



KONGSBERG

KONGSBERG

Kongsberg Renewables Technology/Kongsberg Digital Renewables & Utilities

- Introduction to Kongsberg
- Kongsberg EmPower
- Kongsberg EmPower @ Statoil Hywind demo

200 YEARS OF TECHNOLOGY INNOVATION



From deep sea to outer space

OUR INDUSTRIES



DEFENCE

Modern product portfolio with world leading positions in defence and aerospace niches



SPACE & SURVEILLANCE

Niche products and solutions to the entire value chain; from launch to data download services



MERCHANT MARINE

Scalable automation and control, safety, energy management, navigation and cargo handling solutions



SUBSEA TECHNOLOGY

Hydroacoustic technologies for naval applications, fishery, offshore operations and scientific research



OFFSHORE, OIL & GAS

A global supplier of integrated automation and control systems and engineering services

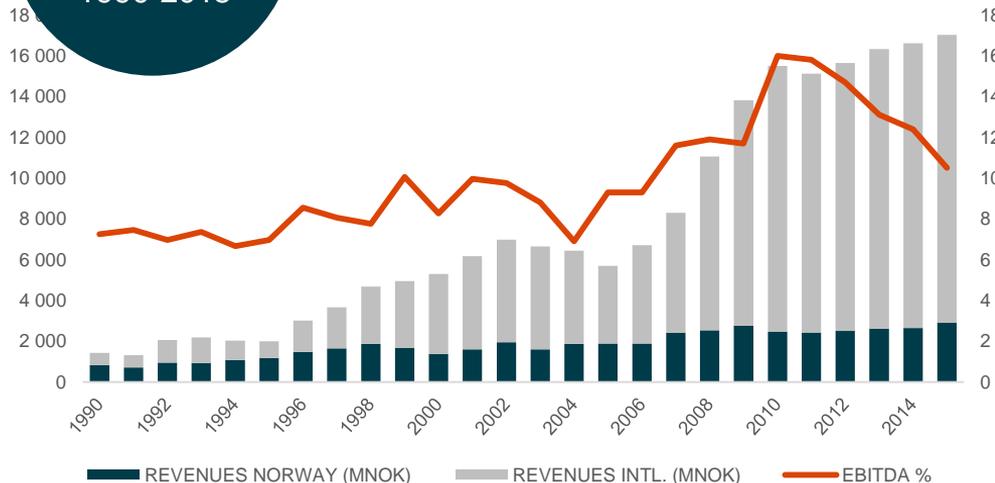


INDUSTRIAL DIGITALIZATION

Staying ahead of the curve on industrial software solutions for efficient operations

FOCUS ON TECHNOLOGY LEADERSHIP FORMS THE BASIS FOR OUR INTERNATIONAL GROWTH

REVENUES AND EBITDA MARGIN 1990-2015



EMPLOYEES

31.12.2015



7 688 EMPLOYEES



38 % EMPLOYED
OUTSIDE NORWAY



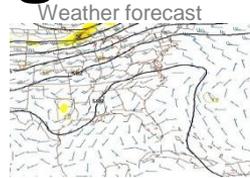
OFFICES IN MORE THAN
30 COUNTRIES



What is Kongsberg EmPower



Energy Trading



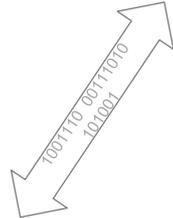
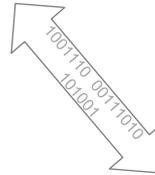
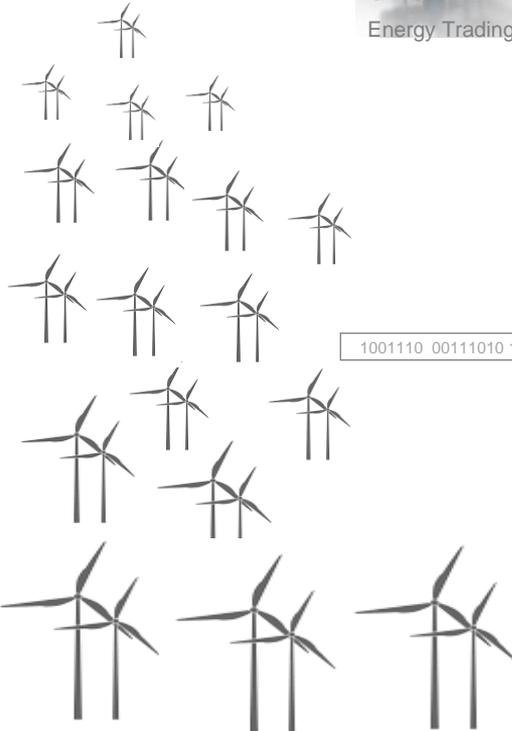
Weather forecast



Third Party System Supplier



Maintenance



Management



Technical Experts



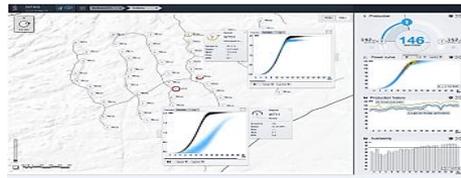
Asset Owner

Kongsberg EmPower: overview – insight - decision

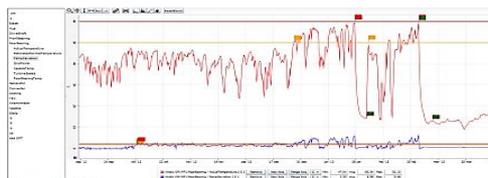
ensure optimal performance and minimize downtime and operational costs



