North Sea
Wind Power Hub
Programme

Videnscafé om Energiøer: Ny undersøgelse dokumenterer store gevinster for Europa

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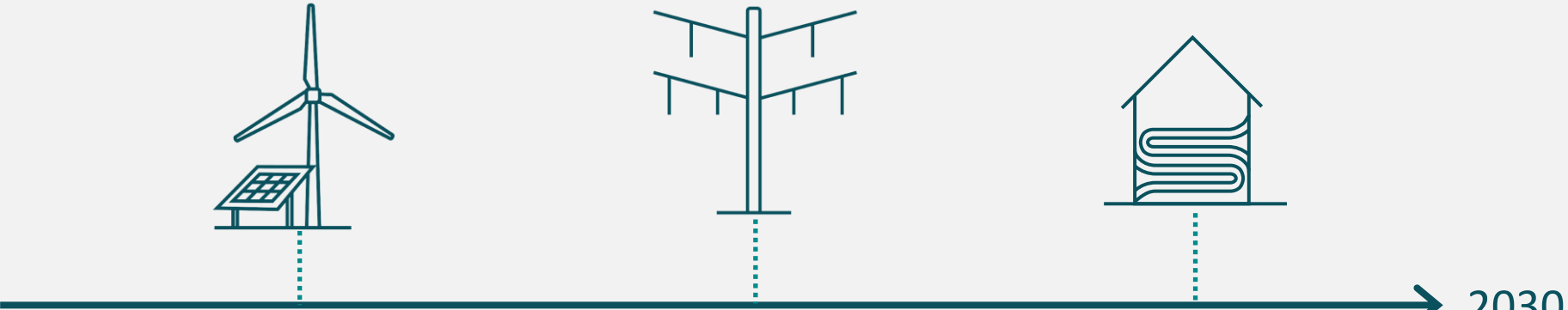
ENERGIØER

På kort og på langt sigt

Hanne Storm Edlefsen, direktør for Megaprojekter Udvikling

NØDVENDIGHEDEN AF DET KORTSIGTEDE PERSPEKTIV

2030 er det korte lys på landevejen for omstillingen af energien. Det korte sigt skal bruges til at fokusere på de løsninger, som er de mindst komplicerede og lige for.



Store sol- og vindmølleparker på land og udbygningen af radiale havvindmølleparker

