

FOU/UTVIKLING I VINDKRAFT

– HVA TROR VI PÅ MHT TEKNOLOGUTVIKLING

25.10.2016

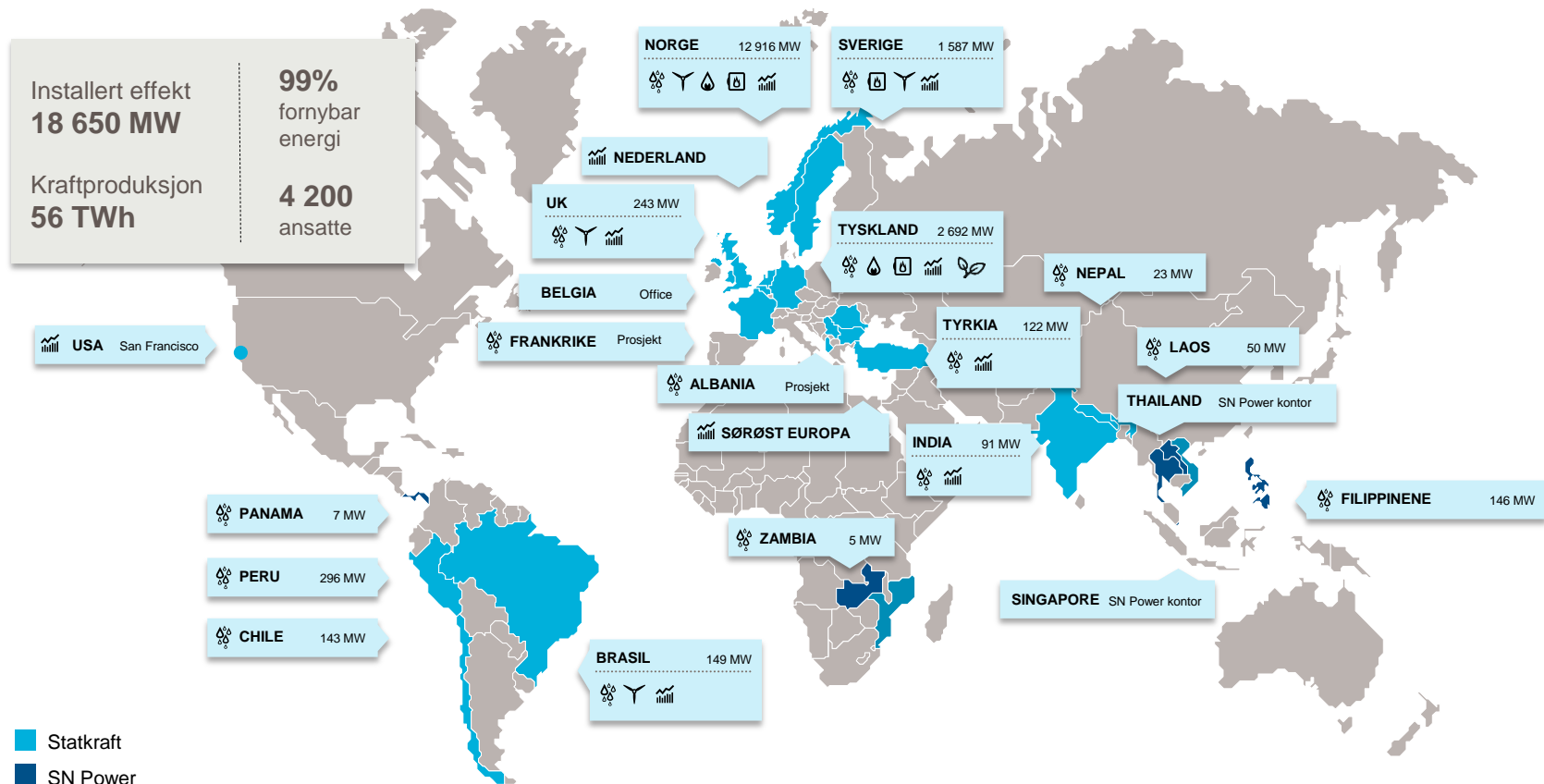
Anne Marie Seterlund



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- **STATKRAFTS WIND POWER ACTIVITIES**
 - **ONGOING R&D – ONSHORE WIND**
 - **TECHNOLOGY DEVELOPMENT AND TRENDS**

