried out by CGC to validate the Certificate.

Date of issue: 2021-10-12

Signature:

China General Certification Center

China General Certification Center

Address:Room 301, 3/F., Building 26, No.6, Hepingli North Street , Dongcheng District, Beijing, China

Website: www.cgc.org.cn

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Machine parameters:

Power regulation:	Variable speed and pitch regulation
Rotor orientation:	Upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	3°
Rated power:	4500kW
Rated wind speed V_r:	10.3m/s
Rotor diameter:	155.06m
Hub height(s):	95m
Hub height operating wind speed range $V_{in} - V_{out}$:	2.5m/s-24m/s
Design life time:	20 years

Wind conditions:

Characteristic turbulence intensity I_{ref} at V_{hub} = 15 m/s:	See appendix
Annual average wind speed at hub height V_{ave}:	8.71m/s*
Reference wind speed V_{ref}:	42.16m/s*
Mean flow inclination:	0.9°*
Wind shear α	0.11 for extreme wind model, 0.12* for other wind models
Annual wind speed distribution	Weibull distribution: Shape parameter k = 2.133* Scale parameter C =9.84m/s*
Hub height 50-year extreme wind speed V_{e50}:	59.024m/s*

Electrical network conditions:

Normal supply voltage and range:	690V±10%
Normal supply frequency and range:	50Hz±2%
Voltage imbalance:	≤2%
electrical power network outages:	7 days
etwork outages:	20 times per year

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Other environmental conditions (where taken into account):

Normal and extreme temperature ranges:	Normal: -30℃ to +40℃ Extreme: -40℃ to +50℃
Relative humidity of the air:	≤95%
Air density:	1.138 kg/m^3*(Annual average temperature) 1.296kg/m^3*(lowest temperature) 1.296kg/m^3*(Instantaneous minimum operating temperature)
Solar radiation:	1000W/m^2
Lightning protection system (standard and protection class):	LPLI
Earthquake model and parameters (standard and key parameters e.g. spectrum, model, seismic zone, soil class, etc.):	NA
Other design conditions:	NA

Note 1: The design parameters marked with "*" are defined by the manufacturer, and the design parameters without "*" are consistent with the definition of IEC 61400-1:2005 Ed.3 incl. A1 2010 and GB/T 29543-2013 standard wind turbine generator sets;

Note 2: In case of any parameters listed in the table above exceeded by the actual external conditions of a wind farm, additional evaluations shall be necessary.

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Major components:
**If not otherwise stated, the certificate holder is the manufacturer.

Blade:

Type:	GW76
Material:	Glass fiber reinforced epoxy resin composite
Blade length:	76m
Number of blades:	3
Manufacturer:	Xinjiang Goldwind Science & Technology Co., Ltd.
Drawing / Data sheet / Part No.:	10.15.01867

Blade bearing:

Type:	Three-row roller bearing slewing ring
Manufacturer:	LIEBHERR
Drawing / Data sheet / Part No.:	ROD02640-050DO18-001-900
Type:	Three-row roller bearing slewing ring
Manufacturer:	Tianma (Chengdu) Railway Bearing Co., Ltd.
Drawing / Data sheet / Part No.:	B130.50.2643K3

Pitch System:

Motor / Actuator Type:	Electric power unit
Pitch System Type:	GW PS05B-PIH02
Manufacturer:	Beijing Etechwin Electric Co., Ltd.
Pitch Controller Type:	PIC-a-CNU
Manufacturer:	PRACTEK Technology Co., Ltd.
Pitch motor Type:	LG132D-15A-RB0
	LEGO
Part No.:	LG132D-15A-RB0

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Pitch motor Type:	MVP2-15D-15CD-R1A4X-GW
Manufacturer:	INOVANCE
Drawing / Data sheet / Part No.:	MVP2-15D-15CD-R1A4X-GW
Pitch gearbox Type:	BJ3000JA
Manufacturer:	ChongQing Gearbox Co., Ltd.
Drawing / Data sheet / Part No.:	BJ3000JA-WX
Pitch gearbox Type:	FDX105F-02-00R1
Manufacturer:	Nanjing High Speed & Accurate Gear (Group) Co., Ltd.
Drawing / Data sheet / Part No.:	FDX105F-02-00R1
Pitch gearbox Type:	2T100130890
Manufacturer:	Bonfiglioli Drives (Shanghai) Co., Ltd.
Drawing / Data sheet / Part No.:	531134100

Wheel hub:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00089882

Main shaft:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00059659
	00059657

Main bearing:

–	Tapered roller
	SKF

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Drawing / Data sheet / Part No.:	BT1-8224
	BT1-8174
Type:	Tapered roller
Manufacturer:	NTN
Drawing / Data sheet / Part No.:	19-04255
	19-03463
Type:	Tapered roller
Manufacturer:	Timken
Drawing / Data sheet / Part No.:	E-58124
	E-58593
	E-55949
Type:	Tapered roller
Manufacturer:	FAG
Drawing / Data sheet / Part No.:	EDD F-636543.03.TR1-WPOS 000
	EDD F-620723.05.TR1-WPOS 000

Yaw System:

