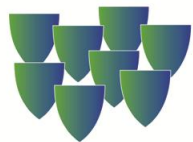


„Energy Grid improvement: EU – North Sea – Offshore“

Thomas Pfannkuch

Senior Adviser for
European Politics

State Chancellery (Schleswig-Holstein)



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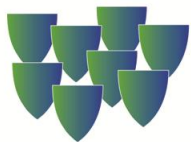
Structure:

1. What's going on at **EU level** – a rough survey...
2. What do the **North Sea countries** do themselves
3. How does this affect **Norway and SH** – also in bilateral terms

*added by some notes from oral presentation given
– where necessary (on green slides, for better distinction)*

The reference: EU Energy & Climate Agenda

- adopted at European Council meeting (Mar 2007)
- overall target: contribute to limiting global temperature increase to 2° (above pre-industrial level)
- **EU 20-20-20 targets by 2020:**
 - 20% less GHG emissions
 - 20% RES share of gross energy consumption
 - 20% more Energy Efficiency



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EU Energy Policy: a rough chronology

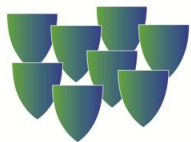
- Mar '07: EU 20-20-20 targets (Europ. Council)
- Nov '08: 2nd Strategic Energy Review (COM)
- April '09: EU legislation in force (RES, ETS, CCS)
- Nov '10: EU Energy Strategy 2020 (Draft), incl.
„Energy Infrastructure Priorities 2020 and beyond“
- Feb '11: Europ. Council Summit on Energy Strategy
- Mar '11: Road map „low carbon economy 2050“



2011: taking stock – a view ahead to 2020

EU targets to be reached by 2020 ??

- **GHG emissions** – yes (from today's view)
 - alleviated by recent/current economic crisis
- **RES share** – possible according to NREAP's (21%)
 - provision: basic grid improvements
- **Energy Efficiency** – additional efforts required
 - otherwise only half (10%) according to NEEAP's



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short notes on: „national 2020 RES targets – varying, but legally binding“ *)

SWE: 49% (39.8)	FRA: 23% (10.3)	POL: 15% (7.2)
LVA: 40% (32.6)	LIT: 23% (15.0)	NL: 14% (2.4)
FIN: 38% (28.5)	ESP: 20% (8.7)	SLK: 14% (6.7)
AT: 34% (23.3)	GER: 18% (5.8)	BE: 13% (2.2)
PRT: 31% (20.5)	GRC: 18% (6.9)	CYP: 13% (2.9)
DK: 30% (17.0)	ITA: 17% (5.2)	HUN: 13% (4.3)
SLO: 25% (16.0)	IRL: 16% (3.1)	CZ: 13% (6.1)
EST: 25% (18.0)	BG: 16% (9.4)	LUX: 11% (0.9)
ROM: 24% (17.8)	UK: 15% (1.3)	MLT: 10% (0.0)

*) as set by EU RES Directive (2009/28/EC)
- % of gross energy consumption (compared to 2005) -

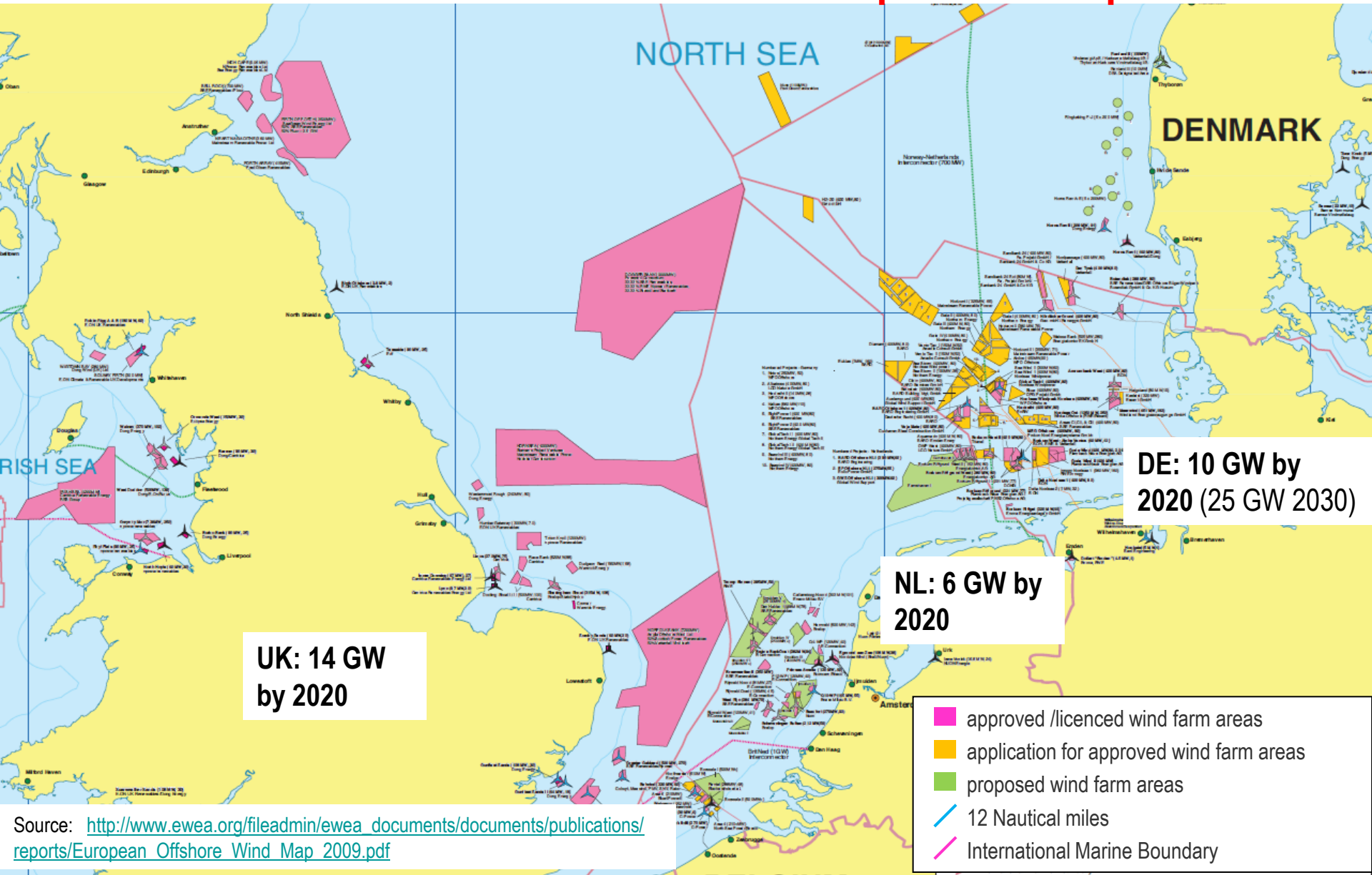
Offshore Wind Energy: a strategic role

- advantages: less conflicts, stronger/more stable wind flows, large-scaled production volumes
- 2010 estimates: 40 GW (2020) → 100 or more GW (2030) *compared to 1,1 GW installed by 2007* *)
- North Seas (low depth marine areas): 90% of EU Offshore capacity projected for 2020 *)

*) numbers quoted from COM documents



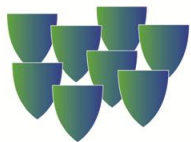
North Seas: Offshore Wind capacities planned



Offshore Wind's major challenge: Infrastructure needs

- land-bound infrastructure from coastlines: *)
transport to major consumption centres (*overlay grid*)
- sub-marine infrastructure: *)
grid integration of large scaled power volumes to coast
- longer term vision: a **European „supergrid“** *)
(mediterranean solar power, northern wind power)
- **North Sea Offshore Grid**: a „blueprint“ for super grid*)?