STATKRAFTS WIND POWER ACTIVITIES

Statkraft globalt



Statkrafts onshore vindkraftportefølje

● I drift

- Sverige	525 MW
- Norge	245 MW
- UK	142 MW
TOTALT	912 MW

● Under utbygging

- Norge	1.001 MW
- UK	36 MW
TOTALT	1.037 MW



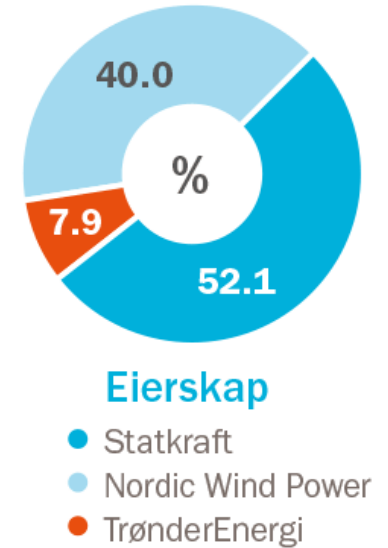
Fosen Vind

- ▶ 6 vindparker
- ▶ 278 vindturbiner
- ▶ 3,6 MW/turbin
- ▶ 3,4 TWh/år
- ▶ Byggeperiode 2016-2020
- ▶ 11 mrd. NOK

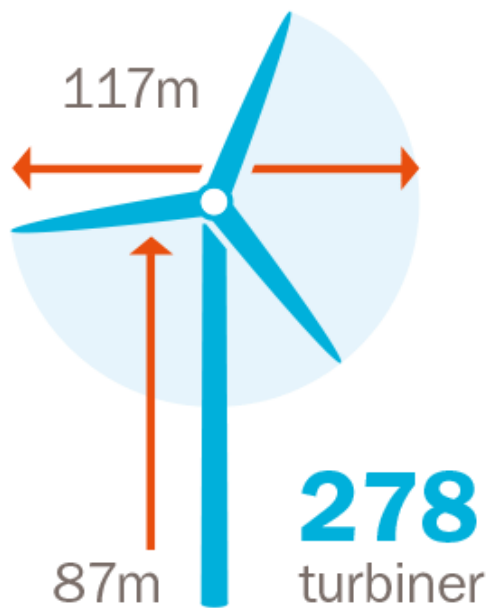
Produserer
nok strøm til
170 000
norske husstander



