GE Energy

Wind Turbine Overview
World Bank

March 13, 2012

Bob Frick
Senior Sales Manager

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GE Energy

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GE's portfolio … structured for growth

- 6 businesses operating in more than 100 countries … 125+ years
- >300,000 employees worldwide
- 2010 revenue ~$150B

	Energy	Aviation	Healthcare	Transportation	GE Capital	Home & Business Solutions
2010 Rev.	$37.5B	$17.6B	$16.9B	$3.4B	$47.0B	$8.6B
						
	Power & Water Energy Management Oil & Gas	Commercial Military Service Avionics/Systems	Healthcare Systems Life Sciences Healthcare IT Molecular Diagnostics	Locomotives Services Propulsion Systems	Commercial Consumer Real Estate GECAS EFS	Appliances Lighting Intelligent Platforms

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GE Energy

25% of GE revenue

Technology partner for customers

Oil & Gas

- Drilling & Surface
- Global Services
- Measurement & Control
- PII Pipeline Solutions
- Subsea Systems
- Turbomachinery

Power & Water

- Aeroderivative Gas Engines
- Gas Engines
- Nuclear Energy
- Power Generation Services
- Renewable Energy
- Thermal Products
- Water & Process Technologies

Energy Management

- Digital Energy
- Industrial Solutions
- Converteam

Energy is a global scale business

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Diverse energy solutions

Gas | Renewables | Water Technologies | Smart Grid

Distributed Power | Electrification | Asset Health | Enhanced Oil Recovery | Subsea Systems

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GE Power & Water

Part of GE's $38B energy business

Gas Turbines

Steam

Biogas

Nuclear

Cleaner Coal

Water

Wind

Solar

Renewable Energy

Renewables – building on power generation technology & expertise

GE's winning renewable portfolio

Wind

1.5 MW series
1.6-100 World's most efficient turbine

2.5 MW series
2.75-103 World's largest wind farms

Offshore 4 MW series
4.1-113 World's highest output shallow water design

Solar

Panels
Thin film record efficiencies

Power electronics
1MW Inverter 15,000 running in wind

Solar power plant
1MW block scalable, reliable, cost effective

Services

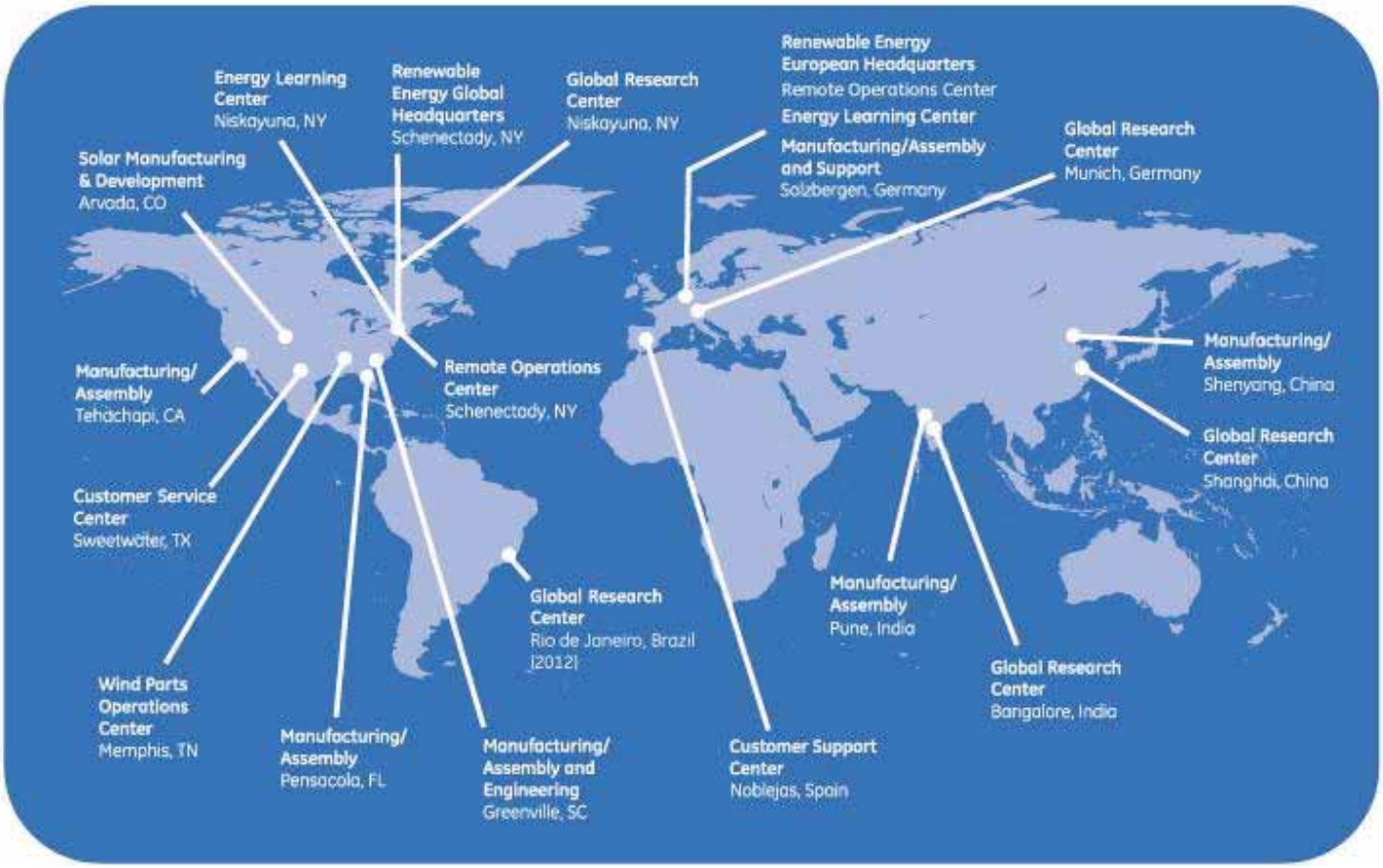
Upgrades, O&M, FSA
Full breadth of customer solutions & parts

Remote operations
Advanced diagnostics & technical support

Availability
Best running fleet 98%+

Delivering the lowest cost of energy solutions with the best products and services

GE Renewables Global Locations



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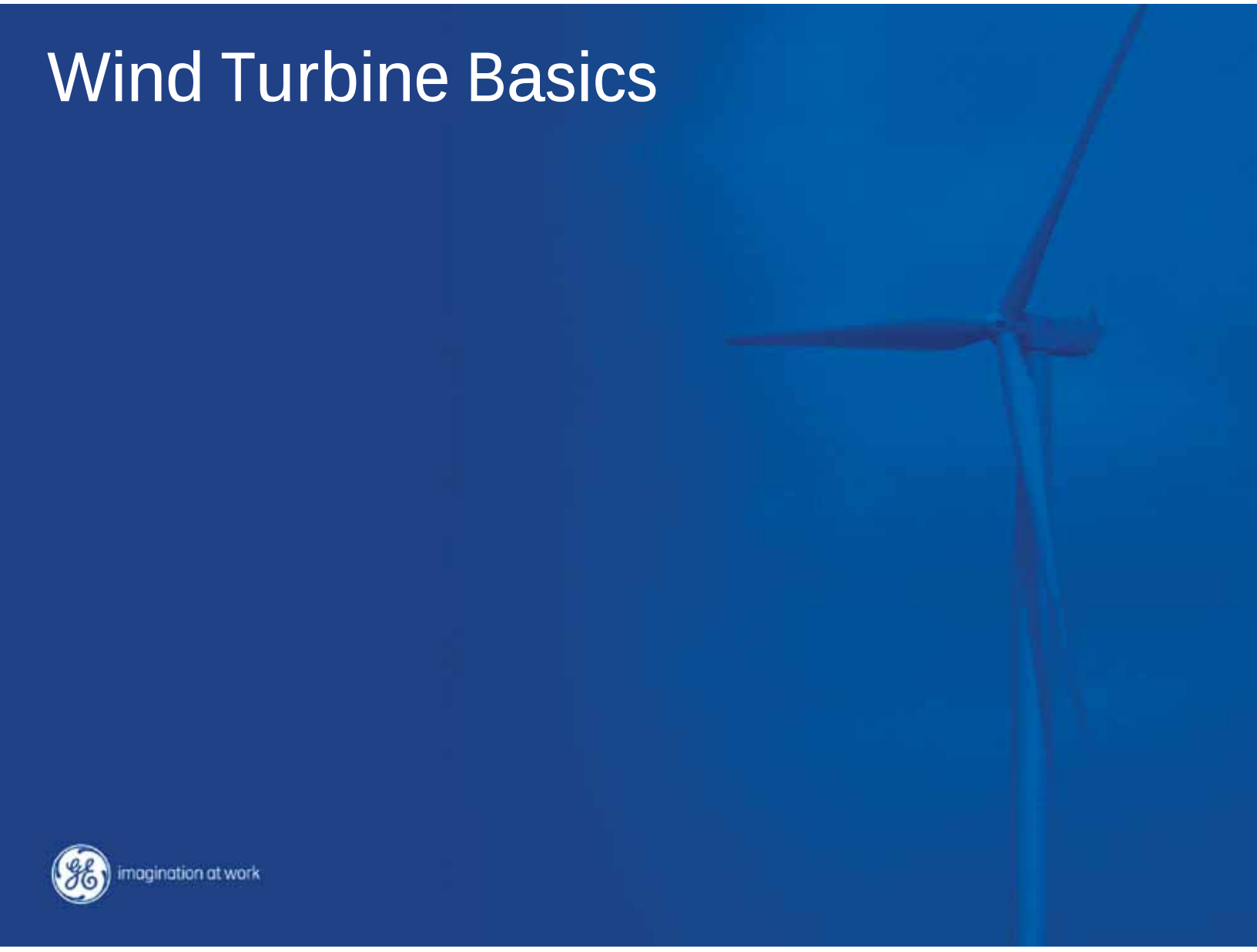
Wind Turbine Basics



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The Wind Turbine

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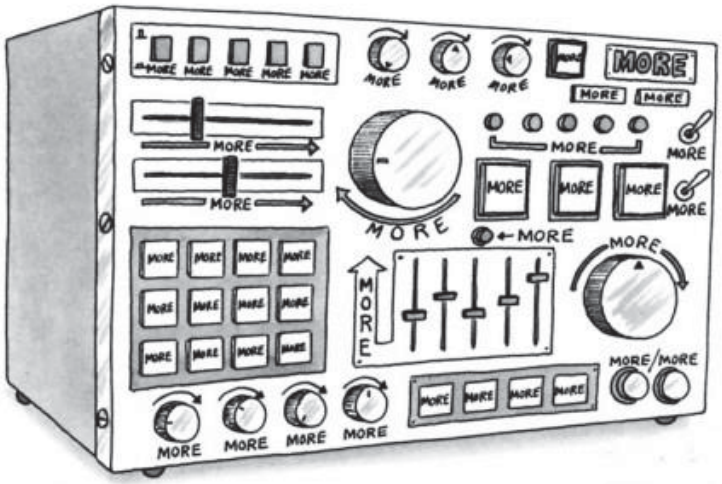
Wind Project Variables

- Wind Speed
- PPA Rate
- Turbine Selection
- Financing
- Available land/scale
- Community Support
- Environment
- Political Landscape
- Interconnect/Transmission



Good Wind

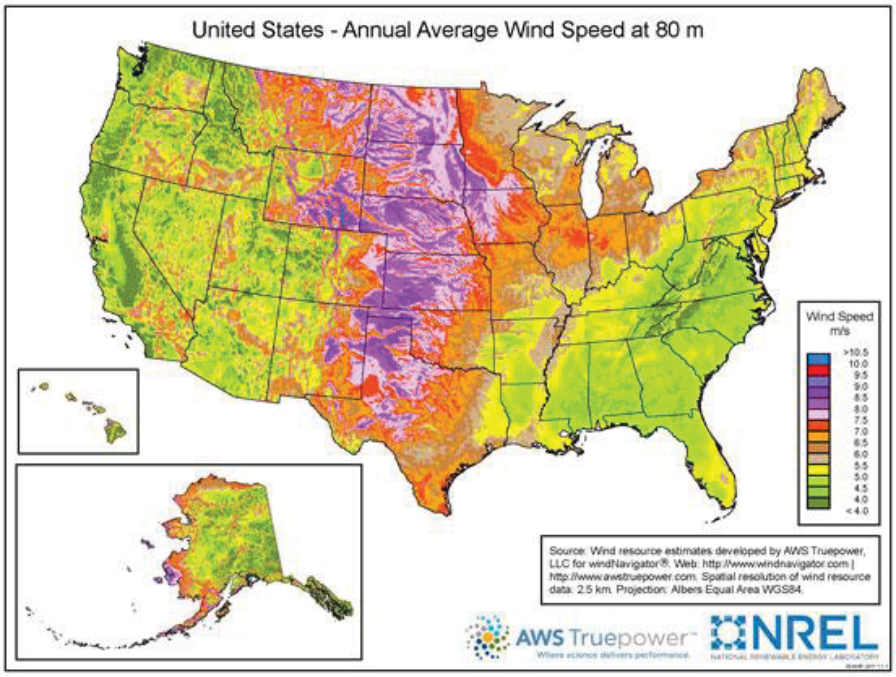
Speed

- Strong >8.0 m/s
- Decent 7.0-8.0 m/s
- Weak <7.0 m/s

Uni-directional

Low Turbulence

Well-defined



GE Wind Energy

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GE Wind Energy

Most efficient, reliable wind turbine fleet

- $30B GE revenue since '03
- 17,000+ units … 27GW+
- 98%+ availability … ↑15%

GE Onshore Product strategy

- **Portfolio flexibility …** value where you need it
- **Evolutionary development strategy** … world's best running fleet
- **Continual investment …** focused on increasing customer value

~$2B invested to date for product evolution

GE's Installed Wind Fleet

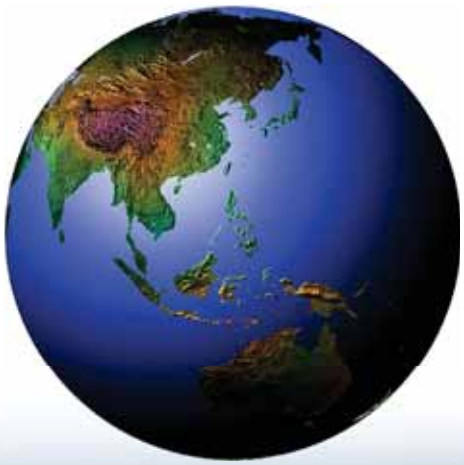
USA
(12,081 units/18,124 MW)

Canada
(936 units/1,411 MW)

Europe +Turkey –
16 Countries
(3,055 units/5,094 MW)

China
(747 units/1,121 MW)

Japan
(290 units/478 MW)



17,000+ WTGs, 27GW+ installed … 22 countries

As of 3Q, 2011

Evolution of GE Wind Products

GE Wind Products	'02	'11	
AEP (GWh/yr)*	6.0	11.6	+94%
Capacity Factor (%)*	45	60	+16%
Availability (%)	85	98	+15%

(* @8.5m/s AMWS)

GE Wind Products … *Proven Performance and Reliability*

1.5/1.6MW availability trends

2007-2010 1.5sle/xle Model Year Trends

	'07	'08	'09	'10	'11 Thru 2Q
2007	95.6%	97.1%	97.6%	96.9%	97.3%
2008		97.0%	98.1%	98.0%	98.3%
2009			97.0%	98.1%	98.1%
2010				97.9%	98.1%
1.5-82.5			98.5%	98.2%	98.3%
1.6-82.5					98.3%

Improved design
Year over year

2Q 2011

Improved service, resolved top issues →

Model year: The year in which a turbine is commissioned

First 12 weeks of operation excluded

World's best running fleet defined

GE’s Evolutionary product strategy

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GE products ... greater customer value through technology

1.6-100

- 47% increase in swept area over the 1.6-82.5
- 19% increase in AEP @ 7.5 m/s
- Class leading performance … 53% GCF @ 7.5 m/s

2.75-103

- 6% increase in swept area over the 2.5-100
- 9.2% increase in AEP at 8.5 m/s when compared to the 2.5-100
- Low Noise Trailing Edge - more power, less sound … siting in sound sensitive areas at full rated power

2.75-118

- 48% GCF @ 7.5 m/s
- Building on 1.5 and 2.5 series platform uprate experience
- Utilize lessons learned of 17,000+ units installed

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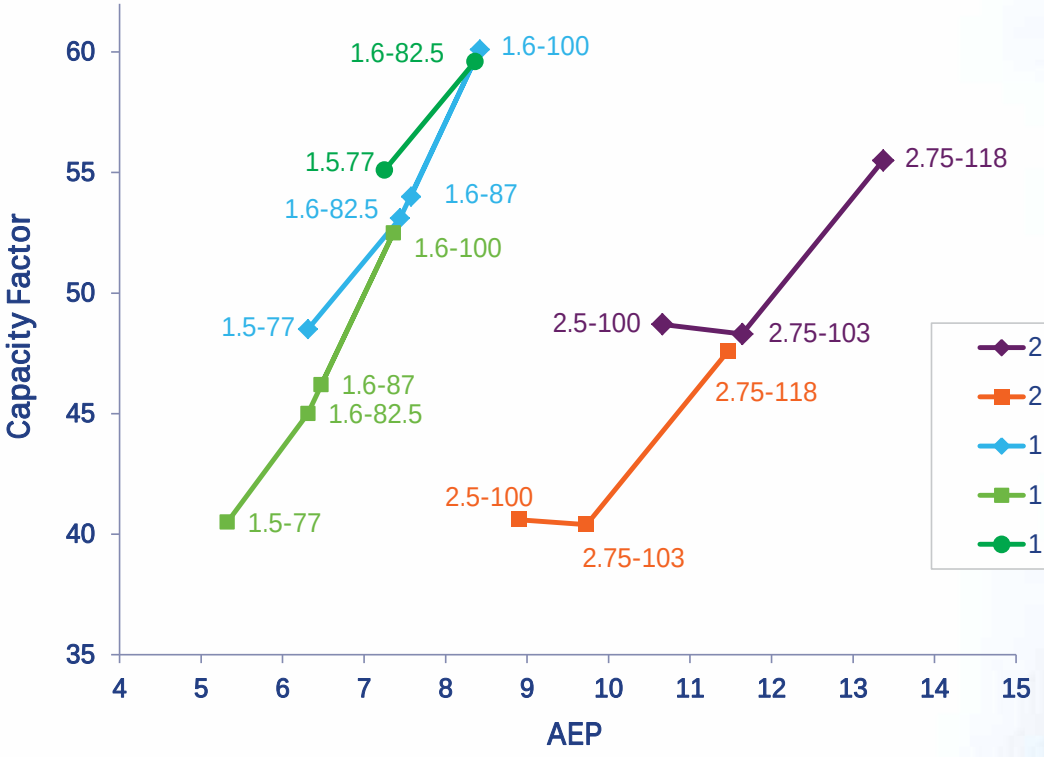
GE Wind product offerings
for land & MW constrained projects

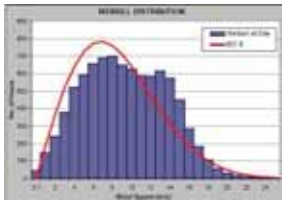


Selecting the correct WTG can increase AEP by as much as 1GW/yr = $1MMNPV*

*based on a $50/MWHr PPA

Mechanical Load Analysis, MLA, Inputs

1. **WIND SPEED DISTRIBUTION, K & A factor:** wind speed distribution, Vavg



2. **AIR DENSITY:** kg/m3

3. **Characteristic Turbulence Intensity, (CTI),** increases the mechanical loads on a wind turbine and is defined by the IEC as the mean value of the turbulence intensity plus one standard deviation.