Drive Type:	Three-phase asynchronous motor
Manufacturer:	Jiangxi Special Electric Motor Co., Ltd.
Drawing / Data sheet / Part No.:	YEJ132S-6-HZ-JFK
Yaw bearing Type:	Double-row ball bearing slewing ring
Manufacturer:	Defontaine Machinery(Qingdao) Co., Ltd.
Drawing / Data sheet / Part No.:	I7120T022500
Yaw bearing Type:	Double-row ball bearing slewing ring
	Tianma (Chengdu) Railway Bearing Co., Ltd.
Part No.:	Y032.65.2975K

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Yaw gearbox Type:	4-stage planetary gear
Manufacturer:	ChongQing Gearbox Co., Ltd.
Drawing / Data sheet / Part No.:	PH3000JA-WX
Yaw gearbox Type:	4-stage planetary gear
Manufacturer:	Nanjing High Speed & Accurate Gear (Group) Co., Ltd.
Drawing / Data sheet / Part No.:	FDX207F-02-00R1
Yaw gearbox Type:	5-stage planetary gear
Manufacturer:	Bonfiglioli Drives (Shanghai) Co., Ltd.
Drawing / Data sheet / Part No.:	I7120T022500
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	GKN Taicang Co., Ltd.
Drawing / Data sheet / Part No.:	8090-50002
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	Jiaozuo Rethel Disc Brakes Co., Ltd.
Drawing / Data sheet / Part No.:	DADH120-B1-00
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	Jiangxi Huawu Brake Co., Ltd.
Drawing / Data sheet / Part No.:	SZSB01540

Generator:

Type:	Permanent magnet synchronous generator
Manufacturer:	Xinjiang Goldwind Science & Technology Co., Ltd. Jiangsu Crrc Electric Co., Ltd
Drawing / Data sheet / Part No.:	GW 4.XMW-TFY (G0812)
Rated Power:	4800kW
	8.8667Hz

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Rated Speed:	9.5rpm
Rated Voltage:	≤760V(stator)
Rated Current:	2086A(stator)
Insulation Class:	F
Degree of Protection:	IP54

Converter:

Type:	Full power converter
Manufacturer:	Beijing Etechwin Electric Co., Ltd.
Drawing / Data sheet / Part No.:	PCS05A-CVT01
Rated Voltage (grid side):	690V
Rated Current (grid side):	4800A
Degree of Protection:	IP54

Main Frame:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00077451

Tower:

Type:	Tapered steel tower
Material:	4
Sections:	91.95m
Length:	Q355NE/Q355NEZ35/Q355NEZ35 （Tower/Flange/Door）
Drawing / Data sheet / Part No.:	60.00.01793

Control System:

Main controller Type:	CX5130
Master controller manufacturer:	Beckhoff Automation GmbH & Co. KG
'are version No.:	4X00_E_V180430 INIT_a4500_bGW_c76_dGT_e95_gGW_hLand

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Main controller software designer: Xinjiang Goldwind Science & Technology Co., Ltd.

Manuals:

Operation & maintenance manual:	GW-08FW. 1022 Rev. A
Transport manual:	GW-08BY. 0048 Rev. A
Installation Manual:	GW-08FW. 0845 Rev. A

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鉴衡认证
CHINA GENERAL CERTIFICATION

Appendix:

Representative value of turbulence intensity					
Wind speed (m/s)	TI for extreme load cases (%)	TI for fatigue load cases (%)	Wind speed (m/s)	TI for extreme load cases (%)	TI for fatigue load cases (%)
2.5	29.5	30.5	14.5	10.4	12.6
3.5	24.4	25.2	15.5	10.3	11.8
4.5	21.3	22.7	16.5	9.7	11.2
5.5	18.9	21.4	17.5	9.4	10.5
6.5	16.9	20.5	18.5	9	10.6
7.5	15	20	19.5	8.7	10.1
8.5	13.5	17.5	20.5	8.3	9.4
9.5	12.8	18.3	21.5	8	9.2
10.5	12.3	17.1	22.5	8.1	9.3
11.5	11.6	14.7	23.5	8	9.6
12.5	11.6	13.4	24	8	9.6
13.5	10.9	12.6			

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鉴衡认证
CHINA GENERAL CERTIFICATION

Design Basis Evaluation Conformity Statement

Statement No.: CGCSZ202046113078

This conformity statement is issued to

Xinjiang Goldwind Science & Technology Co., Ltd.
107 Shanghai Road, Economic & Technological Development Zone, Urumqi,
Xinjiang 83002 6, China

for the wind turbine designed for cold climate

GW155-4.5
With Blade Type GW76 and Hub Height 95m

This certificate attests compliance with IEC 61400-1 "Wind turbines – Part 1: Design requirements", Third edition, 2005-08 and Amendment 1, 2010-10, Class S, GB/T 29543-2013 "Wind turbine generator systems for cold environments" concerning the design.

Design basis evaluation report (5 parts total, part 1~part 5) No. SZ202046113078 2021-10-12

Conformity evaluation was carried out according to GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT).

The wind turbine type is specified in the Annex (9 pages total).

Any change in the design is to be approved by CGC. Without approval, the statement loses its validity.

