Hvordan vind, bølger, sol og biomasse kan dække Danmarks og EU's energibehov

af

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ind, bølger, masse kan nmarks og ergibehov

af

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Åbent hus besøg til toppen 16. juni ; se www.middelgrunden.dk 210 kr/person

Background Hans Chr. Sørensen

Business and university background

- –PhD, 45 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 to 2018
- –European Ocean Energy Association, vice president to 2011

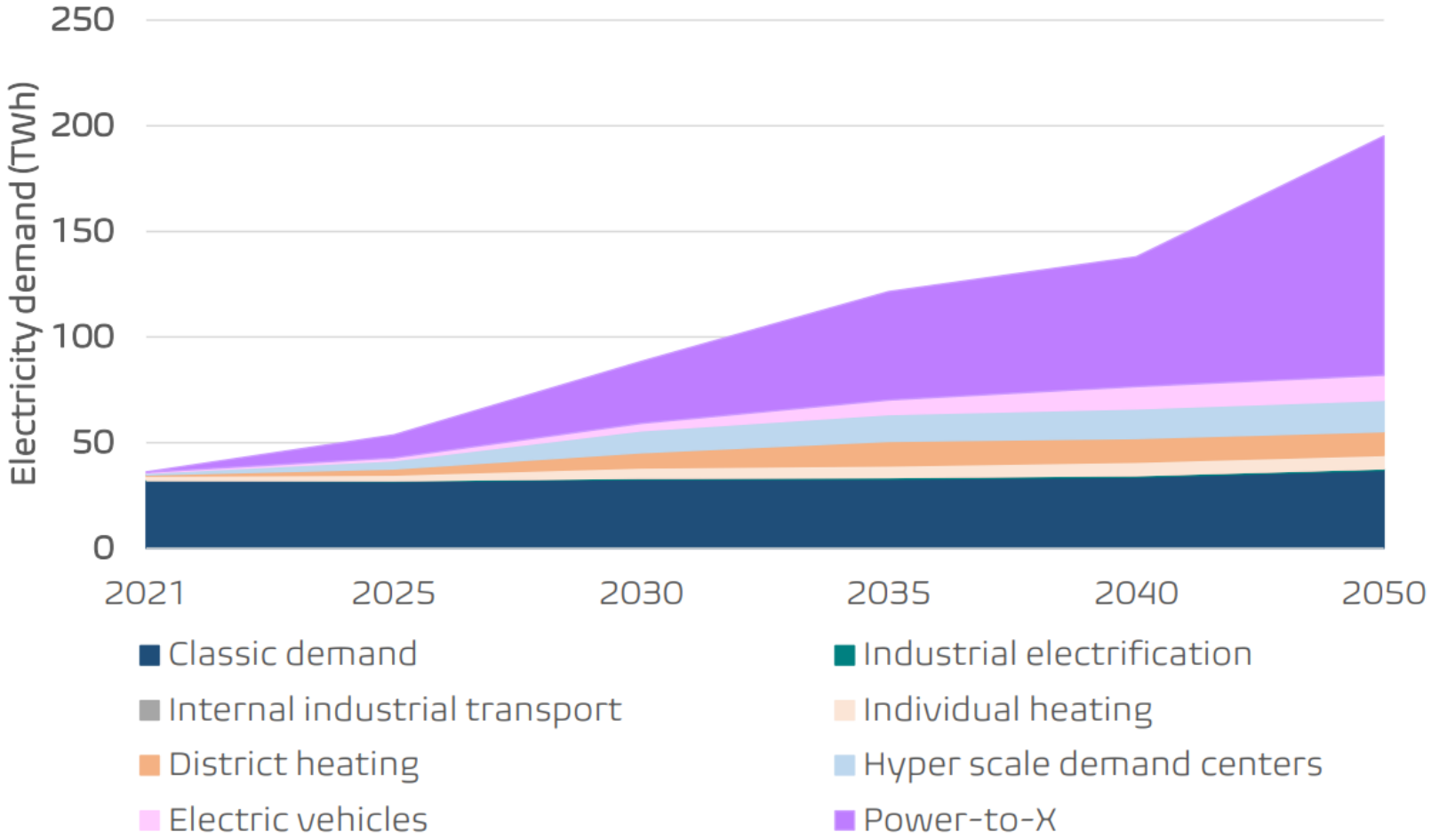
Disposition

- Danish energy plans 1976-2050
- Danish wind energy
- What's next: ocean wave kinetic energy
- Biomass
- PtX as solution for ??

… og PV – der gør man jo bare

- Danish cooperative model for wind
- Middelgrunden wind as case study
- Multiuse of offshore platforms

The Danish demand for power by 203…

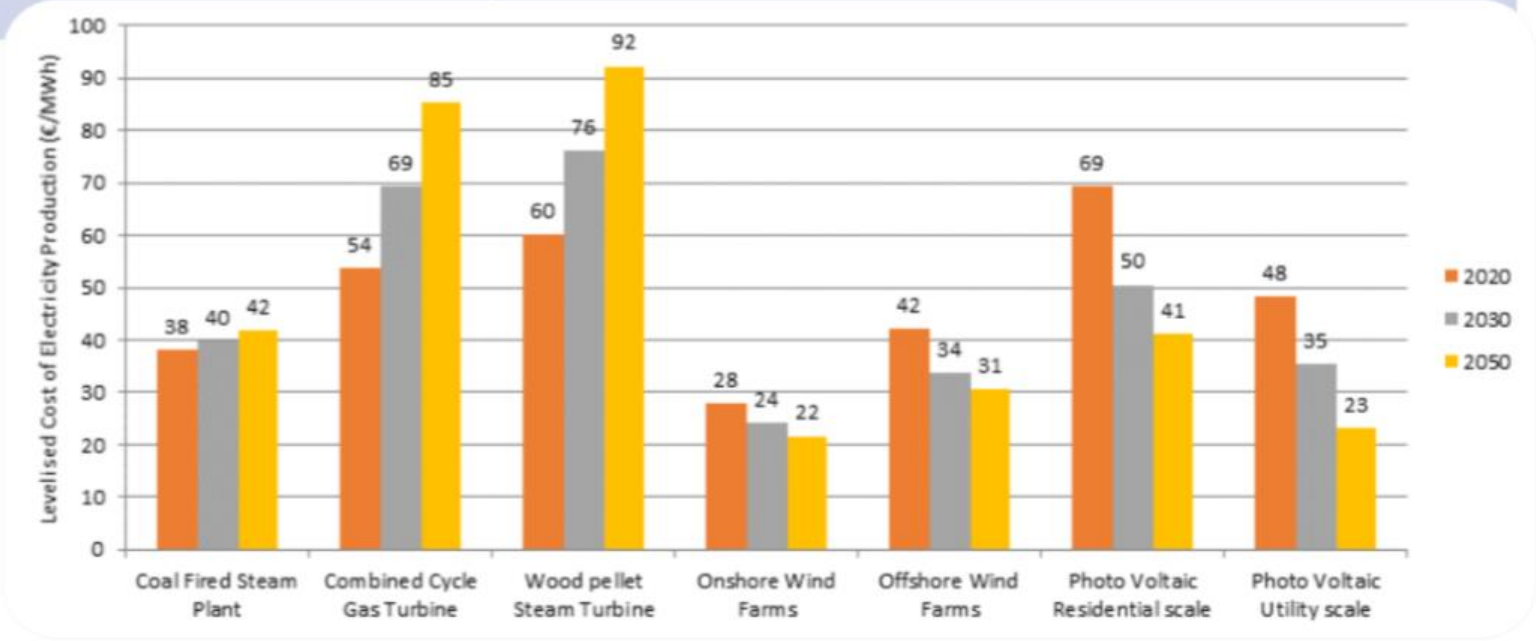


Source: Ea Energy Analyses

Power price in the future

reINVEST

Energy System Challenges and opportunities	Questions and strategic decisions
- Lower and lower Renewable Energy investment costs (Electricity especially) - Batteries are falling in price - Electricity prices are falling (sign of system design failure) and cannot merit investments in new capacity - Power plants for back-up is closing down (lower operation hours)	- How should we use and balance (energy storage) more electricity from renewable energy? - How should we re-design the energy system and how much renewable energy is needed?



EnergyPLAN — Advanced energy system analysis computer model

(sources: EnergyPLAN cost database)

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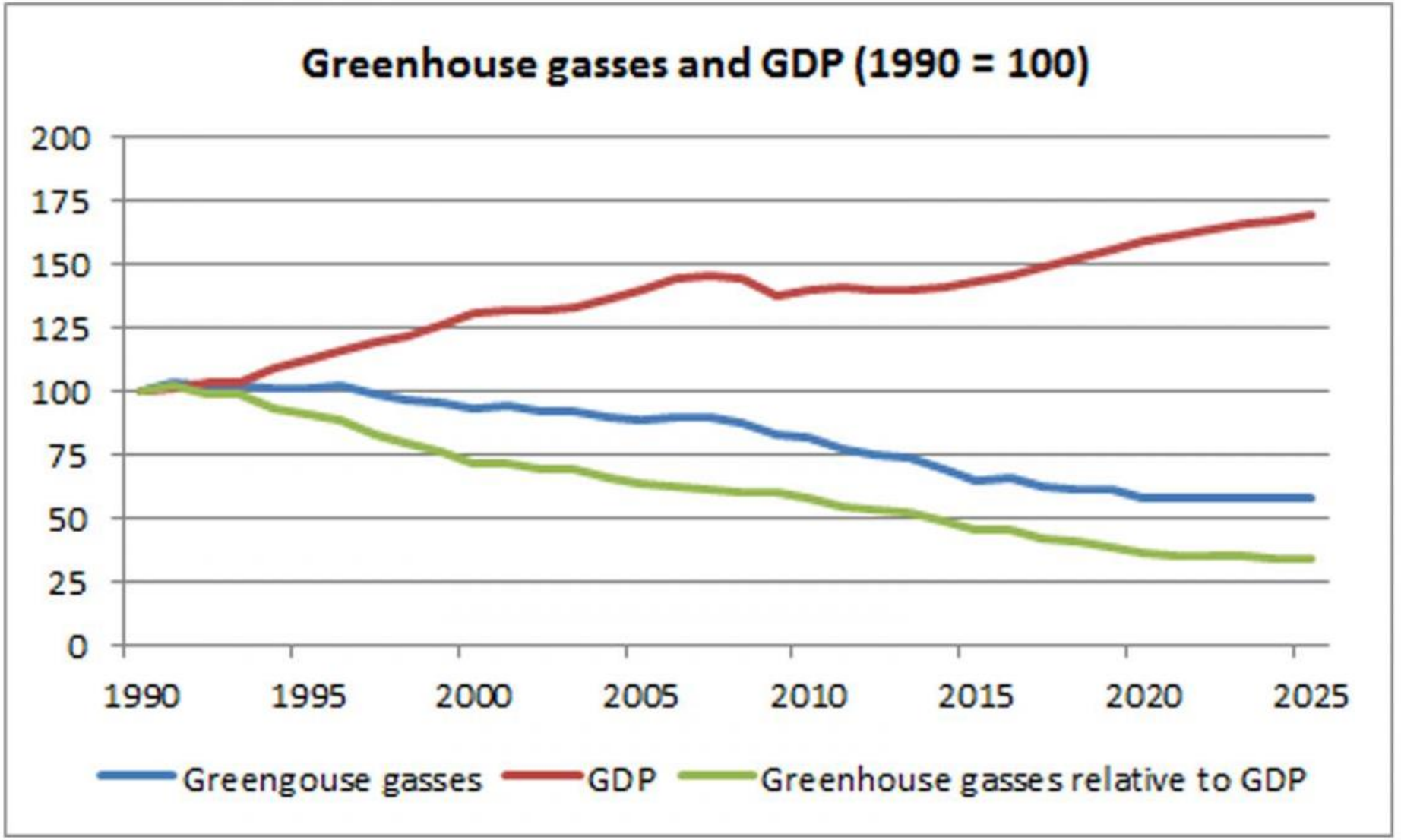
Constant energy consumption with increased GDP



Source: Energy Policy in Denmark, DEA, 2023

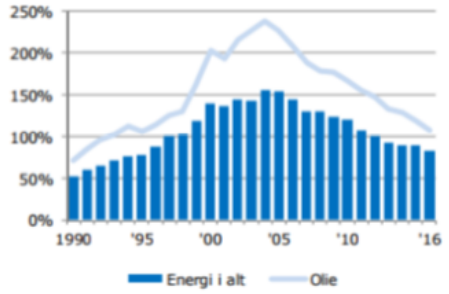
Export and self supply

reINVEST

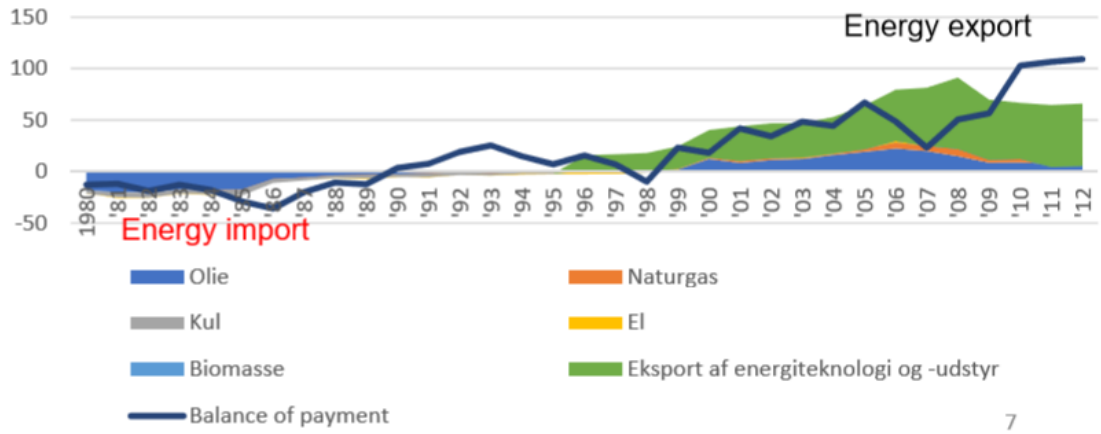
The results of 40 years of energy planning in Denmark

- A cost-effective energy system
- A positive effect on the balance of payment
- Jobs and new companies
- A high security of supply (so far)

Self supply rate



Energy import/export & balance of payment billion DKK



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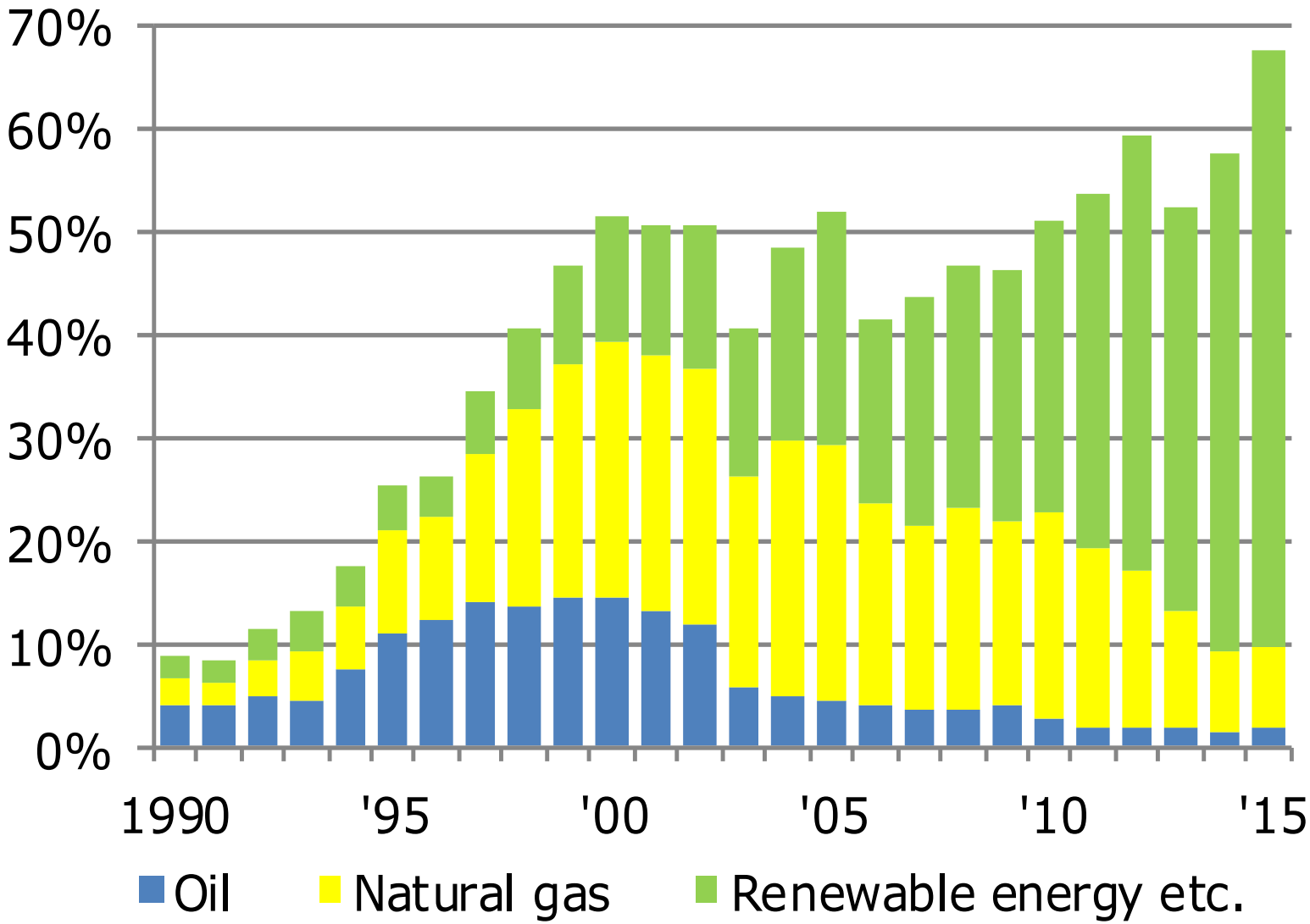
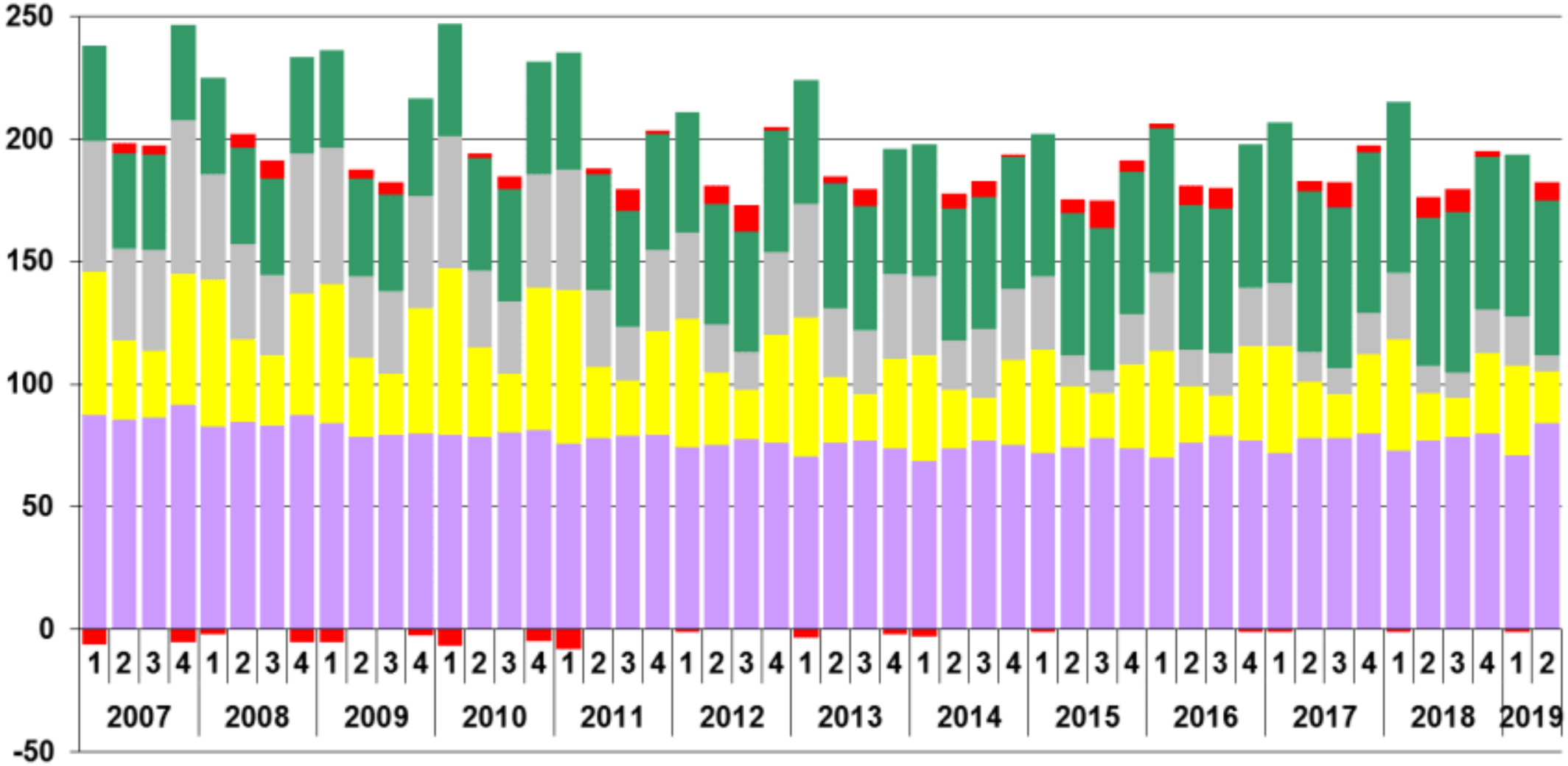
Other fuels than coal for electricity production



Source: Energy Statistics Denmark, DEA, 2015

The Danish Energy consumption



Danish Energy Agency

Oil Gaz Coal RE Electricity import

Olie Naturgas Kul og koks Vedvarende energi og affald Elimport, netto

Disposition

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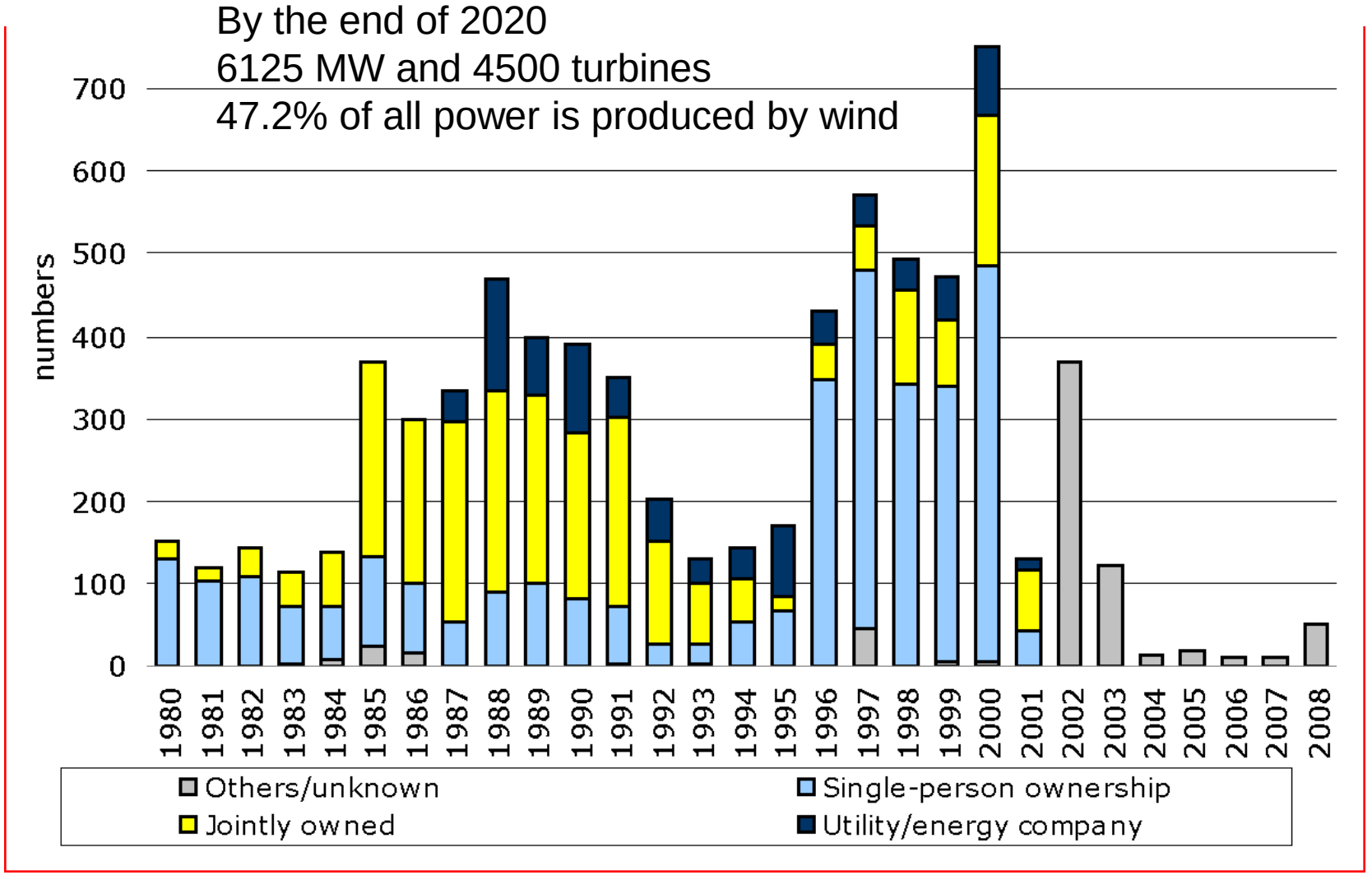
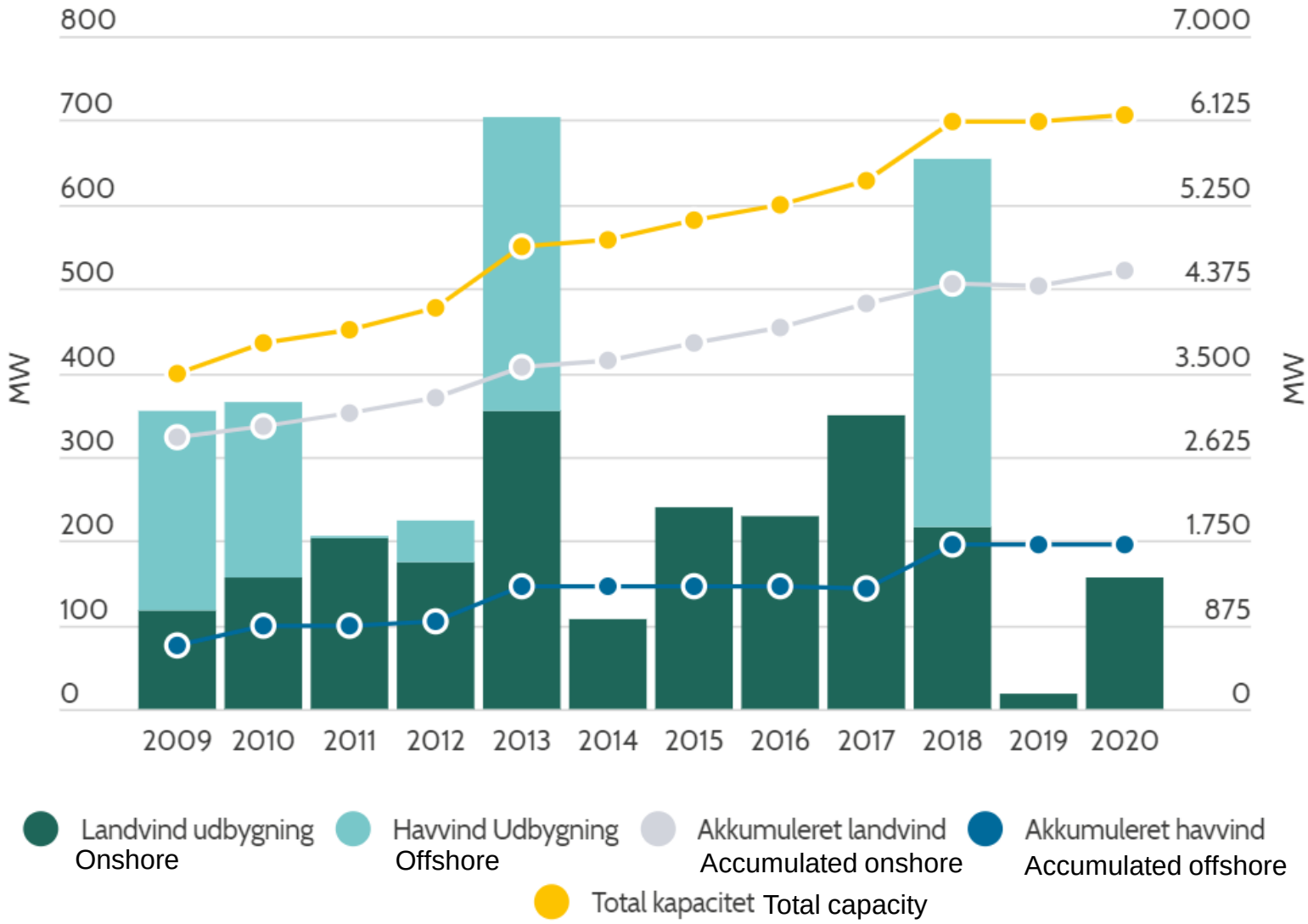
Wind energy to 2008