Udbygningen af elnettet på land

Elektrificering generelt – grøn strøm til husstande, transport og industri

NØDVENDIGHEDEN AF DET LANGSIGTEDE PERSPEKTIV

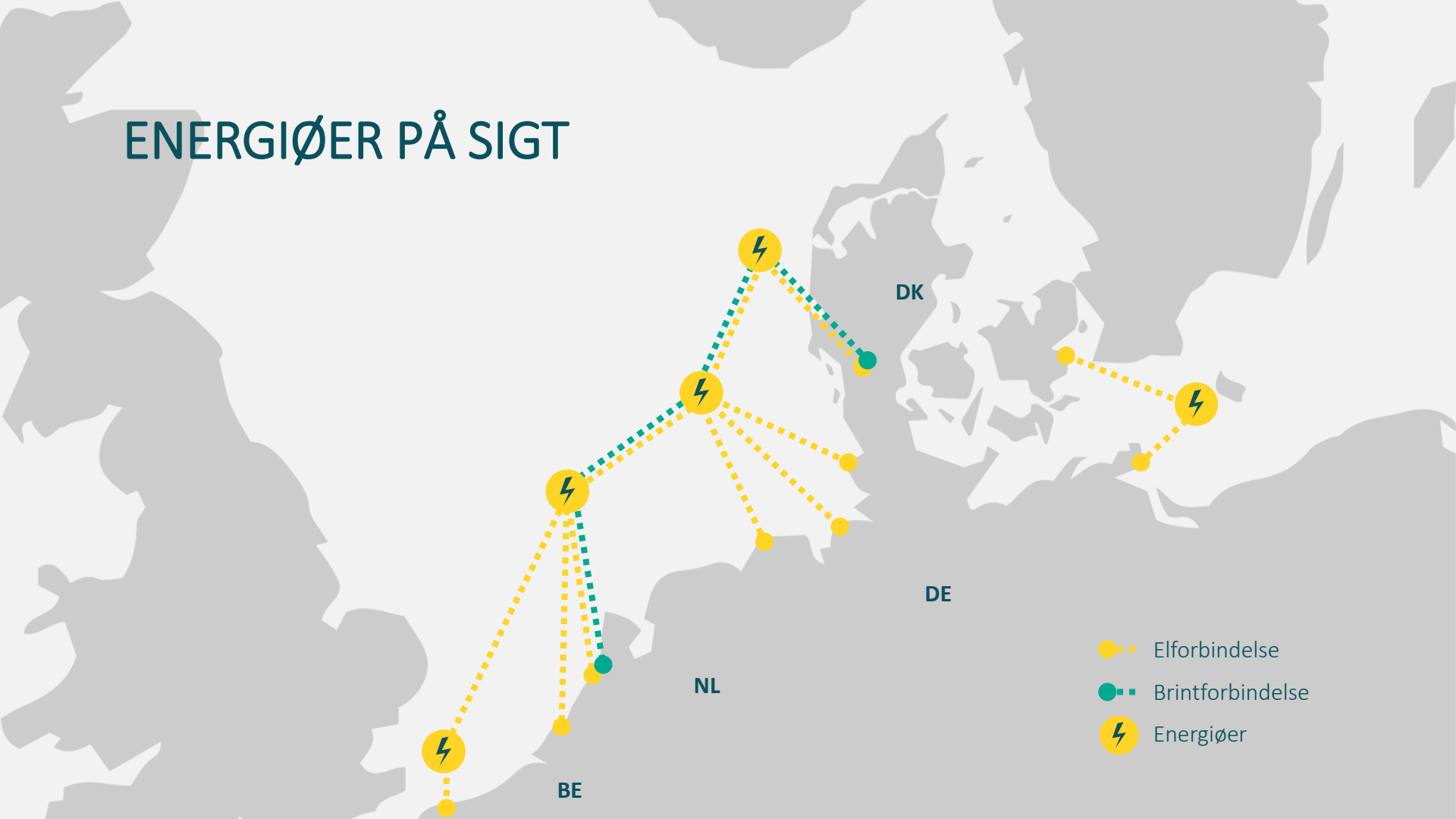
Det langsigtede perspektiv kan ikke vente. De komplicerede og svære valg skal træffes nu, så de kan understøtte gevinster for klimaet efter 2030 og hele vejen frem til 2050.

Udviklingen af komplicerede teknologiske løsninger

Udviklingen af markedsregler og setup for fx energiøer

Internationale samarbejdsaftaler om forbindelser og økonomi

ENERGIØER PÅ SIGT

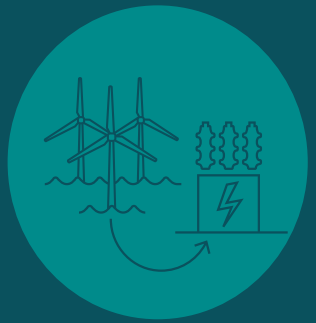


ENERGIØER I DANMARK

Energiø Nordsøen
3 GW havvind, senere 10 GW
– nok til **10 millioner husstande**

Energiø Bornholm
3 GW havvind
– nok til **3 millioner husstande**

PRIMÆRE INDSIGTER FRA STUDIET



300 gw havvind før 2050
kan vanskeligt lade sig gøre
uden energiøer
og energiøer medfører mere
havvind fra Nordsøen

Energiøer styrker Europas
strategiske suverænitet på
energiområdet
og sikrer forsyningen

Energiøer medfører en samlet
systembesparelse på cirka
en milliard euro om året

Reducerer mængden af
ilandsføring af elproduktion
med 24 % og dermed
mindre infrastruktur på land

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Pathway 2.0

Hvor meget havvind har Europa brug for? Og hvor?

Presented by
Martin Hartvig, M.Sc. Ph.D
Energinet System Perspectives

Analyses performed by
Ea Energy Analyses

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Pathway 2.0 is a highly spatially grained investment model of European on- and offshore generation, consumption and infrastructure across electricity and hydrogen on an equal basis…

Among other things we find…

- ✓ System integrated electrolysis is a required driver for spokes
- ✓ Electrolysis offshore, landing zone and onshore all play important roles
- ✓ Spokes allow for 10% more (farshore) wind in the North Sea
- ✓ Spokes reduce the need for biomass in Europe
- ✓ Spokes deliver a strong IC network high utilization rate (up to +70%)
- ✓ Spokes and electrolysis reduce landing capacity needs with +20% in the North Sea
- ✓ Spokes aid EU H2 self sufficiency
- ✓ Spokes reduce system costs (ca. 1EUR/MWh OSW)
- ✓ Solar reduces need for offshore wind to ~200GW
- ✓ …

