



Developments, trends & R&D requirements in the wind industry – GE's perspective

Sebastian Achilles
Lead Scientist

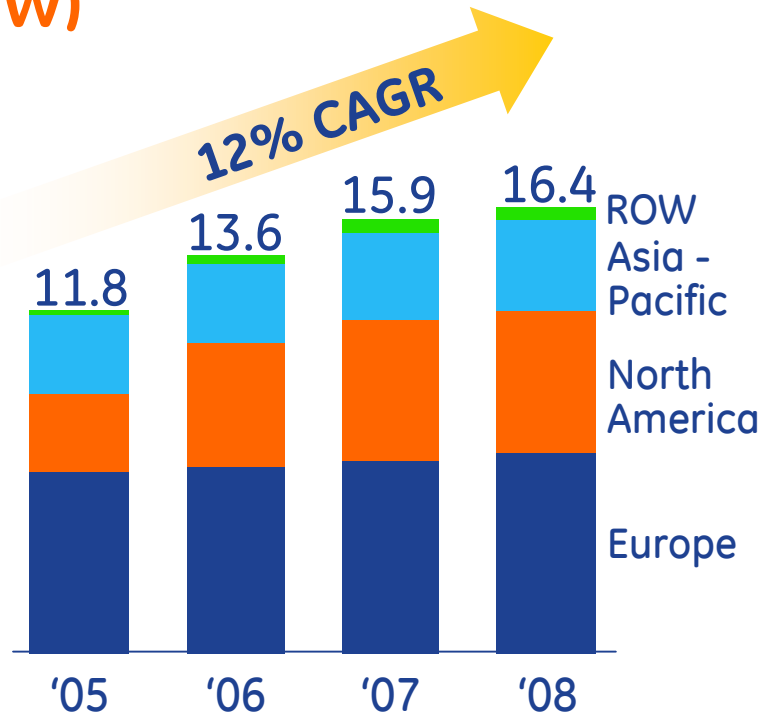
GE Research Center, Munich



GE imagination at work

Wind ... A Viable Solution

Global Installation Forecast (GW)



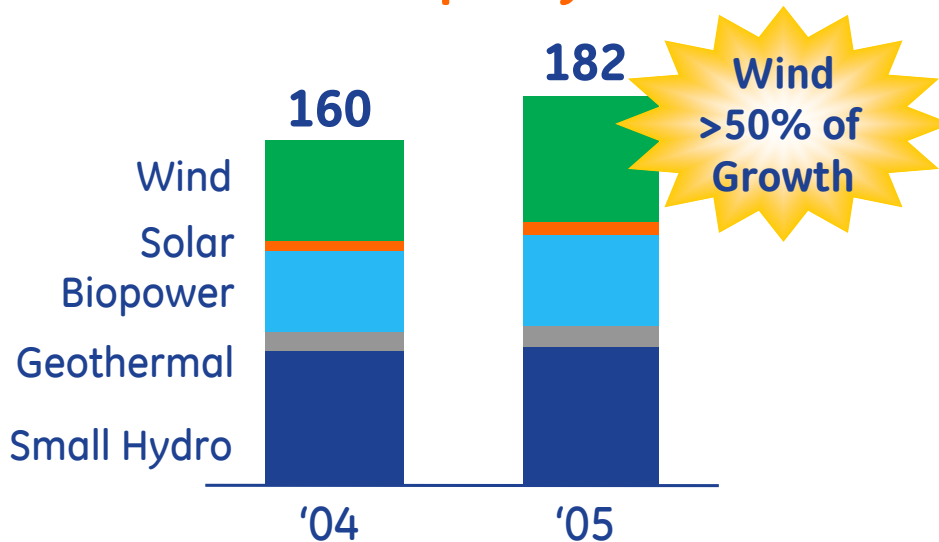
- ✓ COE nearing mainstream ...
~ 7¢ /kWh
- ✓ 20 year 'fixed cost' electricity
- ✓ Energy security
- ✓ Domestic solution
- ✓ Carbon-free generation

12% CAGR impressive...but enough?

Growing demand for renewables ...

- Only 3% of electricity production
- Significant growth ... ~25% CAGR ('95 - '13)
- ~40% global power capital spending

Global renewable Installed capacity (GWs)



Source: REN21 2006 update

Aggressive global targets

- ✓ US ... 20% Wind '30
- ✓ EU ... 22% Wind '30
- ✓ UK ... 20% Renewables '20
- ✓ Germany ... 20% Renewables '15
- ✓ China ... 30 GW Wind '20
- ✓ Spain ... 20 GW Wind '11
- ✓ India ... 12 GW Wind '12

