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Abstract

This document outlines the technical specifications and conditions of a complete wind power plant for sale, consisting of 41 Nordex Delta4000 N149/4.0-4.5 wind turbines. Every component of the wind farm, from the turbines themselves to the transmission cables, transformers, and control cabinets, is new, never mounted, and stored in optimal conditions in warehouses.

Detailed technical specifications for each unit are available. This includes all information concerning the operational capacities of the turbines, their dimensions, construction materials, and control technologies. Additionally, the technical support structure, such as medium and high voltage cables and fiber optic infrastructure, is detailed in the information provided.

A significant aspect of this offer is that the factory warranty for the turbines and associated components is still active.





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Nomenclature

AC	Alternating Current
AVR	Automatic Voltage Regulator
DC	Direct Current
DCS	Distributed Control System
EPC	Engineering, Procurement and Construction
HMI	Human-Machine Interface
I/O	Input / Output
ISO	International Organization for Standardization
LHV	Lower Heating Value
LV	Low Voltage
MCC	Motor Control Cubicle
MV	Medium Voltage
HV	High Voltage
N/A	not applicable / not available
OEM	Original Equipment Manufacturer
P&ID	Process & Instrumentation Diagram
PC	Personal Computer
PFD	Process Flow Diagram
PLC	Programmable Logic Controller
WTG	Wind Turbine Generator
TBD	To be determined / To be defined

1. Introduction

Complete wind power plant available for relocation, this document describes the various characteristics of the plant and its current status. The subject of the opportunity is as follows:

General Data	
Manufacturer	Nordex
Model	Delta 4000 N149/4.0-4.5
Quantity	41
Power	205 MW
Available from	June 2024
Country	Colombia goods in free trade zone
Grid connection	220 kV

Technical Data					
Condition	New				
Year of construction	2021				
Nominal power (unit)	Mode a.01 5 MW				
Tower height	104.7 m				
Rotor diameter	149.1 m				

2. Description of Supply

2.1 Wind Turbine Delta4000 N149 4.0-4.5 TS105 Mode 0.a1

The Nordex Delta 4000 N149/4.0-4.5 TS105 Mode0.a1 wind turbine is characterized as a variablespeed model with a rotor diameter of 149 meters. This turbine has a nominal power ranging from 4000 to 4500 kW, with a design capacity to expand up to 5000 kW, adaptable based on the installation site. This model is developed to operate within the requirements of Class S, compliant with the IEC 61400-1 standard or for areas categorized as wind zone S according to DIBt 2012, and is designed to function at 60 Hz. The main components of the Nordex N149/4.0-4.5 wind turbine include:

- 1. A rotor consisting of a hub, three blades, and a pitch system for adjusting the blade inclination.
- 2. A nacelle, which houses the drivetrain and generator, along with a yaw system for proper orientation, a medium voltage transformer, and a converter.
- 3. A support structure that can be either a tubular tower or a hybrid tower, equipped with a control panel for managing medium voltage.

The Nordex N149/4.0-4.5 wind turbine is mounted on a tubular steel tower, securely anchored to a foundation cage. The tower's surface is treated with an anti-corrosion coating system compliant with ISO 12944 standards. Access to the nacelle is facilitated by a service elevator and a vertical ladder with fall protection, along with work and rest platforms to ensure a safe and sheltered ascent.

The rotor of the Nordex N149/4.0-4.5 wind turbine includes a rotor hub with three slewing bearings, a pitch system for blade adjustment, and three rotor blades. The hub consists of a rigid cast structure



on which the pitch bearings and rotor blades are mounted. A spinner cover allows direct access from the nacelle to the rotor hub.

The blades are made from high-quality fiberglass and carbon-fiber reinforced plastic, tested in accordance with IEC 61400-23 and DNVGL-ST-0376 (2015) standards.

The pitch system adjusts the angle of the rotor blades using an electromechanical drive that includes a rotary current motor, a planetary gear, and a drive pinion, controlled by a unit with a frequency converter and emergency power supply. Power supply and signal transmission are managed through a slip ring located in the nacelle.

The nacelle of the Nordex N149/4.0-4.5 wind turbine houses essential mechanical and electrical components and can pivot on the tower. The transformer converts the low voltage from the generator/converter system to medium voltage. All components necessary for the control and supply of the turbine are located inside the electrical cabinet.

