

Power-to-X – From test and demonstration to reality in DK

Poul Skjærbæk, Chief Innovation & Product Officer, Siemens Gamesa RE

Conference: Danmark som testland i den grønne omstilling, 25.09.2020

Siemens Gamesa – Key Facts*



105 GW
Globally Installed



26,000
Employees



€10.2 B
Annual Revenue**



€10.7 B
Market Capitalization



€31.5 B
Order Book



True **global**,
modern and
scalable
footprint



Advanced **digital**
capabilities



Portfolio covering all
requirements

* End of June 2020

** End of September 2019

Agenda

- **Denmark and Offshore Wind**
- Connecting Offshore Wind and H2
- SGRE R&D Activities
- Conclusions



Denmarks share of the installed offshore wind fleet dropped from 70% to <10% in 15 years... It is a great export story as ~70% of global offshore turbines come from SGRE or MHI-Vestas

wind denmark 05.05.2020

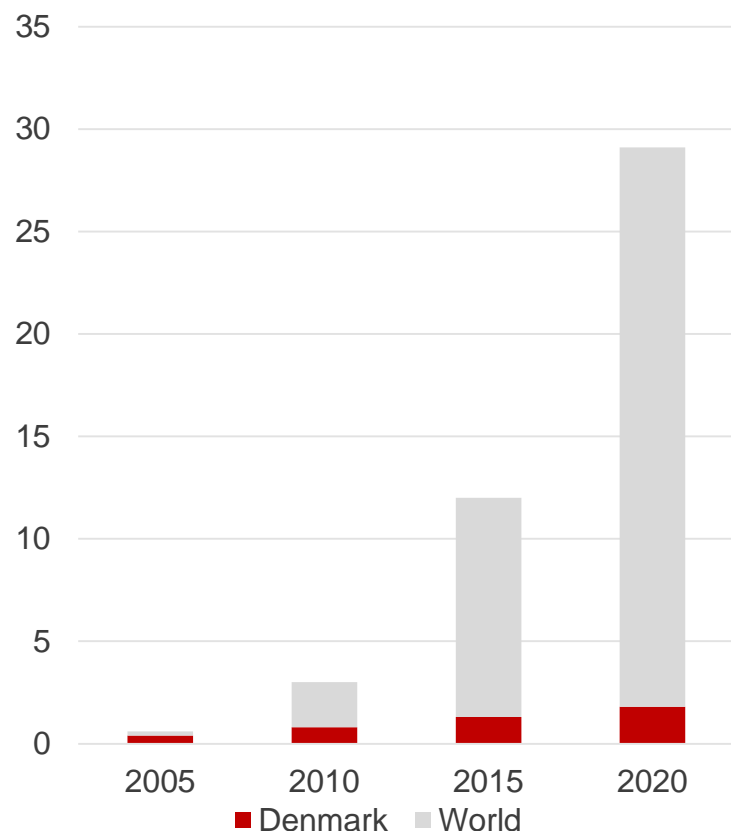