World requiring renewable energy solutions

Long-Term, Stable Policy

Keys To Success

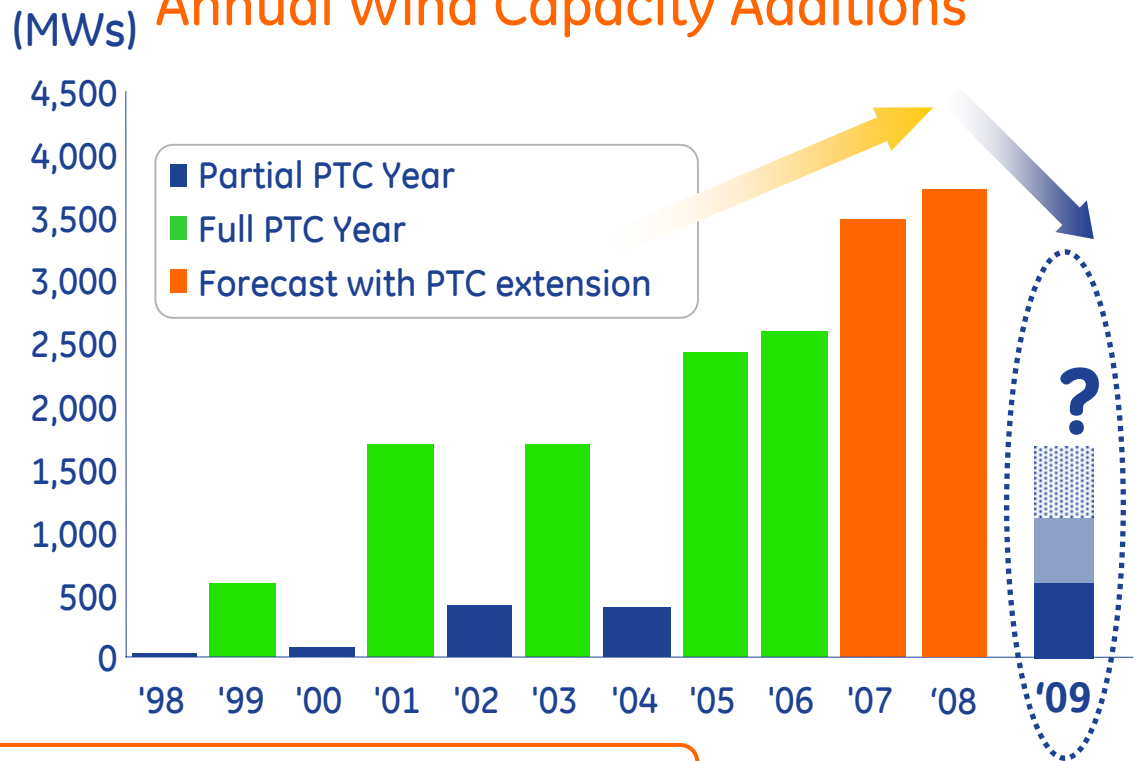
Transmission Strategy
needed

Predictable
Government
Commitment

Emission Targets

R&D Support ...
Government & Industry

Example: US Annual Wind Capacity Additions



Critical to Sustain Growth

Product Portfolio

Rated Capacity

1.5 MW

2.5 MW

3.6 MW

Full Line
of Products



Rotor Diameter

70.5/77/82.5 m

100 m

104/111 m



GE imagination at work

GE Technology Focus

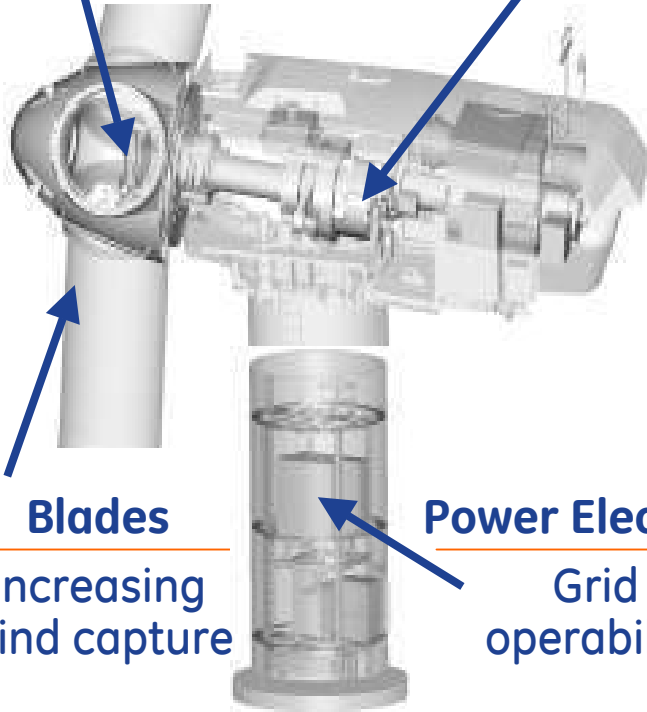
Utilizing GE Technology

Pitch Control

Availability

Gearbox & Drivetrain

Reliability & efficiency



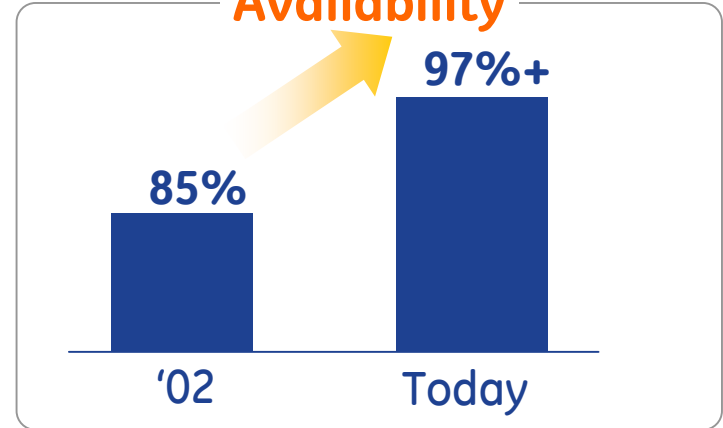
Blades

Increasing wind capture

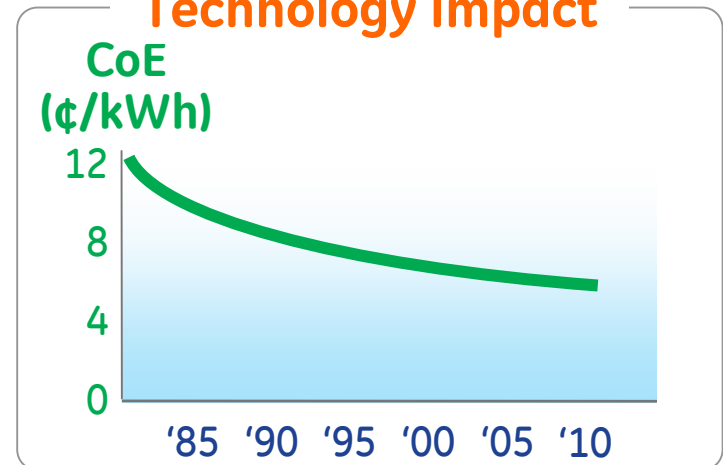
Power Electronics

Grid operability

Availability



Technology Impact



Advancing Technology

Next Gen Turbines...

Higher capacity factors

Improved Reliability

Lighter, longer blades

Advanced Controls

Seamless Grid Integration