*) all of which depending on use of HVDC technology

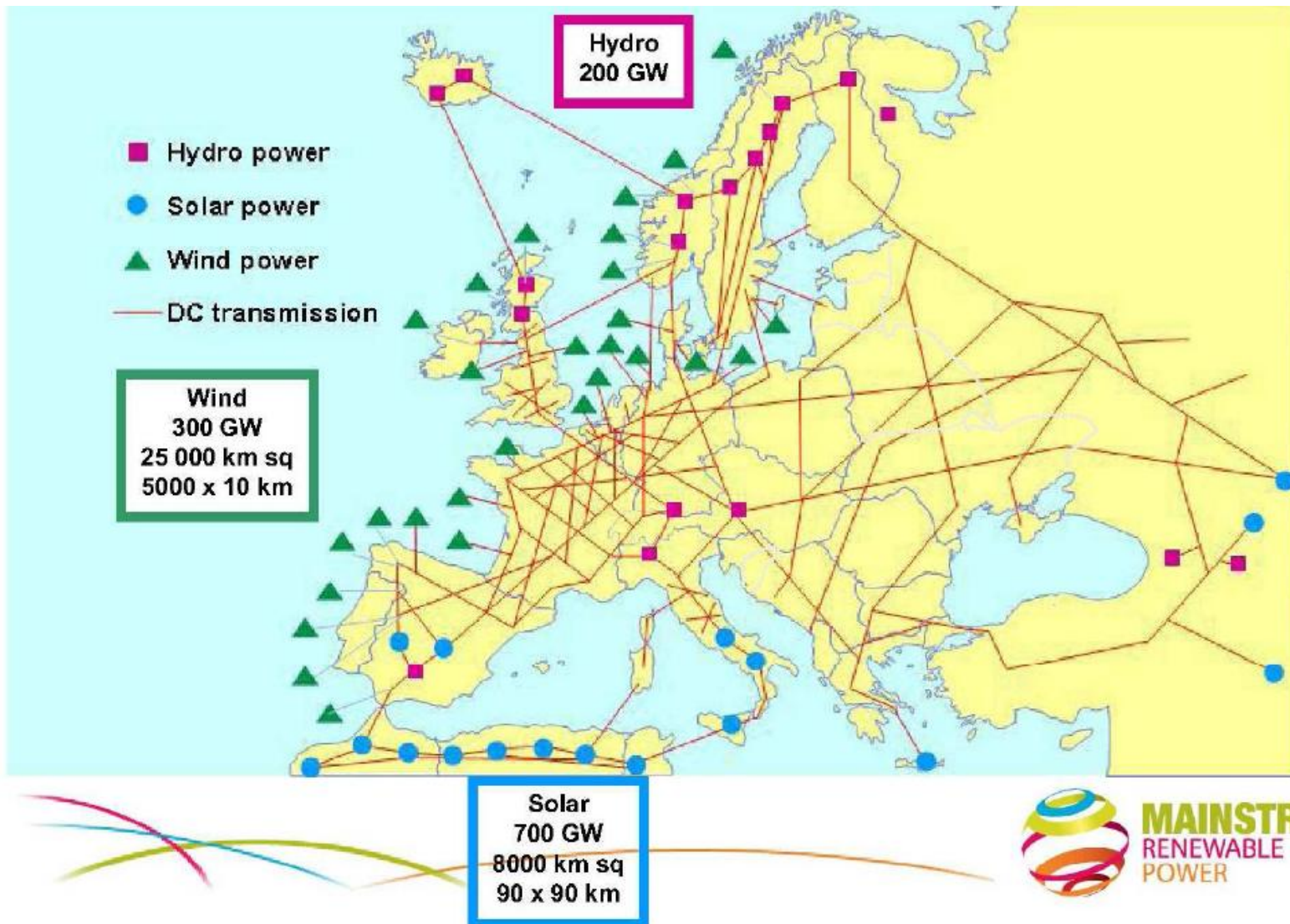


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„Supergrid“ – a vision once to become reality?



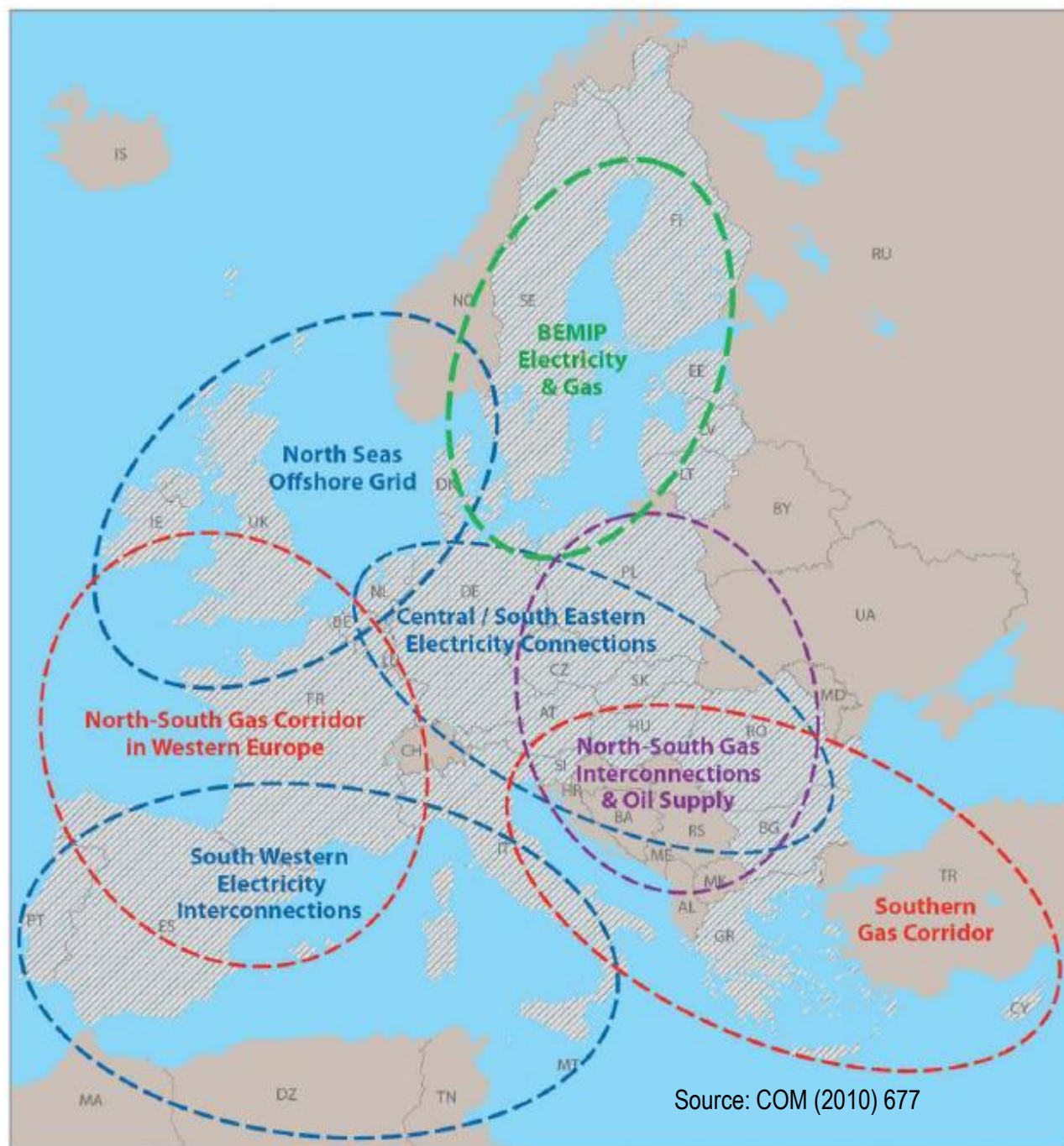
Source: <http://www.mainstreamrp.com/attachments/library/How-the-Supergrid-really-will-be-built.pdf>

short explanation: „Supergrid“

- intensified debate since last decade (2005/08) on
 - grid integration AND power transmission
 - of large-scale powers from Solar (south), Wind (West/North), Hydro (North)
 - via long distance **HVDC subsea cables** alongside coastlines
- initiated first by researchers - taken up by
 - DESERTEC,
 - Offshore wind farm developing companies,
 - Investment companies