Vindeksporten slår rekord

2019 Exports: 66.5 bn. DKK

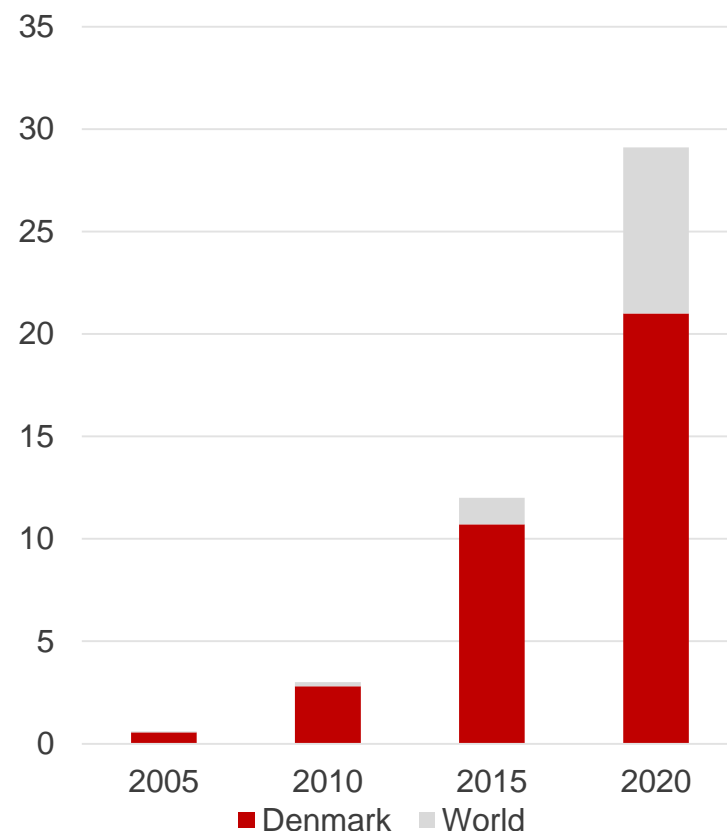
31.000 Wind employees

13 bn. DKK in tax revenue

Cumulative OF Wind (GW)



GW Delivered by DK Roots*



Source: WoodMackenzie: Offshore Project Database, 2019; GWEC OF Wind Report 2020, Mortensen, 2018 – DK Roots means Danish-based companies, Bonus, Siemens SGRE, Vestas, MHI-Vestas. Note: Wind Industry export and employment numbers are based on both onshore and offshore wind turbines.

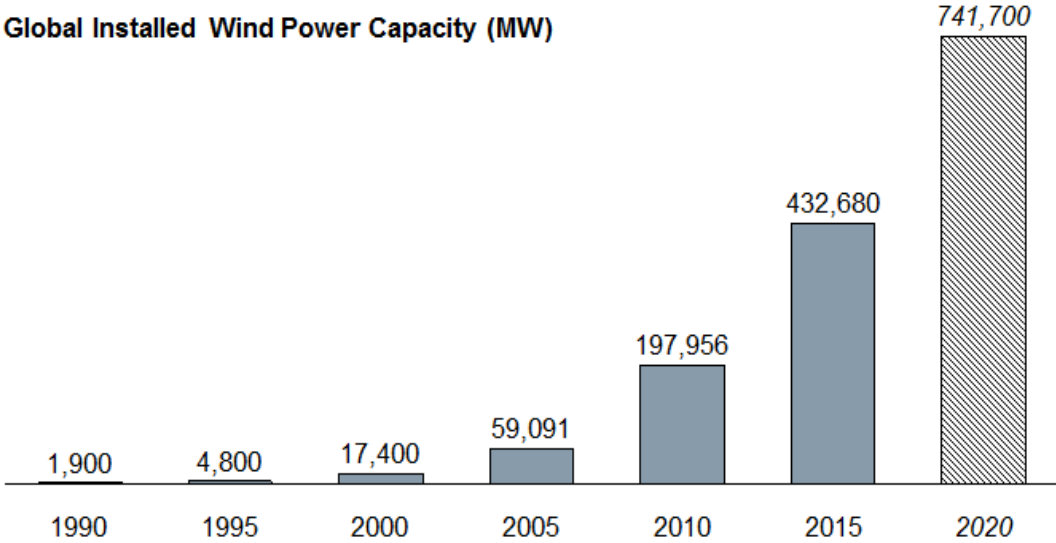
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However, as has also been the case in the onshore wind market, the chinese installation rates will soon overtake Europe and make it hard to maintain dominance in Offshore wind

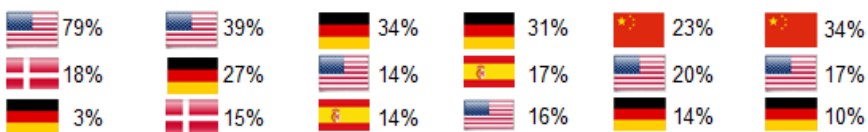


Global Offshore Wind Market Briefing

Global Installed Wind Power Capacity (MW)

