



Danish experience of offshore wind energy in relation to the interests of coastal municipalities and communities

Coastal and Maritime Spatial Planning in Pärnu Bay Area and Coastal Municipalities of Latvia

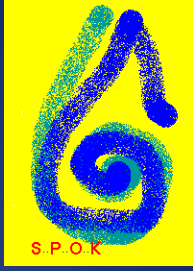
by

Hans Chr. Soerensen, PhD

Board member Danish Turbine Owners Association
CEO SPOK ApS

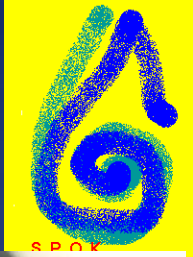


Disposition



- Background Hans Chr. Sørensen
- Danish wind - energy regulative rules
 - Danish wind - who's responsible where
- Danish offshore wind - examples
- Danish offshore wind - some results
- References
- Danish wind energy – background information

Background H C Sørensen



Business and university background

- PhD, 40 years with business development

Project management large projects

- Ocean wave energy (Wave Dragon), Tidal current (Tideng)
- Offshore wind (Middelgrunden 40 MW, Samsø 23 MW, Hvidovre 7.2 MW)

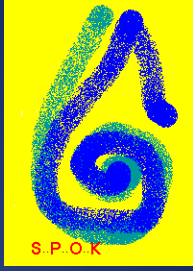
Committees

- Danish Wind Turbine Owners Association, board
- European Ocean Energy Association, vice president to 2011

Lynetten wind farm 7 @ 600 kW in 1996

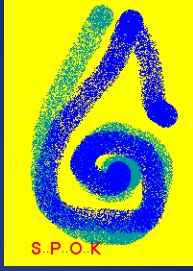


Disposition



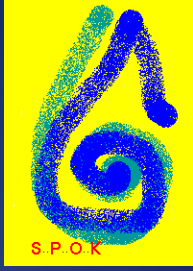
- Background Hans Chr. Sørensen
- Danish wind energy - regulative rules
 - Danish wind - who's responsible where
- Danish offshore wind - examples
- Danish offshore wind - some results
- References
- Danish wind energy – background information

Regulative rules



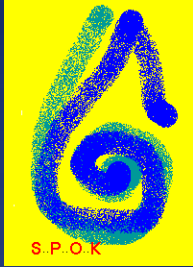
- Onshore wind
- Offshore wind - Action plan projects
- Offshore wind - Near shore projects
- Offshore wind - Open door principle
- Offshore wind – Test zones
- Offshore wind – Land fall

Regulative rules

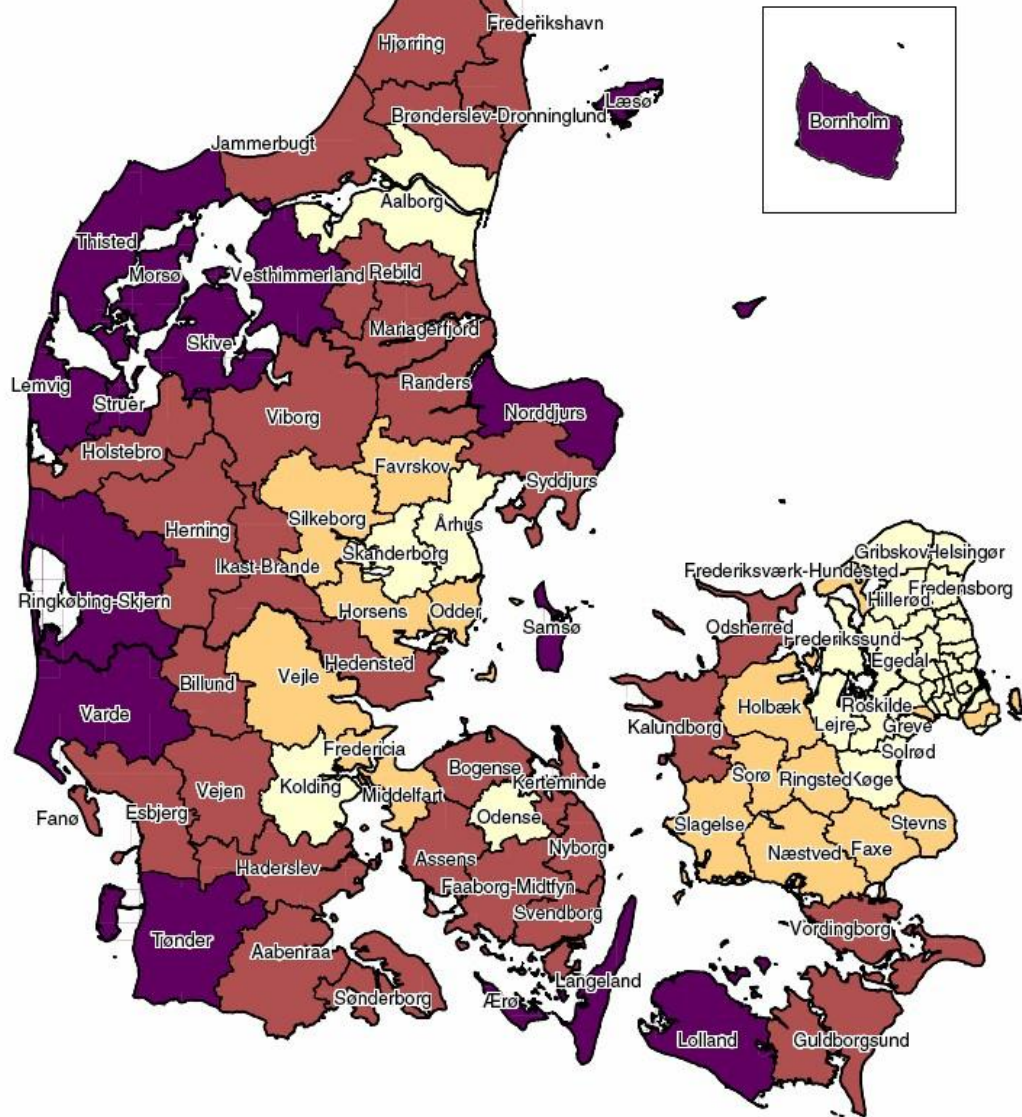


- Onshore wind:
 - *The Municipality has the planning authority*

- Conflicts:
 - *Government decide energy targets;*
Municipalities (98) decide where or not



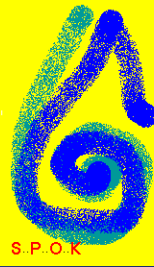
Denmark 98 Municipalities



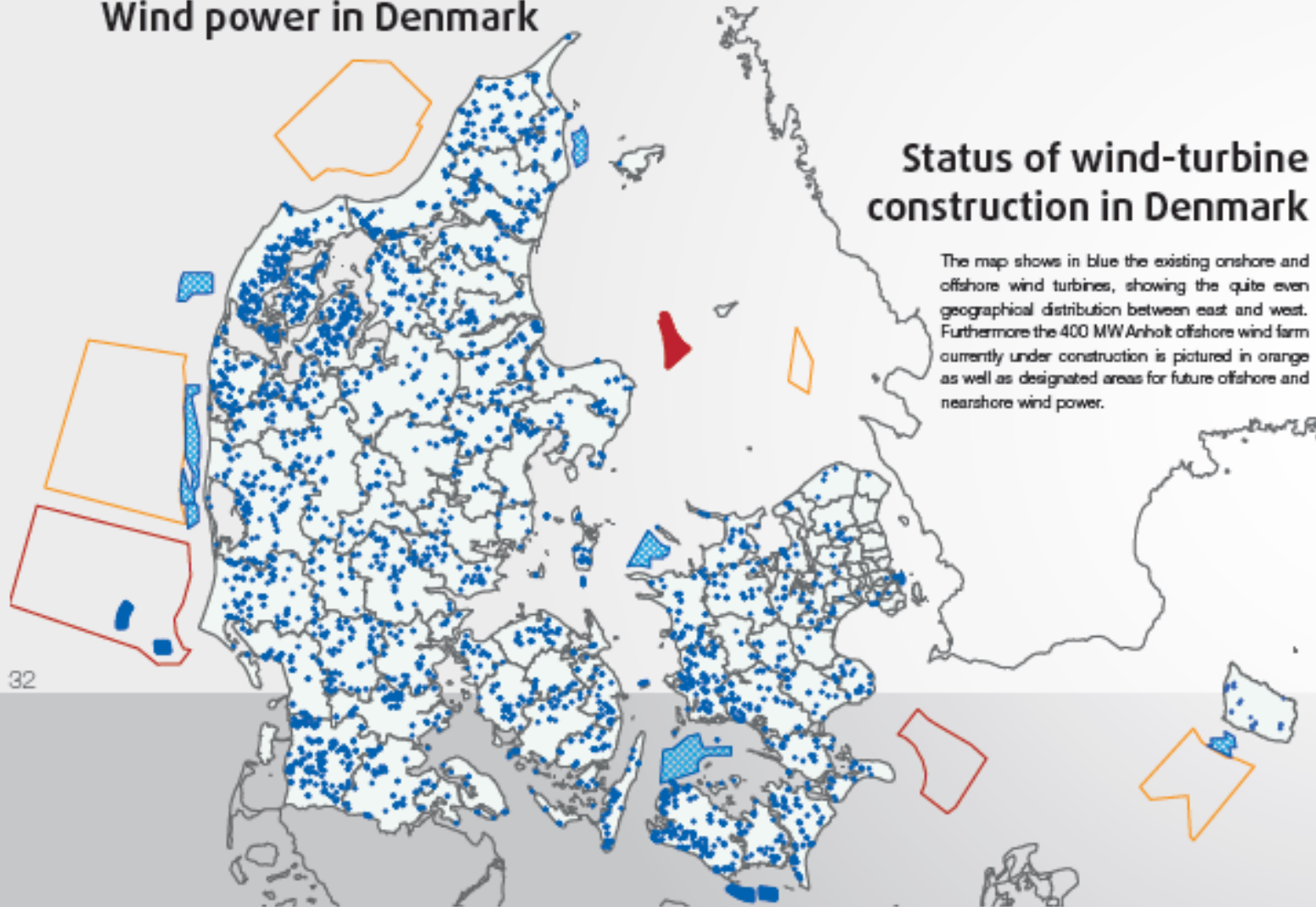
Classification of municipalities (Number of municipalities)	
1. Remote municipalities	(16)
2. Rural municipalities	(30)
3. Intermediate municipalities	(17)
4. Urban municipalities	(35)

The Danish Rural Development Programme 2007 – 2013, Ministry of Food, Agriculture and Fisheries

Where are the turbines?



