



Denmark: Offshore Wind and Interconnectors

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Baltic
InteGrid

Integrated Baltic Offshore
Wind Electricity Grid Development



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pensiondanmark.com

Outline

- ❖ Status and future – offshore wind farms, offshore grids and interconnectors
- ❖ Legal framework and institutional set-up
- ❖ Preliminary remarks on an integrated Baltic Sea solution

Source: Danish Energy Agency, 2016

Danmarks havvindmølleparker



Offshore Wind Farms in Denmark

1. Vindeby (1991) 11 turbines, 4.95 MW
2. Tunø Knob (1995) 10 turbines, 5 MW
3. Middelgrunden (2000) 20 turbines, 40 MW
4. Horns Rev I (2002) 80 turbines, 160 MW
5. Rønland (2003) 8 turbines, 17.2 MW
6. Nysted (2003) 72 turbines, 165.6 MW
7. Samsø (2003) 10 turbines, 23 MW
8. Frederikshavn (2003) 3 turbines, 7.6 MW
9. Horns Rev II (2009) 91 turbines, 209.3 MW
10. Avedøre Holme (2009/10) 3 turbines, 10.8 MW
11. Sprogø (2009) 7 turbines, 21 MW
12. Rødsand II (2010) 90 turbines, 207 MW
13. Anholt (2013) 111 turbines, 399.6 MW

Planned Offshore Wind Farms



Planned Coastal Wind Farms



Source: Energinet.dk, 2016

Source: Energinet.dk, 2016

Source: Vattenfall, 2016



State of play:

- ❑ Radial connections

Planned future:

- ❑ Horns Rev III: Radial connection
- ❑ Kriegers Flak: An interconnected connection (a meshed solution)

