Introduction to Offshore Wind and Insurance

Lillehammer Energy Claims conference

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7 March 2018

Agenda

- A bit of history
- What does an offshore wind farm look like?
- Technology development
- Construction of a wind farm
- What goes wrong?

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Where it all began…

1991:
Vindeby, Denmark
11 turbines – total of 4,95MW

C:\Users\KRINL\Desktop\Vindeby_1991_DK_ref.mp4

2003:
Nysted Offshore Wind Park, Denmark
North Hoyle, Wales

2008:
UK takes off – first round

Today:

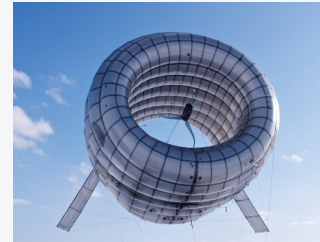https://www.youtube.com/watch?v=exPkb8qNY04

Territories:

- Denmark and UK forerunners

- Northern Europe

- Rest of Europe

- Asia
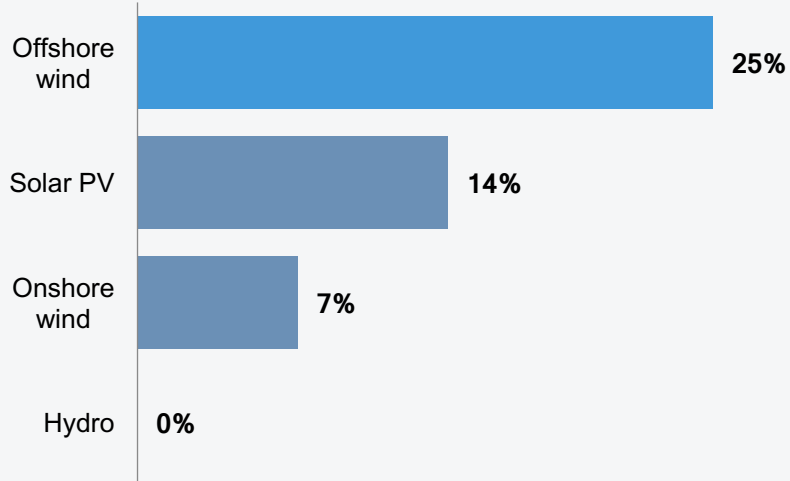
- US

Technologies

- Floating turbines

- Cluster offshore transformers

- Flying turbines

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Offshore wind is a large scale renewable technology with growth rates exceeding other renewables

Fastest growing renewable technology in OECD
Installed capacity CAGR, 2014-2020
%

Technology	CAGR
Offshore wind	25%
Solar PV	14%
Onshore wind	7%
Hydro	0%

Offshore wind offers multiple advantages

Utility size power generation
659 MW Walney Extension will power more than 460,000 UK homes

Offers +45% capacity factors
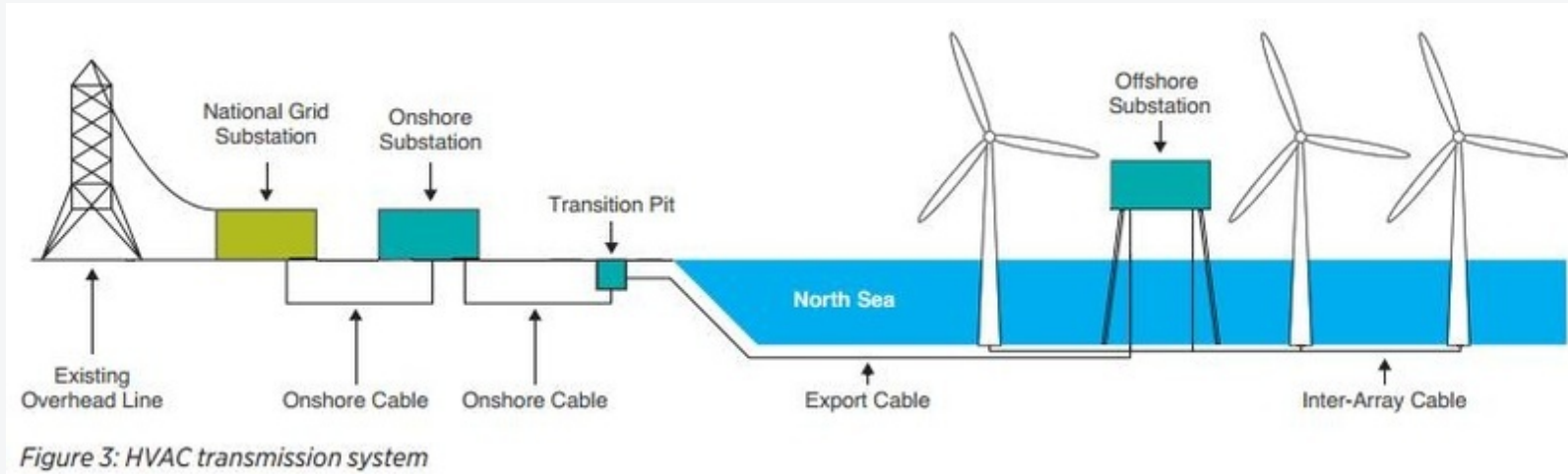*Significantly higher than onshore wind and solar PV*

