# Introduction to Samsung Wind Turbine Business

October 15th, 2010

Wind Turbine Division

Samsung Heavy Industries

# Contents



# The Potential for Wind Turbine Business

## Samsung Wind Turbine Business

**Integrated Technology & Experience**

| Shipbuilding & Fixed / Floating Offshore Structure | Civil Engineering & Plant Engineering | Digital Business Automation / Navigation / Power Control System | Research Institute Noise & Vibration Analysis |
|---|---|---|---|
|  |  |  |  |
| • Drive train designs<br>• Cold climate packages<br>• Offshore turbine designs<br>• Samsung Wind turbine Quality Standard (SWQS) | • Balance of plants | • Wind turbine controller<br>• SCADA<br>• Power quality control | • Blade designs<br>• Structure optimization<br>• Noise & vibration reduction |

# Vision and Target

## 2015 Global Top 10

**M/S 10%**

- Expansion to global market
  - Europe market entry: 2013
- Manufacturing Capacity
  : 400 units/year

## 2020 Global Top 3

**M/S 15%**

- World Top 3 Manufacturer
- Manufacturing Capacity
  : 1000 units/year

# Global Business Network Plan

## U.S.A.

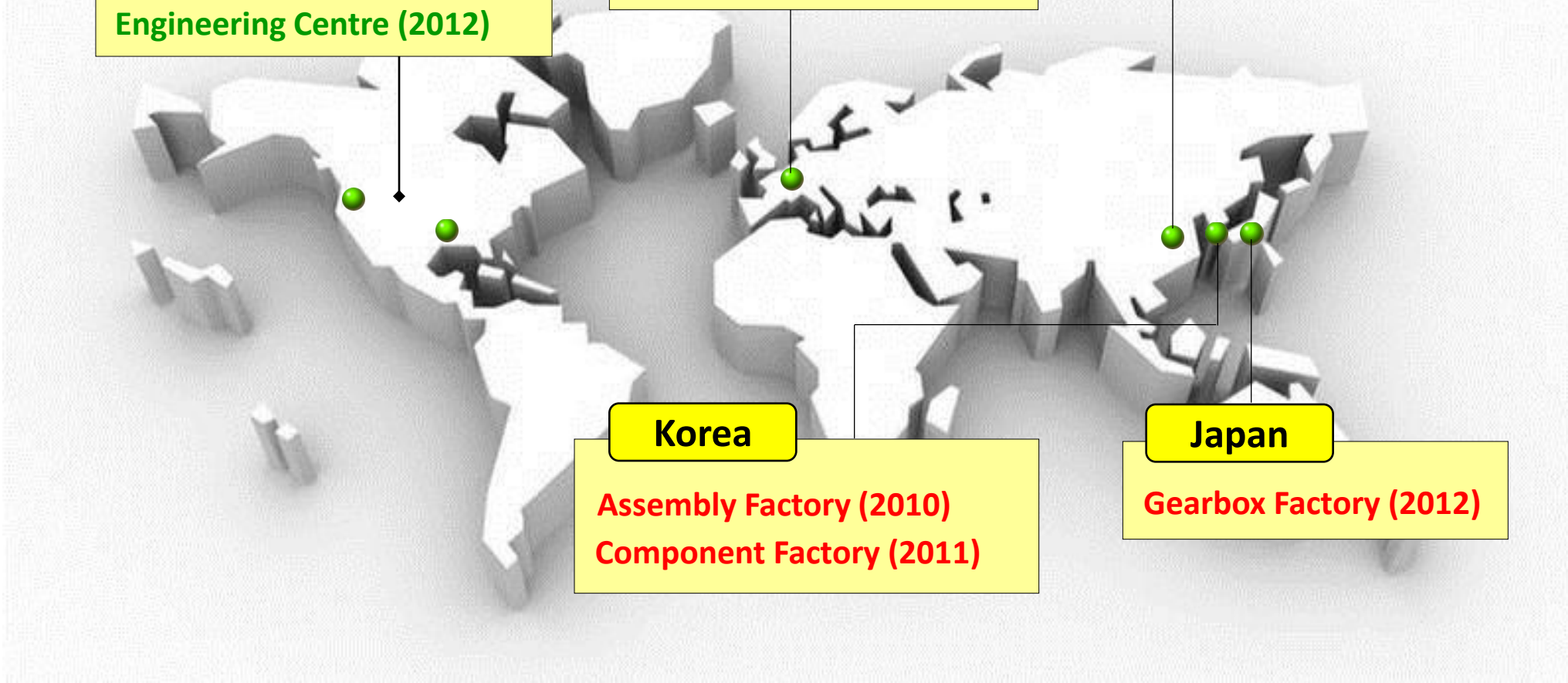
Sales Branch: Houston (2009)
Logistics, A/S Centre (2010)
Sales Branch: Portland (2011)
Blade/Tower Factory (2011)
Engineering Centre (2012)

## Europe

Engineering Centre (2011)
Sales Branch (2012)
Logistics, A/S Centre (2013)
Assembly Factory (2013)

## China

Sales Branch (2012)
Logistics, A/S Centre (2013)
Assembly/Component Factory (2013)