Wind power in Denmark

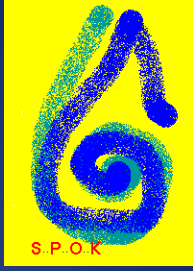


Status of wind-turbine construction in Denmark

The map shows in blue the existing onshore and offshore wind turbines, showing the quite even geographical distribution between east and west. Furthermore the 400 MW Anholt offshore wind farm currently under construction is pictured in orange as well as designated areas for future offshore and nearshore wind power.

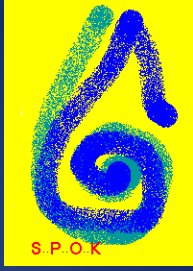
32

Regulative rules



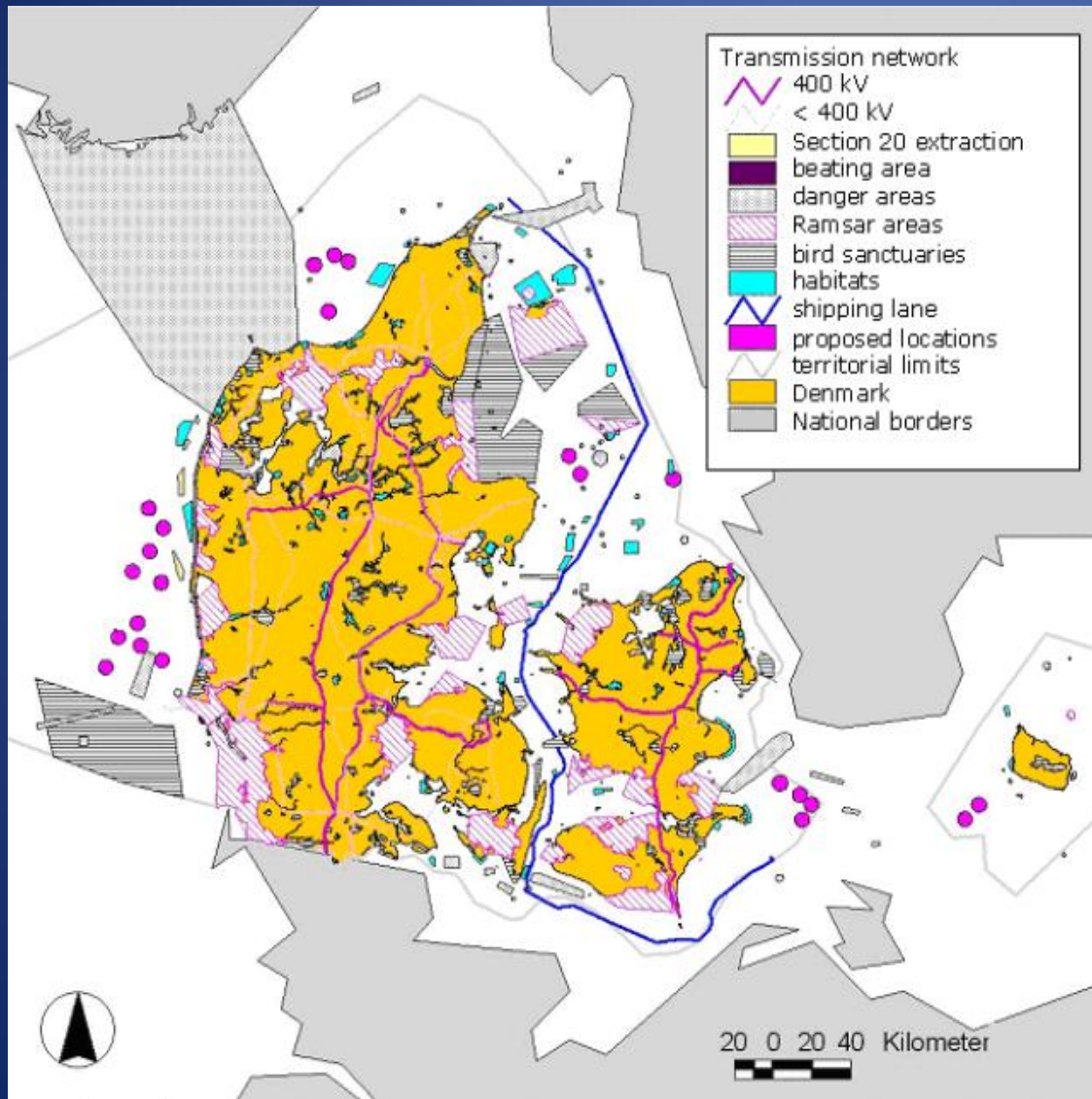
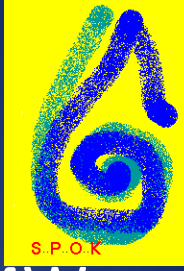
- Onshore wind
- Offshore wind - Action plan projects
- Offshore wind - Near shore projects
- Offshore wind - Open door principle
- Offshore wind – Test zones
- Offshore wind – Land fall

Regulative rules

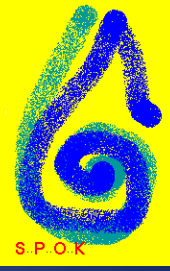


- Offshore wind - Action plan projects:
 - *The Danish Energy Authority has the planning authority*
 - *The “One stop procedure”, all objections to DEA*
- Conflicts:
 - *Only with the users of the sea, minimum 20 km’s from the coast where no visual impact*

Offshore action plan



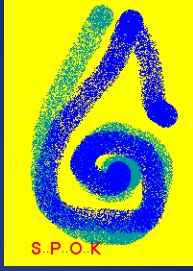
- Minimum 400MW
- Typically >20 km from shore
- Subjected to tender based on lowest price for first 50,000 full load hours
- There after market price
- No coop involvement



The Horns Rev offshore farm

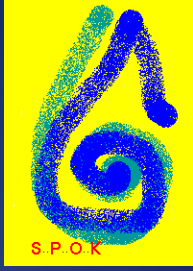


Regulative rules



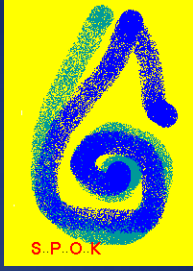
- Onshore wind
- Offshore wind - Action plan projects
- Offshore wind - Near shore projects
- Offshore wind - Open door principle
- Offshore wind – Test zones
- Offshore wind – Land fall

Regulative rules

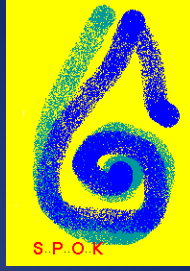


- Offshore wind – Near shore projects:
 - *The Danish Energy Authority has the planning authority*
 - *An Express of Interest has been used*
 - *The “One stop procedure”, all objections to DEA*
- Conflicts:
 - *Visual impact, local interest/objections may not be taken into account*

The process of near shore projects

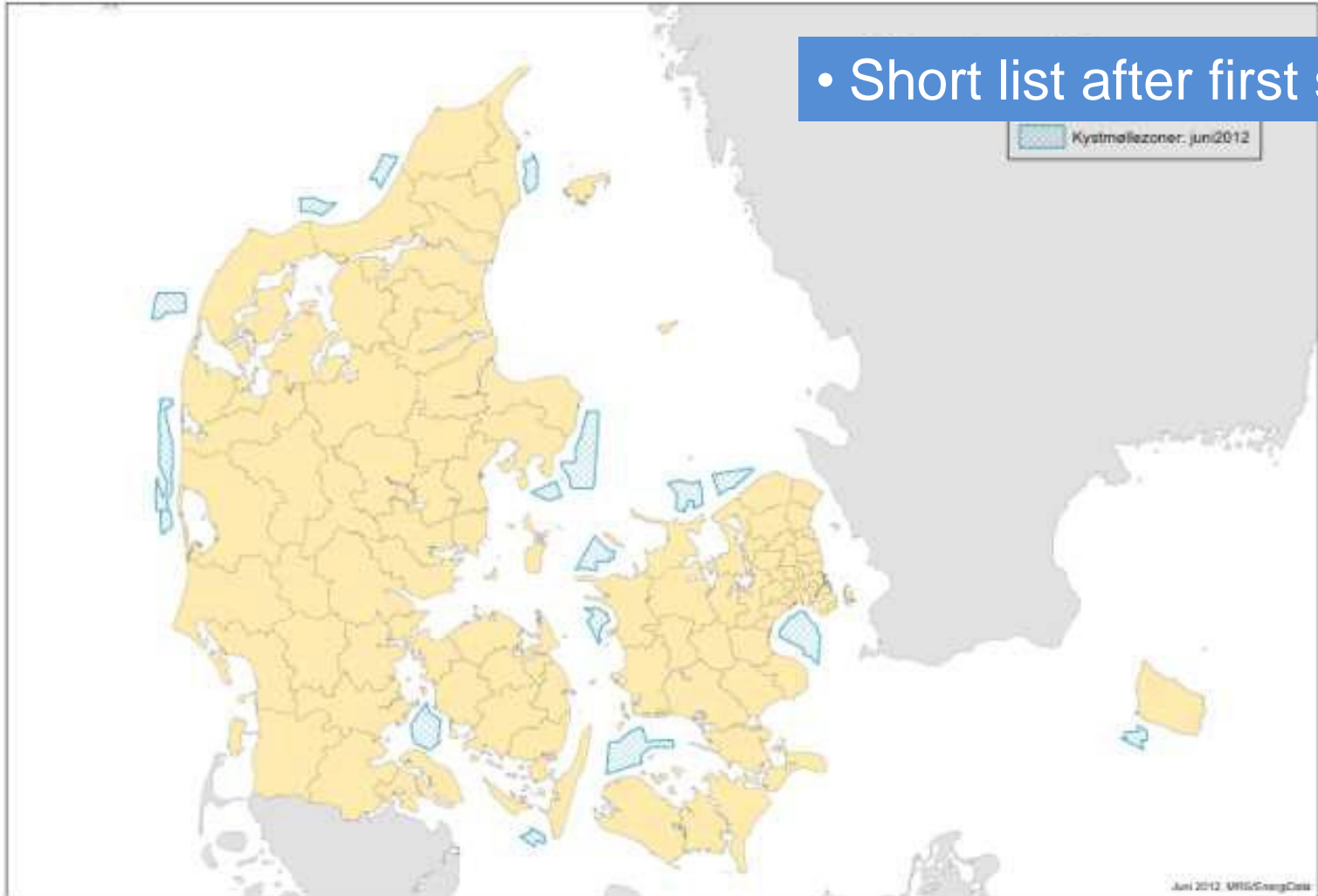


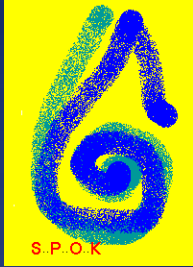
- An Express of Interest has been used
 - *The target was 450 MW later reduced to 350 MW*
 - *The Eol proposed more than 3,000 MW*
 - *All projects where local municipalities and Ministry of Environment had objections were excluded, like*
 - ✓ *Minimum 4 km's to shore or nature reserve*
 - ✓ *No projects where the Municipality was negative*



