

auddee

Asociación Uruguaya de Energía Eólica



Nodex-Acciona

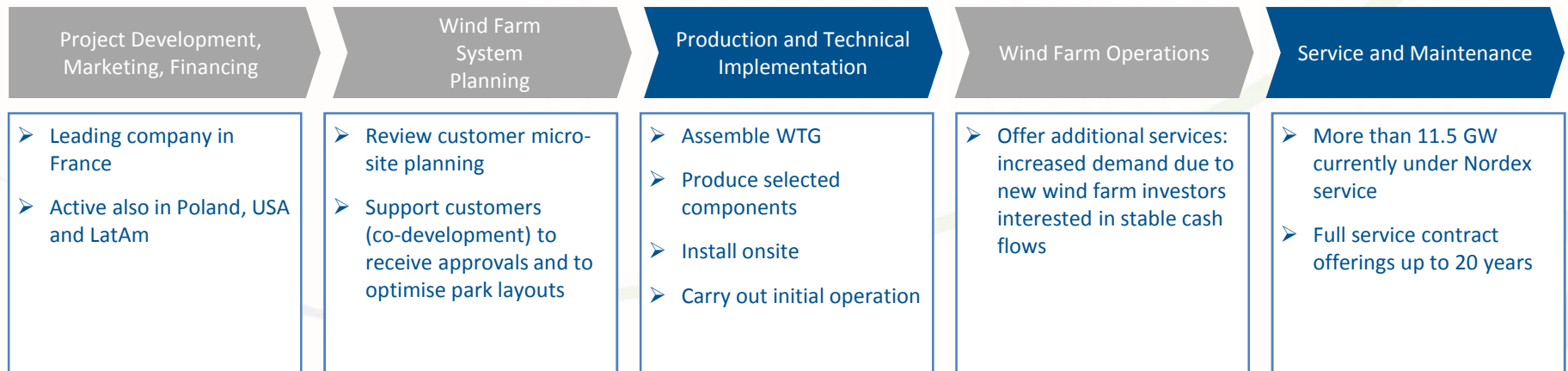
Together on the same course



Agenda

- Nodex-Acciona
 - Nordex at a glance
 - Products
 - Markets
 - Acciona at a glance
 - Products
 - Markets
- Cost of Energy – Key driver in product development