## Korea

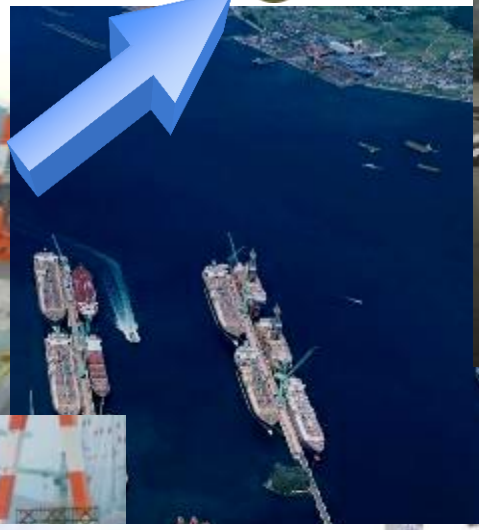
Assembly Factory (2010)
Component Factory (2011)

## Japan

Gearbox Factory (2012)

# Construction of Assembly Factory

- Completion date : July 2010 (26,710m² / Geoje-Si, Korea)
- Production capacity : 2.5MW WTG 200 units/year

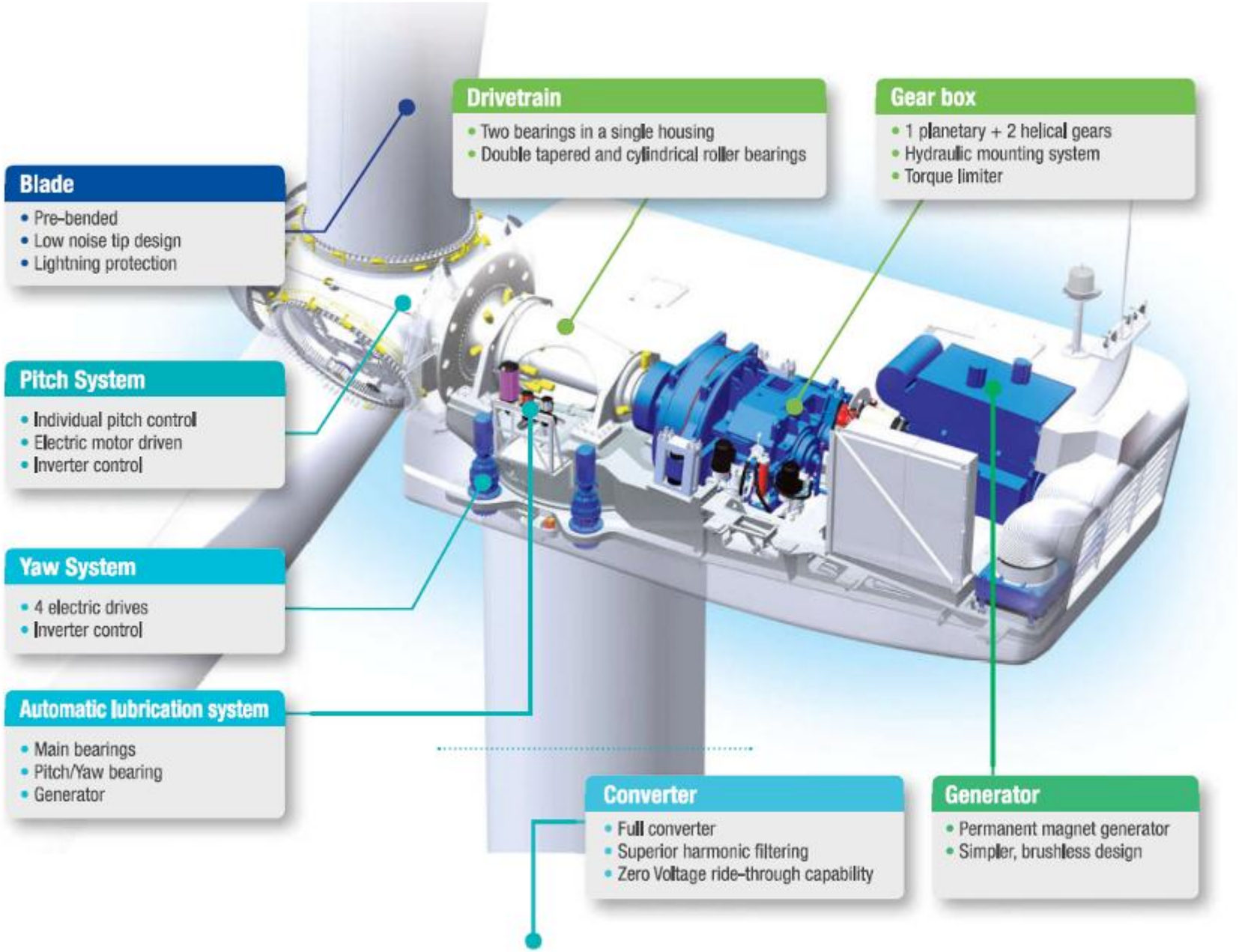


# Onshore WTG Development

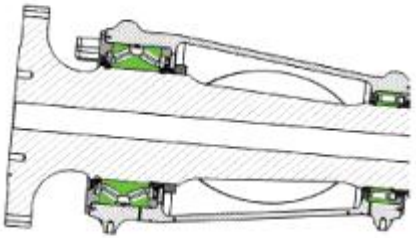
# Onshore 25s/25x Technical Specifications (1/2)