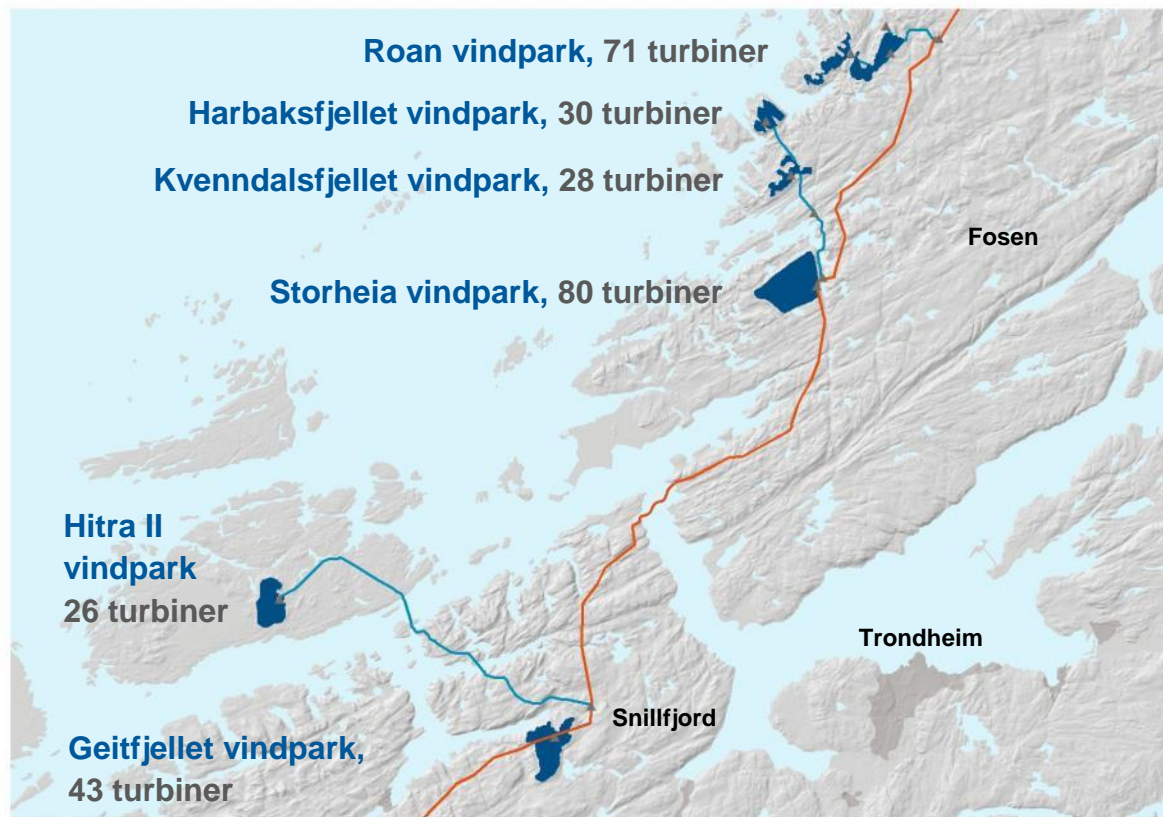
Europas
største
landbaserte
vindkraft-
prosjekt



Vindparkene



Vestas V117
3,6 MW



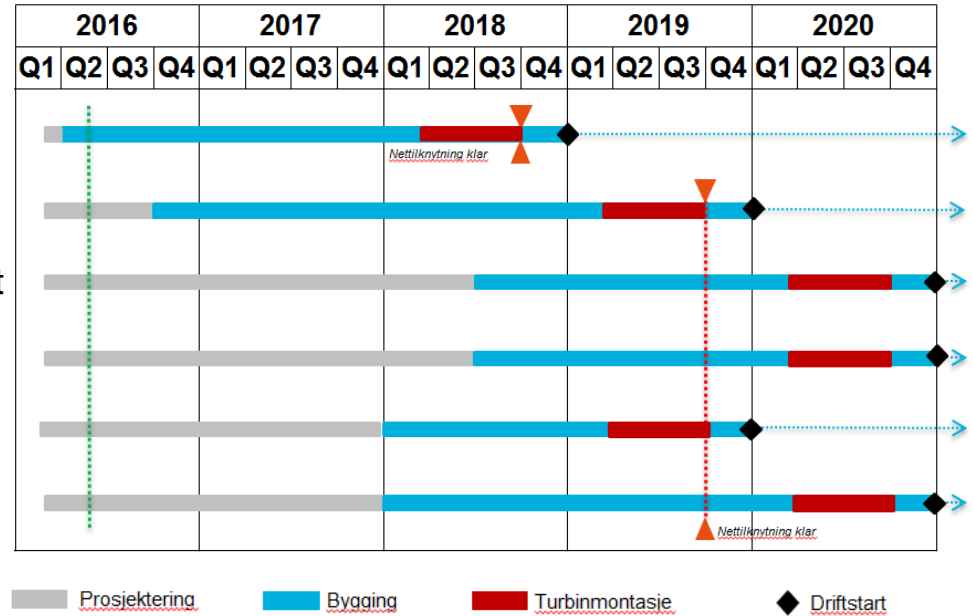
Fremdriftsplan



241 km

vei skal bygges

- ▶ Roan
- ▶ Storheia
- ▶ Kvenndalsfjellet
- ▶ Harbaksfjellet
- ▶ Hitra 2
- ▶ Geitfjellet

