



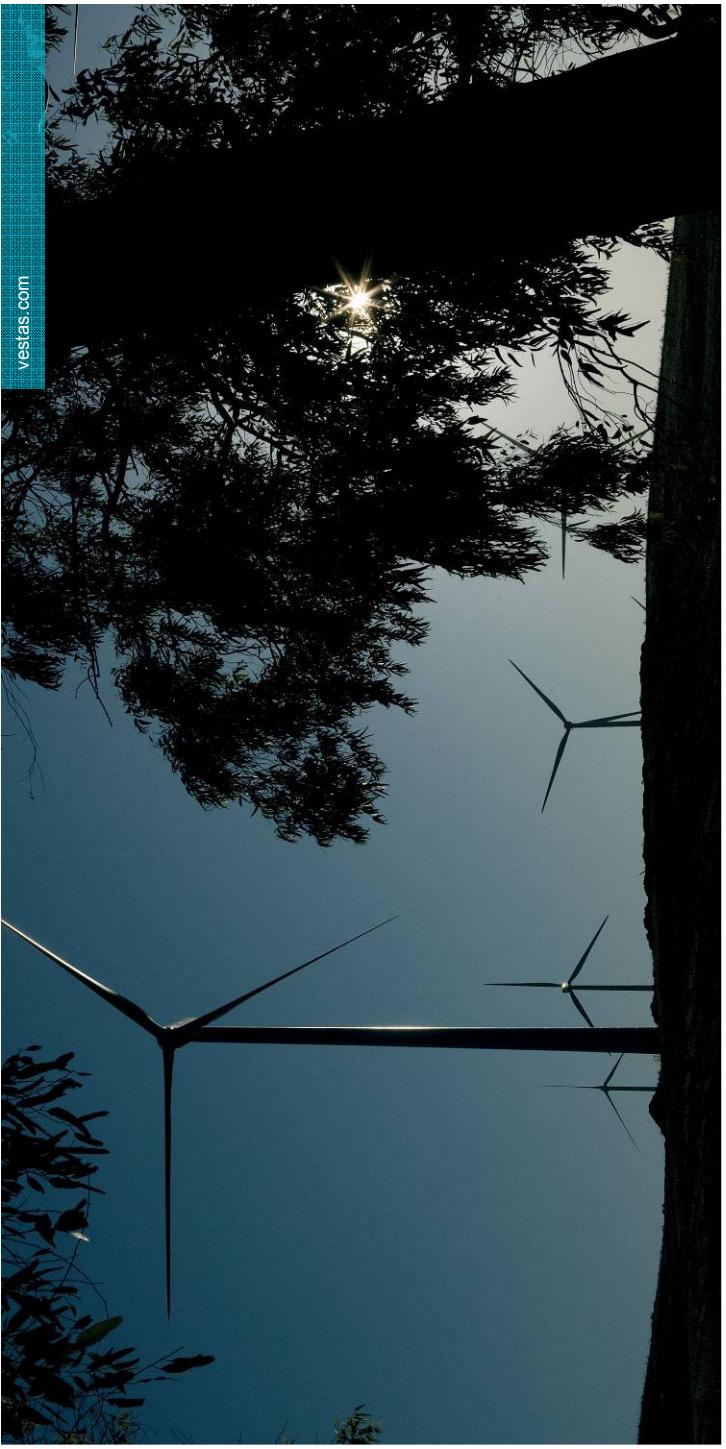
No. 1 in Modern Energy

## Newest technology in wind power generating

Integration Wind Power in Hungary  
12.06.2009

Dipl.-Ing. Ruslan Caraus – Vestas Central Europe  
Product Management / Electrical Engineering