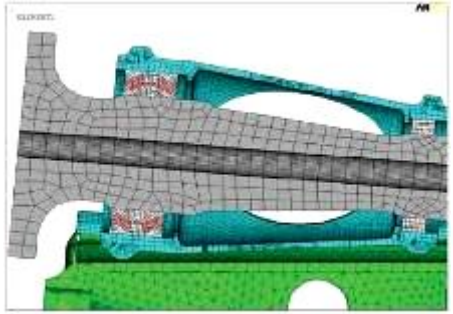
| | Model | 25s | 25x |
|---|---|---|---|
| Rotor | Wind class | IEC class IIA | IEC class IIIA |
| | Rotor diameter | 90 m (295.3 ft) | 100 m (328 ft) |
| | Cut-in speed | 3.5 m/s (6.7 mph) | |
| | Cut-out speed | 25 m/s (55.9 mph) | 21 m/s (47.0 mph) |
| Drivetrain | Main bearing | Two bearings (DTRB + CRB), single housing | |
| Gearbox | Type | One-stage planetary, two-stage spur gear | |
| | Support | Hydraulic mounting | |
| | Output shaft | Power lock type, torque limiter | |
| Generator | Type | Permanent magnet generator | |
| | Rated speed | 1,650 rpm | |
| | Rated power | 2,640 kW | |
| Converter | Type | Pulse-width modulated | |
| | Frequency | 60 Hz | |
| | Cooling | Water | |
| Pitch | Pitch bearing | 2-row ball bearings | |
| | Pitch drive | Electric, individual | |
| Yaw | Yaw drive | Electric, 4 drives, inverter control | |
| | Yaw brake | Hydraulic disk, 6 calipers | |
| Tower | Height | 80 m (262.5 ft), Custom heights available | |
| Operating temperature | | -10°C to 40°C, Cold Climate Package available [ operating temperature : -30 °C survival temperature : -40 °C | |

# Onshore 25s/25x Technical Specifications (2/2)



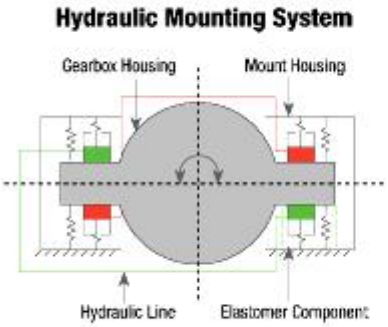
# Engineered for Reliability

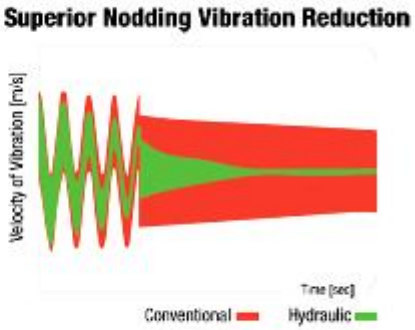




- **Main shafting system of drivetrain**

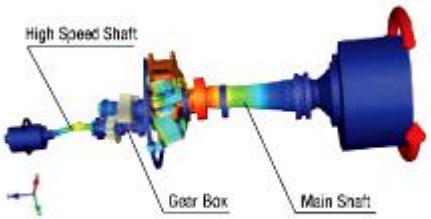
  Two point support main bearings on the main shaft significantly reduce the transmission of external loads from the rotor to the gearbox