A mechanical rotor brake locks the rotor during maintenance, generating the necessary oil pressure through a hydraulic pump. The converter connects the electrical grid to the generator, allowing operation at variable speeds. The gearbox increases the rotor speed to the required level for the generator.

Bearings and gearings are continuously lubricated with oil, facilitated by a two-stage pump that circulates the oil. A combination filter traps solid particles, and the control system monitors filter contamination. The gear oil, which lubricates and cools, is continuously temperature-monitored; a thermal bypass redirects it back to the gearbox if not yet at optimum temperature or cools it if it exceeds the desired level.

Gearbox cooling is achieved with an oil/water cooler mounted directly on the gearbox. The cooling water is recirculated along with that from other major components in a passive cooler on the nacelle roof. The rotor shaft is supported by the rotor bearing inside the nacelle, where a rotor lock is integrated for reliable mechanical locking. All nacelle assemblies are protected from weather conditions by a housing. The coupling provides a force-transmitting connection between the gearbox and the generator. The generator is a 6-pole doubly-fed induction machine with an air/water heat exchanger mounted on it. The yaw drives optimize the nacelle's orientation relative to the wind, with drive pinions meshing with the external teeth of the yaw bearing. In the aligned position, the nacelle is locked by the yaw drives.





The medium-voltage components are used to connect a wind turbine (WT) to the electrical grid of the wind farm or to the local grid operator. The MV switchgear is located at the base of the tower. It includes a transformer field with circuit breakers and at least one ring cable field as the standard configuration, with the option to add up to three ring cable fields depending on the wind farm configuration. The transformer panel is equipped with a vacuum circuit breaker and a disconnector with a ground switch. The ring cable panel includes a switch disconnector with a ground switch. The entire MV switchgear is mounted on a support/adapter frame.

The WT wind turbine operates automatically through a Programmable Logic Controller (PLC) that monitors operating parameters using sensors, comparing actual values to setpoints and managing the WT's components. When there is no wind, the WT remains idle with only auxiliary systems like heating and lubrication active. With sufficient wind, the WT activates, aligns the nacelle and rotor blades towards the wind, and begins generating energy once a certain speed is reached.

At low wind speeds, the WT operates under partial load and switches to full load when the nominal wind speed is achieved, adjusting the rotor blade angle to keep the rotor speed constant. The yaw system ensures the nacelle is always optimally aligned with the wind.

Wind energy is converted into electrical energy by a doubly-fed induction machine with a low-loss system, connected to the grid through a medium-voltage transformer. Only a portion of the power passes through the converter, reducing electrical system losses.

2.2 Control system

The Wind Farm Portal® Nordex Control 2 (NC2) connects the optimal operation control of a wind turbine (WT) to the clear and simple visualization of the control system and its data management.

NC2 ensures the reliable information exchange between the modules for control, monitoring, visualization and data storage either for a single wind turbine or for a complete wind farm (incl. meteorological system and substation). NC2 is a software that has been developed especially for operating and monitoring wind turbines. It is continuously updated and optimized in accordance with the market requirements, such as grid codes. NC2 is the result of the continuous development of the NC1 software, in use since 1999. It is therefore based on the experience from this development, extended by an internet based communication.

The connection to a wind farm or to a single wind turbine is realized via a dial-up connection or the Internet. Independent of the location, dialing up to the wind turbine is possible 24 hours a day.

To establish the communication, only a telephone or Internet connection and the Internet Explorer® are required. The access authorization to a wind farm is determined by means of a password and a log-in name. This prevents unauthorized access and establishes safe data exchange between user and wind turbine.

Within a wind farm, the communication is ensured by an Ethernet network via fiber optic cables. This network can be expanded as required with regard to the number of wind turbines, meteorological systems and substations.

The concept of the wind turbine control system is based on Profinet, an open standard for Industrial Ethernet. This system is continuously enhanced, thus offering a long-term perspective for the automation tasks.

