

Offshore Wind Energy in Germany and Europe: Status Quo and Market Outlook

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Managing Director

German Offshore Wind Energy Foundation

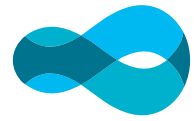




Agenda

1. German Offshore Wind Energy Foundation - Who we are
2. Why Offshore Wind?
3. Legal Framework for Offshore Wind in Germany
4. Offshore Wind Market Development and Outlook

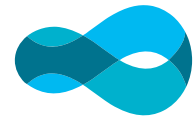




German Offshore Wind Energy Foundation (Stiftung OFFSHORE-WINDENERGIE)

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





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Board of trustees

Representing key stakeholders from German offshore wind & maritime industry, TSOs as well as policy makers, e.g.

- Ministries (federal and state level)



- Utilities & offshore wind farm developers



- Manufacturers of offshore wind turbines and foundations



- Construction companies, suppliers, logistics and service providers, incl. maritime industry



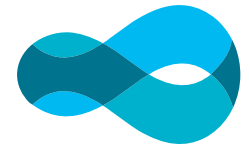
- Banks and financial investors, Insurance companies



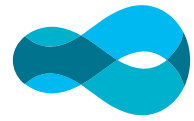
- Trade associations and other regional wind institutions



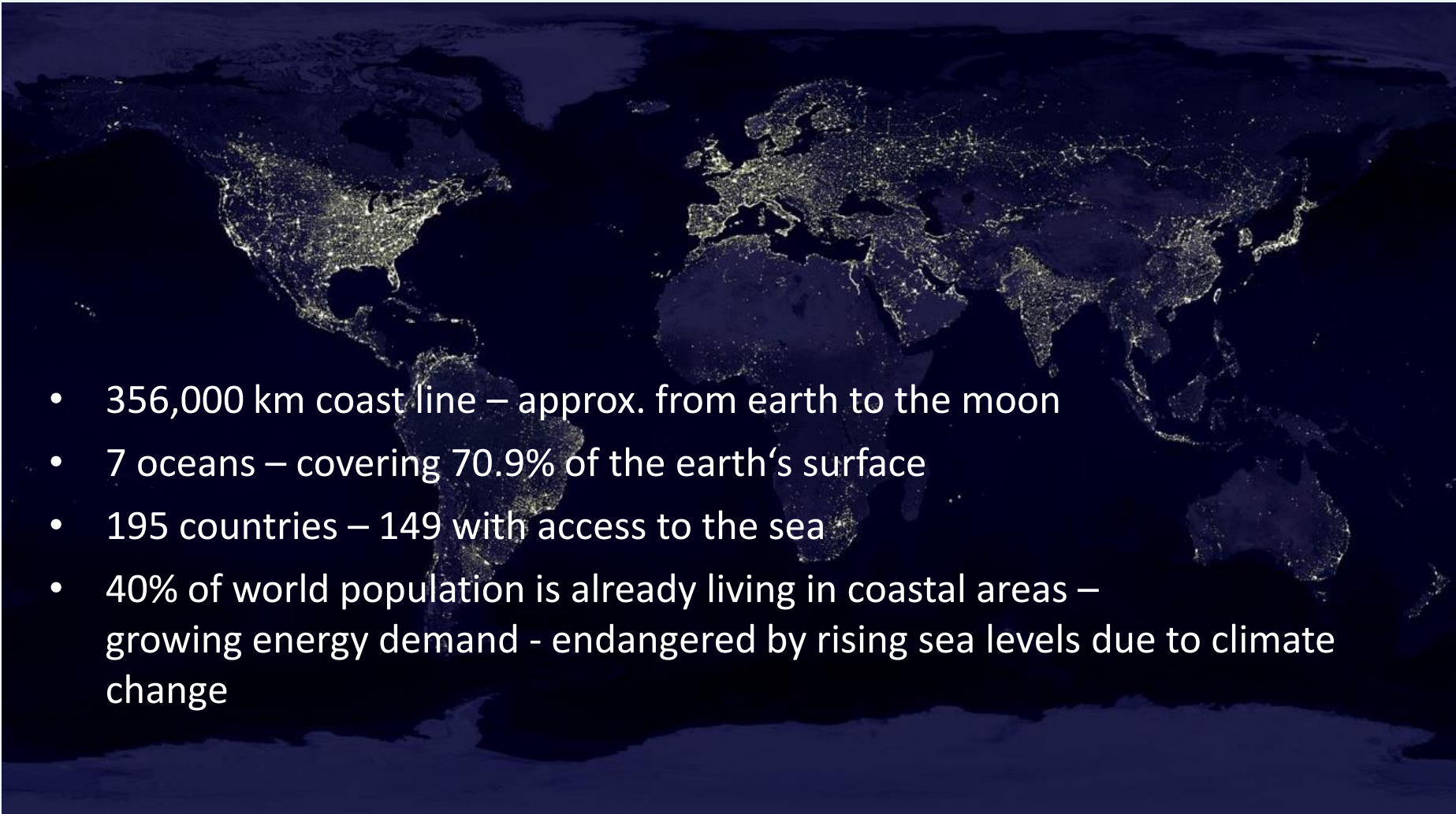
→ approx. 100 trustees

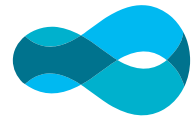


Why Offshore Wind ?



The Facts

- 
- 356,000 km coast line – approx. from earth to the moon
 - 7 oceans – covering 70.9% of the earth's surface
 - 195 countries – 149 with access to the sea
 - 40% of world population is already living in coastal areas – growing energy demand - endangered by rising sea levels due to climate change



Why Offshore Wind?

- **Levelized Cost of Energy (LCOE):**

Electricity from Offshore Wind has become competitive and economically viable

- **Employment:**

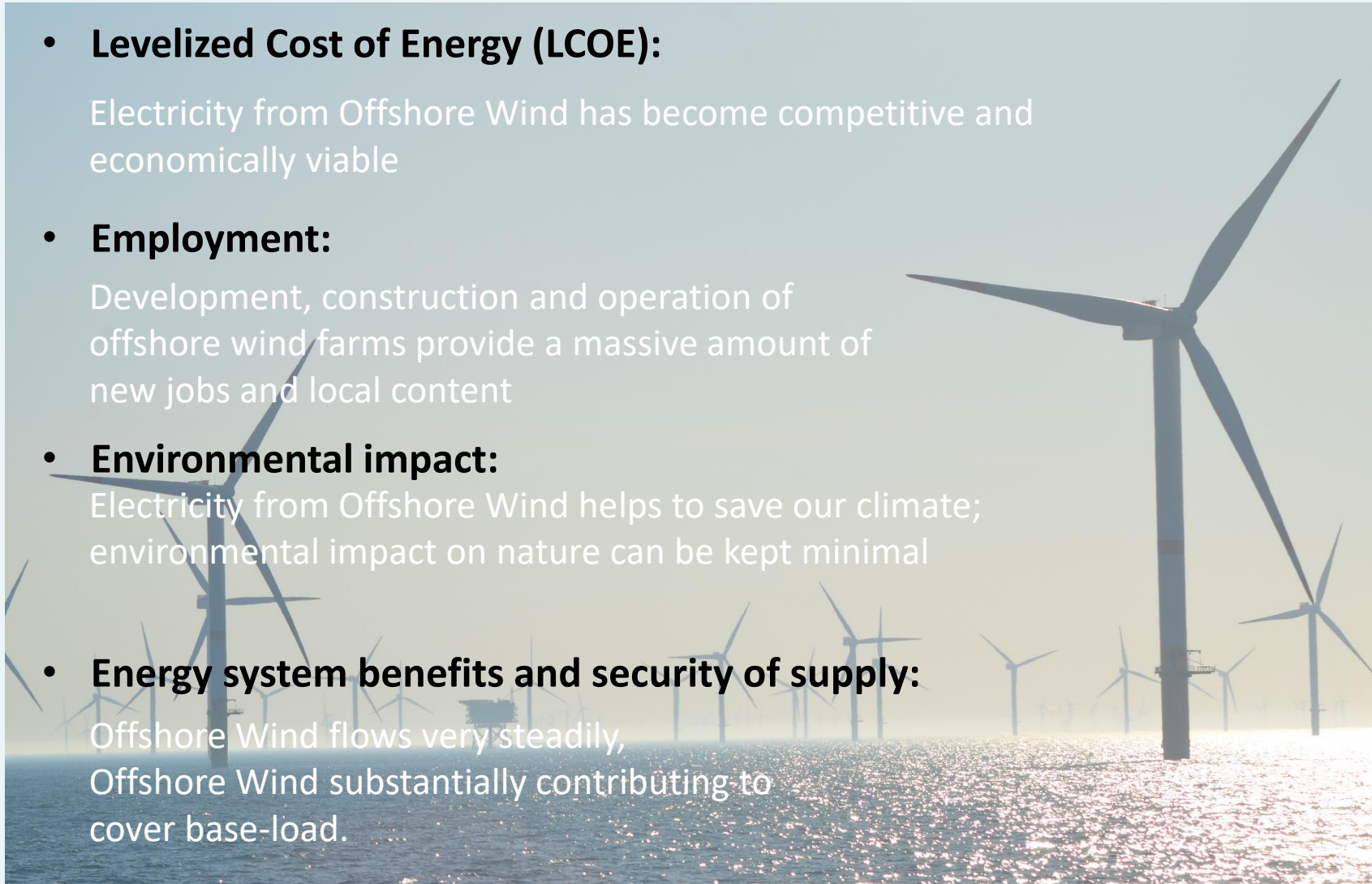
Development, construction and operation of offshore wind farms provide a massive amount of new jobs and local content