- **Hydraulic mounting system for gearbox**

  Hydraulic mounting system effectively dampens shock and transient vibration



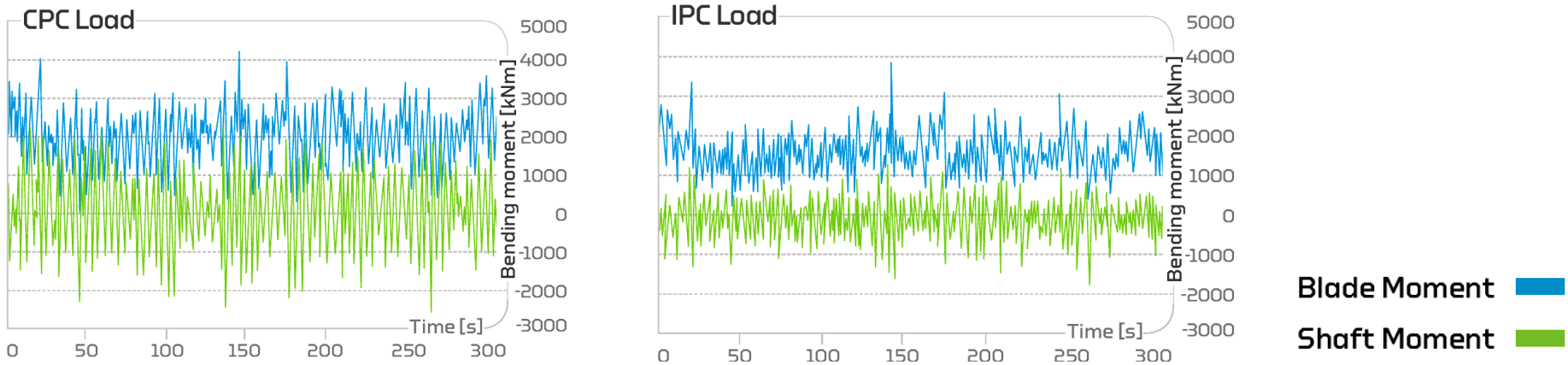

- **Drivetrain validation**

  Drivetrain has been validated for GL certified design life of 25 year through multiple processes i.e. dynamic analysis, gearbox functional and HALT test, and NWTC dynamometer test

# Optimized for Performance

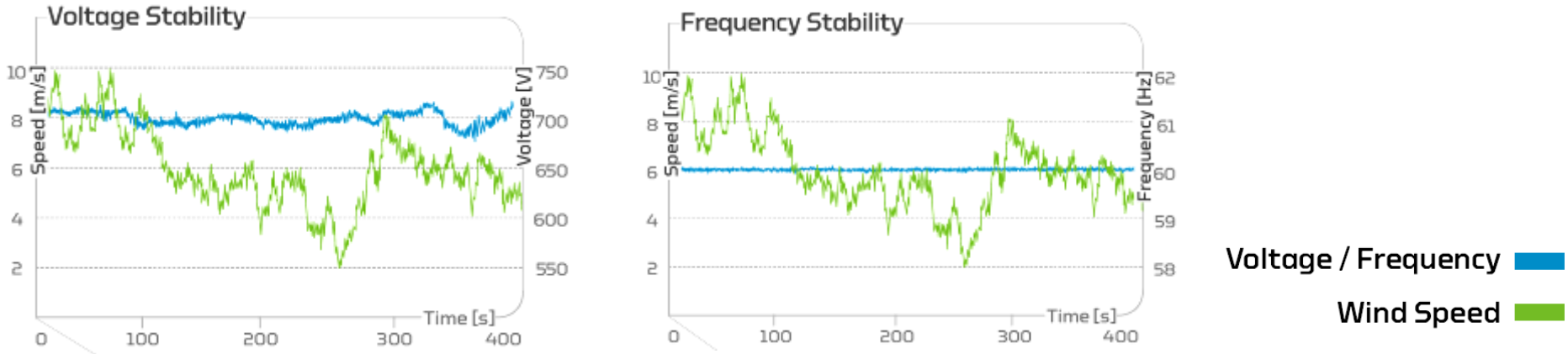
## Individual Pitch Control (IPC)

Significantly reduced fatigue loads compared to collective pitch control system



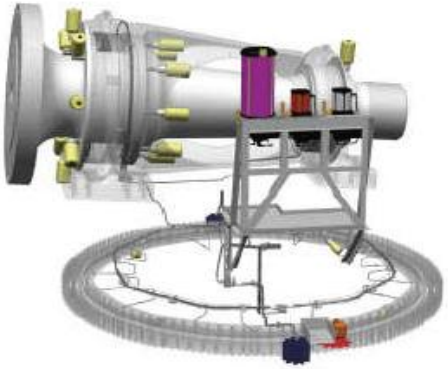

## Power Quality

Ensuring excellent voltage and frequency stability

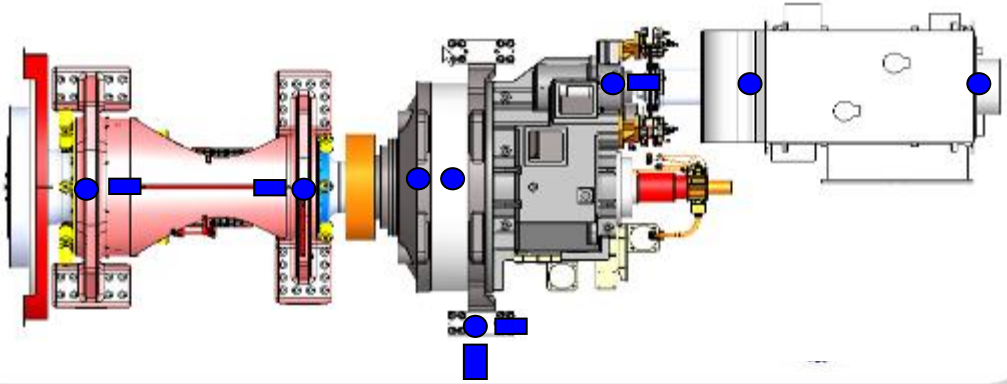


# Built for Maintainability

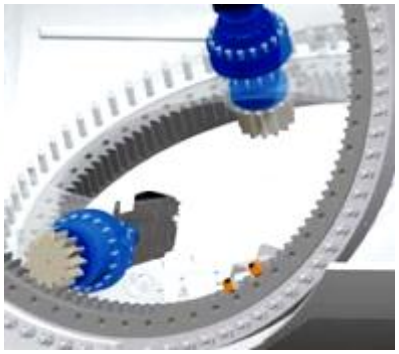
- **Automatic Lubrication System**
  - Maintenance time/frequency reduced by simply replacing grease oil container
  - Enhanced durability of bearings and gears

