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WIND ENERGY

The German Offshore *Windwunder*: lessons learnt and road ahead

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German OFFSHORE WIND ENERGY Foundation

German OFFSHORE WIND ENERGY Foundation (Stiftung OFFSHORE-WINDENERGIE)

- Founded in 2005 to promote environmental and climate protection by **supporting the development of offshore wind in Germany**
- Non-profit trust - multiregional, independent organization
- **Communication platform** for policy makers, maritime and offshore wind industry, as well as research organizations
- Offices in Varel (Lower Saxony) and in Berlin
- **Ownership rights for alpha ventus** (first offshore wind farm in Germany 2010); SOW initiated and moderated overall project with all relevant stakeholders/authorities





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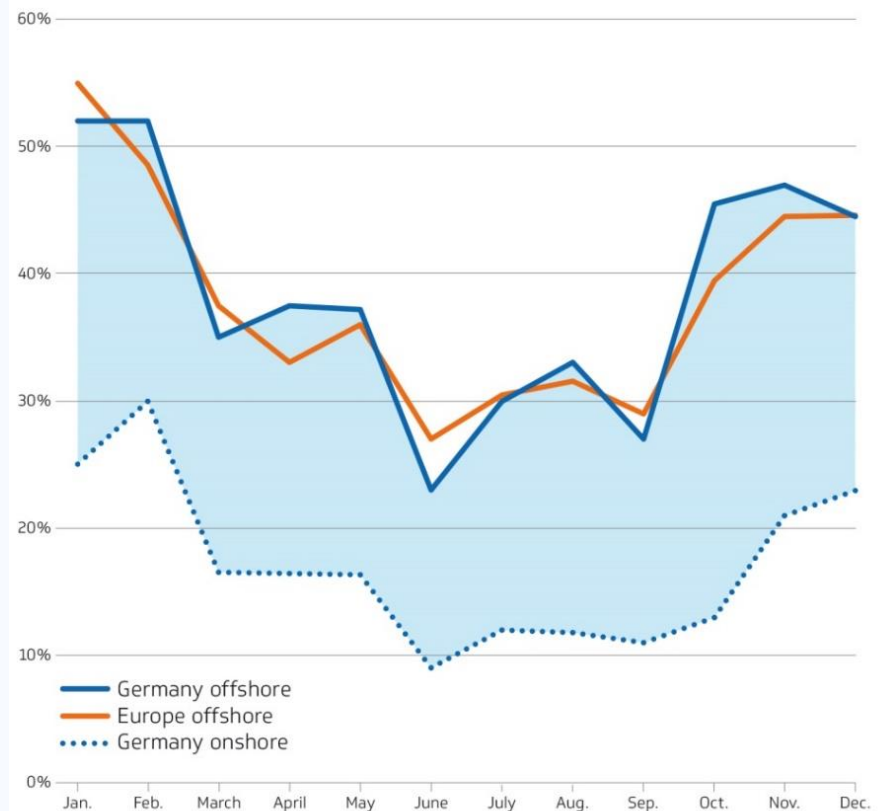
Why offshore wind?



Why offshore wind? Top performance in the German electricity mix

- Offshore wind produces **steady and reliable** quantities of power
- Energy yield from turbines at sea **twice as high as onshore** (capacity factors of 50 % plus)
- **Good predictability** supports security of supply
- Given optimal expansion, offshore wind can provide around **30% of electricity consumption** by the year 2050 (IWES)

OFFSHORE RELIABLY DELIVERS HIGH ENERGY YIELD



High yield per installed capacity: capacity factor (ratio of actual production to theoretical maximum output) on land and at sea
Source: Windguard, WindEurope 2017

Infographics: Ahnen&Enkel

Why offshore wind? Rapidly declining costs

- Already today, **costs of offshore wind energy have fallen** to the level of new fossil power plants.
- When **pricing in external costs** (i.e. with a carbon price), offshore wind is already much cheaper today .
- Further cost reductions are realistic in case of a continuous and **ambitious expansion pathway**.