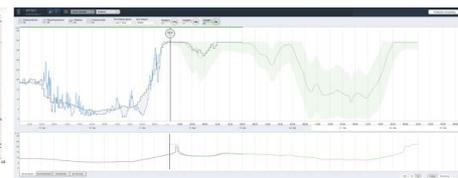
- **Performance Monitoring;** reporting, fault analyses, trending and benchmarking of turbines and wind farms
- **Conditioning Monitoring** with enhanced analysis of turbine data; temp, vibration, AE
- **Production Forecasting** through improved weather analysing tools/ algorithms
- **Wind Farm Control** with dynamic production optimizer reducing wake and turbine loads



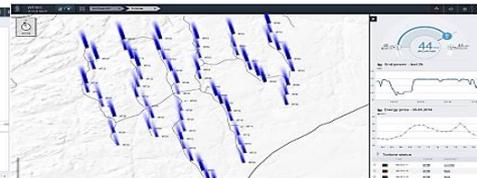
Identify deviations
Improved benchmarking



Reduced down time and
operational cost



Reduced imbalance Improved
maintenance planning



Production optimizer, load
and wake control



Kongsberg EmPower for Hywind Demo
Testing of technology for condition monitoring on wind turbines

HYWIND Demo – Statoil requirement

“For Hywind Demo Statoil sees a large potential in predicting failures and initiating mitigating activities prior to standstill of the turbine.”

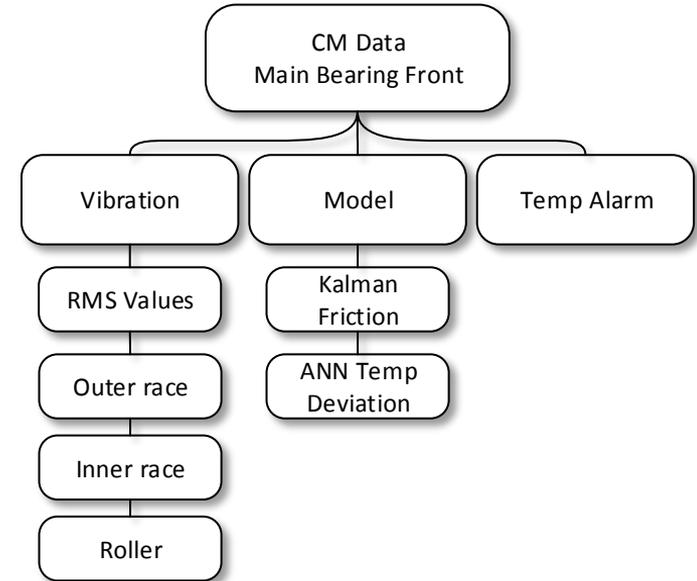
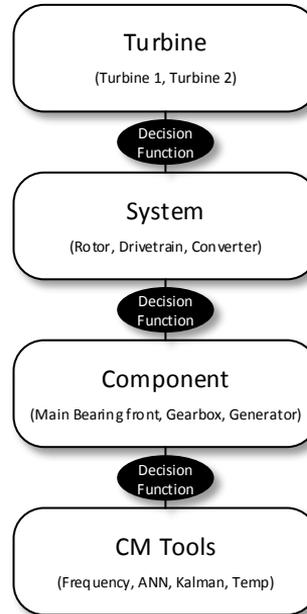
Project Objectives:

1. Better understanding of **degradation mechanisms**
2. **Early warning** of component underperformance/ degradation
3. **Fault recognition** and root cause identification techniques
4. **Remaining operational lifetime** calculations for major component classes
5. **O&M: Introduce CBM methodology**



The Road to Decision

- Use of available data
- Efficient presentation of data
- Create best possible **insights**
- Provide the **overview** for the best **decision**





EmPower for Hywind Demo - Project activities

1. Installation of Kongsberg EmPower at Hywind Demo – supported by Enova
2. Implementation and test of CM RUL modules
3. Introduction of CBM methodology and workflow for Hywind Demo

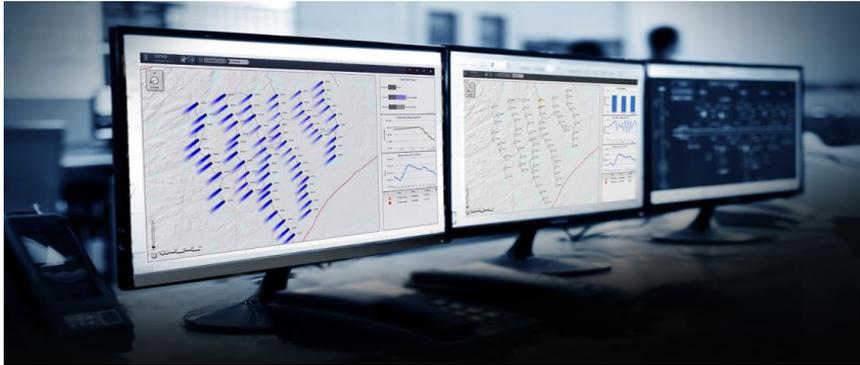


Photo: Teknisk Ukeblad



KONGSBERG

WORLD CLASS

THROUGH PEOPLE, TECHNOLOGY AND DEDICATION