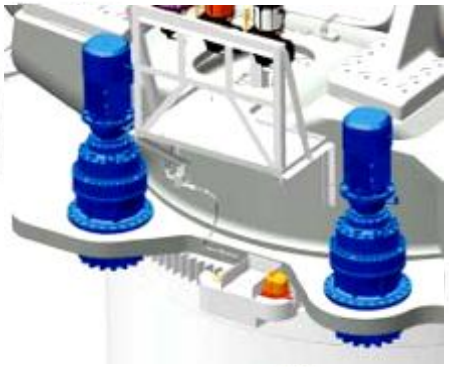


- **Condition Monitoring System**
  - Monitoring of vital drive-train components in 13 locations
  - Alert the operator of abnormal operating conditions



- **Electric Pitch/Yaw Drive System**
  - Reduced maintenance cost by eliminating the need of regular inspections





# 7.5MW Lubbock Wind Ranch Project



- **Terms of a Contract**
  - Contract Date : July 24, 2009
  - Sale of Wind Turbines : 3 X 2.5MW Wind Turbines + Tower + SCADA
  - Project Schedule
    - Prototype : Oct. 2009 — Electrical Eng. Design completed
      Nov. 2009 — Civil Eng. Design completed
      Jan. 2010 — WTG Erection completed
      Apr. 2010 — Commissioning completed
      Sep. 2010 — Power and load measurements completed
      Oct. 2010 — Deliver to Cielo
    - WTG #2, 3 : May. 2011 — Final Completion

# Transportation & Installation of Prototype

Lubbock Wind Ranch Project

# Load Measurement for GL Certification

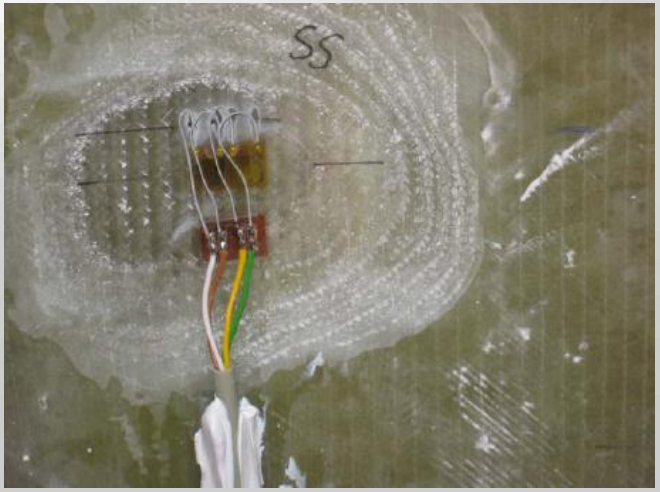
- **Objectives**
  - To verify the structural design of the wind turbine system
  - GL Cert. Requirement according to IEC61400-13

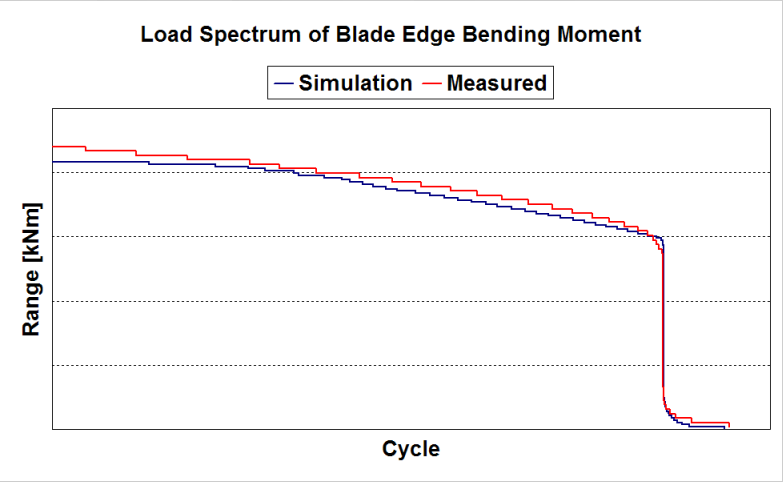
- **Measuring Point**
  - Blade Root
  - Main Shaft
  - Tower Top
  - Tower Bottom
  - Main Frame (additional)
  - Main Bearing Housing (additional)