COM 2010:

„7 European energy infrastructure priority corridors 2020“
(Draft)



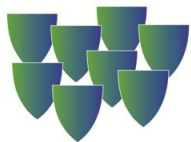
Source: COM (2010) 677

short notes on: „7 European energy infrastructure priority corridors 2020“ (Draft)

- map set-up in **transnational geographic areas**
- to be further concretised in the course of **2011/2012...**
- Electricity grid matters only:
 - 1) **Northern Seas:** → integrate offshore grid
 - connect to consumption centres and storage facilities
 - 2) **SW Europe:** → inter connect Iberian Peninsula & France
 - accommodate wind, hydro & solar
 - make best use of North African RES & exist. Infrastruc.
 - 3) **CE & SE Europe:** → strengthen new North–South, East–West power flows
 - assist market & RES integration
 - connect to storage facilities & integrate energy islands
 - 4) **BEMIP:** → complete integration of Baltics into EU market
 - reinforce Baltics' internal networks
 - strengthen interconnections with FIN, SWE and POL

Next steps at EU level

- Jun '11: COM report on financing needs of energy infrastructure priority projects
- autumn: „Low Carbon Energy Roadmap 2050“, measures for enhancing planning/realisation of priority projects
- Jun '12: strategic „Ten-Year Network Development Plan“ (by ENTSO-E)
- **2012:** selection of concrete EU priority projects
(small sections probably be funded?)



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European Network of Transmission System Operators (Electricity)

- set up by EU directive 714/2009
- tasked to table a „10 Year Network Development Plan“ (**TYNDP**) every 2nd year
- 41 member TSO's from 34 countries
- based on former regional TSO cooperation structures (NordEL, UCTE, UKTSOA /ATSOI, BALTSO)
- European Council Summit (Feb 2011)
 - ➔ „strategic TYNDP“ by **June 2012**

short notes on: „ENTSO-E / TYNDP“

- ENTSO-E:

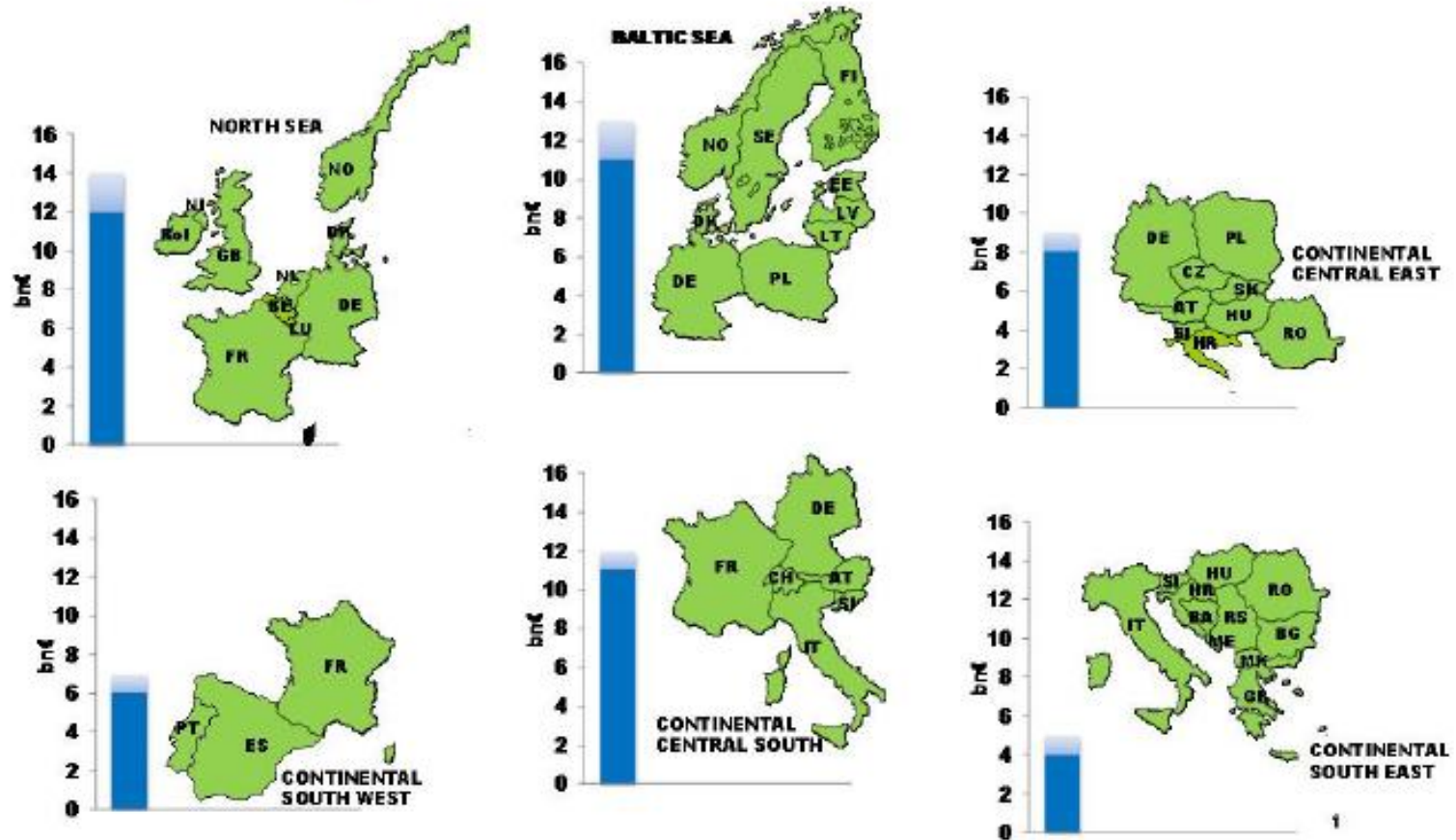
- Members: **ALL** European countries (except: ALB, RUS, BLR, UKR, MLD)
→ i.e. **including NOR/Statnett**
- Some TSO's represented „twice“:
TenneT (NL) → also: „TenneT Transpower“ (DE – central german transmission grid, formerly owned by E.ON)
ELIA (BE) → also: „ELIA 50Hertz Transmission (DE - eastern german transmission grid, formerly owned by Vattenfall Europe)

- TYNDP:

- first „pilot version“ tabled last June → only „taking stock of TSO's plans“
- 2012 version to be **„strategic – but non-binding“** (EU Council Summit)??
→ natural: MStates pay reference to national competencies at home
→ rather obvious: MStates tend to frame references needed to „embrace“ relevant actors at home