The control system consists of the following components:

- Controller hardware
- Automation software
- Profinet peripheral
- components Configuration tools



2.3 Technical data

2.3.1 Design

Design temperature: Operating temperature range : Stop : Max. height above MSL Certificate:

Type :

Output control : Nominal power : Nominal power starting at wind speeds of (at air density of 1.225 kg/m3): Operating speed range of the rotor : Nominal speed Cut-in wind speed Cut-out wind speed Cut-back-in wind speed Calculated service life -20°C to +45°C -20°C to + 40°C Standard -20°C restart -18°C 2000 m In accordance with IEC 61400-1 and DIBt 2012 3-blade rotor with horizontal axis Up-wind turbine Active single blade adjustment mode 0.a1 5000kW

Approx. 11.5 m/s 6.4 min-1 to 12.3 min-1 11.0 min-1 3 m/s 26 m/s 25.5 m/s ≥ 20 years



2.3.2 Power curves – Nordex N149/4.0-4.5 TS105 Mode 0.a1

Wind speed	Power Pel [kW] at air density ρ [kg/m³]								
vhub [m/s]	0.900	0.925	0.950	0.975	1.000	1.025	1.050	1.075	1.100
3.0	13	15	17	18	20	22	23	25	26
3.5	81	84	88	91	95	98	102	105	109
4.0	172	178	184	191	197	203	209	215	221
4.5	286	295	304	313	322	332	341	350	359
5.0	421	434	447	460	473	486	499	512	525
5.5	581	599	616	633	650	668	685	702	719
6.0	769	791	814	836	858	881	903	926	948
6.5	988	1016	1045	1073	1101	1130	1158	1186	1214
7.0	1242	1277	1312	1347	1382	1418	1453	1488	1523
7.5	1533	1576	1619	1662	1705	1748	1791	1834	1877
8.0	1863	1915	1967	2019	2071	2122	2174	2226	2277
8.5	2235	2297	2359	2420	2482	2543	2605	2666	2727
9.0	2640	2713	2785	2857	2930	3001	3073	3145	3214
9.5	3058	3142	3225	3308	3391	3474	3558	3638	3707
10.0	3473	3568	3663	3756	3844	3933	4020	4090	4146
10.5	3879	3976	4072	4164	4237	4310	4383	4439	4484
11.0	4238	4319	4399	4474	4533	4592	4651	4694	4725
11.5	4509	4575	4640	4700	4745	4789	4834	4863	4882
12.0	4709	4760	4809	4854	4884	4915	4945	4960	4967
12.5	4850	4885	4919	4949	4965	4980	4996	4998	4999
13.0	4941	4961	4980	4995	4997	4999	5000	5000	5000
13.5	4990	4995	4999	5000	5000	5000	5000	5000	5000
14.0	5000	5000	5000	5000	5000	5000	5000	5000	5000
14.5	5000	5000	5000	5000	5000	5000	5000	5000	5000
15.0	5000	5000	5000	5000	5000	5000	5000	5000	5000
15.5	5000	5000	5000	5000	5000	5000	5000	5000	5000
16.0	5000	5000	5000	5000	5000	5000	5000	5000	5000
16.5	5000	5000	5000	5000	5000	5000	5000	5000	5000
17.0	5000	5000	5000	5000	5000	5000	5000	5000	5000
17.5	5000	5000	5000	5000	5000	5000	5000	5000	5000
18.0	5000	5000	5000	5000	5000	5000	5000	5000	5000
18.5	5000	5000	5000	5000	5000	5000	5000	5000	5000
19.0	4953	4953	4953	4953	4953	4953	4953	4953	4953
19.5	4833	4833	4833	4833	4833	4833	4833	4833	4833
20.0	4658	4658	4658	4658	4658	4658	4658	4658	4658
20.5	4482	4482	4482	4482	4482	4482	4482	4482	4482
21.0	4307	4307	4307	4307	4307	4307	4307	4307	4307
21.5	4131	4131	4131	4131	4131	4131	4131	4131	4131
22.0	3951	3951	3951	3951	3951	3951	3951	3951	3951
22.5	3776	3776	3776	3776	3776	3776	3776	3776	3776
23.0	3600	3600	3600	3600	3600	3600	3600	3600	3600
23.5	3420	3420	3420	3420	3420	3420	3420	3420	3420
24.0	3245	3245	3245	3245	3245	3245	3245	3245	3245
24.5	3065	3065	3065	3065	3065	3065	3065	3065	3065
25.0	2885	2885	2885	2885	2885	2885	2885	2885	2885
25.5	2/05	2/05	2/05	2/05	2/05	2/05	2705	2705	2/05
26.0	2529	2529	2529	2529	2529	2529	2529	2529	2529

