EVK' 2015

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NORDEX

We've got the power.

1. NORDEX PRODUCT PORTFOLIO

Nordex Multi-MW technology

Evolutionary product development

14 years and

more than **7,600 MW**

*as of Sept.14

Generation Alpha

N80/2500

Generation Beta

N90/2500

Generation Gamma

N80/2500

N90/2500

N100/2500

N117/2400

Generation Delta

N100/3300

N117/3000

N131/3000

Current portfolio

Global fleet availability in 2013: ~**98 %**

Turbines under Nordex Service

2000 › 2007 › 2010 › 2013/14

THE NORDEX 2.4/2.5 MW CLASS (GAMMA GENERATION)

Current platform

Type	Capacity	Swept area	Certified for
N90/2500	2.5 MW	6,362 m²	IEC I
N100/2500	2.5 MW	(+23%) 7,823 m²	IEC II
N117/2400	2.4 MW	(+37%) 10,715 m²	IEC III

N117/2400
First installation
running since 12/2011

THE NORDEX 3.0/3.3 MW CLASS (DELTA GENERATION)

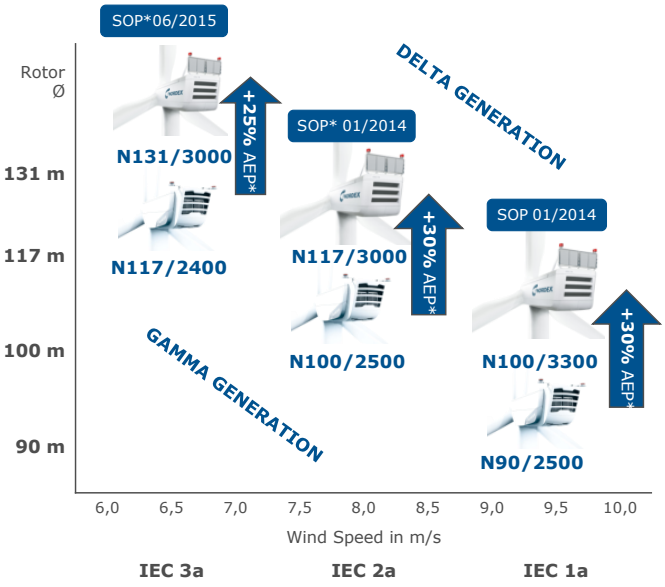
Current platform

Type	Capacity	Swept area	Certified for
N100/3300	3.3 MW	7,823 m²	IEC I
N117/3000	3.0 MW	(+37%) 10,715 m²	IEC II
N131/3000	3.0 MW	(+26%) 13,478 m²	IEC III

N100/3300
First installation
running since 8/2013

WITH THE NEW IEC I / II / III TURBINES, NORDEX WILL PURSUE THE SUCCESSFUL PATH LAID BY THE N117/2400

Current product portfolio



Product Development Principles

1. New product every 18-24 months
2. One highly competitive turbine per wind class
3. Continuous launch of efficiency improvement packages to keep product competitive
4. Innovations like "anti-icing" as differentiator

*SOP = Start of production

*AEP = Annual energy production

N131/3000

Lowest sound power levels in its class – by design

Quiet, more quiet, N131/3000

2 dB(A) lower sound level than average low wind turbine*

- **Less sound effects** on residential areas and surroundings
- **Less curtailment** at sound restricted areas
- **More flexibility** in wind farm layout

N131/3000: 104.5 dB(A)

Average IEC3: 106.5 dB(A)

40 dB(A) 500m

32 dB(A) ***+170m*** 1,000m

23 dB(A) 2,000m

An average IEC3 class turbine* needs to stand **17% further away** from immission point to reach **same sound** pressure level as **N131/3000**

* N131/3000-R99 compared to current IEC3 class turbines with rotor diameter >110m