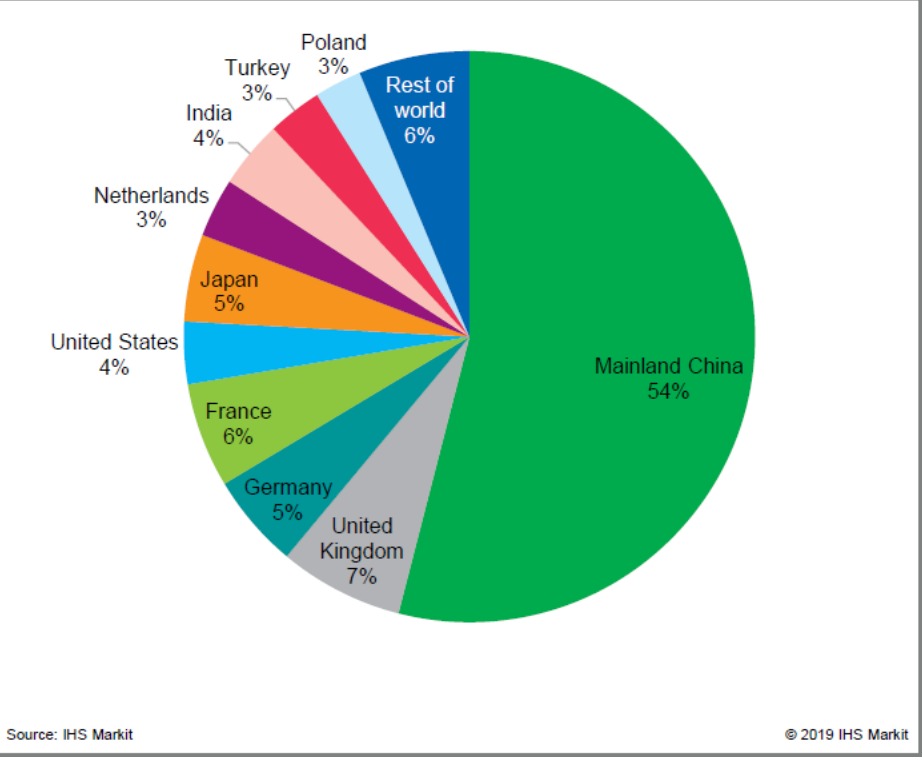


Top 3 Countries by installed capacity



Note: 2020 number is the GWEC forecast. Source: GWEC, 2007, p. 8, GWEC, 2017, p. 18;23