Rapidly declining cost
Industry maturity, volume and technological development reduce LCoE[3]

Limited visual impact on landscape
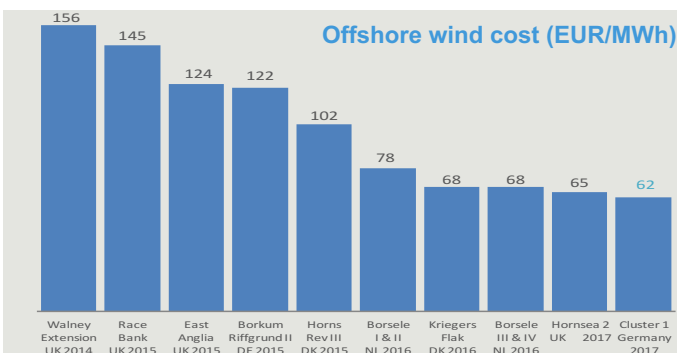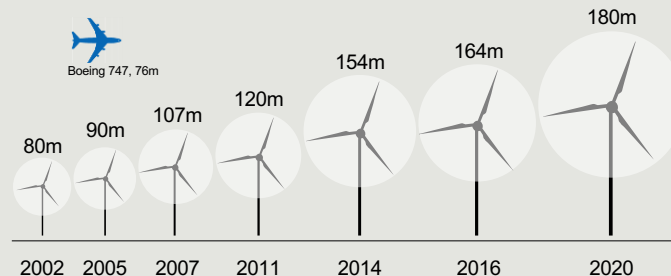*Wind farms are built far from shore*

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Offshore wind farm structure

Figure 3: HVAC transmission system

Technological development

Multiple levers to drive down cost in offshore wind

		Development	Impact
Scale	• Turbines and rotor size	6-8 MW → +10 MW	• Fewer positions
	• Sites	200-300 MW → +1 GW	• Greater overhead leverage • Scale effects
	• Vessel size	2-4 wind turbines → 8 wind turbines	• Less transit time • Higher utilisation
	• Cable capacity	300 MW → 400 MW	• Fewer substations • Fewer cables
Innovation	• Foundation design	Monopile → Suction bucket jackets → floating	• Greater water depth and heavier loads possible • Faster installation time
	• Gearbox	Gearbox vs direct drive	• Less maintenance
	• Electrical	AC → 2nd generation HVDC1 Battery	• Longer distance to shore • Less grid loss • Storage
Industrialisa-tion	• Supply base	Single supply → Multiple global suppliers and purpose built factories	• Broader and more robust supply base • Low-cost country sourcing • Efficient production

1. High-voltage direct current transmission

Rapid technological development
Wind turbine rotor diameter, year of commissioning

Boeing 747, 76m

80m — 2002
90m — 2005
107m — 2007
120m — 2011
154m — 2014
164m — 2016
180m — 2020

Offshore wind cost (EUR/MWh)

	Value
Walney Extension UK 2014	156
Race Bank UK 2015	145
East Anglia UK 2015	124
Borkum Riffgrund II DE 2015	122
Horns Rev III DK 2015	102
Borsele I & II NL 2016	78
Kriegers Flak DK 2016	68
Borsele III & IV NL 2016	68
Hornsea 2 UK 2017	65
Cluster 1 Germany 2017	62

Construction of a wind farm – special features

– Environmental/consent issues

– Changing conditions

– Many interfaces/risk transfers - many contractors

– Interfaces with external parties

– Fast technology development

– Assets are "off the shelf"

– Heavy lifts

– Many fix points

– Power cables…

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What goes wrong?

– Typical losses

  – Frequency

  – Cables and foundations

– Contractual issues

  – Contractors pushing risk onto developer

– Use of MWS

– Policy wordings

  – Interpretations vary

  – Old Marine and Welcar wording merged with Onshore wind wordings continuously being developed

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Questions

–   Which assets are most often damaged during offshore wind construction projects?

A. Foundations

B. Cables

C. Turbines

D. Blades

–   How many households did Vindeby provide electricity to?

A.   100

B.   2.200

C.   50.000

D.   460.000

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Questions?

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