**Vestas**®



# Vestas – No. 1 in Modern Energy

Vestas Nacelles A/S

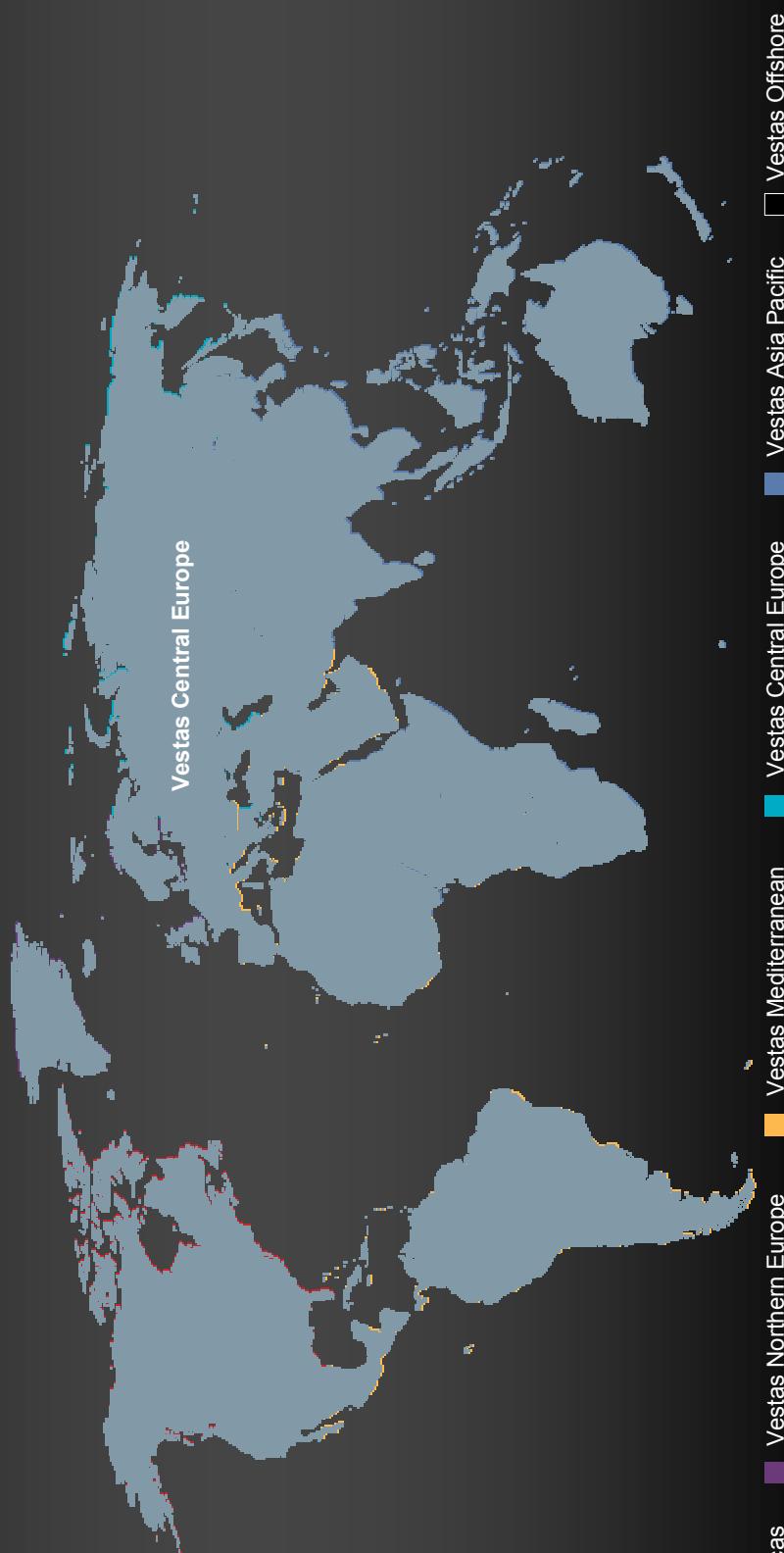
Vestas Blades A/S

Vestas People & Culture

Vestas Towers A/S

Vestas Technology R&D

Vestas Control Systems A/S



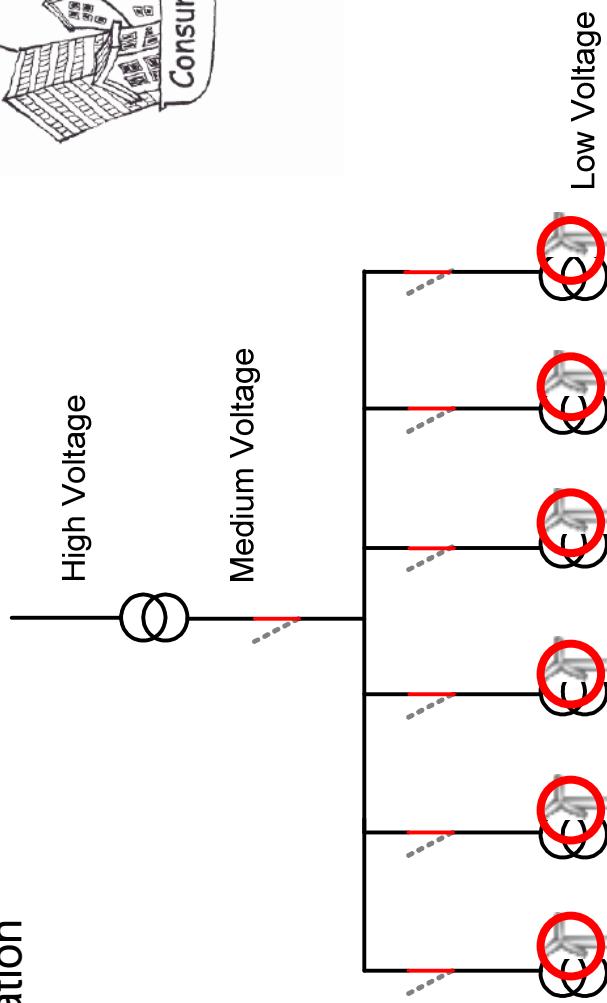
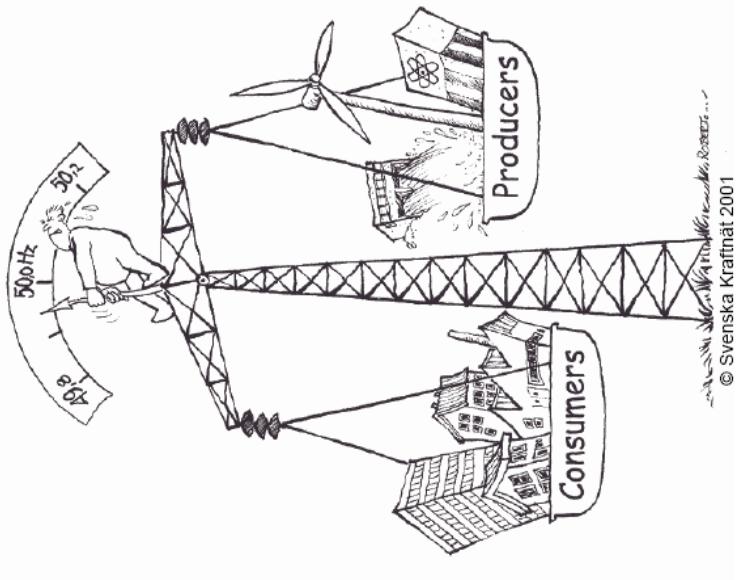
# Vestas has the world's widest serial-produced turbine range