- The tradition for wind development in Denmark from 1980 to 2000: Local people took the initiative
- Utilities build only what government asked them to build
- In Copenhagen we joint with the local utility (political pressure and practical reasons)

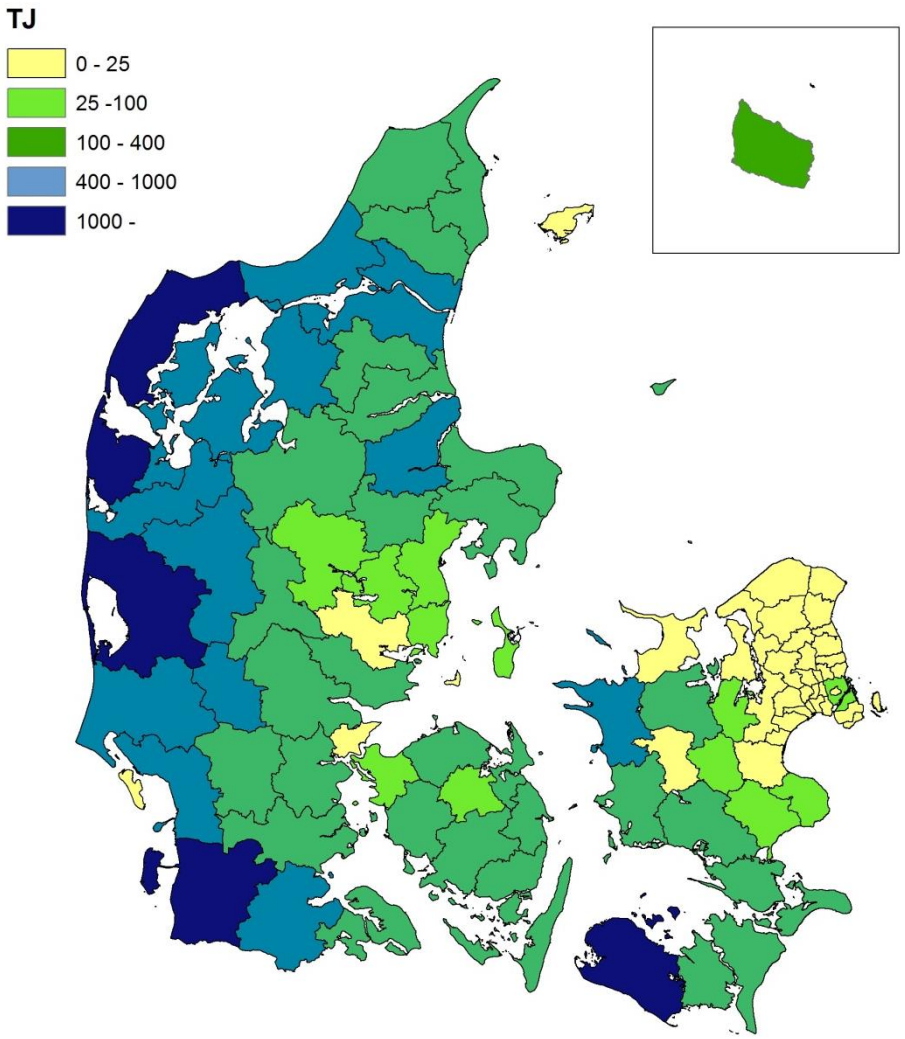


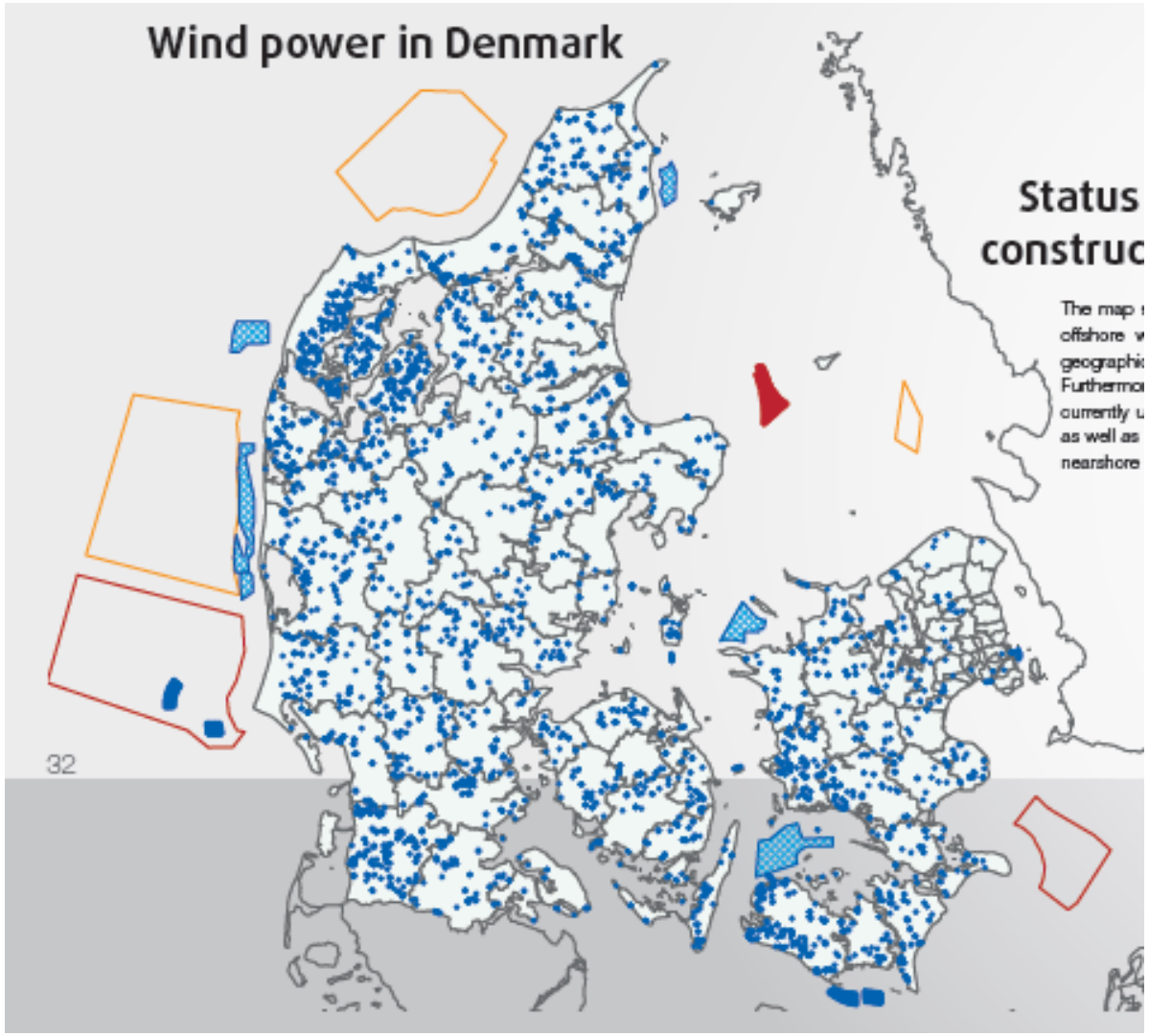
The wind turbines in Denmark 2020



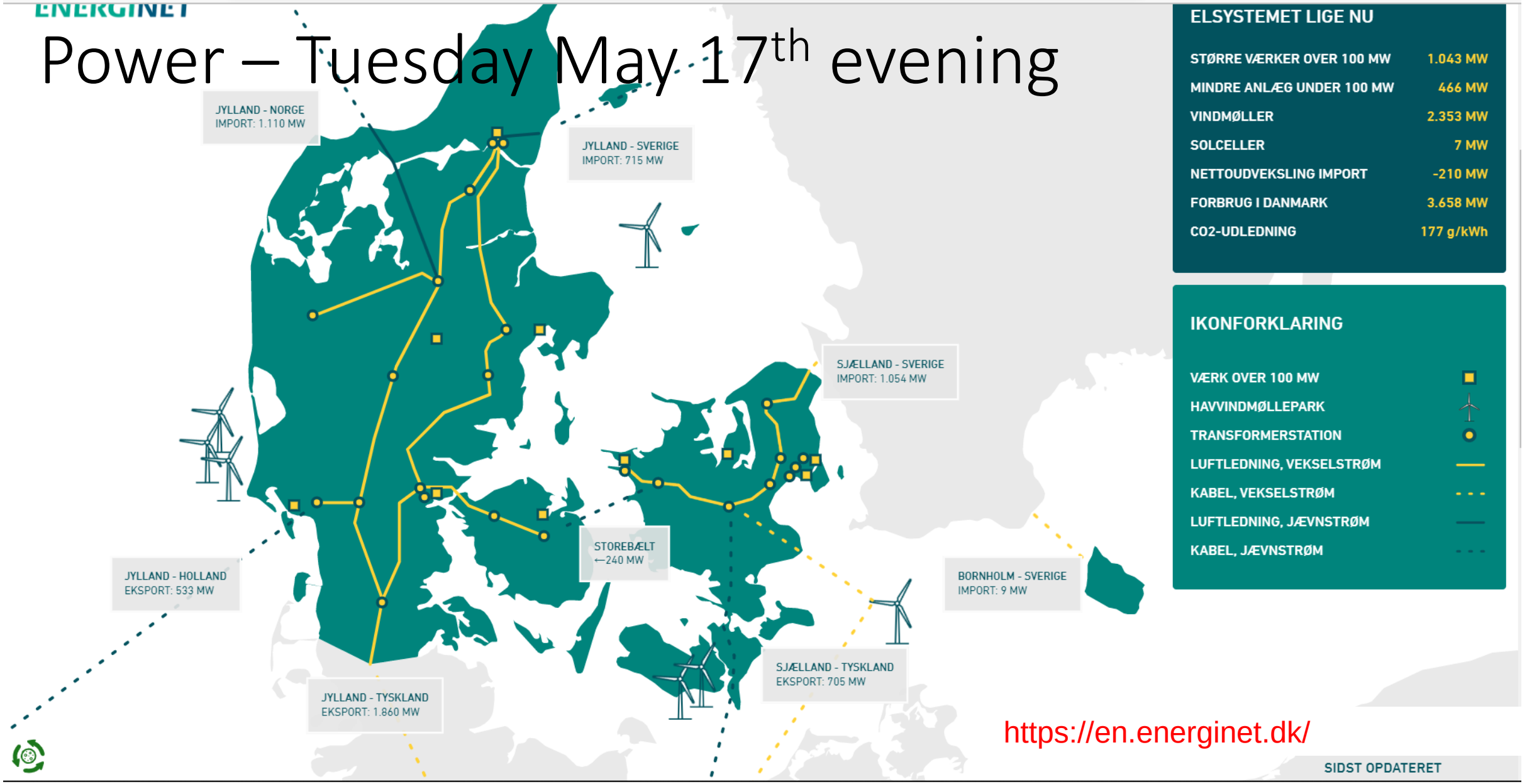
Source:
www.winddenmark.dk

Wind power – Municipalities - offshore





Power – Tuesday May 17th evening



https://en.energinet.dk/

From 5% wind to 100%

- **Separation of distribution from production**
- **Local distribution in the earth**
- **Reinforcement of key components like transformers at key points**
- **Improved wind turbines from 2003 with opportunities for supporting the grid quality**
- **Strengthening of export cables**
- **One more 400kV line in the west**
- **Synchronous capacitor**

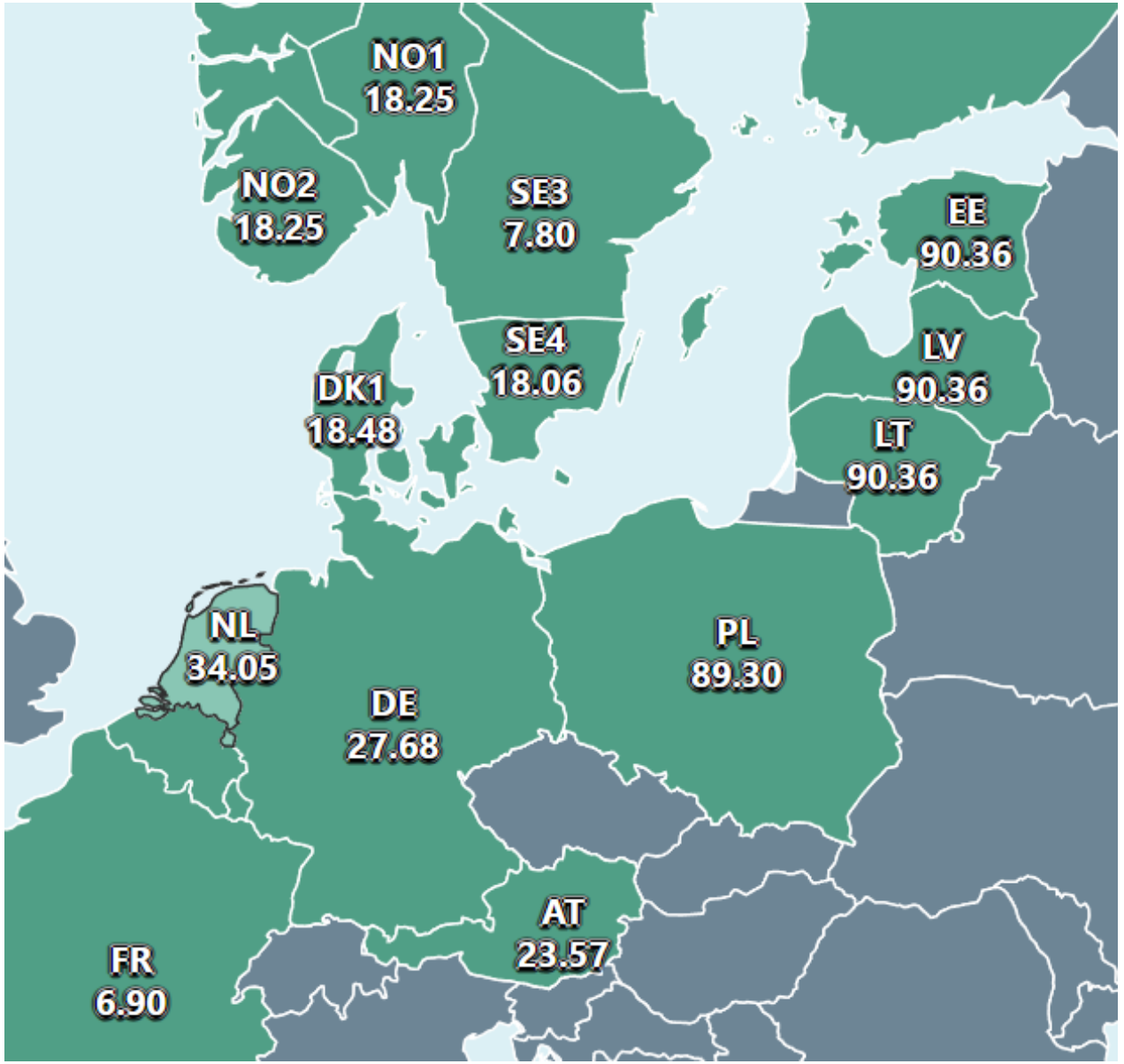
By that:

- **No Market contracts 2018**
- **Reduced expenses for stabilizing the grid from 255 M DKK to 67 M DKK**

OMKOSTNINGER TIL SYSTEMBÆRENDE EGENSKABER

Mio. kr.	2014	2015	2016	2017
Planlagt				
• Markedskontrakter	164	171	18	2
• Beordret efter Elforsyningsloven	0	0	30	8
Ikke-planlagt				
• Beordret efter Elforsyningsloven	54	6	0	0
Omkostninger til egne synkronkompen-satorer[1]:	38	54	54	57
Samlede omkostnin-ger til systembærende egenskaber	255	231	102	67

Reference: energinet.dk : REDEGØRELSE FOR ELFORSYNINGSSIKKERHED 2018



14. Maj 2024

ENERGI UDVEKSLING

JYLLAND - NORGE	EKSPORT: 98 MW
JYLLAND - SVERIGE	IMPORT: 615 MW
JYLLAND - ENGLAND	EKSPORT: 1.456 MW
JYLLAND - HOLLAND	EKSPORT: 700 MW
JYLLAND - TYSKLAND	IMPORT: 421 MW
STOREBÆLT	-> 180 MW
SJÆLLAND - SVERIGE	IMPORT: 447 MW
SJÆLLAND - TYSKLAND	EKSPORT: 682 MW
BORNHOLM - SVERIGE	EKSPORT: 0 MW

ELSYSTEMET LIGE NU

STØRRE VÆRKER OVER 100 MW	25 MW
MINDRE ANLÆG UNDER 100 MW	286 MW
VINDMØLLER	4.557 MW
SOLCELLER	978 MW
FORBRUG I DK	4.394 MW
NETTOUDVEKSLING IMPORT	-1.452 MW
CO2-UDLEDNING	18 g/kWh

The RE-law from 2018

- Bidding procedure for lowest incentive onshore wind and PV with limited incentives available
- Offshore wind following the Action Plan; i.e. one project after the other based on Government decision

Men sådan gik det ikke, for prisen blev så lav på vind og PV så ingen bruger tilskuddene

Disposition

- Danish energy plans 1976-2050
- Danish wind energy spring til hvordan dannes prisen på el?
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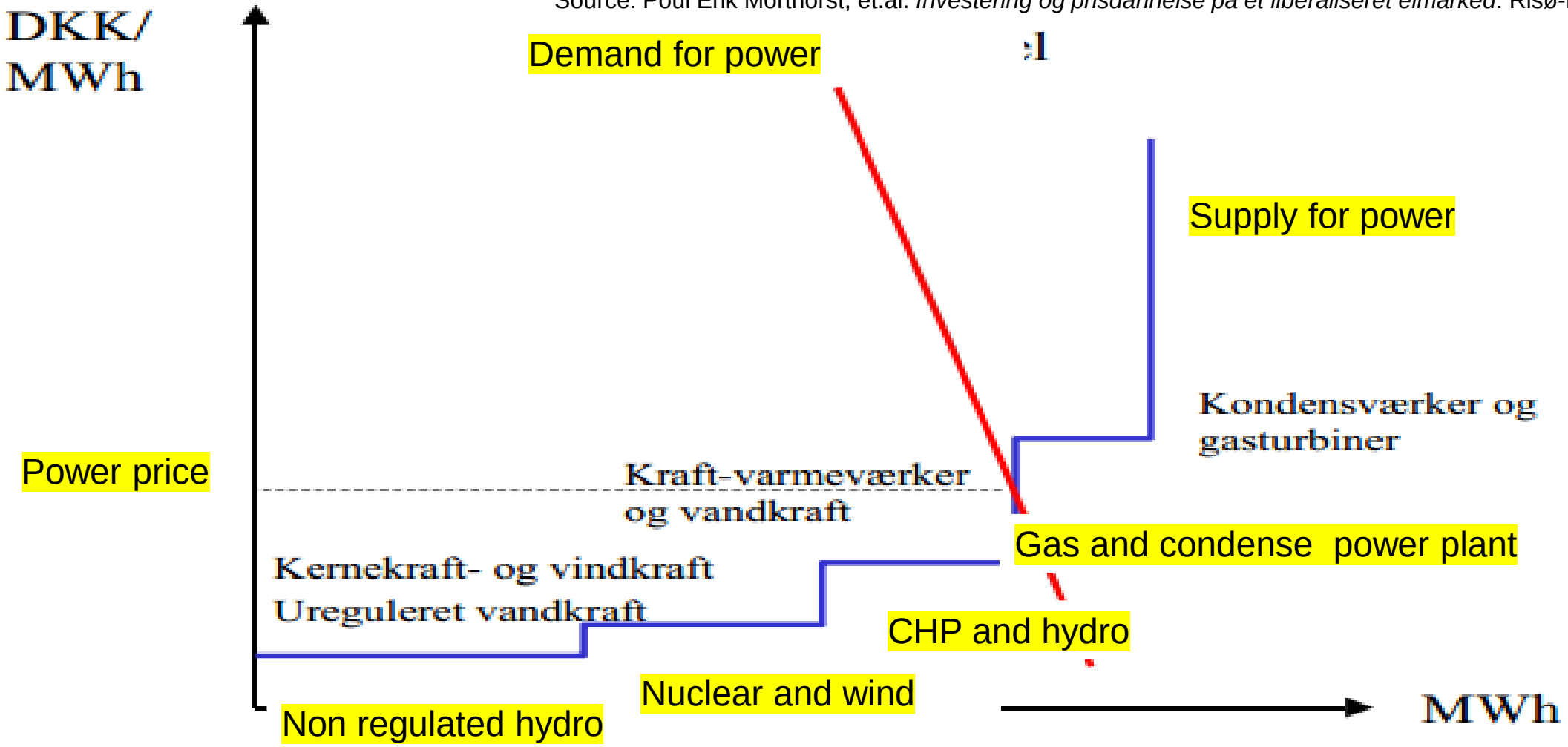
Free market for electricity

http://www.nordpoolspot.com/

Figure 7: Bid/Offer from one player for the hour 1pm – 2pm of tomorrow.

Price on the free market

Source: Poul Erik Morthorst, et.al. *Investering og prisdannelse på et liberaliseret elmarked*: Risø-R-1519(DA)

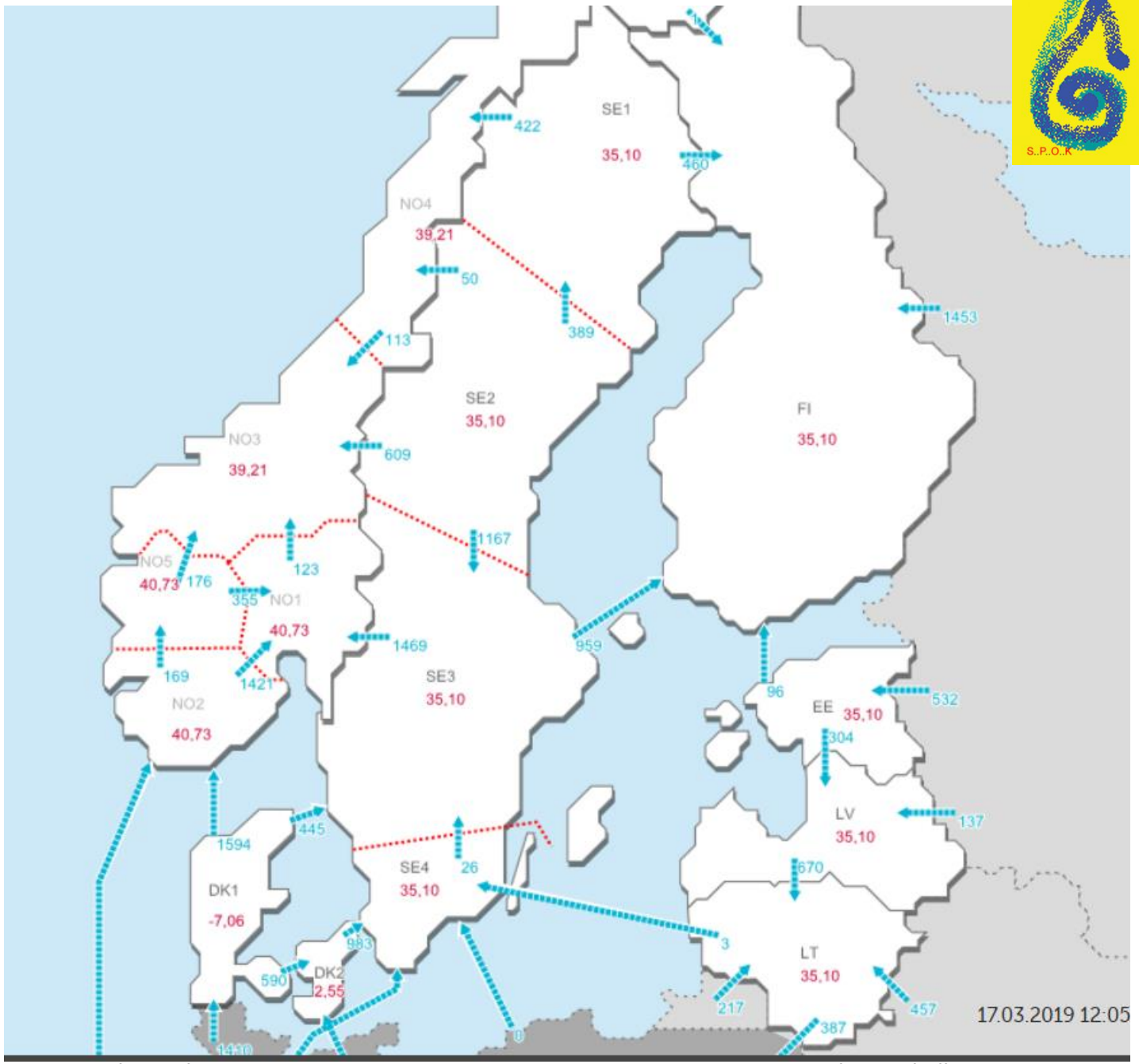


The Nordic power

Direction of flow

€32,90 Price per MWh

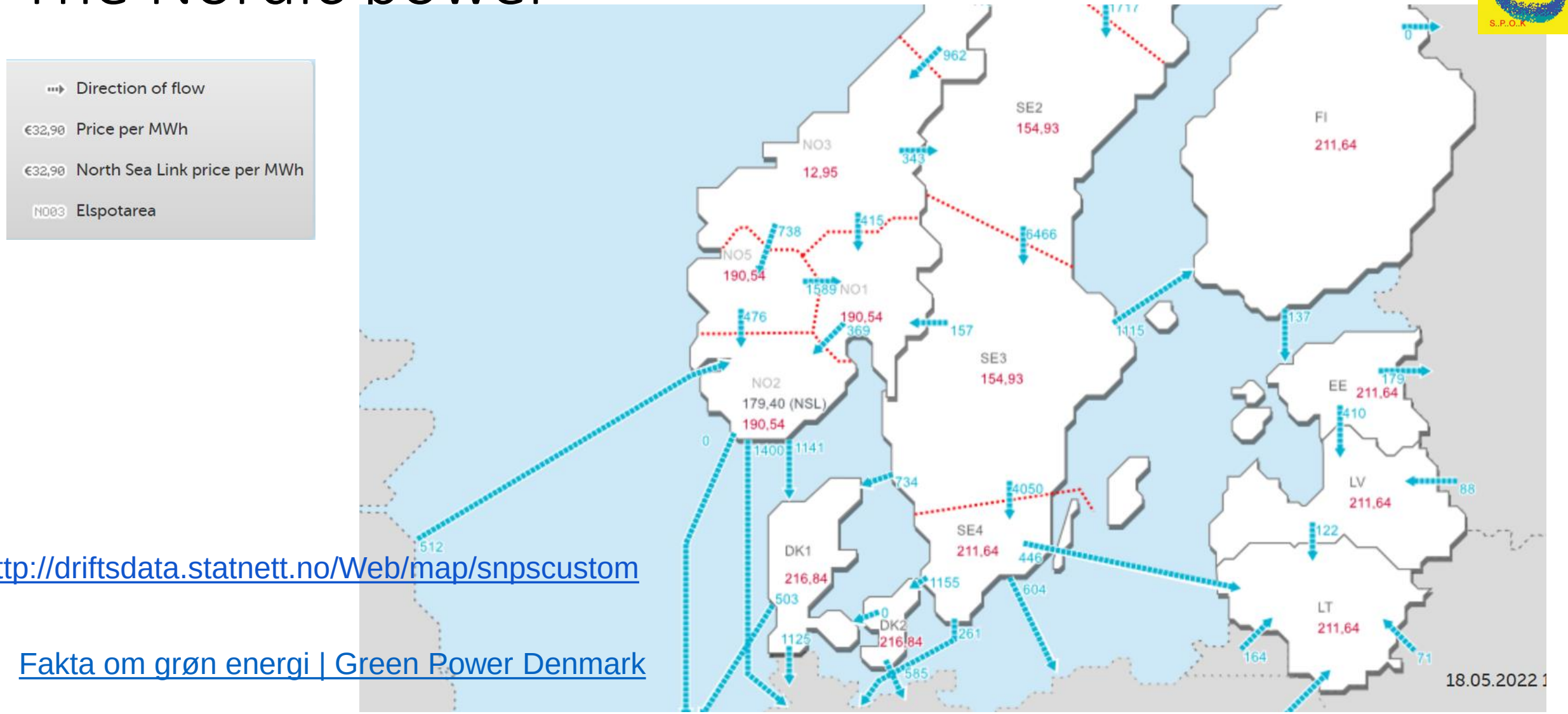
NO03 Elspotarea



http://driftsdata.statnett.no/Web/map/snpscustom

Fakta om grøn energi | Green Power Denmark

The Nordic power



http://driftsdata.statnett.no/Web/map/snpscustom

Fakta om grøn energi | Green Power Denmark

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Offshore wind in Denmark – up to 2030