Top 10 offshore wind markets, 2019–50



Source: IHS Markit

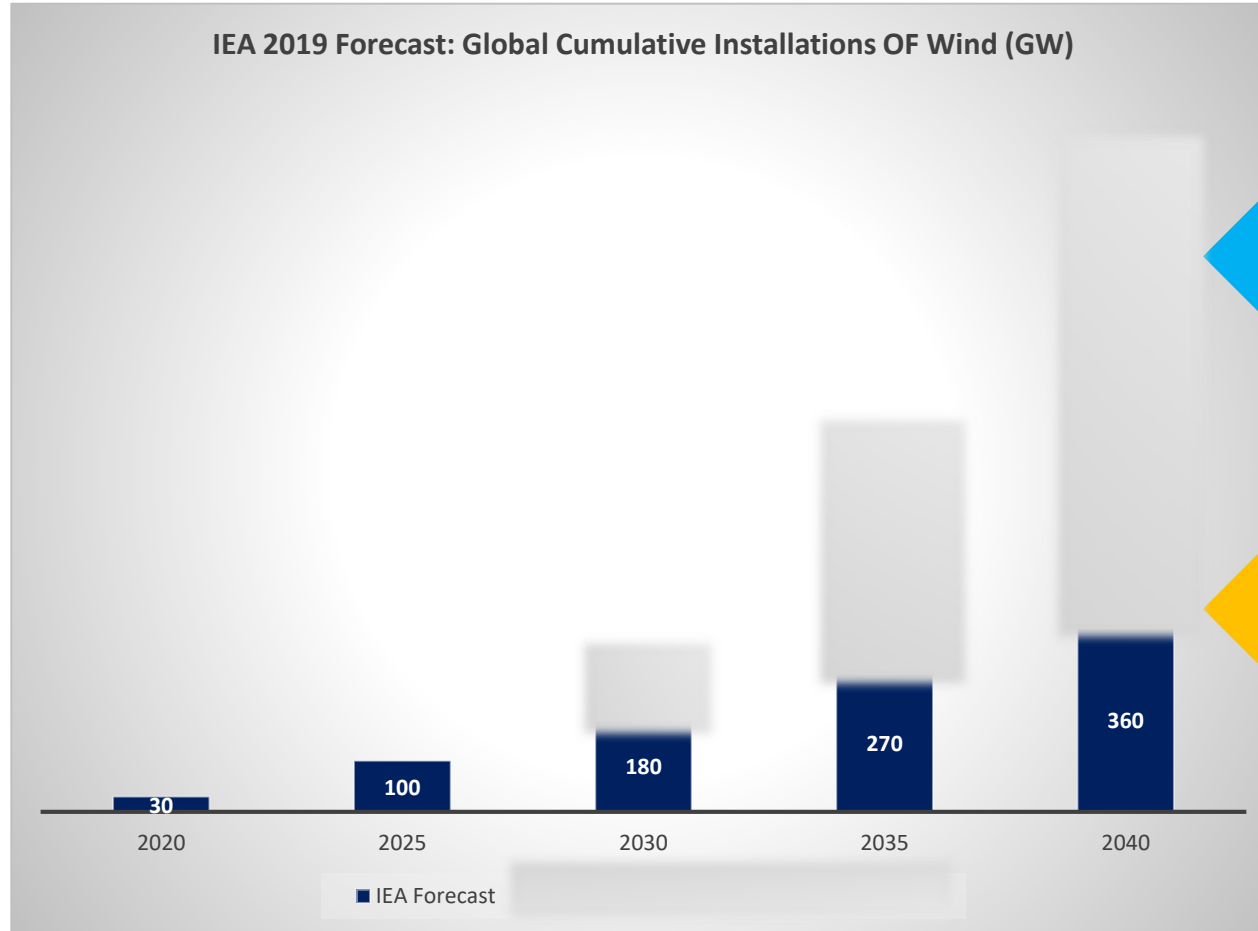
© 2019 IHS Markit

Sources: Mortensen, The valuation History of Danish Wind Power, 2018, p. 395 IHS, Global Offshore Wind Market Briefing, 2019, 59,

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But Denmark can become the frontrunner in the new PtX markets emerging on the horizon



“We identified 22 applications where hydrogen can become a cost-competitive low-carbon option....they account for up to 15% of global energy consumption (17,500 TWh).”