Date of issue: 2021-10-12

Signature:

China 北京鉴衡认证中心有限公司 证书专用章 110105249097 Center

China General Certification Center

Address:Room 301, 3/F., Building 26, No.6, Hepingli North Street , Dongcheng District, Beijing, China
Website: www.cgc.org.cn

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Machine parameters:

Power regulation:	Variable speed and pitch regulation
Rotor orientation:	Upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	3°
Rated power:	4500kW
Rated wind speed V_r:	10.3m/s
Rotor diameter:	155.06m
Hub height(s):	95m
Hub height operating wind speed range V_{in} – V_{out}:	2.5m/s-24m/s
Design life time:	20 years

Wind conditions:

Characteristic turbulence intensity I_{ref} at V_{hub} = 15 m/s:	See appendix
Annual average wind speed at hub height V_{ave}:	8.71m/s*
Reference wind speed V_{ref}:	42.16m/s*
Mean flow inclination:	0.9°*
Wind shear α	0.11 for extreme wind model, 0.12* for other wind models
Annual wind speed distribution	Weibull distribution: Shape parameter k = 2.133* Scale parameter C =9.84m/s*
Hub height 50-year extreme wind speed V_{e50}:	59.024m/s*

Electrical network conditions:

Normal supply voltage and range:	690V±10%
Normal supply frequency and range:	50Hz±2%
Voltage imbalance:	≤2%
Maximum duration of electrical power network outages:	7 days
network outages:	20 times per year

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Other environmental conditions (where taken into account):

Normal and extreme temperature ranges:	Normal: -30℃ to +40℃ Extreme: -40℃ to +50℃
Relative humidity of the air:	≤95%
Air density:	1.138 kg/m^3*(Annual average temperature) 1.296kg/m^3*(lowest temperature) 1.296kg/m^3*(Instantaneous minimum operating temperature)
Solar radiation:	1000W/m^2
Lightning protection system (standard and protection class):	LPLI
Earthquake model and parameters (standard and key parameters e.g. spectrum, model, seismic zone, soil class, etc.):	NA
Other design conditions:	NA

Note 1: The design parameters marked with "*" are defined by the manufacturer, and the design parameters without "*" are consistent with the definition of IEC 61400-1:2005 Ed.3 incl. A1 2010 and GB/T 29543-2013 standard wind turbine generator sets;

Note 2: In case of any parameters listed in the table above exceeded by the actual external conditions of a wind farm, additional evaluations shall be necessary.

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鉴衡认证
CHINA GENERAL CERTIFICATION

Annex

Major components:
**If not otherwise stated, the certificate holder is the manufacturer.

Blade:

Type:	GW76
Material:	Glass fiber reinforced epoxy resin composite
Blade length:	76m
Number of blades:	3
Manufacturer:	Xinjiang Goldwind Science & Technology Co., Ltd.
Drawing / Data sheet / Part No.:	10.15.01867

Blade bearing:

Type:	Three-row roller bearing slewing ring
Manufacturer:	LIEBHERR
Drawing / Data sheet / Part No.:	ROD02640-050DO18-001-900
Type:	Three-row roller bearing slewing ring
Manufacturer:	Tianma (Chengdu) Railway Bearing Co., Ltd.
Drawing / Data sheet / Part No.:	B130.50.2643K3

Pitch System:

Motor / Actuator Type:	Electric power unit
Pitch System Type:	GW PS05B-PIH02
Manufacturer:	Beijing Etechwin Electric Co., Ltd.
Pitch Controller Type:	PIC-a-CNU
Manufacturer:	PRACTEK Technology Co., Ltd.
Pitch motor Type:	LG132D-15A-RB0
	LEGO
/ Part No.:	LG132D-15A-RB0

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Pitch motor Type:	MVP2-15D-15CD-R1A4X-GW
Manufacturer:	INOVANCE
Drawing / Data sheet / Part No.:	MVP2-15D-15CD-R1A4X-GW
Pitch gearbox Type:	BJ3000JA
Manufacturer:	ChongQing Gearbox Co., Ltd.
Drawing / Data sheet / Part No.:	BJ3000JA-WX
Pitch gearbox Type:	FDX105F-02-00R1
Manufacturer:	Nanjing High Speed & Accurate Gear (Group) Co., Ltd.
Drawing / Data sheet / Part No.:	FDX105F-02-00R1
Pitch gearbox Type:	2T100130890
Manufacturer:	Bonfiglioli Drives (Shanghai) Co., Ltd.
Drawing / Data sheet / Part No.:	531134100

Wheel hub:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00089882

Main shaft:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00059659 00059657

Main bearing:

Type:	Tapered roller
	SKF

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CHINA GENERAL CERTIFICATION

Annex

Drawing / Data sheet / Part No.:	BT1-8224
	BT1-8174
Type:	Tapered roller
Manufacturer:	NTN
Drawing / Data sheet / Part No.:	19-04255
	19-03463
Type:	Tapered roller
Manufacturer:	Timken
Drawing / Data sheet / Part No.:	E-58124
	E-58593
	E-55949
Type:	Tapered roller
Manufacturer:	FAG
Drawing / Data sheet / Part No.:	EDD F-636543.03.TR1-WPOS 000
	EDD F-620723.05.TR1-WPOS 000

Yaw System:

Drive Type:	Three-phase asynchronous motor
Manufacturer:	Jiangxi Special Electric Motor Co., Ltd.
Drawing / Data sheet / Part No.:	YEJ132S-6-HZ-JFK
Yaw bearing Type:	Double-row ball bearing slewing ring
Manufacturer:	Defontaine Machinery(Qingdao) Co., Ltd.
Drawing / Data sheet / Part No.:	I7120T022500
Yaw bearing Type:	Double-row ball bearing slewing ring
Manufacturer:	Tianma (Chengdu) Railway Bearing Co., Ltd.
/ Part No.:	Y032.65.2975K