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**Offshore wind
worldwide**

Global development

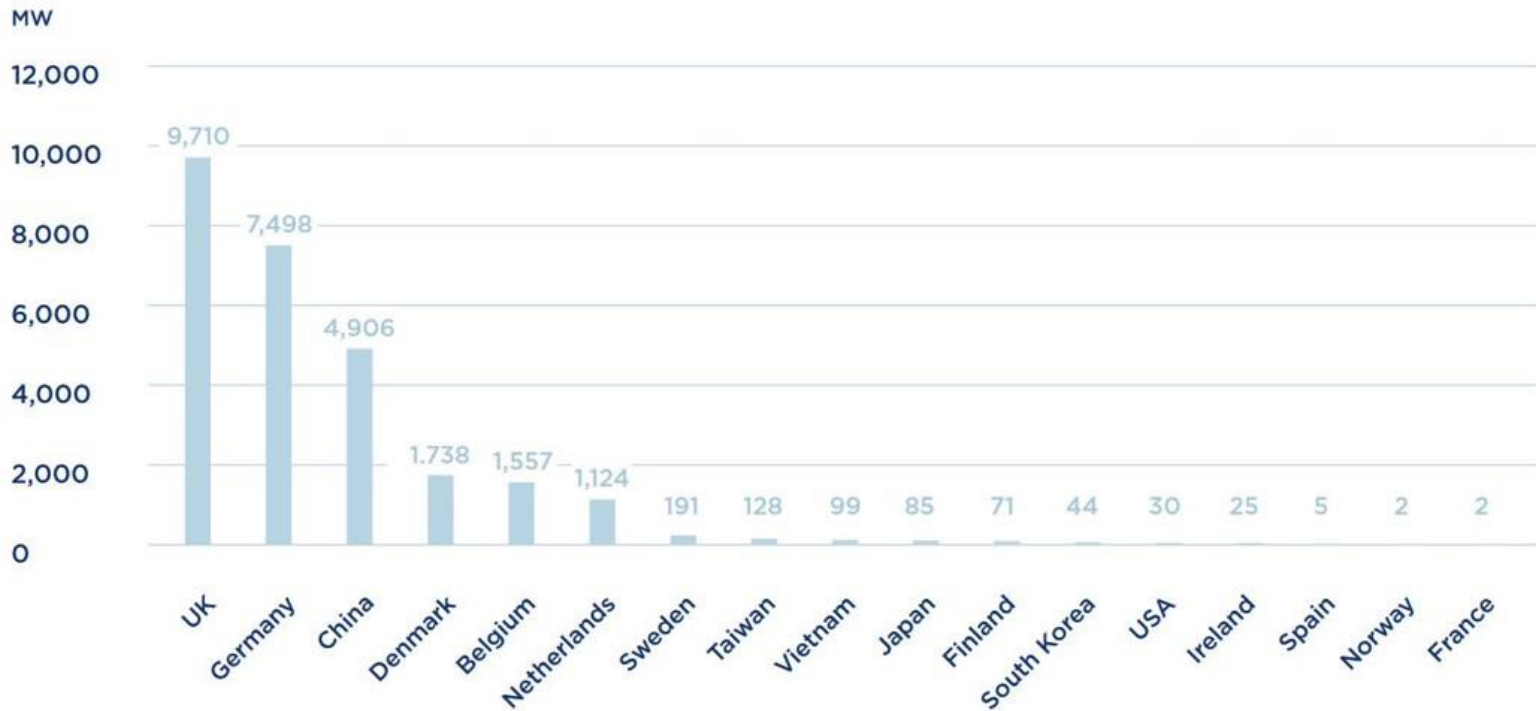
Global offshore wind capacity in operation² - cumulative



WFO (2020)

Global comparison

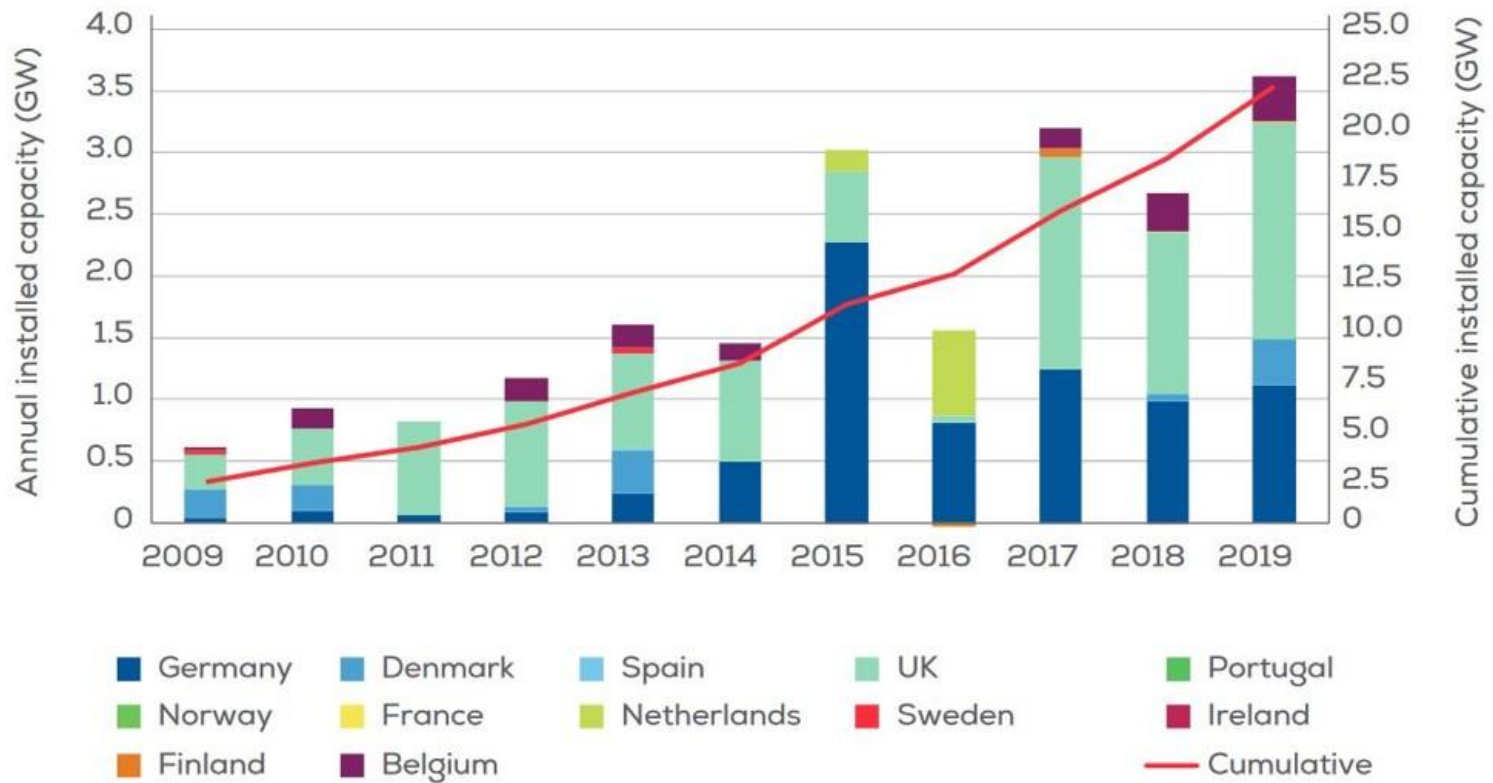
Global offshore wind capacity in operation⁴ - by country