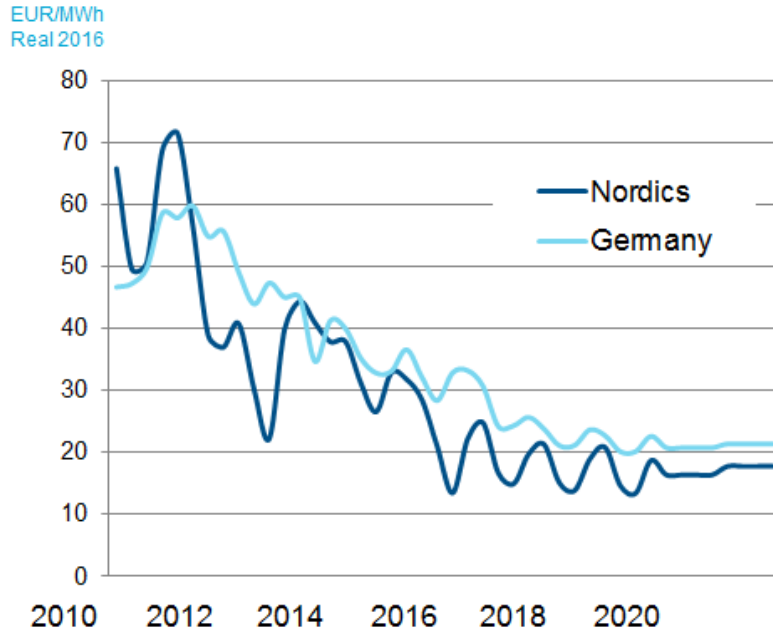


ONGOING R&D ONSHORE WIND



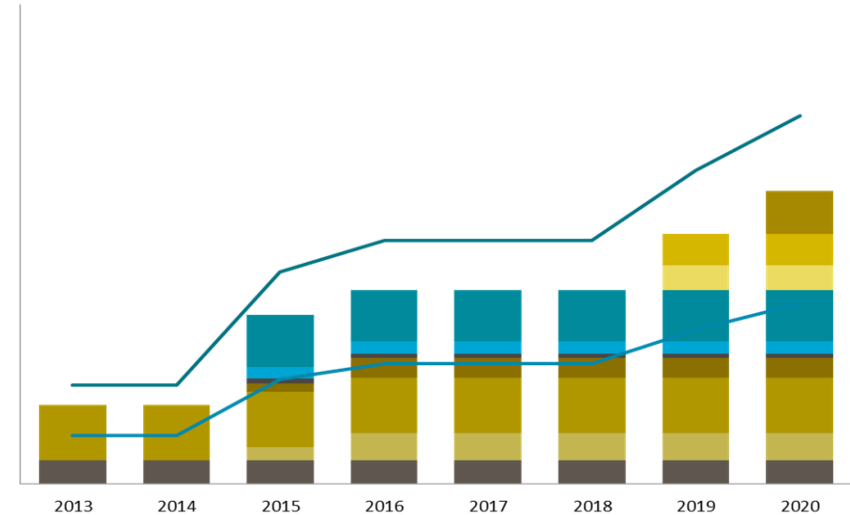
Background

Electricity, quarterly average market prices



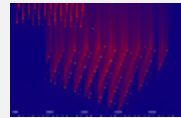
Source: Forward prices from Nasdaq OMX and EEX as of January 2016

Annual maintenance cost



R&D Onshore Wind

- ▶ Develop and strengthen competitive advantage in our core business
- ▶ Ensure good future regulatory framework and company reputation
- ▶ Build long-term competence and capability