Report will be published in June

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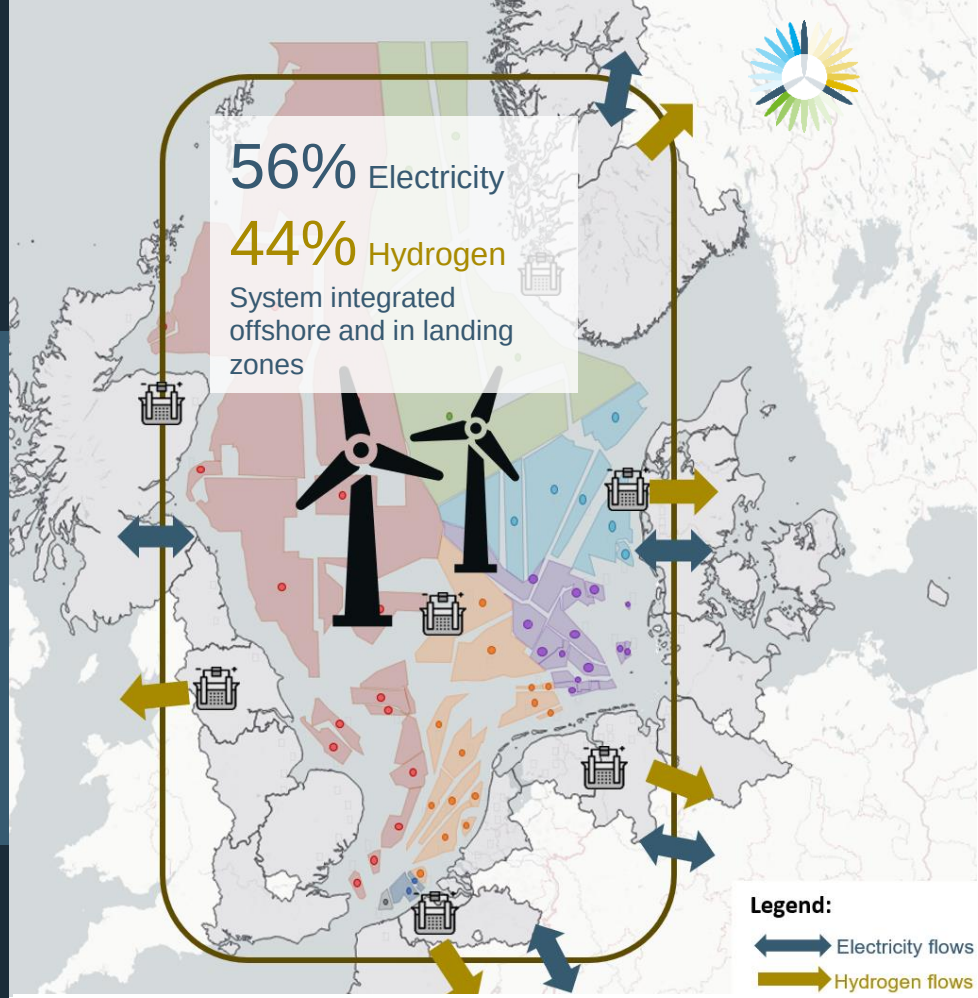

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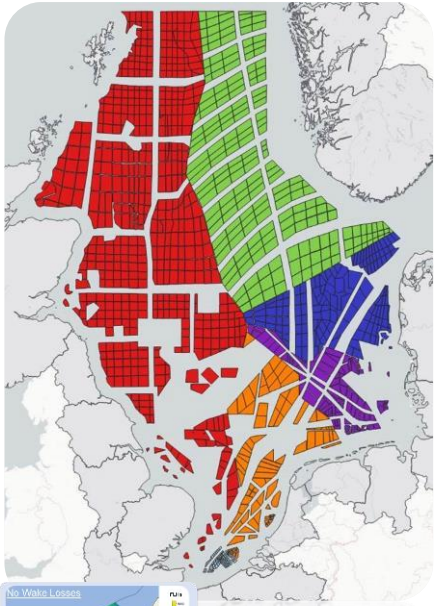
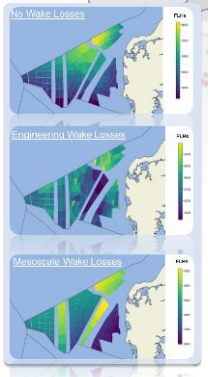
Model scope – state of the art sectorcoupled granular model