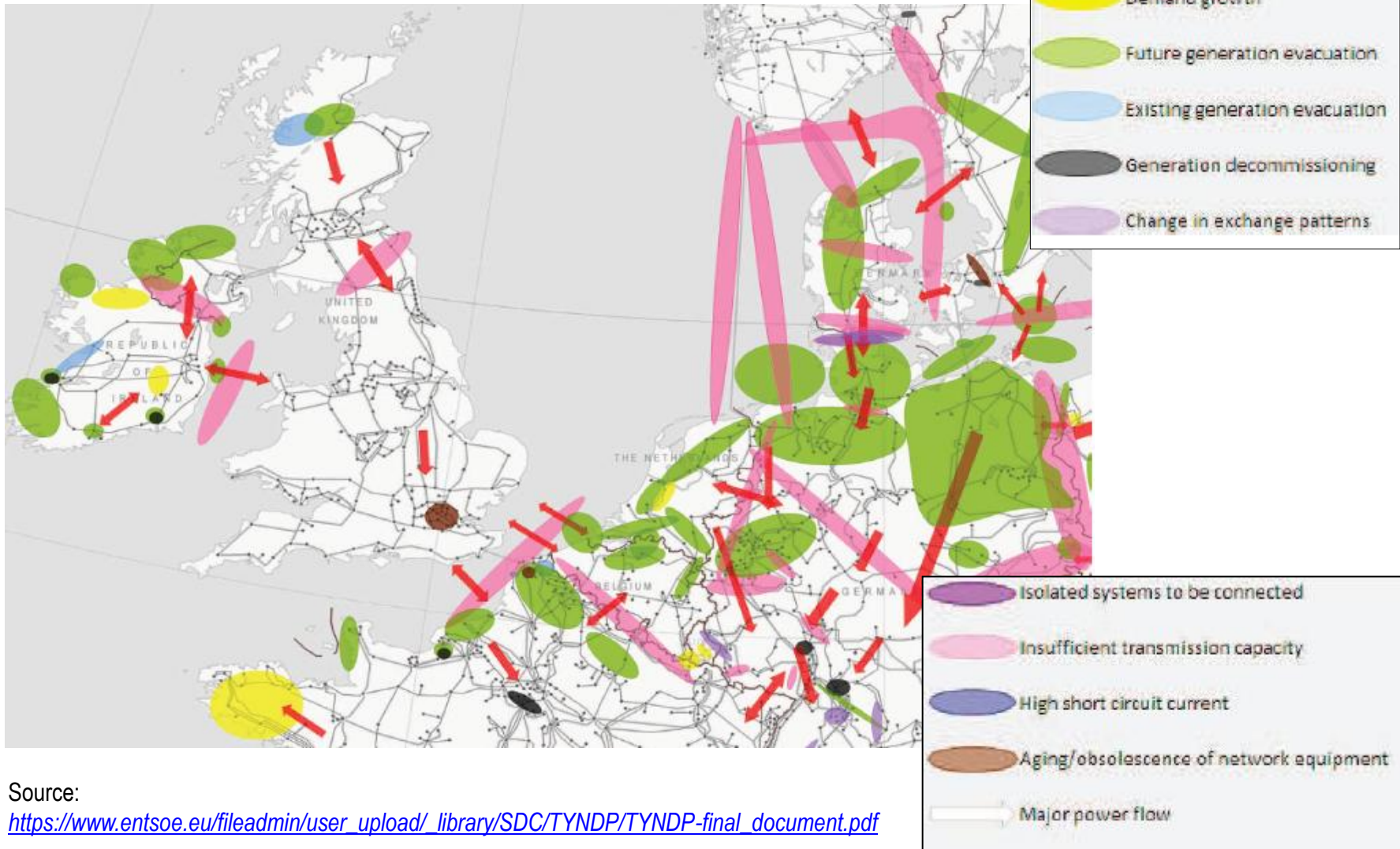


Each market region is concerned



Source: <http://www.dena.de>

Mid-term investment **needs** (regional group North Sea)



Source:

https://www.entsoe.eu/fileadmin/user_upload/library/SDC/TYNDP/TYNDP-final_document.pdf

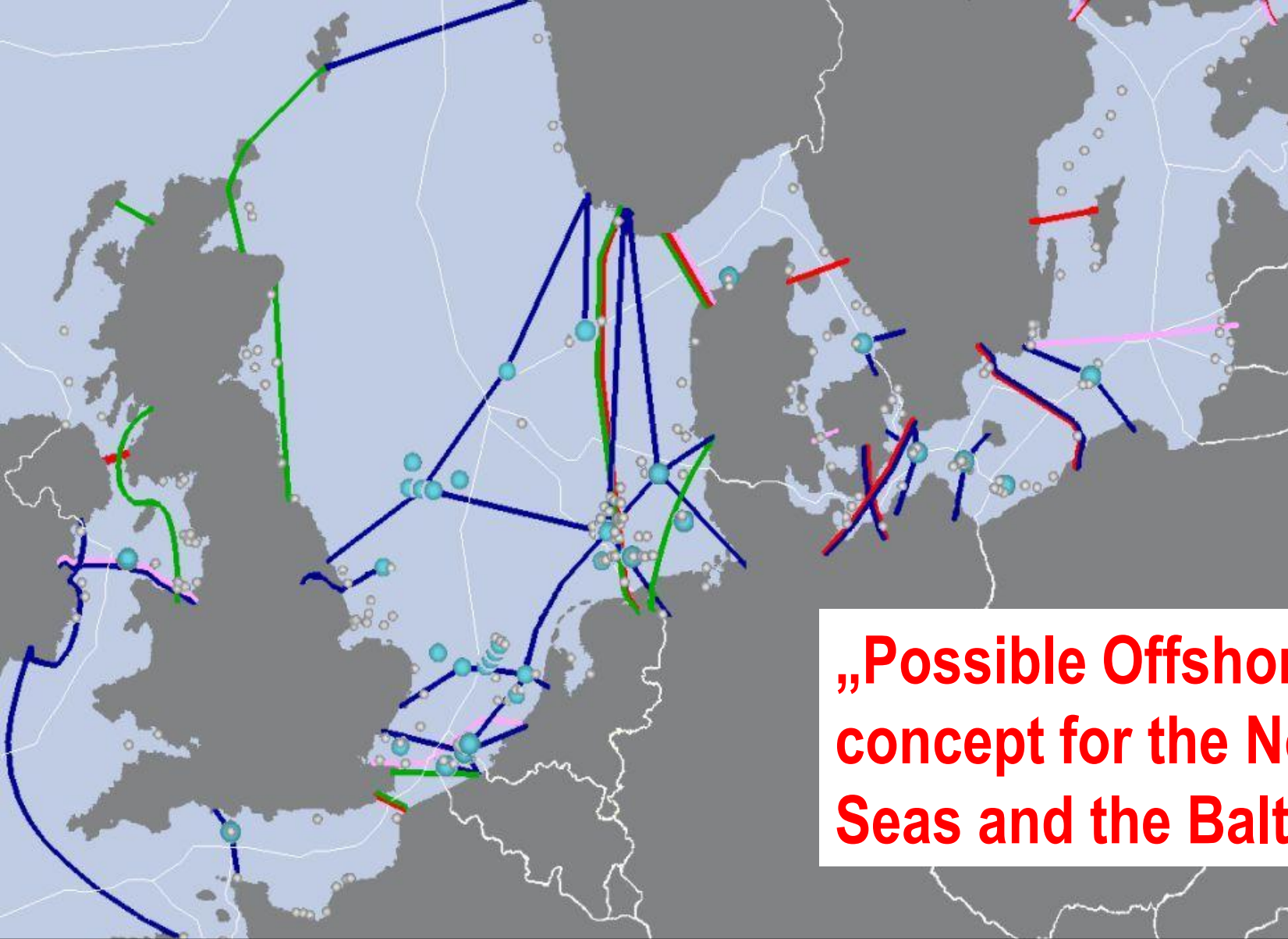
North Sea Grid: from vision to 2030/2050?

- since 2007: EU coordinators monitoring /fostering „most critical trans-European energy networks“
→ i.a. „Baltic & North Sea offshore wind integration“
- Nov '08: officially taken up by „2nd Strategic Energy Review“ (COM,) → „a North Sea offshore grid should become one of the **building-blocks** of a future **European supergrid**“
- Nov '10: no.1 proposed among seven „European Energy Infrastructure priority projects“



short notes on: „North Sea Grid“

- „North Sea Electricity Grid“ firstly suggested by **Greenpeace** (Sep '08)
- From COM report 2008:
 - pre-condition: **clustering wind farms** = enables hubs off-shore for integration to the grid (provided at North Seas)
 - major advantage: **cost-efficiency factor** of a joint grid compared to single radial grid connections (GER up to 30“% – whole North Sea area 20%)
- **HVDC** (High-voltage **D**irect **C**urrent) predetermined to become the technical pillar for this grid



„Possible Offshore Grid concept for the North Seas and the Baltic Sea“

European Commission (2010): „mixed approach“ scenario showing existing (red), planned (green) and commissioned (pink) transmission lines as well as additional lines (blue) necessary according to

Offshore Grid calculations

NSCOGI: a regional self-initiative

- grown up from Working Group of Mr Abramowitsch (EU coordinator for Northern offshore wind integration, since 2007)
- welcomed by COM: „*a model for regional initiatives*“
→ both coordination & implementation (Nov 2010)
- MoU signed by nine states & COM (Dec 2010)
- Programme Board & 3 Working Groups:
 - grid configuration & integration, ▪ market & regulatory issues,
 - planning & authorisation procedures
- First results **late 2012??**