Near shore wind - Screening

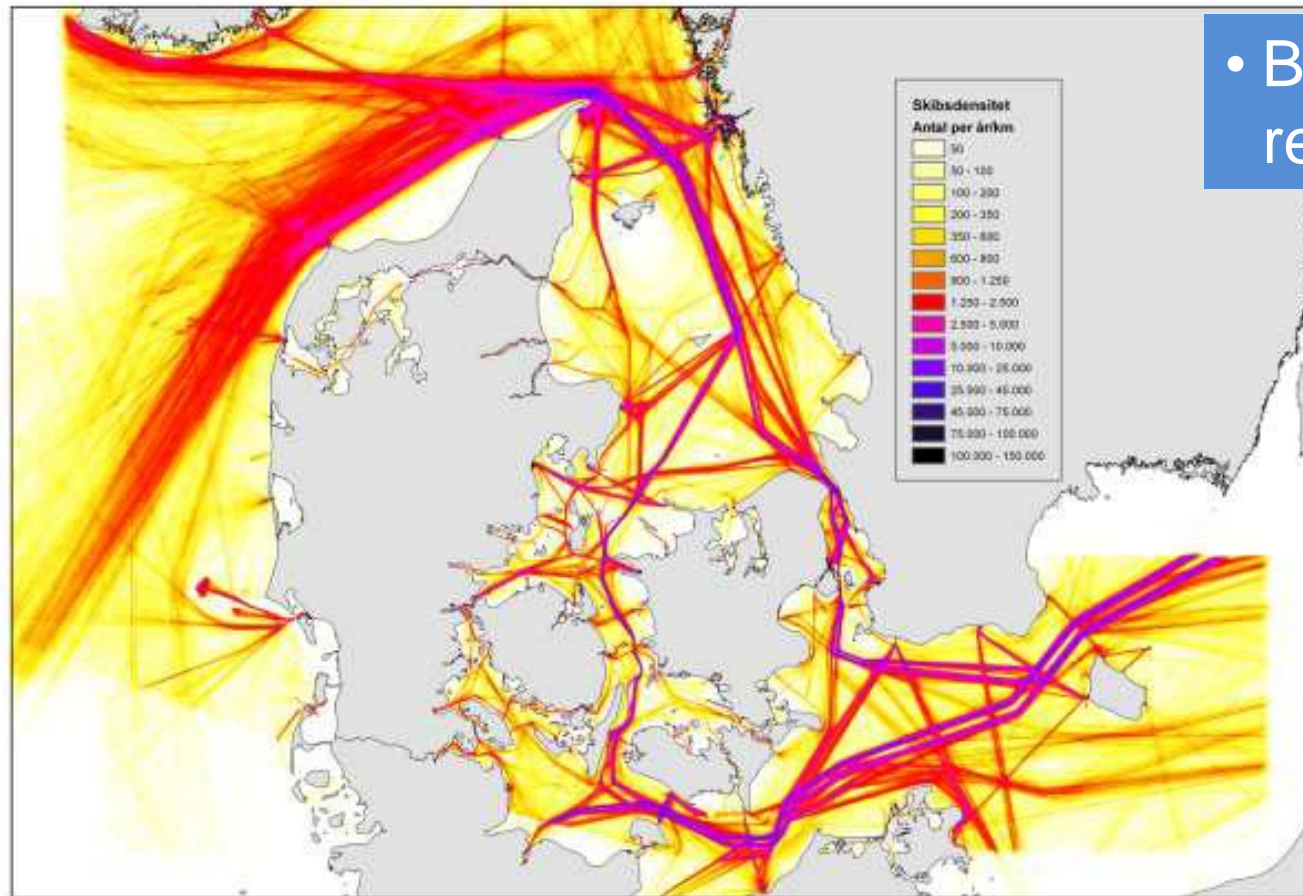
- Short list after first screening

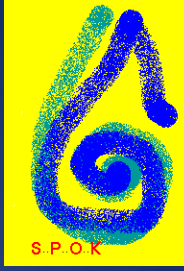




Near shore wind - Excluded

- By ship traffic reasons

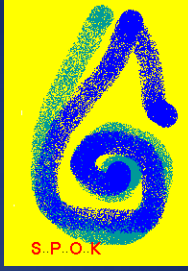




Near shore wind
– Excluded
around
Copenhagen
even though
proposed by the
Copenhagen
Municipality

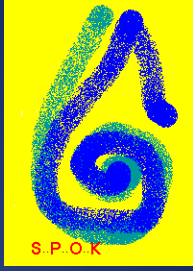
- By too near Natura 2000 reasons
- By one local Municipality reason

Near shore wind 2013-2022



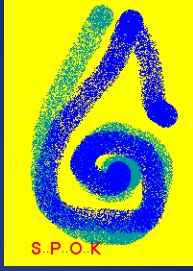
- Near Shore 350 MW reduced from 450
- Test 50 MW

Regulative rules



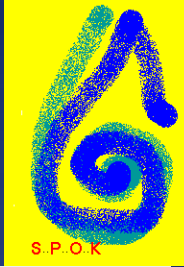
- Onshore wind
- Offshore wind - Action plan projects
- Offshore wind - Near shore projects
- Offshore wind - Open door principle
- Offshore wind – Test zones
- Offshore wind – Land fall

Regulative rules



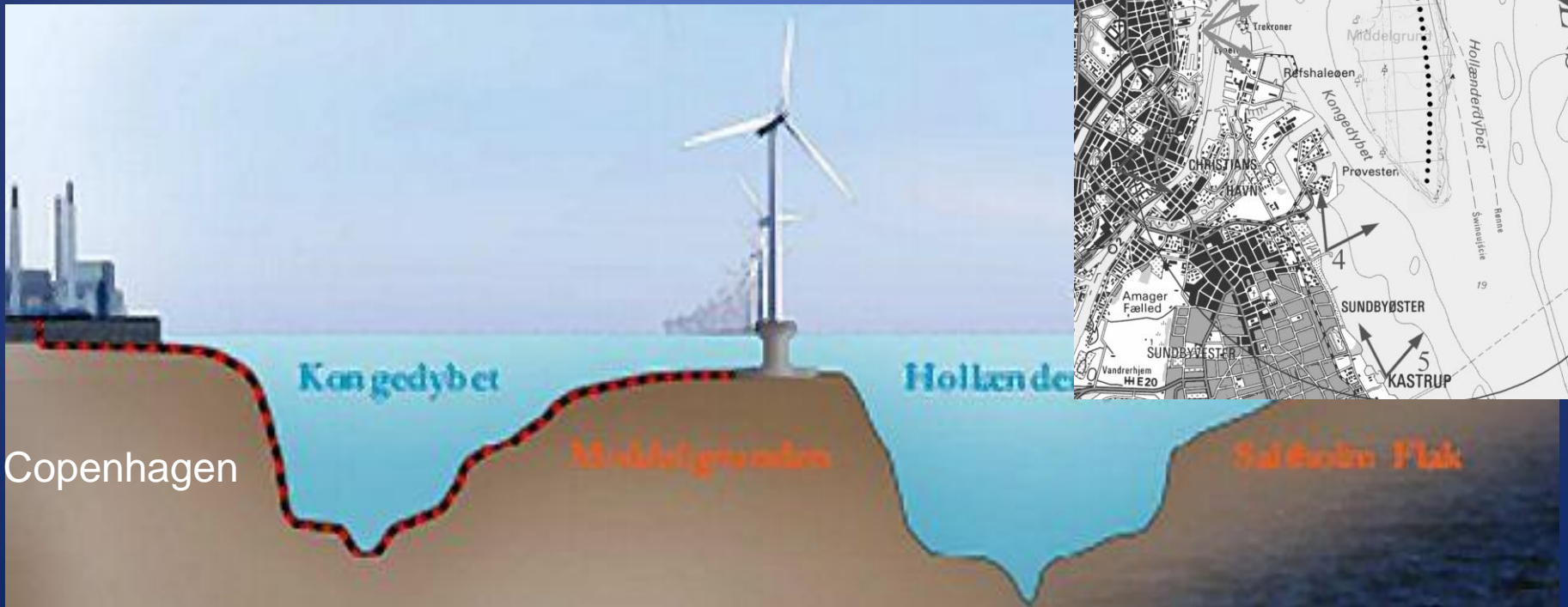
- Offshore wind –Open door principle projects:
 - *Every body can apply; only onshore incentives are granted and subsea cables have to be provided by the developer*
 - *The “One stop procedure”, all objections to DEA*
- Conflicts:
 - *Visual impact, local interest/objections may not be taken into account*

Middelgrunden 40 MW

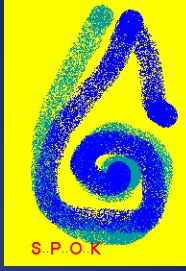


Example: *Open door principle*:

The farm is constructed on a reef called Middelgrunden with a water depth of 1-6 m deep



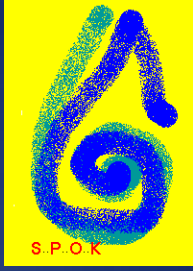
Middelgrunden 40 MW Wind Farm in 2000



The Copenhagen Municipality has no more to say than all other parties.