4. **FLOW INCLINATION ANGLE:** The slope of the terrain influences the approach angle of the wind with respect to the wind turbine rotor and influences the mechanical loads

5. **EXTREME WIND CONDITIONS, V_{50}:** The extreme wind conditions are expressed in terms of gust speeds at hub height having a recurrence period of 50 years. Gust speeds having an averaging period of 10 minutes (Vref) are required for the assessment of the extreme loads.

6. **WIND SHEAR PROFILE:** The vertical variation of the wind *V(z)* is defined using a wind shear exponent and the power law. Knowing the hub height and the wind speed at that height, the velocity at height can be determined.

7. **WIND ROSE:** wind direction

8. **TURBINE SPACING:** wake effect, optimal energy capture

Execute the MLA for optimal product fit

Wind Options should be run on all preliminary turbine selection

1.X platform

- 1.6-100
- 1.6-82.5
- 1.5-77

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Model Overview
1.6-100

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1.6-100 … World's most efficient wind turbine

- **Capacity factor of 60% @ 8.5 m/s**
- **Validation unit installed Feb 2011**
  - Installation time … same as 1.6-82.5
  - Certified power curve measurements ongoing … validating published curve
  - Initial sound measurements in line with expectations
- **Component testing**
  - Blade static test complete
  - Gearbox testing started
- **ADA Certification**
  - Both the 1.6-82.5 & 2.5-100 are ADA certified
  - GE's ADA certification pass rate is 100%

Continued evolution of the industry leader

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1.6-100 Configuration Summary

Component	Common with 1.5-series	Scaled from 1.5-series	Common with 2.5-series	Scaled from 2.5-series	Comment
Blade				✓	GE's 48.7m aerodynamics & blade mold
Controls		✓		✓	Enhanced controls technology
Pitch Bearing			✓		
Pitch Drive			✓		
Pitch System			✓		Add 690V to 400V transformer
Hub			✓		Spinner shortened
Main Shaft		✓			710mm OD main shaft vs. 600mm
Main Bearing		✓			710mm ID
Pillow Block Hsg		✓			Scaled to fit the larger rotor/main bearing
Gearbox		✓			Modifications vary by supplier
Bedplate, frame		✓			Larger casting pattern, opt. gen frame
Tower		✓			Flange mods & thicker steel for fatigue & buckling
Yaw Bearing		✓			Larger ball bearings, same outer diameter
Yaw Drive				✓	Larger bearings, output shaft, flange diameter
Generator	✓				
Power Conversion	✓				

Gearbox: testing & evaluation

IEC Requirements

- HALT test – 20 year simulated lifetime
- Tear down test
- CWE test

IEC Requirements: HALT, 100% load, CWE, and Tear down tests

GE requirements much stricter

GE Requirements

- 200% reverse and 300% overload
- LDM (strain gage) & contact pattern test
- Oil tightness
- Acoustic performance
- Natural frequency
- Oil distribution test
- Fit up test in nacelle

Completed
On plan

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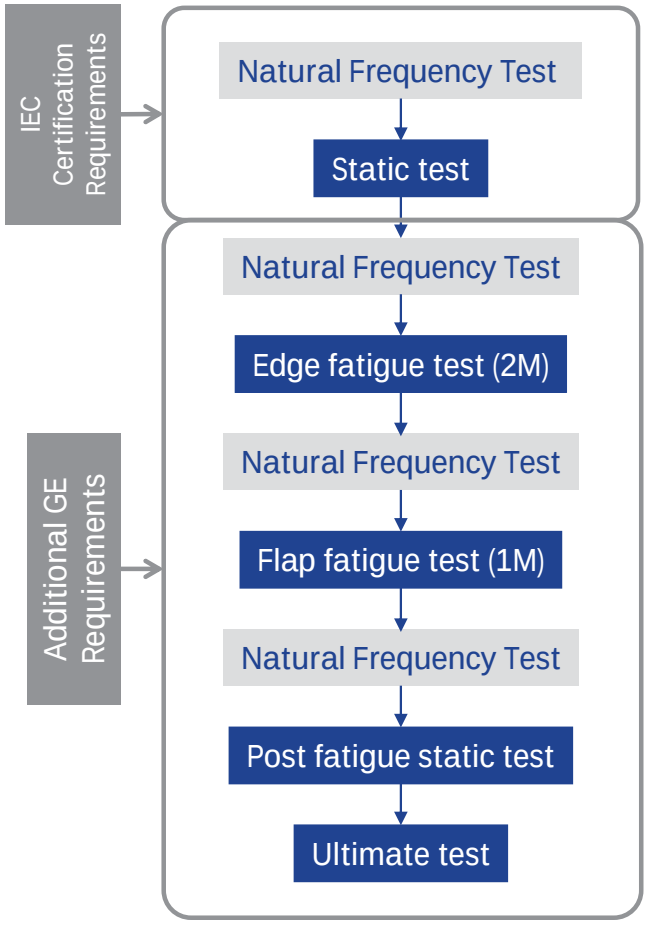
Blade testing overview

- Comprehensive blade testing: static (extreme), fatigue, post fatigue static, natural frequency (NF), test to failure (Ultimate)
- Statically tested to >110% of design loads covering >70% span
- Fatigue 3M cycles (Flap: 1M, Edge: 2M) > 133% of design load…Better understanding on failure mode
- Additional intermediate NF tests to ascertain integrity
- Blades are strategically cut-up and inspected after final testing
- Completed tests demonstrate GE exceeds GL and IEC requirements

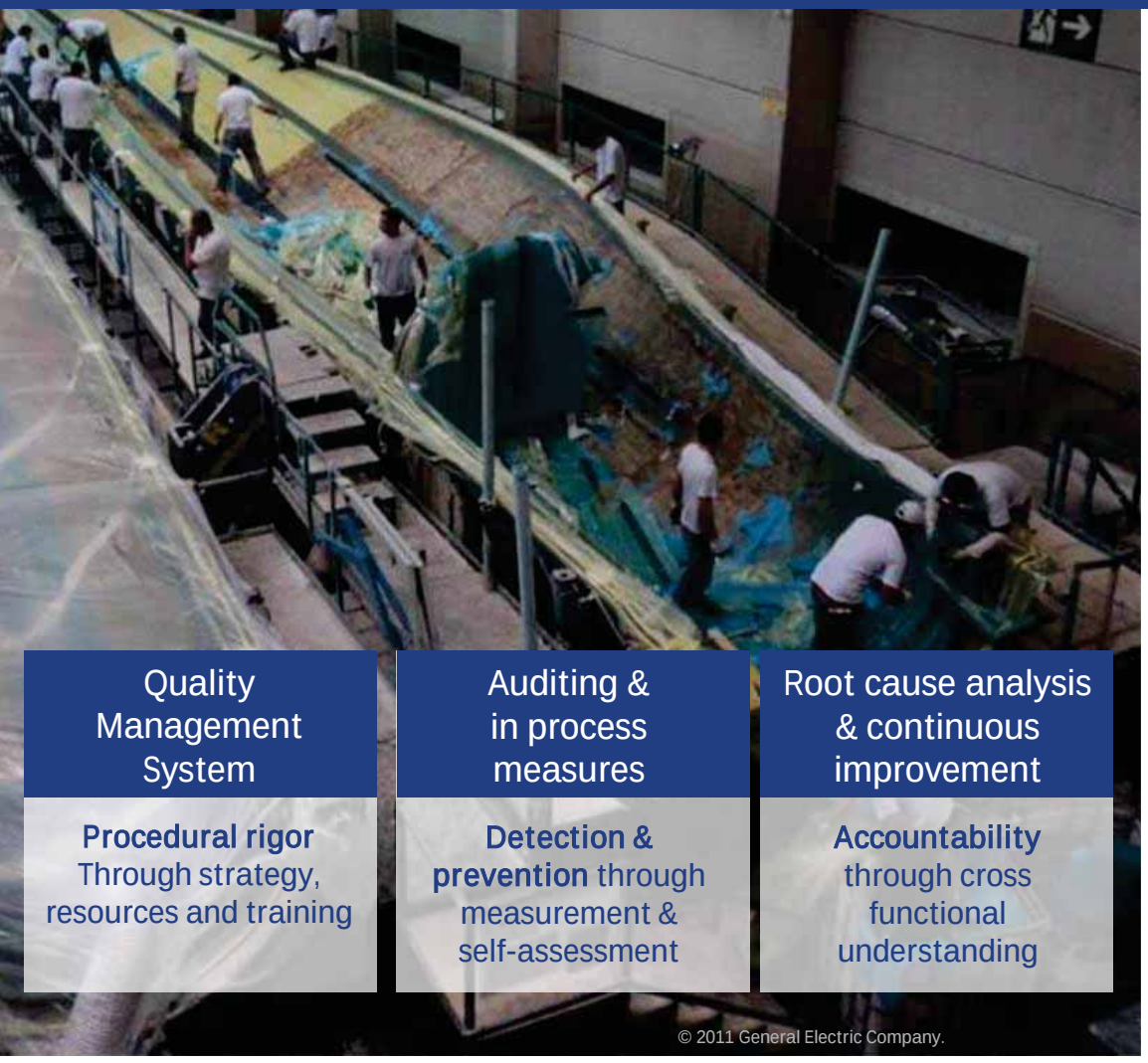


Component Test Lab – Greenville, SC

- Test equipment utilizes real wind turbine field data
- Validates robust design
- Expertise from Thermal heritage

Gold standard lab test facility

GE sources with strict quality control standards



Quality Management System	Auditing & in process measures	Root cause analysis & continuous improvement
Procedural rigor Through strategy, resources and training	**Detection & prevention** through measurement & self-assessment	**Accountability** through cross functional understanding

- GE strictly validates financial stability, safety, & legal viability through **Supplier Approval**
- Supplier process is strictly controlled & capability monitored through **Qualification**
- Supplier compliance to qualification & design requirements audited regularly through **Surveillance**

Model Overview
1.6-82.5

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1.6-82.5 … advancing “The Industry Workhorse”

Increase customer value

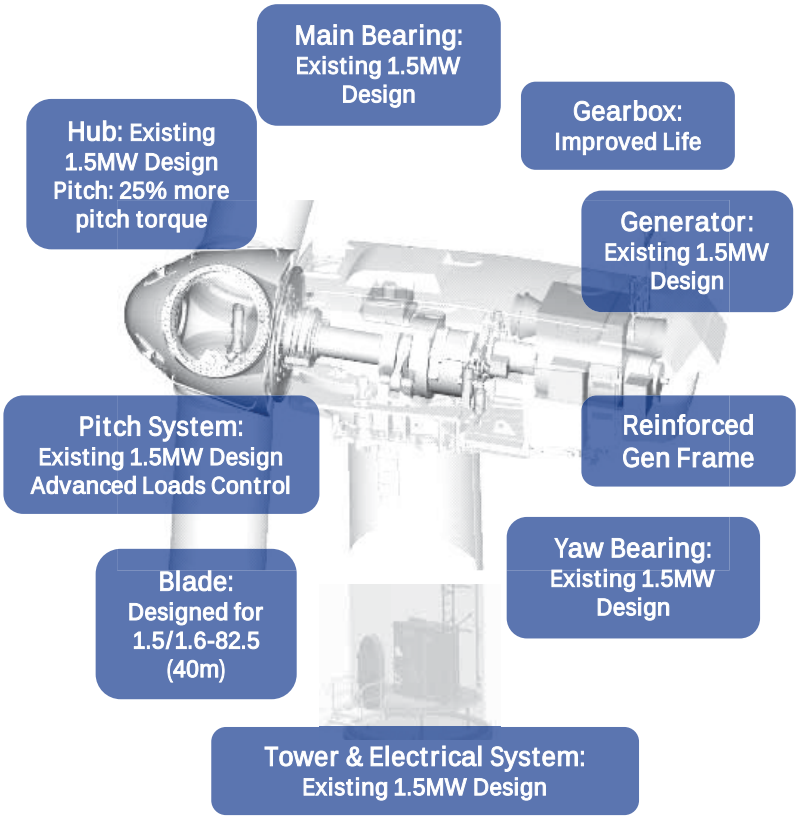
- Performance increase (AEP) of 15% @ 8.5 m/s over the 1.5-77
- 15% larger swept area over the 1.5-77

Features

- Advanced Loads Control enables greater blade length
- Powerful pitch motor with 1:188 pitch drive gearboxes
- 50 and 60Hz, standard and cold weather extreme in IEC II (8.5m/s)

Maintain bedrock of reliability

- Built on proven platform experience



1.6-82.5 Configuration Summary

Component	Common with 1.5 SLE	Common with 1.5 SE	Scaled	Common with 2.5	Comment
Blade			✓		GE40 designed for the 1.6-82.5
Controls				✓	Advanced Loads Control (ALC)
Pitch Bearing		✓			
Pitch Drive	✓				
Pitch System	✓				
Hub		✓			
Main Shaft	✓				
Main Bearing	✓				
Pillow Block Hsg	✓				
Gearbox			✓		New gearbox design with extended gear face widths, enlarged bearings, and changed gear modules
Bedplate, frame	✓				
Tower	✓				
Yaw Bearing		✓			
Yaw Drive		✓			
Generator	✓				
Power Conversion	✓				

Model Overview
1.5-77

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1.5-77 (TCIb)… our new Class I offering

Increase customer value
- Capacity factor of 58% @ 10.0 m/s

Features
- Advanced Loads Control enables greater blade length
- Redesigned root for GE 37m blade, reinforced hub and tower
- 50 and 60Hz, standard and cold weather extreme in IEC I (>10m/s)

Maintain bedrock of reliability
- All components from existing technology

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1.5-77 Class 1 Configuration Summary

Component	Common with 1.5SLE/XLE	Scaled from 1.5SLE/XLE	Comment
Blade		✓	GE37c designed for the 1.5-77 with 1.5-82.5 studs and Barrel nut configuration
Controls		✓	Advanced Loads Control , from 2.5 MW WTG
Pitch Bearing	✓		
Pitch Drive	✓		
Pitch System	✓		
Hub	✓		
Main Shaft	✓		
Main Bearing	✓		
Pillow Block Hsg	✓		
Gearbox	✓		
Bedplate, frame	✓		
Tower	✓		Reinforced Tower
Yaw Bearing	✓		
Yaw Drive	✓		
Generator	✓		
Power Conversion	✓		

2.x Platform

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GE 2.X Platform - Turbine of Choice

Largest Wind Farm in North America

Shepherds Flat
Wind Farm – 845 MWs

Eastern Oregon Morrow & Gilliam counties

Largest Wind Farm in Europe

Fântânele-Cogealac
Wind Farm – 600 MWs

South East Romania

Largest Wind Farm in Germany

Germania Wind Farm - 143 MWs

Huselitz, Germany (100 Km east of Berlin)

Based on proven evolutionary technology

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2.75-103 … increasing customer value through product evolution

Increase customer value
- 6% more swept area than 2.75-100 for greater AEP
- Building on uprate experience of 1.5MW platform
- AEP increase of 9%+ over the 2.5-100