<b>kW</b>	V52-850 kW
<b>1.5 MW</b>	V82-1.65 MW
<b>2.0 MW</b>	V80-1.8 MW V80-2.0 MW
<b>3.0 MW</b>	V90-1.8 MW V90-2.0 MW V90-3.0 MW V112-3.0 MW

**Vestas®**

# Grid Compliance → Wind Power Plant

- Large integration of wind power
- Shift in requirements:
  - Acceptable turbine behavior
  - - Controllable wind power plant behavior
    - Focus moving from turbine connection point to PCC in sub station



## **Grid Operator requirements are mainly focused on**

- Steady state performance
  - Frequency rating
  - Voltage rating
  - Active, reactive power rating
  - Power Quality
  - others
- Communication interface
  - Status information
  - Data collection
  - Remote control
- Dynamic performance
  - Control gradients
  - LVRT capability
  - TOV capability
  - Short circuit protection
  - others
- Simulation/Verification
  - Simulation models design
  - Model implementation
  - Testing performance

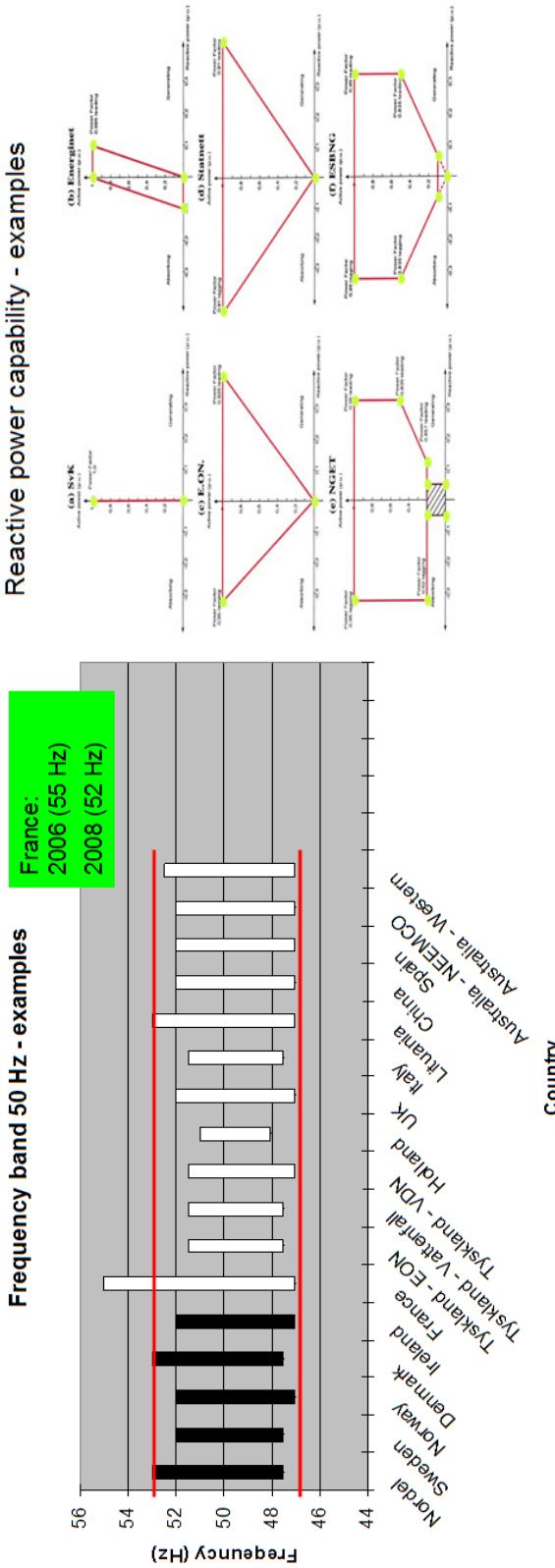
**Todays main challenge for manufacturer is not to fulfil the requirements –  
but to understand the intended implementation behind.**

**Solution → A well structured and clearly defined Grid Code**

**Grid Code Harmonisation needed.**

# Requirement complexity

- Examples:



- The physical phenomena is similar, but not its description.