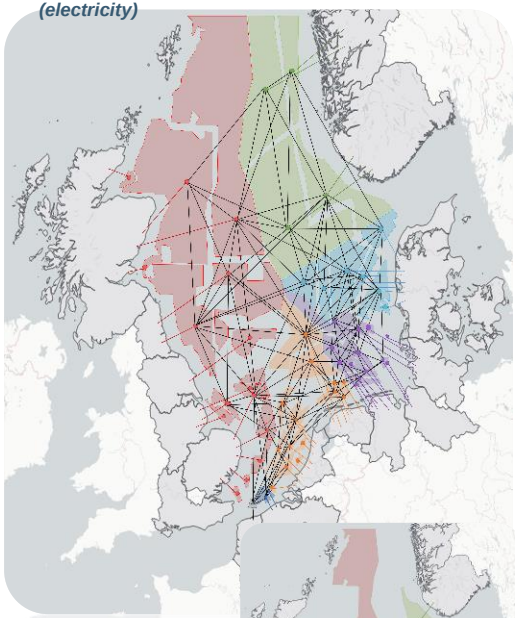
Wind data…



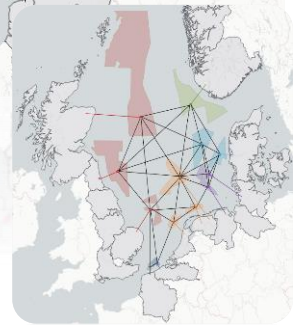


Incl wake losses

Offshore infrastructure (electricity)



Offshore infrastructure (hydrogen)

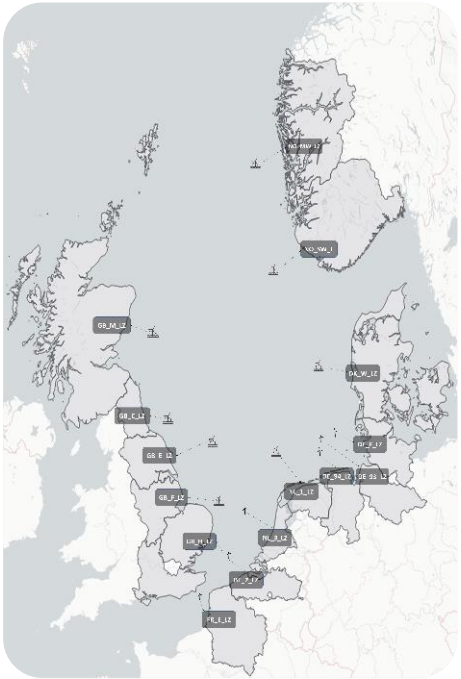


+ connections to Northern Africa and shipping

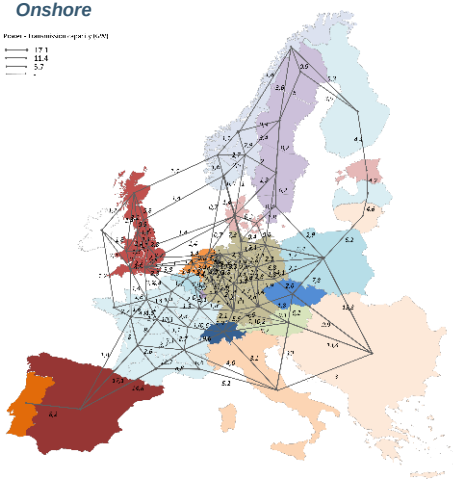
#FreeTheSupplySide

… ”How is offshore wind integrated as economic efficient as possible”