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short notes on: „NSCOGI“

- reads: “North Seas Countries Offshore Grid Initiative“
- EU coordinator’s Work Group based on input from interested parties → most prominent/active: Statnett
- NSCOGI Members: All North Sea Countries plus FRA, BE, LUX, IRL
- started to work on coordination/streamlining of regulatory, technical, planning and similar issues (within national competencies)
- work started early 2011 to be reviewed end 2011

A dynamic process under way:

- **EU** to further take the political lead (frame decisions)
- **TSO's** trying to bind & channel investment plans?
- **North Sea Countries** alleviating grid procedures
- behind: longer term visions („Supergrid“, „2050“)

➔ 2012 to become a year of **essential decisions?**



short comments on: „A dynamic process...“

- picture painted so far reads like a „market of opportunities“ –
- **BUT:** → pictures also the incoming rivaling **competition**
 - among different geographic EU infrastructure priority corridors as well as against other Offshore interested countries (like e.g. US, CHI)
 - about attracting capital, limited capacities of manufacturing industries, raw materials etc
- not to forget: world market prices of raw materials needed (such as copper) are constantly rising ...
- The whole of planning & construction will be a matter of decades,
 - this is why: **the year 2012 could become a decisive one**

Within this frame: SH's successful RES policy

- since early 90ies, supported by Federal RES Act (EEG)
- „SH energy policy concept“ (adopted Mar 2010):
 - min. **100% RES** share of electricity consumption (DE: 40%)
- current status (2010): **44% RES** share (DE: 17%)
- current projections:
 - 2020 wind targets already achieved **by 2015??**
 - 8.5-9.0 GW on-shore, 3.0 GW off-shore??
- new projections: → **min. 50% RES** share of total energy consumption by 2020 a possible new target?



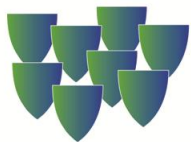
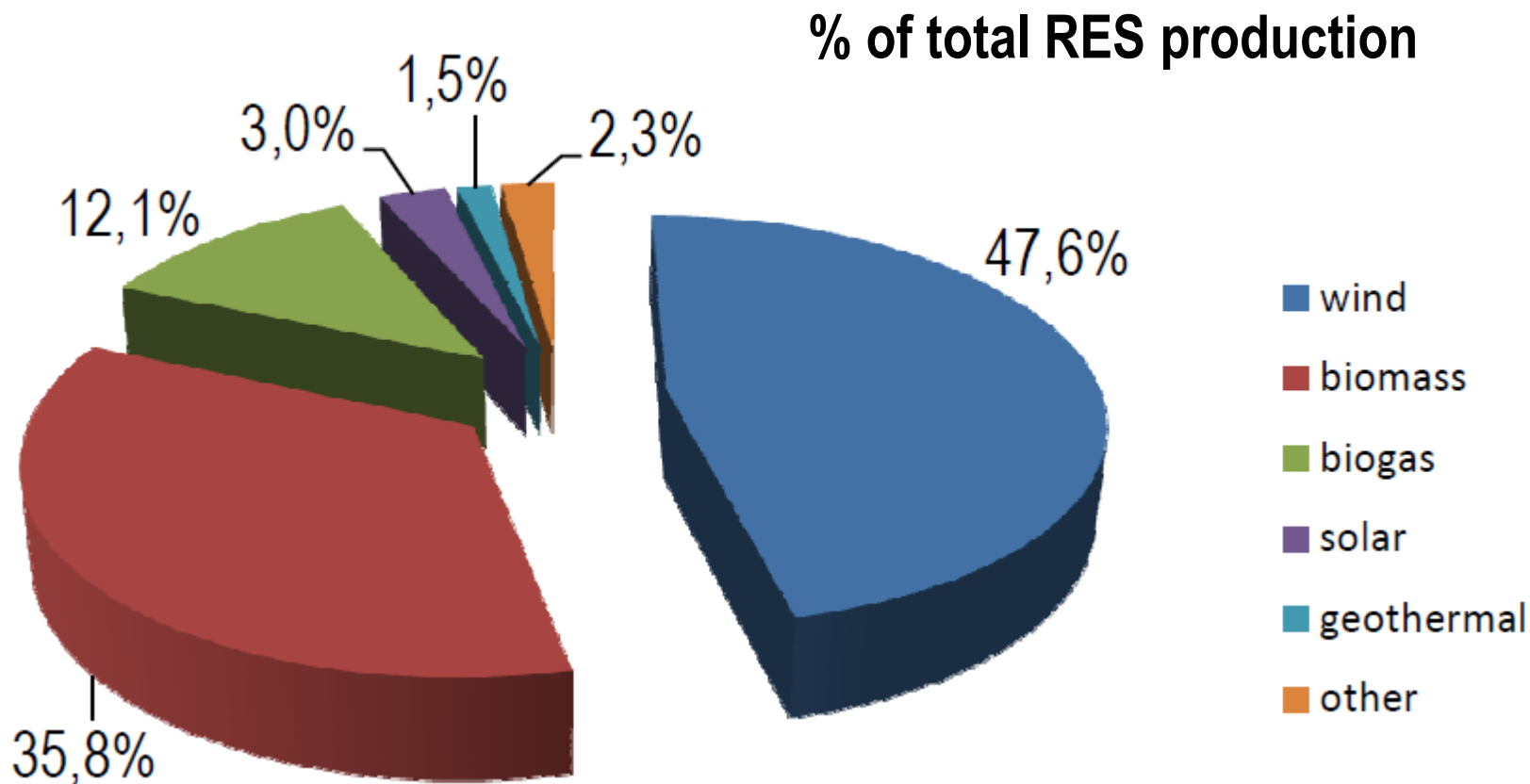
short explanation: „SH's successful RES policy“

- Federal RES Act (EEG): feed-in preference to RES power **plus** feed-in tariffs for RES power higher than regular market price

Current speeding-up of projections due to:

- decision to double land area classified for wind turbines (1.5% instead of 0.75% as of today)
- continuous repowering of on-shore wind turbines
 - ➔ new generations
 - ➔ requiring less surface
 - ➔ generating greater volumes
 - ➔ enabling harvesting stronger winds (height, windy seasons)
- coordinated grid improvement (Land Govt & grid operators)
- projected off-shore wind farms becoming ready for investment (*enabled also by accord achieved on grid integration route through nature-protected Wadden Sea areas*)

Schleswig-Holstein: RES mix 2009



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CC meeting 5 May 2011

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SH Wind Energy – *current status (2009)*

- **Schleswig-Holstein:**
2.7 GW installed capacity (on-shore)
40% of electricity consumption (2010: *44%?*)
9% increase against previous year
- **Germany total:**
25.8 GW installed capacity
16.1% of electricity consumption
8% increase against previous year
- **compared to:**
35.1 GW in the US, 25.1 GW in China



Off-shore wind farms

- **in Germany:**
status: 29 projects approved
at North Sea and Baltic Sea
(1894 turbines = total **7.5 GW**)
- sea depth: 20-35 m,
distance to coast > 30 km
- 3 research platforms on offshore wind
at North Sea and Baltic Sea
- **Schleswig-Holstein:** as of today,
7 offshore wind farms approved
at North Sea, 1 at Baltic Sea
(= total **2.7 GW**)