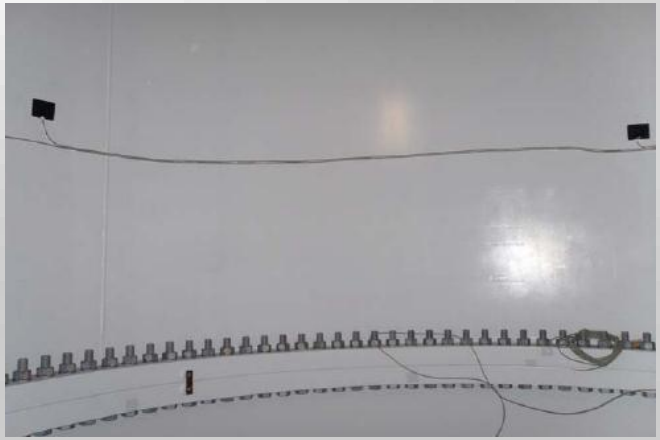
# Load Measurement for GL Certification

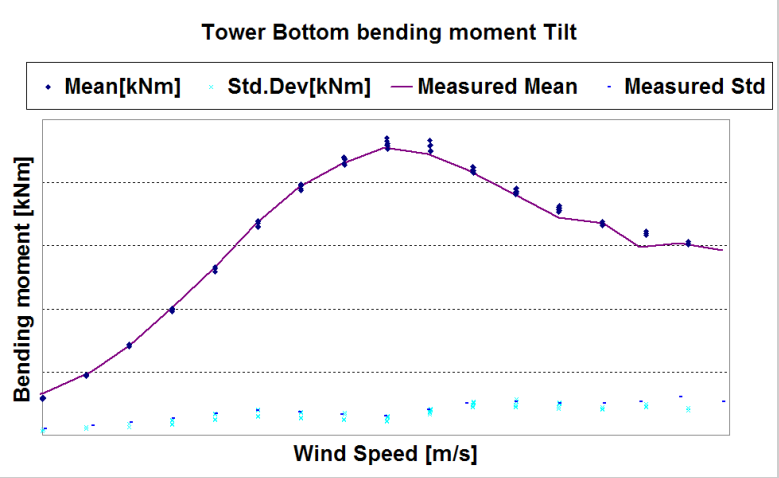
## Measurement Result

- Measurement result match with simulation result that ensure the design and the safety







# Offshore WTG Development


# Turn-Key Solution for Offshore Power Station

Offshore structure

**Various foundation design options**

- Monopile / Tripod / Jacket type
- Robust structural design against harsh environmental conditions (wind & wave)

Installing offshore facilities

**Key-stones in wind turbine installation**

- Offshore crane operation
- Rotor lifting control
- Schedule management
- HSE management

Specialized vessel

**Essence of wind turbine installation vessel**

- Dynamic positioning
- Offshore crane arrangement
- Payload control
- Hydraulic systems for jack-up
- Interface management