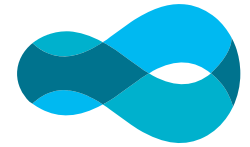
- **Environmental impact:**

Electricity from Offshore Wind helps to save our climate; environmental impact on nature can be kept minimal

- **Energy system benefits and security of supply:**

Offshore Wind flows very steadily,
Offshore Wind substantially contributing to cover base-load.



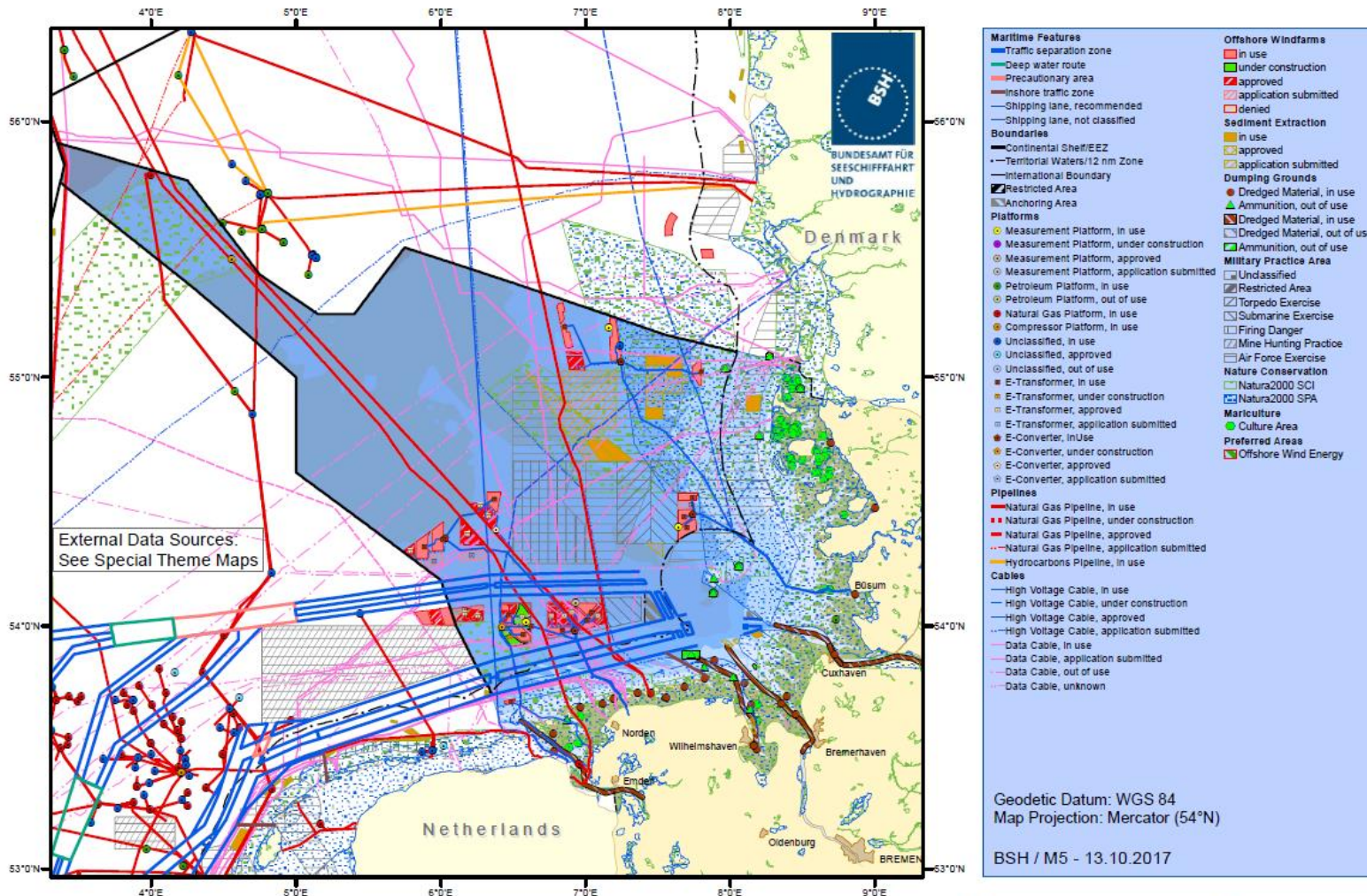


Offshore wind energy development in Germany

Legal Framework

A First Prerequisite: Maritime Spatial Planning

North Sea: Existing and Perspective Uses and Nature Conservation





The Renewable Energy Act - EEG

Support for renewable energy technologies via the EEG since 2000 – specifies remuneration, technology differentiation

Issues for offshore wind during past decade (prior to 2009)

- No investments due to insufficient remuneration for offshore wind energy (9,1 ct/kWh)