Landing zones

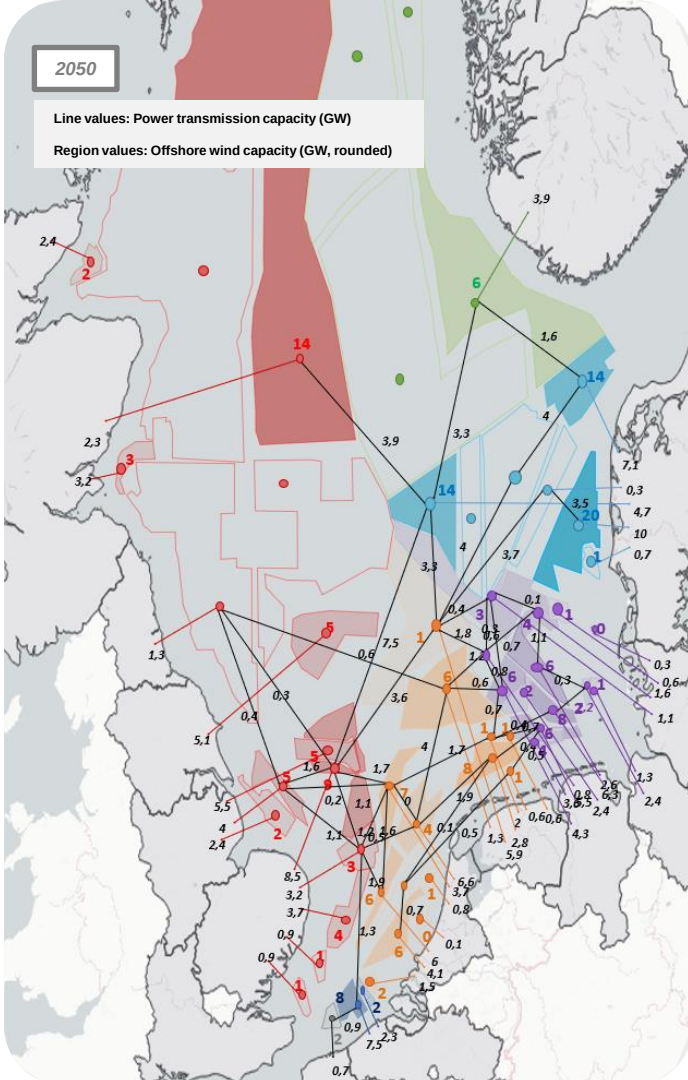


Onshore



Electricity and H2 modelled on an equal (sector coupled) basis

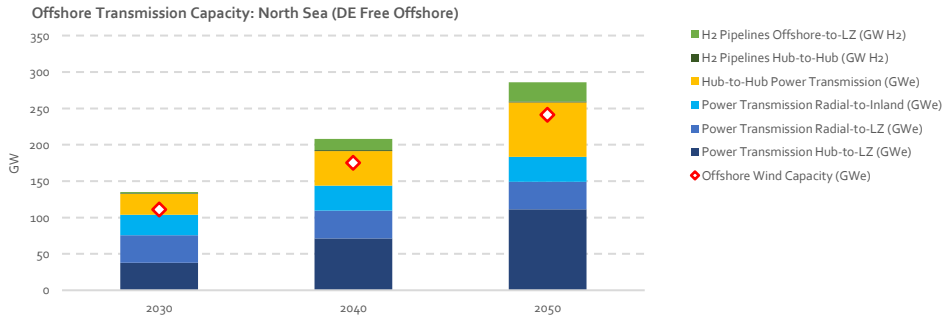
Hubs-and-spokes in the North Sea facilitates efficient system integration