Two models:

Government Call for Tender

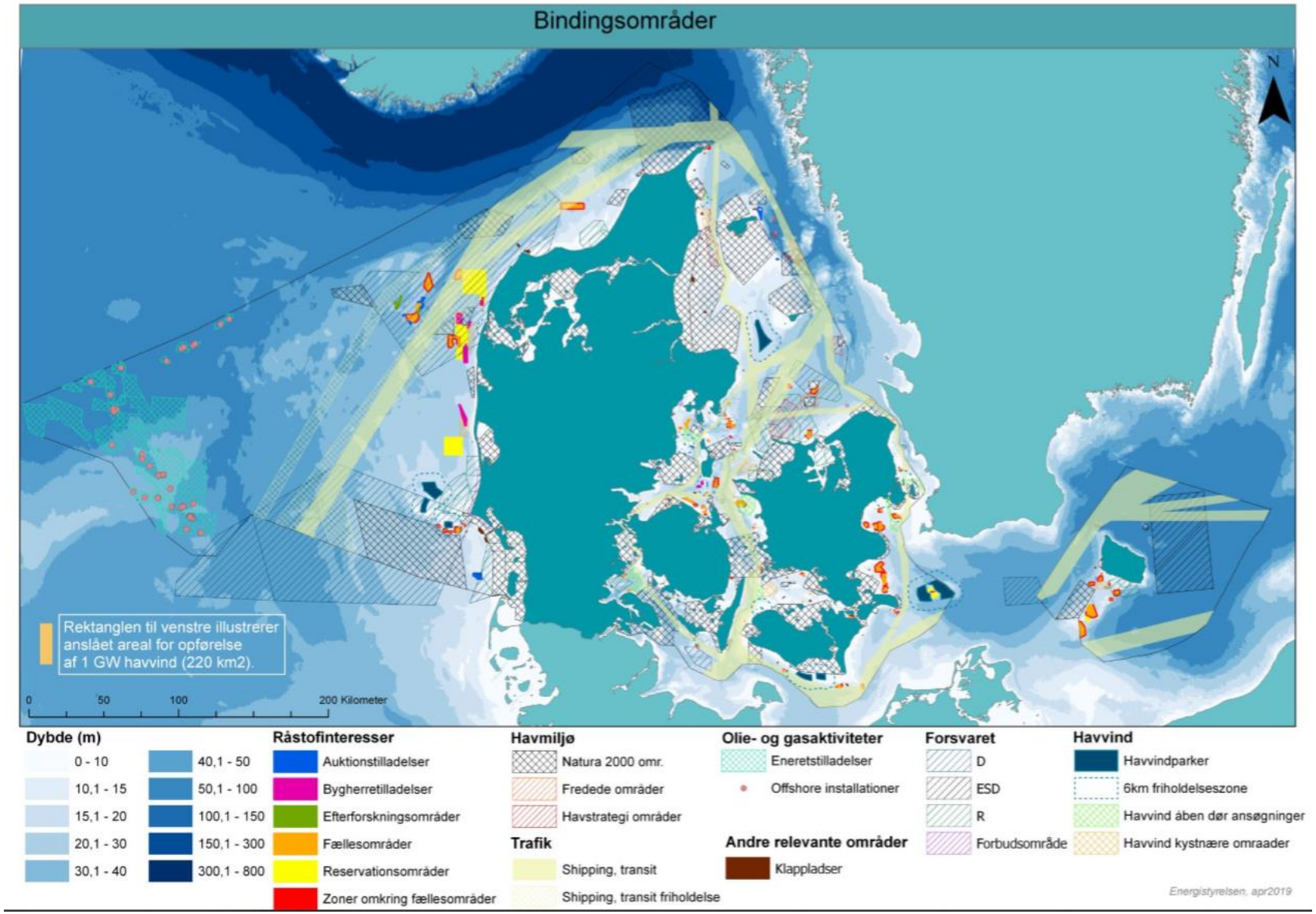
- ✓ 350 MW Nearshore almost ready
- ✓ Thor 1200 MW by 2024 in the North Sea ongoing
- ✓ Hesselø 1200 MW by 2027 in Kattegat just starting up

Open Door Procedure*

- ✓ Several proposals under discussion
- ✓ Like: 65 GW EU offshore wind by 2030 (today 25)

* Without incentives

The potential in Denmark is large as there is space enough

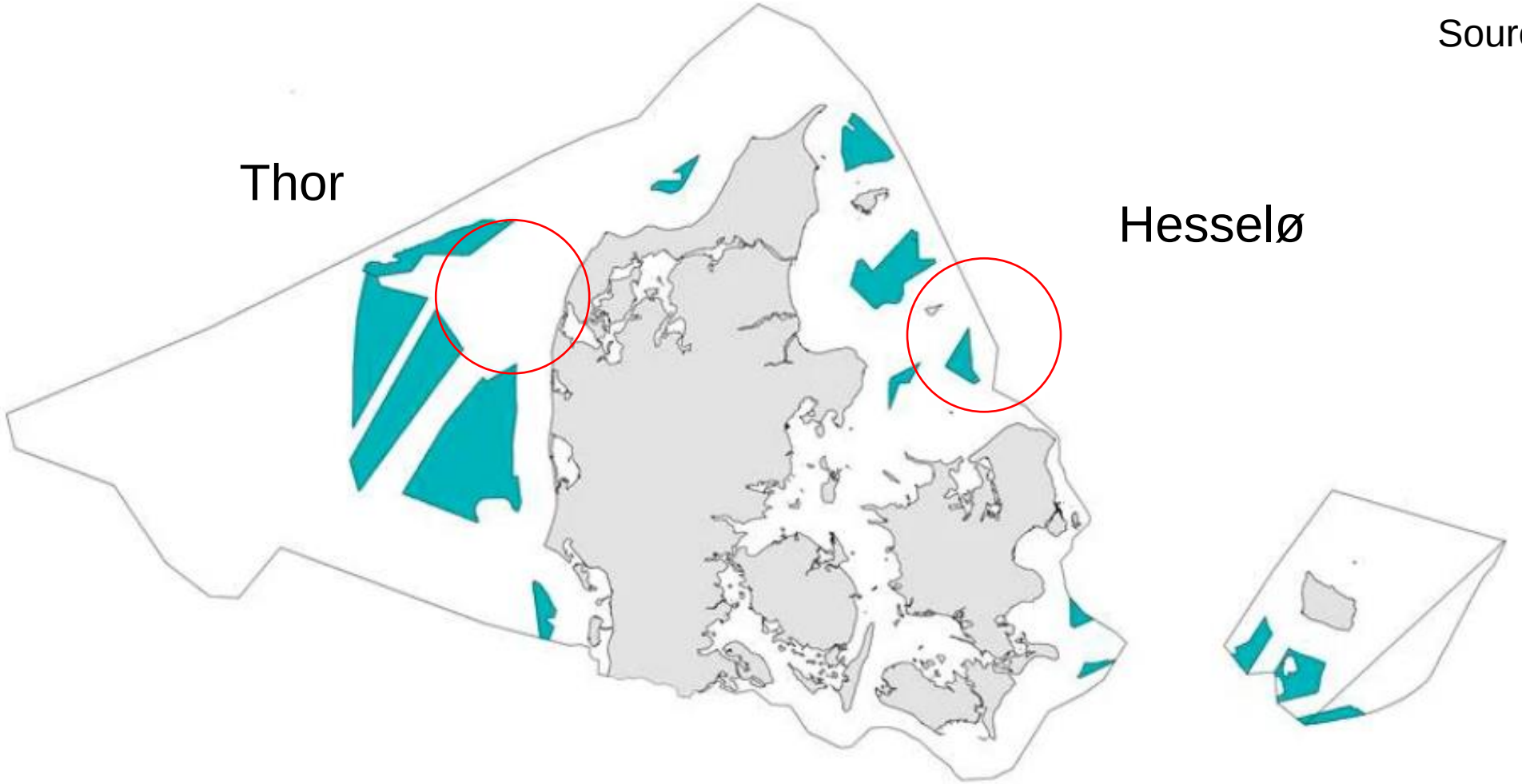


Source: ENS

By end of 2020 we have 25 GW offshore wind power in the Europe.

The Danish Potential for offshore wind is 12.4 GW

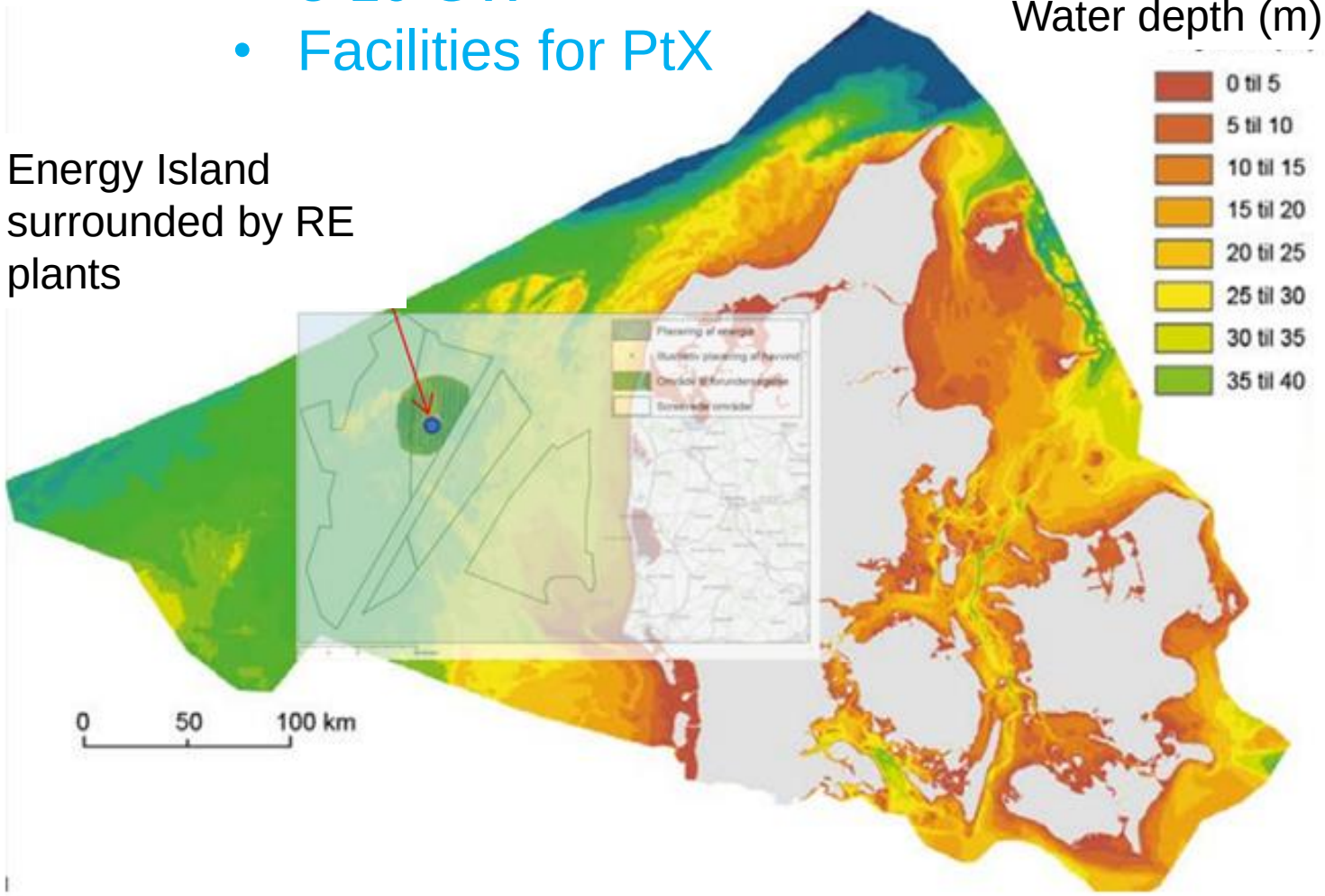
Source: ENS



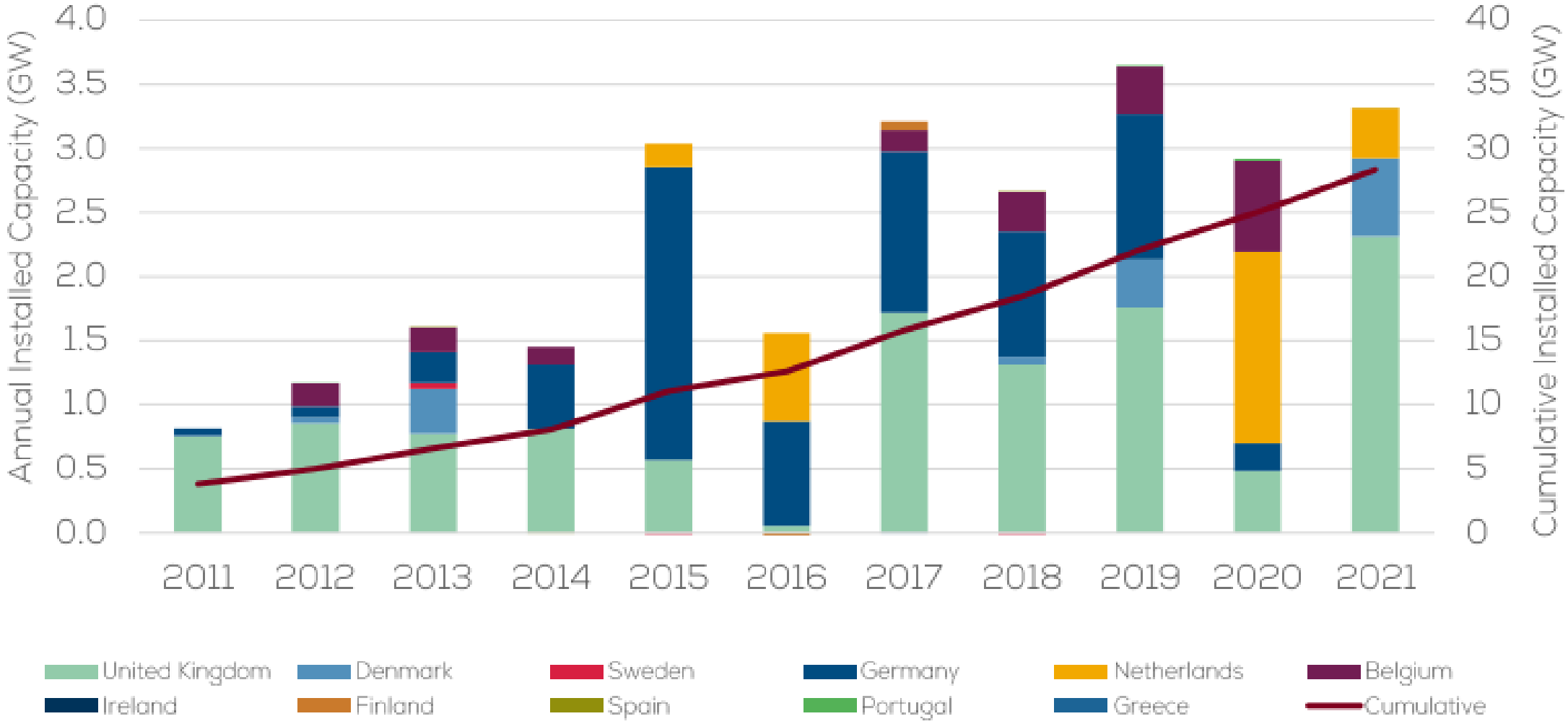
Energy island by 2030-33 in the North Sea

- 3-10 GW
- Facilities for PtX

Energy Island surrounded by RE plants

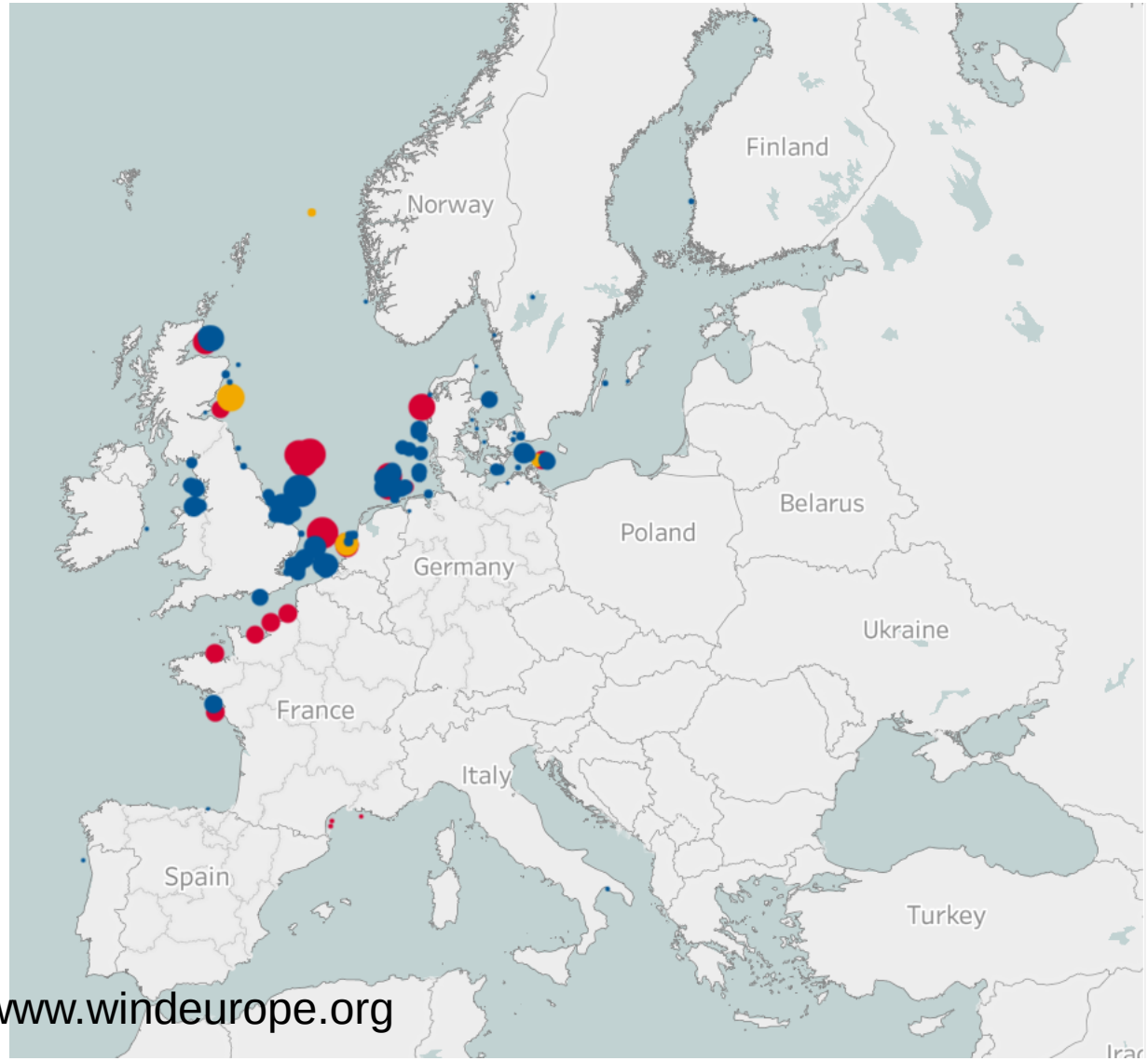


The offshore wind turbines in Europe 2010-2021



Source: www.windeurope.org

The offshore wind turbines in Europe August 2023



Online
Partially online
Under construction

Technology

(All)

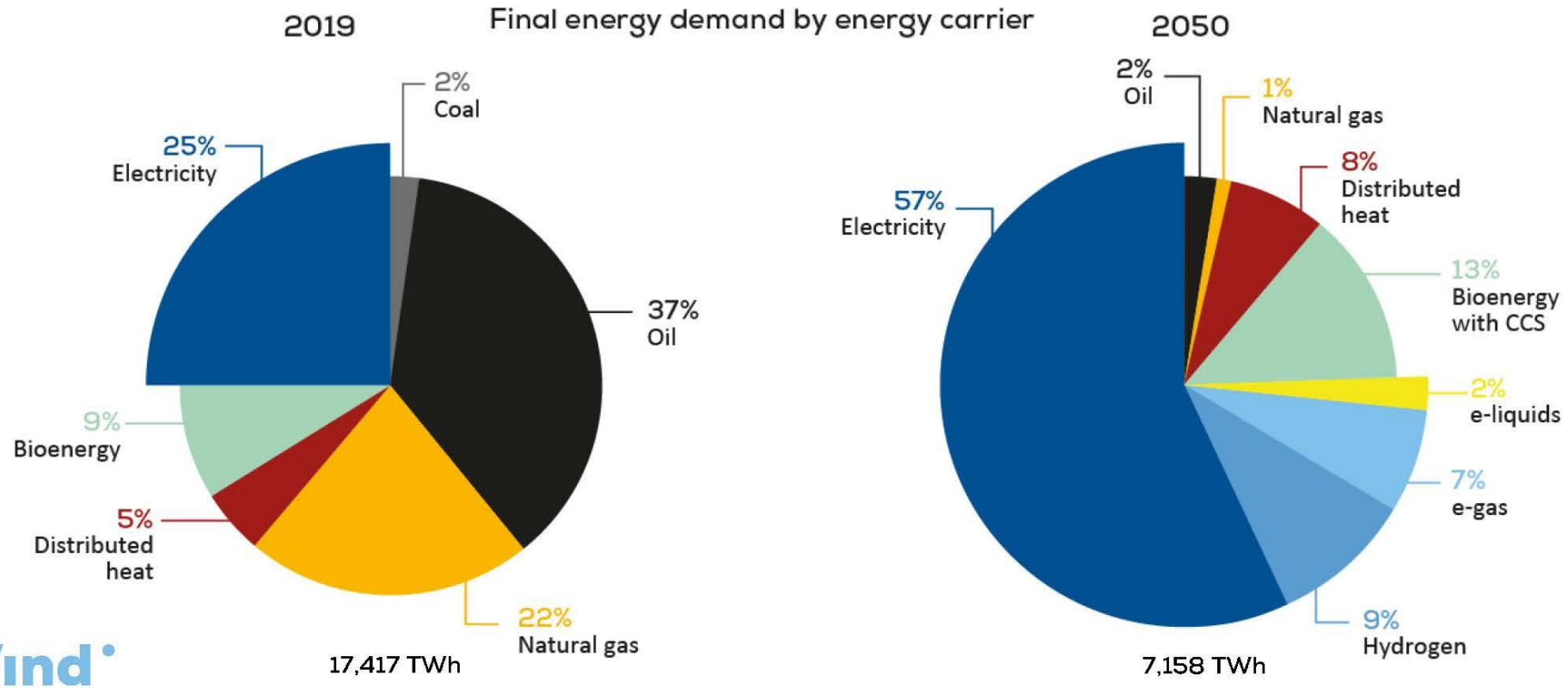
Country details

	MW connected	Turbines connected
UNITED KINGDOM	14,380	2,728
GERMANY	8,064	1,540
NETHERLANDS	3,449	553
DENMARK	2,308	631
BELGIUM	2,261	399
FRANCE	482	81
SWEDEN	192	80
NORWAY	101	13
FINLAND	71	19
ITALY	30	10
IRELAND	25	7
PORTUGAL	25	3
SPAIN	5	1

Source: www.windeurope.org

The role of wind energy in Europe by 2050

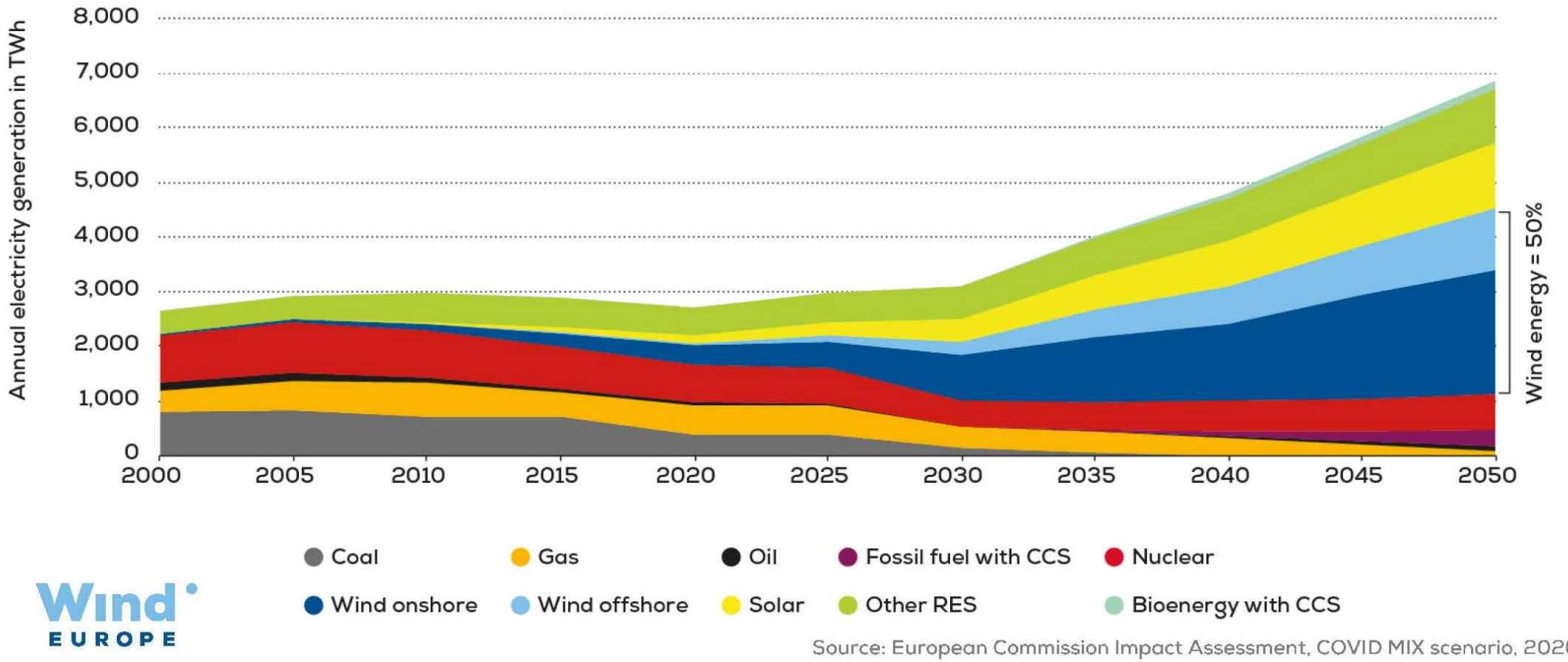
Direct and indirect electrification will meet 75% of energy demand by 2050



Source: www.windeurope.org

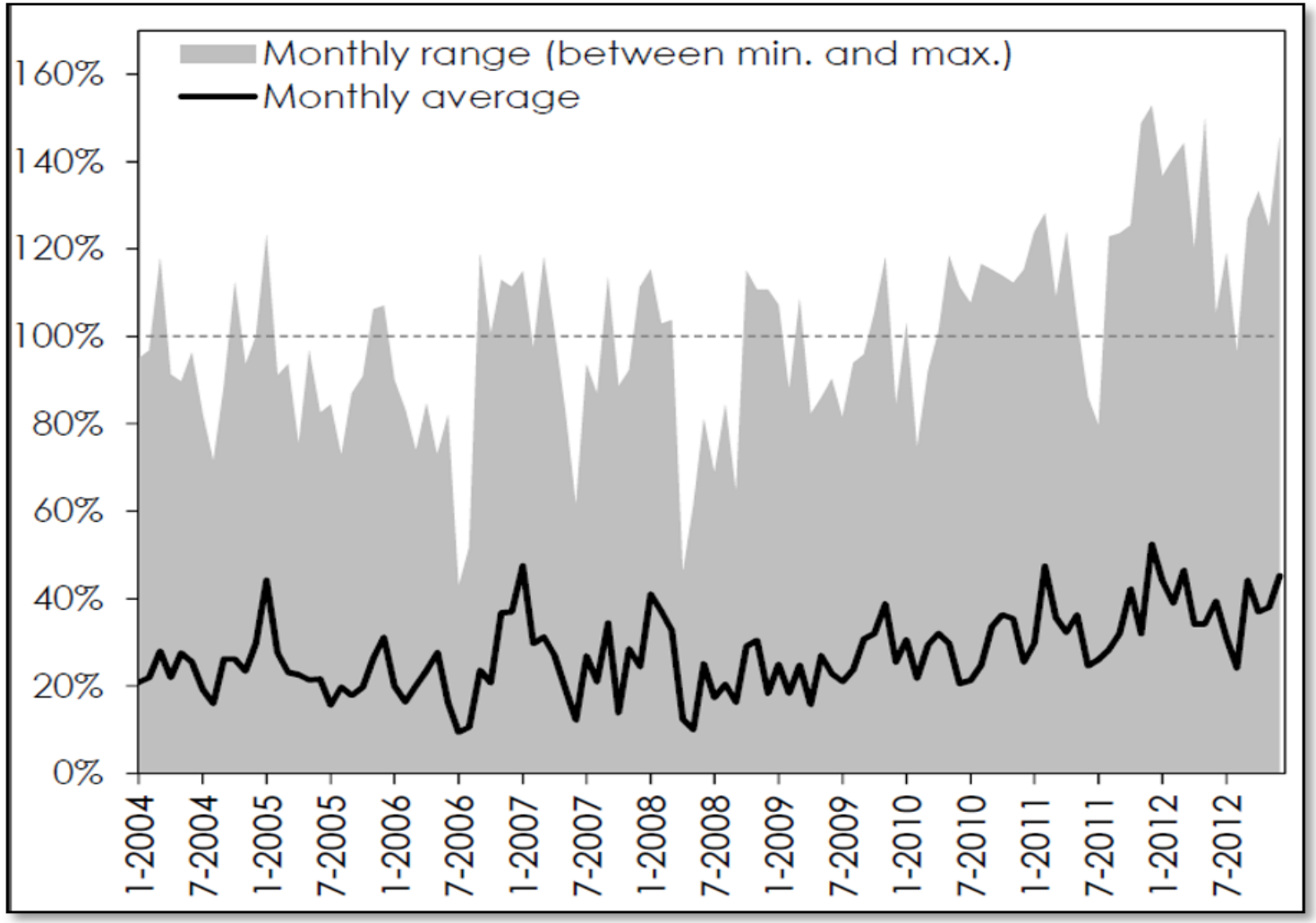
The role of wind energy in Europe by 2050

Demand for electricity will more than double by 2050 with wind energy meeting 50%



Source: European Commission Impact Assessment, COVID MIX scenario, 2020

Source: www.windeurope.org



23 December 2017: 1 hour with 139%

25 December 2017: 1 day with average of 109%

How to plan for 200-300% wind?