Wind speed	Power Pel [kW] at air density ρ [kg/m³]							
vhub [m/s]	1.125	1.150	1.175	1.200	1.225	1.250	1.275	1.300
3.0	28	30	31	33	34	36	38	39
3.5	112	116	119	123	126	130	133	137
4.0	227	233	239	245	251	257	263	269
4.5	368	377	386	396	405	414	423	432
5.0	537	550	563	576	589	602	615	628
5.5	737	754	771	788	806	823	840	857
6.0	970	993	1015	1037	1059	1082	1104	1126
6.5	1243	1271	1299	1327	1355	1384	1412	1440
7.0	1558	1593	1628	1663	1698	1733	1768	1803
7.5	1919	1962	2005	2047	2090	2132	2175	2218
8.0	2329	2380	2431	2483	2534	2586	2636	2686
8.5	2788	2848	2906	2963	3019	3074	3127	3178
9.0	3279	3342	3402	3459	3515	3569	3620	3668
9.5	3770	3830	3887	3940	3992	4041	4087	4125
10.0	4198	4245	4290	4332	4372	4410	4444	4472
10.5	4523	4558	4591	4621	4649	4675	4698	4715
11.0	4751	4775	4796	4815	4833	4849	4864	4873
11.5	4896	4910	4922	4933	4943	4953	4962	4965
12.0	4973	4979	4984	4989	4993	4997	5000	5000
12.5	5000	5000	5000	5000	5000	5000	5000	5000
13.0	5000	5000	5000	5000	5000	5000	5000	5000
13.5	5000	5000	5000	5000	5000	5000	5000	5000
14.0	5000	5000	5000	5000	5000	5000	5000	5000
14.5	5000	5000	5000	5000	5000	5000	5000	5000
15.0	5000	5000	5000	5000	5000	5000	5000	5000
15.5	5000	5000	5000	5000	5000	5000	5000	5000
16.0	5000	5000	5000	5000	5000	5000	5000	5000
16.5	5000	5000	5000	5000	5000	5000	5000	5000
17.0	5000	5000	5000	5000	5000	5000	5000	5000
17.5	5000	5000	5000	5000	5000	5000	5000	5000
18.0	5000	5000	5000	5000	5000	5000	5000	5000
18.5	5000	5000	5000	5000	5000	5000	5000	5000
19.0	4953	4953	4953	4953	4953	4953	4953	4953
19.5	4833	4833	4833	4833	4833	4833	4833	4833
20.0	4658	4658	4658	4658	4658	4658	4658	4658
20.5	4482	4482	4482	4482	4482	4482	4482	4482
21.0	4307	4307	4307	4307	4307	4307	4307	4307
21.5	4131	4131	4131	4131	4131	4131	4131	4131
22.0	3951	3951	3951	3951	3951	3951	3951	3951
22.5	3776	3776	3776	3776	3776	3776	3776	3776
23.0	3600	3600	3600	3600	3600	3600	3600	3600
23.5	3420	3420	3420	3420	3420	3420	3420	3420
24.0	3245	3245	3245	3245	3245	3245	3245	3245
24.5	3065	3065	3065	3065	3065	3065	3065	3065
25.0	2885	2885	2885	2885	2885	2885	2885	2885
25.5	2705	2705	2705	2705	2705	2705	2705	2705
26.0	2529	2529	2529	2529	2529	2529	2529	2529



2.3.3 Tower

Hub height:	105 m
Wind class:	DIBt S/ IEC S
Number of tower sections	4

2.3.4 Rotor

Diameter:	149.1 m
Swept area:	17460 m ²
Angle of inclination:	5°
Blade cone angle:	3.5°

2.3.5 Rotor blade

Material:	fiber glass and carbon fiber reinforced plastic
Length:	72.40 m

2.3.6 Rotor shaft/rotor bearing

Туре:	Forged hollow shaft
Material:	42CrMo4 or 34CrNiMo6
Bearing type	Spherical roller bearing
Lubrication	Regularly using lubricating grease