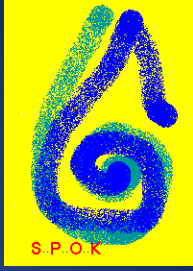
The final decision by Danish Energy Authority

Kalundborg example



Example: *Open door principle conflict*: The farm is planned 4 km's from shore in an area excluded by the local municipality





Kalundborg example

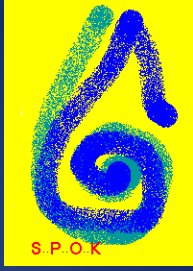


near shore

New open door

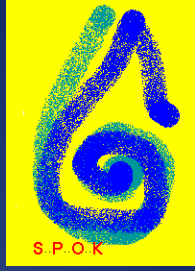
Example: *Open door principle conflict*: The farm is planned 4 km's from shore in an area excluded by the local municipality caused by nature interest and many summer houses

Regulative rules



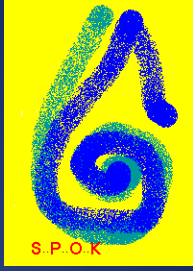
- Onshore wind
- Offshore wind - Action plan projects
- Offshore wind - Near shore projects
- Offshore wind - Open door principle
- Offshore wind – Test zones
- Offshore wind – Land fall

Regulative rules



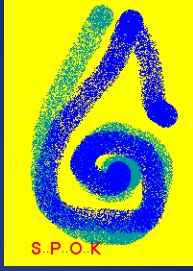
- Offshore wind – Test zones
 - *Is following same rules as near shore projects*

Regulative rules

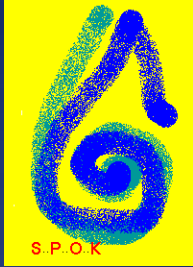


- Onshore wind
- Offshore wind - Action plan projects
- Offshore wind - Near shore projects
- Offshore wind - Open door principle
- Offshore wind – Test zones
- Offshore wind – Land fall

Regulative rules



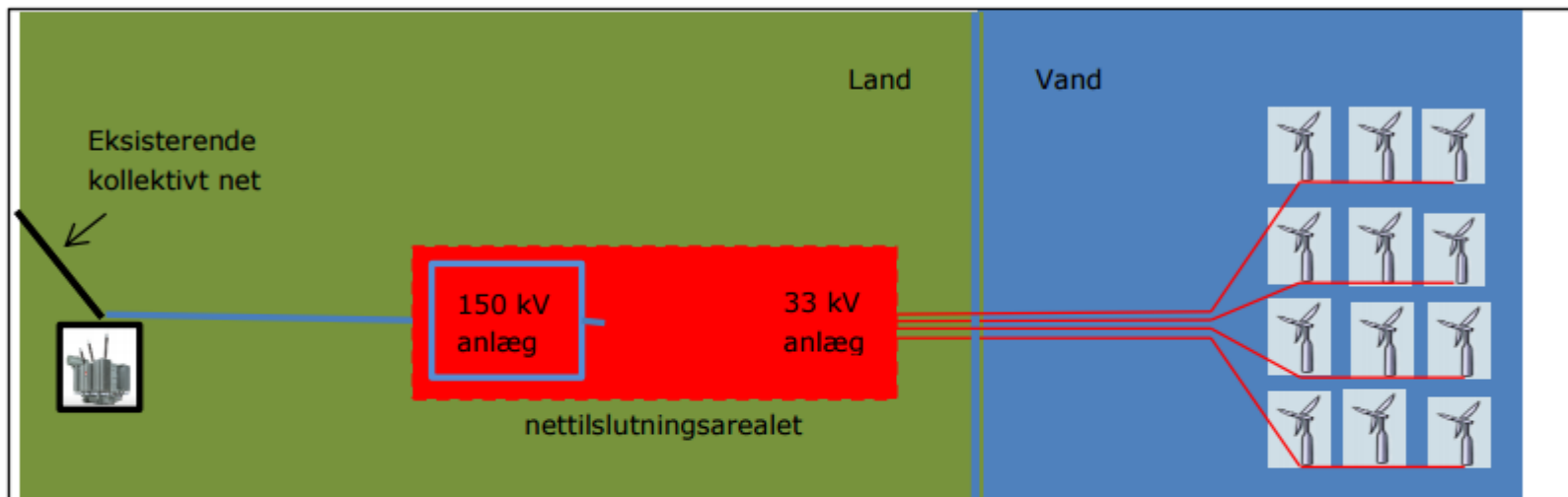
- Offshore wind – Land fall
 - *All land activities are regulated by the Municipality*
- Conflicts:
 - *Municipality has to agree with Danish Energy Authority*





S.P.O.K.

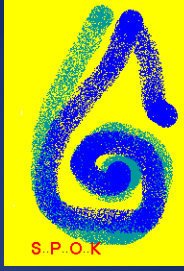
Example of potential conflict

Grid connection point onshore from offshore wind farm; 33 kV from the sea and 150 kV existing onshore grid



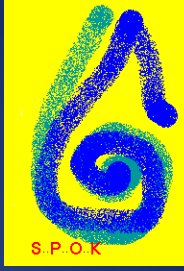
- Forlængelse af det kollektive net, etablering og nettab dækkes af netvirksomheden
-  Fremskudt transformerstation, etableret som en del af det kollektive net
-  Tilslutningspunkt samt målerpunkt. Effekten er samlet i ét elektrisk punkt på land, og der er etableret plads til netvirksomhedens nødvendige installationer, herunder evt. transformere
- Opsamlingsnet, etablering, vedligehold og nettab dækkes af koncessionshaver

Grid: Two options



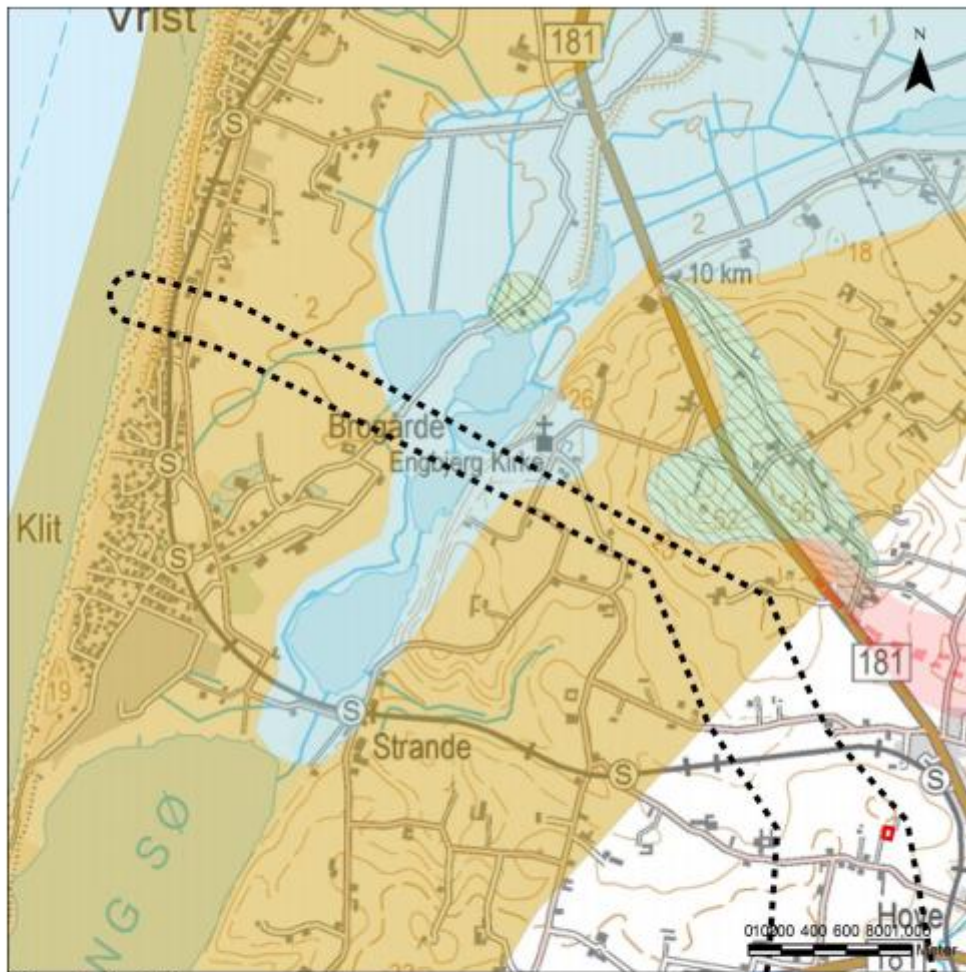
Replacement
old overhead
line proposed
(from EIA report)





One of many GIS layers in EIA report

Here about culture environment

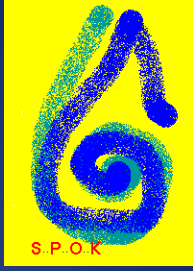


Signaturforklaring

- Eksisterende stationer
- Undersøgelsesområde
- Fremtidige Hovedlandevej
- Arealreservation til Hovedlandevej
- Kulturhistoriske bevaringsværdier
- Værdifuldt kulturmiljø
- Specifik geologisk bevaringsværdi

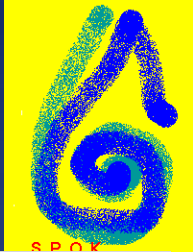


Disposition



- Background Hans Chr. Sørensen
- Danish wind energy - regulative rules
 - Danish wind - who's responsible where
- Danish offshore wind - examples
- Danish offshore wind - some results
- References
- Danish wind energy – background information

Hvidovre 2009/2011



Hvidovre / Avedøre
3 @ 3.6MW



Planning process Hvidovre

20 meter offshore (moved out into the sea in order to be ready by December 2009

- *Now formal role of Municipality*
- *The project group (Utility and NGO group) decided to give Veto to the Municipality in order to have good public acceptance*