EEG of 2008 (entered into force on 1st Jan. 2009)

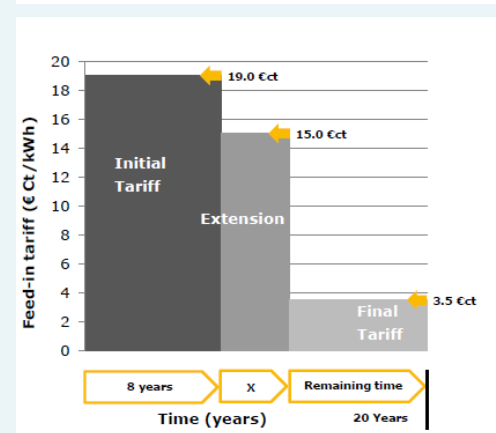
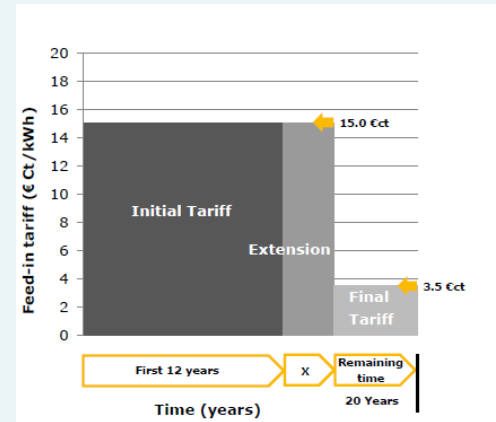
- ✓ Increase of initial Feed-in-Tariff (FiT) to **13.0 ct/kWh**, plus **starter bonus of 2 ct**, granted for **12 years** after commissioning (if commissioning before 1 January 2016)

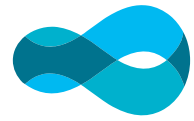
EEG of 2011 (entered into force on 1st Jan. 2012)

- ✓ **Compressed FiT:**
Option to claim an **increased initial rate of 19 ct/kWh** – only granted **for 8 years** after commissioning, afterwards FiT drops to 3.5 ct/kWh
- ➔ Important boost for investment decisions

New issues emerged in 2013

“Electricity price brake” (*Strompreisbremse*) – debate since Feb. 2013
Created **Uncertainty** about future prospects of the EEG