The knowledge sharing is the key to success.

# Lessons learned from Denmark

**Efficient integration of large-scale wind power requires:**

- **A strong transmission grid**
  - to trade and balance in a wide geographical area
- **High flexibility in generation and demand**
  - with technical connection requirements for all resources
- **A revised power system control architecture**
  - to mobilize all adequate resources in markets and operation
- **Efficient electricity markets**
  - with clear price signals and trading close to real-time
- **A closer coupling between energy systems**
  - to utilize synergies and create flexibility

**Report on the Danish Grid story just released - read more on [www.energinet.dk](http://www.energinet.dk)**

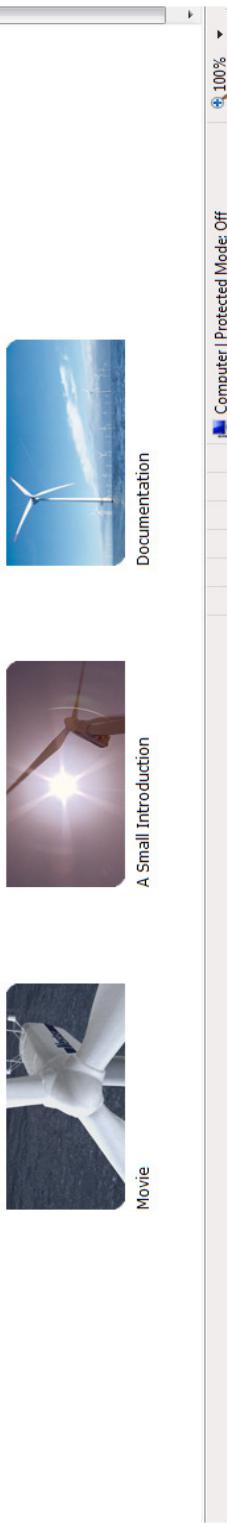
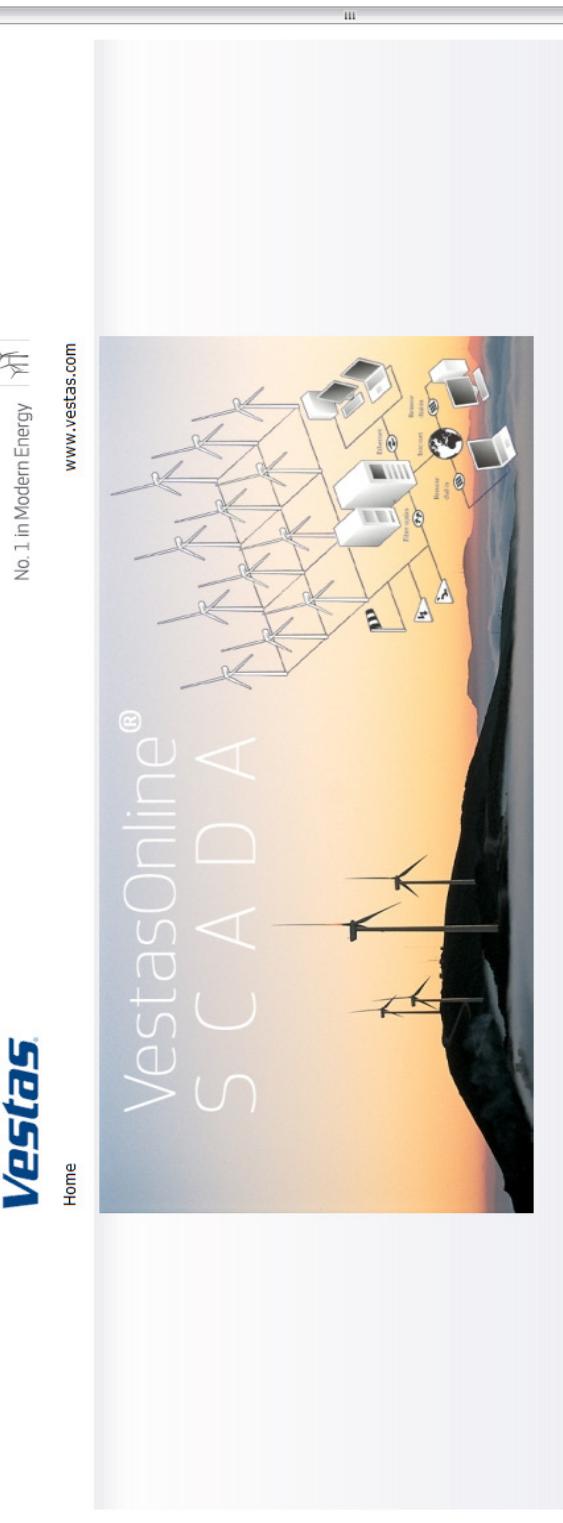
# VestasOnline™ SCADA