⁴ In operation: all turbines of wind farm installed and first electricity being generated

European development

Annual offshore wind installations by country (left axis) and cumulative capacity (right axis) (GW)



WindEurope (2020)



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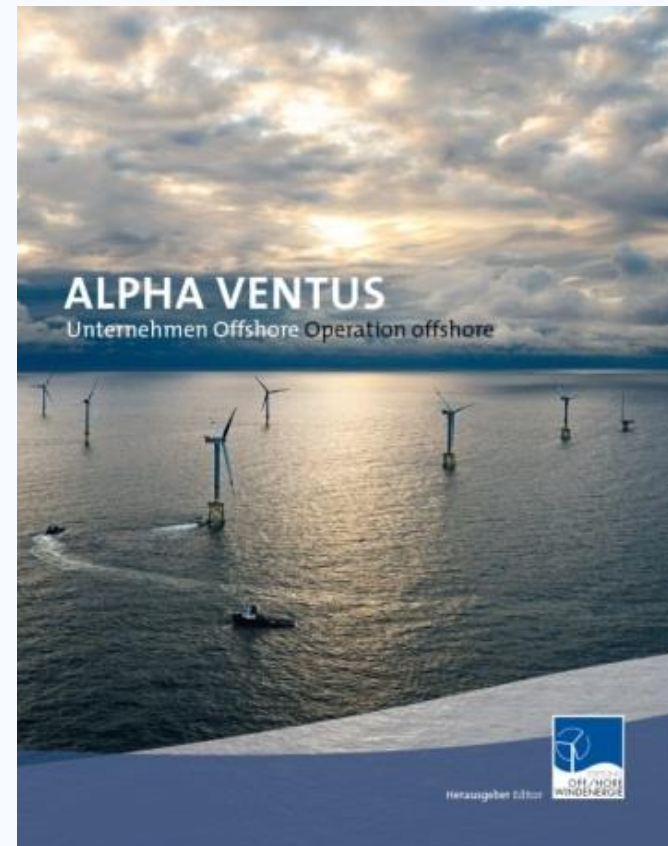
Pioneering project: alpha ventus



Pioneering project: *alpha ventus* test site

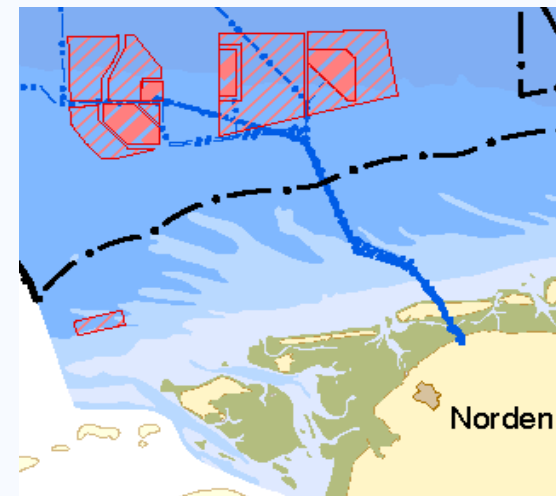
First Offshore Wind Farm (OWF) in Germany, paving the way for commercial projects

- 60 km distance to shore, 30 m water depth
- First OWF with 5 MW class (12 turbines) → 60 MW
- 2 turbine manufacturers (AREVA/Multibrid, REpower)
- 2 types of foundations (tripods, jackets)



Pioneering project: *alpha ventus* test site

- **Permits acquired** by SOW in 2005
- **Leased to DOTI** end of 2006 (EWE, E.ON, Vattenfall)
- **Construction start in 2008**, commissioning in 2009/10
- Impressive operational results – 50 % capacity factor (**4,450 full load hours**) > 1 TWh electricity production by 2014
- RAVE – **Research at alpha ventus**
Extensive ecological and technological R&D Program funded by the German government (50 Mio €)