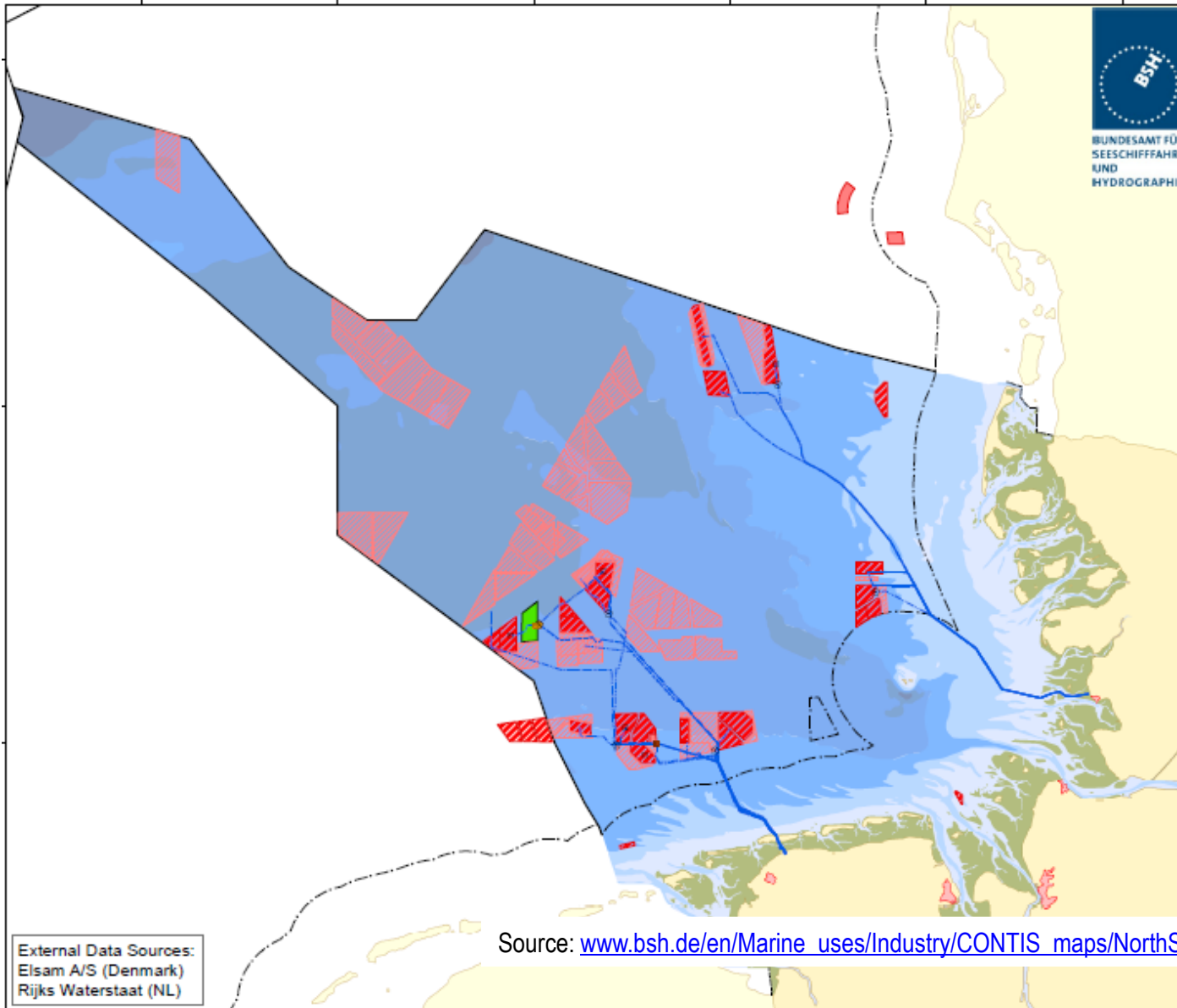


Off-shore wind farms – a little comparison:

The **first German** Offshore Windfarm ever went operational this Monday (2 May):

- ➔ **„Baltic 1“** off the Baltic Sea shores of Mecklenburg-Vorpommern:
- ➔ quite small (21 turbines, 48 MW capacity), nearer to coast (16 km), at shallow waters, to receive less strong winds
- ➔ but expected to generate power scales sufficient to **supply about 50,000 households**

German North Sea zone: Offshore Wind Farms



- **green**
= under construction
(partly operational –
BARD 1 Offshore)
- **dark red** = approved
- **light red** = planned
- **blue lines**
= grid integration
cables to coast
- **black line** = exclusive
economic zone
(continental shelf)
- **dashed black line**
= territorial sea (12
nautical miles zone)

SH: grid improvement needs (1)

existing **transmission** grid
(high voltage, 380 kV):

- under construction:
reinforcing North-South grid
Denmark – SH/Hamburg
(TEN-E project EL.7)
- urgent needs:
continuing improvement further
south (to West/Southwest GER)



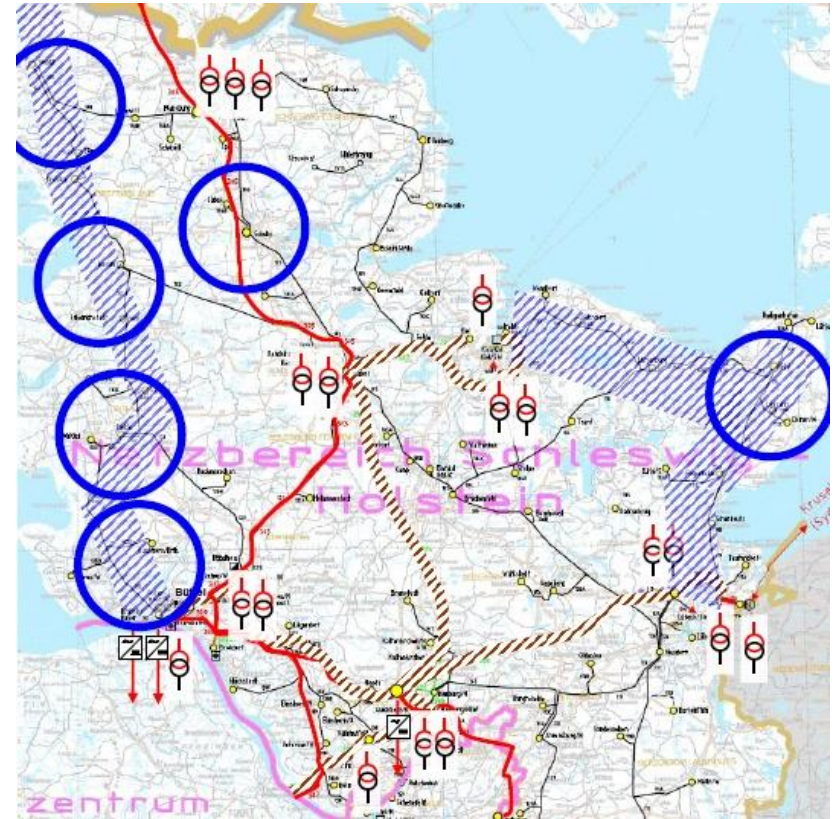
Source: Schleswig-Holsteinischer Landtag – Drs. 17/1250

SH: grid improvement needs (2)

additional grid integration and power transmission (380 kV):

- increasing wind power scales (*coastal areas*)
- increasing decentralised bio energy scales (*rural areas*)