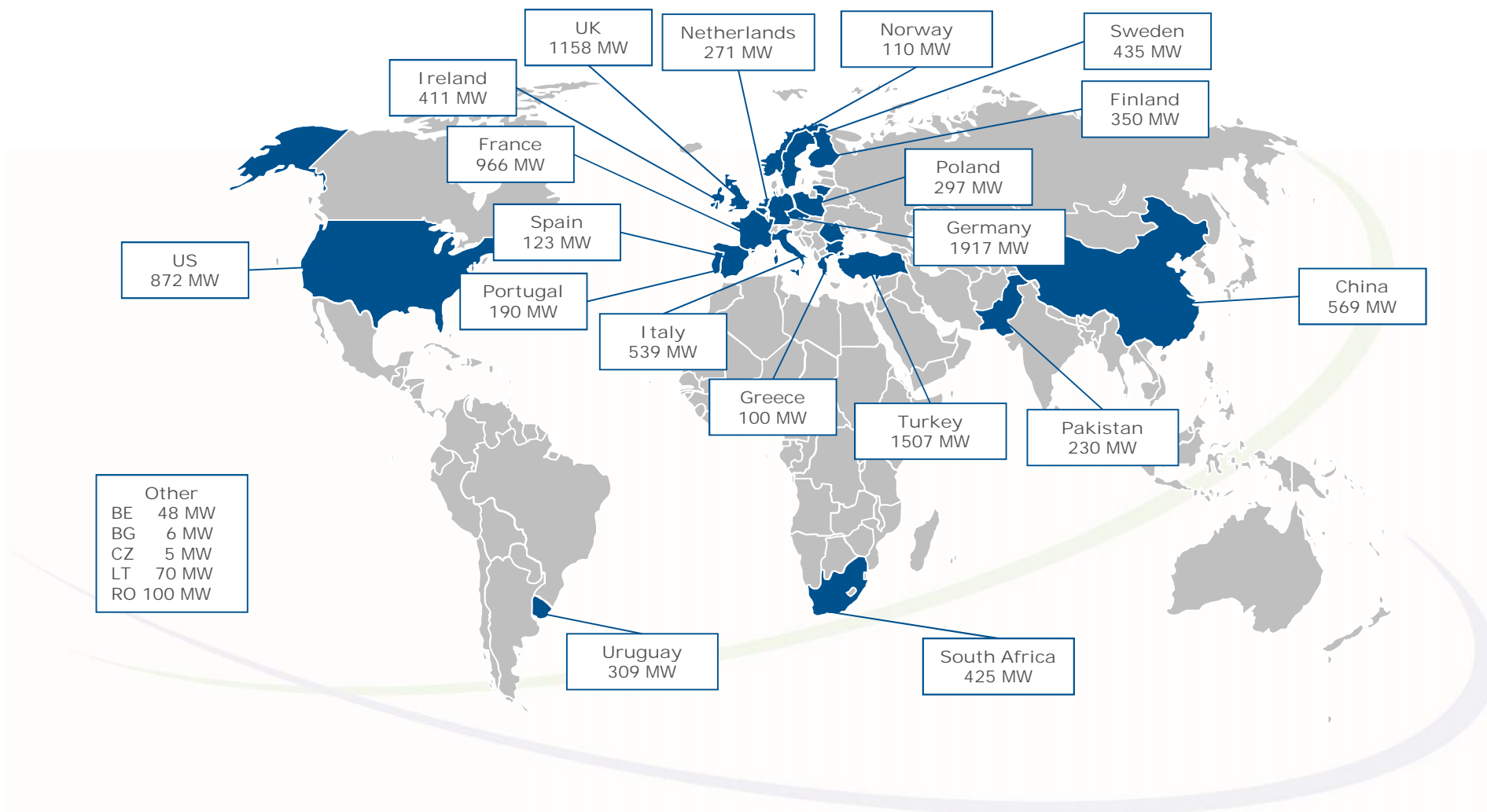
Products & Technology – Nordex is more than a manufacturer



 Core Business

Products & Technology - Track Record: About 11.1 GW contracted between 2007 and 2015 Worldwide

Nordex Contracted MW 2007-2015



Nordex evolutionary development

15 years and more than 10,000 MW*

*commissioned /under construction as of April 2015



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

Global fleet availability in 2013 / 2014 ~ 98 %
 Turbines under Nordex Service



Generation Delta Variants

| | N100/3300 | N117/3000 | N131/3000 |
|---|--|---|---|
| Hub heights | 75 m | 91 m | 99 m |
| | 85 m | 120 m | 114 m |
| | 100 m | 141 m* | 134 m |
| Wind class <small>according to IEC 61400-1</small> | IEC 1a | IEC 2a | IEC 3a |
| Wind zone <small>according to DIBt 2012</small> | DIBt 3 | DIBt 3 / DIBt 2 | DIBt 2 |
| Climate versions <small>(operating range)</small> | NCV (-20 °C...+40 °C) CCV (-30 °C...+40 °C) | HCV (-20 °C...+45 °C) NCV (-20 °C...+40 °C) CCV (-30 °C...+40 °C) | HCV (-20 °C...+45 °C) NCV (-20 °C...+40 °C) CCV (-30 °C...+40 °C) |
| Altitude of installation | Up to 2,000 m | | |
| Sound power | 105.5 dB(A) | 106.0 dB(A) | 104.5 dB(A) |

* IEC3a



Acciona Windpower History and Milestones



2000
- 1,300 kW wind turbine prototype



2003
- First manufacturing facility (Navarre, Spain)
- AW1500 series production



2007
- Factory in Iowa (USA)
- AW3000 in design phase



2008
- First 3 MW prototype installed



2009
- Blade facility opened in Navarre (Spain)