Minimize sound emissions
- Sound Power Management to meet strict sound requirements through controls technology

Maintain bedrock of reliability
- Proven technology … 103m rotor operating since January '10
- Evolutionary product … built to maintain GE's proven performance and reliability

2.75-103 Initial Unit
Wieringermeer, Netherlands
Installed: December 2010

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2.75-103 Configuration Summary

Component	Common with 2.5-100	Scaled from 2.5 -100	Comment
Blade (50.2m)		✓	50.2m blade scaled from 48.7m blade
Tower		✓	98.3m tower modified from 100m tower Revised tower base ring Revised tower door for increased cooling
Generator		✓	Revised operating points
Electrical Power Path		✓	Larger current capability – New cables, GMCB, switchgear
Power Conversion		✓	Thermal monitoring added, modifications to accept larger conductors
Controls		✓	Component based temperature control from 35-40°C
Transformer		✓	New transformer for increased KVA rating
Nacelle	✓		New nacelle in 2011 – enables rail shipment, applies to all 2.x units
Hub and Pitch	✓		
Main Shaft	✓		
Main Bearings	✓		
Gearbox	✓		
Bedplate	✓		
Yaw System	✓		

2.75-118 ... Industry leading performance based on proven technology

Increase customer value

- 18% AEP & Capacity Factor improvement over 2.75-103
- Building on 1.5 and 2.5 series platform uprate experience

Minimize sound emissions

- Low noise trailing edge technology … performance increase with same sound
- Sound Power Management to meet strict regional sound requirements

Maintain bedrock of reliability

- Evolution of existing 1.x and 2.x platforms
- Utilize lessons learned of 17,000+ units installed

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Model overview – Services

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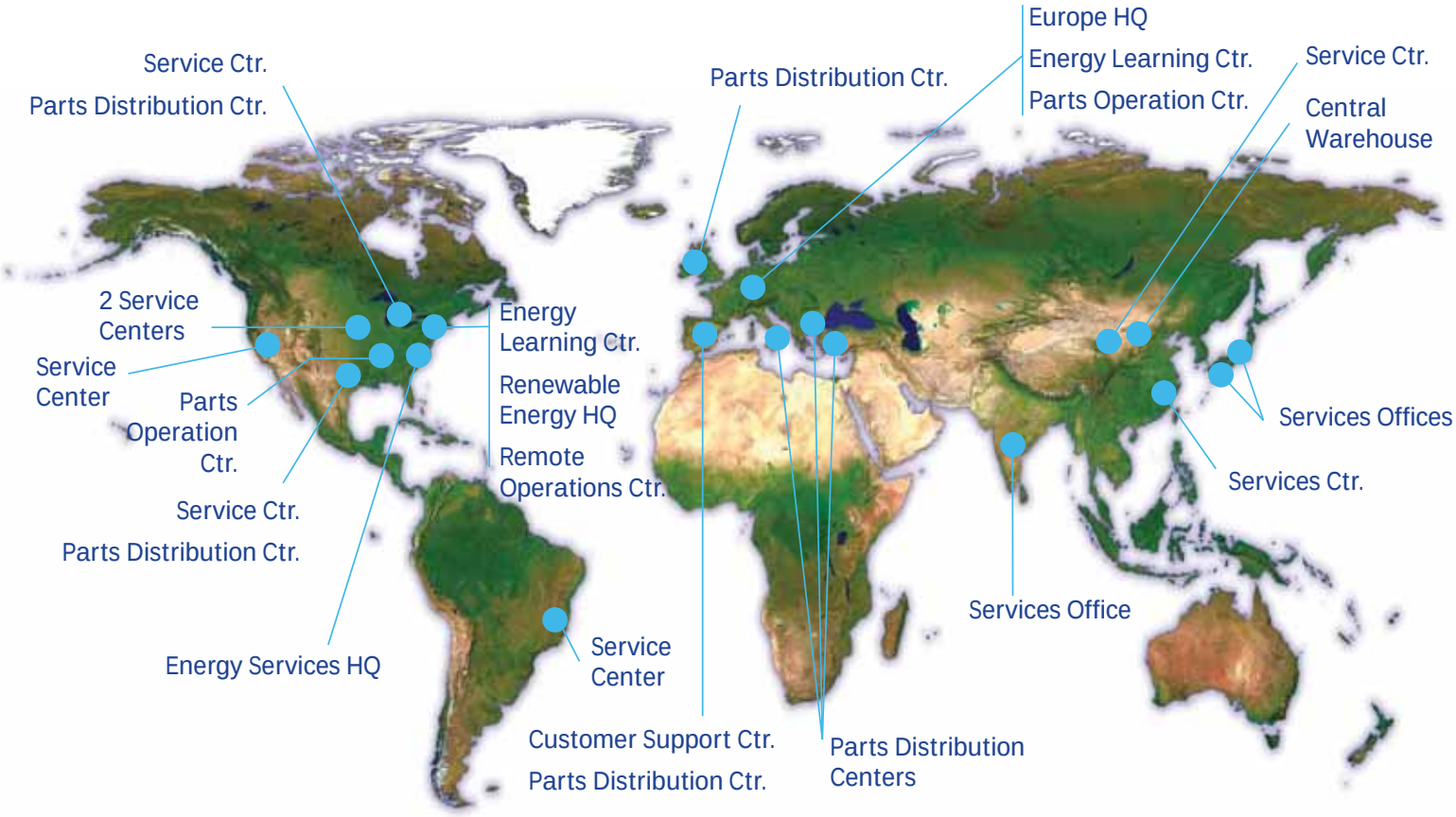
GE's Wind Services business



115 global locations, 900 technicians for local support

World-class service

- Over 115 global GE wind service office locations
- Remote Operations support 24 hrs a day, 365 days a year
- Operations in 30 countries

- $1 billion spent on training across GE/yr
- 900+ highly trained wind service technicians
- Rigorous certification process … hundreds of hrs practical & classroom experience

RESOURCES

EXPERTISE

SOLUTIONS

- Full service agreements
- Knowledge-based solutions
- Upgrades

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Production based availability

VS.

Production Availability

measures MWhs a turbine generates / by the MWhs it should have generated

Time Based Availability

measures the time the turbine is available / by the time it should be available

Aligning with customers metrics

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Remote Monitoring & Diagnostics … maximized availability

- ✓ 24X7 customer support including strong collaboration with field engineers
- ✓ Centers - Salzbergen, Germany & Schenectady, NY – Hot Swap Capability
- ✓ 50+ customer service specialists
- ✓ 7,000+ turbines controlled remotely … 98%+ availability
- ✓ Fleet analysis operating rhythm with engineering-based fault resolution, continuously evolved
- ✓ 12,700+ turbines w/ data connections

* As of 3Q 2011

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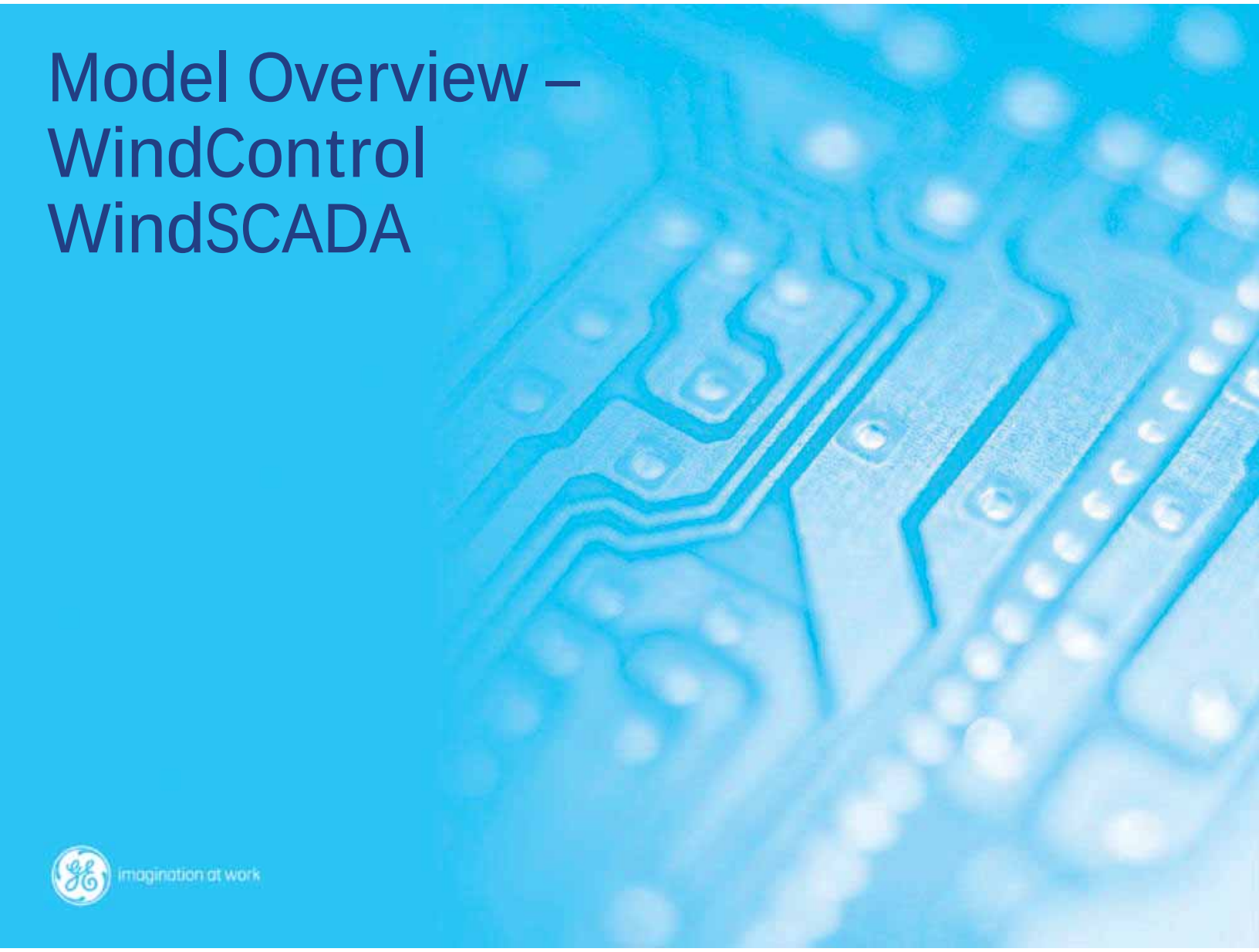
Model Overview – WindControl WindSCADA



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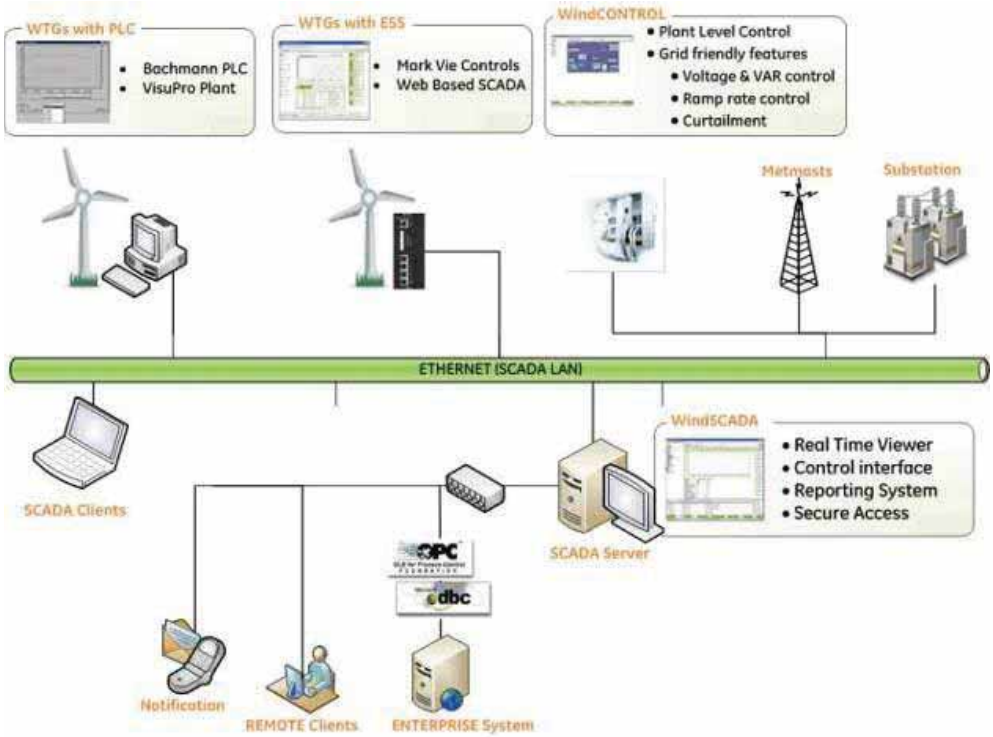
Key components of plant systems



WindCONTROL

- Provide functions similar to conventional power plant
- Coordinated control of all WTG
- Integration with substation equipment

WindSCADA

- Utility grade SCADA system
- Integrated monitoring & control of WTG, substation
- Tools for O&M operations
- Robust remote and local access
- Industry accepted protocols for data transfer

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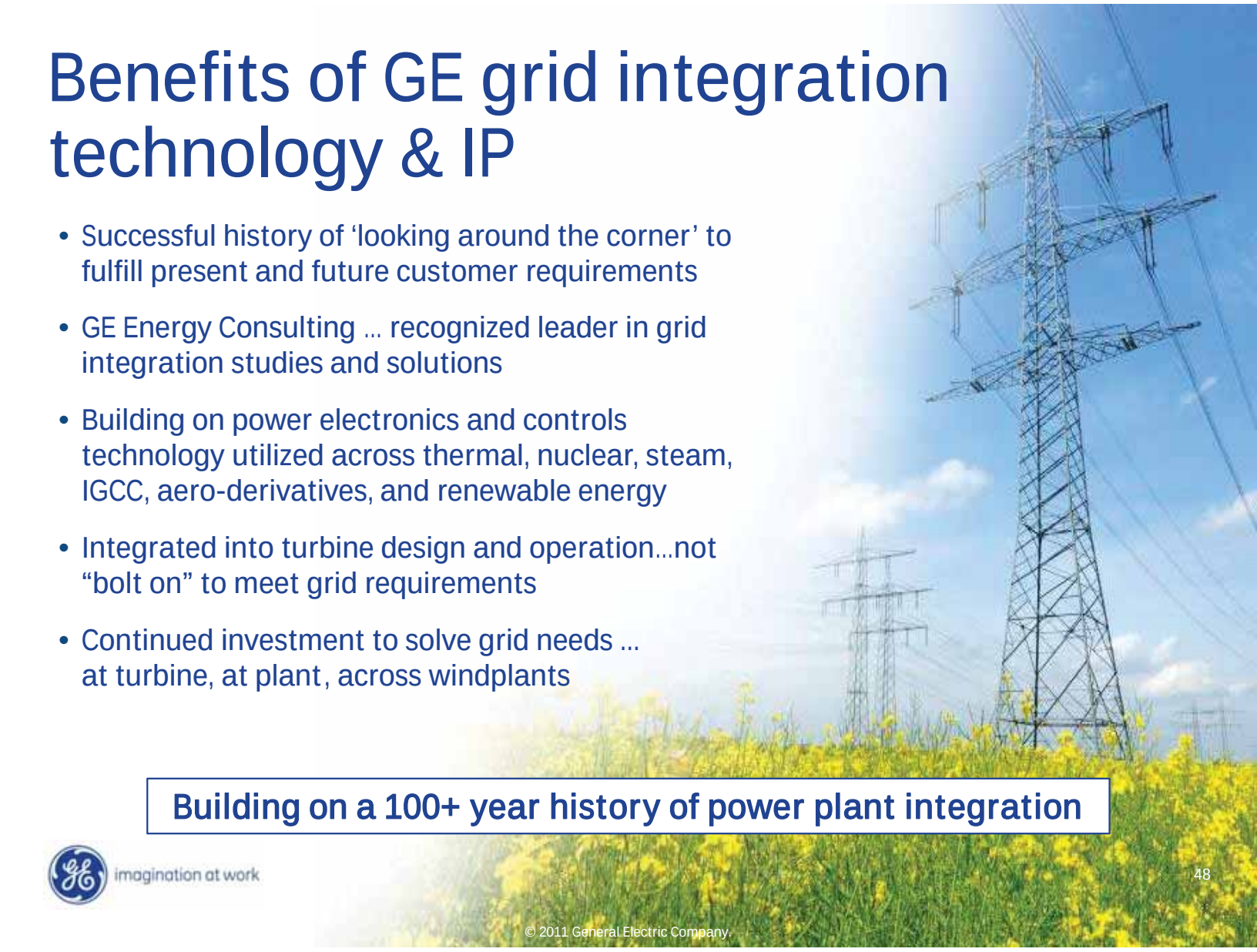
Benefits of GE grid integration technology & IP



- Successful history of 'looking around the corner' to fulfill present and future customer requirements
- GE Energy Consulting … recognized leader in grid integration studies and solutions
- Building on power electronics and controls technology utilized across thermal, nuclear, steam, IGCC, aero-derivatives, and renewable energy
- Integrated into turbine design and operation…not "bolt on" to meet grid requirements
- Continued investment to solve grid needs … at turbine, at plant, across windplants

Building on a 100+ year history of power plant integration

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“Grid Friendly” wind power plant

