

Appendix H

GE Turbine Specifications

GE Renewable Energy

GE's 3 MW Platform

POWERFUL AND EFFICIENT



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GE'S 3 MW PLATFORM

Since entering the wind industry in 2002, GE Renewable Energy has invested more than \$2 billion in next-generation wind turbine technology to provide more value to customers—whether at the turbine, plant or grid level. Through the use of advanced analytics, GE Renewable Energy is redefining the future of wind power, delivering with proven performance, availability and reliability. With the integration of big data and the industrial internet, we can help customers manage the variability that comes with this resource for smooth, predictable power. Our onshore product portfolio includes wind turbines with rated capacities from 1.6-3.8 MW and flexible support services that range from basic operations and maintenance to farm- or fleet-level enhancements.

For more information visit our website:

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MONITORING

SOFTWARE COE

PITCH

CONTROLS

Predix™

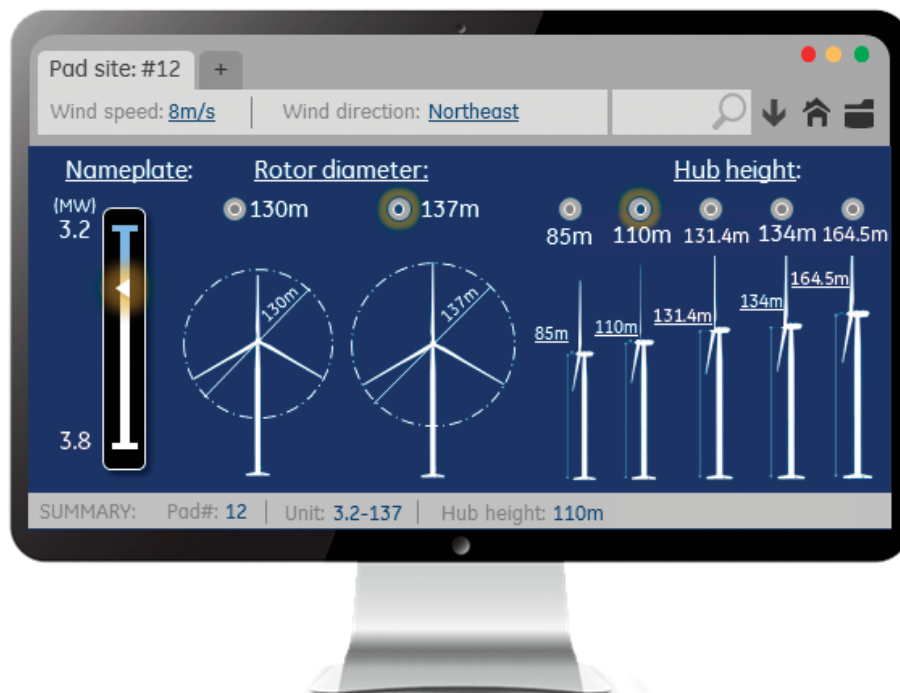
GE's 3 MW Platform

Extending the capability of the Digital Wind Farm to our 3 MW machines, GE's powerful and efficient 3.2–3.8 platform is adaptable to a full spectrum of wind regimes. The platform includes the 3.6-137, our highest performing turbine for Class III winds.

GE has employed selected legacy components with proven performance for the 3 MW platform, helping to ensure the consistent performance and reliability for which GE wind turbines are known. Turbine models within the 3 MW platform share drivetrain and electrical system architecture, with both systems scaled and upgraded for improved performance and greater energy production, as compared to previous models.

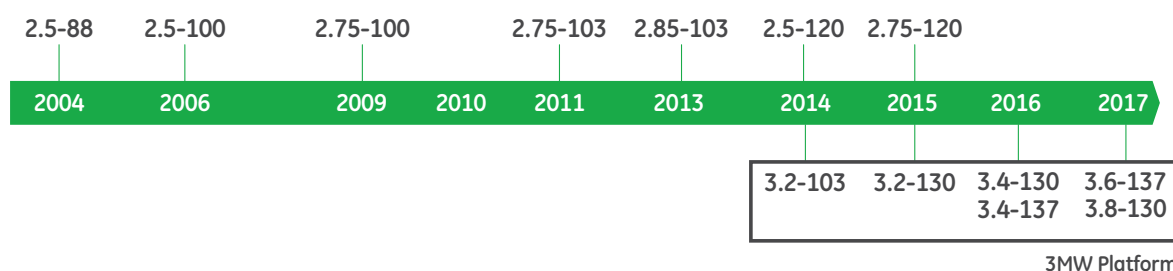
Parameters of the 3MW Platform

GE's 3MW platform can be customized based on nameplate, rotor diameter and hub height.