2.3.7 Mechanical brake

Туре:	Friction plain bearing system
Material Slewing ring bearing:	EN-GJS-500-7Uby EN 1503
Material Plain bearing:	PETP
Orientation speed:	less than 0.5 %; 1 turn every 12 min. approx.
Mechanism:	Planetary / 2-stage helical gear combination
	Planetary / 1 Helical self-locking
Motor:	Asynchronous 1.5 kW 6 poles

2.3.8 Tower

Туре:	Actively actuated disk brake
Location:	On the high-speed shaft
Number of brake calipers:	1
Brake pad material:	Organic pad material

2.3.9 Gearbox

Type: Gear ratio: Lubrication: Oil quantity including cooling circuit: Oil type: Max. oil temperature: Multi-stage planetary gear + spur gear stage 60 Hz: i = 136.2 Forced-feed lubrication Max. 650 I VG 320 Approx. 77 °C



2.3.10 Electrical installation (690 V AC) - wind turbines with a power of up to 5000 kW

Nominal power PnG:	Up to 5000* kW
Nominal voltage:	3 x AC 690 V ± 10 % (specific to grid code)
Nominal current during full reactive current feed-in	
InG at SnG:	4571 A
Nominal apparent power SnG at PnG:	5463 kVA
Power factor at PnG:	1.00 as default setting
	0.8785 underexcited (inductive) up to 0.8785 overexcited (capacitive) possible
Frequency:	60 Hz

^{*)}All data are maximum values. The values may deviate depending on the rated voltage, rated apparent power and WT active power.

2.3.11 Three-phase- Oil transformer

Description

Three-phase- Oil transformer acc. to IEC60076-16 hermetic sealed, designed for ambient temperature of -25°Cup to 55°C and max. altitude for installation of 2.000 m, suitable for indoor installation with aluminium winding Routine test acc. to DINEN60076-1 corresponds to Normal Climate Version /(NCV) according and where applicable to Nordex Specification E0004486644:

Туре:	DST 5350 H/30
Nominal Capacity:	5.350 kVA
Nominal Voltage:	33.000 V /690 V
Nominal Current HV:	93,6 A
Nominal Current LV:	4.477 A
Tappings HV:	±2x2,5%
ACHV / LV:	70,0 kV /3,0 kV
BIL HV /LV:	170 kV
Insulated for:	36,0 kV /1,1 kV
Cooling method:	KFWF
Operating Mode:	Continuous
Frequency:	60.00 Hz
Туре:	LT
Insulation Class:	120
Degree of protection transform:	IP54
Degree of protection bushings:	IP54/IP00
Vectorgroup:	Dy5
Neutral point:	not brought out
Water inlet temperature:	max 55°C
Water flow rate:	160l/min
Losses	
No-load losses:	4500 W
impedance losses:	59000 W
Total Losses:	63500 W
Impedance voltage:	9.00%
Reference Temp. uk /Pk:	75°C
Sound power:	80 db

2.3.12 Technical data of the switchgear 8DJH36

Voltages

Rated voltage	36.0 kV
Test voltage	36.0 kV
Rated short-duration power-frequency withstand voltage	70.0 kV
Rated lightning impulse withstand voltage	170.0 kV
Rated frequency	60 Hz
Short-circuit ratings	
Rated short-time withstand current lk	25 kA
Rated duration of short circuit	1 s

Current ratings

Rated peak withstand current Ip

Rated normal current of the busbar

2.3.13 Generator

Degree of protection:	IP 54 (slip ring box IP 23)	
Nominal voltage:	690 V	
Frequency:	60 Hz	
Speed range:	60 Hz: 1230 min-1	
Poles:	6	
Weight:	approx. 10.6 t	

2.3.14 Generator and convert cooling

Туре:	 Cooling circuit: Oil circuit with oil/water heat exchanger and thermal bypass Cooling circuit: Water/air combined with generator, main converter and transformer
Filters:	Coarse filter 50 μm / fine filter 10 μm / ultrafine filter <5 μm
Flow rate:	Stage 1: Approx. 100 l/min / Stage 2: Approx. 200 l/min