“Supervisory Control And Data Acquisition”



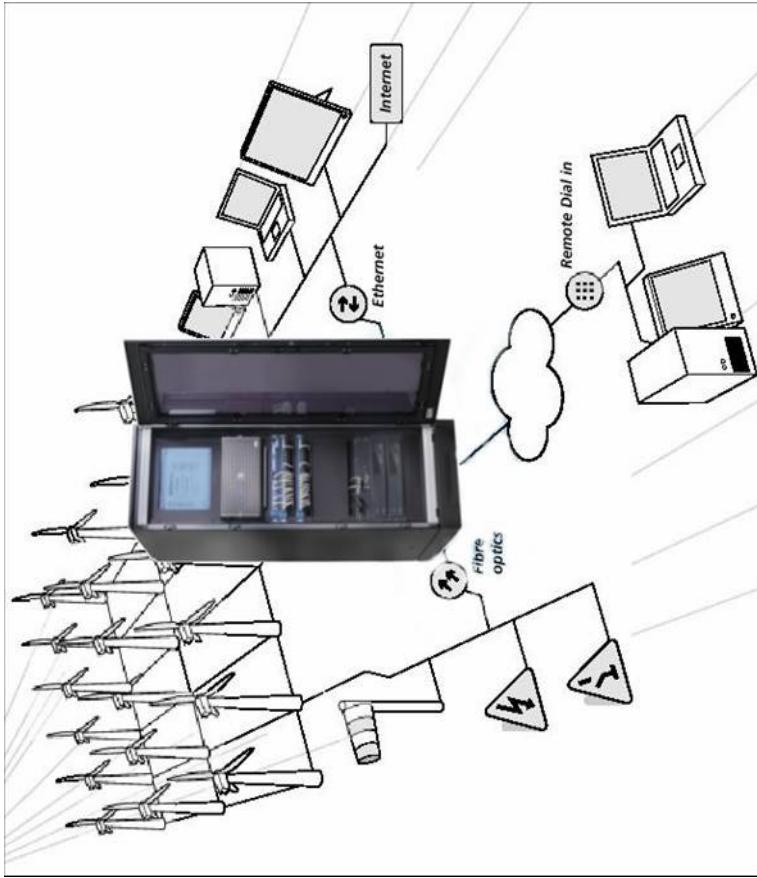
**Vestas**

Home



# Why SCADA system?

- Power Plant overview
- Event notification
- Remote monitoring
- Remote control
- Basic Statistics
- Online Production View
- Management reporting
- Preventive maintenance
- Power Plant regulation