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Yaw gearbox Type:	4-stage planetary gear
Manufacturer:	ChongQing Gearbox Co., Ltd.
Drawing / Data sheet / Part No.:	PH3000JA-WX
Yaw gearbox Type:	4-stage planetary gear
Manufacturer:	Nanjing High Speed & Accurate Gear (Group) Co., Ltd.
Drawing / Data sheet / Part No.:	FDX207F-02-00R1
Yaw gearbox Type:	5-stage planetary gear
Manufacturer:	Bonfiglioli Drives (Shanghai) Co., Ltd.
Drawing / Data sheet / Part No.:	I7120T022500
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	GKN Taicang Co., Ltd.
Drawing / Data sheet / Part No.:	8090-50002
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	Jiaozuo Rethel Disc Brakes Co., Ltd.
Drawing / Data sheet / Part No.:	DADH120-B1-00
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	Jiangxi Huawu Brake Co., Ltd.
Drawing / Data sheet / Part No.:	SZSB01540

Generator:

Type:	Permanent magnet synchronous generator
Manufacturer:	Xinjiang Goldwind Science & Technology Co., Ltd. Jiangsu Crrc Electric Co., Ltd
Drawing / Data sheet / Part No.:	GW 4.XMW-TFY (G0812)
Rated Power:	4800kW
	8.8667Hz

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Rated Speed:	9.5rpm
Rated Voltage:	≤760V(stator)
Rated Current:	2086A(stator)
Insulation Class:	F
Degree of Protection:	IP54

Converter:

Type:	Full power converter
Manufacturer:	Beijing Etechwin Electric Co., Ltd.
Drawing / Data sheet / Part No.:	PCS05A-CVT01
Rated Voltage (grid side):	690V
Rated Current (grid side):	4800A
Degree of Protection:	IP54

Main Frame:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00077451

Tower:

Type:	Tapered steel tower
Material:	4
Sections:	91.95m
Length:	Q355NE/Q355NEZ35/Q355NEZ35 （Tower/Flange/Door）
Drawing / Data sheet / Part No.:	60.00.01793

Control System:

Main controller Type:	CX5130
Master controller manufacturer:	Beckhoff Automation GmbH & Co. KG
are version No.:	4X00_E_V180430 INIT_a4500_bGW_c76_dGT_e95_gGW_hLand

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Main controller software designer: Xinjiang Goldwind Science & Technology Co., Ltd.

Manuals:

Operation & maintenance manual: GW-08FW. 1022 Rev. A

Transport manual: GW-08BY. 0048 Rev. A

Installation Manual: GW-08FW. 0845 Rev. A

北京鉴衡认证中心有限公司 证书专用章 1101052249097

鉴衡认证
CHINA GENERAL CERTIFICATION

Annex

Appendix:

Representative value of turbulence intensity					
Wind speed (m/s)	TI for extreme load cases (%)	TI for fatigue load cases (%)	Wind speed (m/s)	TI for extreme load cases (%)	TI for fatigue load cases (%)
2.5	29.5	30.5	14.5	10.4	12.6
3.5	24.4	25.2	15.5	10.3	11.8
4.5	21.3	22.7	16.5	9.7	11.2
5.5	18.9	21.4	17.5	9.4	10.5
6.5	16.9	20.5	18.5	9	10.6
7.5	15	20	19.5	8.7	10.1
8.5	13.5	17.5	20.5	8.3	9.4
9.5	12.8	18.3	21.5	8	9.2
10.5	12.3	17.1	22.5	8.1	9.3
11.5	11.6	14.7	23.5	8	9.6
12.5	11.6	13.4	24	8	9.6
13.5	10.9	12.6			

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鉴衡认证
CHINA GENERAL CERTIFICATION

Design Evaluation Conformity Statement

Statement No.: CGCSP202046113078

This conformity statement is issued to

Xinjiang Goldwind Science & Technology Co., Ltd.
107 Shanghai Road, Economic & Technological Development Zone, Urumqi,
Xinjiang 83002 6, China

for the wind turbine designed for cold climate

GW155-4.5
With Blade Type GW76 and Hub Height 95m

This conformity statement attests compliance with IEC 61400-1 "Wind turbines – Part 1: Design requirements", Third edition, 2005-08 and Amendment 1, 2010-10, Class S, GB/T 29543-2013 "Wind turbine generator systems for cold environments" concerning the design.

Design control evaluation report	No. SK202046113078	2021-10-12
Control and protection evaluation report	No. KP202046113078	2021-10-12
Loads and load cases evaluation report	No. ZP202046113078	2021-10-12
Machine and structural components evaluation report	No. JP202046113078	2021-10-12
Electrical components evaluation report	No. DP202046113078	2021-10-12
Personnel safety and manuals evaluation report	No. SA202046113078	2021-10-12
Rotor blade design evaluation report	No. YP202046113078	2021-10-12

Conformity evaluation was carried out according to GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT).
The wind turbine type is specified in the Annex (9 pages total).
Changes in the system design or the manufacturer's quality system are to be approved by CGC.
Without approval, the statement loses its validity.