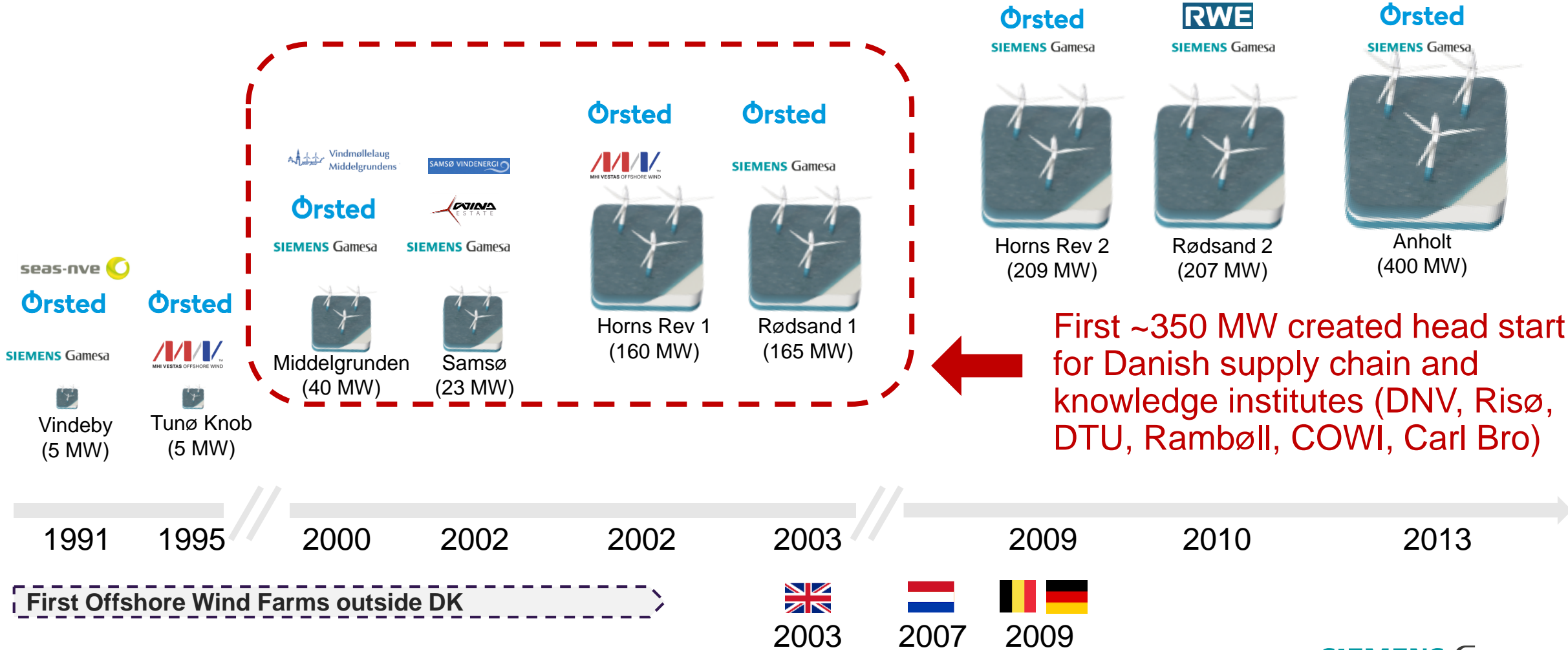


“Additional demand of up to 500 GW may be created by dedicating offshore farms to electrolysis for renewable hydrogen production.”



Sources: Forecast is from IEA, Offshore wind Outlook, p. 27: The "Stated Policies Scenario" is used. For 2030 and 2040;

The Danish offshore wind advantage was not born in a lab – It was made from early projects in the field setting the standards for the world to follow



First ~350 MW created head start for Danish supply chain and knowledge institutes (DNV, Risø, DTU, Rambøll, COWI, Carl Bro)

First Offshore Wind Farms outside DK

 2003
  2007
  2009

Pictures from the pioneering days when offshore installation was done for the first time.



Vindeby
(5 MW - 1991)



Middelgrunden
(40 MW - 2000)



Rødsand 2
(207 MW - 2010)

Picture Credits: Vindeby: Bonus, Middelgrund & Rødsand 2: SGRE

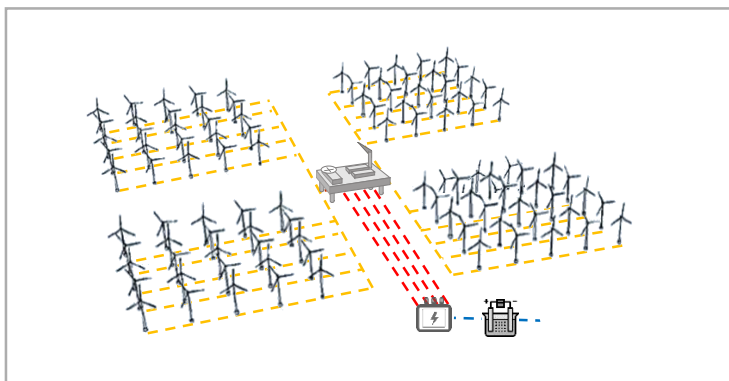
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Offshore Wind is key – There are three ways to go from electron to molecule.

Scenario I: Offshore kWh plant (as-is)



Berlingske



25.09.2019

Ørsted foreslår kæmpe vindmøllepark ud for Bornholm

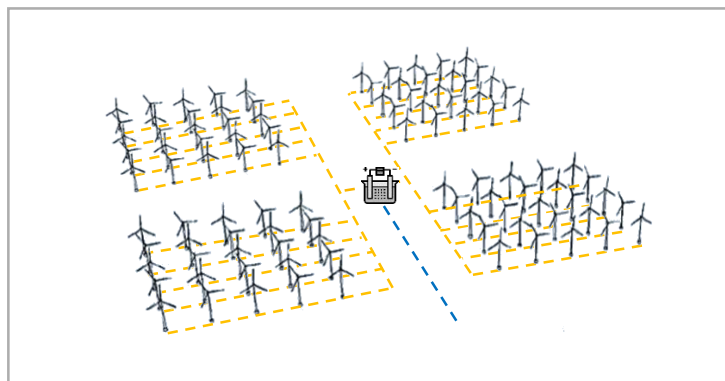
Berlingske



19.08.2020

Gigantisk brintfabrik i København rykker tættere på første spadestik: Søger kæmpe beløb hos statsfond