2011
- Start of commercial activities with the AW3000
- AW116 launched

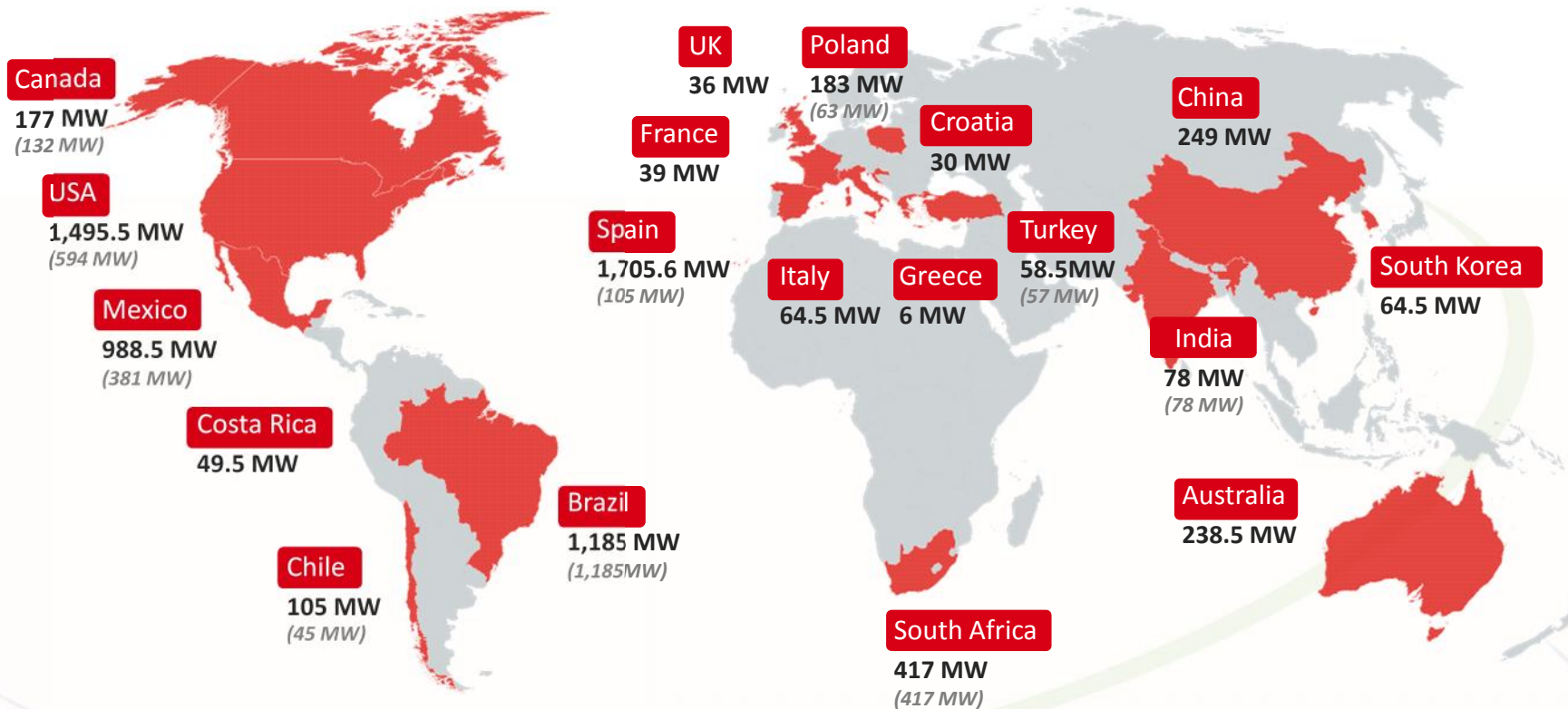


2012
- AW125 launched
- Brazil hub factory



2014
- Brazil nacelle factory
- AW132 launched

Products & Technology – Track Record: More than 7.1 GW contracted Worldwide



Total Contracted Capacity: 7,170 MW

AW3000: 3,057 MW