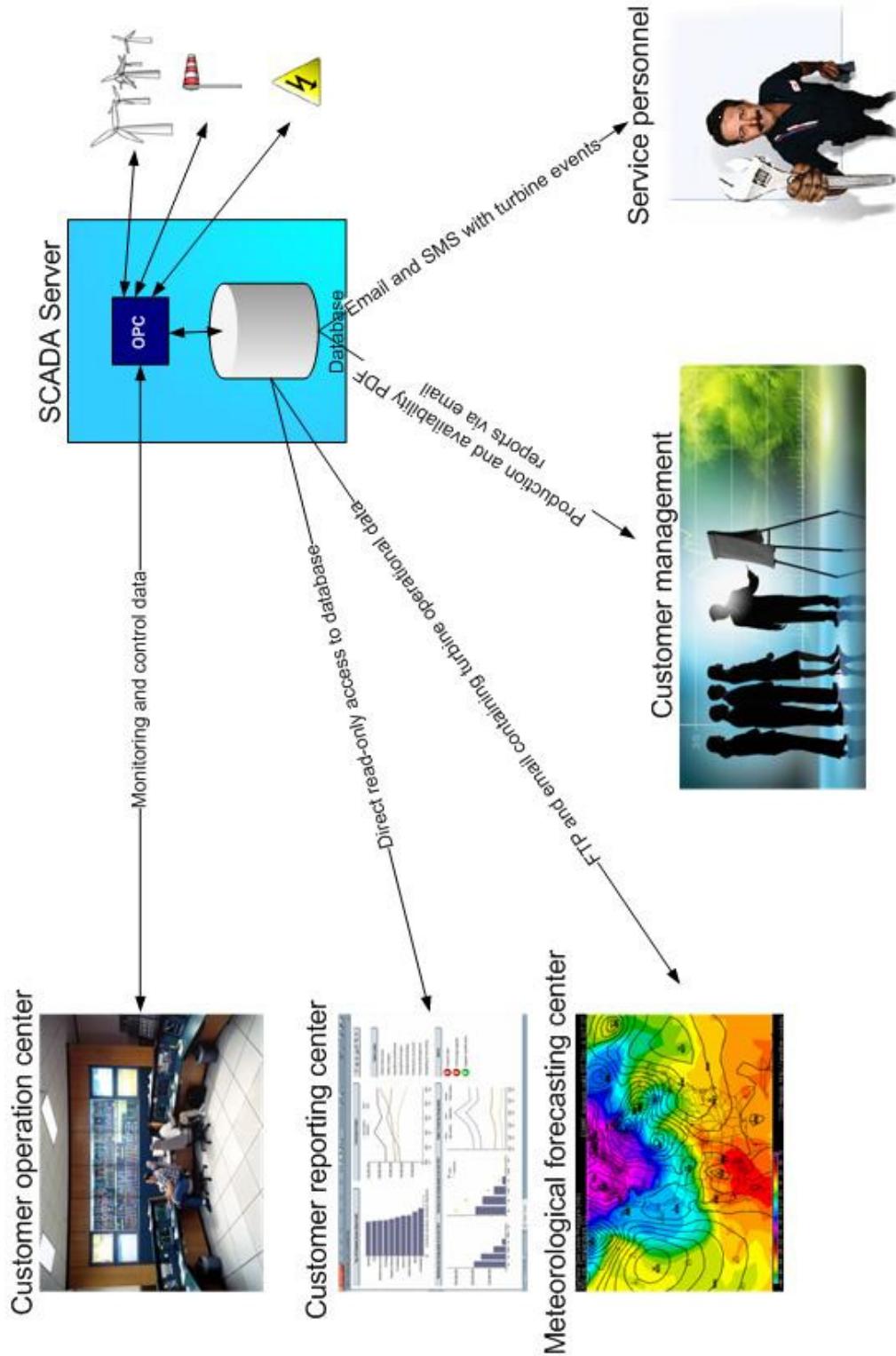


**SCADA turns a collection of Wind Turbines into a Wind Power Plant**

→ Better Performance and Production

# VestasOnline™ SCADA: The Key To Information

The information flow in the VestasOnline system