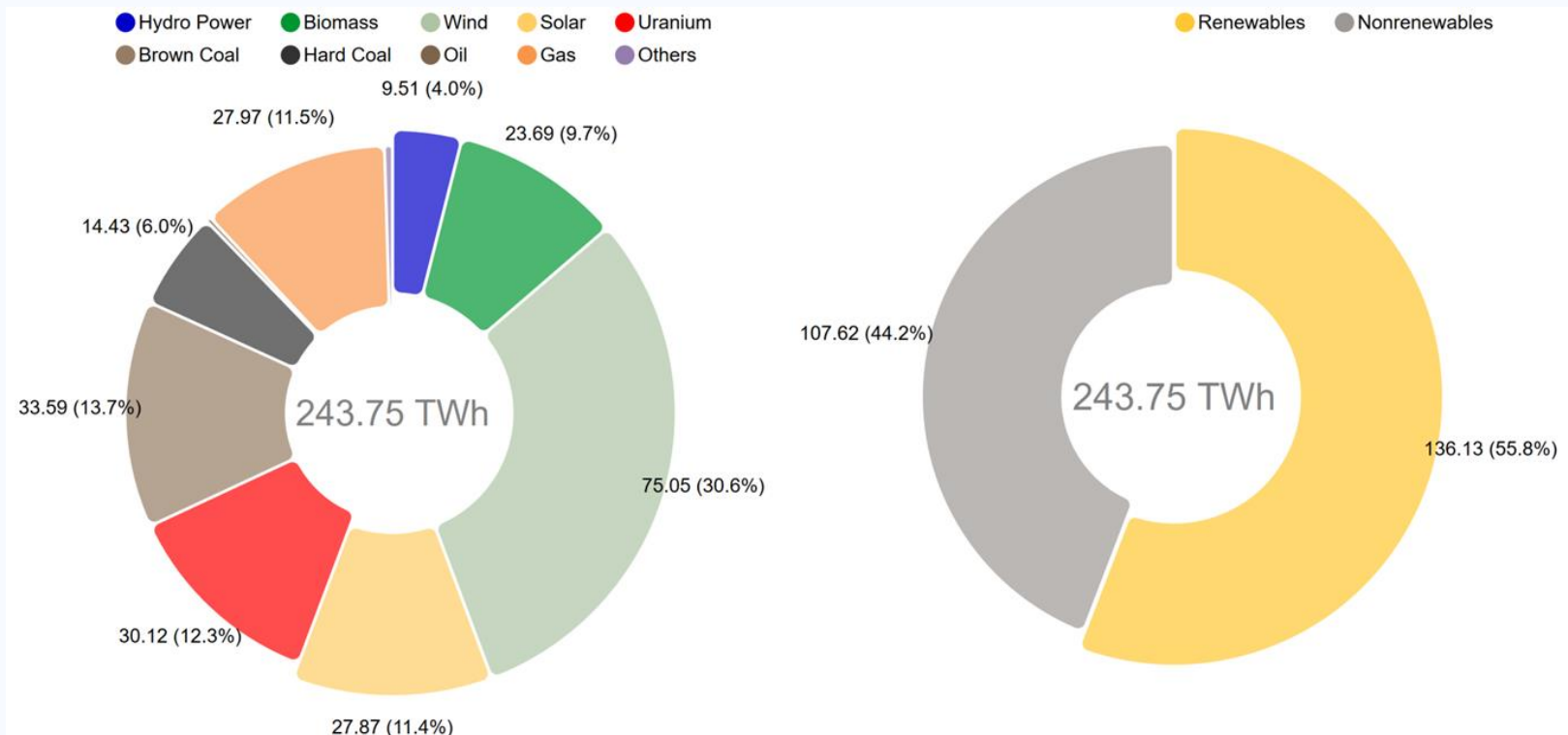


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Status quo and developments

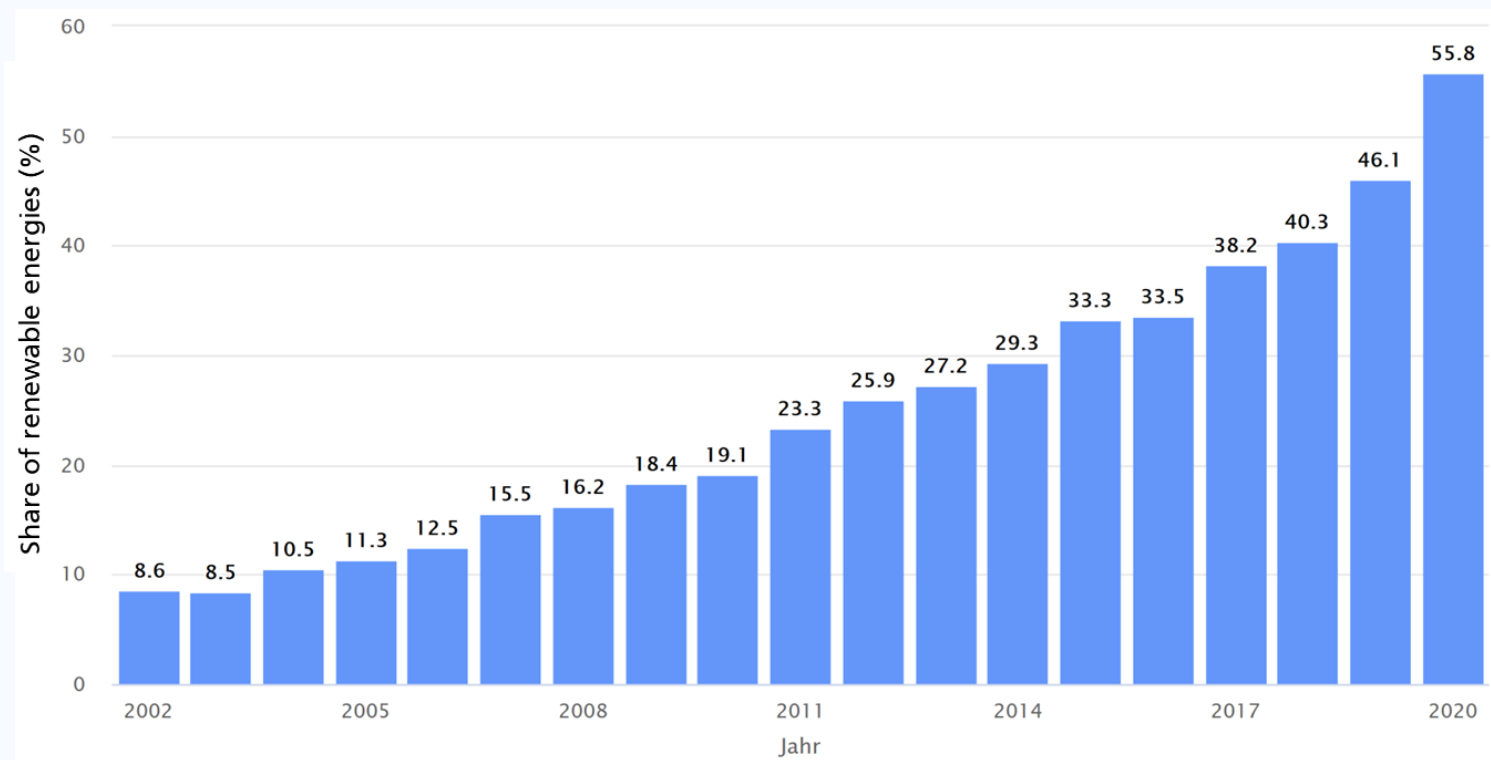


German net electricity generation: first half of 2020



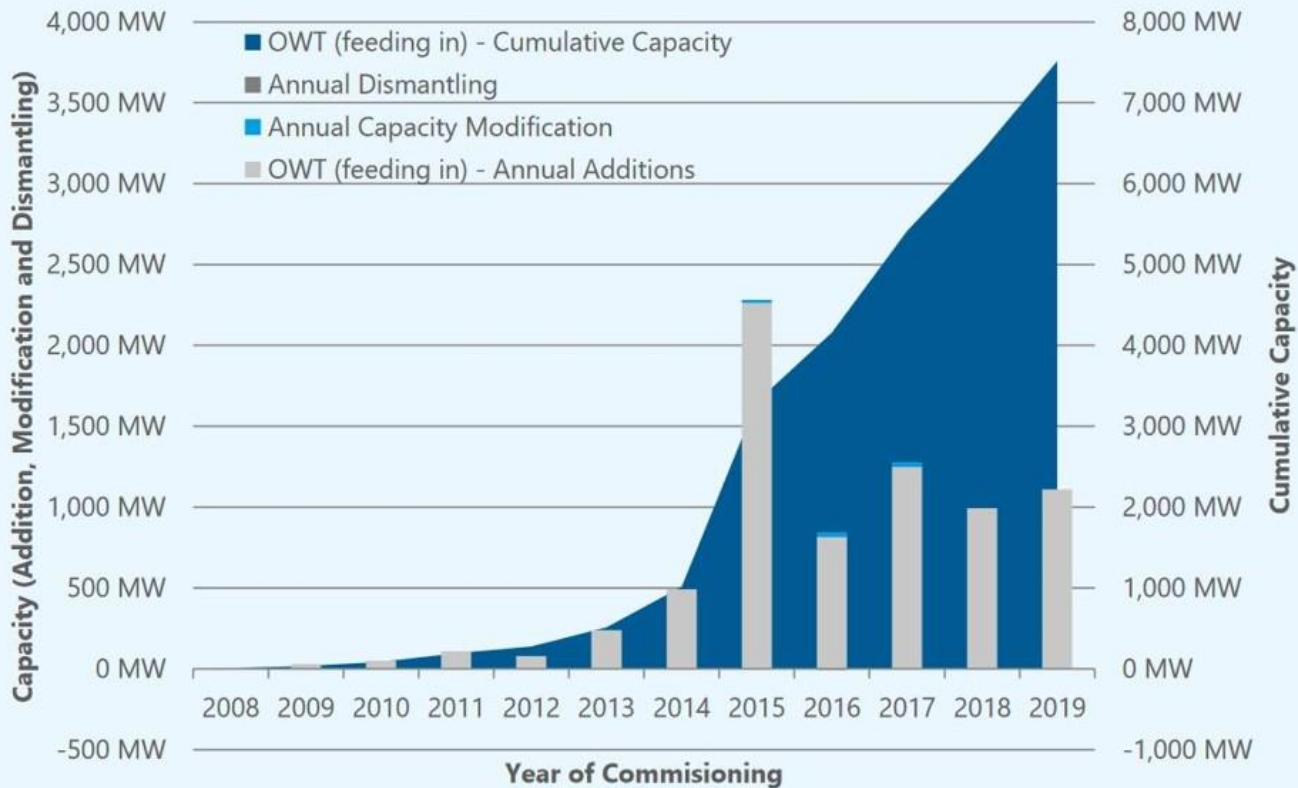
Fraunhofer ISE (2020)

Share of renewables in net electricity generation: first half of 2020



Fraunhofer ISE (2020)

Offshore wind expansion 2008 to 2019



Development of the Offshore Wind Energy in Germany (Capacity of OWT Feeding into the Grid)

Deutsche WindGuard (2020)




Offshore wind farms: status by July 2014



July 2014
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	German territory and EEZ		Operating		Maintenance port
	Priority zone for offshore wind farms		Under construction		Manufacturing port
	Border between the EEZ and the territorial waters		Approved (Investment decision made)		Base port

Offshore wind energy
Operating | Under construction | Approved (Investment decision made)