**World #1 Offshore WTG Provider**

**Turn-Key Solution Provider**

# Voice of Customer

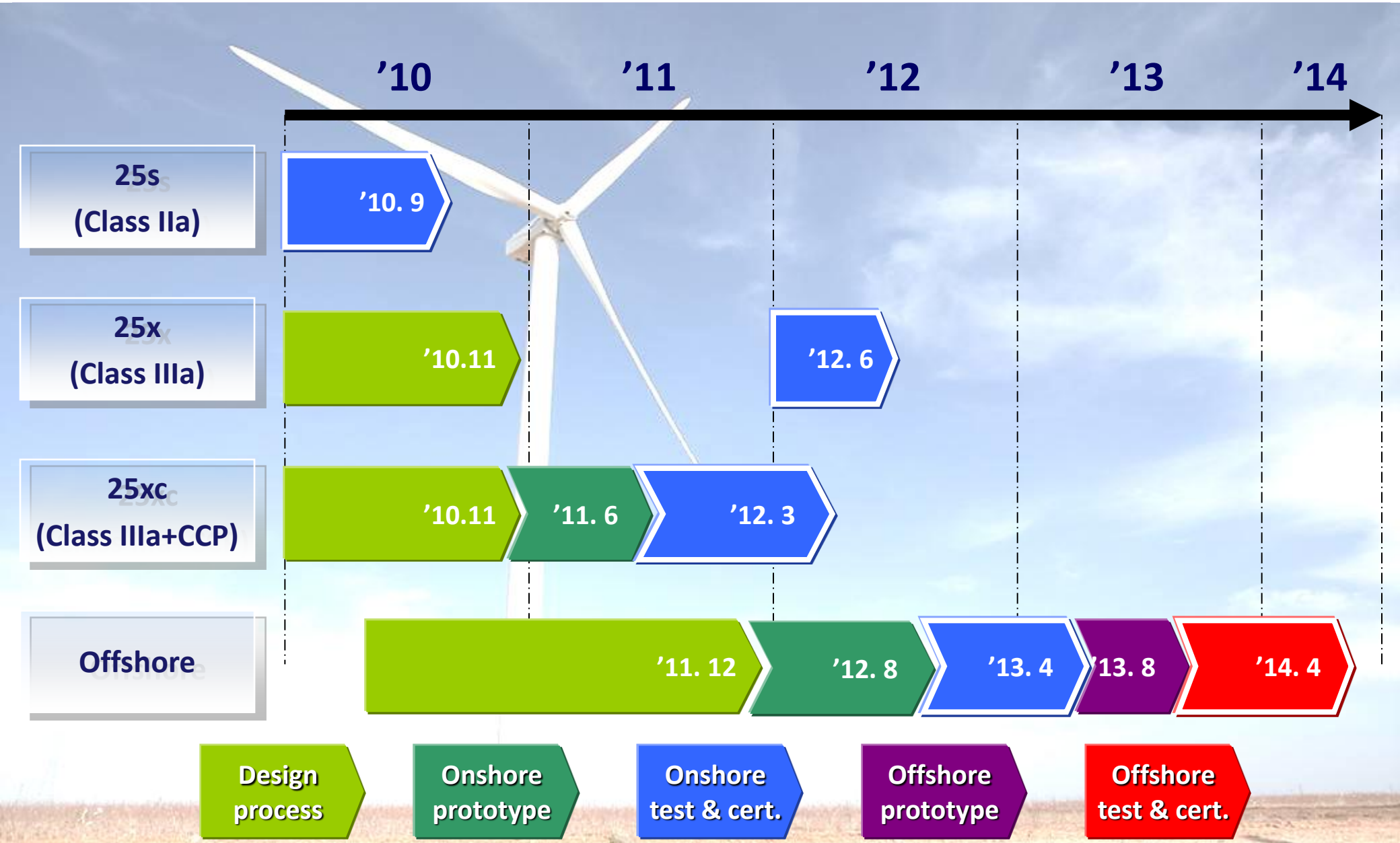
## Target Market: European offshore

- Low O&M cost
- High reliability
- Low nacelle weight
- High energy capture
  Low cost of energy
- Grid compatibility
- Wind farm management
- Easy installation
- Turnkey solution