# VestasOnline® Business – Wind Power Plant Control

Remote SCADA Client

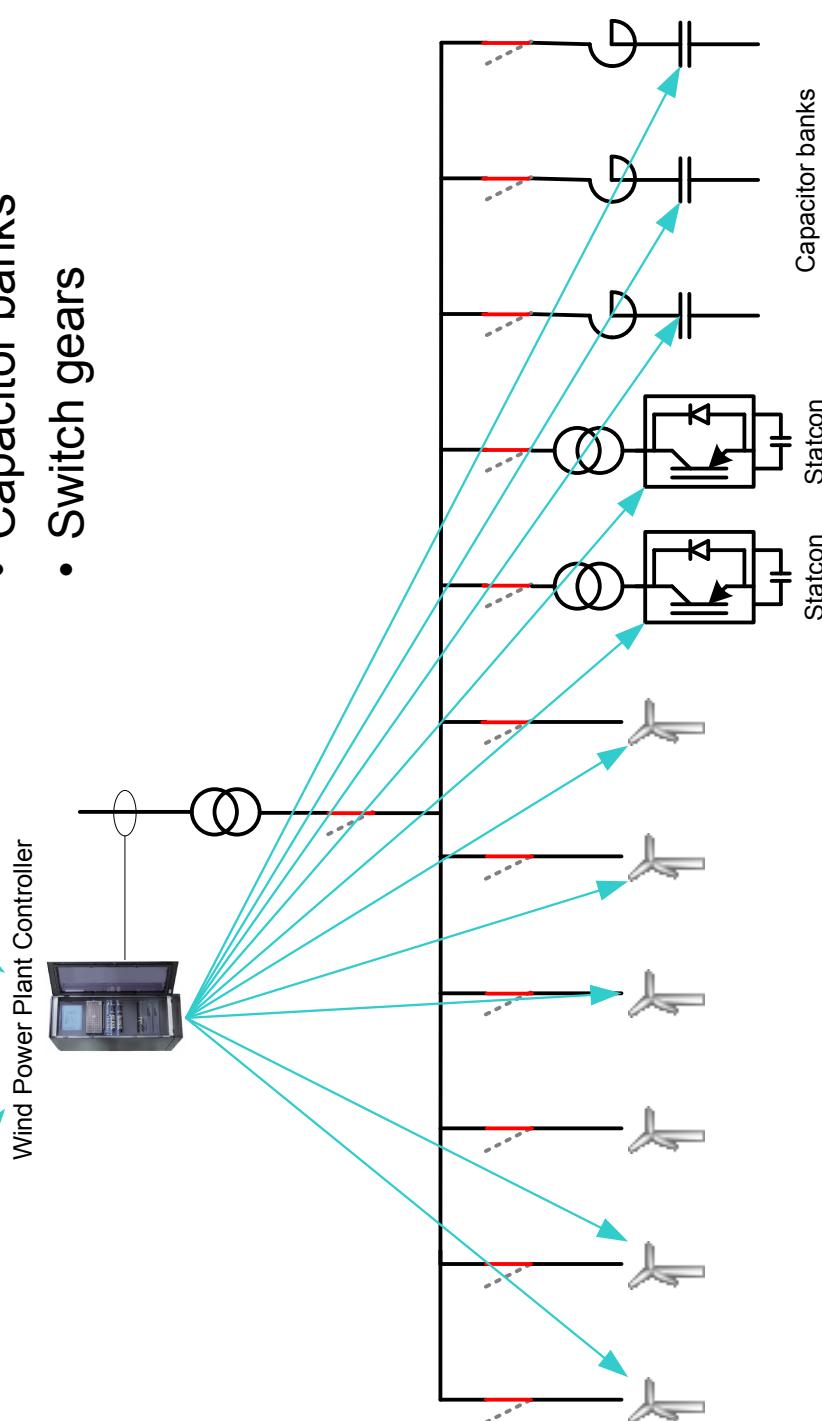


Local Utility

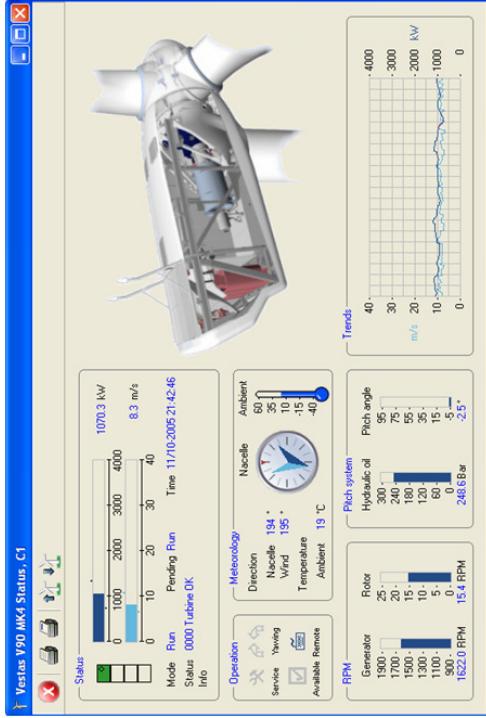
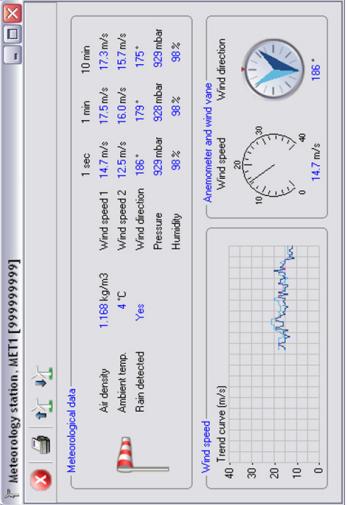
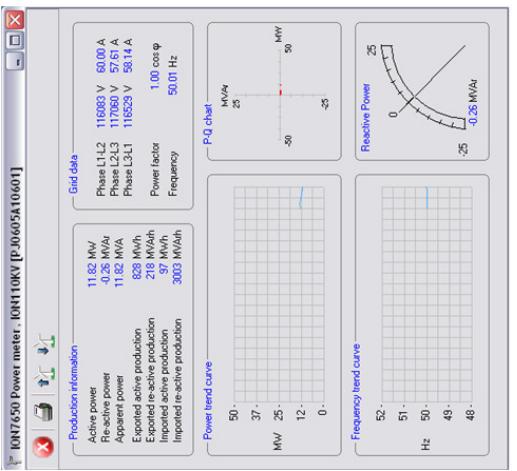
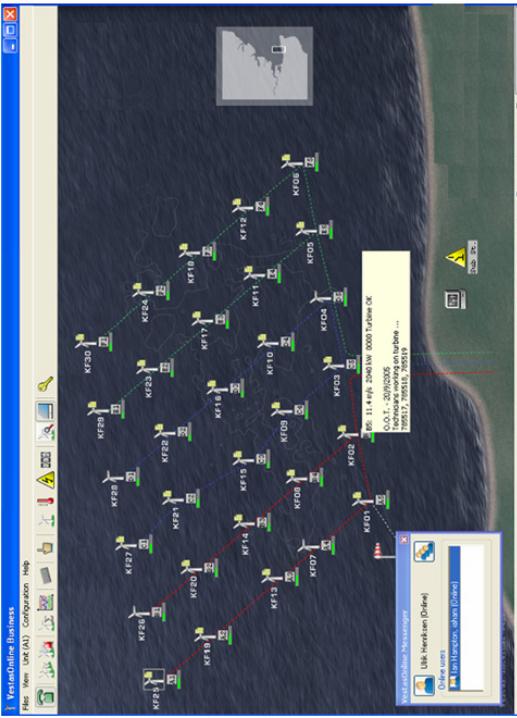