Date of issue: 2021-10-12

Signature:

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Machine parameters:

Power regulation:	Variable speed and pitch regulation
Rotor orientation:	Upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	3°
Rated power:	4500kW
Rated wind speed V_r:	10.3m/s
Rotor diameter:	155.06m
Hub height(s):	95m
Hub height operating wind speed range $V_{in} - V_{out}$:	2.5m/s-24m/s
Design life time:	20 years

Wind conditions:

Characteristic turbulence intensity I_{ref} at V_{hub} = 15 m/s:	See appendix
Annual average wind speed at hub height V_{ave} :	8.71m/s*
Reference wind speed V_{ref} :	42.16m/s*
Mean flow inclination:	0.9°*
Wind shear α	0.11 for extreme wind model, 0.12* for other wind models
Annual wind speed distribution	Weibull distribution: Shape parameter k = 2.133* Scale parameter C =9.84m/s*
Hub height 50-year extreme wind speed V_{e50}:	59.024m/s*

Electrical network conditions:

Normal supply voltage and range:	690V±10%
Normal supply frequency and range:	50Hz±2%
Voltage imbalance:	≤2%
Maximum duration of electrical power network outages:	7 days
network outages:	20 times per year

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Other environmental conditions (where taken into account):

Normal and extreme temperature ranges:	Normal: -30℃ to +40℃ Extreme: -40℃ to +50℃
Relative humidity of the air:	≤95%
Air density:	1.138 kg/m^3*(Annual average temperature) 1.296kg/m^3*(lowest temperature) 1.296kg/m^3*(Instantaneous minimum operating temperature)
Solar radiation:	1000W/m^2
Lightning protection system (standard and protection class):	LPLI
Earthquake model and parameters (standard and key parameters e.g. spectrum, model, seismic zone, soil class, etc.):	NA
Other design conditions:	NA

Note 1: The design parameters marked with "*" are defined by the manufacturer, and the design parameters without "*" are consistent with the definition of IEC 61400-1:2005 Ed.3 incl. A1 2010 and GB/T 29543-2013 standard wind turbine generator sets;

Note 2: In case of any parameters listed in the table above exceeded by the actual external conditions of a wind farm, additional evaluations shall be necessary.

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Major components:
**If not otherwise stated, the certificate holder is the manufacturer.

Blade:

Type:	GW76
Material:	Glass fiber reinforced epoxy resin composite
Blade length:	76m
Number of blades:	3
Manufacturer:	Xinjiang Goldwind Science & Technology Co., Ltd.
Drawing / Data sheet / Part No.:	10.15.01867

Blade bearing:

Type:	Three-row roller bearing slewing ring
Manufacturer:	LIEBHERR
Drawing / Data sheet / Part No.:	ROD02640-050DO18-001-900
Type:	Three-row roller bearing slewing ring
Manufacturer:	Tianma (Chengdu) Railway Bearing Co., Ltd.
Drawing / Data sheet / Part No.:	B130.50.2643K3

Pitch System:

Motor / Actuator Type:	Electric power unit
Pitch System Type:	GW PS05B-PIH02
Manufacturer:	Beijing Etechwin Electric Co., Ltd.
Pitch Controller Type:	PIC-a-CNU
Manufacturer:	PRACTEK Technology Co., Ltd.
Pitch motor Type:	LG132D-15A-RB0
	LEGO
/ Part No.:	LG132D-15A-RB0

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Pitch motor Type:	MVP2-15D-15CD-R1A4X-GW
Manufacturer:	INOVANCE
Drawing / Data sheet / Part No.:	MVP2-15D-15CD-R1A4X-GW
Pitch gearbox Type:	BJ3000JA
Manufacturer:	ChongQing Gearbox Co., Ltd.
Drawing / Data sheet / Part No.:	BJ3000JA-WX
Pitch gearbox Type:	FDX105F-02-00R1
Manufacturer:	Nanjing High Speed & Accurate Gear (Group) Co., Ltd.
Drawing / Data sheet / Part No.:	FDX105F-02-00R1
Pitch gearbox Type:	2T100130890
Manufacturer:	Bonfiglioli Drives (Shanghai) Co., Ltd.
Drawing / Data sheet / Part No.:	531134100

Wheel hub:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00089882

Main shaft:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00059659
	00059657

Main bearing:

Type:	Tapered roller
	SKF

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Drawing / Data sheet / Part No.:	BT1-8224
	BT1-8174
Type:	Tapered roller
Manufacturer:	NTN
Drawing / Data sheet / Part No.:	19-04255
	19-03463
Type:	Tapered roller
Manufacturer:	Timken
Drawing / Data sheet / Part No.:	E-58124
	E-58593
	E-55949
Type:	Tapered roller
Manufacturer:	FAG
Drawing / Data sheet / Part No.:	EDD F-636543.03.TR1-WPOS 000
	EDD F-620723.05.TR1-WPOS 000

Yaw System:

Drive Type:	Three-phase asynchronous motor
Manufacturer:	Jiangxi Special Electric Motor Co., Ltd.
Drawing / Data sheet / Part No.:	YEJ132S-6-HZ-JFK
Yaw bearing Type:	Double-row ball bearing slewing ring
Manufacturer:	Defontaine Machinery(Qingdao) Co., Ltd.
Drawing / Data sheet / Part No.:	I7120T022500
Yaw bearing Type:	Double-row ball bearing slewing ring
Manufacturer:	Tianma (Chengdu) Railway Bearing Co., Ltd.
/ Part No.:	Y032.65.2975K