2. TURBINE'S OPTIONAL FEATURES

TURBINE OPTIONS

NORDEX TURBINE OPTIONS MOSTLY OFFERED IN TURKEY

1. **Aviation Lights**
2. **Condition Monitoring (CMS)**
3. **Cold Climate Version**
4. **NCV Operation to -20°C (Gamma)**
5. **Rotor blade Ice Detection System**
6. **CCV Anemometer Kit – for Gamma NCV**
7. **Extended Reactive Power for Gamma**
8. **Lightning Detection System**
9. **Customer Interface Module (CIF) & SQL Online Access**
10. **Fire Detection and Extinguishing System**
11. **Burglar Alarm**

OBSTACLE LIGHTS

Aviation Lights

Purpose:

In order to be able to protect low-flying aircraft, wind turbines must in some cases be marked and illuminated using obstacle lights.

Their common features are:

- LED lights only
- Flashing lights
- Constant light
- Dusk sensor
- Red and/or white lights
- Day/night lights single or combined in the housing

CONDITION MONITORING SYSTEM

Condition Monitoring

A condition monitoring system serves to regularly monitor the condition of the main components of wind turbines.

- Service operations can be planned in advance
- Total breakdowns and consequential damage to components are avoided
- As Nordex is able to order and provide spare parts, components, cranes and vehicles in good time, downtime on site is shortened,
- The date and time for exchanging a component can therefore be arranged during low wind periods
- Inspection cycles can be extended

CCV OPTION

Cold Climate Version

Ambient temperature **CCV:**

Survival**: -40 ºC…+50 ºC**
Nominal power***: -30 °C…+40 ºC**
Stop: **-30 °C,** restart **at -28 °C**

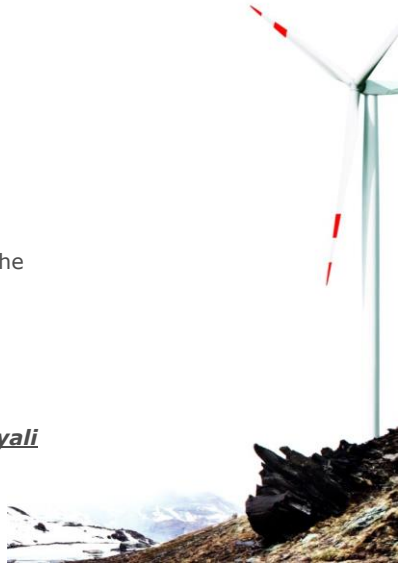
➢ The control system monitors the temperature of all relevant components.

➢ Should the temperature of the components fall under the permissible operating range, the temperature-sensitive components are kept at the lowest possible start temperature via heating.

➢ Power Generation even in cold climate site conditions

➢ *First N117/2400 CCV turbines will be installed for **Yahyali** Project in Turkey. (Installed capacity is 52.5 MW)*

To meet the design restraints of the wind turbine, if necessary, nominal power and cut-out wind speed can be slightly reduced.



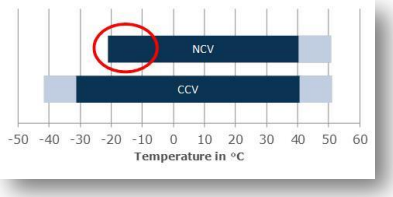
EXPANDED NCV OPERATION DOWN TO -20°C

NCV Operation to -20°C (Gamma) - CCV Light Option

Increased temperature range for K08 Gamma turbines

N100/2500 IEC 2a , 3a
N117/2400 IEC 3a

for operation to -20°C.



ROTOR BLADE ICE DETECTION SYSTEM

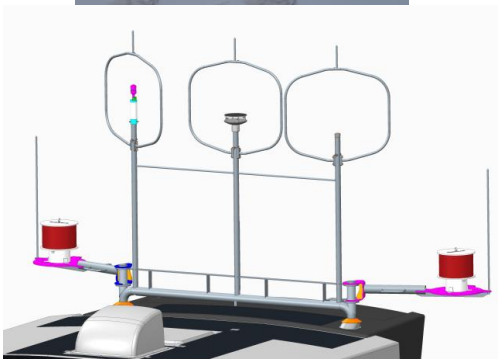
TURBINE STOP DURING ICING CONDITIONS

- Reduce risks related to ice throw
- Comply with local regulations
- Reduce vibrations and fatigue loads
- Avoid increased noise

CCV-ANEMOMETER-KIT FOR NCV TURBINES

Purpose:

To ensure that the lightning cage and mounting rods kept free of ice at severe icing sites, Nordex offers an optional CCV Anemometer and mast heating upgrade for normal climate version Turbines (NCV).