Wind and site conditions



O&M, HSE

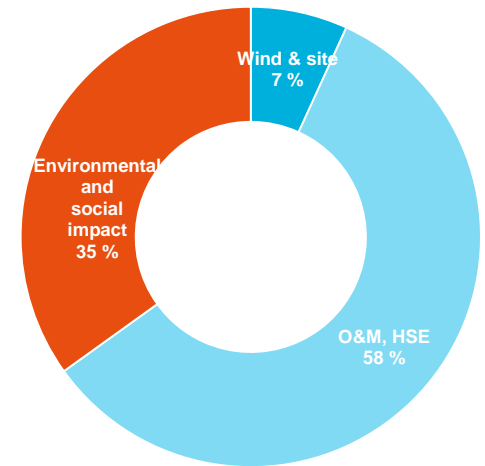


Electrical infrastructure



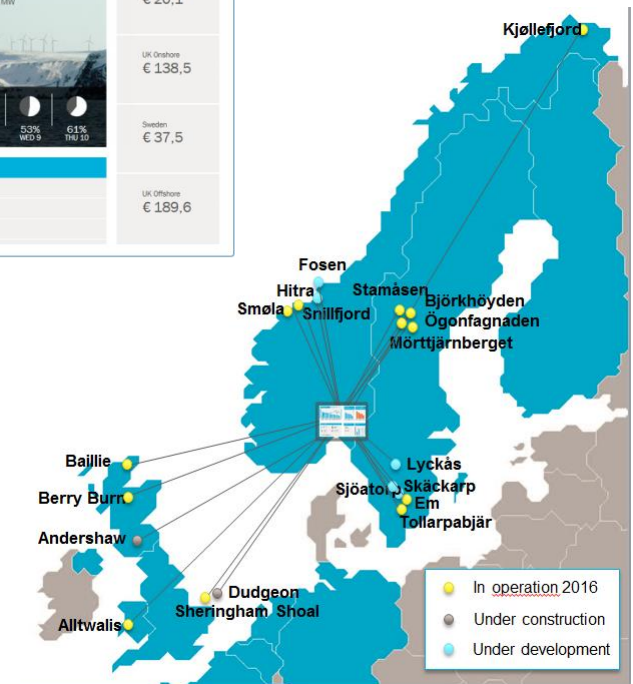
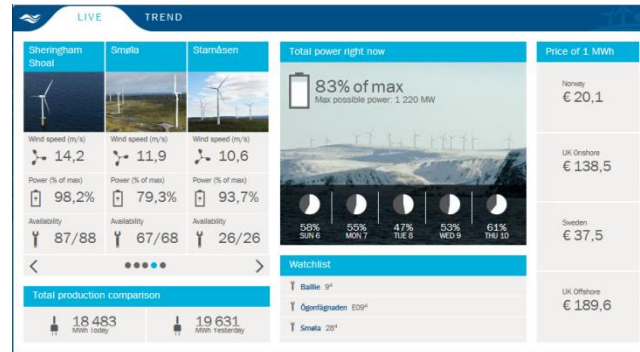
Environment and social impact