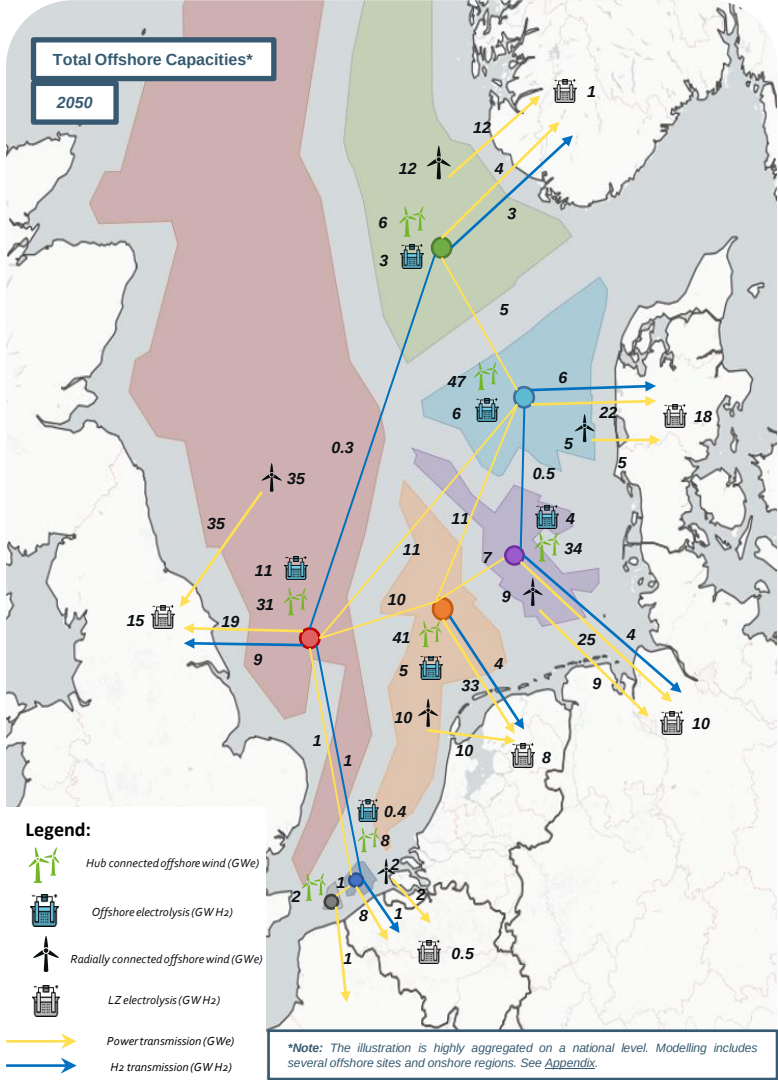


Note: LZ: Landing zone. Connection to main demand zones can be limited, e.g. because electrolysis is established in landing zones and a full electrical connection to the main demand zone is not needed. See here.

Hubs-and-spokes in the North Sea facilitates efficient system integration

- The North Sea house 241GW of 350GW of offshore wind (base case)
- **Strong electrical transmission corridor** connecting the Nordic power system and Danish offshore wind in the North with the UK, Germany and the Netherlands in the South and West. While varying in size, this corridor is found across analysed sensitivities.
- Systems with hubs and spokes are **more interconnected** than radial + classical IC.
- **Reduction of electrical landing** cable capacity with 24% due to **spatiotemporal utilization** of wind
  - 184GW electrical landing connection for 241GW OSV (24%)
  - Offshore electrolysis 38GW, but 34+184=222GW is still 9% reduction
  - … without counting in needed classical IC capacity
- Hubs-and-spokes concept can **reduce total system costs** by 1.0 bn EUR/year (1 EUR22/MWh offshore wind)





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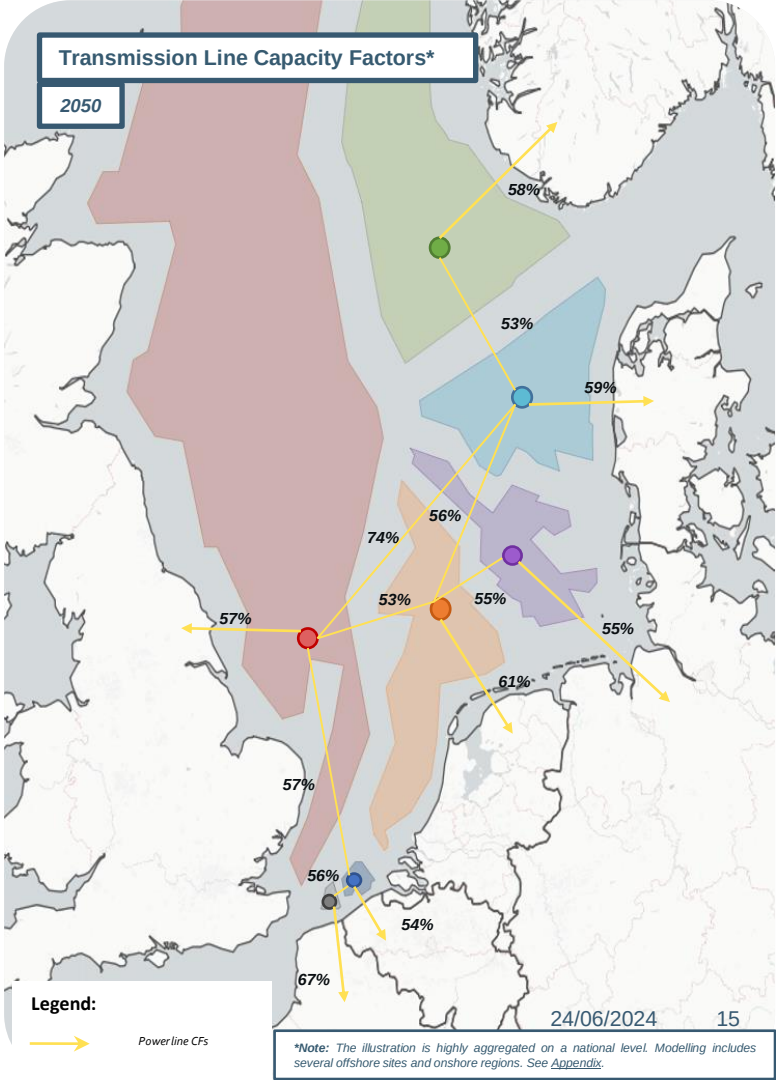
Simplicity