Address reliability concerns

Industry leading ride-through technology WindRIDE-THRU™ since 2005

Improve grid operability & security

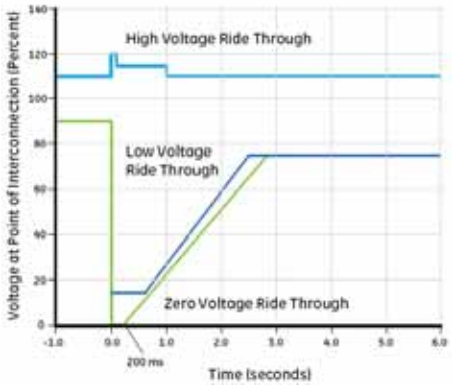
200+ WindCONTROL™ installs, 8,500 turbines

Voltage and Megawatt control

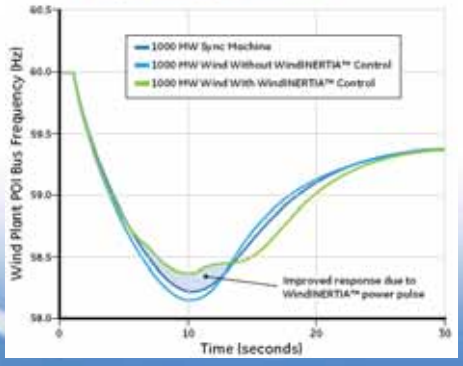
Enable high levels of wind penetration

WindINERTIA™ – new grid feature by GE

GE's Standard WindRIDE-THRU® Offerings



Simulated System Response Following a Trip of a Large Generator



Controls technology driving grid leadership

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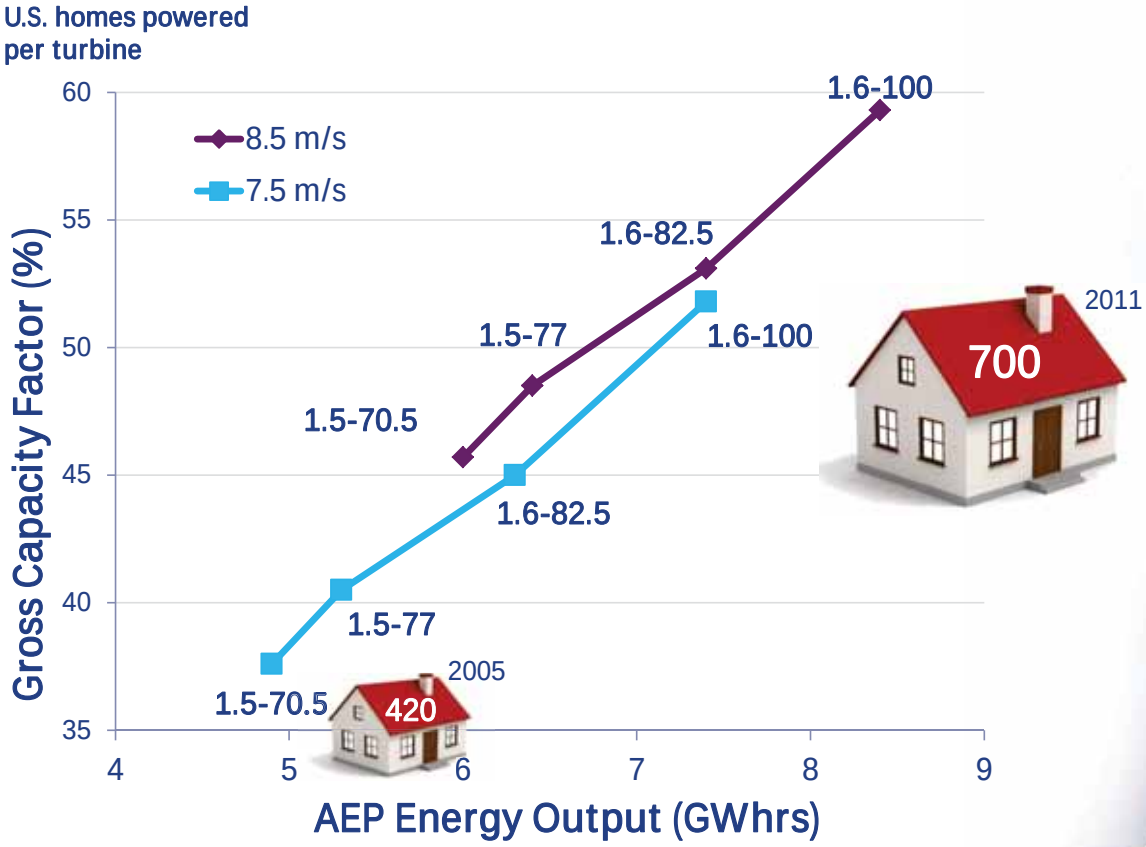
REFERENCE ONLY

Presentation Chapter - Index

Chapter 1: 1.X platform technical slides

1.x Wind product advancements



Continuing to lead wind industry evolution

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1.X MW technical summary

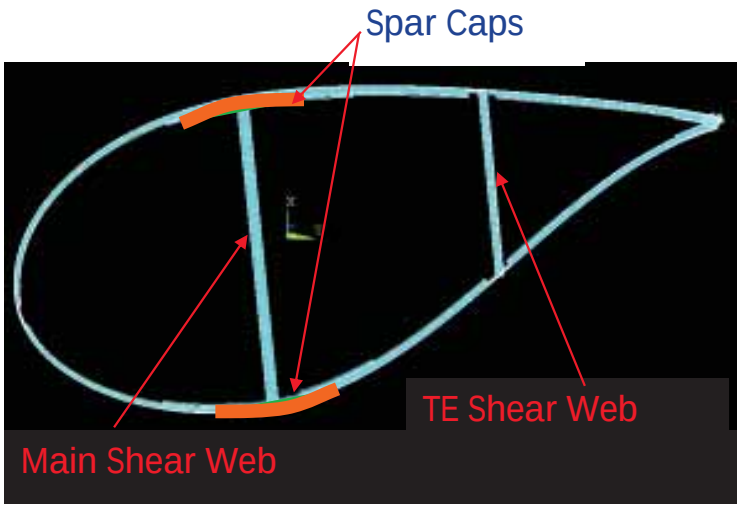
	1.5–77	1.6-82.5	1.6-100
Rotor diameter	77m	82.5m	100m
Hub height	65m, 80m	80m, 100m	80m, 96m
Wind class (IEC)	IEC TC IB	IEC TC IIB	IEC TC IIIs
Blade length	37m	40m	48.7m
Swept area	4,418m	5,014m, **+ 15%**	7,451m, **+ 47%**
Cut-In wind speed	3.5 m/s	3.5 m/s	3.5 m/s
Cut-Out WS	25 m/s	25 m/s	25 m/s
RE-Cut-In WS	22 m/s	22 m/s	22 m/s
Noise	106dBA	106dBA	105dBA
7.5 m/s, CF - AEP	**40.5% 5.32**	**45.0% 6.31**	**52.5% 7.36**
8.5 m/s, CF - AEP	**48.5% 6.37**	**53.1% 7.44**	60.1% **8.42**
9.5 m/s, CF - AEP	**55.1% 7.25**	**59.6% 8.36**	66.1% **9.26**
STD Weather	-20°C to 40°C	-20°C to 40°C	-20°C to 40°C
CWE	-30°C to 40°C	-30°C to 40°C	-30°C to 40°C
STD ADA Cert	4th Q2012	TUV Nord IEC 61400-1	4th Q2011
CWE ADA Cert	4th Q2012	TUV Nord IEC 61400-1	4th Q2011
V_{avg}	8.5/10 m/s	8.0/8.5 m/s	7.5 m/s
V_{ref}	45 m/s	40 m/s	37.5 m/s
V_{50}	70.0 m/s	56.0 m/s	52.5 m/s
TI; % @ 15m/s	18/16 %	16%	16%

Generating customer value through technology

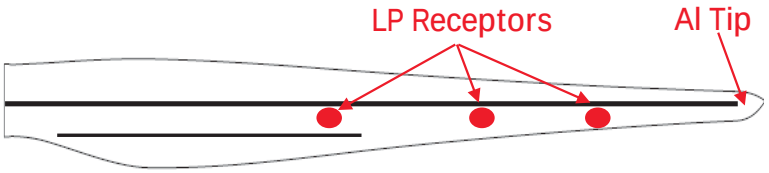
Blades

1.6-100, 48.7 Meter Blades

- 1.6MW 48.7 same aerodynamic shape as the 48.7 blade on the 2.5-100, validated performance on over 1,500 blades in service
- Full-length main shear web and trailing edge shear web – based on the GE 37C blade design, validated on over 12,000 GE1.5 SLE blades
- Advanced Lightning Protection - copper mesh tip first 3 meters and multiple receptors



Blades: lightning protection



- Designed per IEC 61400-24, Level 1 strength and 2010 GL Guidelines.
- Protection system includes 1 solid tip receptor & 3 receptors each on PS & SS blade shells

  - Added extra receptors. As recommended by GL 2010 guidelines

  - Use of Erico receptor system, validated in lightning strike test

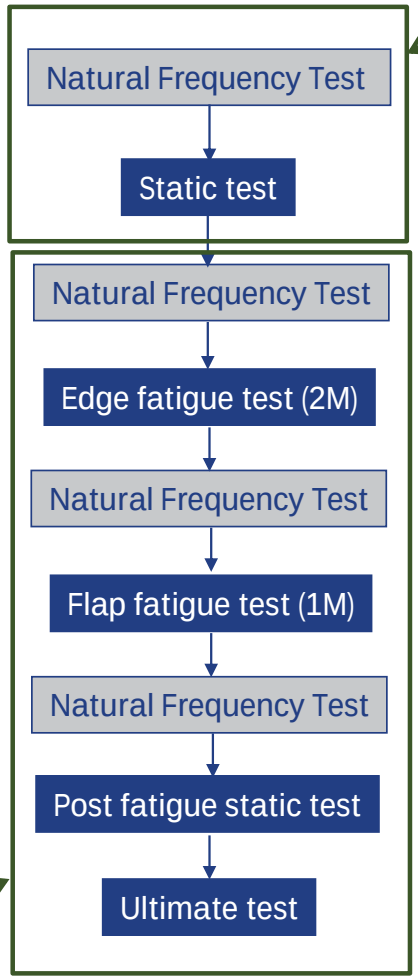
  - Solid aluminum tip receptor from 2.5-100

Erico Receptor

Erico Receptor Strike Test

Blade Testing overview

- Comprehensive blade testing: static (extreme), fatigue, post fatigue static, natural frequency (NF), test to failure (Ultimate)
- Statically tested to >110% of design loads covering >70% span
- Fatigue 3M cycles (Flap: 1M, Edge: 2M) > 133% of design load…Better understanding on failure mode
- Additional intermediate NF tests to ascertain integrity
- Blades are strategically cut-up and inspected after final testing
- Completed tests demonstrate GE exceeds GL and IEC requirements



GE-Tecsis collaboration

Static (horizontal/vertical pull)

Fatigue (rotating mass)

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Blades: lightning protection

- Faraday cage created around tip of spar cap. Outer 3m of blade surface covered in copper foil
- Design employed for 55AT tech demo blade
- Spar cap grounded to aluminum tip through internal copper mesh layer
- Lightning strike test:
  - High voltage strike attachment
  - High current physical damage
  - Testing according to IEC 61400-24 Ed. 1, Annex D guidelines
  - Full 48.7 blade test planned for end 2011

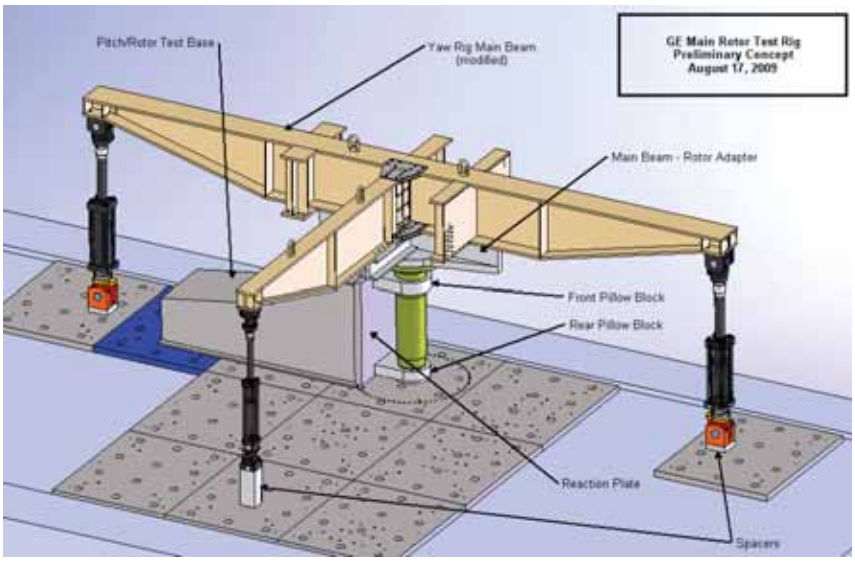
Copper Mesh Faraday Cage

Spar Cap Grounding

Main shaft: Validation testing

GL requires for certification 5,200 cycles of the Main Shaft, test was stopped after 1,456,530 cycles due to: **Cracking of the test rig!** Large Main beam adaptor cracked.

- No indications in change of strain, flange displacement, and no cracks shown during dye-penetrant inspections.
- Lab time constraints – other tests delayed by the longevity of the shaft



Tests validated shaft stress and fatigue strength calculations

Evolution of 1.6-100: Enhanced Controls Technology (ECT)

Key features:

- 4 main control regulators
- Sensor set equivalent to 1.6-82.5
- Adjust control gains as a function of wind speed
- ECT incorporates turbine model into control system to estimate wind speed

Over 3,000 MWs of ALC in operation & 5,000 MWs committed

Component	Description	Experience	What's new
Speed & power	Control generator speed and turbine power production	All 1.x and 2.x **26,000+ MWs**	Control gains are variable not fixed
Tower Damping	Tower fore-aft, side-to-side damping	1.5-77/1.5-82.5, 1.6-82.5, 2.5-100 **20,000+ MWs**	Control gains are variable not fixed
Drive train damping	Damp drive train modes	All 1.x and 2.x **26,000+ MWs**	Control gains are variable not fixed
Rotor imbalance	Asymmetric blade pitch for shear, yaw, gravity loads, etc.	1.5/1.6-82.5 2.5-100 **3,000+ MWs**	Extends ALC to tower damping reduction due to blade passing
MBC estimator	Sensor data + turbine model to calculate wind speed	Field Validated 2.5-100, 1.6-100	New component in control strategy

Key control components build on fleet experience

*2Q 2011

1.6-100 Enhanced Controls Technology

- Next step in evolution of GE wind turbine controls

  'Collective Pitch' → Advanced Loads Control →ECT

  1.5-77 *1.6-82.5* *1.6-100*
- Utilizes physics-based models & *Estimator-model* design
- Builds upon Global Research Center new technology & 2.5MW-based testing
- Includes 1.6-82.5 Advanced Loads Control (ALC) benefits - rotor imbalance compensation, tower damping, and drivetrain damping
- Addresses higher-order rotor harmonics, gain scheduling, power/loads optimization
- Benefit: up to 20% fatigue loads reduction

Towers

96 Meter Tubular Steel Tower

Value:

4%-9% AEP increase depending on site conditions

Features:

Tubular steel, 4 sections

Maximizes Customer Value

4 tower sections vs. 5 tower sections for 100 M tower - reduction of 1 truck transportation

Decreased Installation time & crane usage

Takes advantage of increased average wind speed at higher hub height

Application:

IEC TC IIIs (Vavg 8.0 m/s)

1.6-100 Commercialization

Independent Engineer Reviews

Location: GE's Wind Engineering Center, Greenville, SC

AWS Truepower
Black & Veatch
Chinook Wind
DNV
Garrad Hassan
Genivar
Hatch
Ortech
R W Beck
V-Bar
Wind Logics
Zephyr North

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Meetings with Lenders

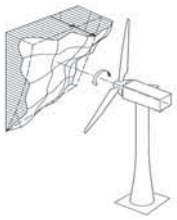
Bank of Tokyo-Mitsubishi UFJ
Bayern LB
BNP Paribas
Capstar Partners
Citi
Credit Agricole
Dexia
Manulife Financial
Nord LB
Taylor-DeJongh
West LB

Controls

Advanced Loads Control (ALC)

ALC is a load mitigation strategy

1) Optimizes turbine performance and energy capture by pitching each blade individually .,.. Measures and calculates the effects of the wind throughout the blade rotation.