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Yaw gearbox Type:	4-stage planetary gear
Manufacturer:	ChongQing Gearbox Co., Ltd.
Drawing / Data sheet / Part No.:	PH3000JA-WX
Yaw gearbox Type:	4-stage planetary gear
Manufacturer:	Nanjing High Speed & Accurate Gear (Group) Co., Ltd.
Drawing / Data sheet / Part No.:	FDX207F-02-00R1
Yaw gearbox Type:	5-stage planetary gear
Manufacturer:	Bonfiglioli Drives (Shanghai) Co., Ltd.
Drawing / Data sheet / Part No.:	I7120T022500
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	GKN Taicang Co., Ltd.
Drawing / Data sheet / Part No.:	8090-50002
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	Jiaozuo Rethel Disc Brakes Co., Ltd.
Drawing / Data sheet / Part No.:	DADH120-B1-00
Yaw brake Type:	Friction brake, motor brake
Manufacturer:	Jiangxi Huawu Brake Co., Ltd.
Drawing / Data sheet / Part No.:	SZSB01540

Generator:

Type:	Permanent magnet synchronous generator
Manufacturer:	Xinjiang Goldwind Science & Technology Co., Ltd. Jiangsu Crrc Electric Co., Ltd
Drawing / Data sheet / Part No.:	GW 4.XMW-TFY (G0812)
Rated Power:	4800kW
	8.8667Hz

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Rated Speed:	9.5rpm
Rated Voltage:	≤760V(stator)
Rated Current:	2086A(stator)
Insulation Class:	F
Degree of Protection:	IP54

Converter:

Type:	Full power converter
Manufacturer:	Beijing Etechwin Electric Co., Ltd.
Drawing / Data sheet / Part No.:	PCS05A-CVT01
Rated Voltage (grid side):	690V
Rated Current (grid side):	4800A
Degree of Protection:	IP54

Main Frame:

Type:	Cast
Material:	QT400-18AL-1
Drawing / Data sheet / Part No.:	00077451

Tower:

Type:	Tapered steel tower
Material:	4
Sections:	91.95m
Length:	Q355NE/Q355NEZ35/Q355NEZ35 (Tower/Flange/Door)
Drawing / Data sheet / Part No.:	60.00.01793

Control System:

Main controller Type:	CX5130
Master controller manufacturer:	Beckhoff Automation GmbH & Co. KG
re version No.:	4X00_E_V180430 INIT_a4500_bGW_c76_dGT_e95_gGW_hLand

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Main controller software designer:	Xinjiang Goldwind Science & Technology Co., Ltd.

Manuals:

Operation & maintenance manual:	GW-08FW. 1022 Rev. A
Transport manual:	GW-08BY. 0048 Rev. A
Installation Manual:	GW-08FW. 0845 Rev. A

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Appendix:

Representative value of turbulence intensity					
Wind speed (m/s)	TI for extreme load cases (%)	TI for fatigue load cases (%)	Wind speed (m/s)	TI for extreme load cases (%)	TI for fatigue load cases (%)
2.5	29.5	30.5	14.5	10.4	12.6
3.5	24.4	25.2	15.5	10.3	11.8
4.5	21.3	22.7	16.5	9.7	11.2
5.5	18.9	21.4	17.5	9.4	10.5
6.5	16.9	20.5	18.5	9	10.6
7.5	15	20	19.5	8.7	10.1
8.5	13.5	17.5	20.5	8.3	9.4
9.5	12.8	18.3	21.5	8	9.2
10.5	12.3	17.1	22.5	8.1	9.3
11.5	11.6	14.7	23.5	8	9.6
12.5	11.6	13.4	24	8	9.6
13.5	10.9	12.6			

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Type Test Conformity Statement

Type Certificate No.: CGCXS202046113078

This conformity statement is issued to

Xinjiang Goldwind Science & Technology Co., Ltd.

107 Shanghai Road, Economic & Technological Development Zone, Urumqi,

Xinjiang 830026, China

for the wind turbine designed for cold climate

GW155-4.5

With Blade Type GW76 and Hub Height 95m

This conformity statement attests that the wind turbine has been evaluated by CGC concerning type testing.

Conformity evaluation was carried out according to GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT).

This conformity statement is issued on the basis of the type test evaluation report listed below and the type test report listed in Annex (1 page total).

Safety and function test evaluation report	No. AGPJ201946113070	2020-12-22
Power performance and load measurement test evaluation report	No. GZPJ201946113070	2020-12-22
Blade type test evaluation report	No. XS201946113070	2021-10-12

Any change in the design is to be approved by CGC. Without approval, the statement loses its validity.

Date of issue: 2021-10-12

Signature:

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Website: www.cgc.org.cn

Statement No.: CGCXS202046113078

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Safety and function test:

Test standard:	GB/T 35792—2018 "Wind Turbine Generator Qualification Test and Certification" (IEC 61400-22: 2010 IDT)
Test report No.:	GW-08DG.0004

Load measurement:

Test standard:	IEC 61400-13 "Wind turbines – Part 13: Measurement of mechanical loads", First edition, 2015-12
Test report No.:	UL-CHN-ML20-13275685-01.01

Power performance measurement:

Test standard:	IEC 61400-12-1 "Wind energy generation systems 12-1: Power performance measurements of electricity producing wind turbines", Second edition, 2017-03
Test report No.:	UL-CHN-PPT20-13275686-01.01

Blade test:

Test standard:	IEC 61400-23 "Wind turbine generator systems – Part 23: Full-scale structural testing of rotor blades", First edition, 2014-04 IEC 61400-24: "Wind energy generation systems - Part 24: Lightning protection", Second edition, 2019-07
Test report No.:	Static test: WPB/ST/GW76(001)-002, LZL/BG-05-20201224-01 Fatigue test (edgewise): WPB/FT/GW76(001)-002/EDGE, LZL/BG-05-20201224-01-02 Fatigue test (flapwise): GW-08CB.0832, LZL/BG-05-20201224-01-03 Static test after fatigue: GW-08CB.0844, LZL/BG-05-20201224-01-04 Lightning protection system test: AB2020030302, AB2020030303

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Manufacturing Conformity Statement

Statement No.: CGCZN202046113078 Valid unit: 2025-06-14

This conformity statement is issued to

Xinjiang Goldwind Science & Technology Co., Ltd.
107 Shanghai Road, Economic & Technological Development Zone, Urumqi,
Xinjiang 830026, China

for the wind turbine designed for cold climate

GW155-4.5
With Blade Type GW76 and Hub Height 95m

This conformity statement attests compliance with GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT) concerning the manufacturer's quality system.

This conformity statement is issued on the basis of the manufacturing capacity assessment report listed below and the performance parameters of the machine and parts listed in Annex (1 page total).

Assembly manufacturing evaluation report	No. GS202046113059	2020-07-30
Blade manufacturing evaluation report	No. GS201946113070	2020-12-15

Any change in the manufacturer's quality system is to be approved by CGC. Without approval, the statement loses its validity.

Date of issue: 2021-10-12

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Machine parameters:

Power regulation:	Variable speed and pitch regulation
Rotor orientation:	Upwind
Number of rotor blades:	3
Rotor tilt:	6°
Cone angle:	3°
Rated power:	4500kW
Rated wind speed V_r:	10.3m/s
Rotor diameter:	155.06m
Hub height(s):	95m
Hub height operating wind speed range V_{in} – V_{out}:	2.5m/s-24m/s
Design life time:	20 years

Blade:

Type:	GW76
Material:	Glass fiber reinforced epoxy resin composite
Blade length:	76m
Number of blades:	3
Manufacturer:	Xinjiang Goldwind Science & Technology Co., Ltd.
Drawing / Data sheet / Part No.:	10.15.01867

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Xinjiang Goldwind Science & Technology Co., Ltd.
GW155-4.5 WTG for Cold Climate
(Blade Type: GW76; Hub Height: 95m)
Final Evaluation Report

Contract No.:	CGC202046113078
File No.:	CGCTC202046113078
Version No.:	1.0
Disclosure Level:	Client's Discretion

Prepared by:	Sun Peng
Checked by:	
Approved by:	
Date:	

北京鉴衡认证中心有限公司

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Restricted to CGC:	**For CGC's use only**
Restricted to Client:	**For Client's use only**
Client's Discretion:	**Client decides the publication scope based on contract**
Published:	**Completely available to public**

Applicant Information

Applicant:	Xinjiang Goldwind Science & Technology Co., Ltd.
Address:	No.107 Shanghai Road, Economic & Technological Development Zone, Urumqi, Xinjiang 830026, China
Product name:	WTG for Cold Climate
Product type:	GW155-4.5(Blade Type: GW76; Hub Height: 95m)

Revision History

Edition	Issuing Date	Summary
1.0	2021.10.12	First issue

Contents

1 General

This report gives the evaluation result and conclusion of Xinjiang Goldwind Science & Technology Co., Ltd.GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) which was type certified by China Generation Certification (CGC) according to GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT).

2 Wind Turbine description

GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) is three-blade, upwind and active yaw. The power is pitch regulated. The basic information is listed in Table 1. The external condition of the wind turbine complies with the S. The hub height wind conditions of this class are shown in Table 2.

Table 1. Basic design information of GW155-4.5 WTG
(Referred to as hub height wind speed)

Machine parameters	
Type	GW155-4.5
Power regulation	Variable speed and pitch regulation
Rotor orientation	Upwind
Rotor tilt	6°
Cone angle	3°
IEC WT class	IEC 61400-1: 2005 S
Rated power	4500kW
Rated wind speed Vr	10.3m/s
Rotor diameter	155.06m
Hub height(s)	95m
Hub height operating wind speed range Vin -Vout	2.5m/s -24m/s
Design life time	20 years

Table 2. Environmental conditions (Referred to as hub height wind speed)

Environmental Conditions			
Turbulence Intensity:	Wind speed (m/s)		
	2.5	29.5	30.5
	3.5	24.4	25.2
	4.5	21.3	22.7
	5.5	18.9	21.4
	6.5	16.9	20.5
	7.5	15	20
	8.5	13.5	17.5
	9.5	12.8	18.3
	10.5	12.3	17.1
	11.5	11.6	14.7
	12.5	11.6	13.4
	13.5	10.9	12.6
	14.5	10.4	12.6
	15.5	10.3	11.8
	16.5	9.7	11.2
	17.5	9.4	10.5
	18.5	9	10.6
	19.5	8.7	10.1
	20.5	8.3	9.4
	21.5	8	9.2
	22.5	8.1	9.3
	23.5	8	9.6
	24	8	9.6
Annual average wind speed at hub height Vave	8.71m/s		
Reference wind speed Vref	42.16m/s		
Mean flow inclination	0.9°		
Wind shear exponent α	Extreme wind speed model 0.11 Normal wind profile model 0.12		
Wind speed distribution	Weibull distribution: Shape parameter K=2.133 Scale parameter C=9.84m/s		
Hub height 50-year extreme wind speed Ve50	59.024m/s		
Normal and extreme temperature ranges:	Normal: -30°C to +40°C		
	Extreme: -40°C to +50°C		