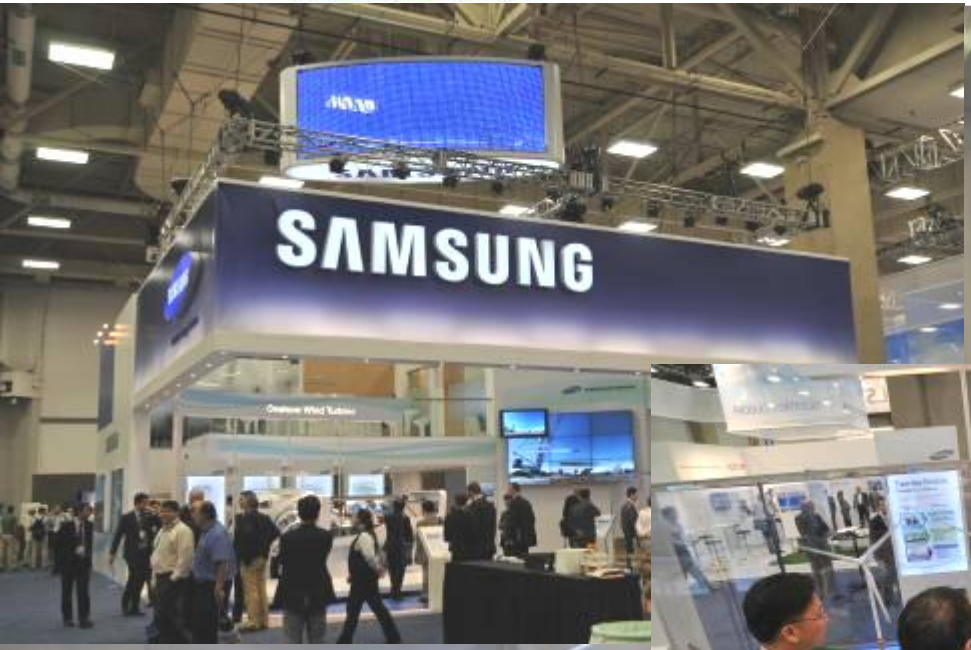
*** Preliminary specification ***

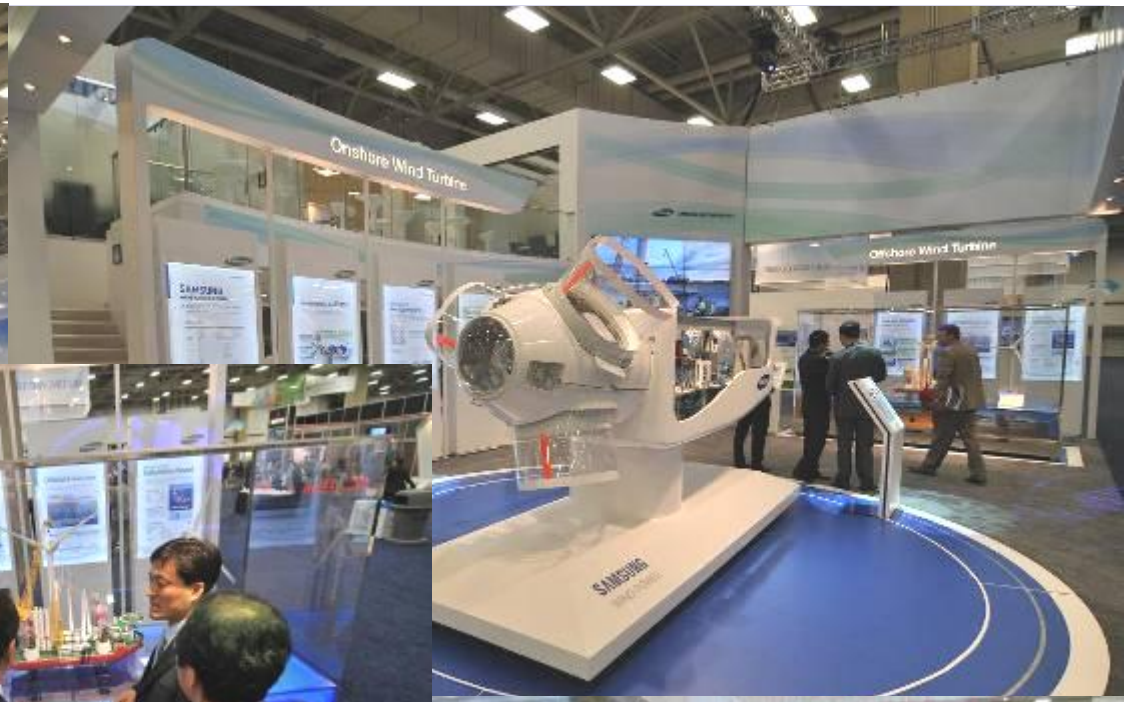
| Contents | Specification |
|---|---|
| Class | IEC Class I |
| Capacity | 6MW~ 7MW |
| Drive Train | 2-Stage geared / Direct-drive |
| Generator Type | PMG, Medium Voltage |
| Design Life | 25 years |
| Voltage & Frequency Control | Available |
| Foundation | Monopile / Tripod / Jacket |

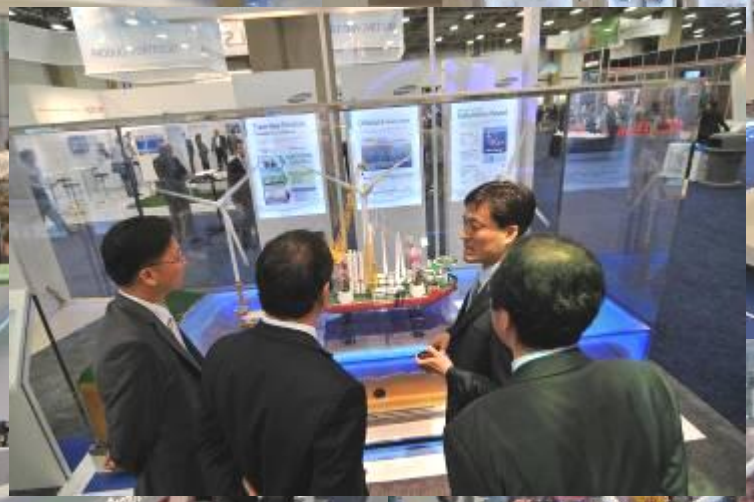
# Schedule for WT Development

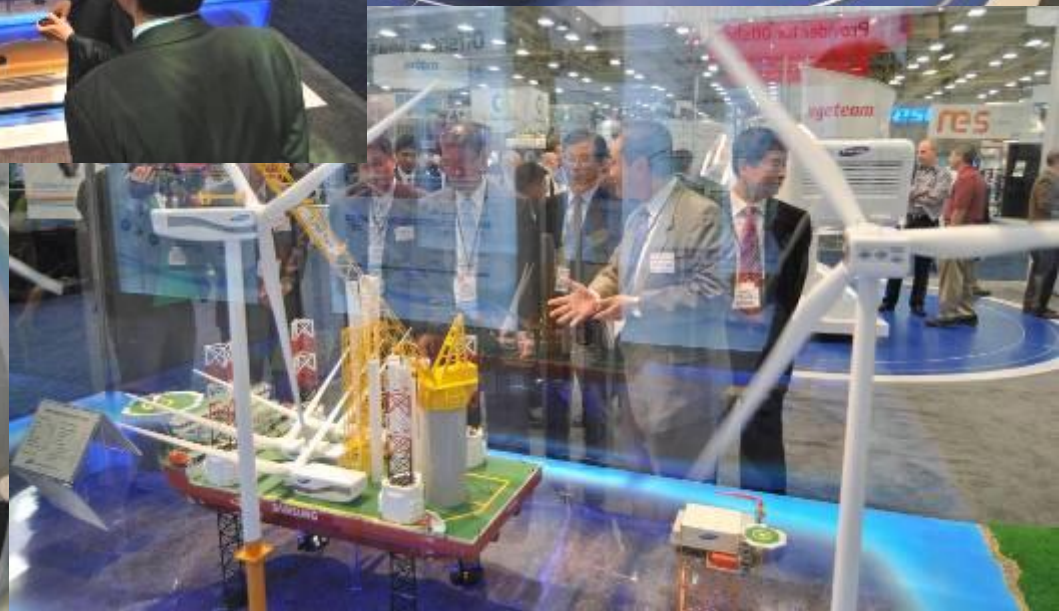


# Windpower 2010 Exhibition in Dallas




Thank you!
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