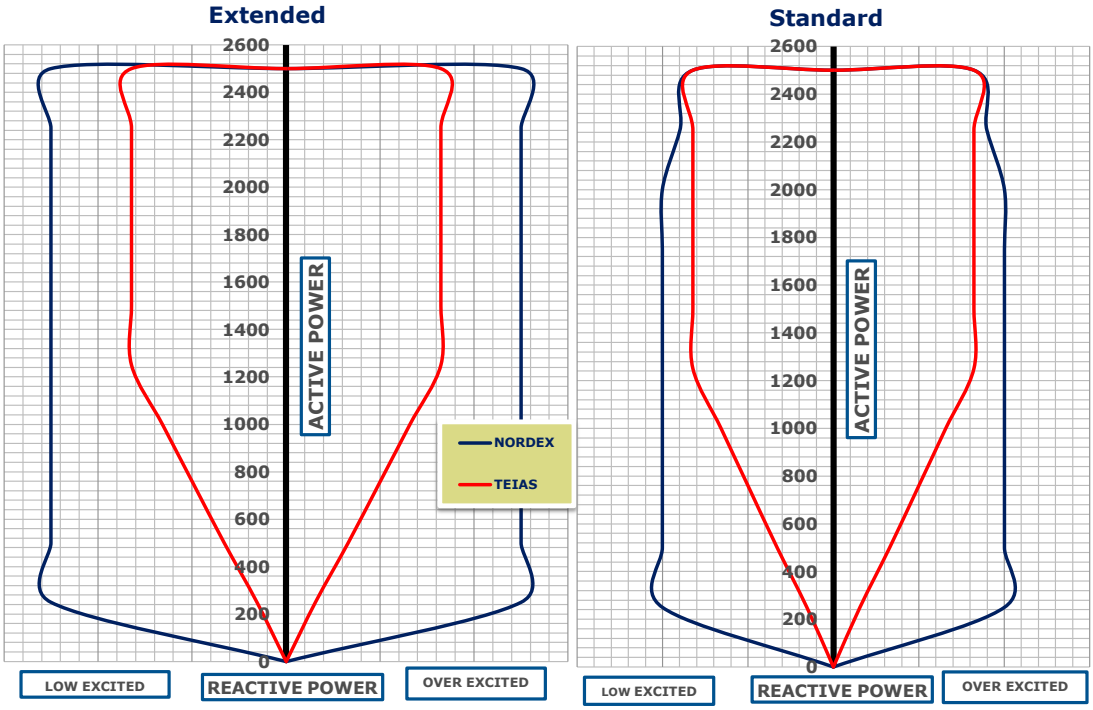


EXTENDED REACTIVE POWER (0.90 POWER FACTOR)

Power Factor Value (cos phi:0.9)

- Reactive power capability option ensures more reactive power in range between 0 (kW) - rated power in comparison to existing standard reactive power capability.
- Existing system is operated 0.95lead to 0.95lag power factor range
- With the use of extended reactive power capability option, power factor value can be achieved as 0.90lead to 0.90lag.
- This option is only for Gamma turbines, in Delta turbines this option is included in the standard turbine.