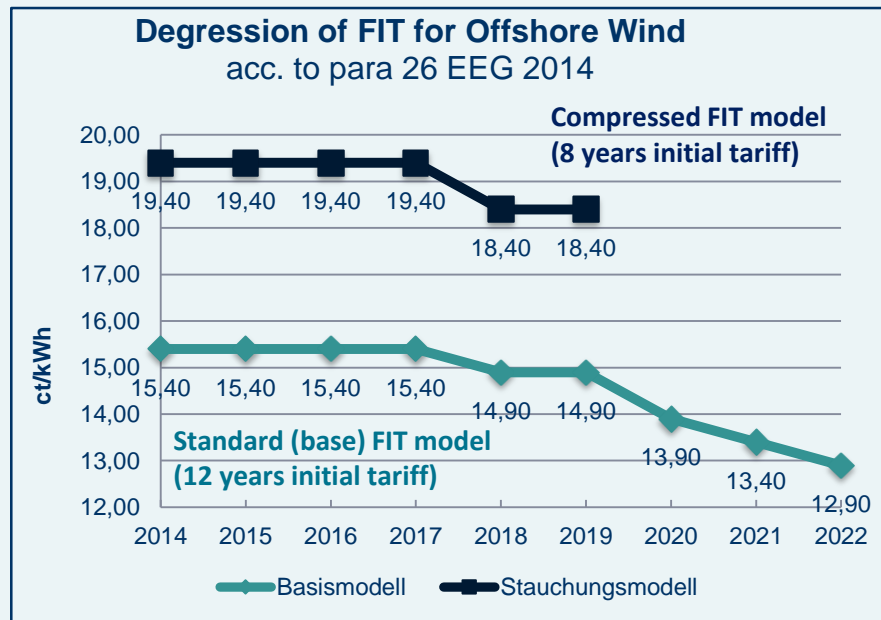




EEG 2014 – Revised targets for OWE

Year	IECP* of 2007	§ 3 EEG 2014
2020	10 GW	6,5 GW
2030	25 GW	15 GW

* Integrated Energy and Climate Programme of German Govt.



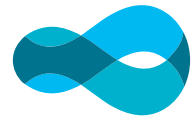
... **but** 2-year FIT-extension granted until Dec. 2019;

NOTE:

After 2020, new tendering scheme for OWE envisaged.

For other RES, tenders in 2017, based on outcome of (greenfield) PV pilot tender

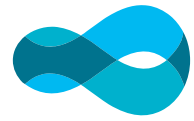
Degression of FIT	para 20 EEG 2012	para 26 EEG 2014
Standard (base) model	7 % annual degression after 2017	in 2018: 0,5 €ct/kWh in 2020: 1,0 €ct/kWh
Compressed FIT	No degression	in 2018: 1,0 €ct/kWh