AW1500: 4,113 MW

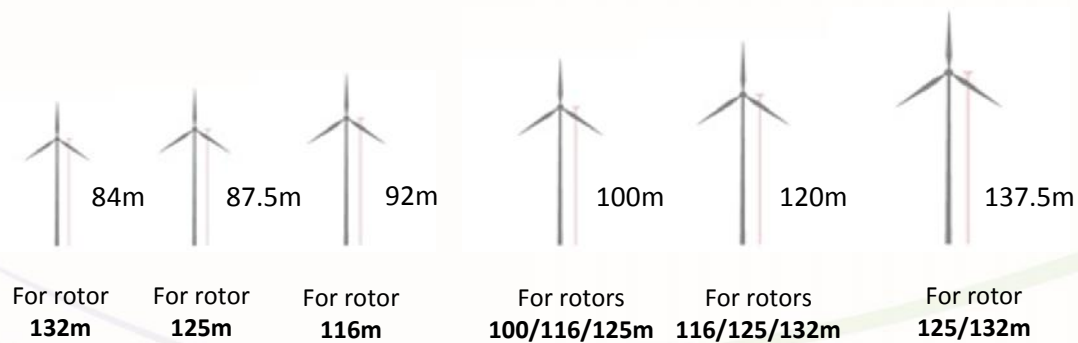
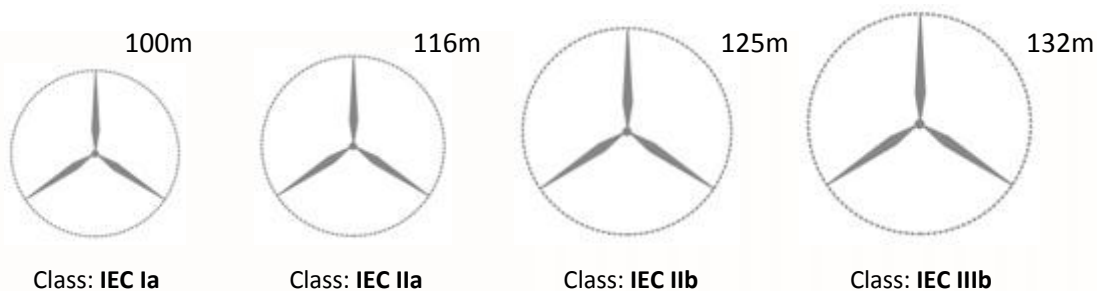
● Countries with AW turbines
() AW3000

* Data through Q4 2015

Products & Technology – Acciona Wind Power Products

AW3000

4 rotor diameters and 6 tower heights

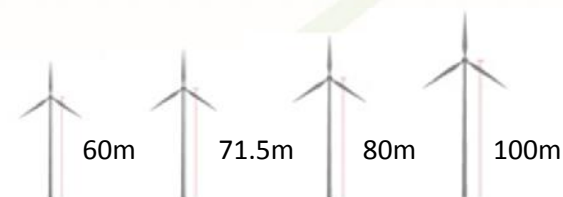
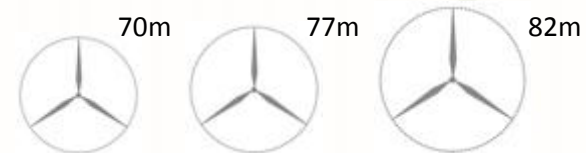