EXTENDED REACTIVE POWER (0.90 POWER FACTOR)



LIGHTNING DETECTION SYSTEM

Methode:

- Lightning field is observed as a magnetic signal in the two antennas.
- Magnetic signals picked up by antenna and fed via coax cables to a converter box
- Converter box signals are combined, filtered and converted to optical signals
- Lightning current itself provides power to generate optical signals (no power supply needed)
- Control box for direct indication and NC2 interface

Setup:

- 2 Antenna outside
- Connection box
- Control box

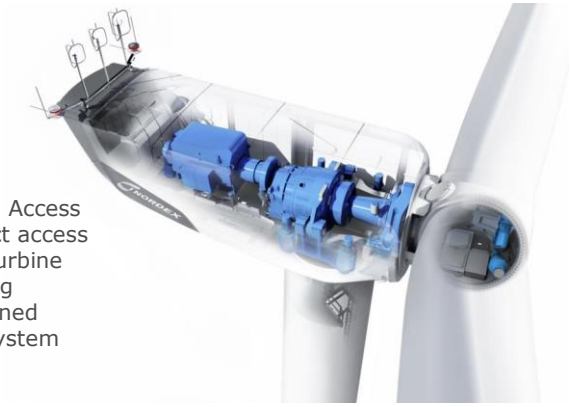
Connection

CUSTOMER INTERFACE MODULE (CIF) & SQL ONLINE ACCESS

OPC XML DA CIF MODULE & SQL ONLINE ACCESS

- OPC XML DA CIF MODULE:
  With the use of Customer Interface module, investors can query the NC2 module online data of their wind farms such as the power data at the wind farm grid connection point and generates the set points and then process this data in their own Software / SCADA systems.

- SQL ONLINE ACCESS:
  The Nordex Control 2 module SQL Online Access is intended for customers who need direct access to historical data of the wind. The wind turbine (WT), the met mast (MET), the Monitoring System Substation (MSS) and the Combined Wind Farm Management and Electrical System (CWE) can be used as data sources.

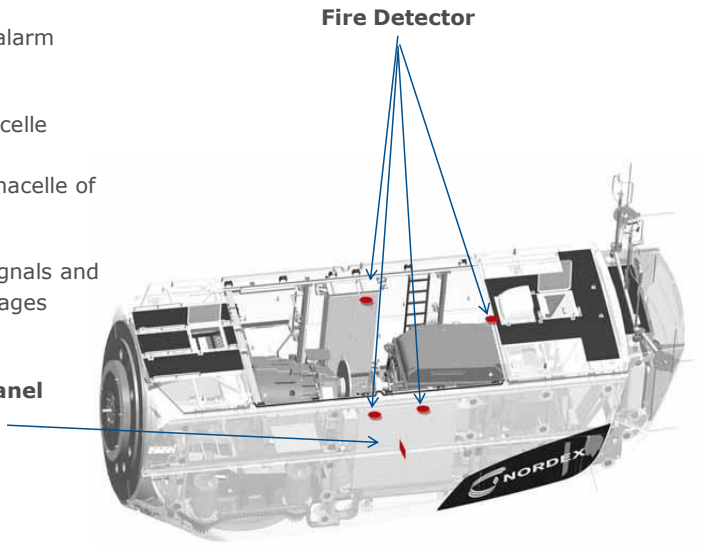


FIRE DETECTION SYSTEM OPTION

Fire Detection System

The fire detection and alarm system serves to:

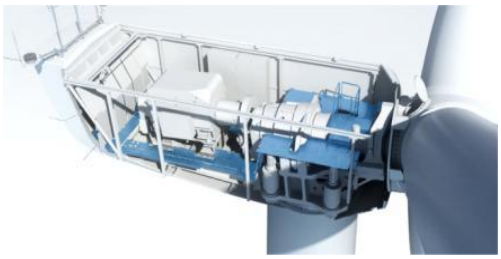
- Fire detection in the nacelle
- Reporting a fire in the nacelle of the wind turbine
- Generating electrical signals and forwarding alarm messages



FIRE EXTINGUISHING SYSTEM

Fire Extinguishing System

- Fire Monitoring and Fire Fighting in Wind Turbines
- The fire extinguishing system serves to detect and put out a fire in the nacelle of the wind turbine.
- The fire extinguishing system is an independent unit.



BURGLAR ALARM SYSTEM

Burglar Alarm System

- Detecting of any unauthorized access to the wind turbine
- Providing preventive protection to the wind turbines against vandalism

Components:

- System consists of sensors, detectors, GSM module, transponders, acoustic and visual signalling device etc.