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Ocean Energy Potential

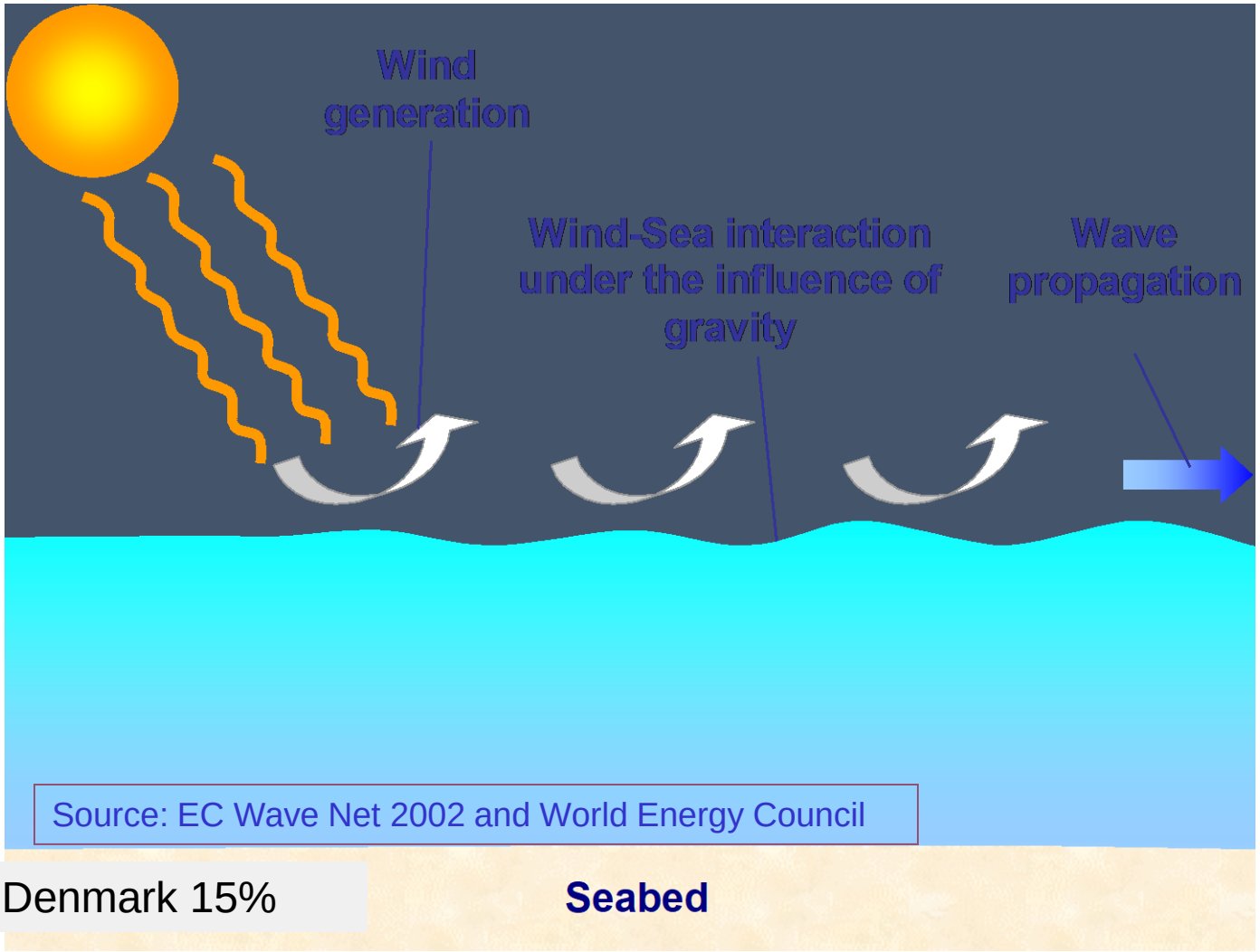
- The theoretical global resource is estimated to be in the order of:
  - 8,000 - 80,000 TWh/year for wave energy;
  - 800 TWh/year for tidal current energy;
  - 2,000 TWh/year for salinity gradient energy;
  - 10,000 TWh/year for ocean thermal energy
- No OE potential has been reported by IPCC up to 2008

Worlds electricity consumption 22,000 TWh/year

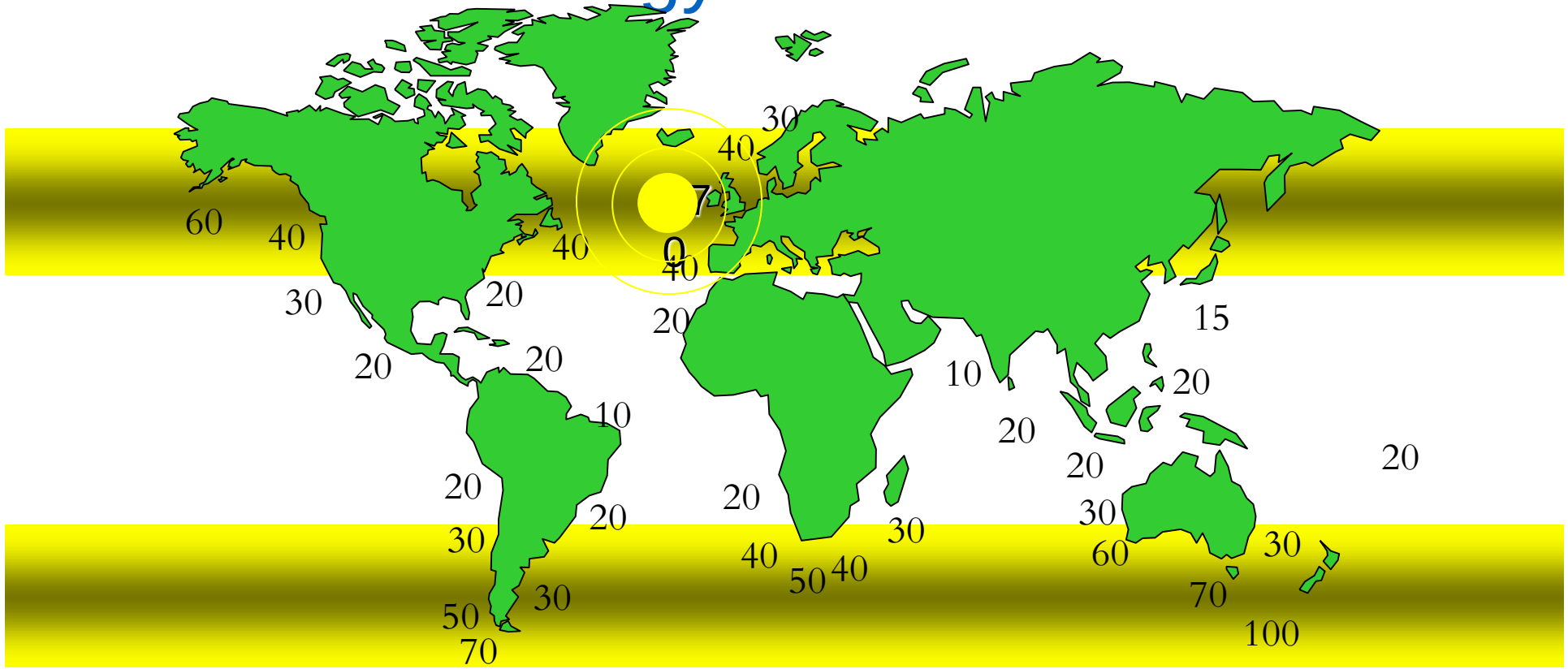
Source: EC SET plan, World Energy Council

The origin of Ocean Wave Energy

- Oceans cover 3/4 of earth's surface
- 0.1% ocean renewable energy is equivalent to 5 times world demand
- 50% of the Worlds electricity consumption can be covered by wave energy



Wave energy resource



- Annual average energy flux in MW per km of wave crest in the deep ocean

Waves are easy to forecast (6 days)

Sea states are very stable

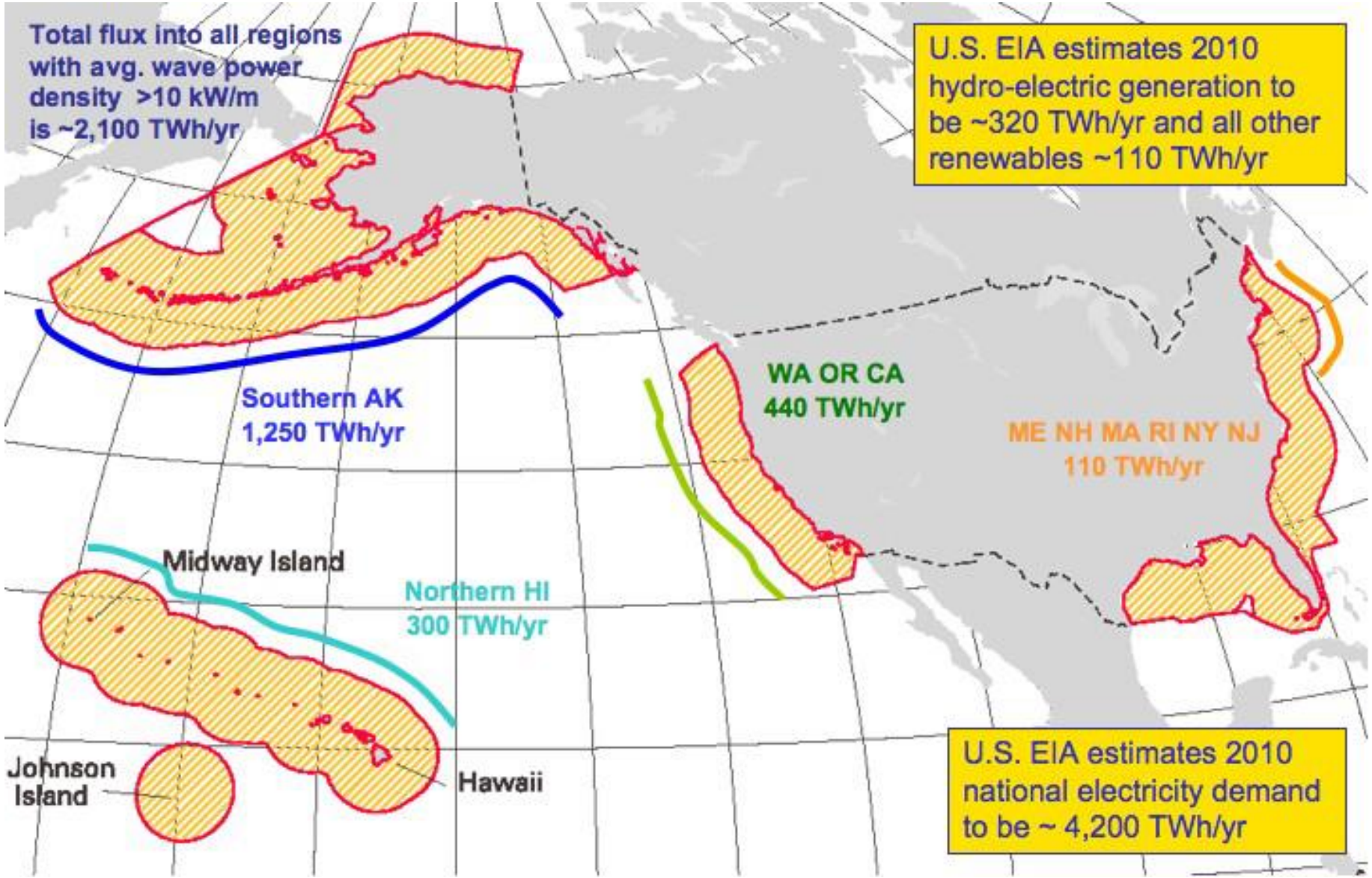
"Easy" integration in the electrical grid

High energy density per m^2

IPCC JAN 2008

Wave Energy Centre

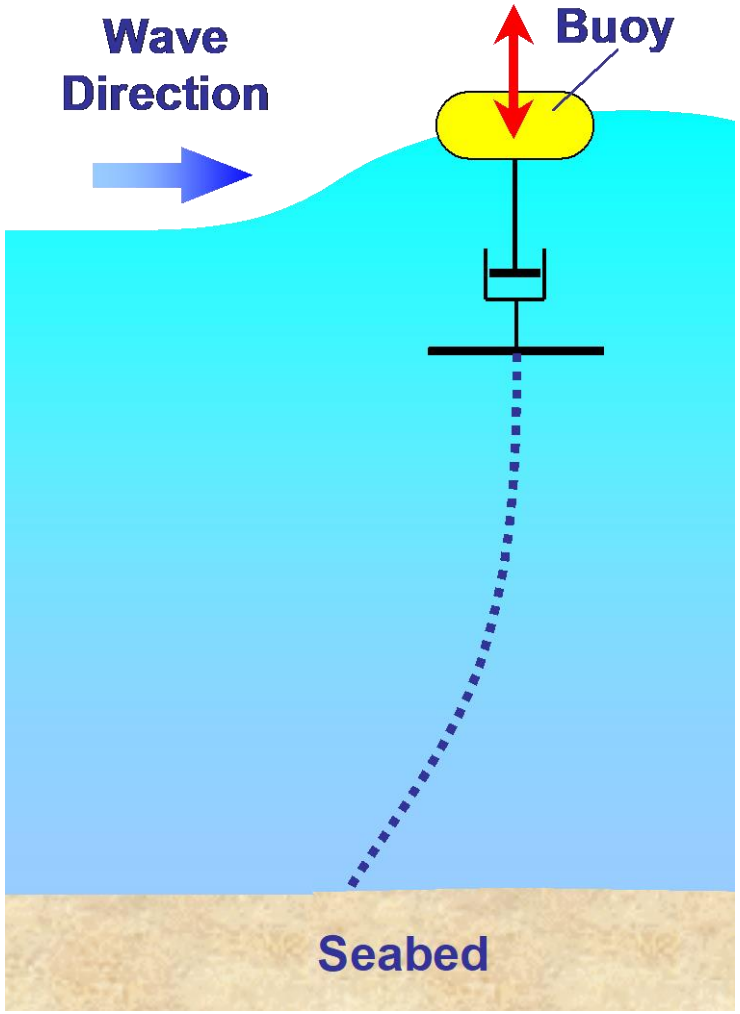
US potential



IPCC JAN 2008

Wave Energy Conversion Techniques

Heaving Devices



Rambøll, Denmark

1:10 tests in open sea, 1:4 scale model (2.5 m diameter)

OPT, USA, 2004

Teamwork Technology BV, The Netherlands

2 MW pilot plant deployed 2004 in Portugal

State of the Art - Large Scale Demo

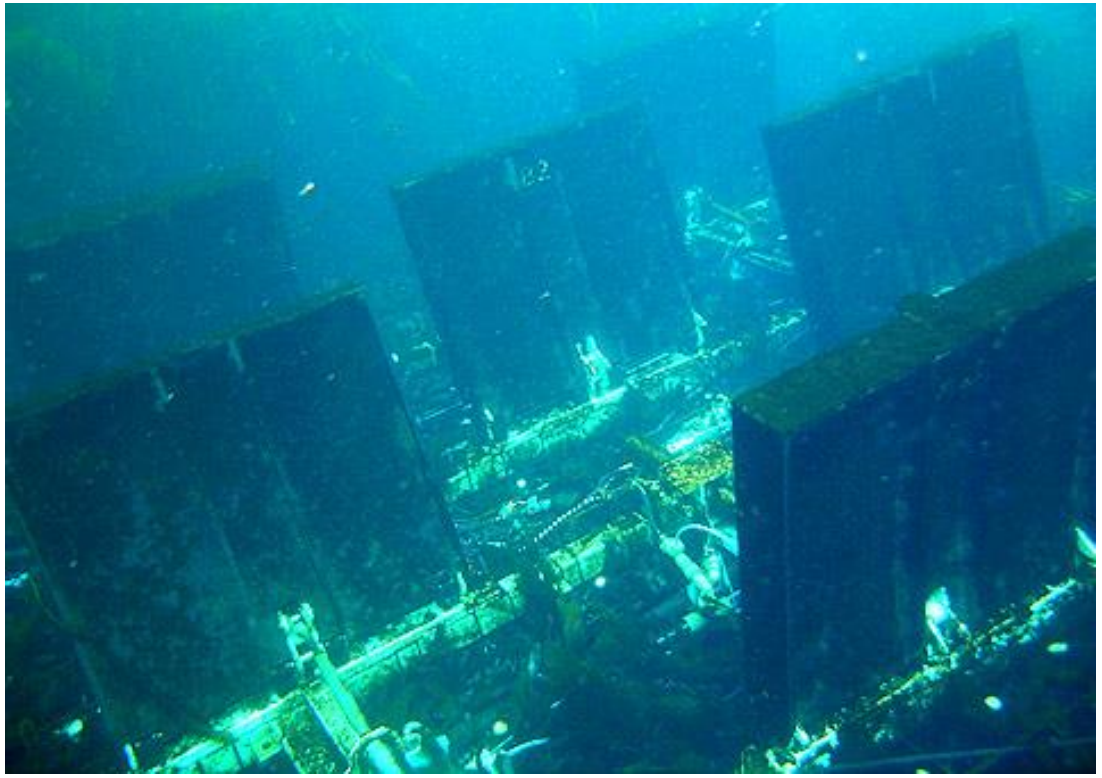
Power Buoy, USA
2005, 40kW

AquaBuoy, USA
2007, 200kW

Wavebob, Ireland
2006, 200kW

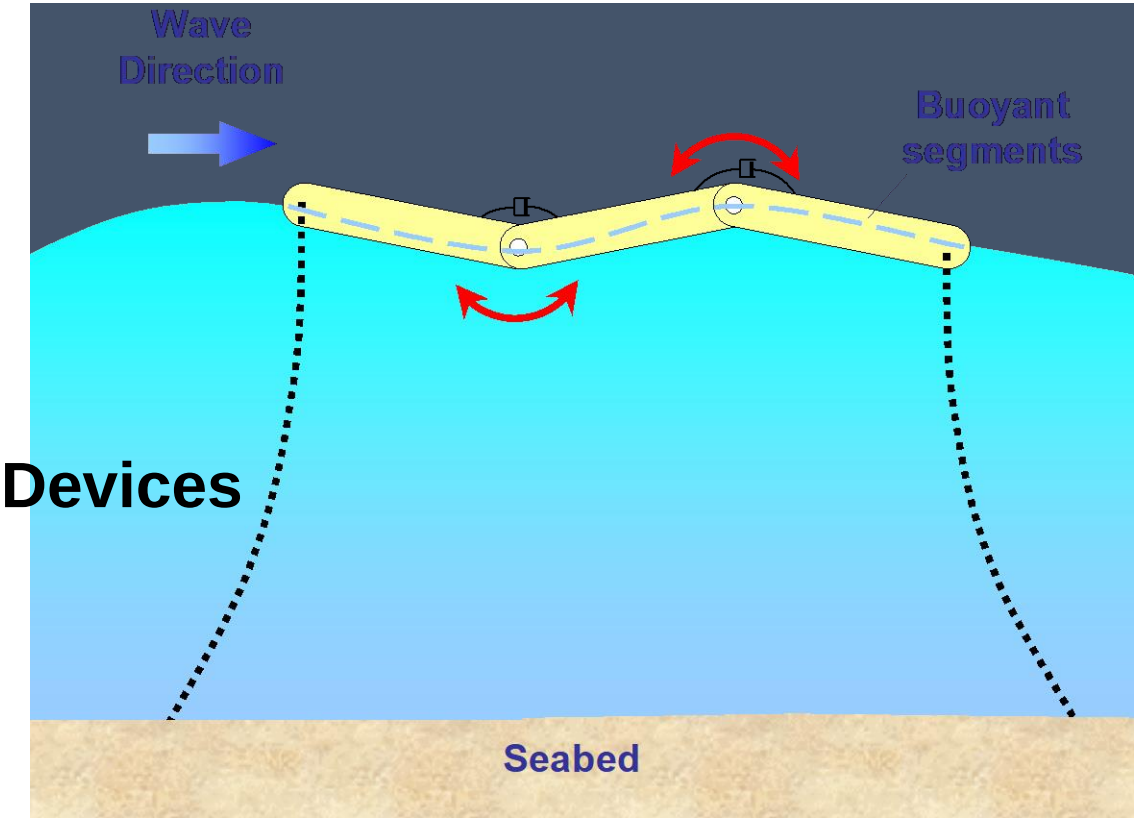
State of the Art - Large Scale Demo

Oyster, Orkney UK
2009, 500 kW ?



Wave Roller, Finland
2006, 13 kW
Demo Portugal 2015

Wave Energy Conversion Techniques



Pitching Devices

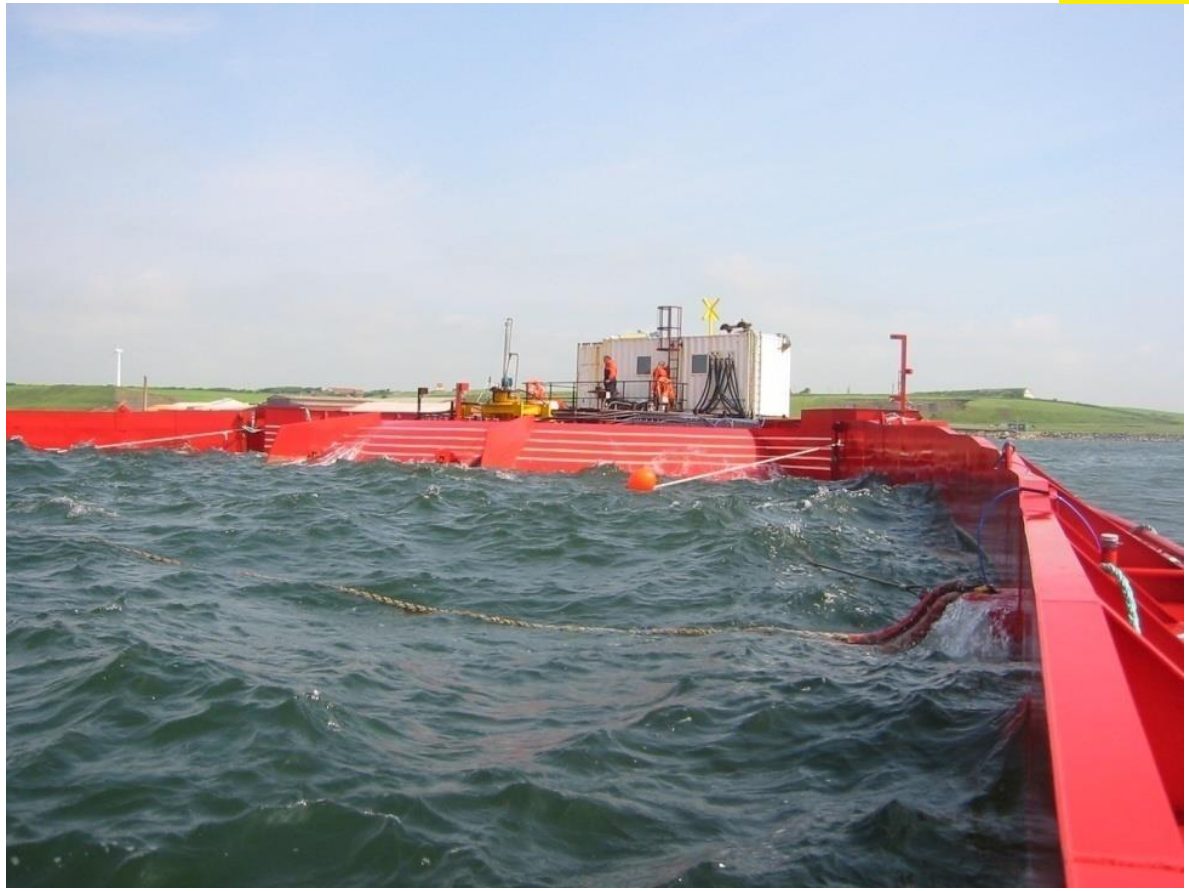
Pelamis, Ocean Power Delivery Ltd (OPD), Scotland

Tank tests in small scales (1:80, 1:35, 1:20)

Open sea tests 1:7 (2001), 1:1 (2004), 750 kW scheme

State of the Art - Large Scale Demo

AWS, Portugal
2001, 2MW



WaveDragon, Denmark
2003, 20kW

Where are we today – in Denmark?

- Wave Dragon
- Floating Power Plant
- Crestwing
- Weptos
- Wave Piston
- Resen Waves
- Leancon

FEB 2019

Several devices under small prototype testing

Conclusion: to reach a considerable capacity is a question of will/money!