2) Controls the tower movement through generator torque and blade pitch

Where Used

- 2.75-100 & 103
- 2.5-100 & 103
- 1.6-82.5
- 1.5-77

Customer Benefit

- Increases energy capture to provide more revenue generation.
  - Higher capacity factor and AEP
  - Optimizes land utilization for turbine siting
  - Increases performance envelope by extending cutout speed from 20m/s to 25 m/s
  - Evolution of technology ensuring lender acceptance

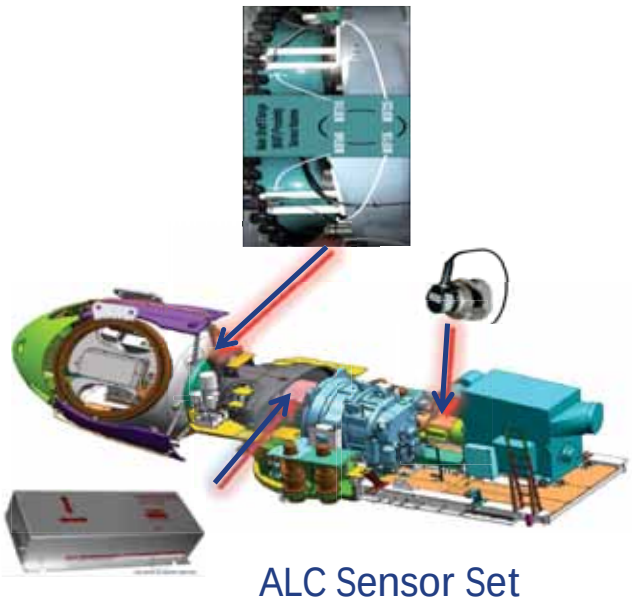
How it works

- Implementation of sensors enables improved machine control.
- Sensors allow the control system to adjust generator torque and speed more accurately for fatigue reduction.
- ALC allows individual blade pitching by sensing main shaft deflection

ALC … technical information

Evolutionary strategy

- Proven technology…6+ years operation in 2.5 MW series (and 1.6-82.5 prototype) With minor changes to integrate standard sensors



ALC Sensor Set

Technical value

- Main shaft proximity sensors and additional yaw sensor allow individual blade pitching and torque control. Simple components easy to implement
- Advanced Loads controller in the top box integrated into existing configuration
- Enhanced performance through expanded cutout speed
- Reduces fatigue loading on major turbine components, maintaining reliability
- Allows rotor growth, enabling 15% more AEP on the 1.6 82.5*

*As compared to the 1.5-77

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Enhanced Controls Technology

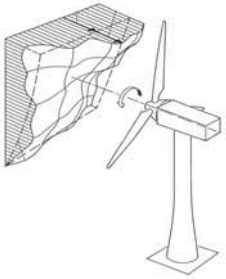
Customer Benefit

- Increases energy capture to provide more revenue generation.
  - Higher capacity factor and AEP
  - Optimizes land utilization for turbine siting
  - Evolution of technology ensuring lender acceptance

How it Works

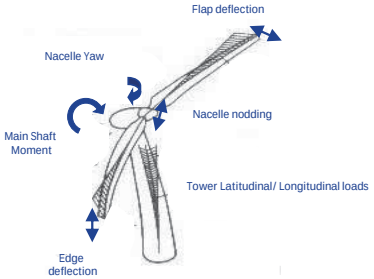
- ECT utilizes the Flex 5 model of turbine…Same tool developed and used by GE's siting and wind resource analysis team.
- Advanced Loads Control sensor data, and turbine operational conditions are processed by the control-logic estimator. The estimator continuously optimizes control set points for near-term operating conditions.
- Controller implements settings

Physics Based Model
(Characterizes)



Sensors assess wind conditions acting on the wind turbine

Estimator
(Optimizes)



Sensor data from Physics Based Model is used to continuously optimize control set points for near-term operating conditions

Controller
(Executes)

Controller implements these set points

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ECT …Technical Information

Evolutionary Strategy

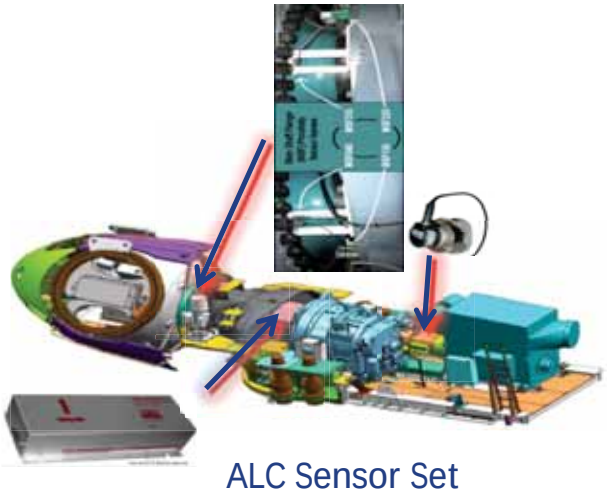
- Built on proven controls technology operating across GE businesses (Aviation, Transportation, Energy).
- Proven advanced loads control technology as a foundation. Design validated by field testing.
- Uses same hardware as Advanced Loads Control feature.
- Test results match model predictions

Where Used

- 1.6-100

Technical Value

- Up to 20% fatigue loads reduction enhancing longevity.
- Continuous tuning control for full operating region. Maximizes power production.
- Co-Ordinated interaction between control parameters



ALC Sensor Set

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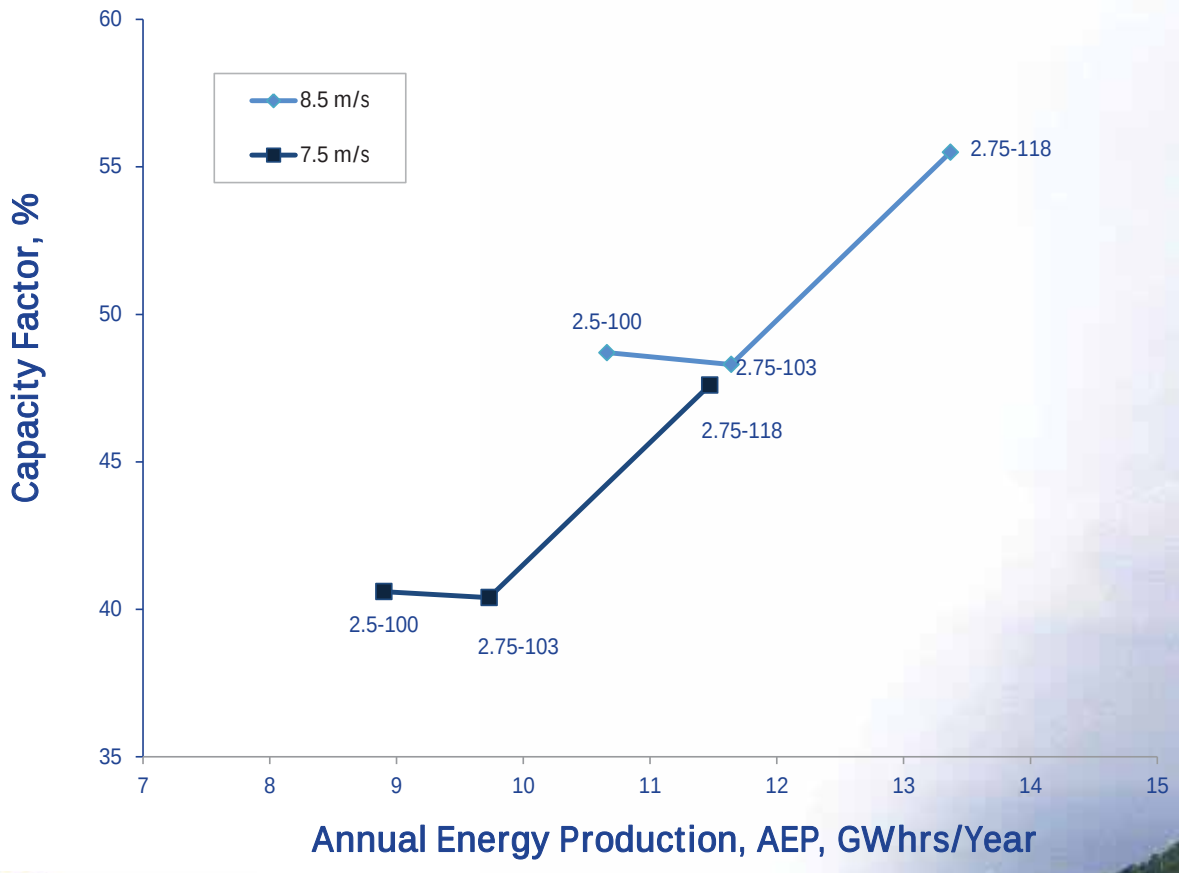
Chapter 2: 2.X platform technical slides

2.x Wind product advancements



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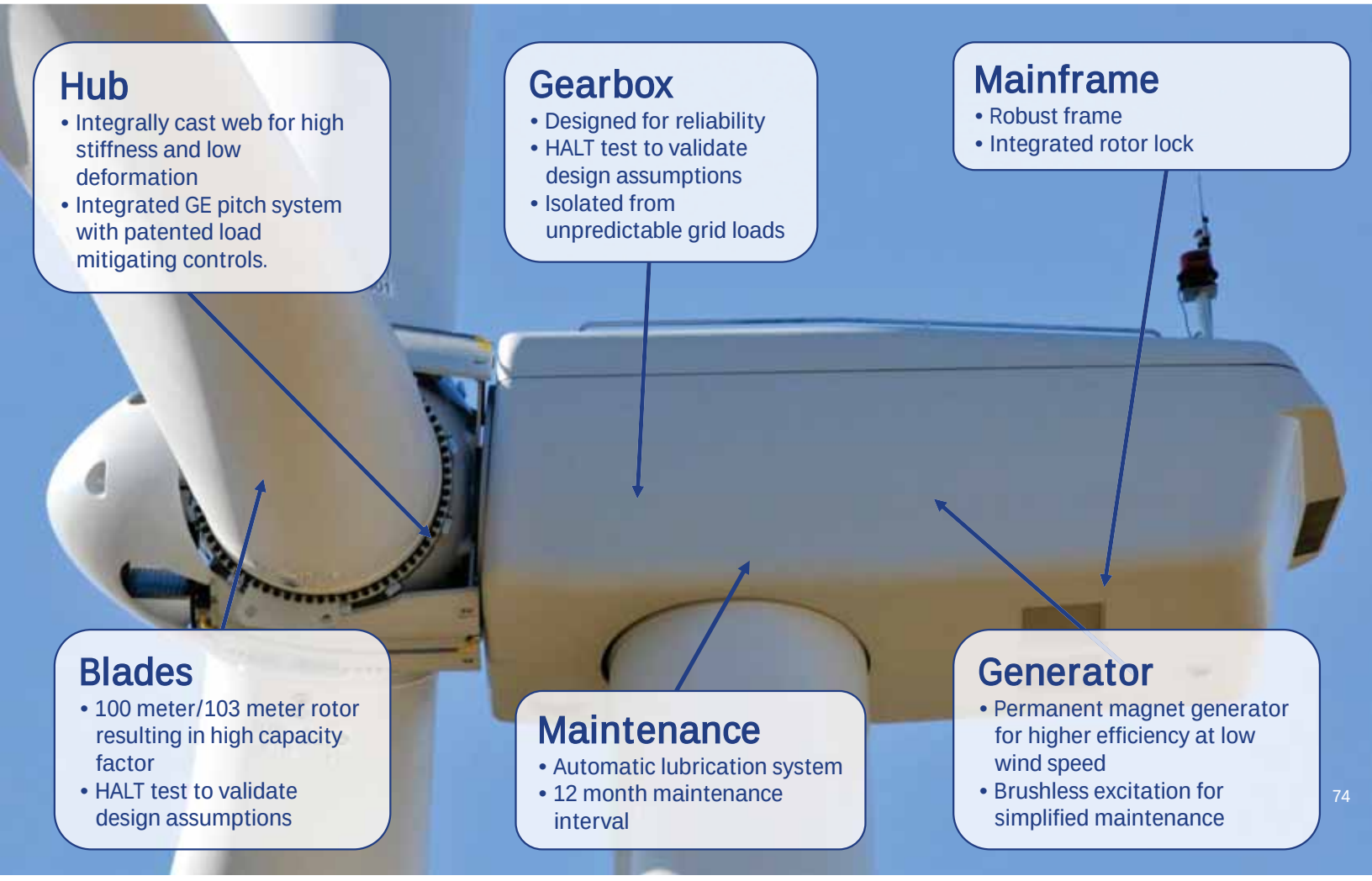
2.X MW series: reliability by design

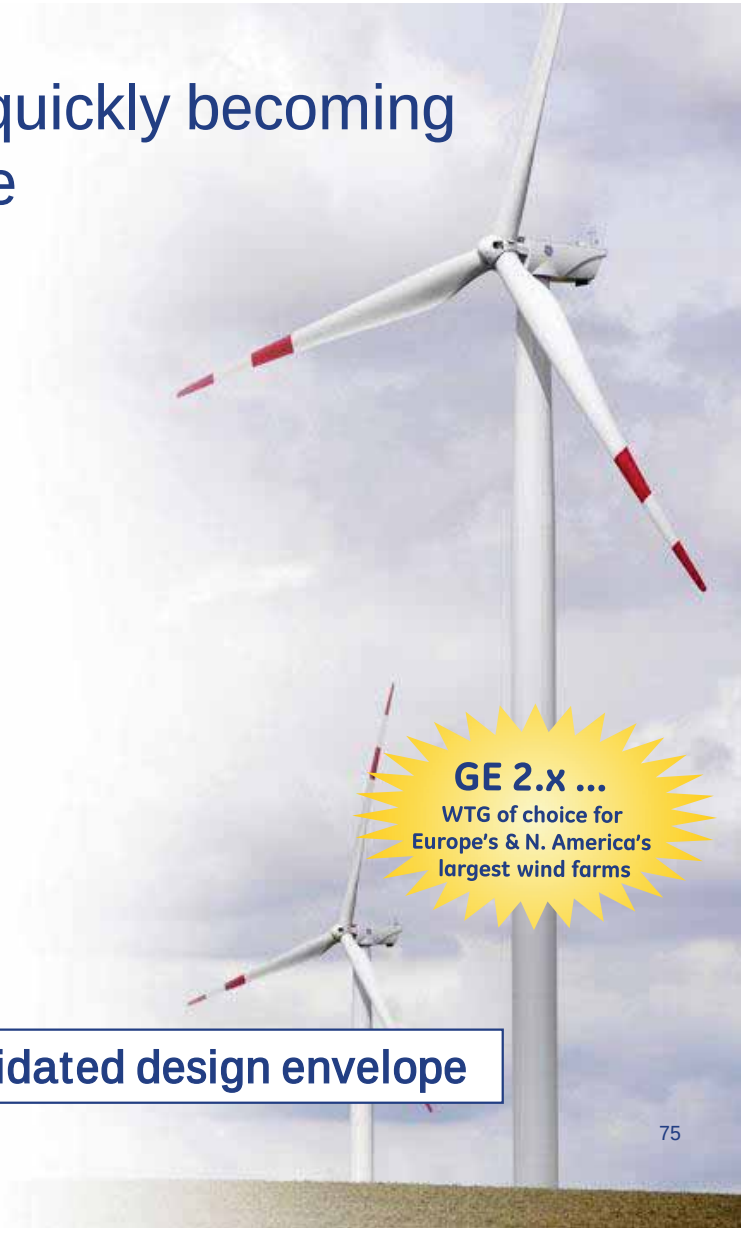


GE's 2.XMW series ... quickly becoming the industry's MMW workhorse

600+ 2.x turbines installed
(as of 3Q 2011)

We have validated

- Operating temperature ... Japan, Spain, Turkey
- Turbulence intensity ... Portugal, Japan, Turkey
- Altitude ... Turkey
- Wind speed ... The Netherlands, Turkey
- Grid ... Turkey, Eastern Europe
- Humidity, seismic, typhoons ... Japan
- 60Hz operation ... Japan



Diverse site conditions validated design envelope

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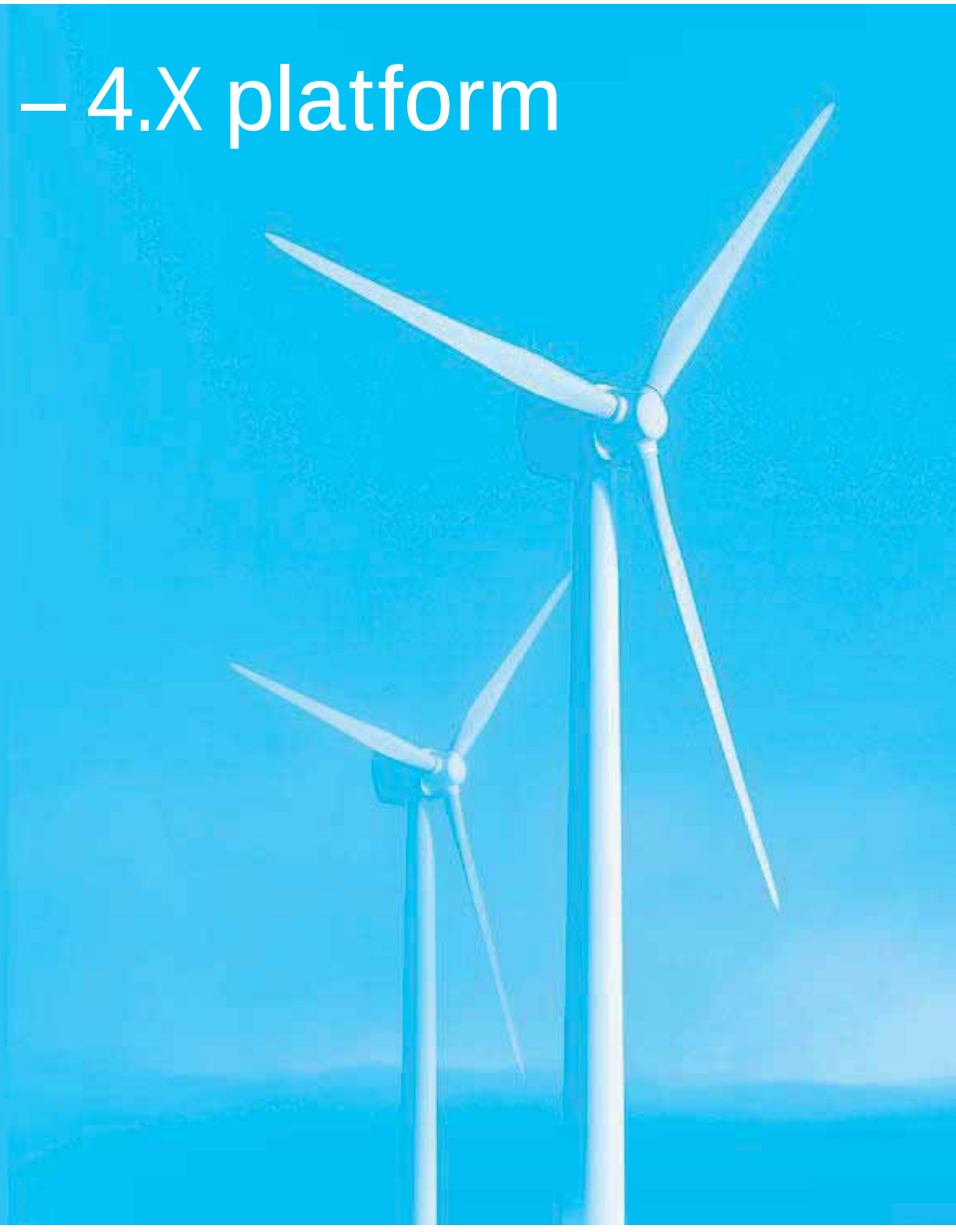
Chapter 3: 4.X platform technical slides