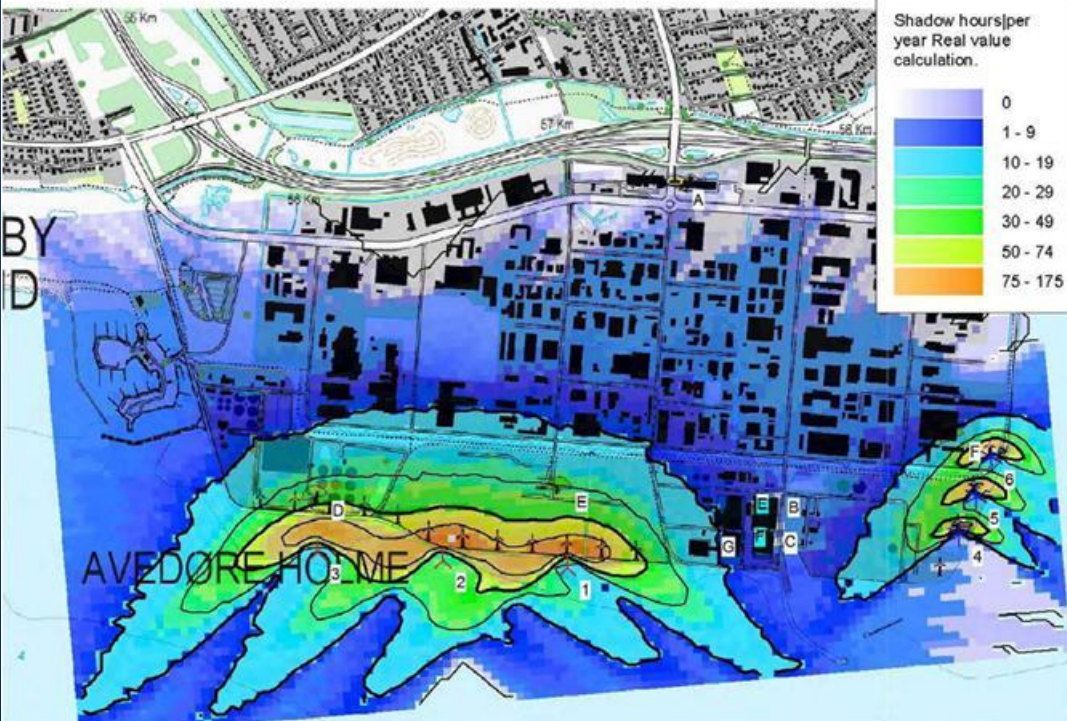
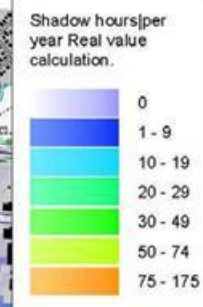
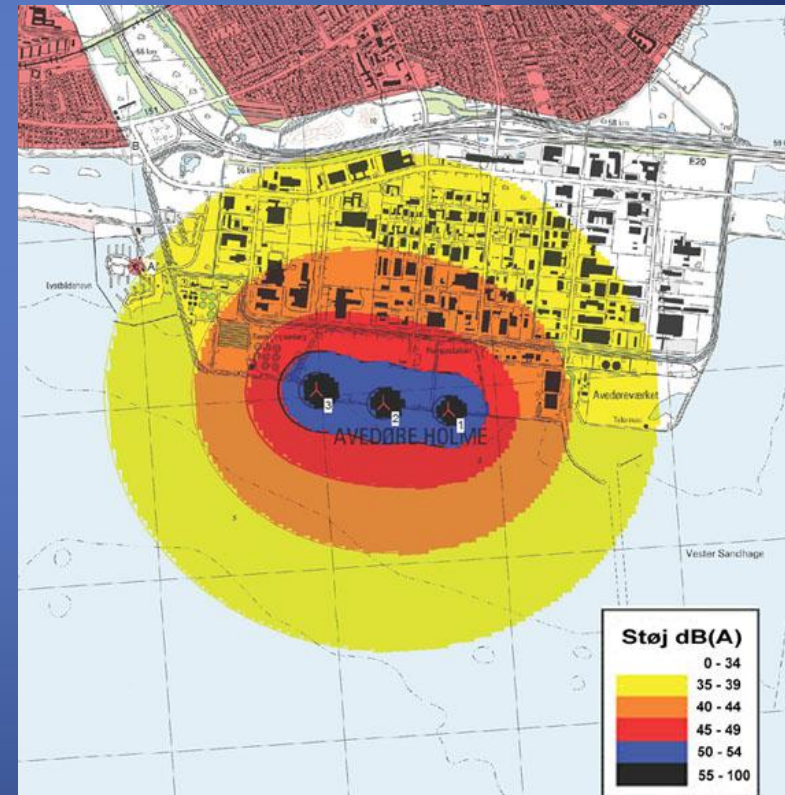


Planning process Hvidovre

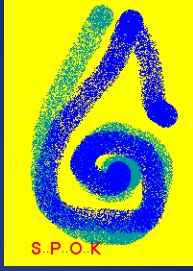


Public acceptance

- Visual impact
- Noise
- Shadow

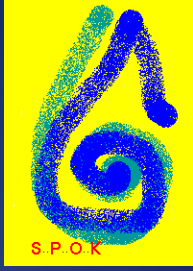


Disposition



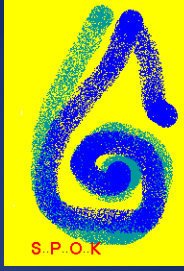
- Background Hans Chr. Sørensen
- Danish wind energy -regulative rules
 - Danish wind - who's responsible where
- Danish offshore wind - examples
- Danish offshore wind - some results
- References
- Danish wind energy – background information

Results environment

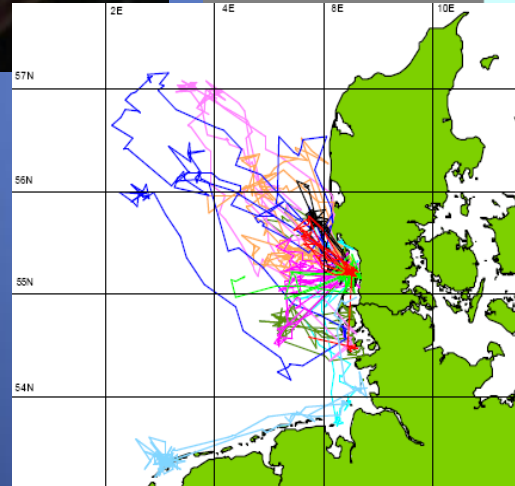
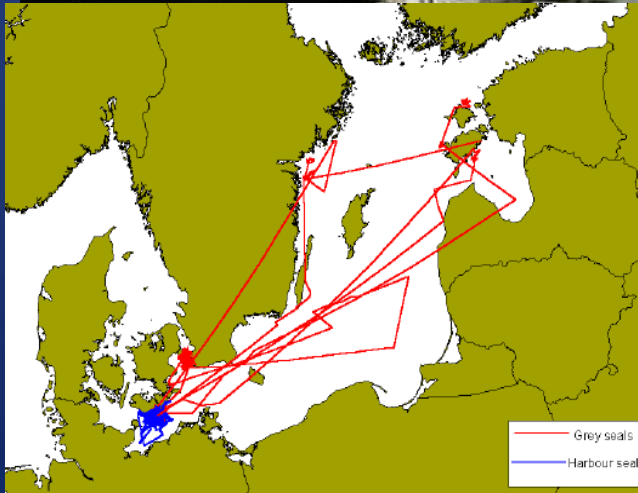
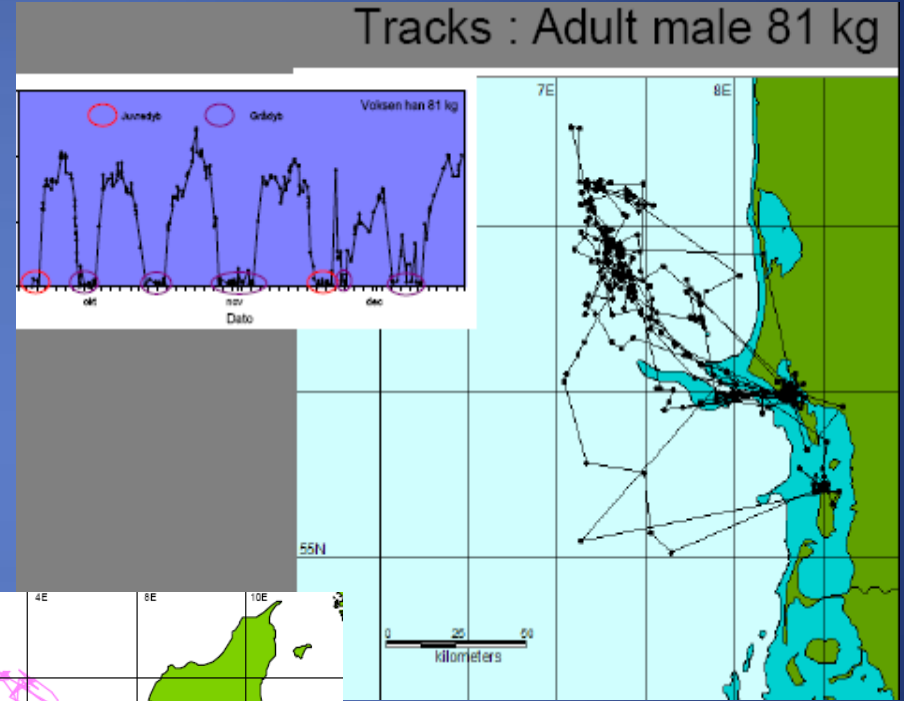