Wave Dragon from test tank to real sea Part 1

Hans Christian Soerensen

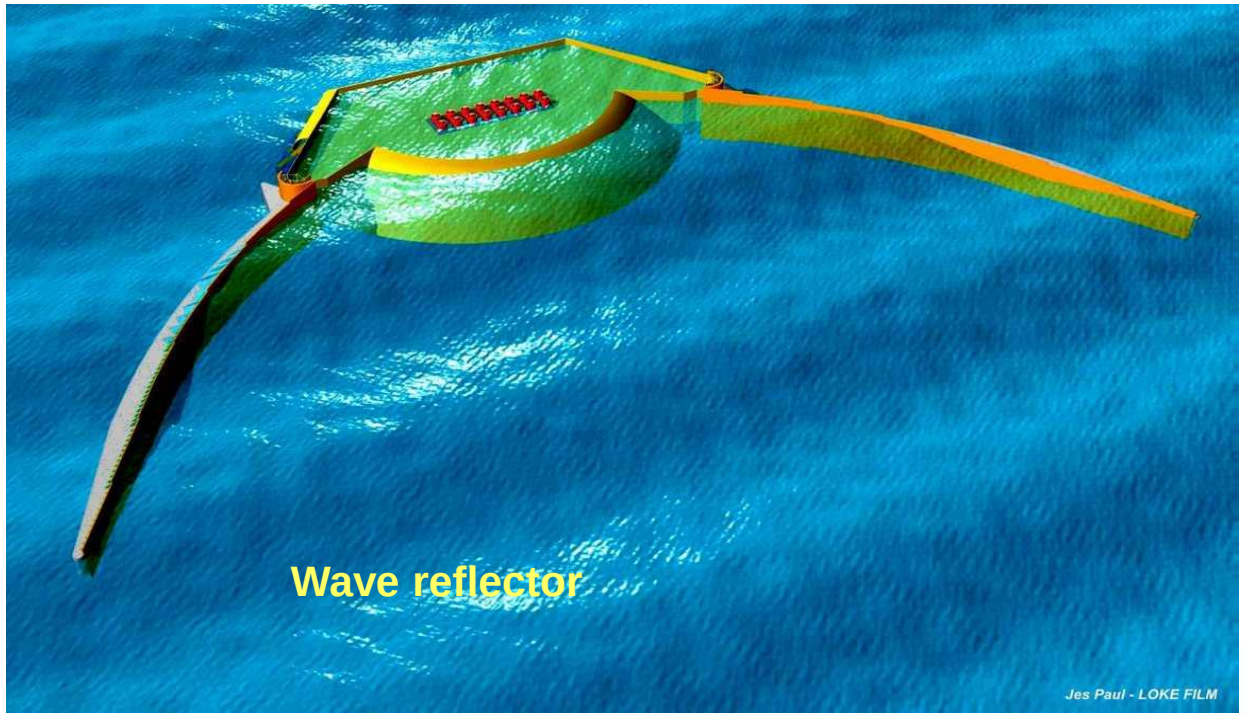
Erik Friis-Madsen (WD)

May 2022

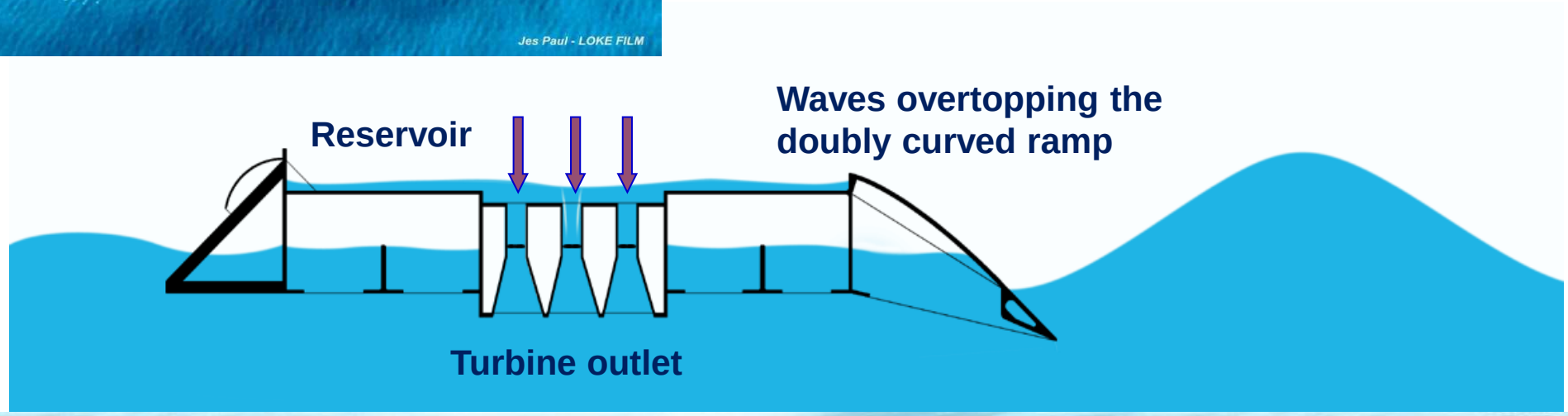
Wave Dragon

hcs@wavedragon.net #51

The *Wave Dragon* Principle



Wave climate - Power - Production		
12 kW/m	1.5 MW	4 GWh/y/unit
24 kW/m	4 MW	12 GWh/y/unit
36 kW/m	7 MW	20 GWh/y/unit
48 kW/m	12 MW	35 GWh/y/unit



The *Wave Dragon* Technology

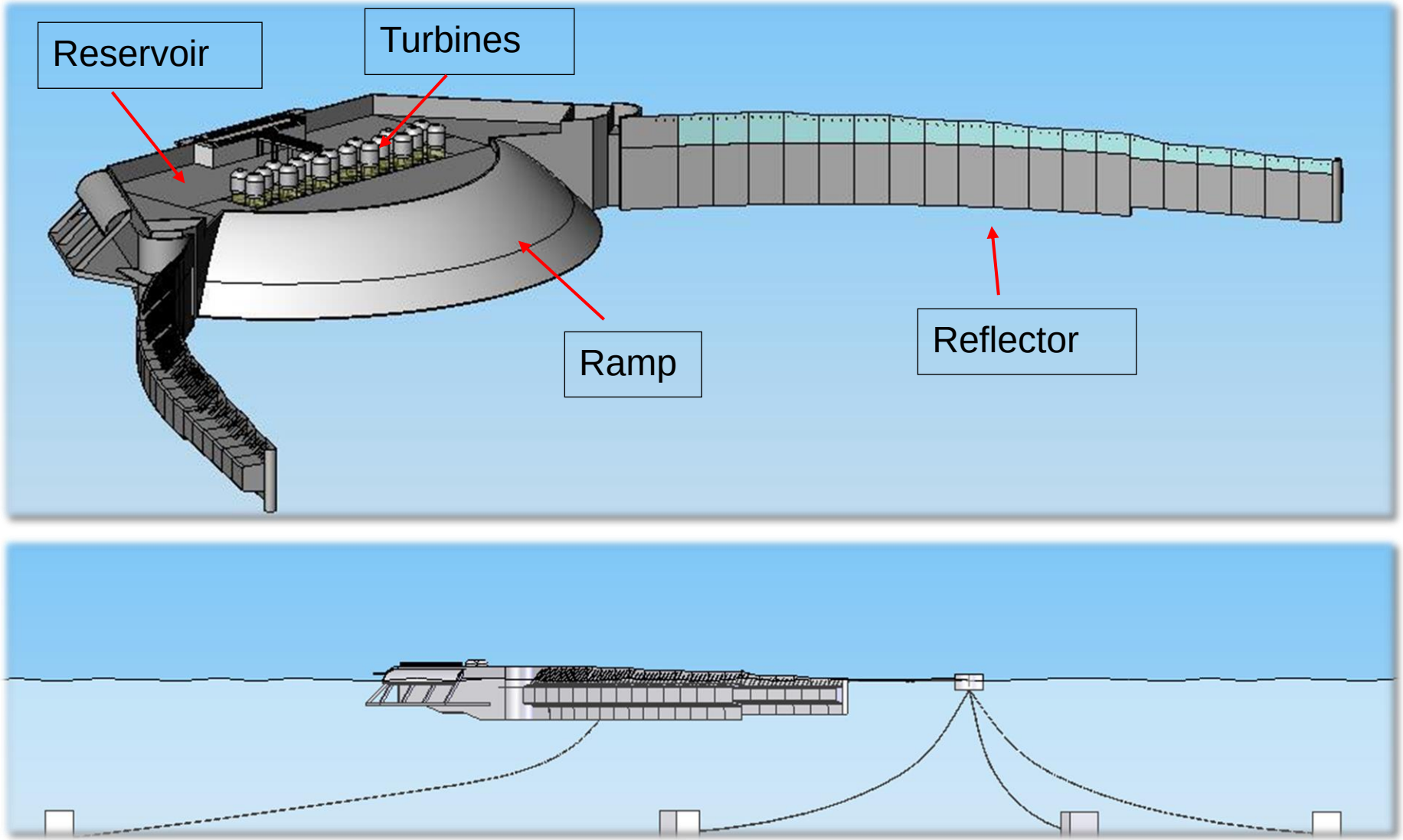
Floating Barge

+

River Hydro Power Station

=

Wave Dragon



The *Wave Dragon* Designs

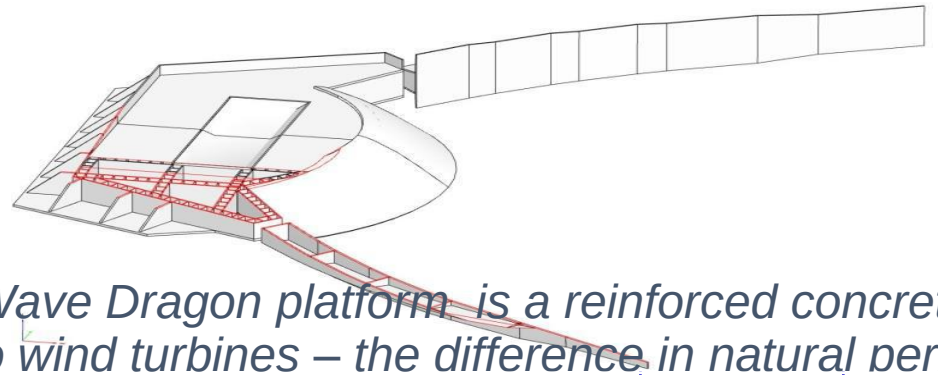
57 m wide 200 tonnes Wave Dragon prototype with 7 turbines deployed and connected to the grid in 2003 as Worlds first floating WEC

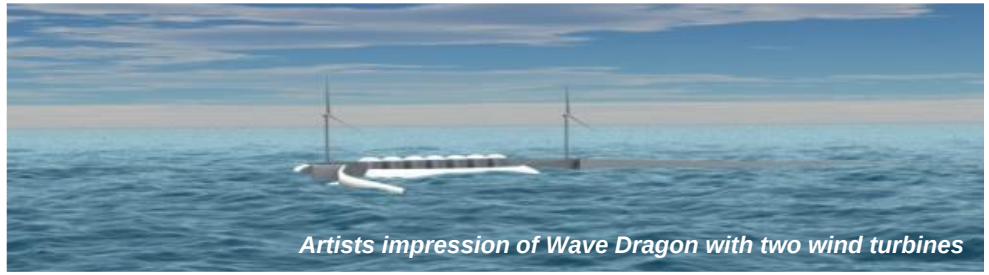
Wave Climate	Width	Weight	Turb.	Rated Power	Yearly Production
12 kW/m	170 m	6'500 tonnes	8	1.5 MW	4 GWh
24 kW/m	260 m	22'000 tonnes	16	4 MW	12 GWh
36 kW/m	300 m	33'000 tonnes	16–20	7 MW	20 GWh
48 kW/m	390 m	54'000 tonnes	16–24	12 MW	35 GWh

Full scale Wave Dragon device sizes

And with two floating wind turbines

Wave Dragon - multiuse of space - with two wind turbines





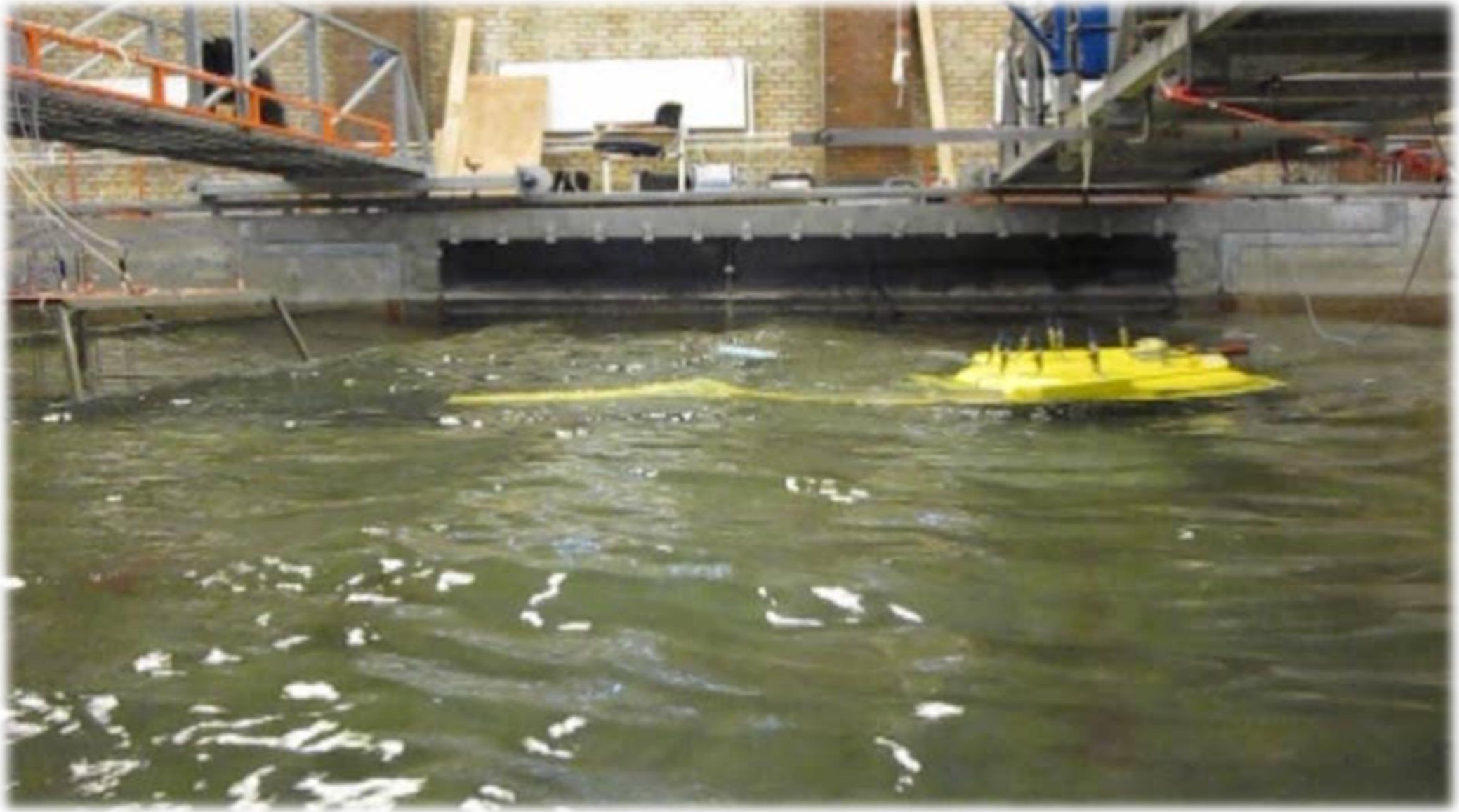
The Wave Dragon platform is a reinforced concrete structure well suited as floating foundation for two wind turbines – the difference in natural period is 10 times larger than for the wind turbine

Expected rated power and annual power production of 4 sizes of Wave Dragon + 2 wind turbines, calculated for an annual mean wind speed at 8.5 m/sec (46% capacity factor)

Source: Feasibility and LCA for a Wave Dragon platform with wind turbines , ISOPE 2016

Wave climate (kW/m)	Wave rated power (MW)	Wave Dragon weight (tonnes)	Annual wave production (GWh/y)	Wind rated power (MW)	Annual wind production (GWh/y)
12	1.5	6,500	4	0.85 x 2	6.8
24	4	22,000	12	1.65 x 2	13.2
36	7	33,000	20	2.3 x 2	18.4
48	12	54,000	35	3.0 x 2	24

Wave Dragon development phases, improved design in real time scale



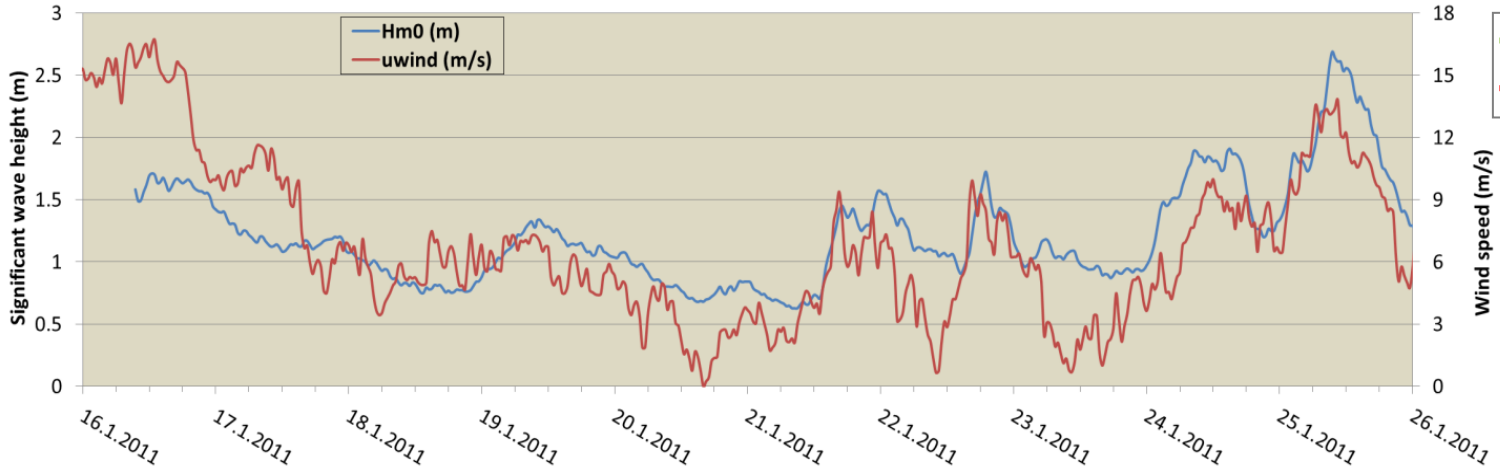
Influence of the air cushions

The *Wave Dragon* in production

Wave and wind sharing the cable. Data from the North Sea

Source: ICOE 2012 report by Julia Fernandez Chozas, H. C. Soerensen et. al

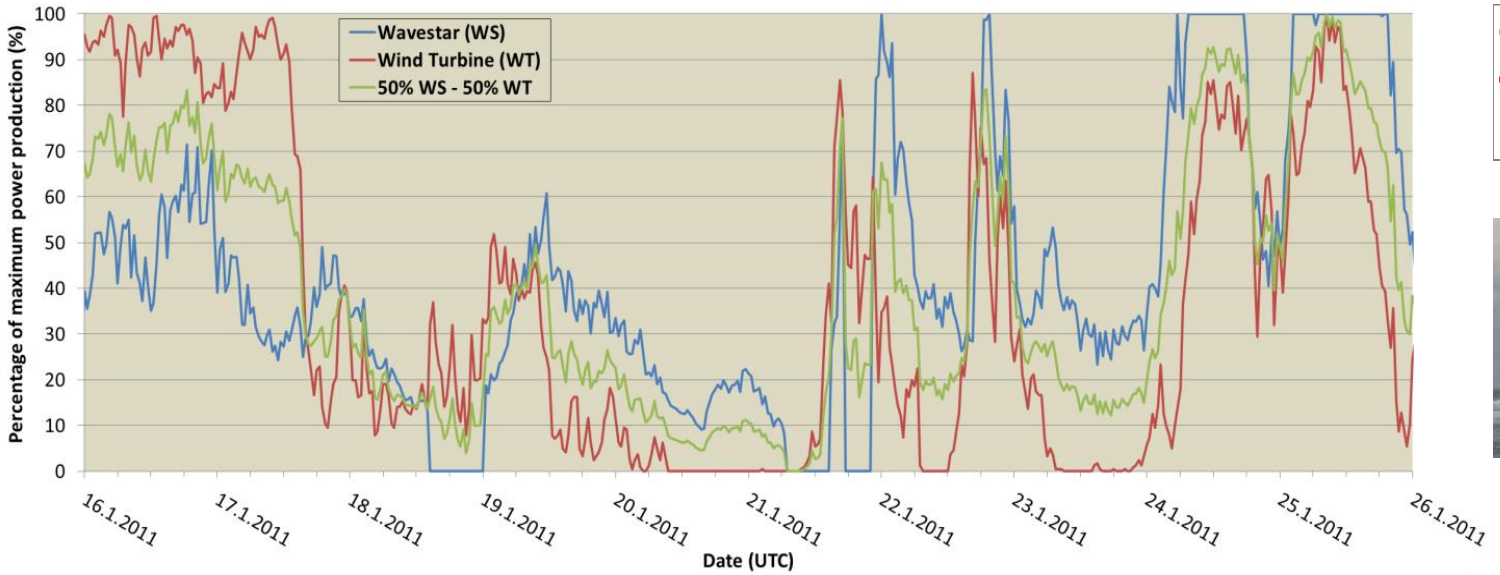
H_{m0} (m) and Wind Speed (m/s)



Hm0 (m)
Wind Speed (m/s)

100 MW wind and 100 MW wave ➡
75 MDKK saved in balancing cost

Percentage of maximum production (%)



Wavestar (WS)
Wind Turbine (WT)
50% WT – 50% WS

Disposition

- Danish energy plans 1976-2050
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- PtX as solution for ??
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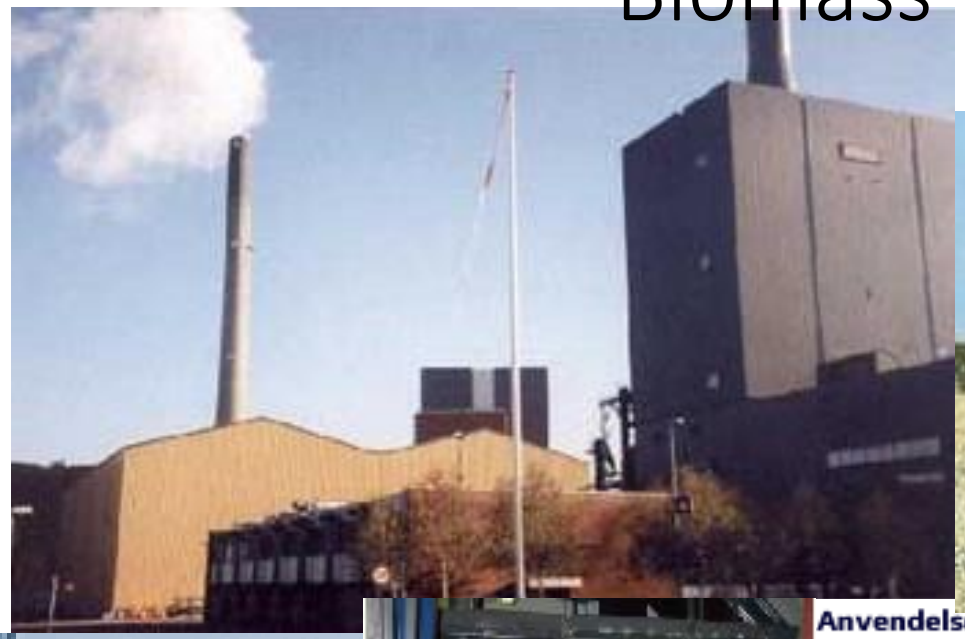
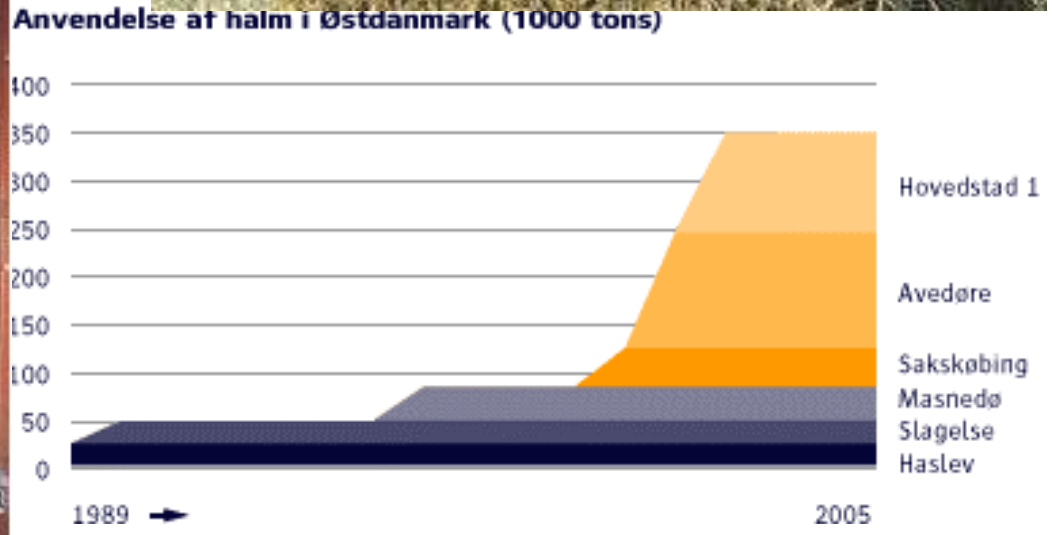
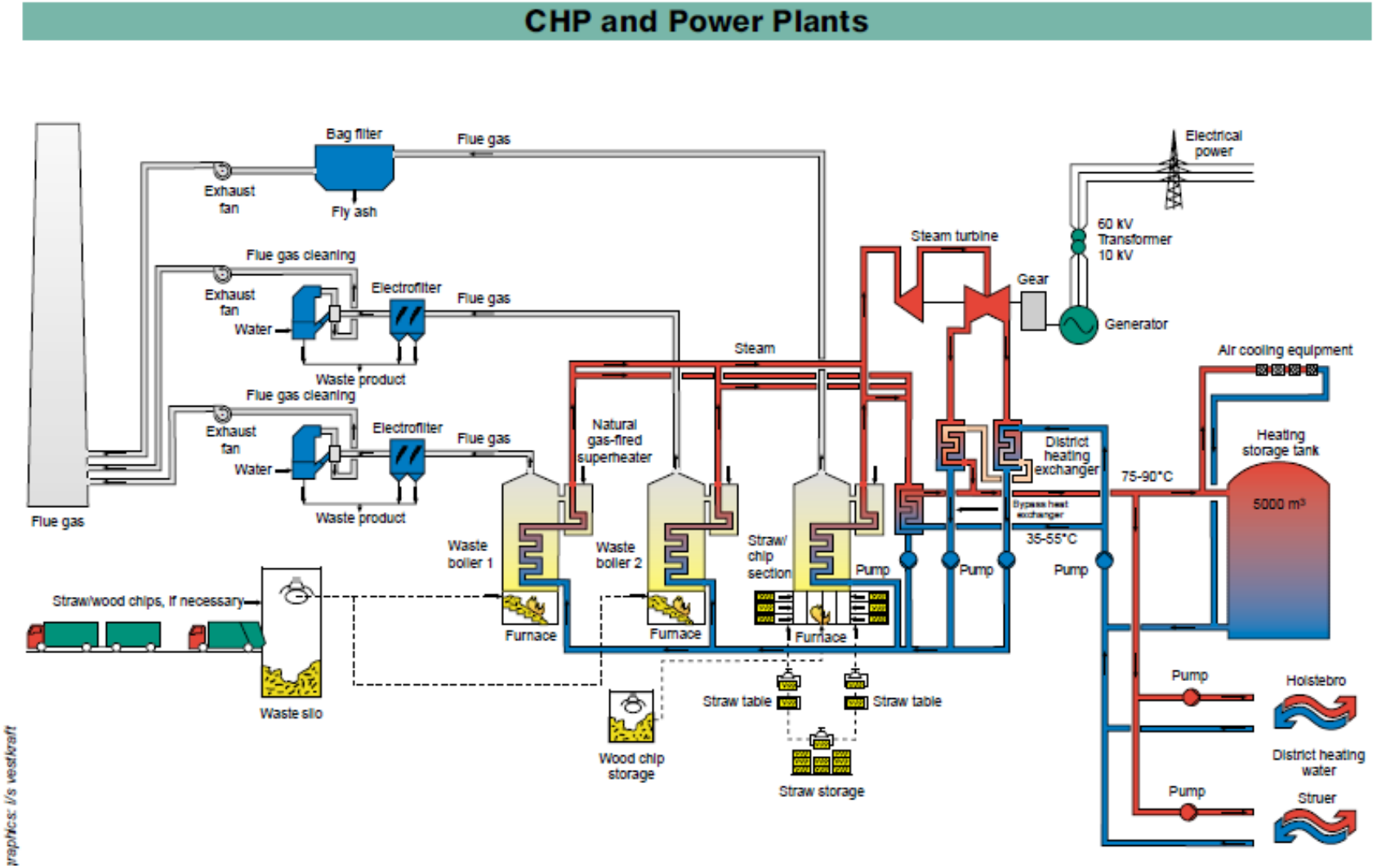
Biomass




Anvendelse af halm i Østdanmark (1000 tons)
400
350
300
250
200
150
100
50
0
1989
2005
Hovedstad 1
Avedøre
Sakskøbing
Masnedø
Slagelse
Haslev

Pellet factory – 150,000 tons straw pellets / year

Mårbjerg waste, straw and wood CHP



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How to use wind for electricity and store it?