Scenario II: Offshore H₂ plant

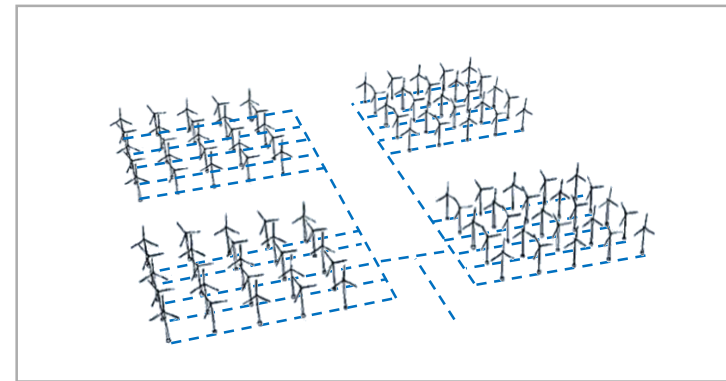


BYENS
Ejendom
Videnscenter for Byudvikling

05.06.2020

PFA, PensionDanmark og SEAS-NVE vil bygge 250.000 kvm ø med beton-sænkekasser

Scenario III: Offshore H₂ WTG



RECHARGE
Global news and intelligence for the Energy Transition

08.09.2020

Siemens Gamesa wind turbine pilot targets 'cheapest green hydrogen'

--- kWh – 66KV --- kWh – 220KV --- H₂ – Hydrogen (Pipeline incl. auxiliary power)

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SGRE has started the construction of the first pilot plant in Brande – A 0.4 MW Electrolyzer will be connected to a 3 MW Onshore DD wind turbine

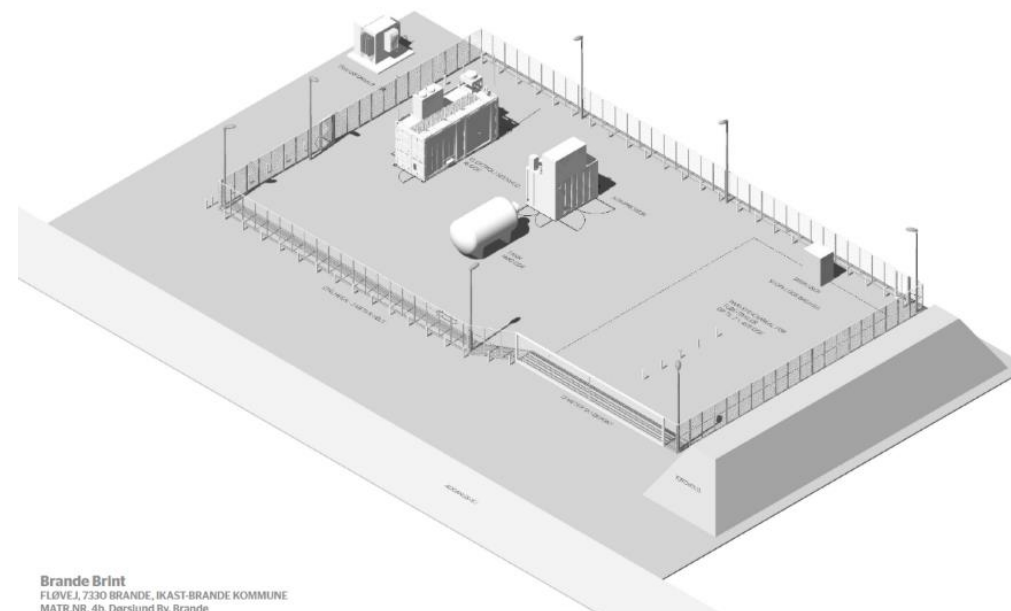
BloombergNEF

Wind Turbine Behemoth Plans for Future by Getting Into Hydrogen

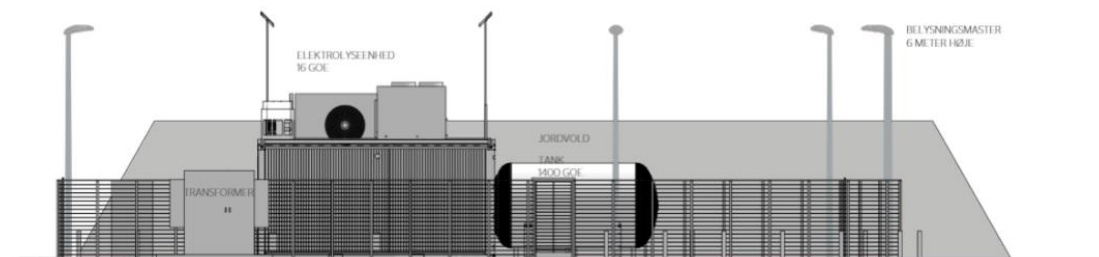


Wind Turbine Behemoth Plans for Future by Getting Into Hydrogen

bloomberg.com • 3 min. læsetid



Brande Brint
FLØVEJ. 7130 BRANDE, IKAST-BRANDE KOMMUNE
MATR.NR. 4b, Dørstund By, Brande



The site preparation is progressing as planned with offtake agreement for the hydrogen signed this month – Plan to start operations at the site by end of 2020.