15 wind farms **885 wind turbines**

616 MW
584 MW
2647 MW
3847 MW Total capacities

Offshore wind farms: status by December 2019



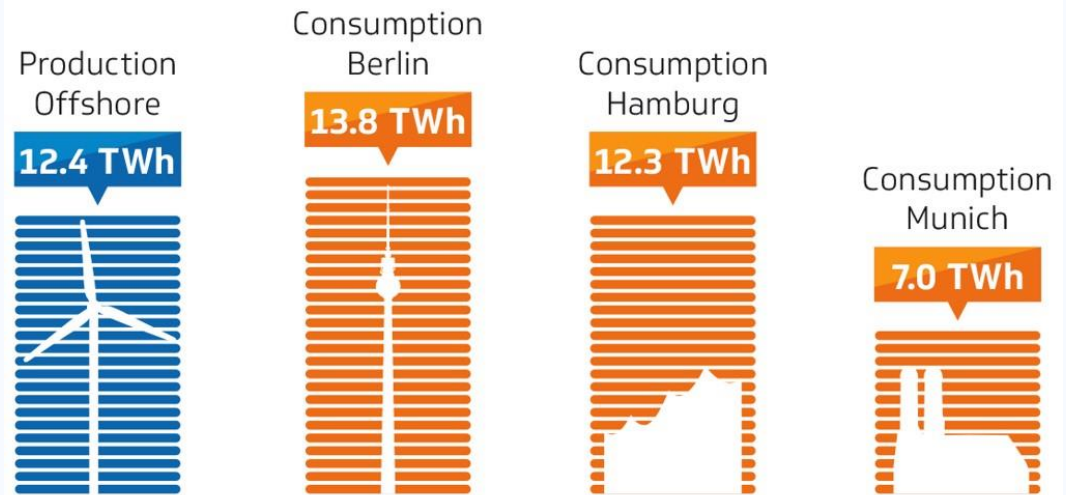
CAPACITY OF OFFSHORE WIND TURBINES IN THE GERMAN NORTH AND BALTIC SEAS



Offshore wind energy in Germany

- By Dec. 2019, some **1,500 offshore wind turbines** are operational in German waters
- These installations generated approx. **25 TWh electricity in 2019** alone (only 2 years earlier, it was just 12.4 TWh).
- That amount of power is equal to the entire annual electricity demand of **Berlin and Hamburg** combined.

OFFSHORE WIND CAN SUPPLY MAJOR CITIES



Electricity production offshore 2016 and energy consumption of German cities
Source: Agee-Stat 2017, municipal utilities

Infographics: Ahnen&Enkel

Offshore: Deutschlands Windstärke (2017)

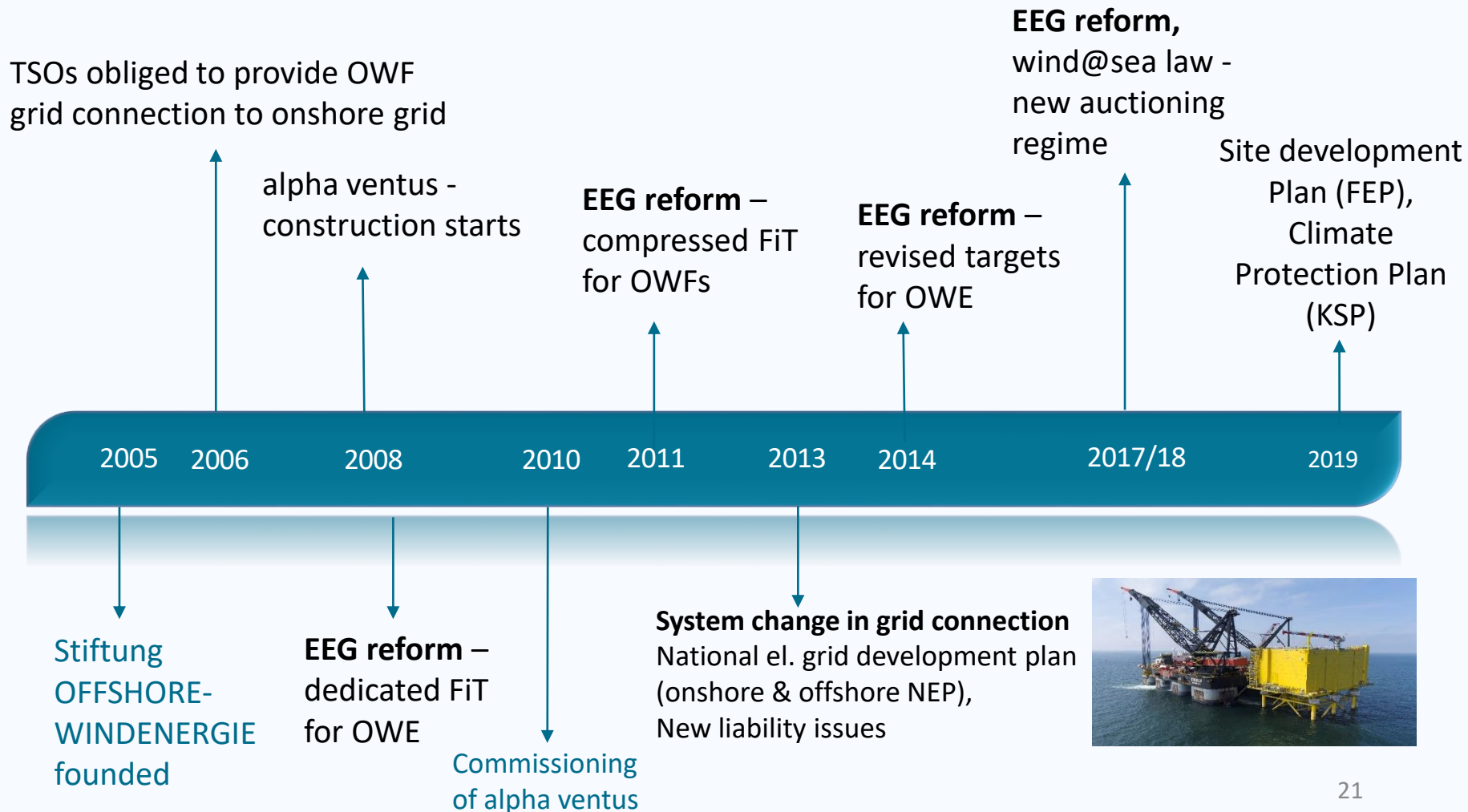


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Regulatory overview



Major regulatory developments in the past decade



Expanding offshore wind power: recent trends

- **September 20, 2019:**
German Climate Cabinet agrees to raise offshore target from 15 to 20 GW by 2030
- **May 12, 2020:**
Federal government and coastal states officially agree on 20 GW target for 2030
- **May 26, 2020:** Government presents draft bill for Wind-at-Sea Law with 20 GW target for 2030, and 40 GW for 2040 respectively.
- **June 3, 2020:** Cabinet adopts reform bill for Wind at Sea law – legislative process to follow after the summer break
- **June 19, 2020**
BSH publishes draft FEP (Site Development Plan) to accommodate 20 GW by 2030 – open for consultation until 20 June 2020