Fast and precise control of:

- Turbines
- Statcom/SVC equipment
- Capacitor banks
- Switch gears



# VestasOnline® Business – Wind Power Plant Control



# V112-3.0 MW

Highest efficiency in low to medium winds

- Full Scale Converter
- Permanent Magnet Generator
- Compact design
- Water jacket cooling
- No need for slip rings
- Low own consumption
- High control performance
- **Grid Compliance**

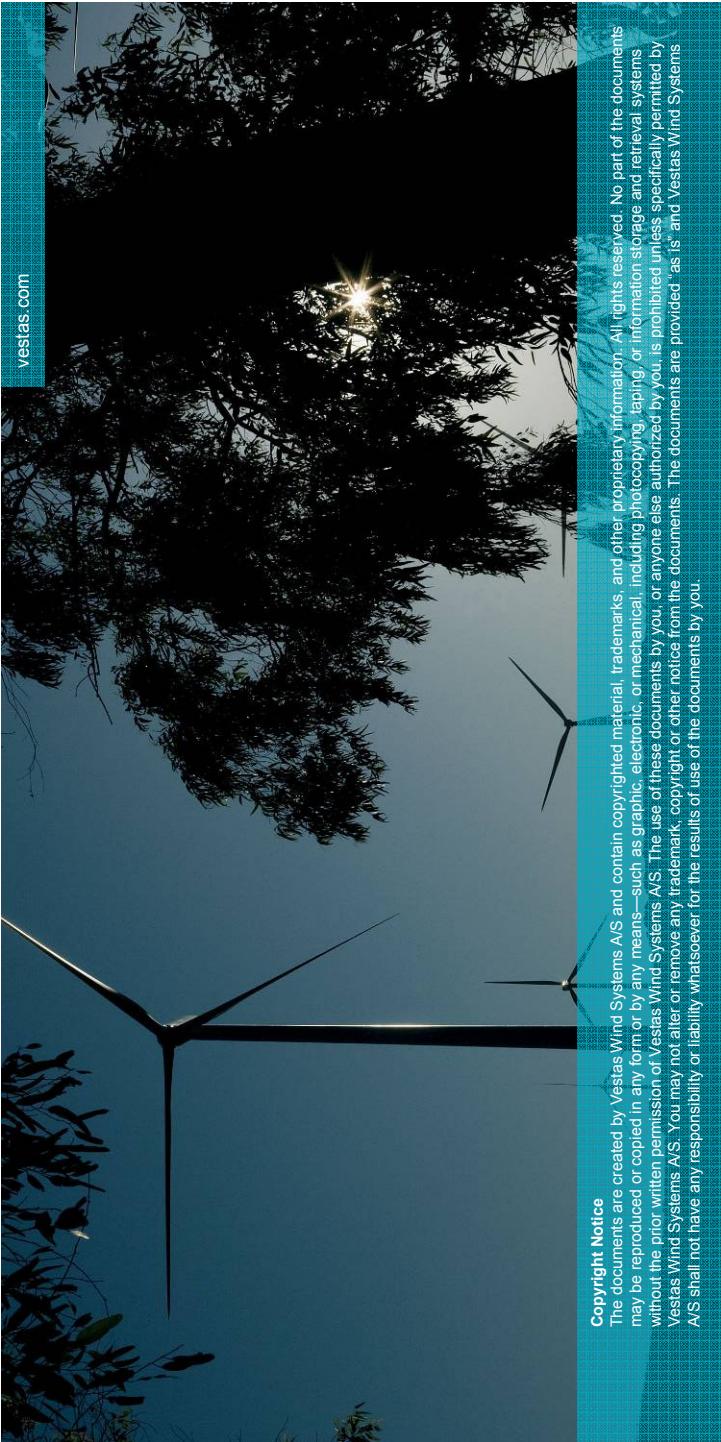




No. 1 in Modern Energy

# Thank you for your attention

**Vestas**®



**Copyright Notice**

The documents are created by Vestas Wind Systems A/S and contain copyrighted material, trademarks, and other proprietary information. All rights reserved. No part of the documents may be reproduced or copied in any form or by any means—such as graphic, electronic, or mechanical, including photocopying, taping, or information storage and retrieval systems—without the prior written permission of Vestas Wind Systems A/S. The use of these documents by you, or anyone else authorized by you, is prohibited unless specifically permitted by Vestas Wind Systems A/S. You may not alter or remove any trademark, copyright or other notice from the documents. The documents are provided "as is" and Vestas Wind Systems A/S shall not have any responsibility or liability whatsoever for the results of use of the documents by you.