Steel tower

Concrete tower

AW1500

3 rotor diameters and 4 tower heights

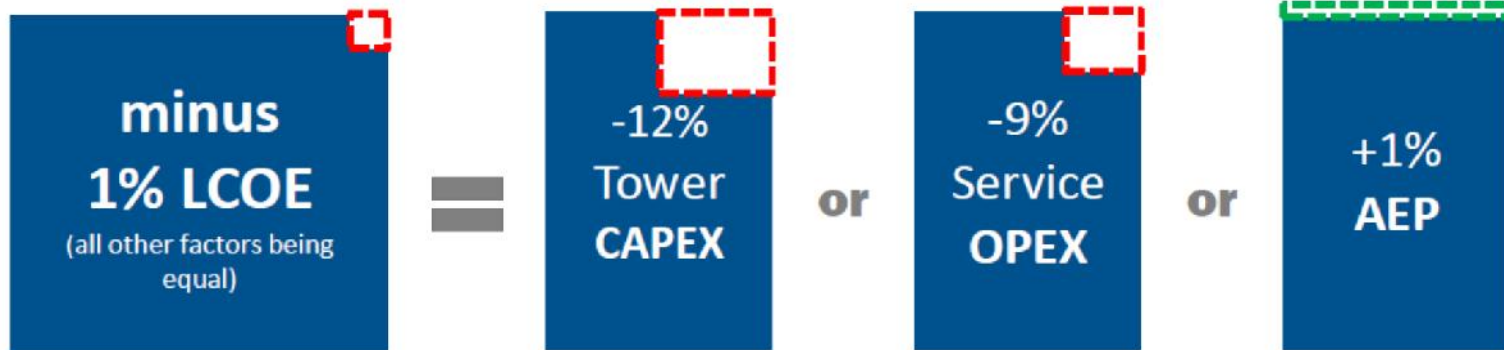


Products & Technology – AW3000 Platform approach

- Different rotor and tower options optimized for different IEC Classes
- Minimal differences between each main rotor option:

| Component | AW116 | AW125 | AW132 |
|-----------------------|---|--|--|
| IEC Class | IIa | IIb | IIIb |
| Blades | Same aerodynamic shape up to 48m (see next slide) Optimized structural design for each blade | | |
| Nominal tip speed | 80.3 m/s | 86.5 m/s | 80.1 m/s |
| Gearbox ratio | 1:83 (50Hz)/1:100 (60Hz) | | 1:104 (50Hz)/1:125 (60Hz) |
| Hydraulic valve | - | One additional block added for AW125/AW132—minor change to ensure proper braking in case of grid event | |
| Pitch bearings/plates | - | | Slightly larger to accommodate longer/heavier blades |