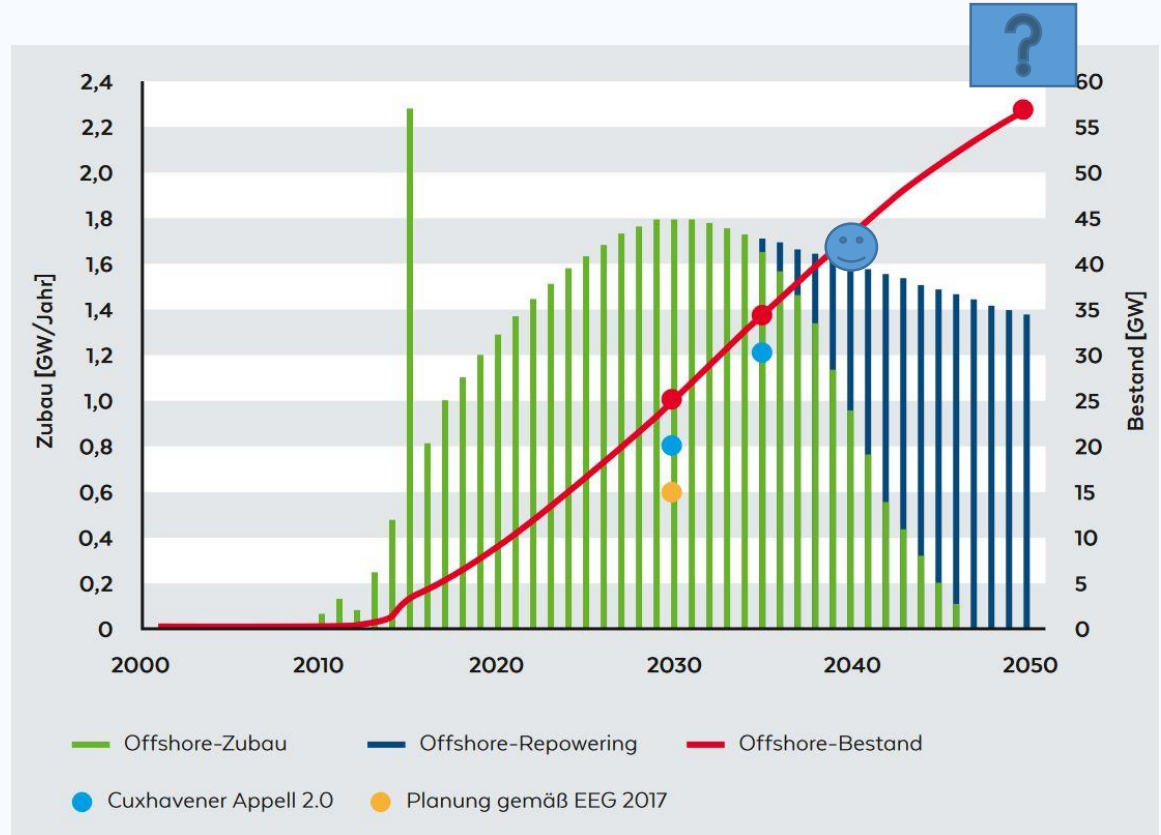


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Outlook and perspectives

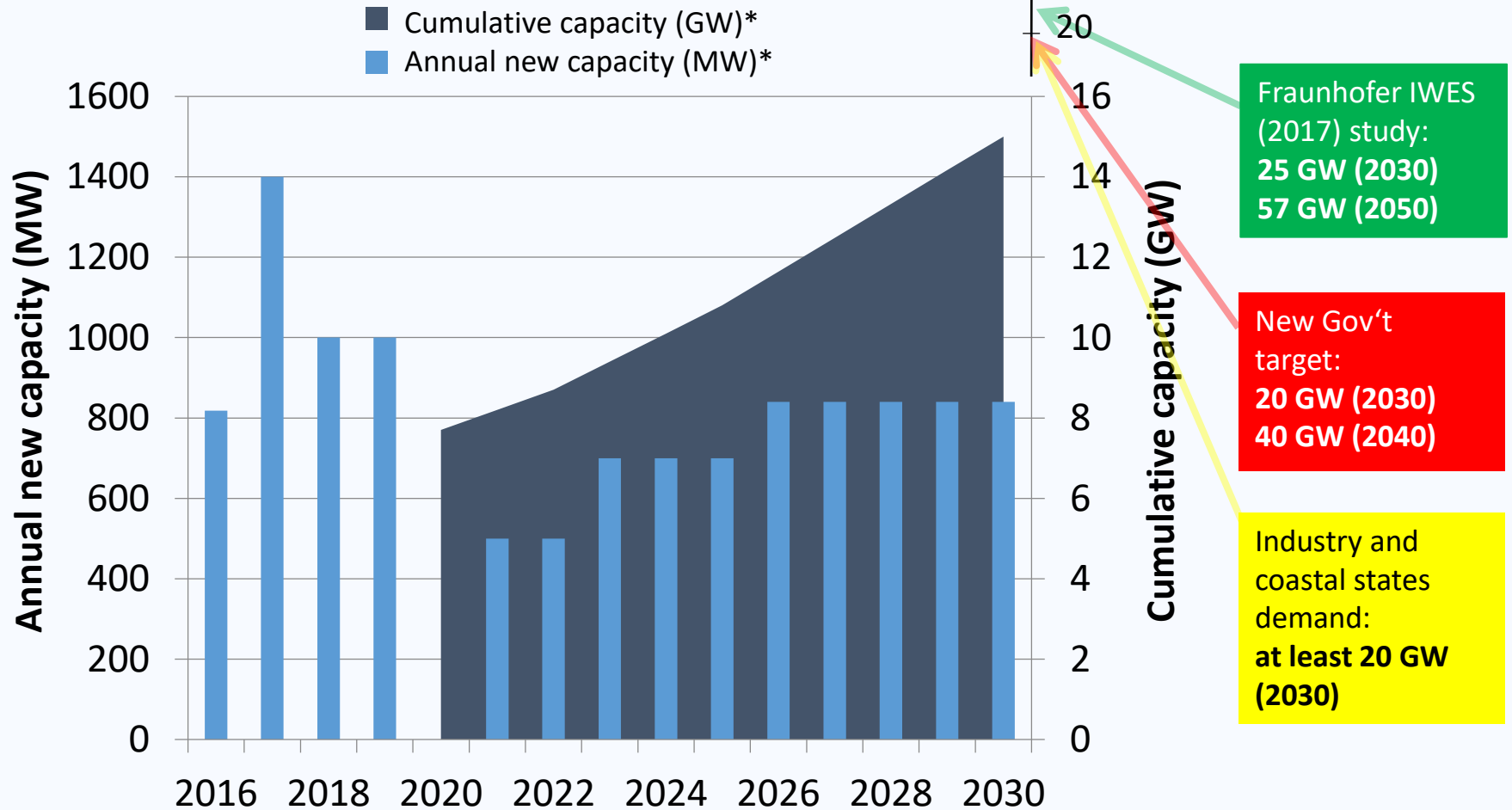


Projected offshore wind expansion until 2050



Fraunhofer IWES (2017)

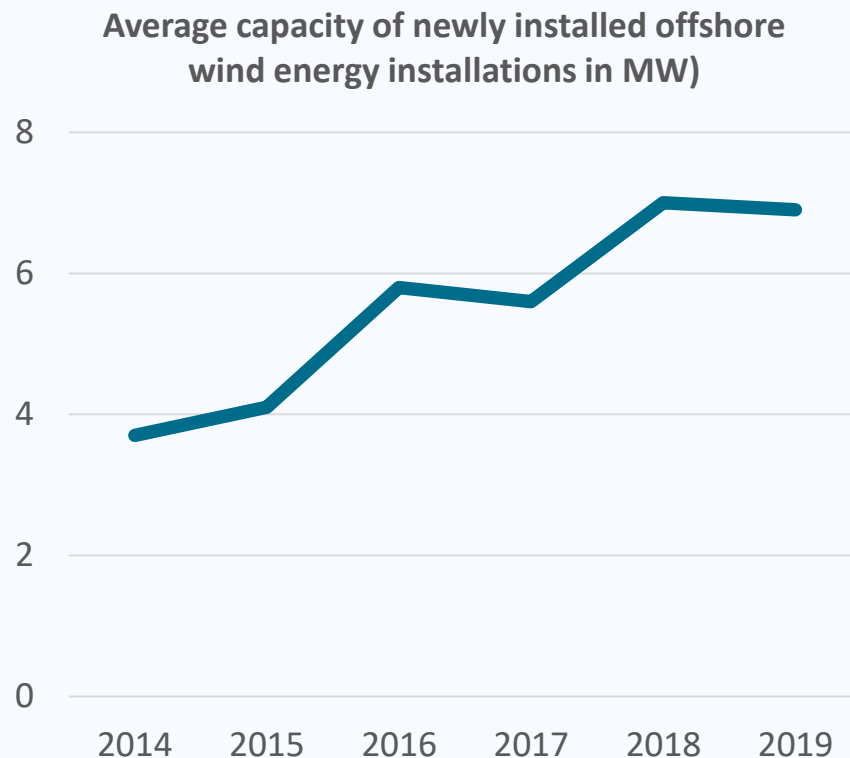
Future expansion pathway: goals



*according to WindSeeG/EEG 2017

Rapidly declining costs

- Massive **technological advancements**: the average capacity of installations has doubled in only five years.
- Extreme **cost degression** per kilowatt-hour generated.
- The offshore industry remains **highly innovative**.
- **Worldwide growth markets** for offshore wind energy.



Deutsche WindGuard (2020)

Policy framework: The end of fossil fuels has begun

- **Nuclear phase-out** will soon be completed – offshore wind as energy transition's backbone with high full load hours.
- **Coal phase-out** has been agreed on by the government.
- **Carbon pricing** as an important market signal.
- Expansion perspective for renewables after 2030 is insufficient („**electricity gap**“).



Industrial policy perspective: Increasing demand for renewables

- Massively **growing industrial demand** needs to be served.
- **National hydrogen strategy** requires additional renewable energy (especially offshore wind).
- **Carbon price** as an important market signal for future investment.



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North Sea Grid for the European Green Deal

How to unlock Europe's Offshore Wind potential - a deployment plan for a meshed HVDC grid

Pre-conference Breakout Sessions

August 24th - September 18th 2020

Final Event

September 21st 2020

<https://register.gotowebinar.com/register/6564018855193404687>

www.promotion-offshore.net





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Thank you for your attention!

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Foundation

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zur Nutzung und Erforschung der
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