Onshore Wind 2015



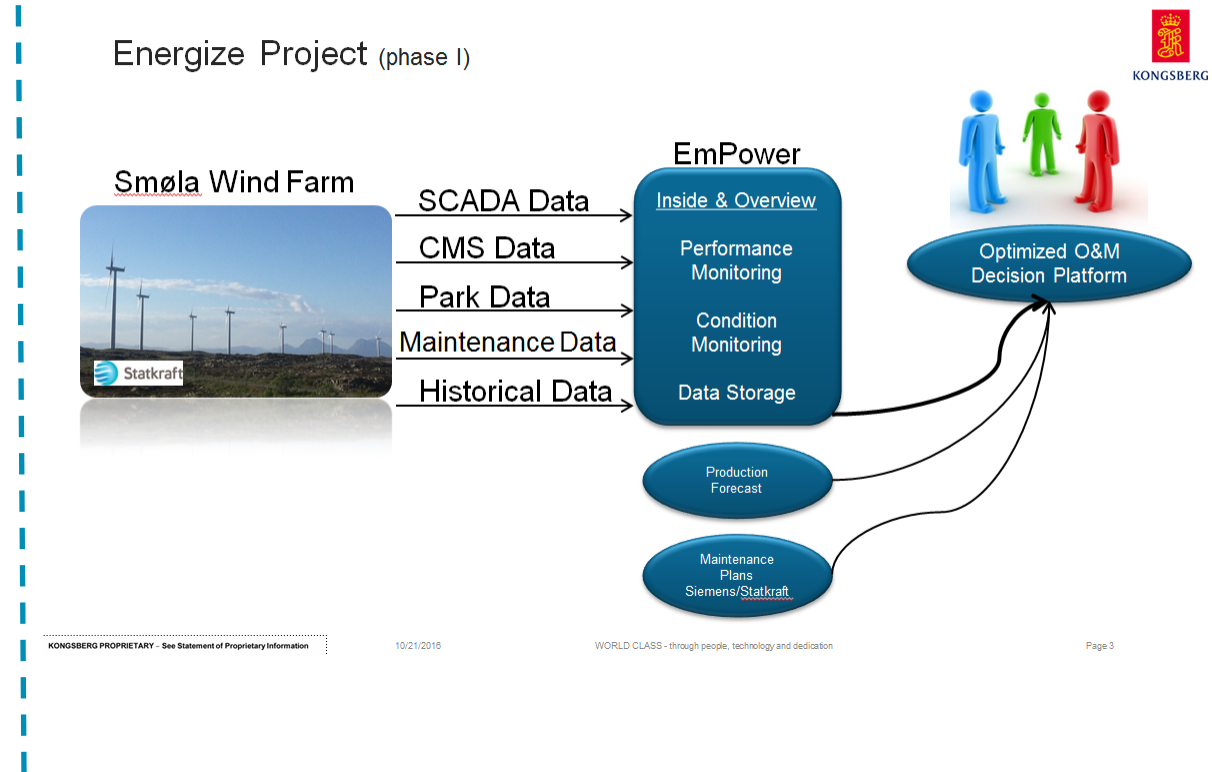
Wind Management System

- ▶ System for data collection, presentation, analysis and reporting
- ▶ One system for all wind farms, independent of turbine suppliers



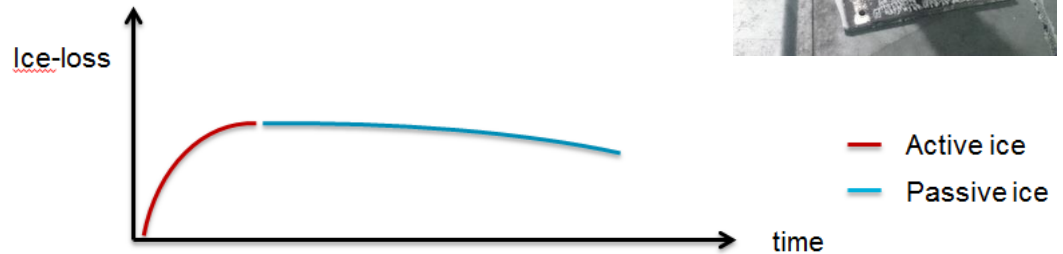
Improve operational performance

- ▶ Utilizing Turbine and Wind Farm Data to Increase Wind Farm Performance and Lower Maintenance Cost



Icing Optimization

- ▶ Reduce HSE risk
- ▶ De-icing/anti-icing
 - Operation regimes
 - Coatings
 - Ice detectors
 - Icing forecast



Blades

- ▶ Blade data collection
- ▶ Blade degradation
 - Production loss
 - Leading edge protection



Hours	Coating 2	Shell 1
3 hours	<p>Specimen: 004-4.2 Duration [h]: 3,0 h Erosion: Small spots of erosion</p> 	<p>Specimen: 012 Duration [h]: 3,0 h Erosion: Small spots of erosion</p> 
13 hours	<p>Specimen: 004-4.2 Duration [h]: 13,0 h End of test Erosion: Severe erosion</p> 	<p>Specimen: 012 Duration [h]: 13,0 h End of test Erosion: Spots of erosion</p> 