Some days we produce 3-400% of the needed power

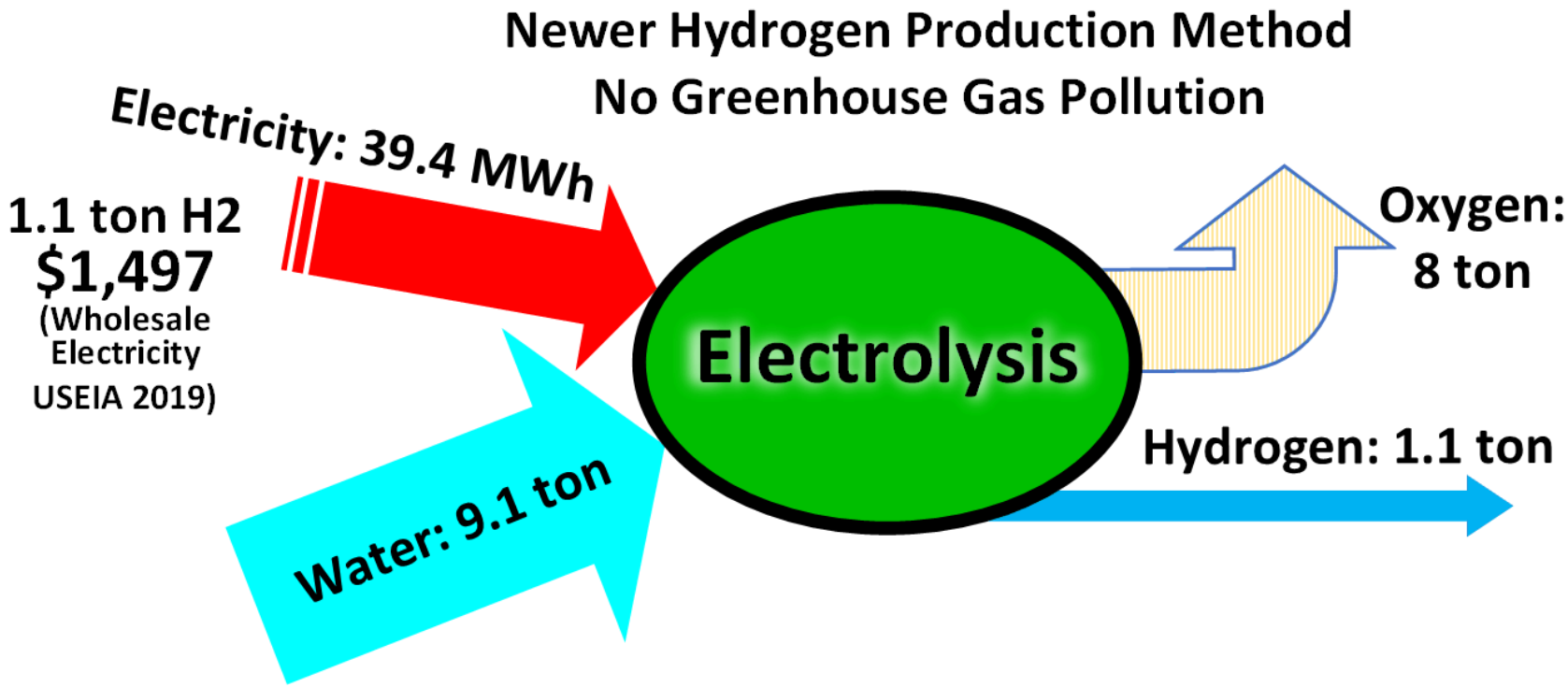
- Battery storage?
  - ✓ The technology is not there
- Synthetic Gas?
  - ✓ Can be stored for 3-6 month in existing caves
- Ammonia?
  - ✓ Can be stored like diesel today

PtX

PtX

How to produce PtX?

First: we need Hydrogen



Source: wiki

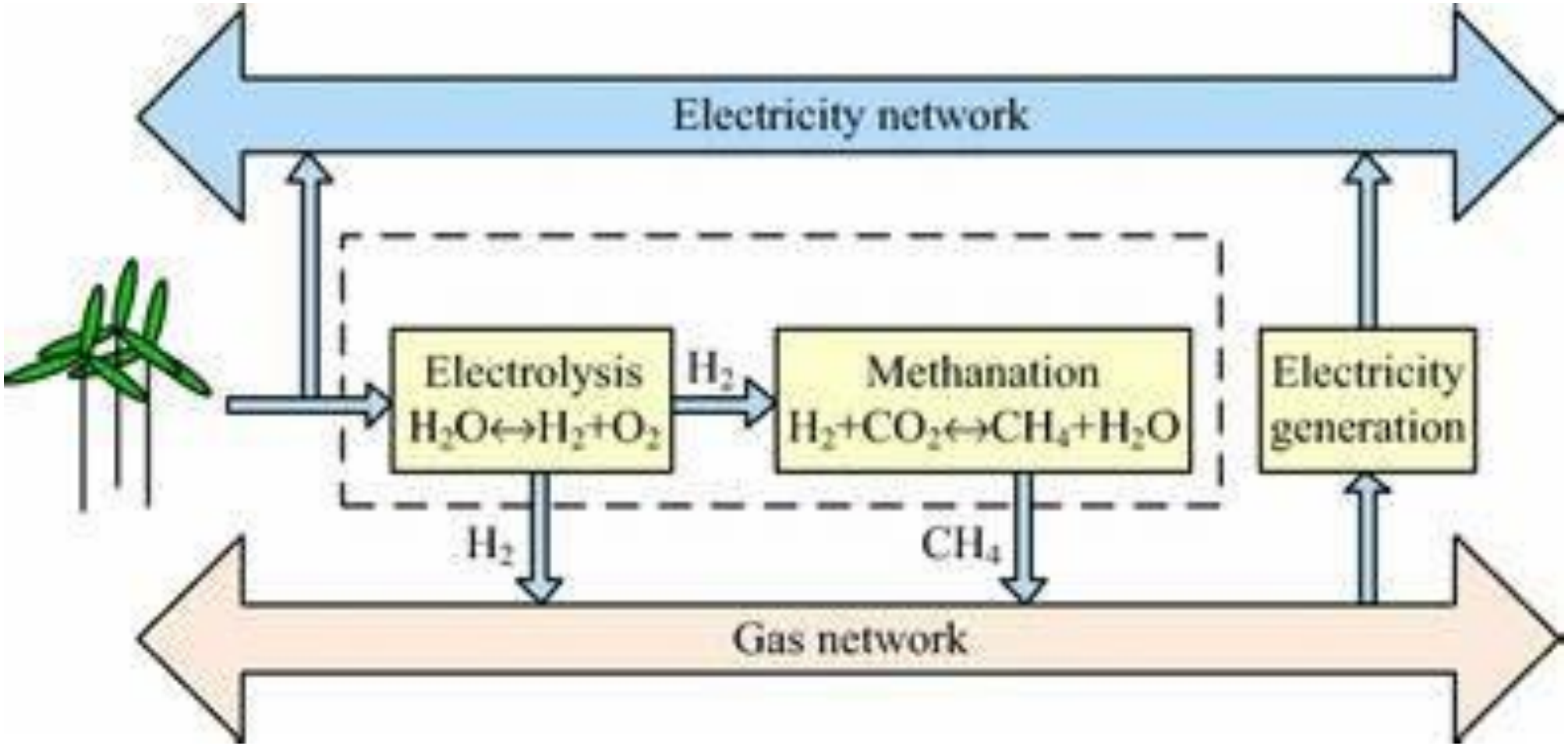
How to produce Synthetic Gas or Ammonia?

Hydrogen can be converted to methane (CH_4) via methanation or with CO_2 to methanol.

Hydrogen can be converted to Ammonia (NH_3) via methanation or with CO_2 to methanol.

Source: wiki

How to produce Synthetic Gas?



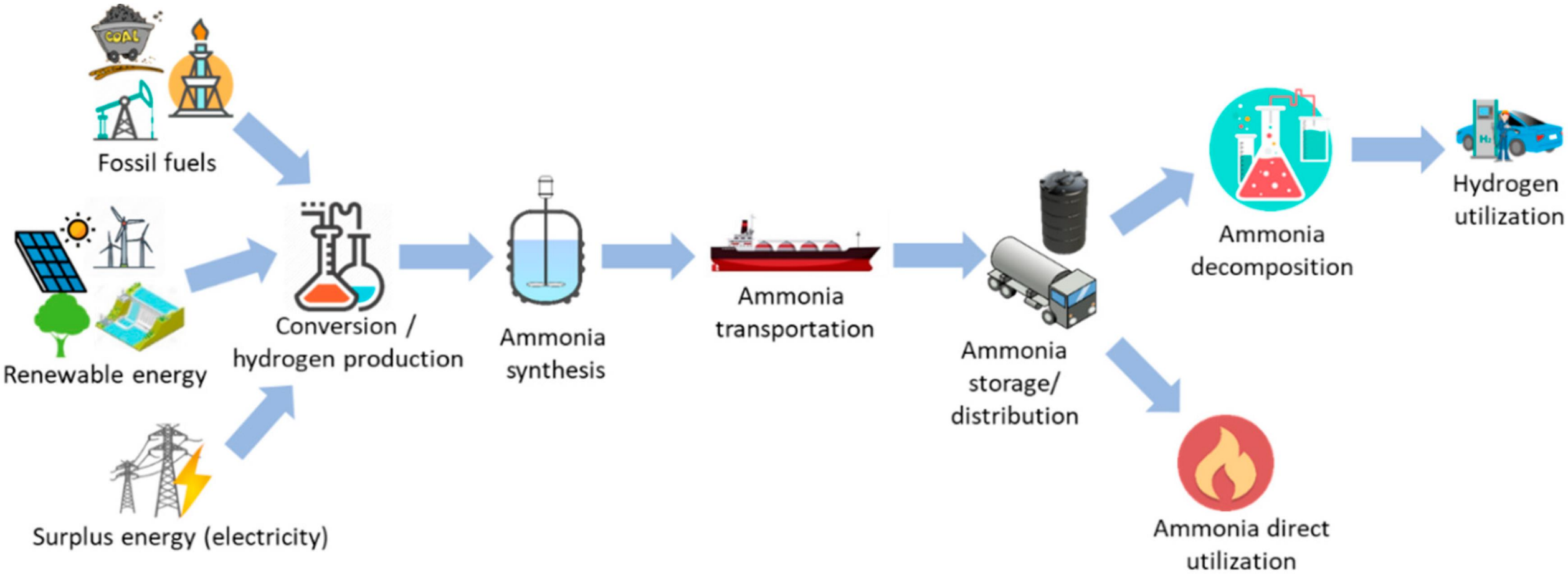
Source: springer.com

Synthetic Gas

Can be stored for 3-6 month in existing caves and used for

- High value fuel, like airplanes, maybe trucks
- Can be reformed to electricity, but …
- Can be used a raw material like oil products today

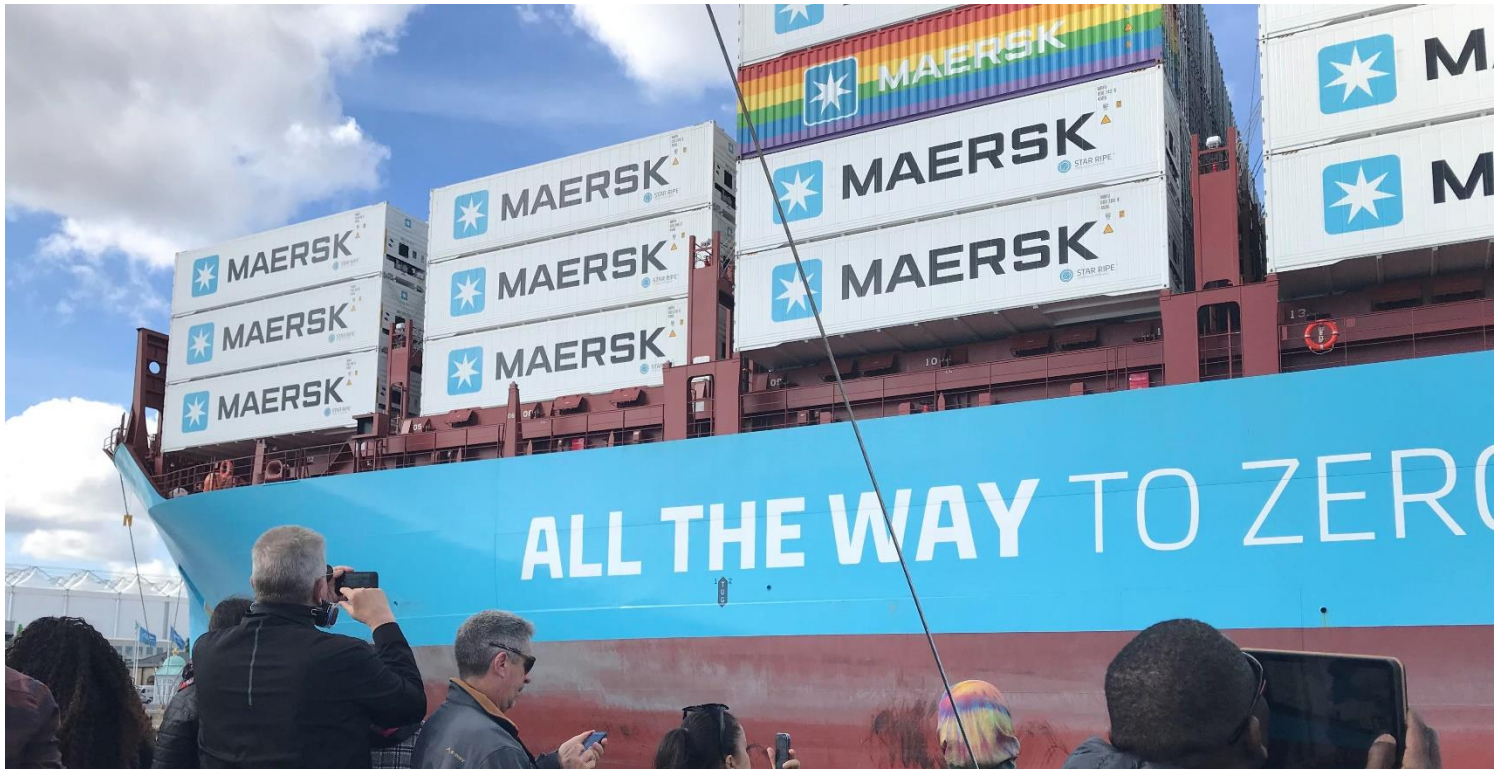
How to produce Ammonia?



Source: ammoniaenergy.org

Ammonia

- Can be stored like diesel
- Can be used in container ships replacing heavy diesel
- Maersk is testing



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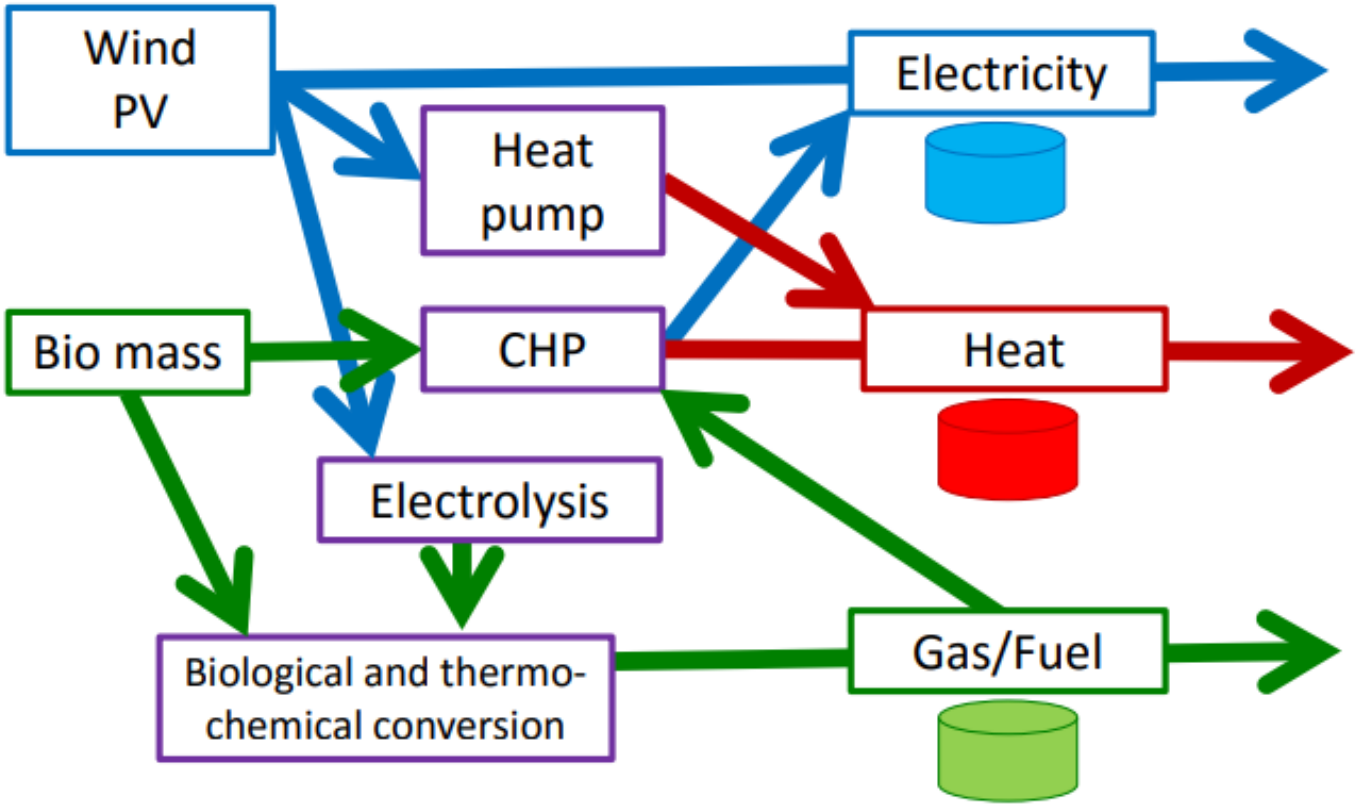
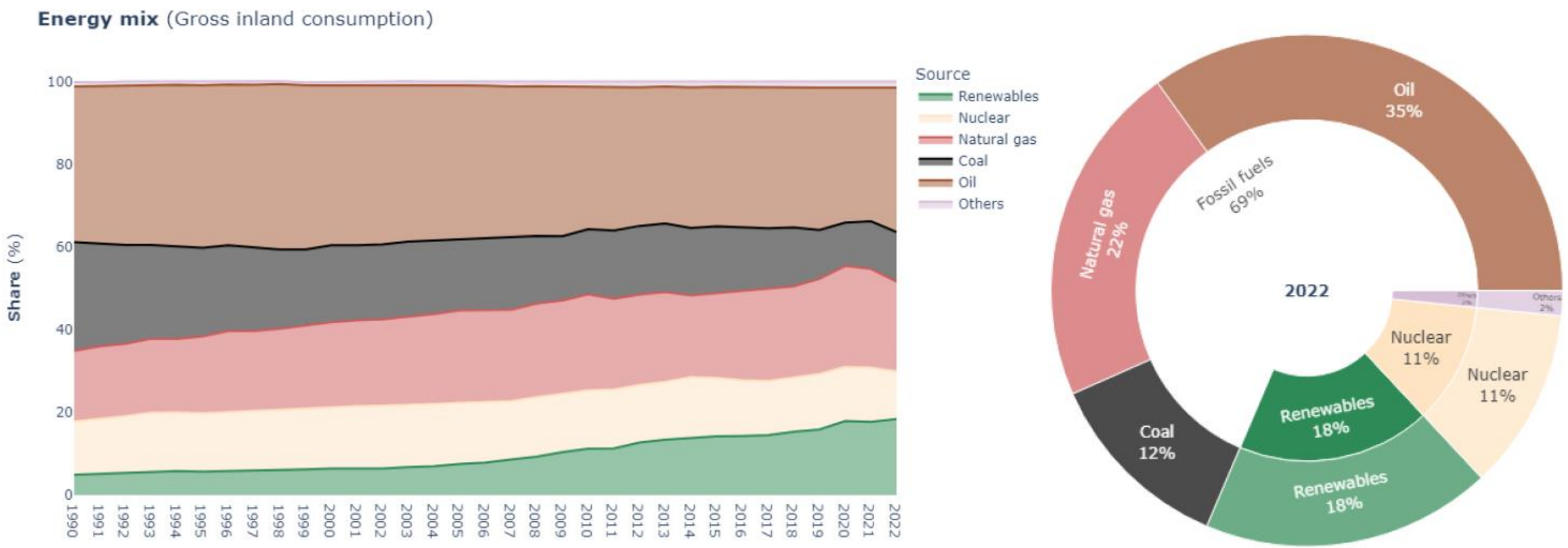
DK 2030 – No fossil fuel

Flexibility and storage



Source: Bindslev & Wenzel, CIGR AgEng 2016

EU Energy mix



Sources: Eurostat

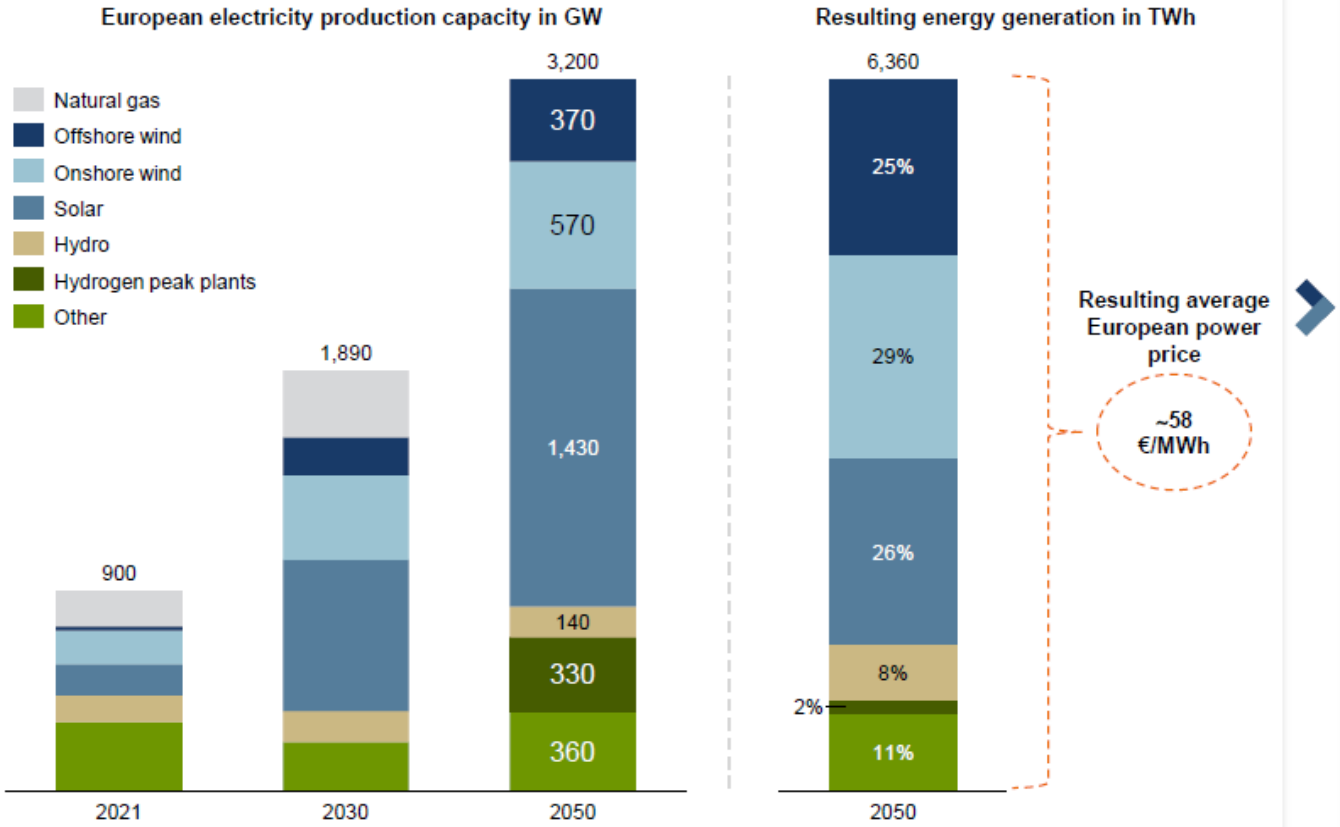
Europe's Net Zero transition supplied by power from wind and solar PV

Offshore wind play a vital role in Europe's Net Zero transition supplying ~25% of all European electricity in 2050

Power production capacity buildout and resulting energy generation

Offshore wind has important role in reaching Net Zero

370 GW of OFW
Can supply 25% of total electricity in 2050



Conclusions

Solar PV, onshore wind and offshore wind to supply ~80% off all Europe's electricity by 2050 supplying "roughly" 1/3 European power production each

Benefits from offshore wind:
- Stabilization of supply due to high-capacity factor
- Interconnector points for integration of transmission systems between countries

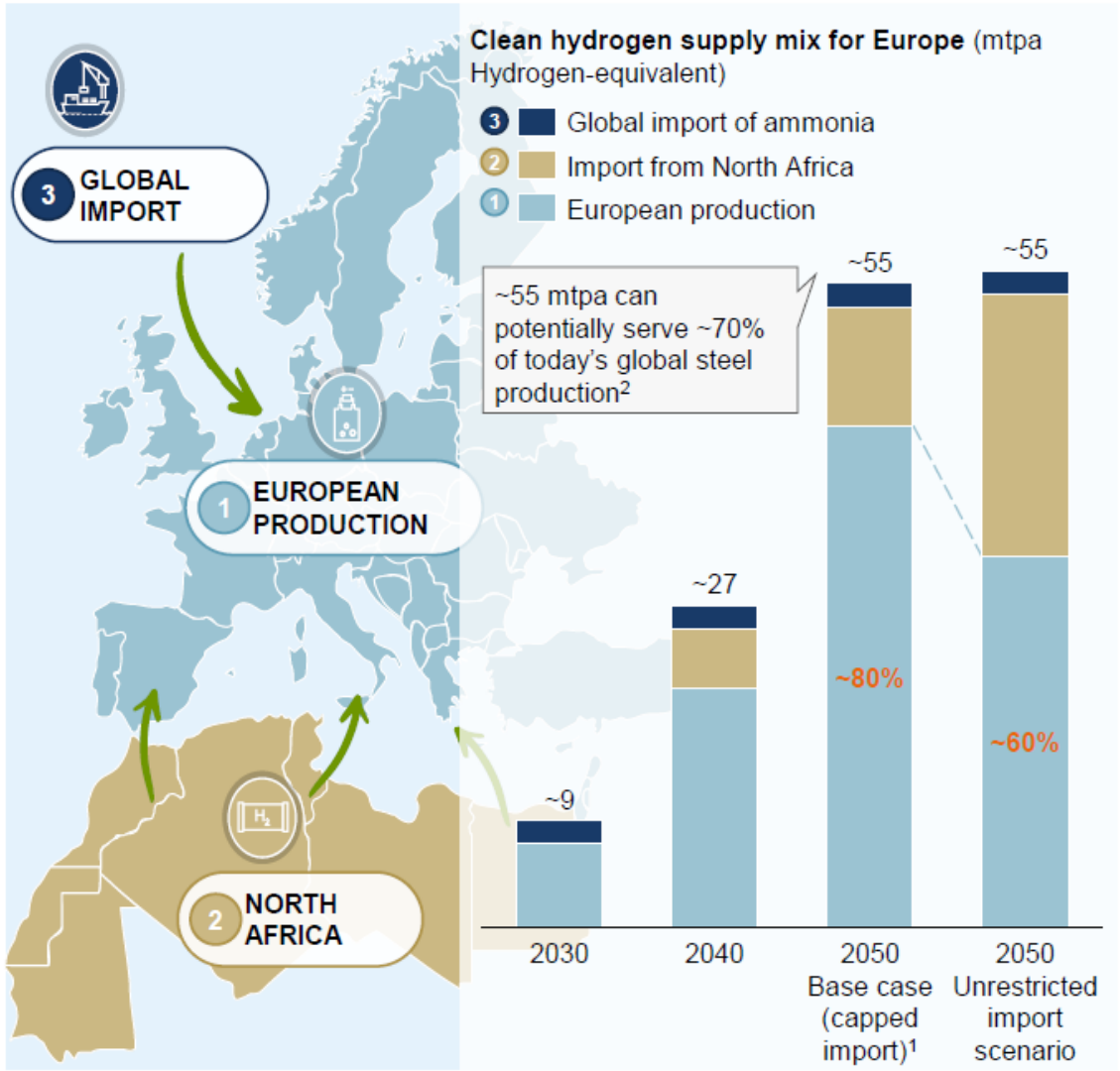
In Northern Europe, offshore wind provides a competitive alternative to PV + storage for supply of electricity during night and winter times

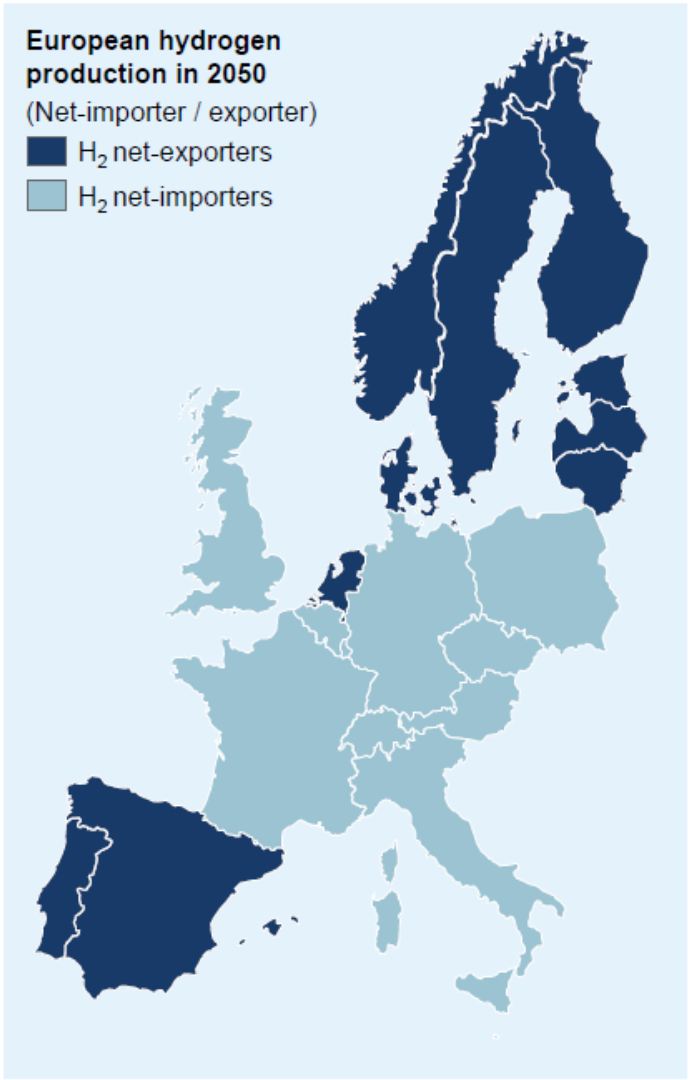
Important Information: The model-based insights presented are based on historical data and current market trends and are intended for informational purposes only. They should not be construed as financial advice or a guarantee of future market performance.