63 kA

630 A

2.3.15 Pitch system

Pitch bearing:	Double-row four-point contact bearing
Gearing/raceway lubrication:	Regular lubrication with grease
Drive:	Electric motors incl. spring-loaded brake and
	multi- stage planetary gear
Emergency power supply:	Gel batteries

2.3.16 Yaw system

ele-row four-point contact bearing
lar lubrication with grease
ric motors incl. spring-loaded brake and stage planetary gear
's

3. Substation

The electrical substation forming part of the wind farm ready for sale consists of:

Description	Quantity	Technical documentation	
2	20 kV system		
Current Transformer 245 kV	1	Available	
Potential transformer 245 kV	6	Available	
Disconnector or disconnector 245 kV	1	Available	
Lightning arrester 240 kV	3	Available	
Power circuit breaker 245 kV	3	Available	
Pedestal Isolator	6	Available	
CT's and PT's Grouping Boxes	2	Available	
33 kV system			
Capacitor Bank 12 MVAR	2	Available	
33 kV/208V SSAA Transformer	2	Available	
Zig-Zag Transformer 33 kV	2	Available	
Medium voltage switchgear 33 kV	22	Available	
Step up Transformer			
Step up transformer model chint sffz- 220000/220, class 220/33/33 kv, 180/90/90 mva (onan), 220/110/110 mva (onaf) and 60 hz.	1	Available	

Substation control and protection		
Transformer protection enclosure	1	Available
Line protection cabinet	1	Available
Control panel	1	Available
SSAA Controller Board	1	Available
DC board	2	Available
AC Board	2	Available
Essential Services Board	1	Available
Non-Essential Services Board	1	Available
Cuestecitas ICT Board	1	Available
ICT SCADA Board	1	Available

The facility includes substation structures, power cable towers, medium voltage cables, communication cables (fiber optics), and grounding cables.

Auxiliaries				
Battery banks	1	Available		
Battery charger	1	Available		
Generator unit	1	Available		



4. Storage status

- 4.1 WTGs
- 4.1.1 Blades



Figure 1: Blades storage status 1



Figure 2: Blades storage status 2



4.1.2 Drive train



Figure 3: Drive train storage status 1



Figure 4: Drive train storage status 2



4.1.3 Hub



Figure 5: Hub storage status

4.1.4 Nacelle



Figure 6: Nacelle storage status



4.1.5 Towers



Figure 7: Towers storage status 1



Figure 8: Towers storage status 2



4.2 Cables



Figure 9: cables storage status 1



Figure 10: cables storage status 2





Figure 11: cables storage status 3



4.3 Substation



Figure 12: Substation parts storage status 1



Figure 13: Substation parts storage status 2





Figure 14: Substation parts storage status 3



Figure 15: Substation parts storage status 4



4.4 Scope of Supply

Position	Quantity	Description
1000		Wind power plant
1001	41	Wind turbine • Manufacturer: Nordex • Model: Delta 4000 N149/4.0-4.5
1002	1	Step up transformer • Manufacturer: Chint • 220 KV
1003	1	Substation, structure and cables

Table 1: scope of supply.

4.5 Exclusions

Scope not explicitly listed in the Scope of Supply (Table 1) is excluded.

The following items are explicitly excluded:

Mechanical			
Modification of any existing systems not explicitly cited.			
Missing parts and components.			
Electrical			
Modification of existing systems not explicitly cited.			
Civil			
Land and land preparation and permits			
Temporary accesses and final accessing roads			
Security plan and hardware			
Temporary accommodation			
Finishing and fencing			
Waste disposal facility			
Table 2: exclusions from the Scope of Supply.			



Project Management

Attainability of installation, commissioning and operation permits, or any other permit.

Assessment and acceptance of safety relevant issues.

Any study, engineering, documentation, or other service.

Additional works resulting from changes in laws or any other reasons.

Building of Site Facilities of any kind (lights, water supply and treatment, heating, power supply, etc.).

Custom duties and taxes.

Engineering

Feasibility studies, basic, design and detailed engineering of existing equipment.

Table 3: exclusions from scope of Services.

4.6 Technical documentation

Following documents are part of the technical documentation (list is preliminary):

Pos.	Document	Available
1	General	
1.1	Document & drawing list	yes
1.2	Technical data sheet	yes
1.3	Component manuals	yes
1.4	Quality documentation	yes

 Table 4: technical documentation.