Environmental and social impact

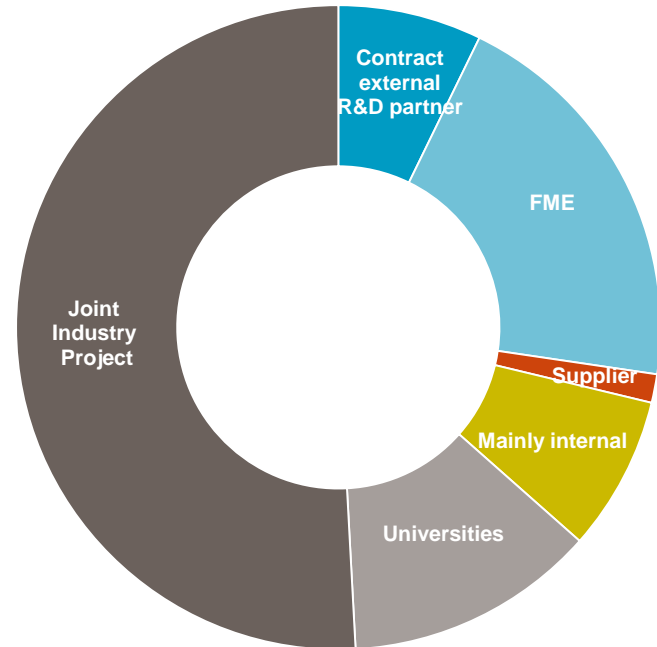
- ▶ Ornithology
 - INTACT – Innovative Tools to reduce Avian Collisions with wind turbines
- ▶ Domestic Reindeer
 - Mid-Norway and Northern Sweden



Samarbeid med norske aktører

- ▶ Tilstand- og levetid på komponenter
- ▶ Elektriske systemer
- ▶ Vindressurs
- ▶ Miljøpåvirkning
- ▶ Modellering/simulering/analyse
- ▶ Marine operasjoner og strukturer

Collaboration R&D Wind 2015



TECHNOLOGY DEVELOPMENT AND TRENDS

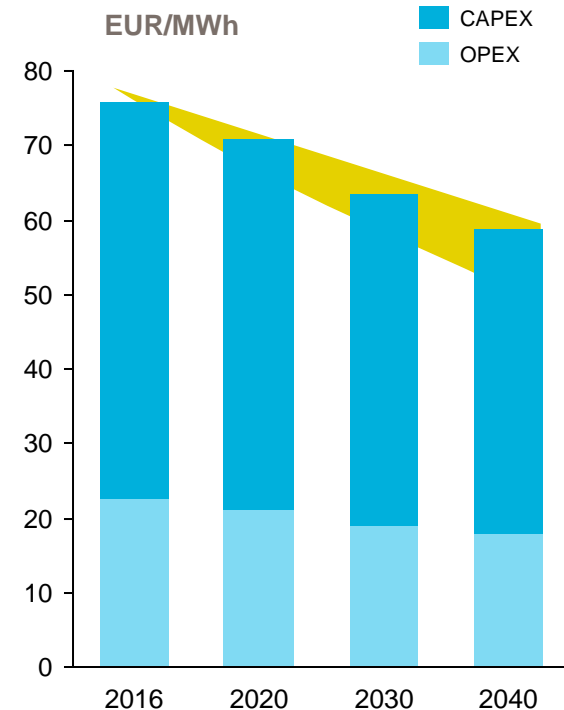


Onshore wind power is a mature technology - but there is still room for innovation

- ▶ Reduce cost of energy

$$LCOE = \frac{CAPEX + OPEX}{Energy\ Output}$$

- ▶ Improve Health and Safety systems
- ▶ Comply with regulatory requirements



Tech. development do not stop, even if country specificities create differentiations