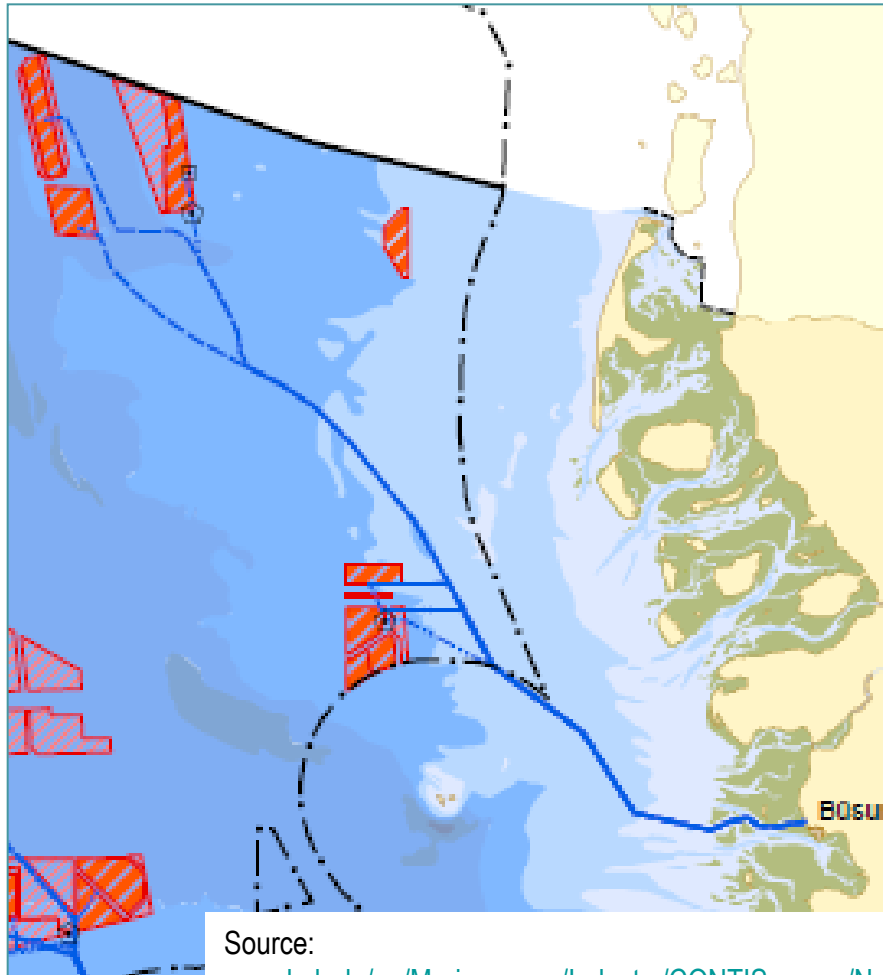
- existing 380 kV
- new 380 kV line corridor considered
- new 480 kV line using existing 220 kV line corridor



Source: www.tennetso.de

SH: grid improvement needs (3)

- integrating Offshore wind:



Source:

www.bsh.de/en/Marine_uses/Industry/CONTIS_maps/NorthSeaOffshoreWindfarmsPilotProjects.pdf

- accessing storage capacities:



Source: www.statnett.no

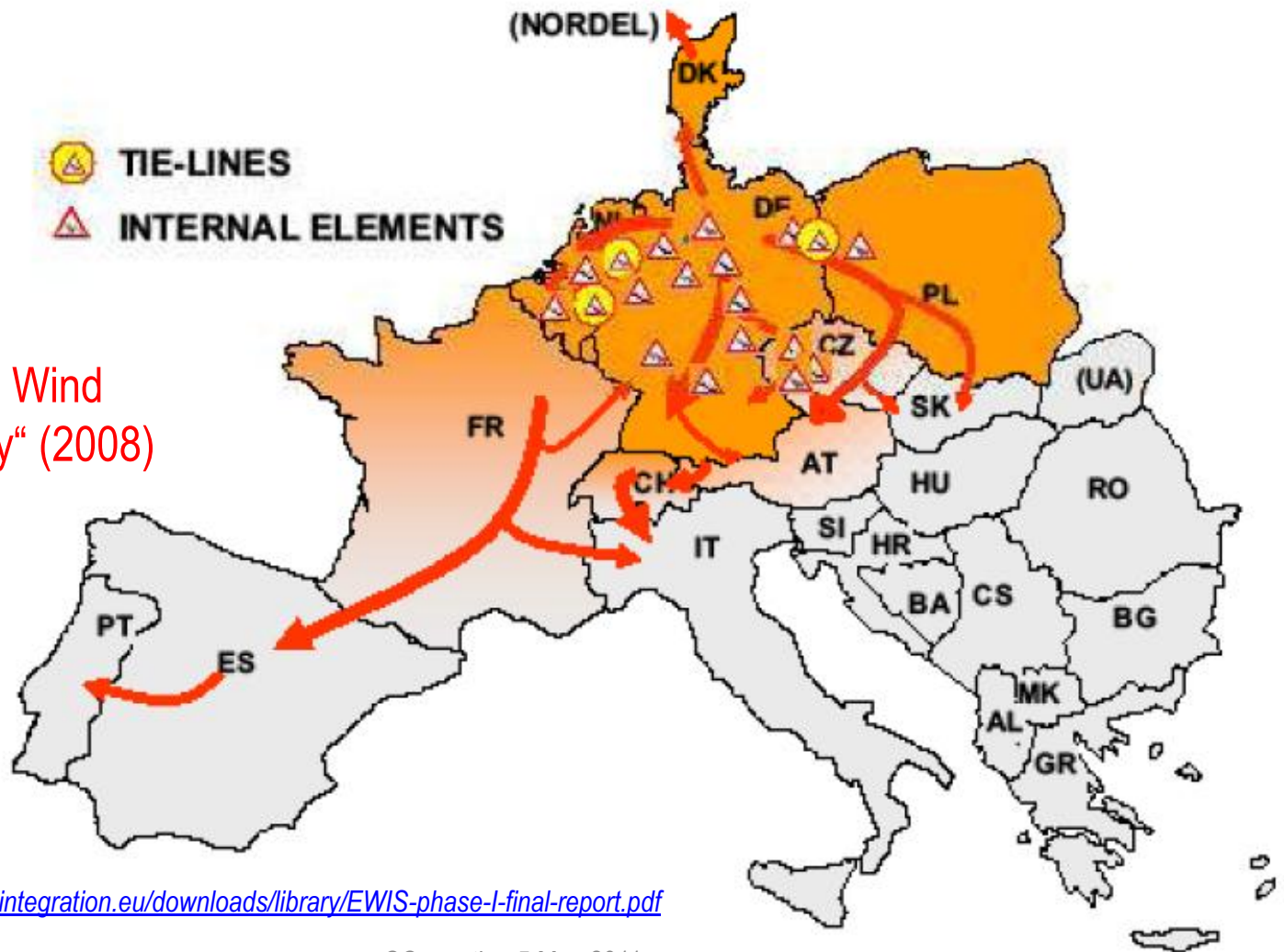
short notes on: sub-sea cable integrating Offshore wind

- accord achieved last November due to legal restrictions given by environmental protection law at coastal seas:
 - German Wadden Sea National Park regulations
 - EU: NATURA 2000 protected areas (Bird Protection Directive, Habitat Directive)
- max. 4 cables (total: 2,800 MW capacity)
- if using HVDC: connected to land-bound 380 kV (AC) high-voltage grid near Brunsbüttel
- to be operated by „TenneT Transpower“

short notes on: sub-sea cable accessing storage capacities

- in times of strongest wind flows:
„natural twin“ to needs of integrating Offshore wind
- fresh project, jointly promoted by Statnett and „TenneT Transpower“
- allowing **storage** of generated wind power surplus
= **additional power supply** for Norway in times of less hydropower generation
- to become operational by 2017/2018??
- similar corridor as Offshore integrating corridor
 - ➔ to pass authorisation schemes similar to the SH Offshore grid corridor
 - ➔ according to existing nature protection law

Germany: a major bottleneck to wind integration



from: „European Wind Integration Study“ (2008)

Source: <http://www.wind-integration.eu/downloads/library/EWIS-phase-I-final-report.pdf>

short notes on:

„GER – a major bottleneck to wind integration“

German Federal Energy Agency (dena) recently stated in a survey on grid requirements by 2020/2025:

- 3,400 – 3,600 km new HV transmission grids needed across GER
- total costs estimated (incl. offshore grid integration):
9.7 bn € (in German: „9.7 Milliarden €“)