DI – CIP seminar Maj 2024

European production to account for majority of Europe's hydrogen supply

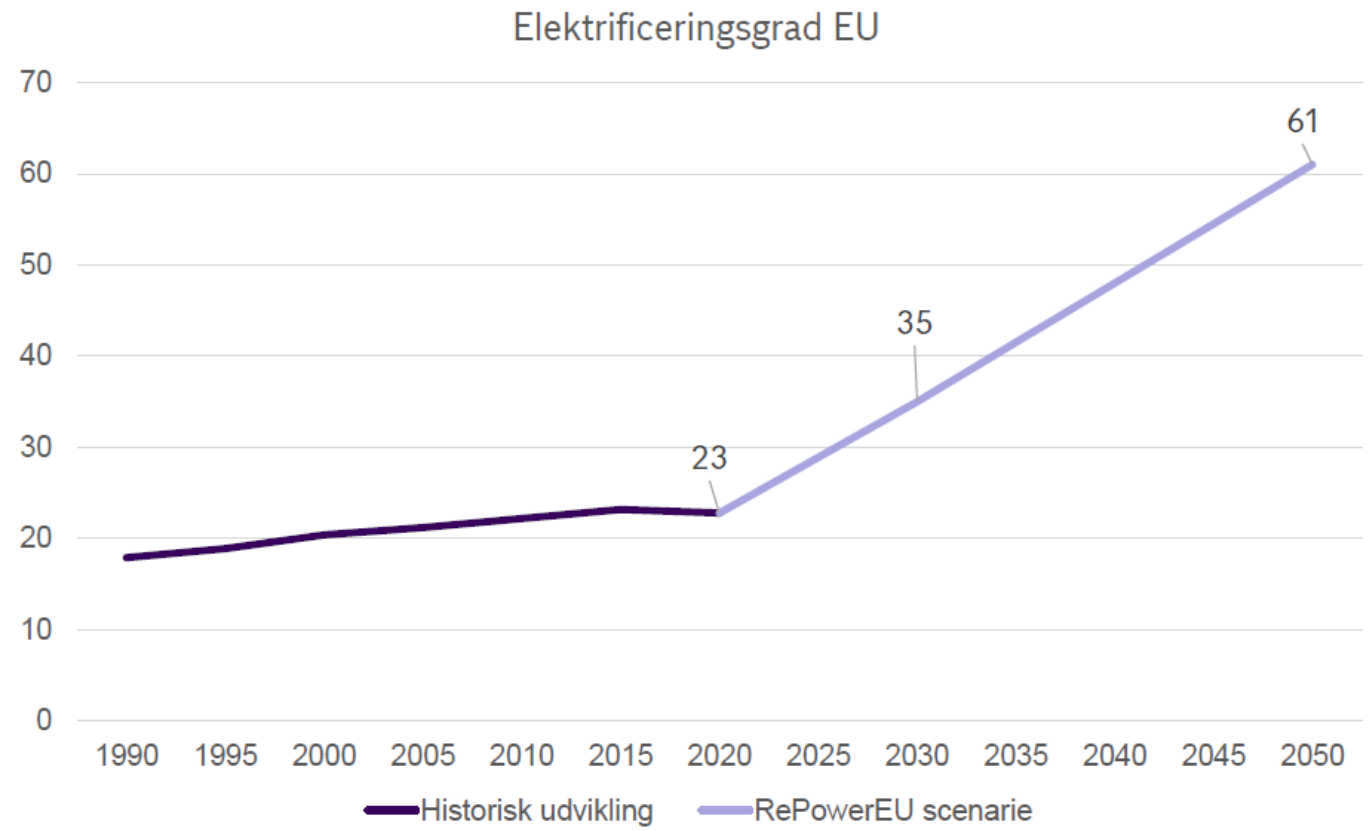
European-based hydrogen production to account for ~60-80% of total supply in 2050, North Sea, Baltic Sea and Iberia to be main exporters of cheap European hydrogen





DI – CIP seminar Maj 2024

Elektrificeringsgraden i EU skal accelereres kraftigt



Kilde: Euroelectric Electrification Action Plan (2024). Note: Elektrificeringsgraden er elektricitetens andel af det samlede energiforbrug.

Fremskrivningen er baseret på de ambitiøse planer i REpowerEU og EU's 2040 mål.

Elektrificeringsgraden i EU skal øges markant frem mod 2030 og 2050.

Der ligger i RePowerEU planer for elektrificering, men foreløbig uden den store effekt.

DI – CIP seminar Maj 2024

DI Energi

CIP, Green Power Denmark, DI Energi og Tænketanken EUROP May 2024

- 85 % af europæisk industri kan elektrificeres. Udrulning af grænseoverskridende energiinfrastruktur, herunder elnet og brintforbindelser, er afgørende for elektrificering, da produktionen af vedvarende energi og efterspørgslen fra de energiintensive industrier ikke nødvendigvis er placeret samme sted på Europakortet (f.eks. Nordsøen).
- CIP's analyse viser, at der skal bygges omkring 370 GW havvind i Europa frem mod 2050 – omkring en tidobling af havvindkapaciteten fra i dag.
- Et samarbejde med bl.a. Nordafrika kan forsyne EU med billig grøn brint, der kan bidrage til dekarbonisering af Europas tunge industrier, da elpriserne i denne region ligger under den europæiske.
- EU er stadig afhængig af energiimport i form af naturgas, og har skabt nye afhængigheder på import af LNG. Diversificeringsambitionerne har gjort EU mindre afhængig af Rusland, men EU bruger fortsat store summer på fossil energiimport.

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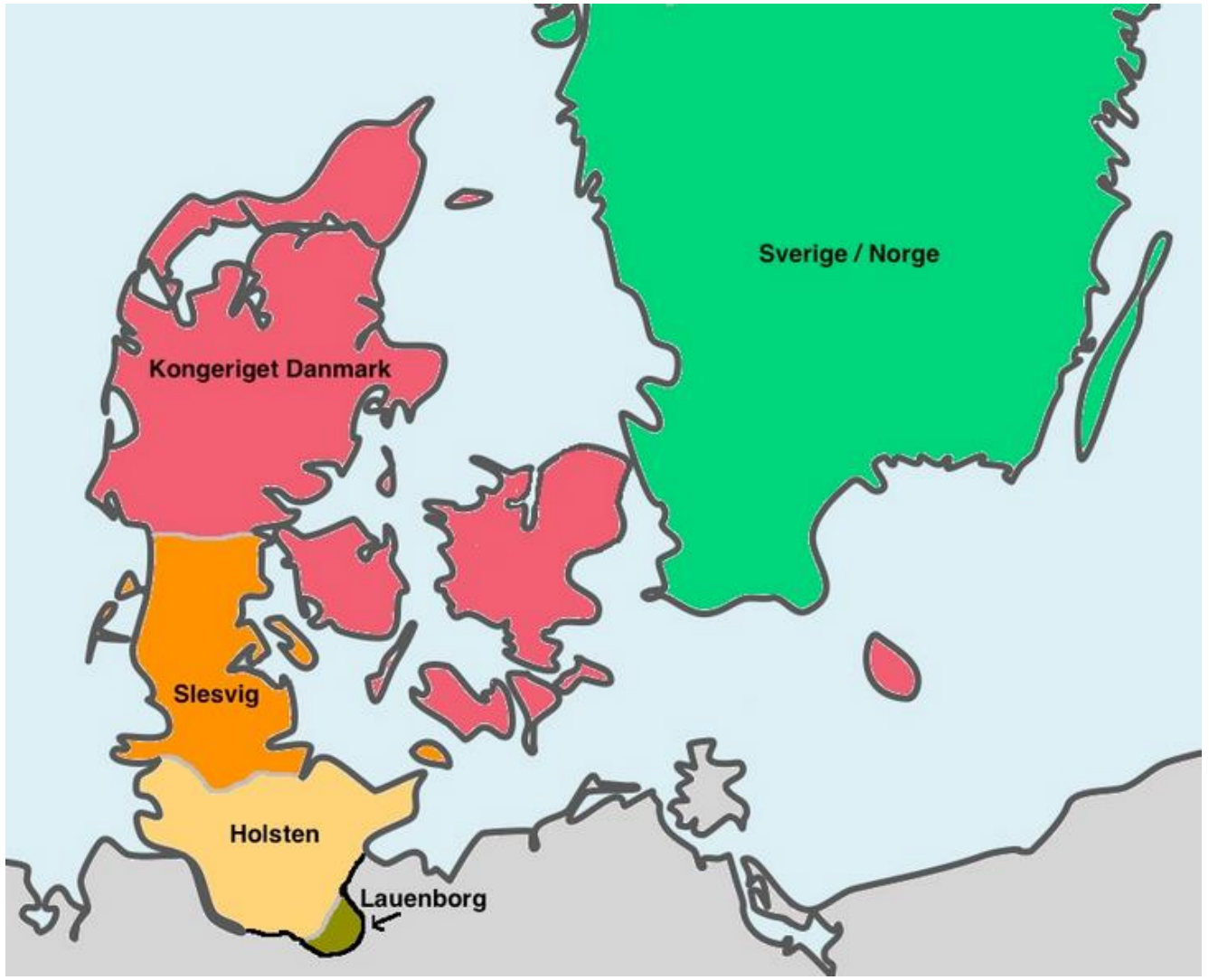
Danish Cooperation, history from 1866

- Demark lost the war with Preussen/Austria in 1864
- 40% of the agriculture area
- Political fight between family farmers and large farm owners



Danish Cooperation, history from 1866

- 1844:
  Rockdale UK
  In Denmark
- Shop in 1866
- Diary 1882
- 1882-1888
  fast growth

Shop Rønne
1892

The cooperative approach - Benefits

Advantages

- Local involvement
- Earlier involvement
- Profit stays locally

Disadvantages:

- Upfront payment even before consents
- Dependency of manufacturers when no grants

Today (from 2009-2019 onshore):

- Minimum 20% local ownership to be offered within 4.5km, thereafter to local county
- Near shore farms: special incentives if local people is involved

Danish Cooperative model for wind

- Shared ownership, one person one vote independent of shares
- Typically, no loans – up front payment of total cost *
- One share equal to a production of 1,000 kWh/y
- Historically: ownership equal to own consumption of electricity
- Typically, 3-5 shares => 3,000 – 5,000 kWh/y up to 2008
  * Typically, 350€ to 670€ a share
  * A few banks are giving loans for individuals with security in revenue only

<u>Simple tax rules possible – and needed:</u>

- No tax when production revenue less than 940€/y
- Simple tax revenue form
- Only an advantage with less than about 10-20 shares**

** Else use standard for companies: profit less depreciation, but then remember auditor for the tax authorities

The organisation

- Board of 5-7 people selected every 2 years
- No fee to board members
  - Administration office/book keeping /volunteers dependant of shares
  - One part time person paid to follow up on maintenance
  - Service company or manufacturer to do service
  - Audit company for account
- Home page for information; e-mail if possible
- Newsletter with call for General Assembly each year
- Open house for visiting if possible

COOP's in Denmark today

- Agriculture: about 50% ; 15-20% of Danish industry
- Shops: 42% of turnover; 35.000 people
- Water supply: 2.600 (330/2.300 public/private)

Energy:

- Power distribution: most companies
- Power production – wind 18% / 850 MW
- District heating : 460 plants
- Biogas COOP's: 190 plants

The Copenhagen cooperative projects

	Lynetten	Middelgrunden	Hvidovre	Prøvestenen
Year	1995/96	1996/2000	2007/2009/ 2011	2013
Power	7 x 600kW	20 x 2MW	3 x 3.6MW	3x2MW
COOP/Utility	4/3	10/10	1/2	1/2
Shares/owners	3,600/902	40,500/8,553	10,700/2,268	4,055/1,800+
Price/share	604€	570€	670€	663€
Upfront work	Coop/Utility	Coop & Utility	Coop & Utility	Utility/Coop
Upfront payment	Coop/Utility	Grant/Utility	Utility	Utility
Cost	4.1mill€	49.5 mill€	22 mill€	8,07 mill€

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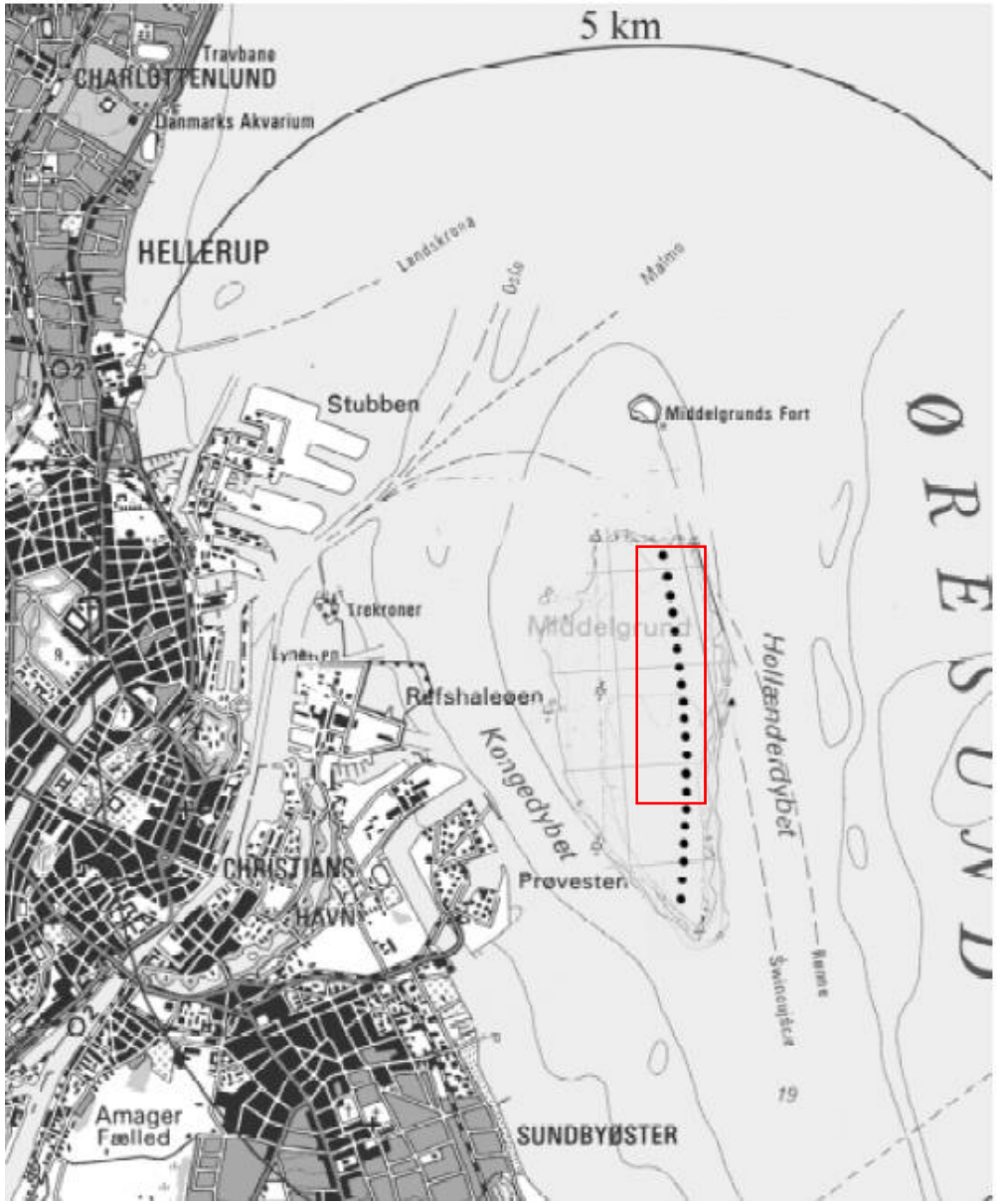
The planning process and public involvement



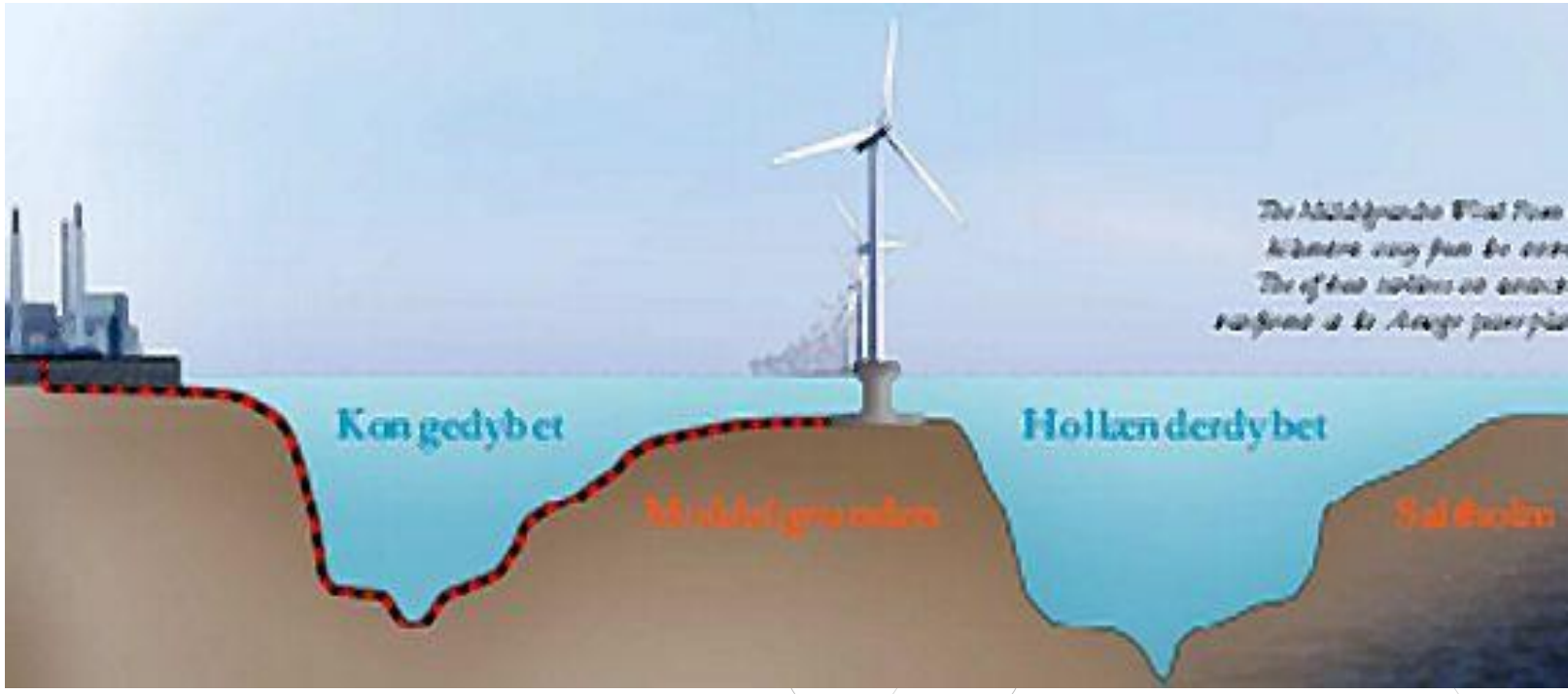
3 rows in the north part, 27 turbines –

Changed to one line over the whole length, 20 turbines

Why?

Public protests

Placed on a natural reef 6 meters water depth

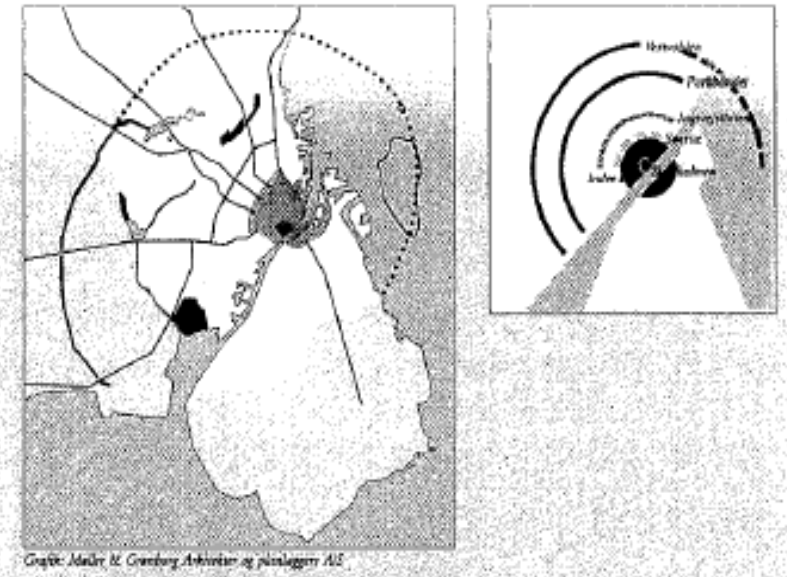


Source: www.middelgrunden.dk

Our closest 1997 – potential neighbor

Visual Impact – two alternatives

Visual impact – the defence circles



Parkens layout følger Københavns gamle forsvarsanlæg.
The Farm layout is following the defense system of Copenhagen dating back to the Middle Age.