Horns Rev III



Source: Energinet.dk, 2016

Kriegers Flak



Source: Energinet.dk, 2016

Source: Danish Wind Industry Association, 2015



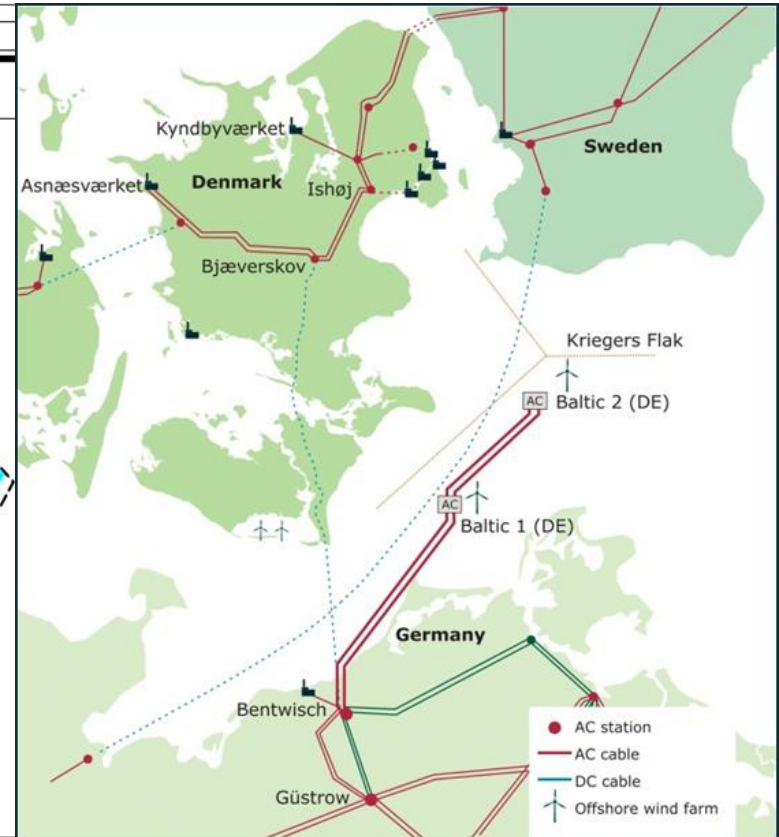
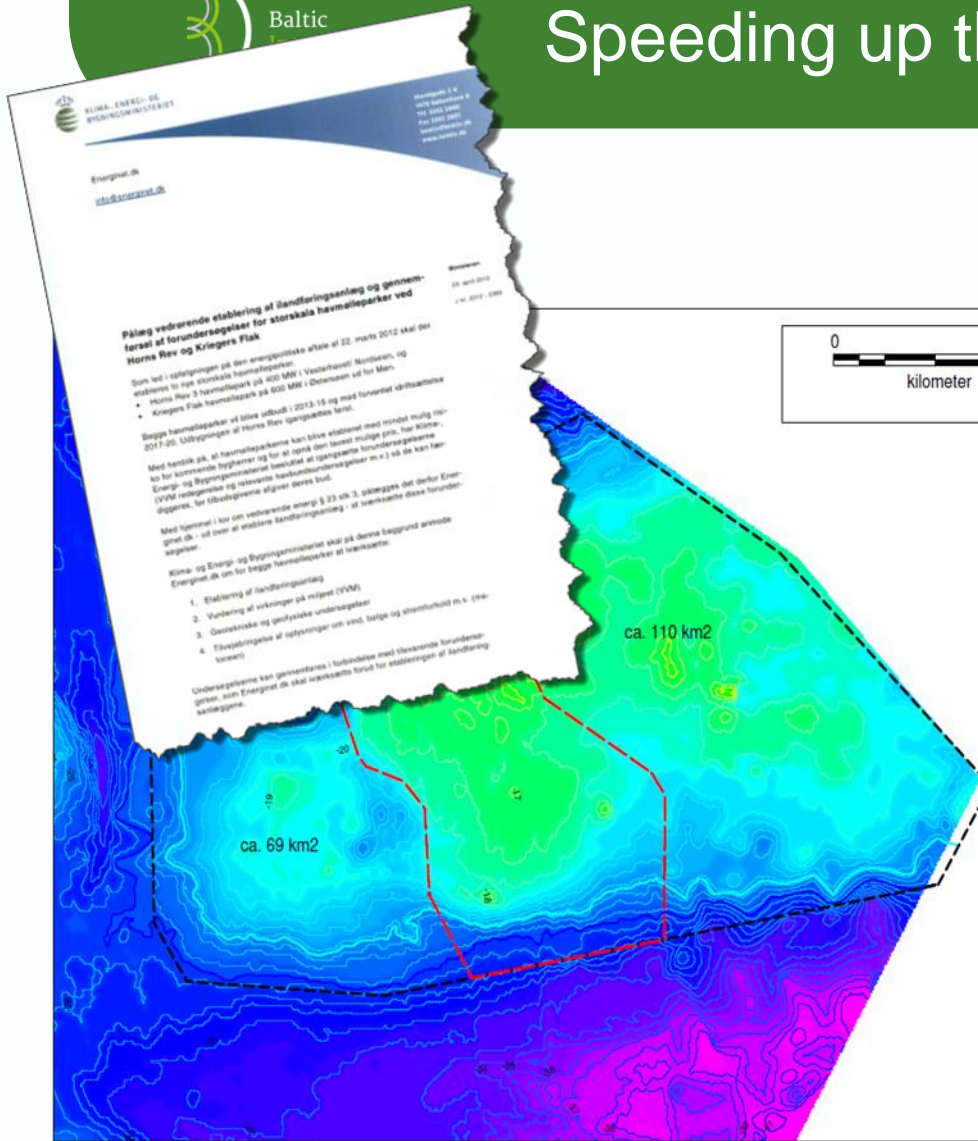


Infrastructure	Phases	Legal basis	Competent authority	Implementing authority
Offshore wind	Strategic planning, tender etc.	RE-Act	DK Energy Agency	
	Project planning, EIAs, permitting and licensing	RE-Act	DK Energy Agency	Energinet.dk (TSO)
Only coastal wind	Public Acceptance	RE-Act	Valuation Aut. Energinet.dk	Energinet.dk
Support schemes	Premium	RE-Act	Energinet.dk	Energinet.dk
Offshore grid	Step-by step approach, planning, EIAs etc.	RE-Act ESupply Act	DK Energy Agency (Nature Agency)	Energinet.dk
Interconnectors	Strategic and project planning, permits etc.	ESupply Act TSO Act Bilateral agree.	DK Energy Agency	Energinet.dk

Energy Board of Appeal
 Courts



Speeding up the process





Source: www.hvidesande.dk

Offshore Wind (tender)

The costs of connection

Coastal Wind (tender)

Super shallow approach

- | | | |
|-----|--|-----|
| No | The plant developer covers the costs of the connection to shore | Yes |
| Yes | The TSO covers all costs not related to the internal infrastructure | No |
| No | The plant developer is obliged to compensate land owners inflicted by the transmission net on land | Yes |
| No | The plant developer is obliged to offer a minimum of 20 percent ownership to local citizens | Yes |
| No | The plant developer is obliged to compensate neighbors for loss of value to their dwellings | Yes |

Shallow approach

Issues that may constitute barriers

- ❖ Political, economic and legal framework
- ❖ Grid regulation and infrastructure
- ❖ Market structure
- ❖ Administrative processes
- ❖ Public perception and local acceptance
- ❖