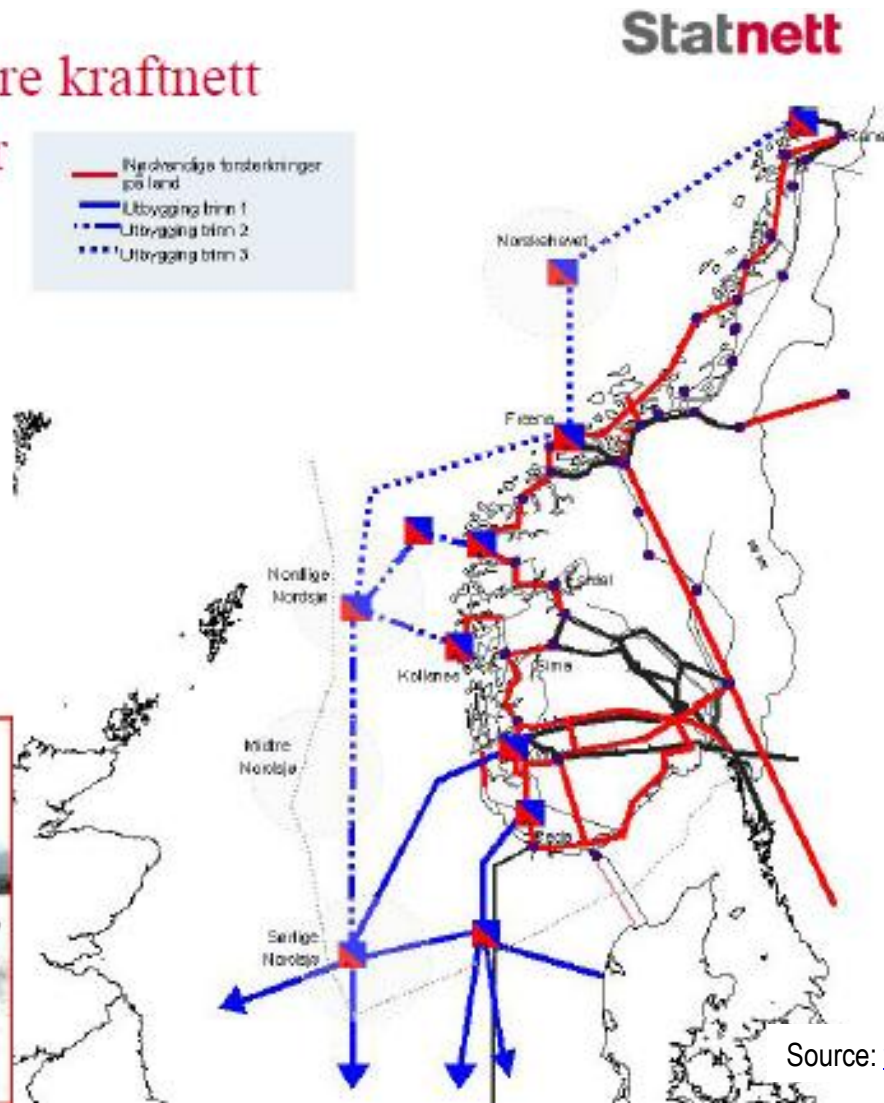
Schleswig-Holstein:

- approx. 500 km new HV grids needed by 2020

Connecting Norway to Offshore Grid

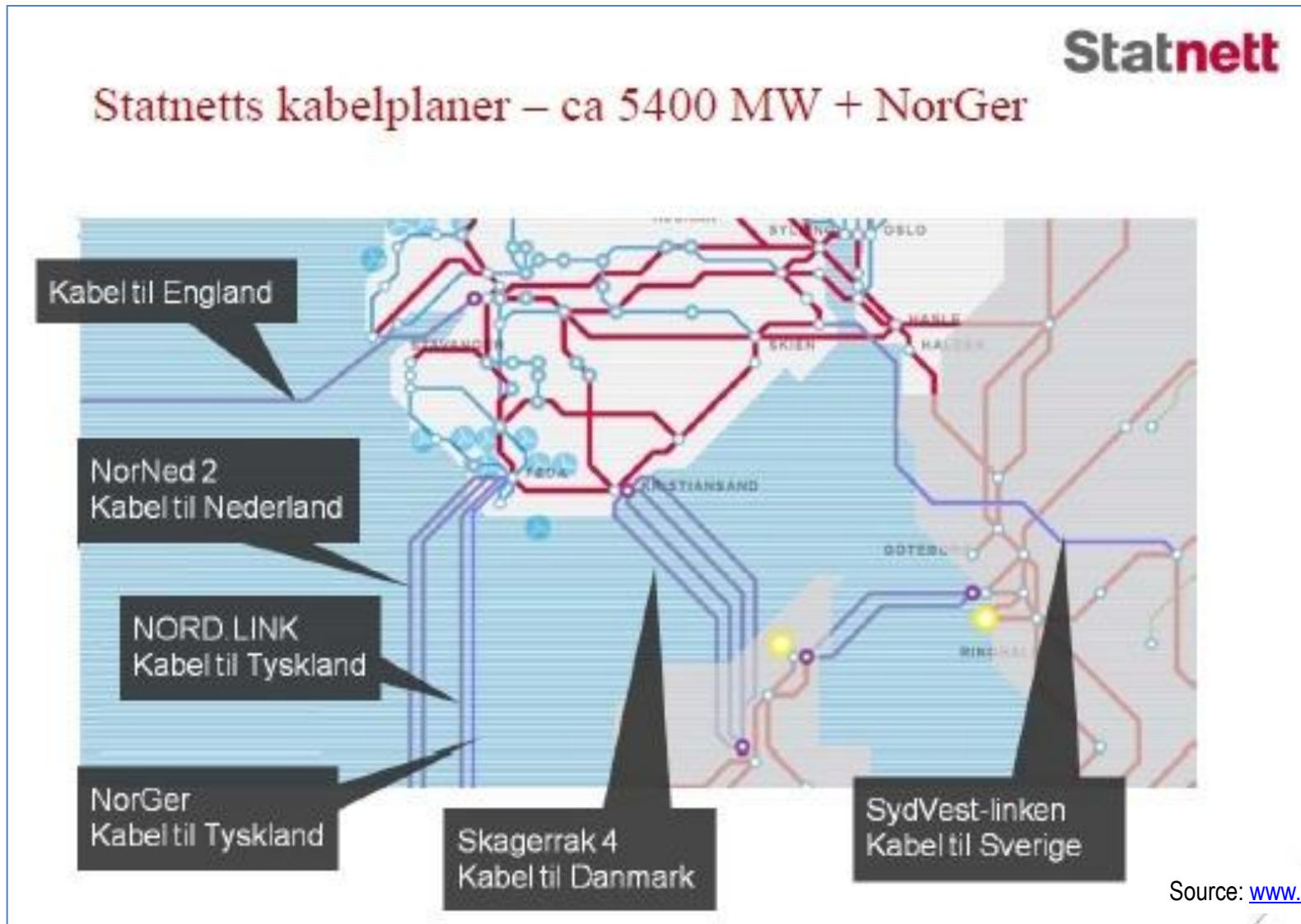
Mulig skisse for et offshore kraftnett
-visjon 2030 og fremover

- Gir mulighet for:
 - kraftutveksling
 - salg av balansetjenester
 - offshore vindkraft
 - elektrifisering



Source: www.nve.no

A best experience in HVDC subsea cables



short notes on: „best experience HDVC subsea...“

projects planned in addition to **existing subsea interconnections** (HVDC), operated by Statnett (and its partners):

- **NorNed 1:** longest subsea cable in the world (580 km sea distance), Eemshaven/NL, 700 MW – in operation: May 2008
→ stage 2 in planning
- **NorGer:** 570 km sea distance to Wilhelmshaven/DE, 1,400 MW – in preparation together with a Swiss partner
- **Skagerrak 1-3:** 130 km sea distance to Jutland/DK, 940 MW – in operation: 1977/1993 → stage 4 under preparation
- **NORD.LINK:** 530 km sea distance to Büsum/DE, 1,400 MW
→ new „old“ project, presented 5 weeks ago at Kiel
- **NOR-UK:** approx. 700-800 km sea distance to East England/Scotland, 1,400 MW – suggested

...compared to other experiences:

across the North Sea:

- **Cross-Channel** (FRA/UK):
46 km, 2,000 MW – in operation: 1986
- **BritNed** (NL/UK):
260 km, 1,000 MW – under construction
- **Cobra Cable** (NL/DK):
275 km, 700 MW – in preparation

or the German „experiences“ ...

- **connecting Windfarm „Bard Offshore 1“** to Lower Saxony
mainland: 125 km sea distance, 400 MW – in operation: Dec 2010

Nord.Link – the „new“ Statnett’s project



Dear friends,
the floor
is yours!