System integration with flexible electrolysers enables HIGH utilisation of spokes, which then again renders them as interesting investments in the optimal system.

System integration in landing zones plays a key role in reducing the expansion of onshore systems



*Note: The illustration is highly aggregated on a national level. Modelling includes several offshore sites and onshore regions. See Appendix.

Flexible consumers are important for the electricity grid

- Location is not s simple “either or” (on- vs offshore) but a **“both and”**.
  - North Sea offshore house 38GW electrolysis, landing zones 70GW and much higher capacity in the onshore system
- Electrolysers are the **largest balancing asset** in the electricity system
- When placed smart electrolysers can **increase the utilization rate** of electrical infrastructure
  - Electrolysers in LZ (“overplanting behind POC”) can have higher FLH compared to inland electrolysers
- Electrolysers **role vary** according to location

Balancing assets, 2050	Capacity (GWe)	Generation/ Demand (TWh electricity)	Capacity factor (%)
Hydrogen G2P	139	16	1% *(~115 FLHs)*
Batteries	335	765	26% *(~2,280 FLHs)*
Electrolysis	566	1,854	38% (~3,275 FLHs)
Flexible load*	259	167	7% (~645 FLHs)

NS LZ (2050)	NS Offshore Electrolysis GWe (FLHs)	NS LZ Electrolysis GWe (FLHs)	Inland Electrolysis GWe (FLHs)	Offshore-to-LZ Power Connection GWe (FLHs)	LZ-to-Mainland Power Connection GWe (FLHs)
BE	1 (3,827)	1 (3,436)	- (-)	10 (4,747)	9 (4,943)
DE	6 (4,362)	13 (3,797)	33 (2,688)	33 (4,789)	21 (5,322)
DK	8 (4,027)	19 (4,933)	13 (3,297)	25 (4,789)	8 (5,434)
FR	- (-)	- (-)	- (-)	1 (5,214)	1 (5,955)
GB	14 (5,860)	21 (3,372)	7 (4,330)	43 (4,929)	25 (5,907)
NL	6 (4,770)	11 (3,599)	11 (3,505)	36 (5,281)	27 (5,348)
NO	4 (5,836)	1 (6,546)	1 (5,892)	4 (4,988)	3 (6,408)

Note: FLH values represent weighted averages across the corresponding national regions. Offshor connections reflect all connections to the referred LZ. Onshore connection represents the connection of the L to its parent region (inland).

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Grøn energi fra Nordsøen kan sætte strøm til Europa

Frigørelse af potentialet gennem internationalt samarbejde

18 June 2024

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Vores flerårige program har leveret viden af afgørende betydning og reduceret risici ved implementeringen af offshore infrastruktur