Model overview – 4.X platform



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GE 4.1-113 World's highest output shallow water turbine

Solid electrical system design…

- Enhanced reliability… modular generator & converter design
- High efficiency… PM Generator
- Direct-drive

Simple mechanical design…

- Protected from offshore environment… sealed nacelle containing all components
- Robust & reliable… up-scaled components from proven 1 – 3 MW models

Designed with service in mind…

- Serviceability… In place tower exchange for converter and generator parts
- Spacious nacelle with internal hub access

Proven direct drive technology … over 5 years operating experience

Chapter 4: Controls & WindSCADA

WindSCADA* 2010 … focus on wind farm analytics

Reporting – identify trends

- Novel data visualization
- Interactive data analysis versus static reports

Anomaly detection – be proactive

- User defined rules for alarming
- Statistical analysis of real-time data

User defined I/O – integrate new info

- Ability to add additional monitoring sensors
- Tools for user configuration of SCADA screen & alarming

* Trademark of the General Electric Company

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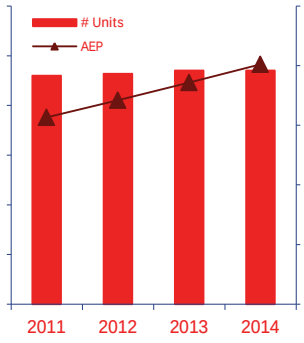
Chapter 5: Services, siting & extended life

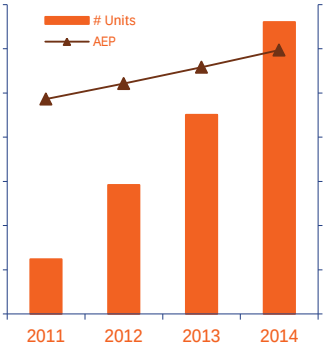
GE's pathway to increasing AEP …

GE 1.5-70.5

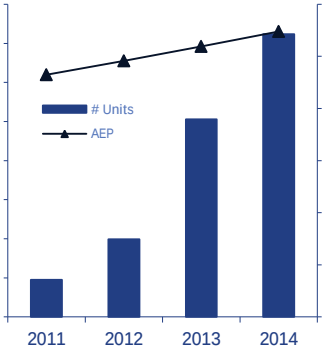


GE 1.5-77

GE 1.5/1.6-82.5



GE 2.x



Investing in a multi-generational R&D plan to increase fleet value by:

- Establishing annual targets by model type
- Flowing-down technology from new turbines
- Offering production based maintenance optimization

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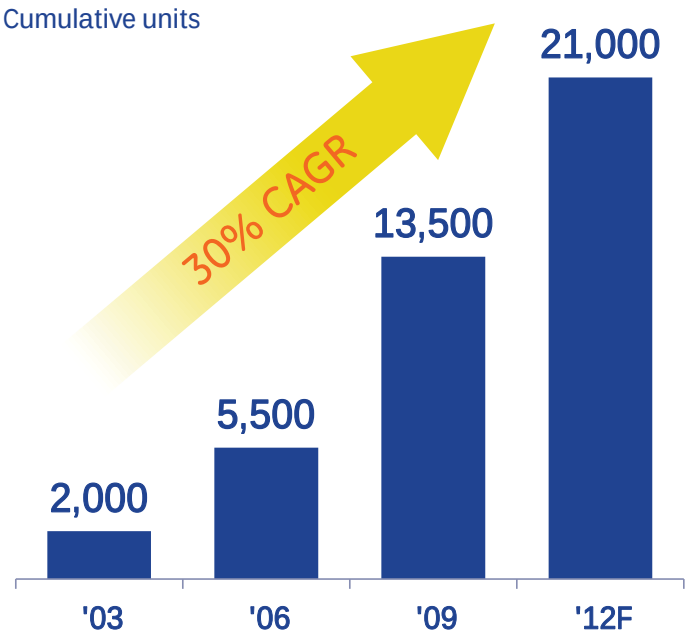
Expanding after-market service option

GE wind fleet



Servicing \the installed base

Technical fleet data and insight

- 17,000+ units operating globally
- 1,000+ technicians, 350 reliability engineers

Differentiated rigor and speed

- 80% of issues resolved within 10 mins
- Smart early warning algorithms

Upgrading fleet performance

- Driving new tech into fleet
- 1% fleet output↑ … $300MM+

World's best running fleet … 98%+ availability

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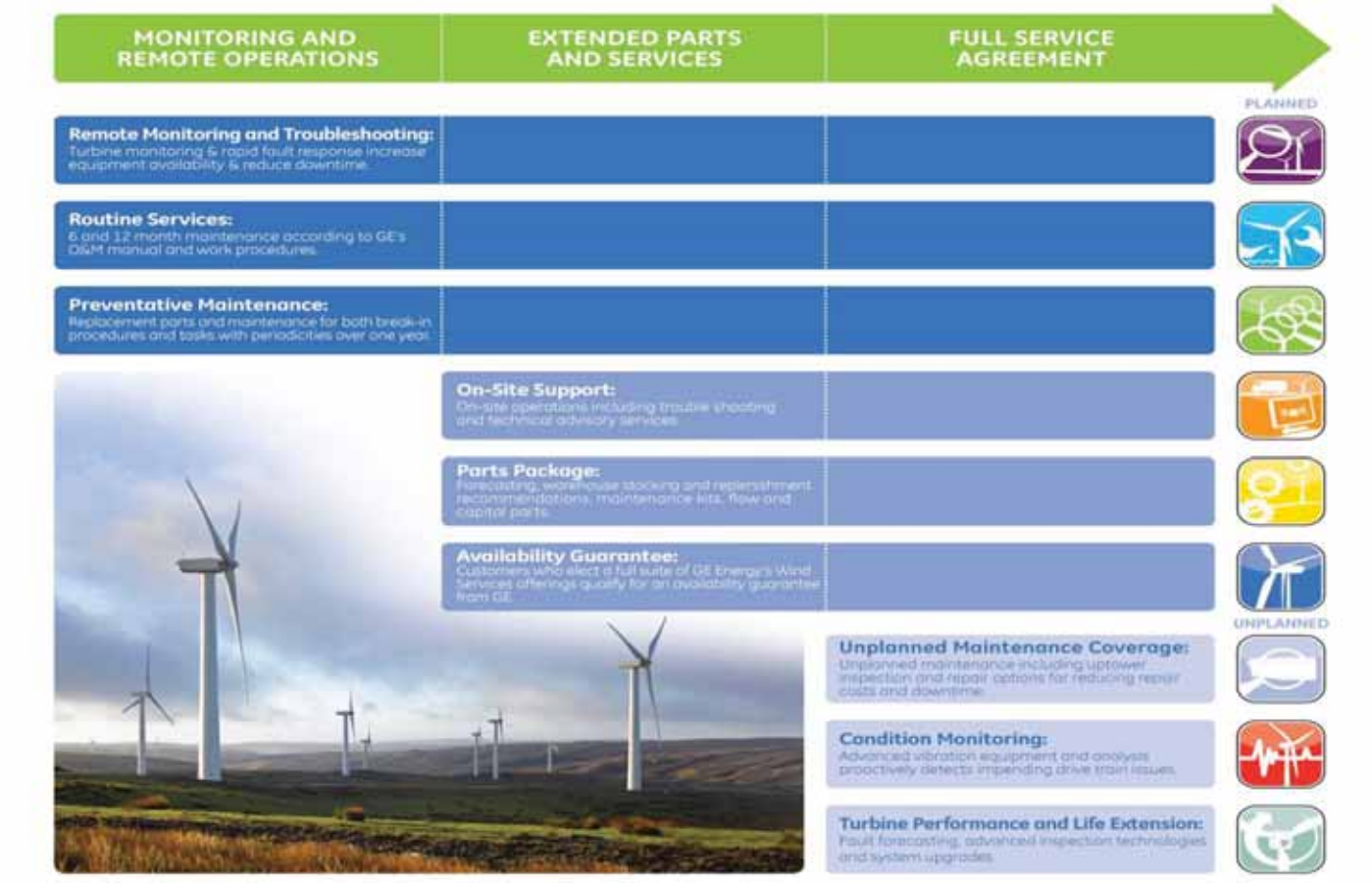
Complete service packages



Customizable solutions for every wind services need.

State-of-the-art service support

Resources

Global Reach
- 15K WTs, 30+ countries
- 115+ WS facilities

Remote Ops Centers
- 24/7, 365 coverage
- Monitoring
- Troubleshooting/resets

Parts Warehouses & Dispatch Centers
- Regional
- Availability of parts
- Kits & capitals

Expertise

Services-focused
- 900+ trained technicians
- 50 engineers
- EHS & training priority

Investment
- Production, life extension
- Technology, IT, controls

Energy Learning Centers
- High quality training
- Hands-on

Solutions

Service Packages
- Monitoring/Remote op
- Ops Service Agreement
- Full Service Agreement

Optimization
- Upgrades
- Parts management
- Wind farm optimization

Tools
- REConnect
- REStore
- REView

For our Best-In-Class turbine technology

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GE Wind training programs & facilities… for GE and customer service technicians

- Theoretical class room in modern and well equipped facility
- Hands-on-training on turbine equipment under realistic conditions

GE Wind Salzbergen Training Center

Fully functional training units:

- 1.5 (Nacelle, GE Pitch Hub, DTA)
- 2.5 (Nacelle, GE Pitch Hub, DTA)
- Live 1.5 Converter
- 2.5 Blade

Energy Learning Center – Schenectady, NY

Hands-on training units:

- 1.5 - 2 Nacelles (1.5-70.5, 1.5-77), 3 Hubs (2 SSB, 1 GE pitch), 2 complete DTA's, 2 dedicated controls room with ESS DTA, top box, WindCONTROL* system and 1.5 GE Converter
- 2.5 – gearbox, generator, DTA, GE Pitch Trainer

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*Trademark of the General Electric Company

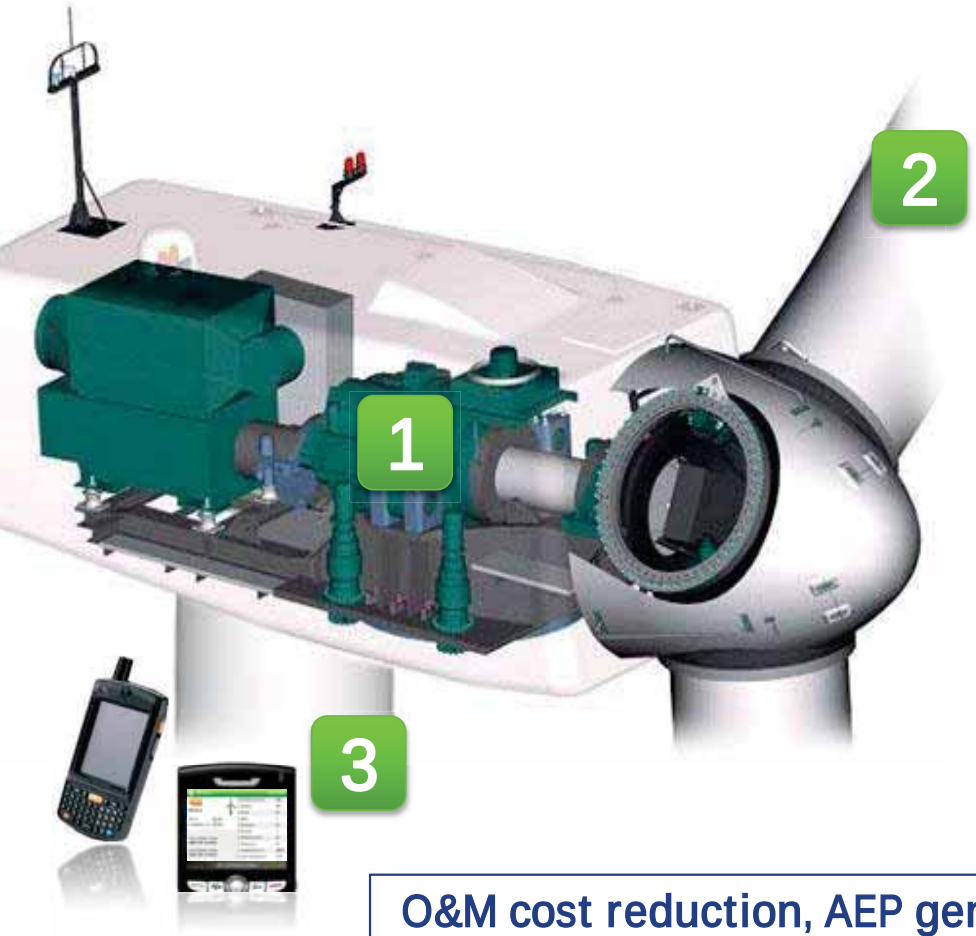
Investing in the growth & development of GE wind technicians

GE Wind U.S. field services technician classification & compensation structure

Technician I	Technician II	Technician III
Basic commissioning, troubleshooting & maintenance	Specialized in control systems (GE pitch, ESS & converter)	Very specialized & experienced (HV, TPM, EHS specialist, lead technician)
2008: 42%	40%	18%
2009: 15%	62%	23%
Today 13%	63% of technician population	24%

Tech III leads and specialists are promoted to Site Manager, Field Engineer, EHS Professional, Parts Specialist, Fleet Availability Engineer, Training Instructor

Investing in future technologies



Doubled investment in 2011

1. **Gearbox:** upgrades, anomaly detection, single crane exchange
2. **Blades:** pitch optimization, subsurface imaging, blade tip extension
3. **Information Tech:** advanced SCADA analysis, real-time imaging, software upgrades

O&M cost reduction, AEP generation and life-extension … 20 yrs +

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Solving customers toughest problems

"Providing custom engineered solutions"

Solutions for under performing sites:

- Turbine controls upgrades
- Blade modifications – AEP increase
- Continuous pitch and yaw optimization
- SCADA data anomaly detection

Grid integration solutions:

- Power curtailment management
- Reactive power options

SCADA / Pi data integration

Technology making a difference

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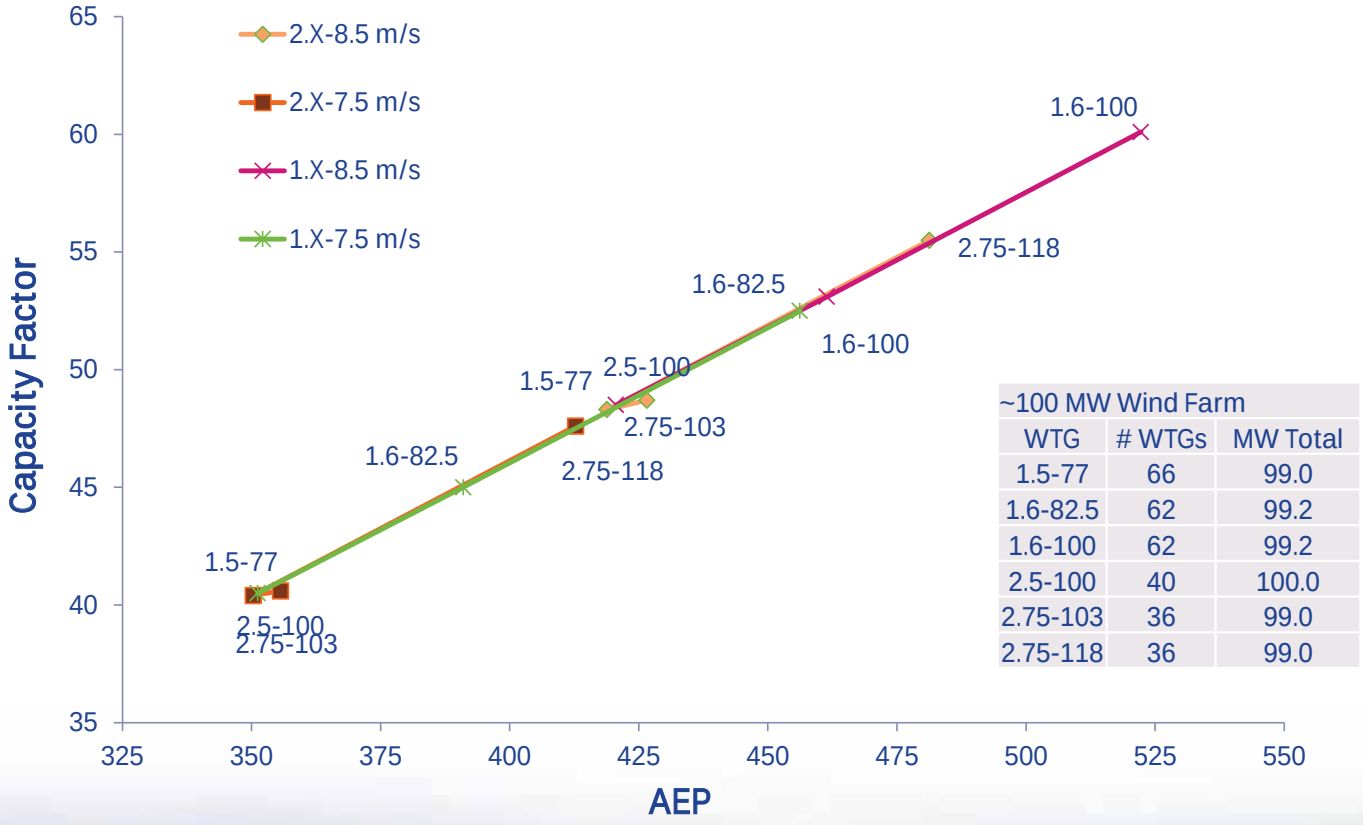
Wind turbine siting

100 MW wind farm production



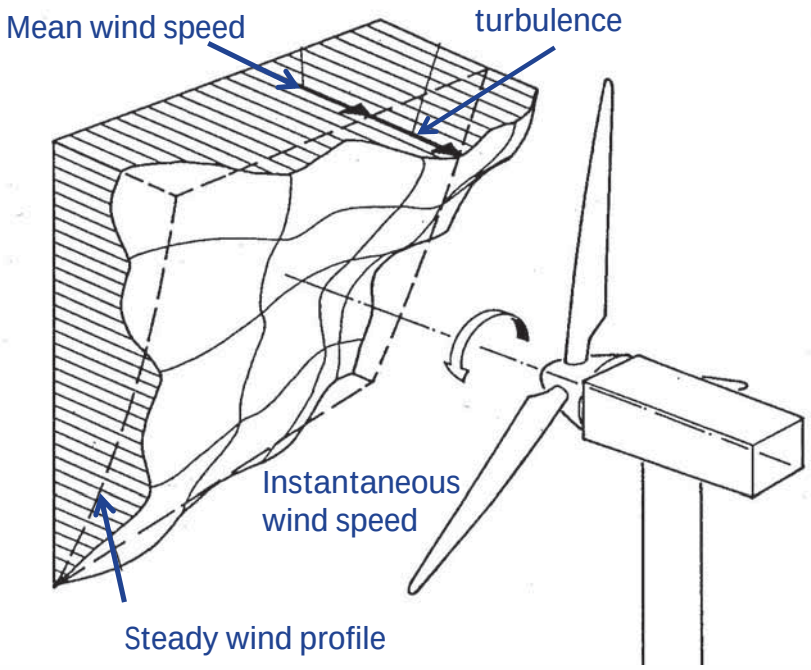
~100 MW Wind Farm		
WTG	# WTGs	MW Total
1.5-77	66	99.0
1.6-82.5	62	99.2
1.6-100	62	99.2
2.5-100	40	100.0
2.75-103	36	99.0
2.75-118	36	99.0

Bigger not always better

Evolutionary WTG design approach

Mature development methodology:

- Evolution of next offerings builds off 17,000+ install-base
- Process-rigor, component validation mitigate IE and Lenders concerns
- Field validated development tools
- Thousands of site analyses



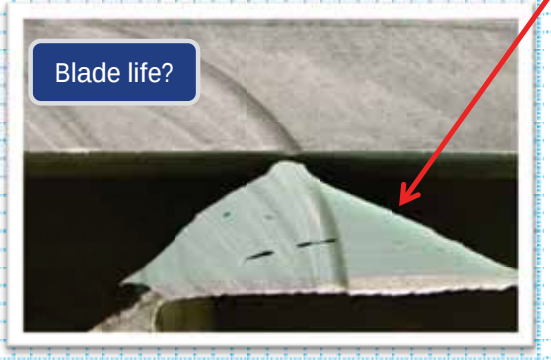
Evolutionary design drives greater customer value while maintaining reliability

Chapter 6: Quality control & manufacturing

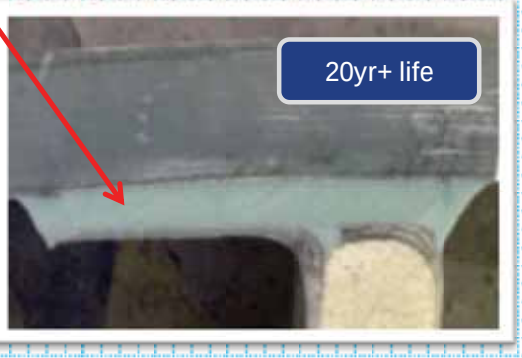
Quality and performance critical … the downside of getting it wrong

Cross-section of wind blades

Bond joint critical to blade life

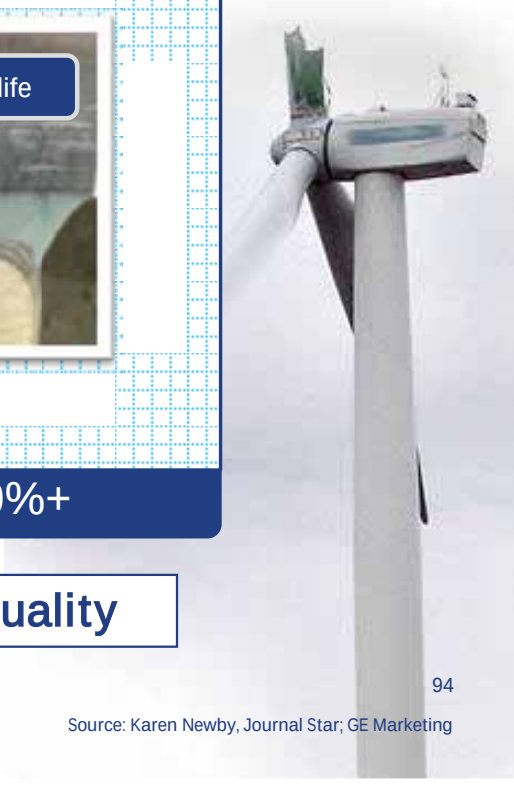


Other OEM blade



GE designed blade

Poor quality can reduce wind farm value by 80%+



Long term asset … customers buy quality

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Source: Karen Newby, Journal Star; GE Marketing

GE Quality standards … the highest in the industry

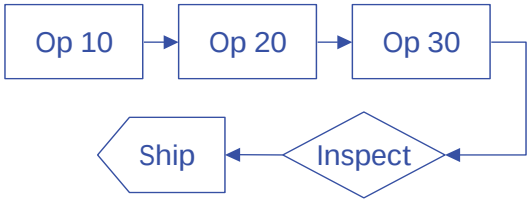
QMS Audit

Can your quality system comply with ISO standards?
Quality Management System

Product Audit

Is the product 100% compliant to requirements?

Process Audit



Is the process 100% compliant?
NDT Process

Compliance Audit

Compliance to applicable regulations

GE Pensacola manufacturing experience

- 300,000 sq. ft. factory in Pensacola, Florida
- 9+ years of wind manufacturing experience
- Over 7,500 machine heads manufactured to date
- Over 10,000 hubs manufactured to date
- Production of both the 1.X and 2.X Platforms

*As of 3Q 2011

Chapter 7: GE logistics & transportation

GE Global Projects

Leading on-time global execution

Wind tower erection

Installed experience

1.x turbines: ~16,500 units

2.X turbines: ~500 units

Executing complex logistics

Excellence in field operation

Installation and commissioning

Fântânele-Cogealac Wind Farm – **600 MWs**

GLOBAL PROJECTS OPERATION

On-time project completion … proven track record

* 3Q 2011

Transportation

GE WTG logistics -truckload comparisons

	2.x-100, 85m Tower	1.x-82.5, 80m Tower	1.x-77, 80m Tower
Component	Truck Loads	Truck Loads	Truck Loads
Hub	1	1	1
Machine head	1	1	1
Gear box	1	MH shipped complete	MH shipped complete
PPM/DTE	2	0.2	0.2
Parts shipped loose	1	Not required	Not required
Tower	4	3	3
Base ring	1	Not required	Not required
Blades	3	3	1.5
Misc hardware	1	1	1

100 MW project comparisons

- 1.6-82.5 requires 567 truck loads for 63 WTGs at a rate of 5-15 trucks per week or 5-13 weeks of deliveries
- 2.75-100 requires 600 truck loads for 40 WTGs at a rate of 4-6 trucks per week or 7-10 weeks of deliveries

1.x truck examples

2.x truck examples

Chapter 8: Research & NextGen

GE global research footprint

4 global research centers … 5 by 2012

Niskayuna, New York

Munich, Germany

Shanghai, China

Bangalore, India

Rio de Janeiro, Brazil

2012 completion

Highlights

- 2,600 research employees (nearly 1,000 PhDs)
- 27,000 GE technologists worldwide
- $5.7B technology spend
- 700+ renewable energy patents filed since 2002

Global research driving advanced technology solutions

GE and Renewable Energy … combining our strengths

GE Energy Financial Services
Energy investing and financing

GE Oil & Gas
Offshore platforms/experience

GE Energy
Controls, materials, technology
Fulfillment & logistics capability
Efficient supply chain management

GE Transportation
Gearbox and power converter technologies

GE Global Research Centers
China, India, US, Brazil and Europe

GE Aviation
Aerodynamic and aero-acoustic modeling expertise

Product strategy

1. High reliability
2. Capacity factor leadership
3. Advanced integration

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Chapter 12: Development Overview

GE Wind Project Development

When a piece of the puzzle is missing…

✓ Identify and execute win-win opportunities with strategic customers across all GE Energy product lines (wind, solar, gas turbine, aeroderivitive, Jenbacher)

✓ Cultivate new GE customers by investing knowledge , capability, or development capital to bring great ideas to fruition

✓ Launch new GE products into strategic and key countries

✓ Support and manage GE Energy owned prototype projects

✓ Provide financial solutions during development to support profitable GE product sales

Project Development global organization …

Global reach….local presence

How do we get from here...

To here?

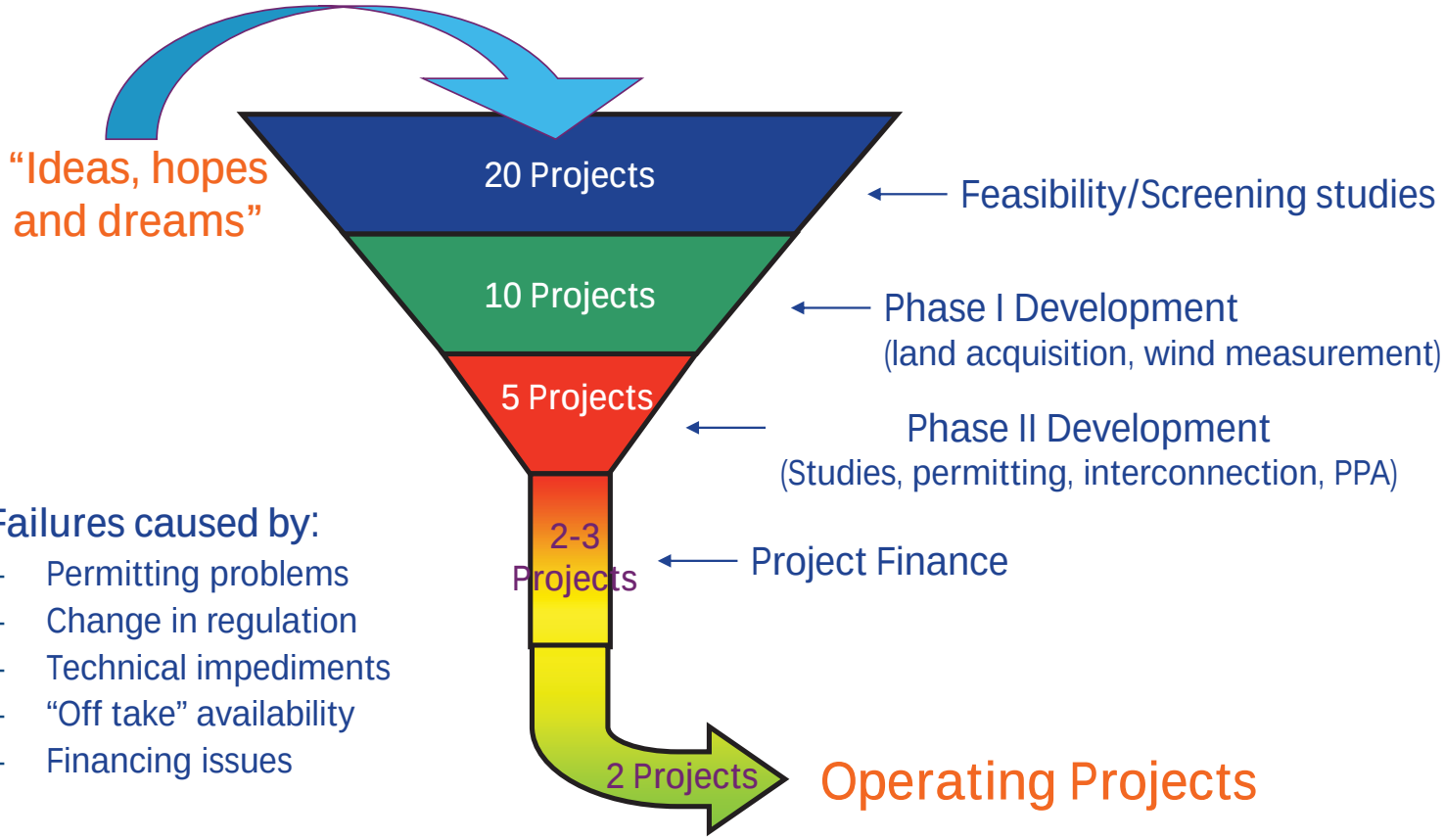
By developing...

a project that is sustainable

- environmentally & socially
- technically
- economically
  - for energy buyer (COE)
  - for investor (ROE / IRR)
- financially
  - lenders (DSCR)