Can be downloaded from www.ens.dk
together with the follow up report

Results environment marine mammals, seals

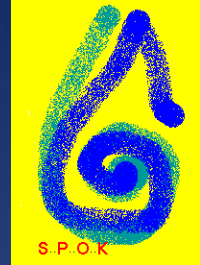


Argos transmitter

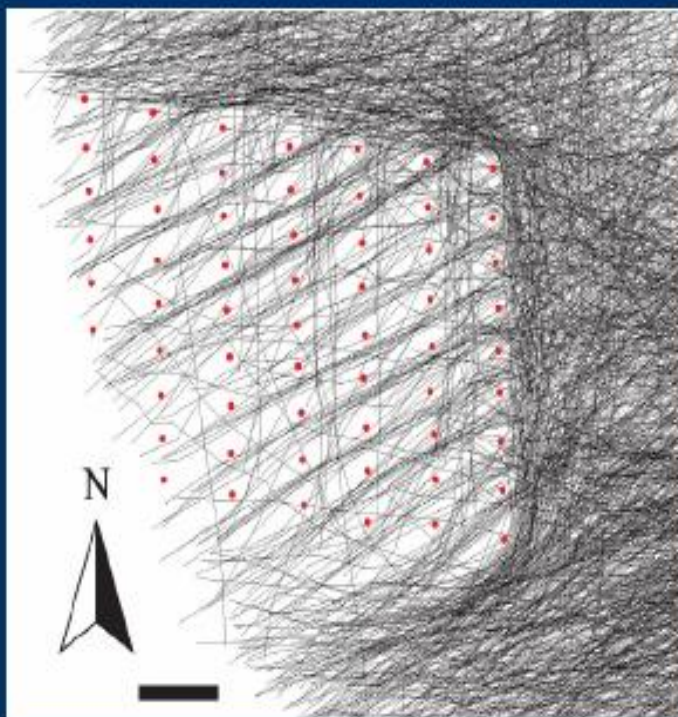


Results environment birds

Flight behaviour inside the wind farms

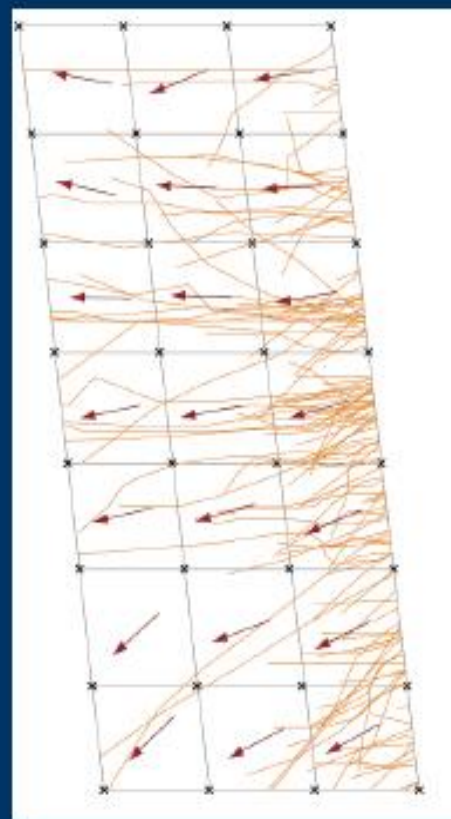


Nysted

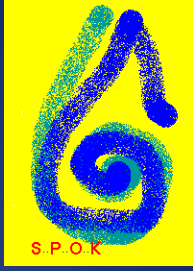


(Desholm & Kahlert (2005), *Biology Letters* 1: 296-298)

Horns Rev

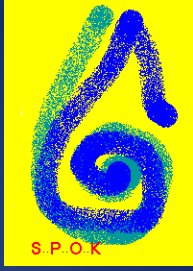


Disposition



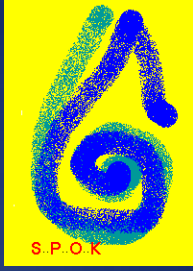
- Background Hans Chr. Sørensen
- Danish wind - energy regulative rules
 - Danish wind - who's responsible where
- Danish offshore wind - examples
- Danish offshore wind - some results
- References
- Danish wind energy – background information

References

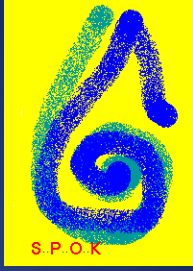


- Kystnære havmøller i Danmark - Screening af havmølleplaceringer indenfor 20 km fra kysten, Juni 2012, Draft for public consultation; www.ens.dk
- Betingelser for udbud af etablering af 350 MW havvindkapacitet i kystnære områder Foreløbige udbudsbetingelser offentliggjort 4. maj 2015. Version 1.0 Endelige udbudsbetingelser forventes offentliggjort i januar 2016 efter forhandlinger med de prækvalificerede bydere
- EIA: grid: VESTERHAV NORD HAVMØLLEPARK ATR 19 Arealinteresser - Onshore og offshore arealbindinger. April 2015
- www.ens.dk/undergrund-forsyning/vedvarende-energi/vindkraft-vindmoller/havvindmoller/kystnaere-havmolleparke-12
- www.energinet.dk/DA/EI/Vindmoeller/For-kommuner/Sider/default.aspx
- Soerensen, Hans Chr. et al. (2002): Experience with and strategies for public involvement in offshore wind projects, Int. Journal of Environment and Sustainable Development, V.1, No.4, 2002, pp 327-336
- Law no. 1392 of 27. December 2008 about promotion of RE (om fremme af vedvarende energi), last change law no. 622 of 11. June 2010 (VE-loven)
- Danish Energy Authority (2007): Future Offshore Wind Power Sites – 2025, (“Action plan for offshore wind”), UK Summary 11 pp
- Soerensen, Hans Chr. et. al. (2009): Experiences from Middelgrunden 40 MW Offshore Wind Farm, Copenhagen Offshore Wind, 8pp.
- Soerensen, Hans Chr. (2009): Hvidovre Offshore Wind Farm, EWEA Offshore wind conference, Sweden, 8 pp
- www.dkvind.dk
- www.middelgrund.com; www.lynettenvind.dk; www.hvidovrevindmollelaug; www.middelgrunden.dk

Disposition



- Background Hans Chr. Sørensen
- Danish wind energy - regulative rules
 - Danish wind - who's responsible where
- Danish offshore wind - examples
- Danish offshore wind - some results
- References
- Danish wind energy – background information

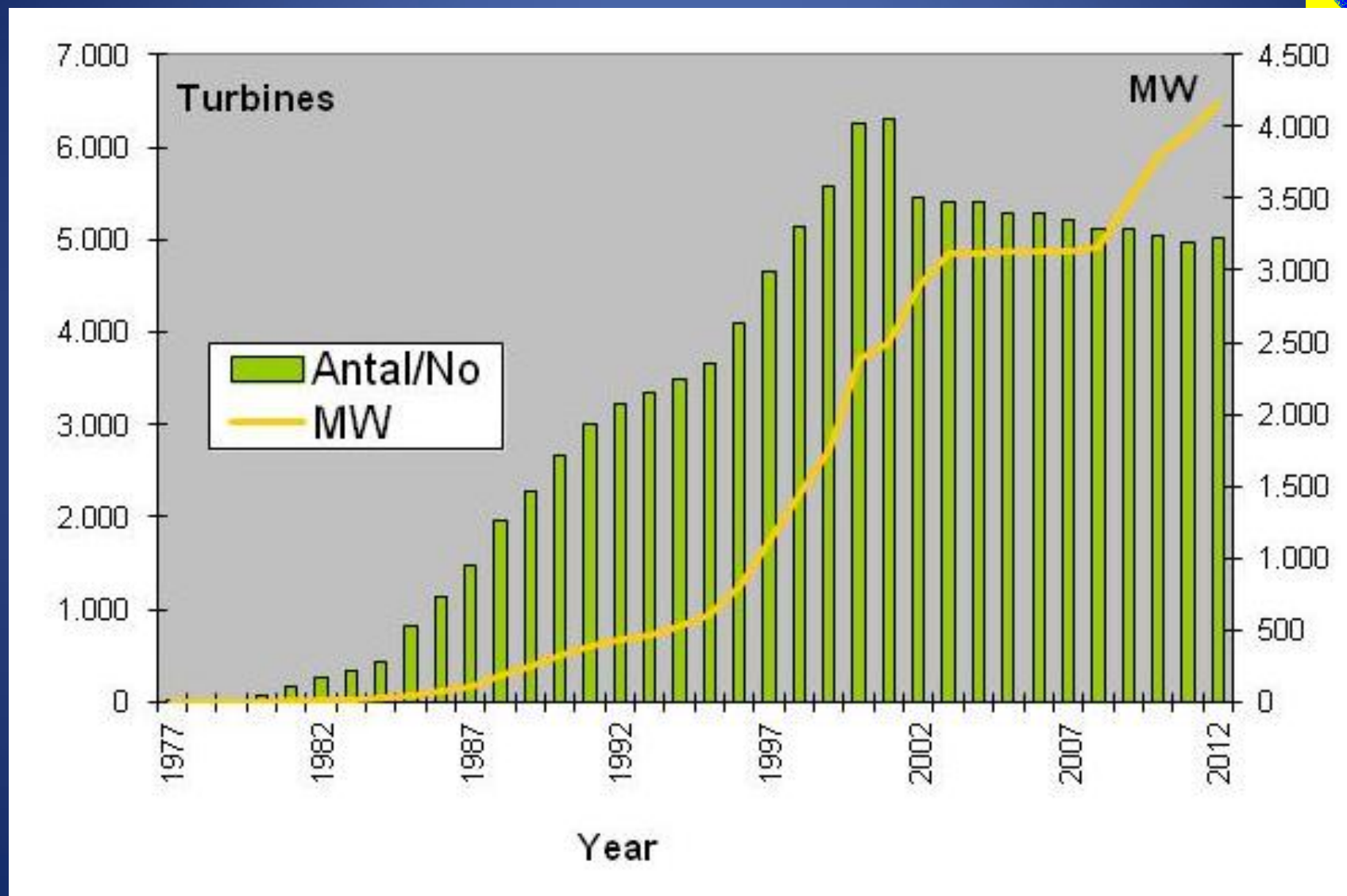
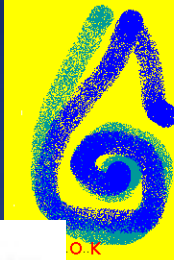