~30% More Energy Capture

R&D Support from EWEA includes...

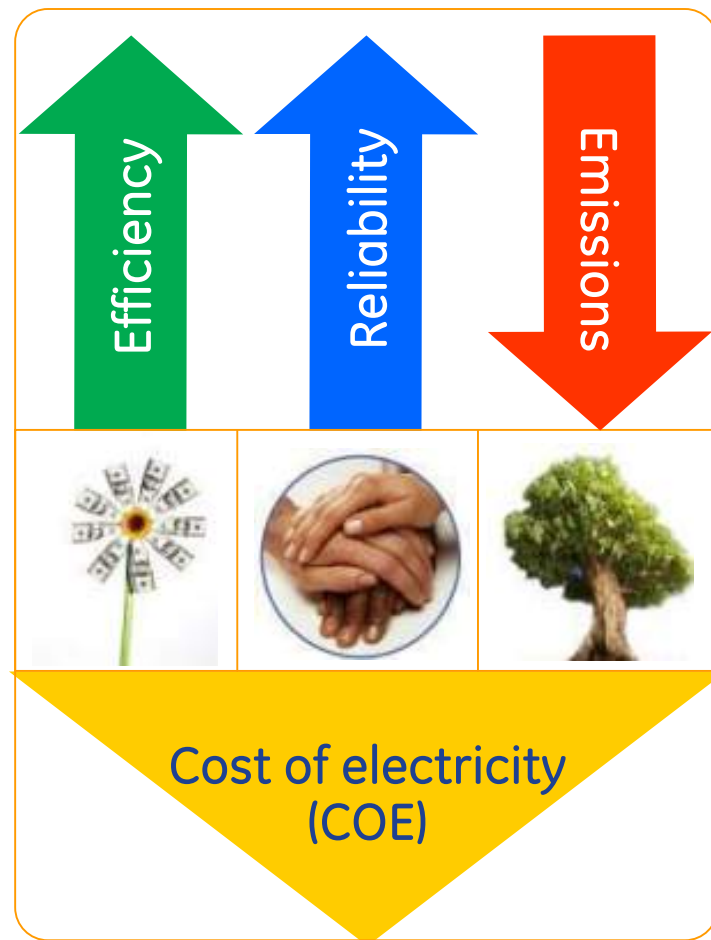
Grid integration and dispatch ability to serve future large scale wind power plants: grid codes & accessibility

Wind resources: forecasting and data accuracy

Standardization of certification & test procedures

Offshore, e.g. modeling and prediction of ocean and ice conditions

Development of components for large MW wind turbines



Further R&D needs...

Efficiency, quality and reliability are the key long term drivers for OEMs.

...let's push together for

- ✓ more efficiency
- ✓ better quality
- ✓ higher reliability



GE imagination at work



GE is committed long term... **ecomagination**

GE's commitment to imagine and build innovative solutions that benefit our customers and society at large.

Our commitments include:

- Doubling our research investment
- Introducing more ecomagination products
- Reducing greenhouse gas emissions
- Make customers true partners
- Keeping the public informed





Thank you !