► Larger turbines

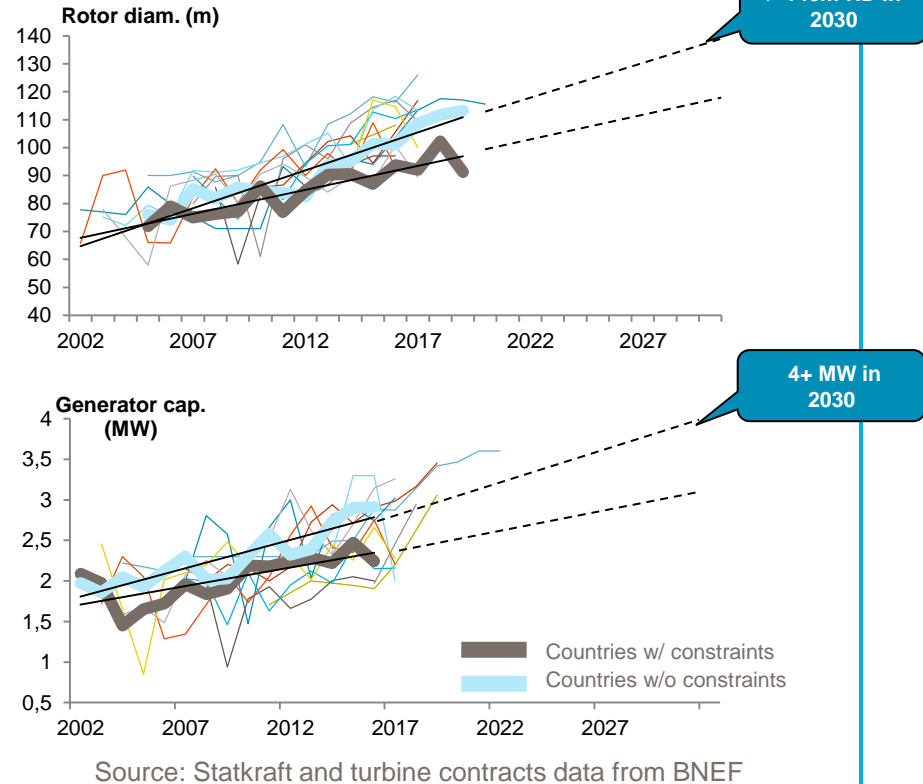
- Lighter materials and components
- New towers, hybrid concrete/steel
- Modular generator, segmented blade
- On-site tower production
- Logistics solutions
- Turbine tip extension

► Manufacturing

- Automation and standardization
- Local content, assembly and finish

► Life extension

- Extend turbine life past 20-25 years
- Remaining useful life assessments
- Recycling of wind turbines and components



More efficient Operation and Maintenance

- ▶ Condition monitoring and analysis
 - Condition based maintenance
 - Combine more data sources and statistics
- ▶ Production optimization
 - Individual WT adjustment
- ▶ Automation of inspection and maintenance
- ▶ Maintenance planning
 - Reduced reaction time
 - Maintenance at low wind/low price
- ▶ Improved quality and durability of components
 - Life extension of components
 - Less need for maintenance

	2016	2017	2020
Signals/turbine	50	150	300
Data resolution	10 minute min / max /average	10 minute 1 s for new wind farms	1 s
Data points/ day/turbine	~20 k		~25 M

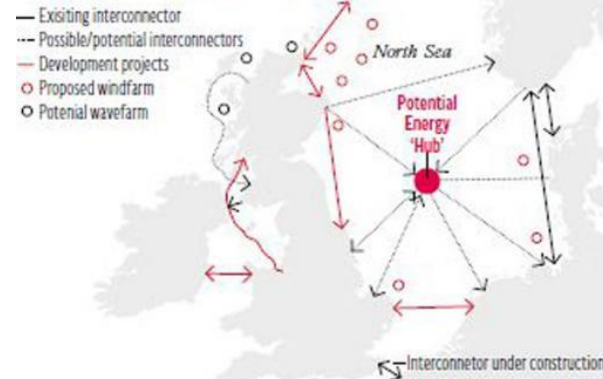


Increase value of production

- ▶ Storage of energy
 - Reserve capacity to take energy peaks (both top and bottom peaks)
- ▶ Production/energy price forecast utilising the storage capacity
- ▶ European interconnectors
 - Access to a larger and more stable energy market



NORTH SEA OFFSHORE GRID



SOURCE - SCOTTISH GO



THANK YOU

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