The general conditions for wind farms

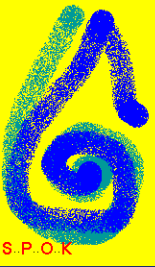
- 50% of electricity consumption by 2020 – today 39%
- Power produced to be bought by Transmission System Operator (TSO) - standard PPA
- Price - premium tariff on top of market price¹:
 - First (22,000 hours x rated power): +33.6€/MWh
 - Wind producer to pay cost for balancing, but compensation paid with 3.1 €/MWh
- Offshore farms within Action Plan: tender procedure

¹ market price mean value 2009: 50€/MWh - 2011: 43€/MWh – 2012: 32€/MWh
2014: 29€/MWh - but varies and can even be negative

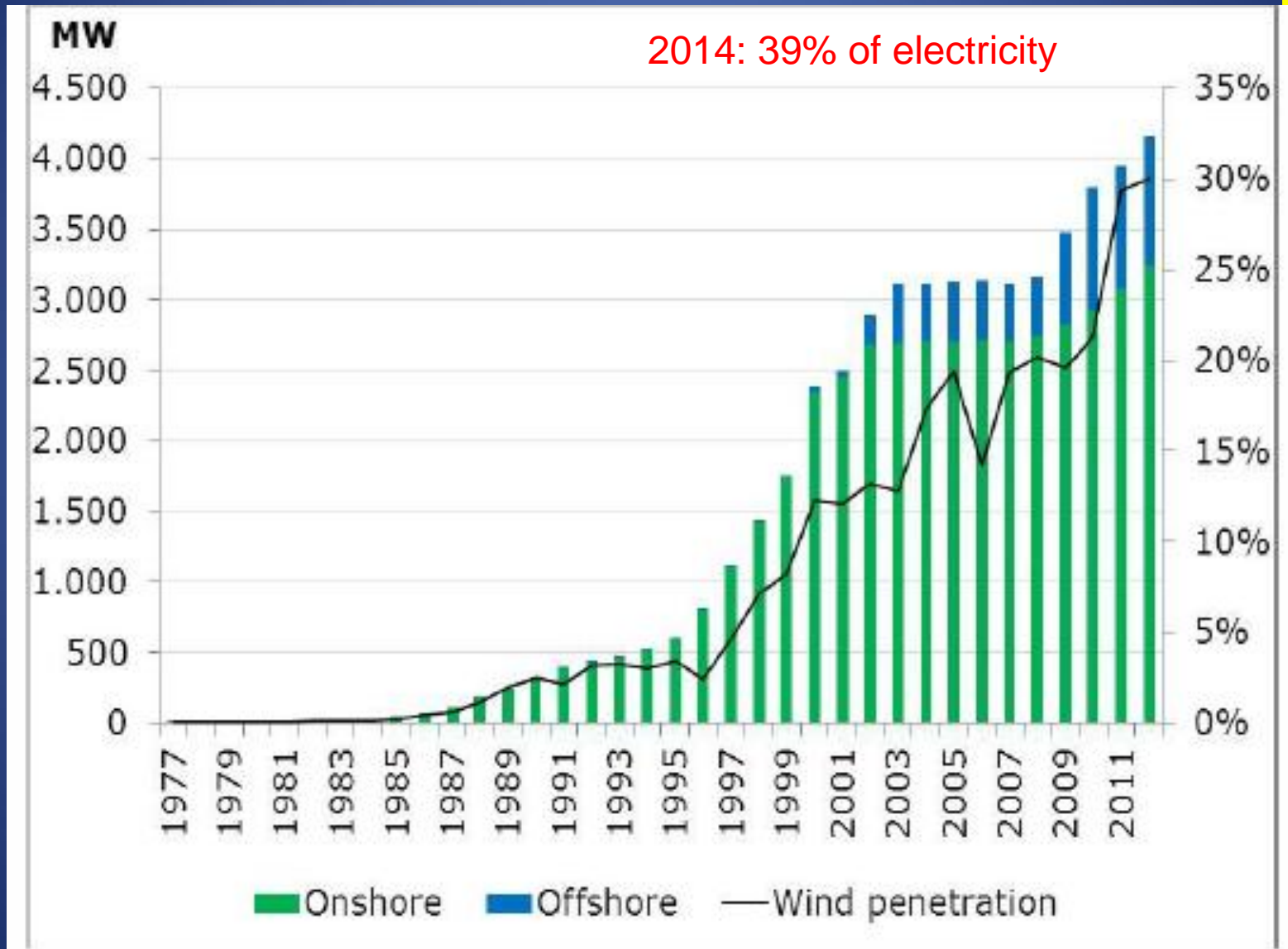
Growth in wind energy Denmark



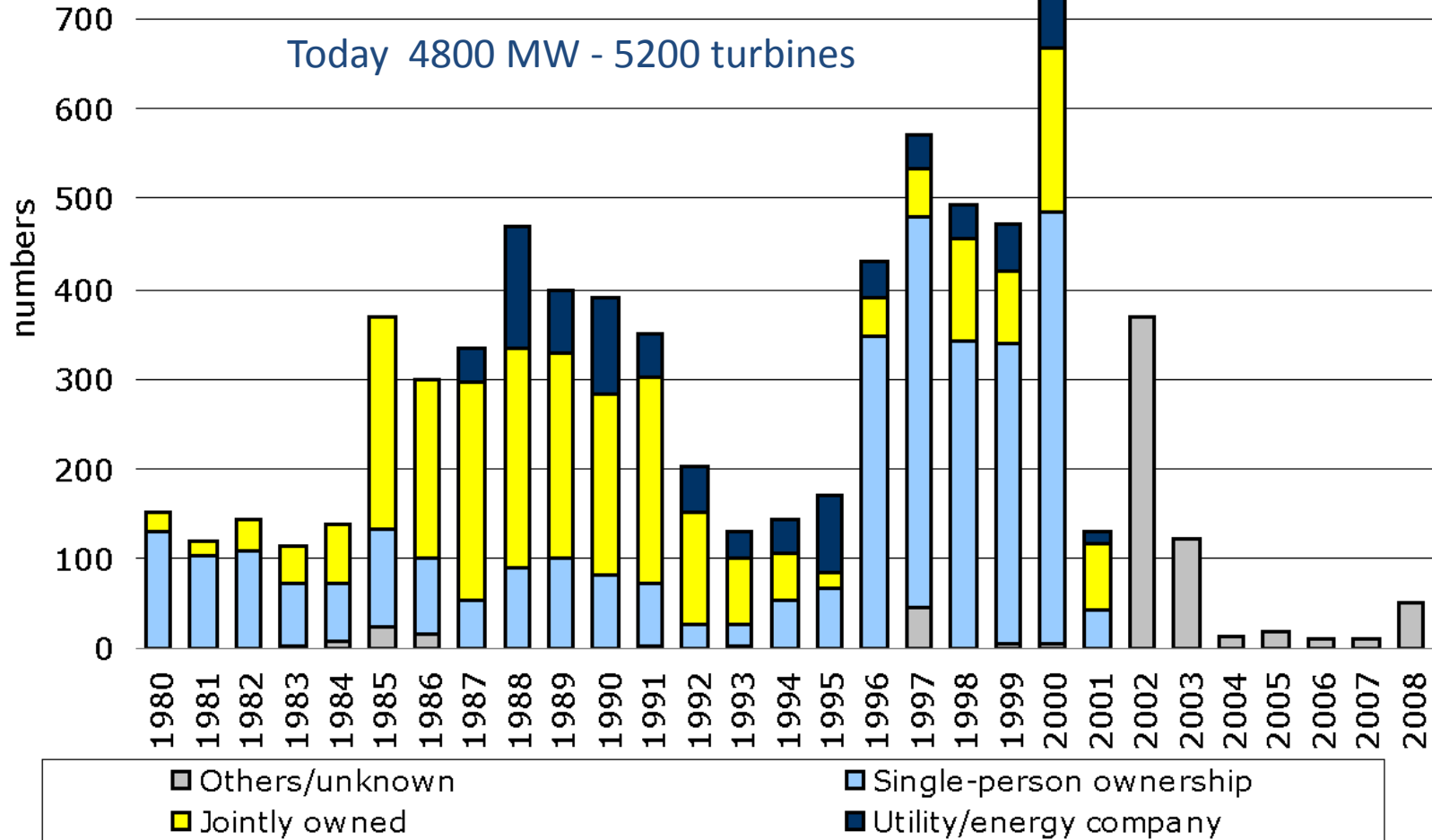
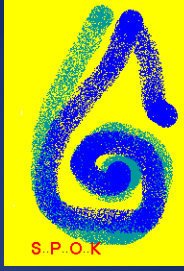
Offshore - onshore



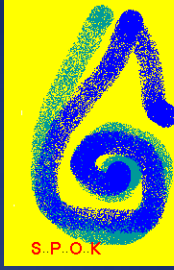
S.P.O.K.