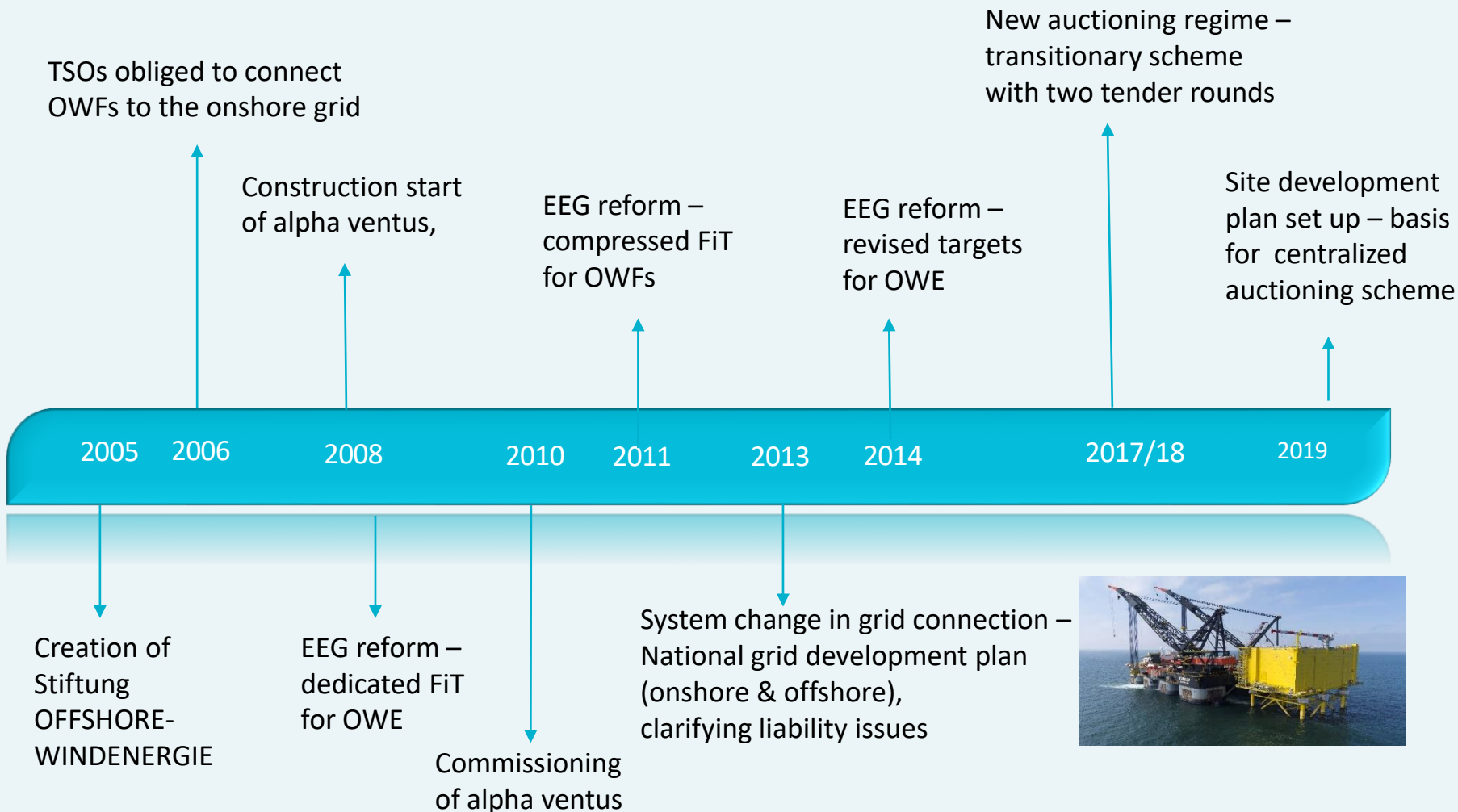
EEG 2017 / Wind @ Sea Law –

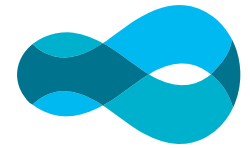
Introduction of auctions with new installation trajectories

- **Government target for OWE** capacity by 2020 is 6.5 GW, and **15 GW by 2030**
- + 1.2 GW for offshore grid capacity by 2020
→ total OWE capacity by 2020 may potentially grow to a max. of 7.7 GW
- Wind @ Sea Law – Transition from FiT (feed-in tariff) to auctions.
New installation trajectory for 2021 – 2030 → **Total new capacity of 7.3 GW (only)**, average 730 MW/yr during 2020s
- based on differential of 7.7 GW max. capacity by 2020, and 15 GW by 2030
- Offshore wind tender volume cut back to only 500 MW in 2021 (exclusively in Baltic Sea) and 500 MW in 2022 (up to 50 % for Baltic Sea), plus 700 MW/yr from 2023-2025, and 840 MW/yr from 2026-2030
- Political reasoning for keeping low targets:
better sync. of onshore grid expansion and offshore wind development.



Many System Changes during the past 12 years in support scheme provisions and grid connection regime





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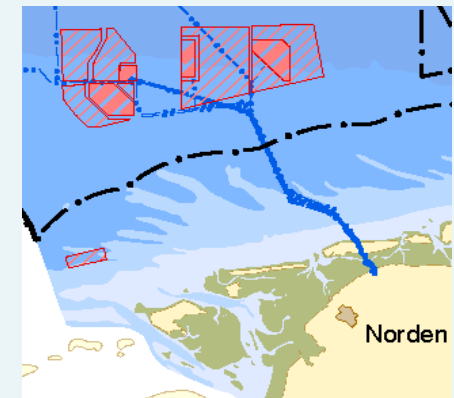
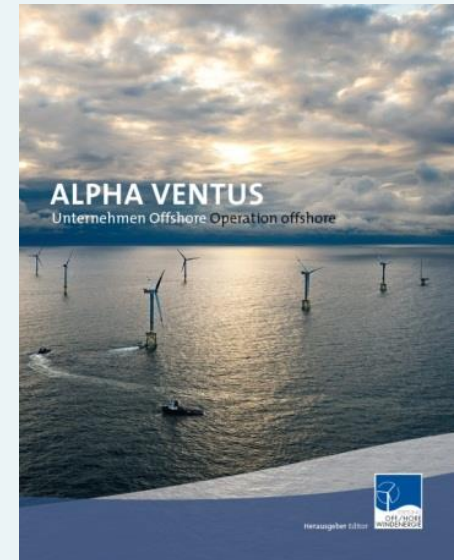
Offshore Wind Development in Germany and Outlook