Troværdig stemme og vidensopbygger inden for udvikling af havvind I Nordsøen

+40 publikationer af tekniske studier og diskussionspapirer

+50 præsentationer ved internationale events og konferencer

+200 involverende interessenter på tværs af Europa

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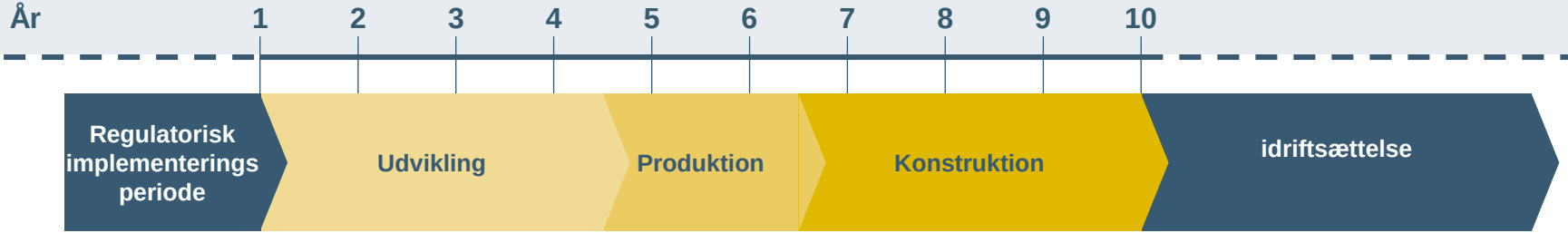
Det langsigtede perspektiv kræver kortsigtede handlinger



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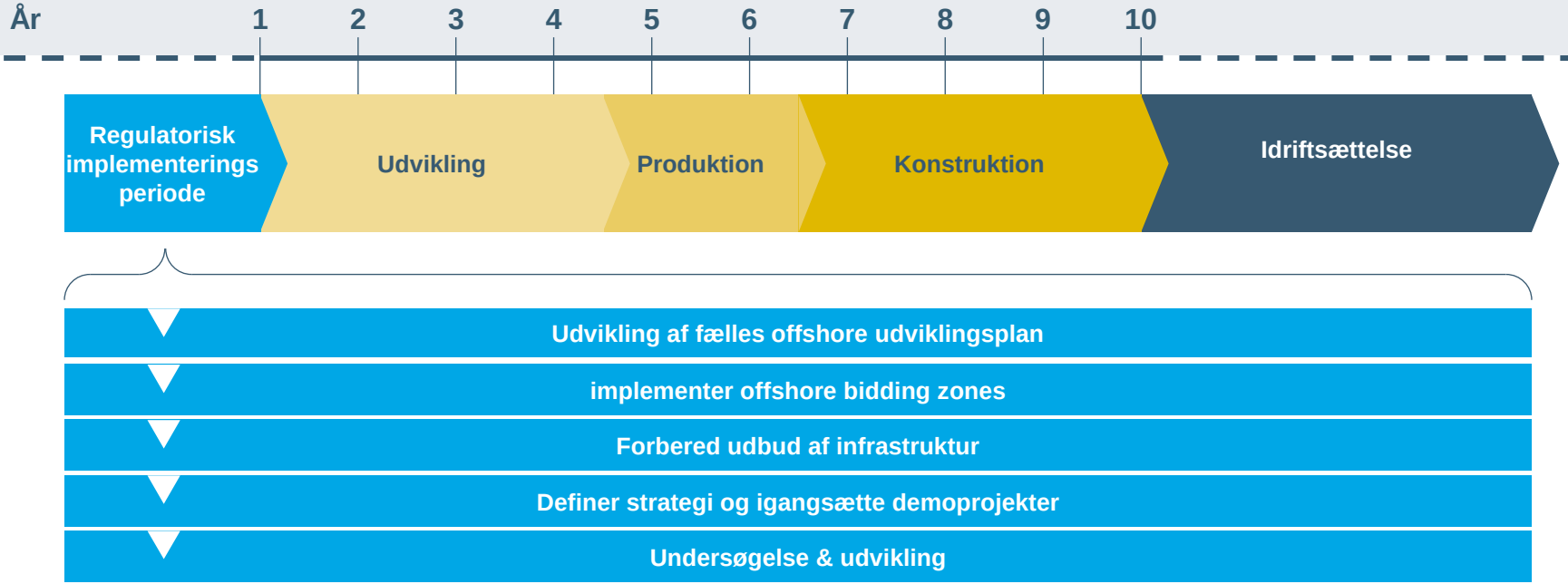

Hvad er der behov for nu?

***Intensiveret international samarbejde** er afgørende for at realisere 2050-visionen om 300 GW havvind*

***Kritiske offshore infrastruktur elementer skal forudses.** Overvejelse af systemintegration og modulære designs generer mulighed for en effektiv udrulning*

*At opretholde momentum kræver en **stabil investeringsramme,** der balancerer kortsigtede handlinger og langsigtet strategi*

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