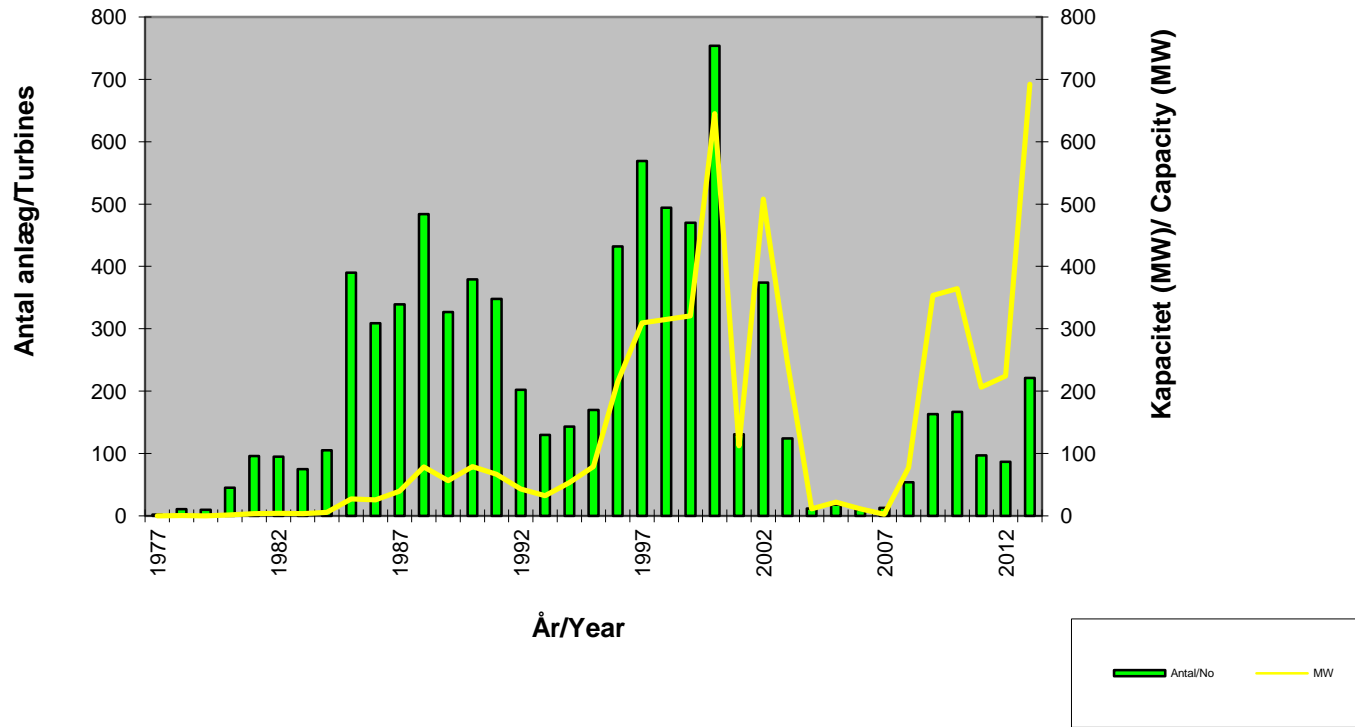
The development up to 2008



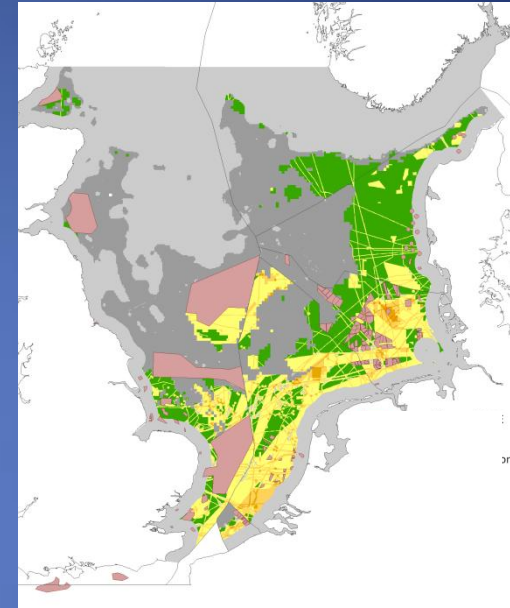
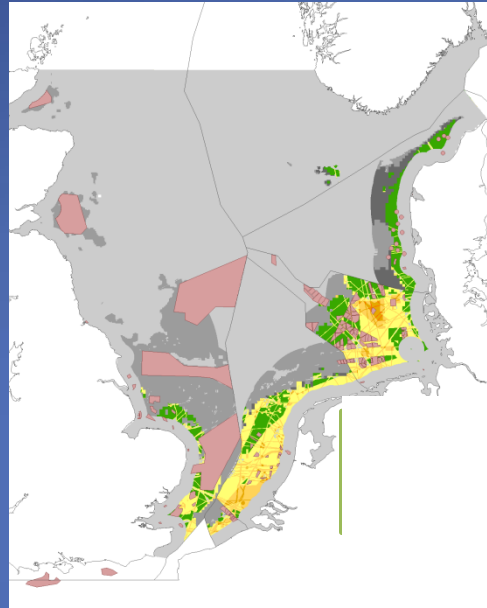
The development from 2008



Årlig tilvækst i anlæg og kapacitet/
Annual growth in number of turbines and capacity Danmark/Denmark

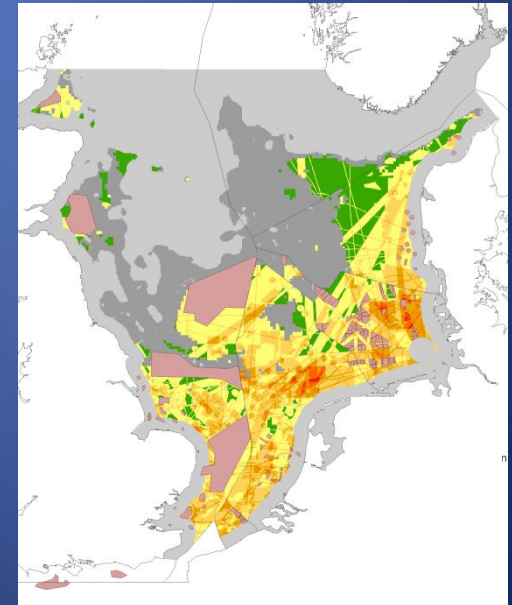
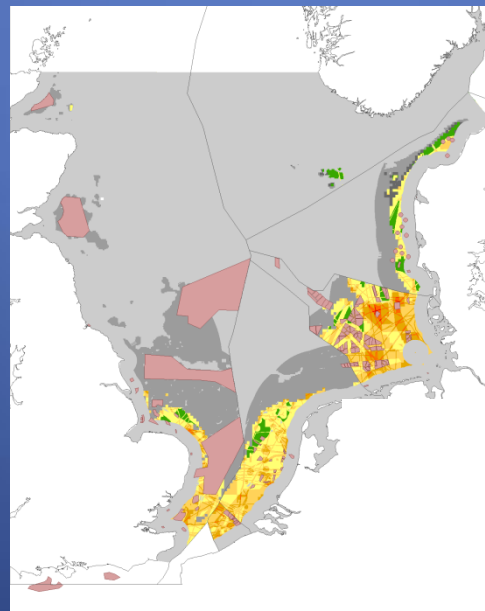


Economic Potential North Sea trans-national



4 scenarios
WindSpeed
project

Map of economic potential
in the WINDSPEED area for
each scenario: Little Will
Little Wind [bottom left],
Going Solo [top left], In the
Deep [bottom right] and
Grand Design [top right]



Economic Potential North Sea trans-national

15,000 GW in the North Sea - then we need sub sea cables

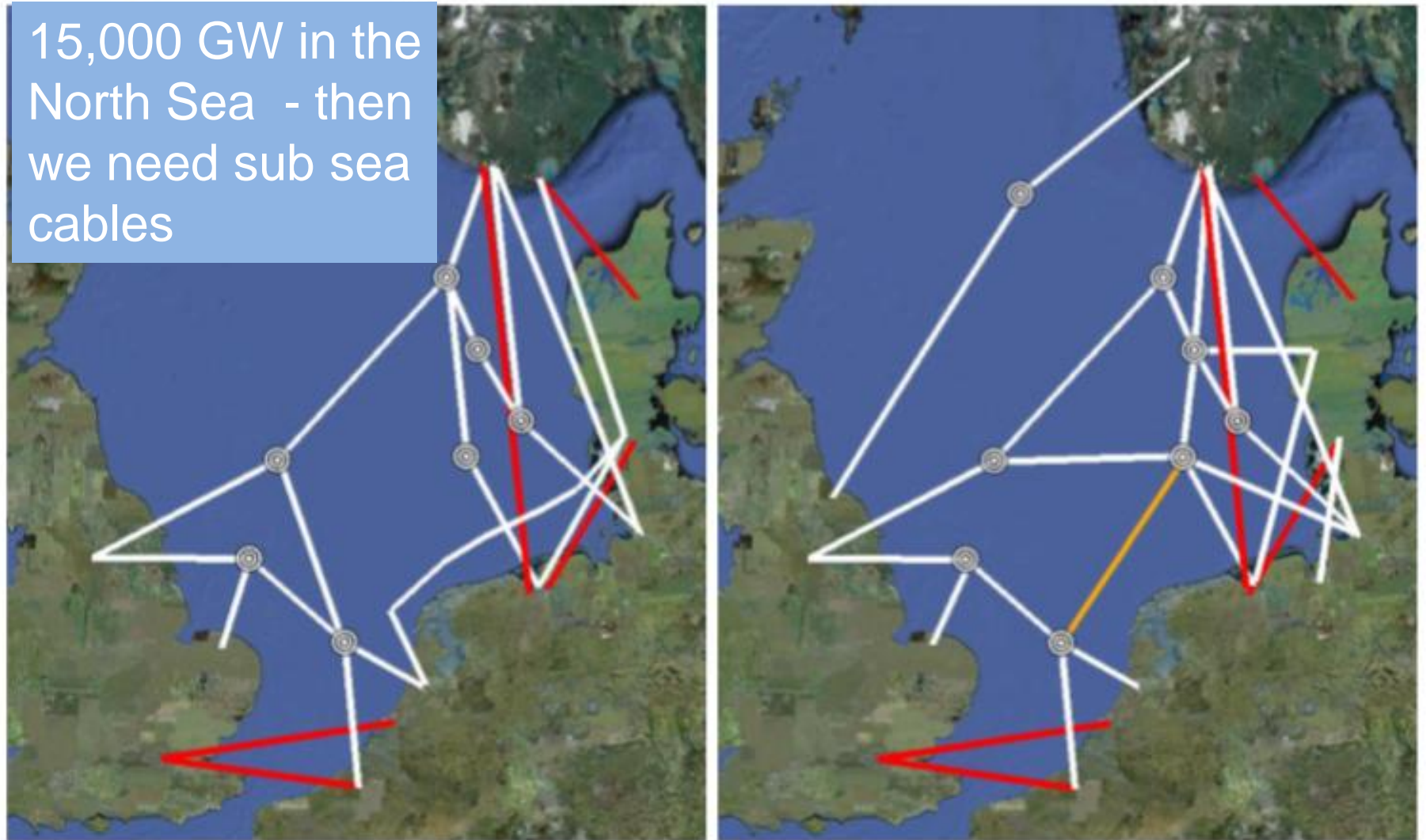


Figure 18: Illustration of the key components of an offshore grid: In the Deep [left] and Grand Design [right] (source: Huertas Hernando *et al.*, 2011)