18 km's away
Barsebäck nuclear power plant, 1200 MW

- Closed since 2005

What it could have been with the knowledge of today

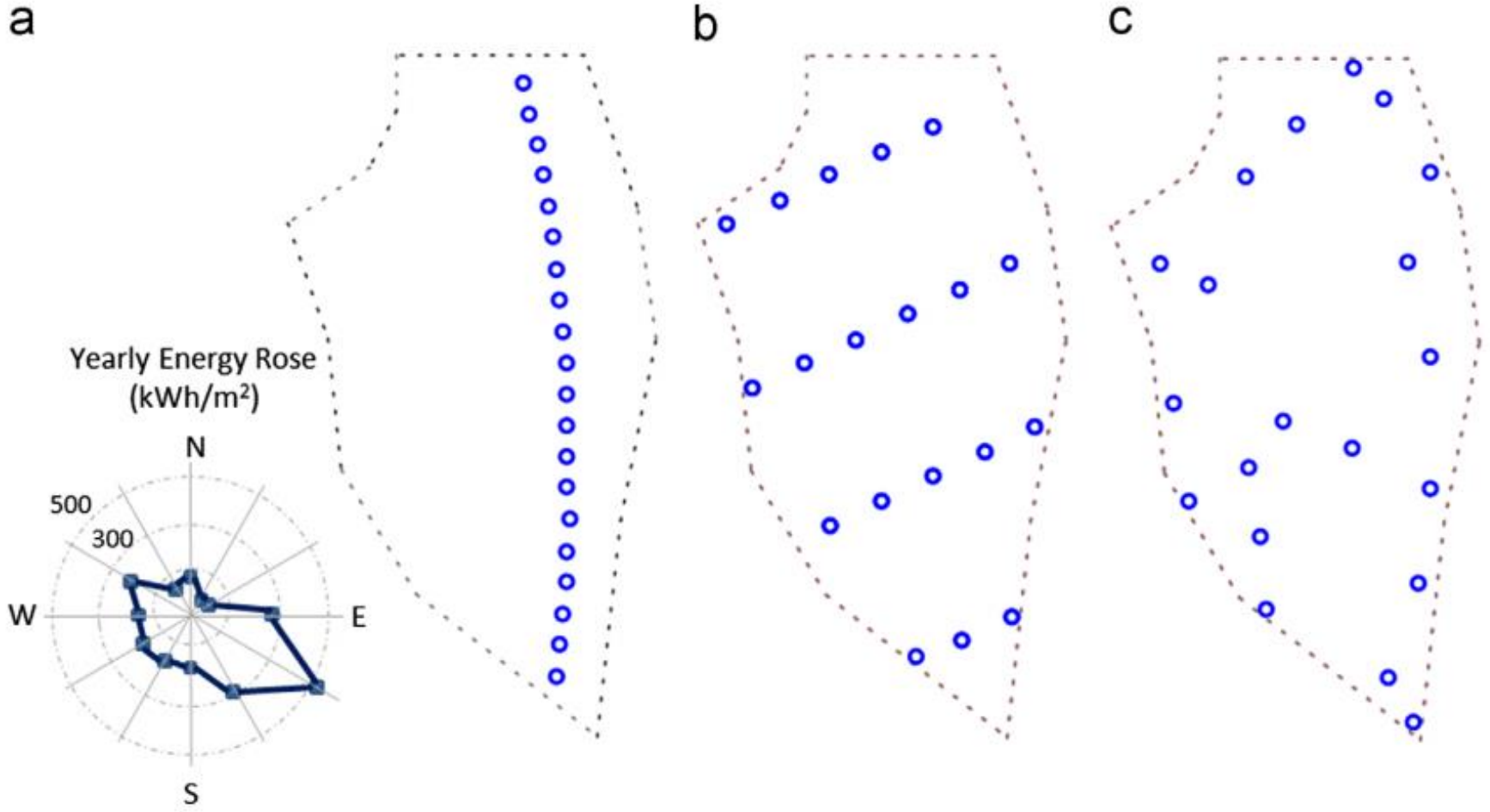
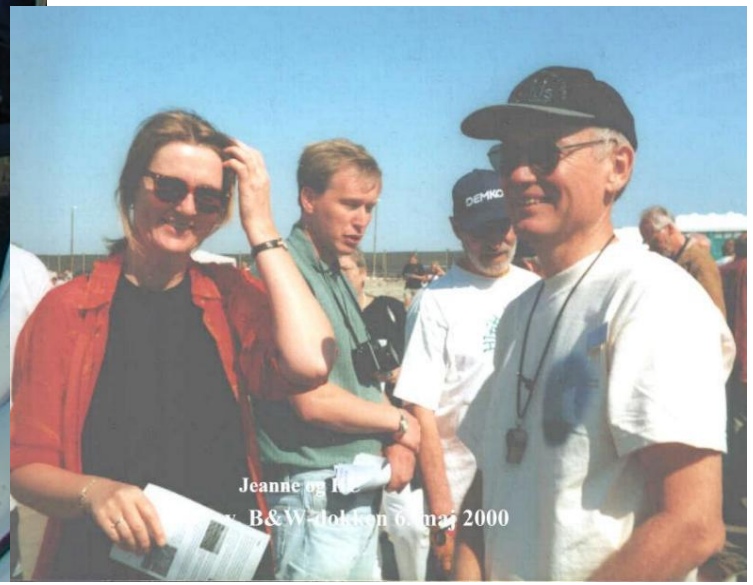


Fig. 1. Layout of the Middelgrunden offshore wind farm: (a) actual, (b) optimized with symmetrical constraints, (c) optimized [7]

The continues public involvement

Involvement of local people in the project:

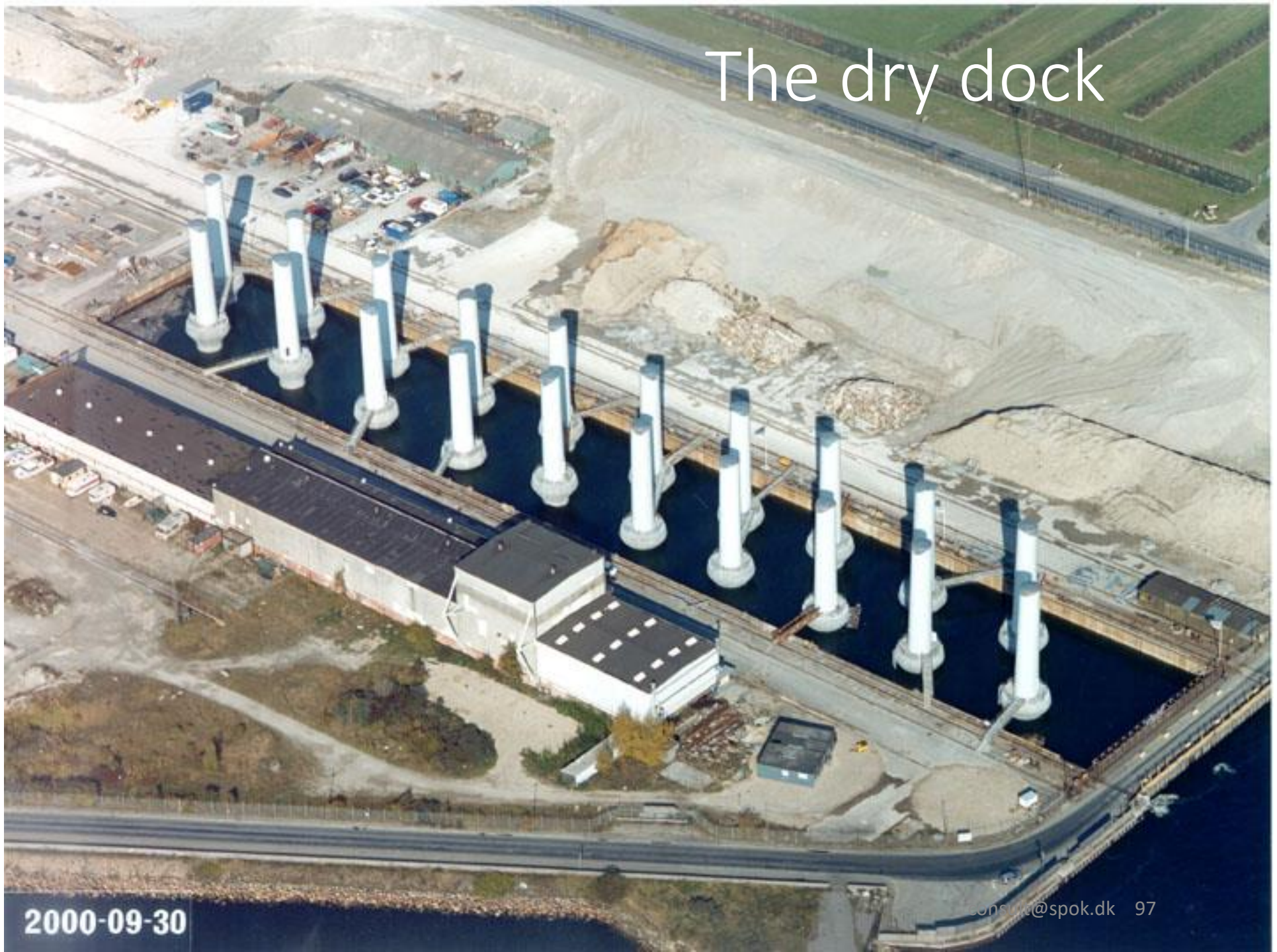
- Boat trips
- Visit building site
- Artist with wind song for kids



Casting concrete

1600 visitors on a sunny Sunday visiting the building site

The dry dock



Deployment

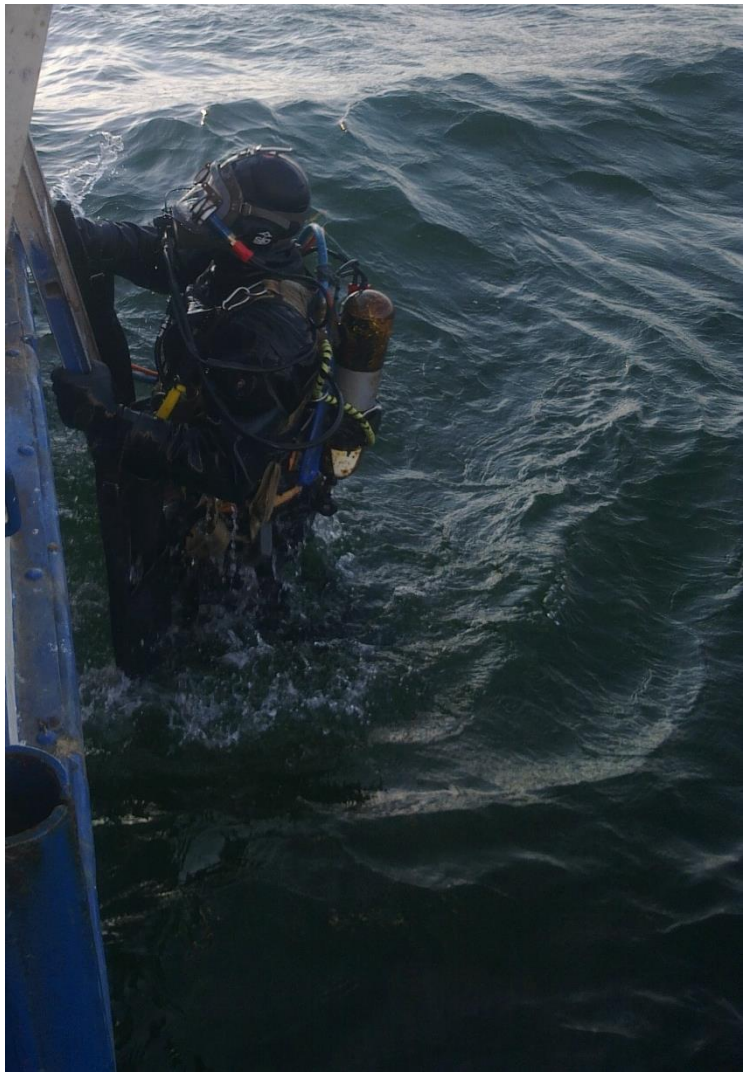
Ready for lifting in place

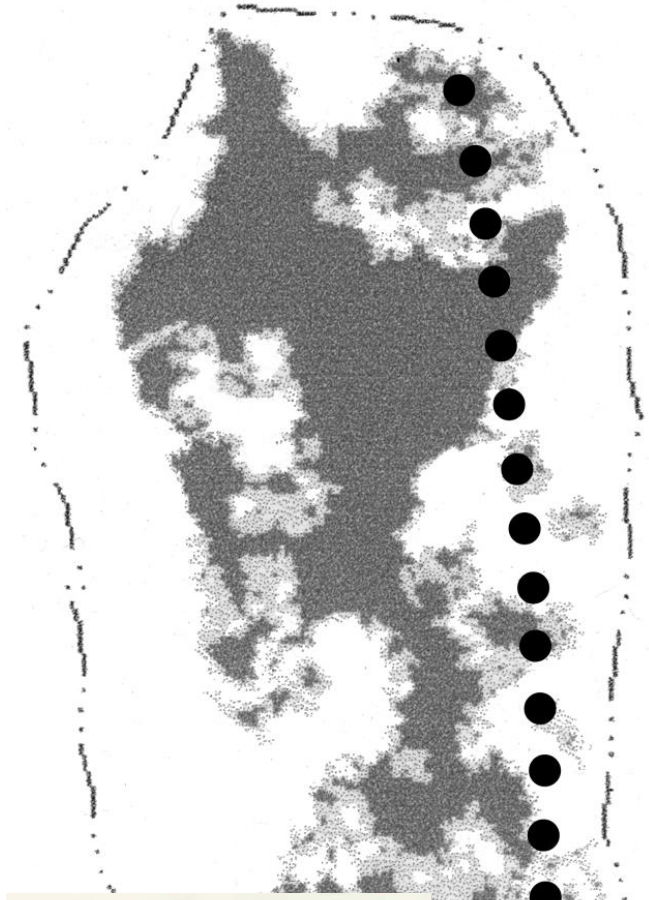
On the way up

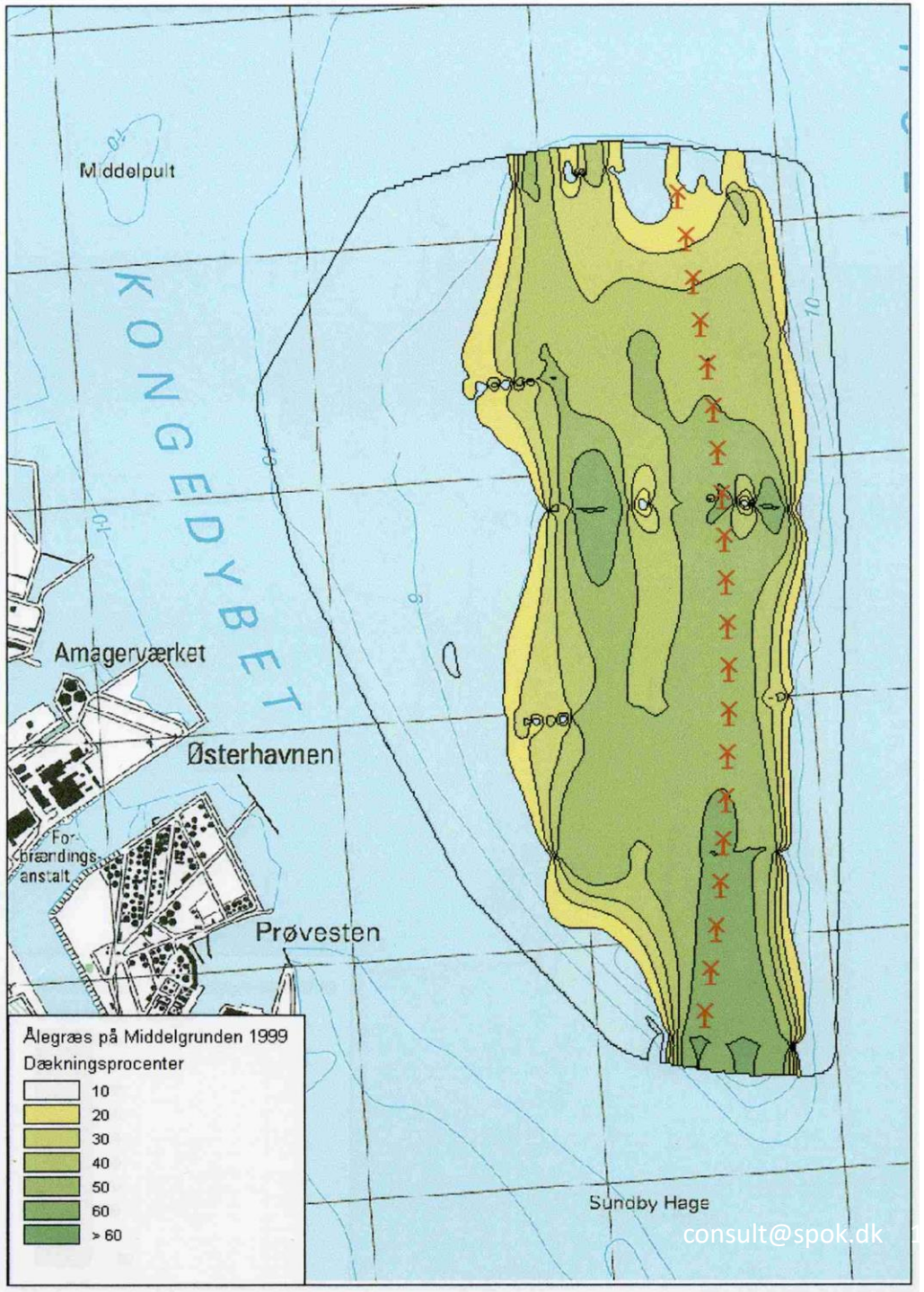
Cable deployment

2019 H C Soerensen

There is fish !

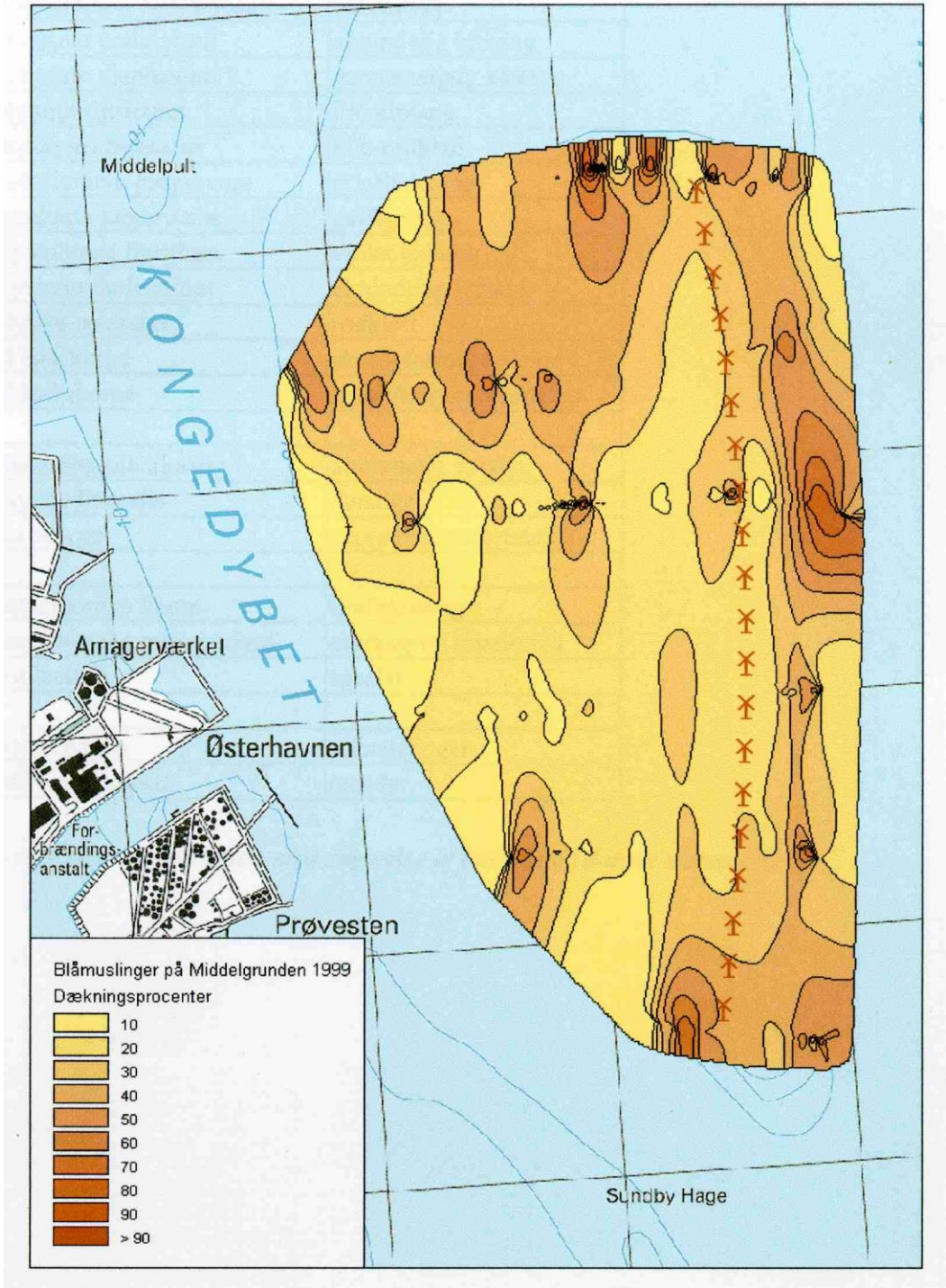






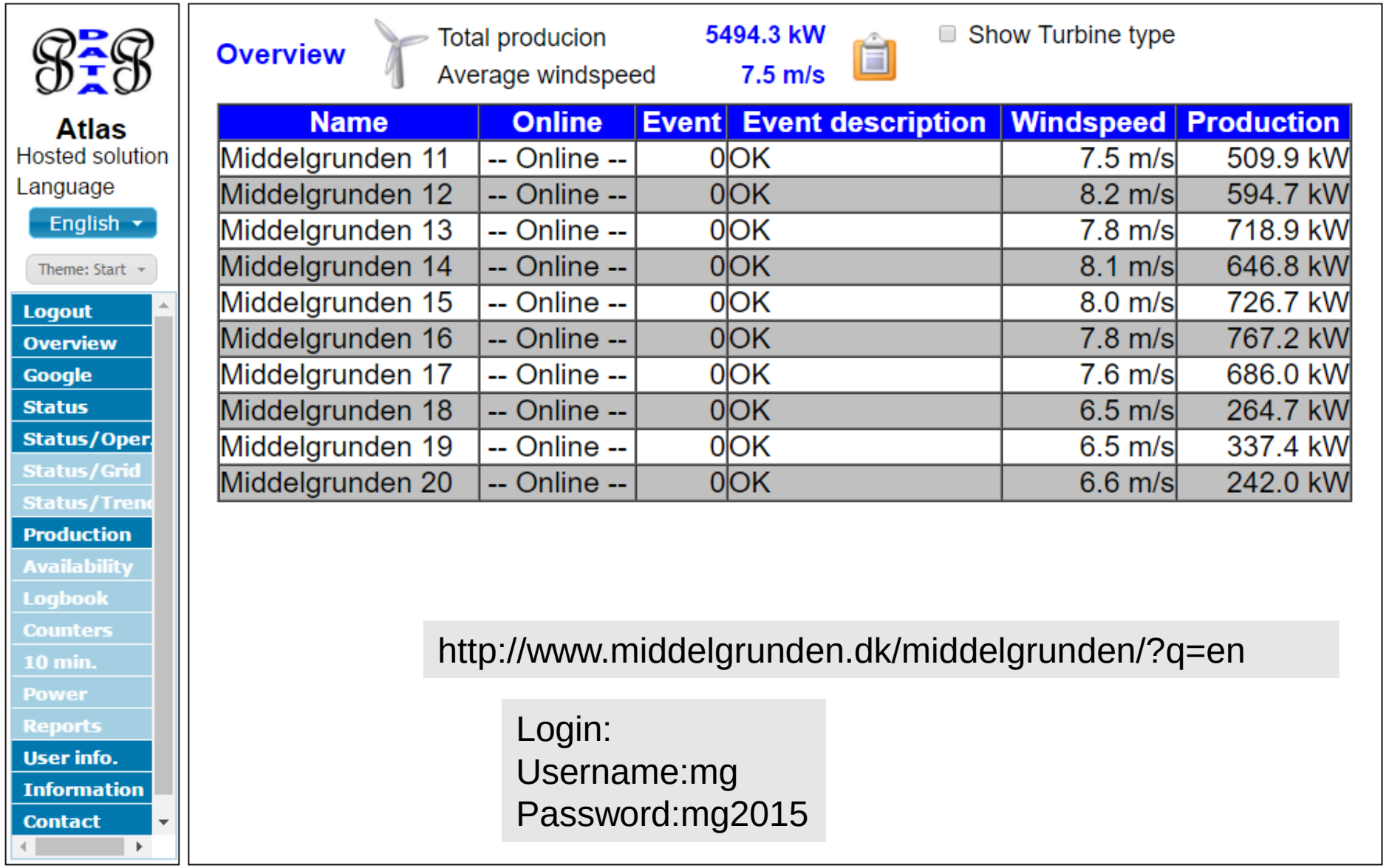
Eel grass before and after con-struc-tion

consult@spok.dk


Middelgrund
KONGEDYBET
Amagerværket
Østerhavnen
For-
brændings-
anstalt
Prøvesten
Sundby Hage
Blåmuslinger på Middelgrunden 1999
Dækningsprocenter
10
20
30
40
50
60
70
80
90
> 90

Shellfish

The continues public involvement



Name	Online	Event	Event description	Windspeed	Production
Middelgrunden 11	-- Online --	0	OK	7.5 m/s	509.9 kW
Middelgrunden 12	-- Online --	0	OK	8.2 m/s	594.7 kW
Middelgrunden 13	-- Online --	0	OK	7.8 m/s	718.9 kW
Middelgrunden 14	-- Online --	0	OK	8.1 m/s	646.8 kW
Middelgrunden 15	-- Online --	0	OK	8.0 m/s	726.7 kW
Middelgrunden 16	-- Online --	0	OK	7.8 m/s	767.2 kW
Middelgrunden 17	-- Online --	0	OK	7.6 m/s	686.0 kW
Middelgrunden 18	-- Online --	0	OK	6.5 m/s	264.7 kW
Middelgrunden 19	-- Online --	0	OK	6.5 m/s	337.4 kW
Middelgrunden 20	-- Online --	0	OK	6.6 m/s	242.0 kW

http://www.middelgrunden.dk/middelgrunden/?q=en

Login:
Username:mg
Password:mg2015

All data for production updated every 10 minutes – only for the cooperative part

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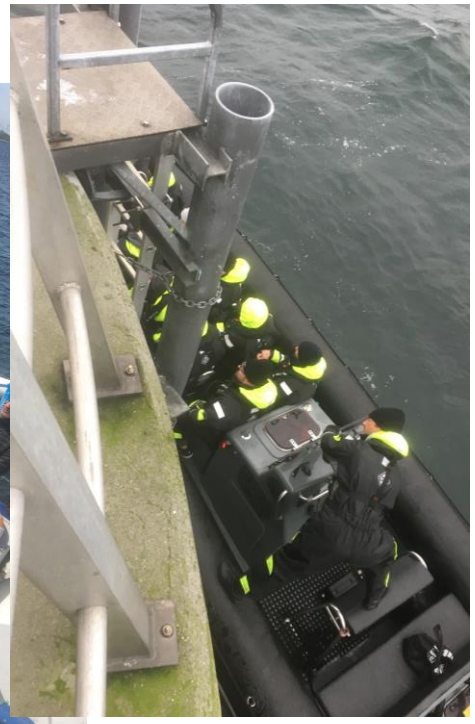
Offshore wind and tourism

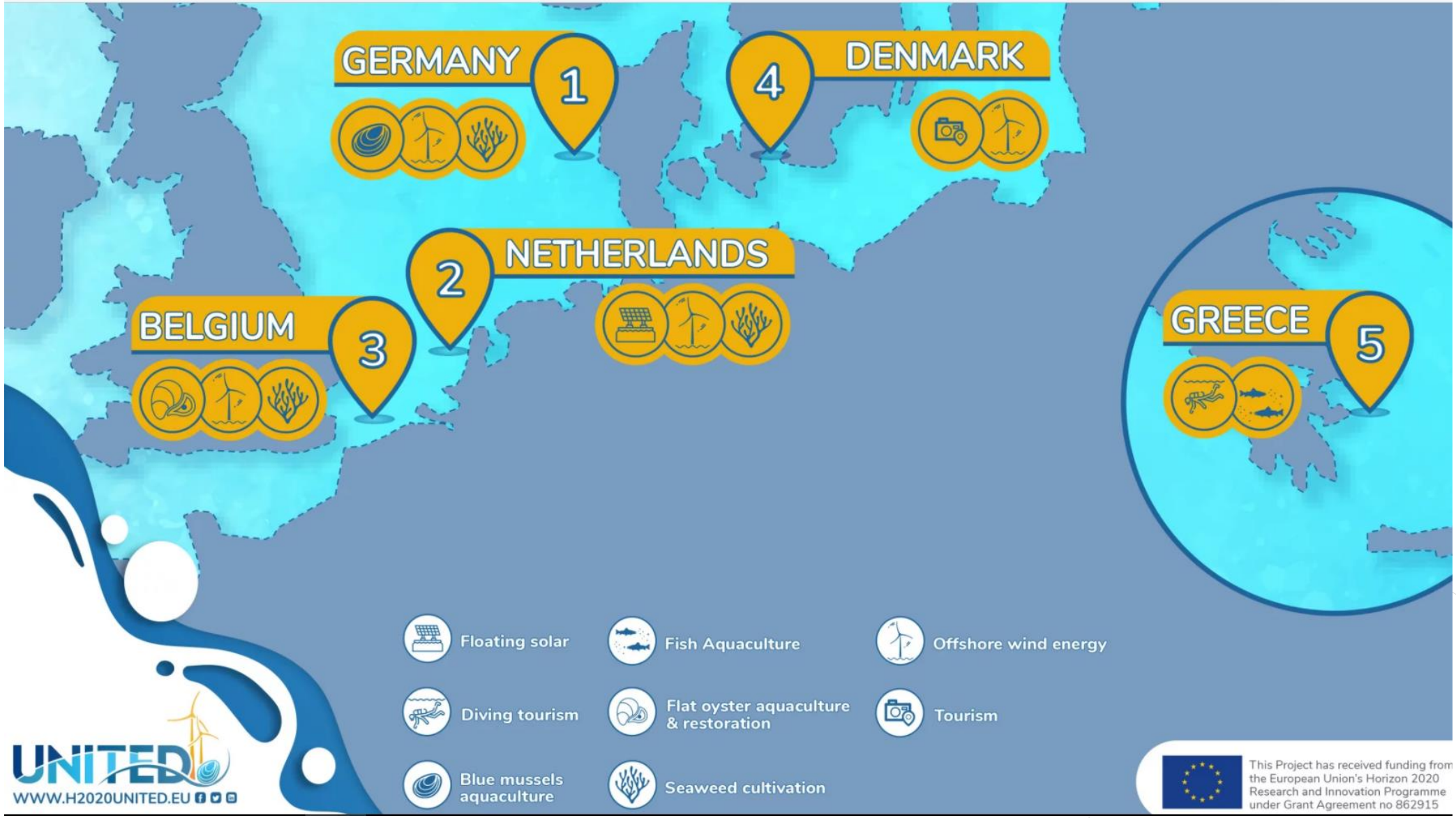


- Slowly visits by shareowners every 2 years turned out to be tourism
- We have 90 boat trips last year visiting – 50% of them including climbing the turbine
- To develop further we are part of the UNITED project

Source: https://www.h2020united.eu/

European Union funded project as part of the Horizon 2020 Initiative : Grant Agreement 862915

The UNITED demonstration Multi-Use Platform project



Source: https://www.h2020united.eu/

The Perspectives of Multi-Use Platforms

- Space offshore is limited
- Synergies can be found

- Examples from other combinations than UNITED
  - ✓ MUSICA, multi-use use of space solutions for the small islands; http://musica-project.eu/

Source: https://www.h2020united.eu/

European Union funded project as part of the Horizon 2020 Initiative : Grant Agreement 862915