3 Evaluation criteria

3.1 IEC 61400-1 "Wind turbines – Part 1: Design requirements", Third edition, 2005-08 and Amendment 1, 2010-10.

3.2 GB/T 29543—2013 "Wind turbine generator systems for cold environment"

3.3 GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT)

3.4 CGC-R46001: 2020 "Guideline for Wind Turbine Certification"

4 Documentation noted

Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) is designed by changing hub, the rated wind speed, air density and other design parameters expansion on the basis of Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height:110m) (Certificate No. CGCTC2020461130028). Design basis evaluation and design evaluation are performed with respect to the design modifications. Type test evaluation and manufacturing evaluation of GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height:110m) can be applied to GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m).

4.1 Design Basis Evaluation

4.1.1 Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) Design Basis Evaluation Report (Part 1~Part 5), Doc. No.: SZ202046113078, Date: 2021.10.12, Version1.0.

4.2 Design Evaluation

4.2.1 Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) Design Control Evaluation Report, Doc. No.: SK202046113078, Date: 2021.10.12, Version1.0.

4.2.1 Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) Control and Safe System Evaluation Report, Doc. No.: KP202046113078, Date: 2021.10.12, Version1.0.

4.2.2 Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for

Cold Climate (Blade Type:GW76; Hub Height: 95m) Load and Load Case Evaluation Report, Doc. No.: ZP202046113078, Date: 2021.10.12, Version1.0.

4.2.3 Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) Mechanical and Structural Evaluation Report, Doc. No.: JP202046113078, Date: 2021.10.12, Version1.0.

4.2.4 Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) Blade Design Evaluation Report, Doc. No.: YP202046113078, Date: 2021.10.12, Version1.0.

4.2.5 Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) Electrical System Evaluation Report, Doc. No.: DP202046113078, Date: 2021.10.12, Version1.0.

4.2.6 Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) Manual and Personnel Safety Evaluation Report, Doc. No.: SA202046113078, Date: 2021.10.12, Version1.0.

4.3 Type test

4.3.1 Xinjiang Goldwind Science & Technology Co., Ltd. GW155/4500 WTG (Blade Type:GW76; Hub Height: 110m) Safety and Functional Test Evaluation Report, Doc. No.: AGPJ201946113070，Date: 2020.12.22，Version2.0.

4.3.2 Xinjiang Goldwind Science & Technology Co., Ltd. GW155/4500 WTG (Blade Type:GW76; Hub Height: 110m) Power performance and load measurement test evaluation report, Doc. No.: GZPJ201946113070，Date: 2020.12.22，Version2.0.

4.3.3 Xinjiang Goldwind Science & Technology Co., Ltd. GW155/4500 WTG (Blade Type:GW76; Hub Height: 110m) Rotor Blade Type Testing Evaluation Report, Doc. No.: XS201946113070, Date: 2021.10.12, Version3.0.

4.4 Manufacturing evaluation

4.4.1 Xinjiang Goldwind Science & Technology Co., Ltd. Manufacturing Evaluation Report, Doc No.: GS202046113059，Date: 2020.07.30, Version 1.0.

4.4.2 Xinjiang Goldwind Science & Technology Co., Ltd. Rotor Blade Manufacturing Evaluation Report, Doc. No.: GS201946113070, Date: 2020.12.25, Version1.0.

5 Scope of assessment

5.1 Design Basis Evaluation

According to the evaluation report in section 4.1, the design basis of Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) meets the class S requirements of IEC 61400-1 "Wind turbines – Part 1: Design requirements", Third edition, 2005-08 and Amendment 1, 2010-10 and GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT).

5.2 Design Evaluation

According to the evaluation report in the section 4.2, the design of Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) meets the class S requirements of IEC 61400-1 "Wind turbines – Part 1: Design requirements", Third edition, 2005-08 and Amendment 1, 2010-10, and GB/T 29543—2013 "Wind turbine generator systems for cold environment"

5.3 Type test Evaluation

According to the evaluation report in the section 4.3, the type test of Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) meets the requirements of GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT).

5.4 Manufacturing evaluation

According to the evaluation report in the section 4.4, the manufacturing of Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) meets the requirements of GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT).

6 Conclusion

6.1 According to the relevant requirements of CGC-R46001:2022 "Guideline for Wind Turbine Certification" and GB/T 35792-2018 "Wind turbines-Conformity testing and certification" (IEC 61400-22, IDT), China General Certification Center performed the type certification of Xinjiang Goldwind Science & Technology Co.,

Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m). According to the section 5 of this report, the design of Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) meets the requirements of IEC 61400-1 "Wind turbines – Part 1: Design requirements", Third edition, 2005-08 and Amendment 1, 2010-10, and GB/T 29543—2013 "Wind turbine generator systems for cold environment"

Any changes in the design of the wind turbine shall be submitted to CGC. This evaluation report will be invalid if the design of Xinjiang Goldwind Science & Technology Co., Ltd. GW155-4.5 WTG for Cold Climate (Blade Type:GW76; Hub Height: 95m) is changed without being approved by CGC.