Building Upon Proven Technology

Model introduction
in Europe



Built from the maturity of its predecessors, the 3 MW platform increases the capacity factor, annual energy production (AEP) and application space. Component enhancements to the 2.5 MW models have resulted in a substantial performance increase, enabling the use of a 130- and 137- meter rotor on the 3 MW series and a nameplate ranging from 3.2–3.8 MW. These enhancements include gearbox and controls improvements, and a new aerodynamic structure enabling a greater blade length (130–137 meter rotor). Crafted for high reliability, GE's 3 MW platform offers excellent availability that is comparable to the 2.5 MW series units operating in the field today.

Technical Description

GE's 3 MW platform machines are three-blade, upwind, horizontal axis wind turbines with a rotor diameter ranging from 130 to 137 meters. The turbine rotor and nacelle are mounted on top of a tubular steel tower, with a range of hub height options that includes 85-, 110-, 131.4-, 134- and 164.5-meter variants. The turbines use active yaw control to keep the blades pointed into the wind. The 3 MW platform is engineered to operate at variable speeds and uses a doubly fed asynchronous generator with a partial power converter system.

Specifications

3 MW platform

- Standard and cold weather extreme options
- Standard tower corrosion protection: C2 internal and C3 external with internal and external C4/C5 options available
- Rotational direction: Clockwise viewed from an upwind location
- Speed regulation: Electric drive pitch control with battery backup
- Aerodynamic brake: Full feathering of blade pitch

GE's 3.2-130 IEC 2B/3A

- Up to 20% higher output than GE's 2.5-120
- Improved load management system and more efficient drive train technology
- Same electrical system as 3.2-103 turbine
- Sound power level of 106 db(A), reduced noise modes available
- Tip heights include 150 m, 175 m, and 199 m rotor

GE's 3.8-130 IEC2B

- Up to 30% higher output than GE's 3.2-103
- Increased electrical rating of 3.4 MW combined with 130-meter rotor
- 106.5 dB(A) normal operation sound power level, reduced noise modes available
- Tip heights include 150 m, 175 m, 199 m, and 233 m

GE's 3.6-137 IEC3B

- Up to 28% higher output than GE's 2.75-120
- New blade for more efficient production in low wind conditions
- Sound power level of 106 db(A), reduced noise modes available
- Tip heights include 178.5 m, 199 m, and 223 m

Features and Benefits

- Engineered to meet or exceed the 2.5 MW platform's historic high availability
- Available grid-friendly options:
 - Enhanced Reactive Power, Low & Zero Voltage Ride Thru, Power Factor Control, WindFreeReactive Power
- Wind Farm Control System; WindSCADA*
- Available in both 50 Hz and 60 Hz versions

Construction

Towers:

- Tubular steel sections provide a hub height of 85 m, 110 m, and 131 m
- Hybrid pre-cast concrete/tubular steel towers for multiple hub heights
- Logistic friendly tower for a hub height of 85 m, 110 m, and 131 m

Blades:

- 63.7-meter blades (130-meter rotor); 67.2-meter blades (137-meter rotor)

Drivetrain components:

- GE's 3 MW platform uses an enhanced gearbox, main shaft with double bearings, and generator with appropriate improvements to enable the 130- and 137-meter diameter rotor in medium and lower wind speeds.

Enhanced Controls Technology

The 3 MW platform uses enhanced controls features:

- GE's patented Advanced Loads Control reduces loads on turbine components by measuring stresses and individually adjusting blade pitch.
- Controls were developed by GE Global Research to reduce extreme loads, including those near rated wind speeds, to improve annual energy production (AEP).

Condition Monitoring System

GE's Condition Monitoring System (CMS) and SCADA Anomaly Detection Services, a complementary suite of advanced condition monitoring solutions, proactively detects impending drive train and whole-turbine issues, enabling increased availability and decreased maintenance expenses. Built upon half a century of power generation drivetrain and data anomaly monitoring experience, this service solution is now standard on GE's 3 MW platform.

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CONNECTED MACHINES

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YAW

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GE Renewable Energy

BEST-IN-CLASS
CAPACITY FACTOR

GE's 1.7-100



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CONTROLS

PowerUp™

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Since entering the wind industry in 2002, GE Renewable Energy has invested more than \$2 billion in next-generation wind turbine technology to provide more value to customers—whether at the turbine, plant or grid level. Through the use of advanced analytics, GE Renewable Energy is redefining the future of wind power, delivering with proven performance, availability and reliability. With the integration of big data and the industrial internet, we can help customers manage the variability that comes with this resource for smooth, predictable power. Our onshore product portfolio includes wind turbines with rated capacities from 1.6-3.4 MW and flexible support services that range from basic operations and maintenance to farm- or fleet-level enhancements.