Cable Ladder (week35)



Offtake agreement (week37)

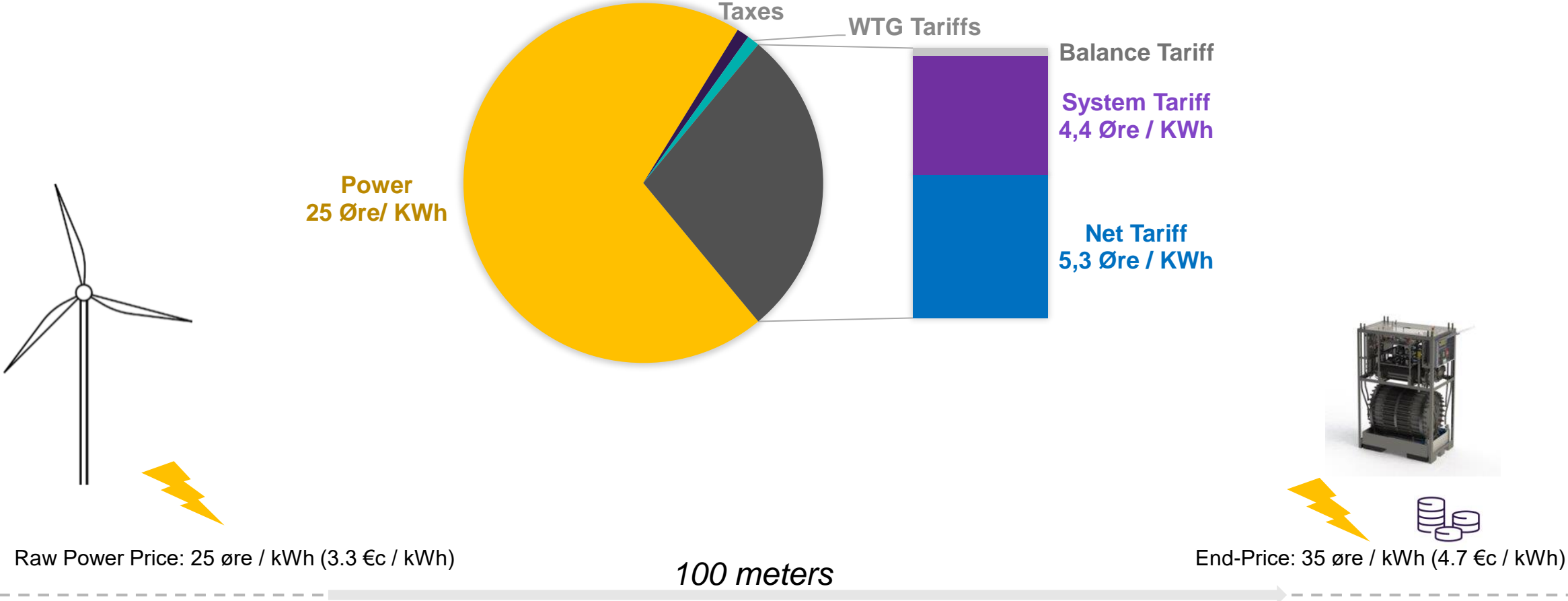


Transformer Station (week36)



Electrolyzer and Buffer Tank (Week 38)

With the offgrid solution we can solve the challenge of grid congestion – But tariffs hold back H2 innovations – Moving power 100 meters at our site costs us ~10 øre/kWh in tariffs.



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Conclusion: Offshore wind coupled to hydrogen can decarbonize ‘hard-to-abate sectors’ but grid tariffs hinder the innovative first projects to take off.

New market regulation is urgently needed to enable this key block in the green transition.

- Denmark is a leader in offshore wind, because of the first large projects.
- Rambøll, DNV-GL, COWI are global go-to companies within offshore wind.
- Power-to-X could turn DBI, DHI, Force etc. into tomorrows Rambøll for PtX.
- Innovation in value chain set-up is urgently needed.
 - Reduced tariffs for PtX conversion.
 - Flexible test set-up through lean approval processes
 - Safety standards to ensure safe large-scale hydrogen production.
 - Hydrogen Infrastructure to enable cost-efficient storage.
- Denmark again has the opportunity to set the global standard – Let’s seize it!