CoE – Key driver in product development



- Therefore continuing evolution of proven platforms

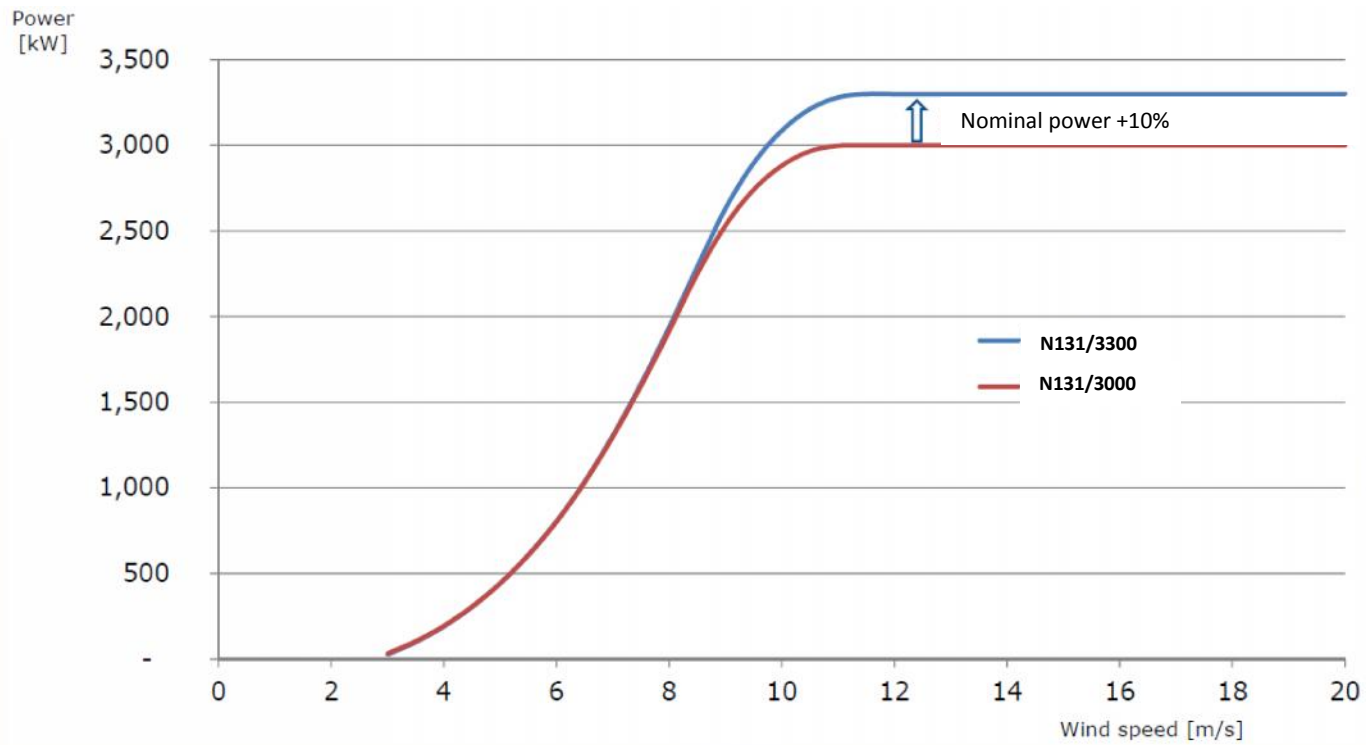
N131/3300 Optimized solution for low wind sites in Germany

| | N100/3300 | N117/3000 | N131/3000 | N131/3300 |
|---|--|---|---|-----------------------|
| Hub height | 75 m | 91 m | 99 m | 134 m |
| | 85 m | 120 m | 114 m | |
| | 100 m | 141 m* | 134 m | 164 m |
| | | | 144 m | |
| Wind class <small>according to IEC 61400-1</small> | IEC 1a | IEC 2a | IEC 3a | - |
| Wind zone <small>According DIBt 2012</small> | DIBt 3 | DIBt 3 / DIBt 2 | DIBt 2 | DIBt "S" |
| Climate variants <small>(operating range)</small> | NCV (-20 °C...+40 °C) CCV (-30 °C...+40 °C) | HCV (-20 °C...+45 °C) NCV (-20 °C...+40 °C) CCV (-30 °C...+40 °C) | HCV (-20 °C...+45 °C) NCV (-20 °C...+40 °C) CCV (-30 °C...+40 °C) | NCV (-20 °C...+40 °C) |
| Installation heights | | Up to 2,000 m | | Up to 1,000 m |
| Max. sound | 105.5 dB(A) | 106.0 dB(A) | 104.5 dB(A) | 104.5 dB(A) |

* IEC3a



N131/3300 Optimized solution for low wind sites in Germany



N131/3300 Optimized solution for low wind sites in Germany

High AEP

- power: upgraded to **+300kW** rated power
- Heightened **AEP** up to **+4% to +6%** compared to N131/3000 turbine

quiet

- Low sound power level of **104.5 dB(A)**
- **Sound-optimized**
Power curve and flexible curtailment

versatile

- High hub heights:
PH134, PH164
- Multiple options to ensure **permits** at challenging project sites

proven

- Evolutionary development focusing on **Reliability** and **Availability**
- **measured and certified**



Many thanks for your attention

- Nordex SE
Langenhorner Chaussee 600, 22419 Hamburg, Germany
- Telephone +49 (40) 30030 1000
- Fax +49 40 30030 1101
- E-Mail info@nordex-online.com