Sustainability = risk management

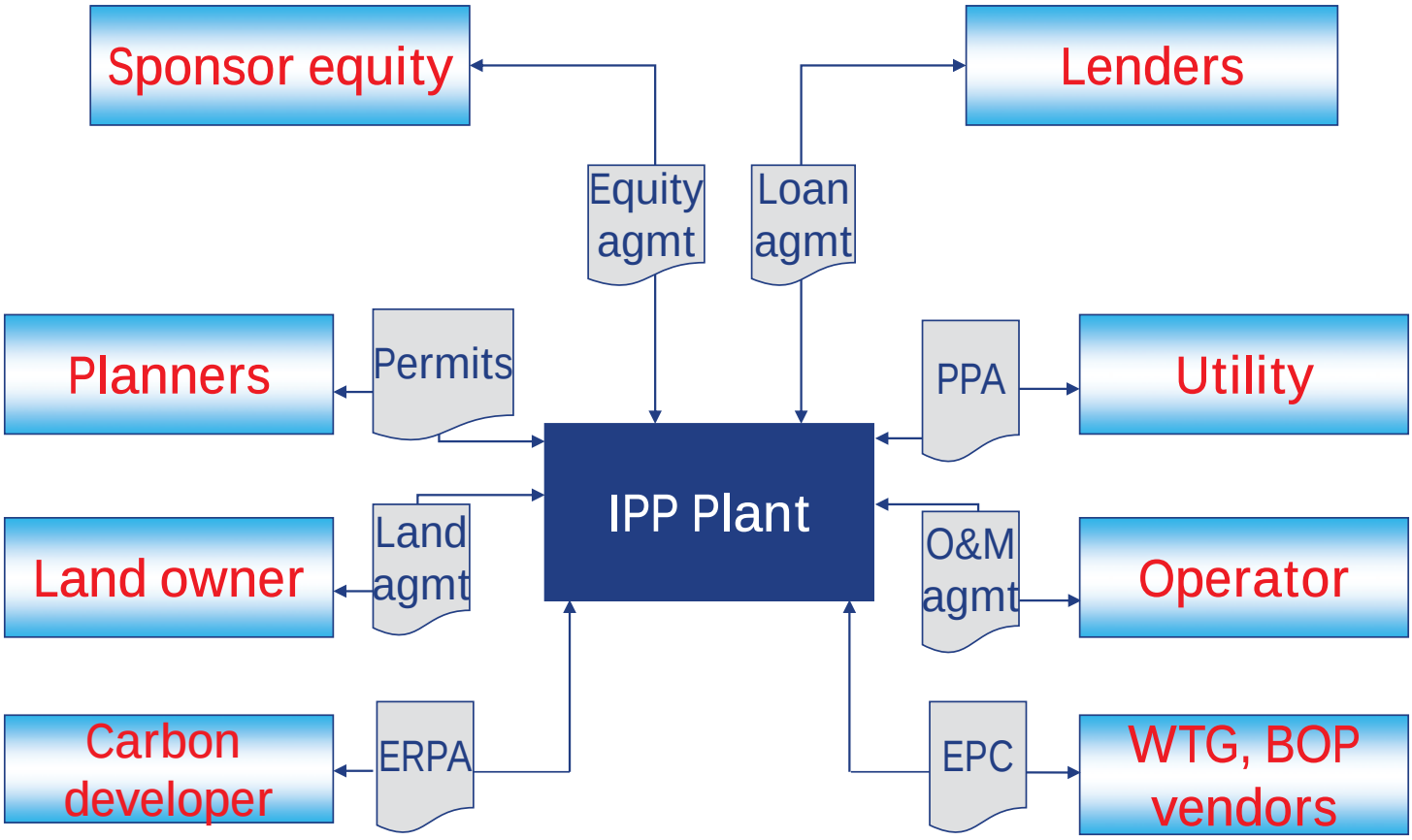
Development begins with…



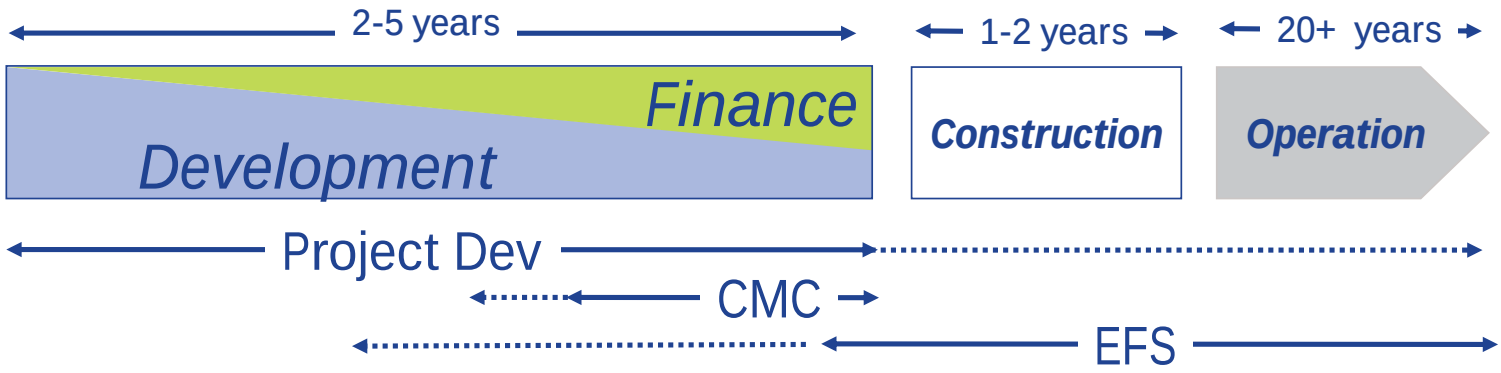
Failures caused by:

- Permitting problems
- Change in regulation
- Technical impediments
- "Off take" availability
- Financing issues

Developers bring together...



Project Development Timeline



Greenfield development

- Project definition
- Feasibility studies (technical, economic, financial)
- Site selection & acquisition
- Permitting & licensing

Core development

- Commercial structuring
- Contract negotiation
  - Grid connect
  - Fuel supply
  - Power off-take
  - EPC
- Financial structuring & credit evaluation

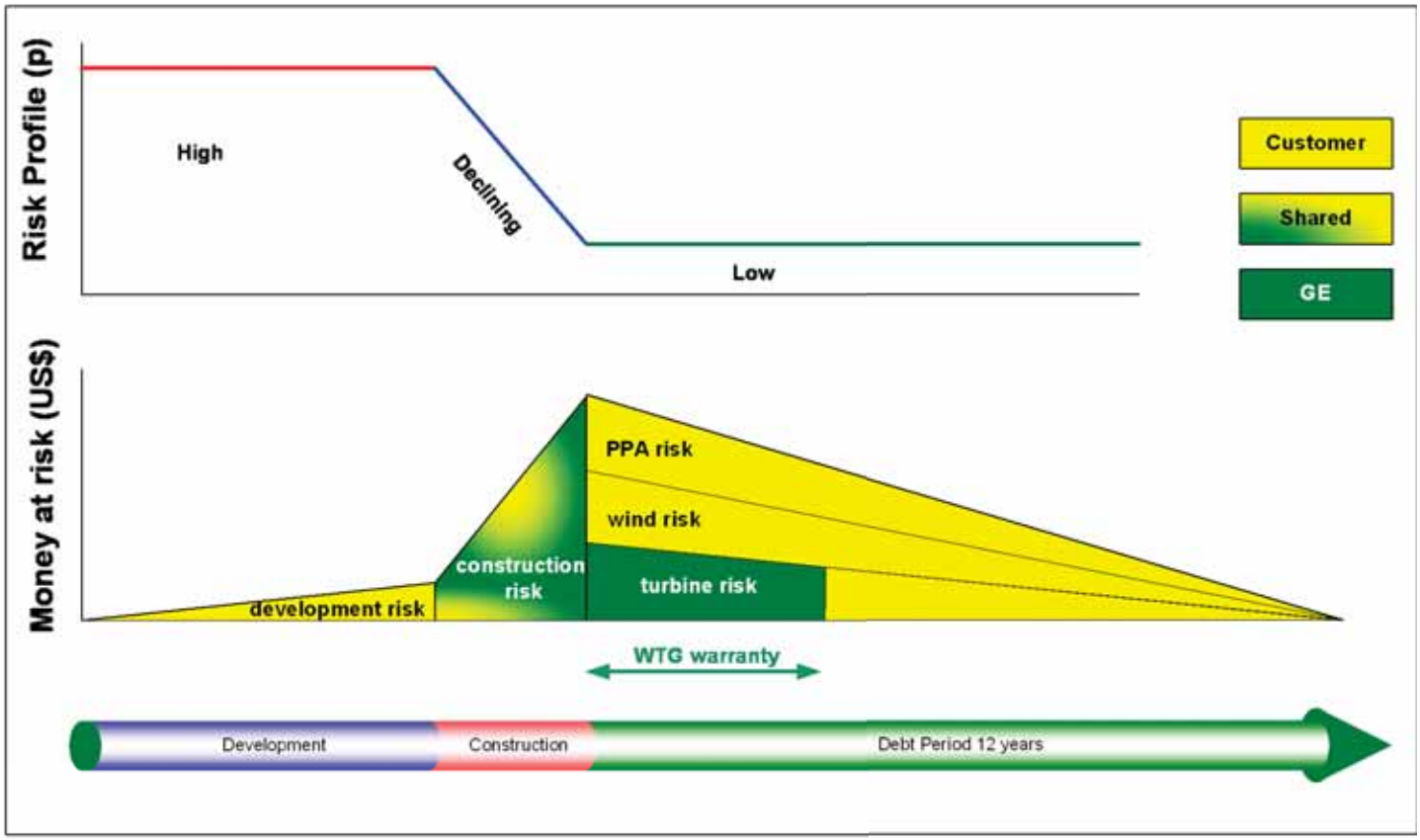
Financial structuring

- Financial engineering
- Debt & equity arrangement
- Develop or co-develop opportunistically
- Development financing
- Minority investment in international developers with a strong deal pipeline

Post COD

- Ownership & asset management

Wind power project life cycle risk profile



Site selection/screening

The two most basic questions:

1. Is the site windy?
2. Can I get the power to market?
   - "Stranded resources"
   - Adequate transmission

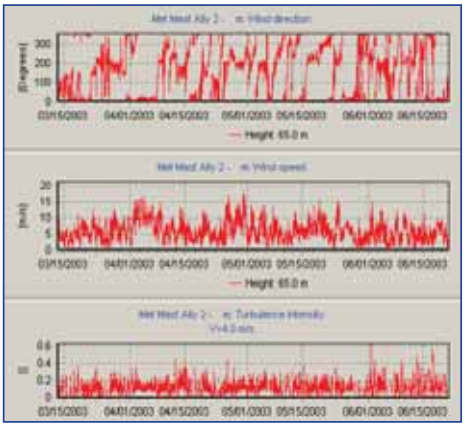
Permitting policy critical

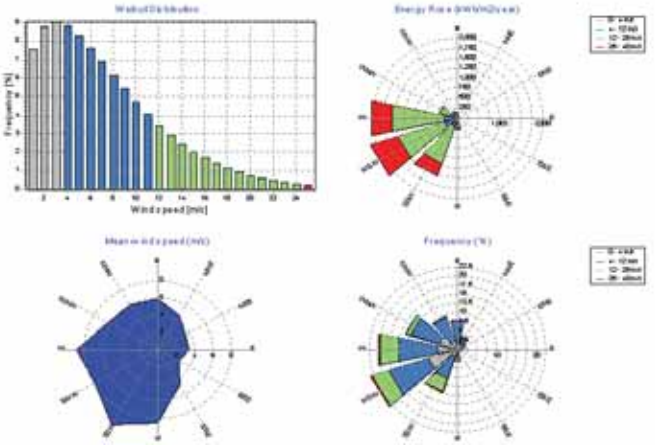
+

=

Power of the wind…

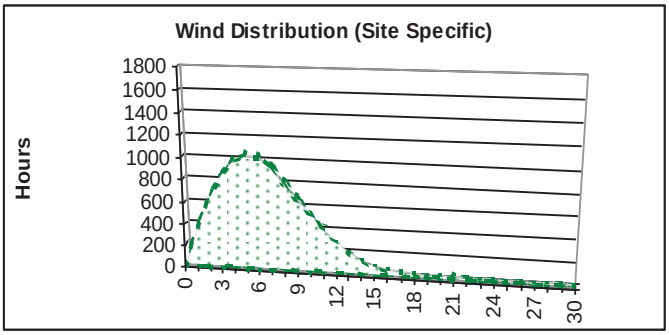
- ✓ 1 Year or more of Data
- ✓ Forecasts 20 Years of Operation



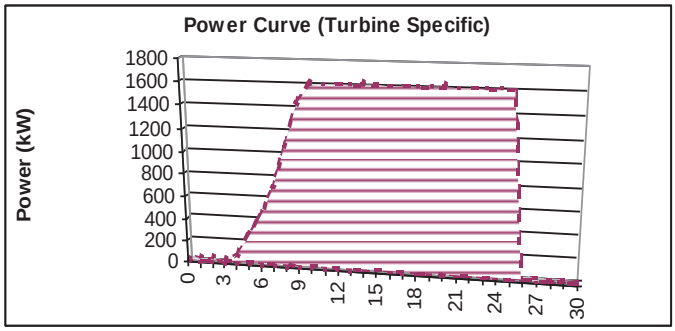


Measure Evaluate Predict

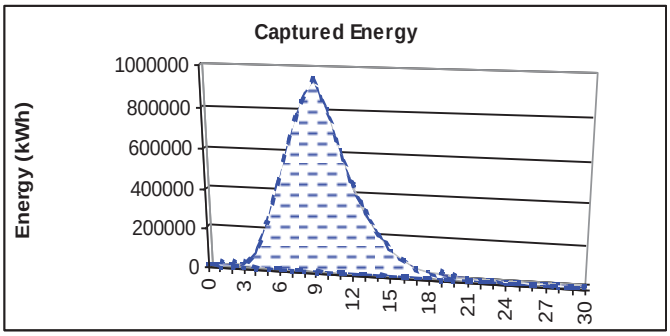
Computation of Annual Energy Production, AEP



AEP = sum of (power × # hours per year) for each wind speed.



AEP losses: due to Plant and Availability.



Safe & reliable operation

- ✓ Wind Resource Prediction
- ✓ Mechanical Loads Assessment per IEC 6400-1
- ✓ Bankable Report from GE

Energy

Fatigue	Extreme Gust
Gust & Fault	Hurricane
Grid Loss	Earthquake
50 Year Gust	Runaway
Extreme Shear	Tornado

Effect

Compliance

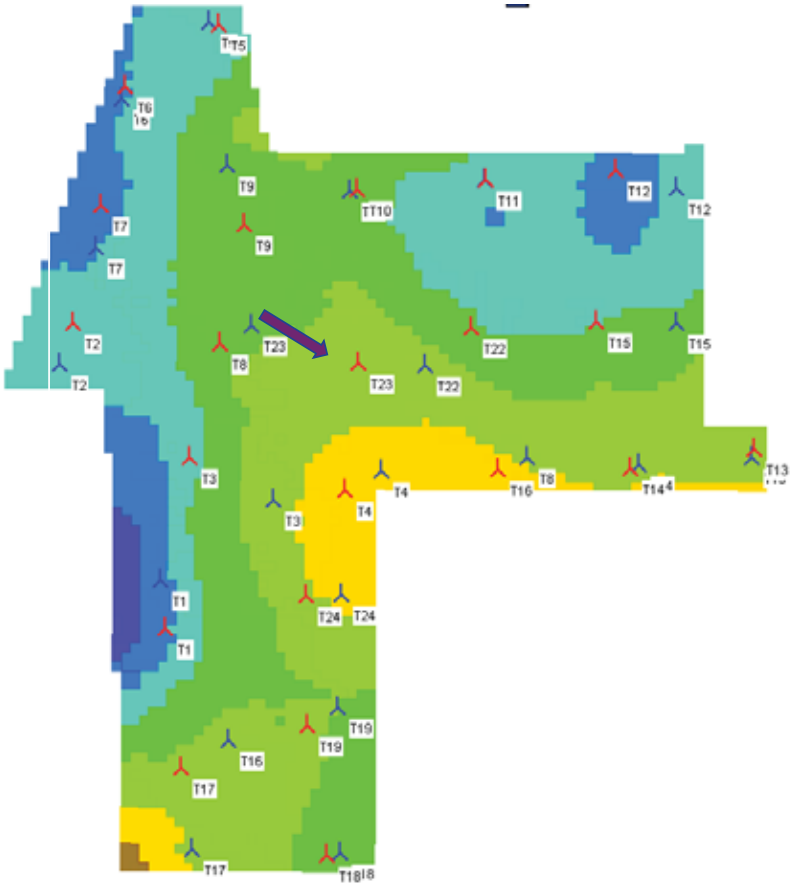
Maximize the value

- ✓ Customer specific analysis
- ✓ Product selection
- ✓ Turbine locations
- ✓ Meet local noise requirements
- ✓ Increase park capacity factor
- ✓ Target NPV/IRR

GE offers WindLAYOUT

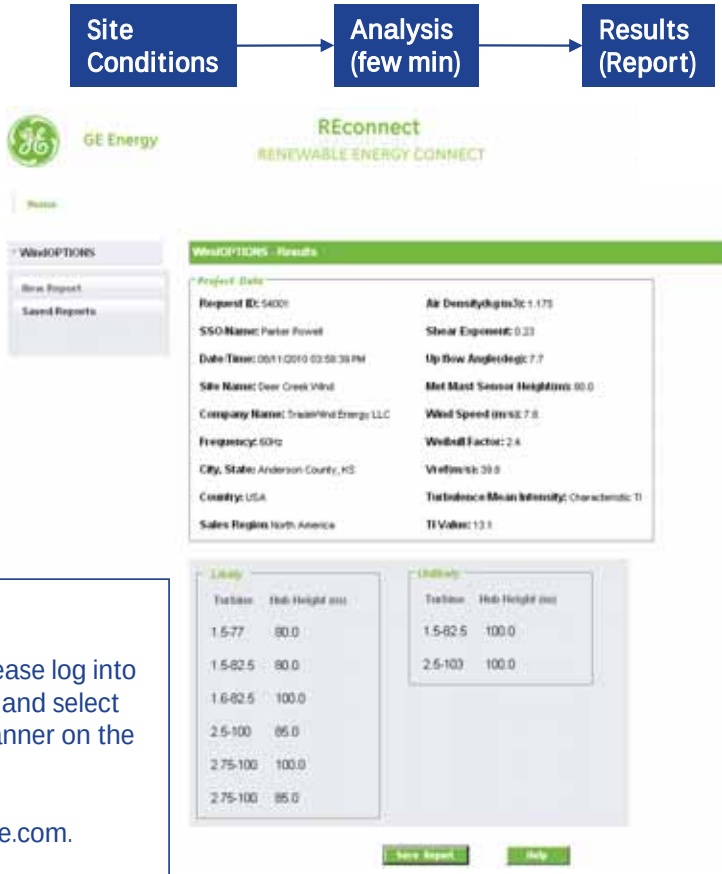
To Improve Project Economics

WindLAYOUT™
(Patent pending)



WindOptions Tool: Web Based Response

- Single-turbine loads suitability tool
- Wind conditions extrapolated to hub height if needed
- Several turbines configurations automatically analyzed
- Request access to WindOPTIONS
- Email notification when results ready



Thank you for using WindOPTIONS!

The results from your latest analysis are now available. Please log into to the REconnect portal (https://www.ge-reconnect.com/) and select WindOPTIONS. Once open, click on the "Saved Reports" banner on the left.

For any questions, please e-mail energy.WindOPTIONS@ge.com.

Regards,
-WindOPTIONS Team.


Thank You!