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GE's 1.7-100 Wind Turbine

GE's 1.7-100 wind turbine offers a 47% increase in swept area when compared to the 1.6-82.5 turbine, resulting in a 24% increase in Annual Energy Production (AEP) at 7.5 m/s. This increase in blade swept area allows greater energy capture and improved project economics for wind developers. GE's 1.7-100 turbine has a 53% gross capacity factor at 7.5 m/s—a class leading performance. GE's proprietary 48.7 meter blade uses the same proven aerodynamic shape as the blades found on the 2.x-100 fleet.

GE's stringent engineering procedures result in a turbine made for high performance, reliability and availability. The use of the rotor from the proven GE 2.x-100 turbine and selected component modifications provide increased annual production with the same reliable performance as the 1.5 MW series turbine.

GE's 1.7-100 meter wind turbine advances the 1.6-100 wind turbine series by utilizing electrical system upgrades to increase the rating from 1.6 MW to 1.7 MW, allowing higher energy production while maintaining consistent workhorse performance, reliability and efficiency.

Available in 80-meter and 96-meter hub heights, these sizes provide flexible options for Class III wind sites, allowing for higher energy capture in lower wind speed environments.

Building Upon the Proven 1.5 MW and 2.5 MW Platforms

The evolution of GE's 1.5 MW turbine began with the 1.5i turbine introduced in 1996. The 65-meter rotor was increased to 70.5-meters in the 1.5s then to 77-meters in the 1.5sle turbine which was introduced in 2004. Building on the exceptional performance and reliability of the 1.5sle, GE introduced the 1.5xle with its 82.5-meter diameter in 2005. Subsequent improvements led to the 1.6-82.5 turbine, introduced in 2008. Ongoing investment in the industry workhorse resulted in the introduction of GE's 1.6-100, and now the 1.7-100 wind turbine with a 100-meter rotor. This product evolution provides an increased capacity factor while increasing AEP by 20–24%.

Incremental changes to the 1.6-100 and 1.7-100 have resulted in significant performance enhancements which include: greater blade length, controls improvements and enhanced power conversion capabilities resulting in increased AEP. With high-reliability to ensure continued operation in the field, GE's 1.7-100 can provide excellent availability comparable with the 1.5 MW series units operating in the field today.

Technical Description

GE's 1.7-100 wind turbine is a three-blade, upwind, horizontal axis wind turbine with a rotor diameter of 100-meters. The turbine rotor and nacelle are mounted on top of a tubular steel tower providing hub heights of 80-meters and 96-meters. The machine uses active yaw control to keep the rotor pointed into the wind. The turbine can operate at a variable speed and uses a doubly fed asynchronous generator with a partial power conversion system.

Specifications:

1.7-100 Wind Turbine:

- Engineered to IEC 61400-1
- Standard and cold weather extreme options
- Standard tower corrosion protection; C2 internal and C3 external with optional C4 internal and C5 external available
- Rotational direction: Clockwise viewed from an upwind location
- Speed regulation: Electric drive pitch control with battery backup
- Aerodynamic brake: Full feathering of blade pitch

Features and Benefits

- Higher AEP than its 1.6 MW predecessors
- Highest capacity factor in its class
- Engineered to meet or exceed the 1.5 MW platform's historic high availability
- Grid friendly options are available:
 - Enhanced Reactive Power, Voltage Ride Thru, Power Factor Control
- Wind Farm Control System; WindSCADA*
- GE proprietary 48.7 meter blade
- Available in both 50 Hz and 60 Hz versions for global suitability

Construction

Towers: tubular steel sections provide hub heights of 80-meters or 96-meters

Blades: GE 48.7-meter blades

Drivetrain components: GE's 1.7-100 uses proven gearboxes, mainshaft and generators with appropriate improvements to enable the larger rotor diameter on the 1.7 MW machine

Enhanced Controls Technology

The 1.7-100 wind turbine employs enhanced control features:

- GE's patented Advanced Loads Control reduces loads on turbine components by measuring stresses and individually adjusting blade pitch
- Controls developed by GE Global Research to minimize loads including those at near rated wind speeds to improve Annual Energy Production (AEP)

Condition Monitoring System (option)

GE's Condition Monitoring System* (CMS) and SCADA Anomaly Detection Services, a complementary suite of advanced condition monitoring solutions, proactively detect impending drive train and whole-turbine issues enabling increased availability and decreased maintenance expenses. Built upon half a century of power generation drivetrain and data anomaly monitoring experience, this service solution is available as an option on new GE Units and as an upgrade.





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