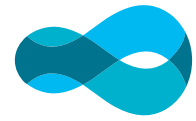


alpha ventus – a pioneering project

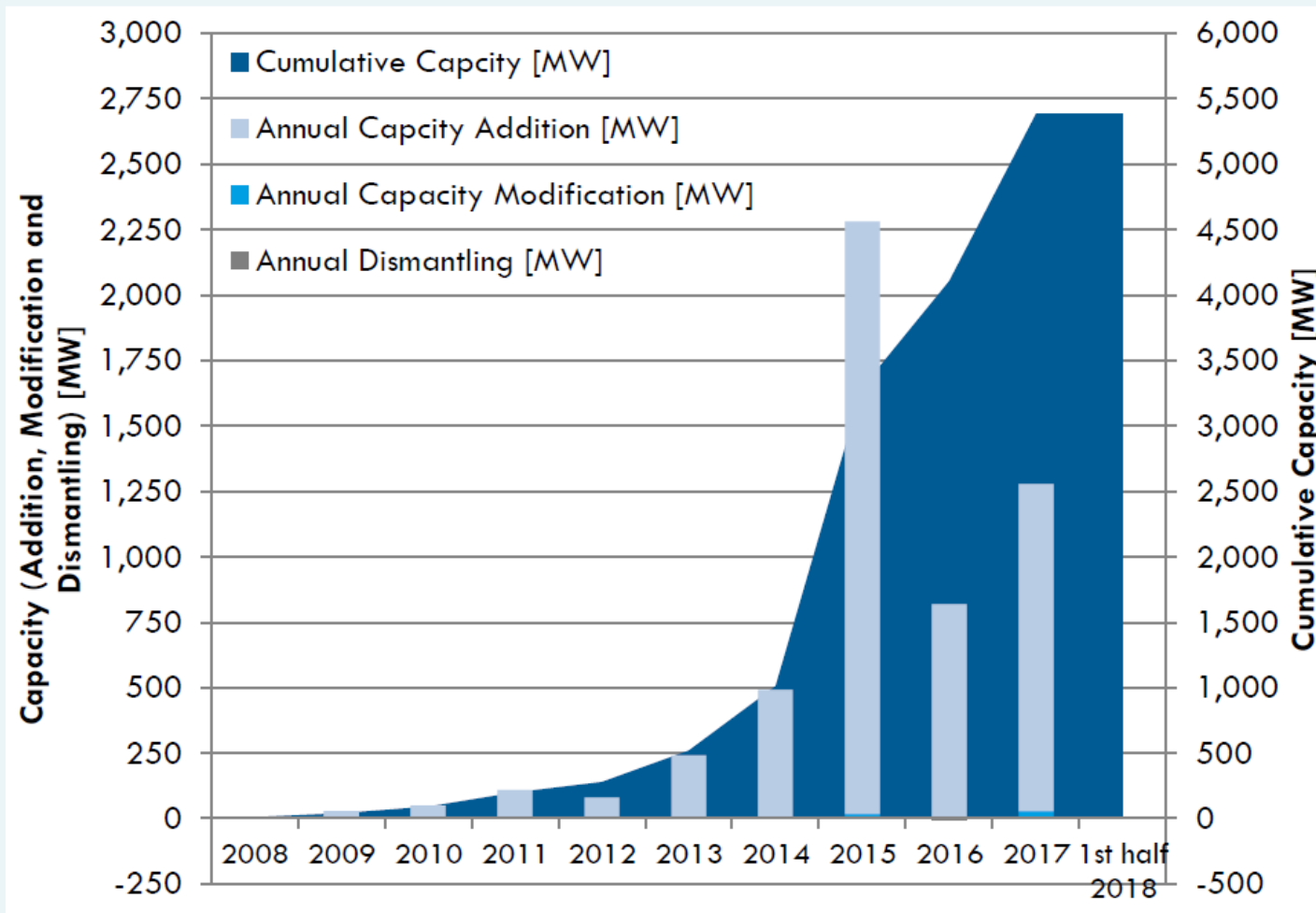
**First Offshore Wind Farm (OWF) in Germany –
‘Moonlanding Project’ - Paving the way for commercial projects**

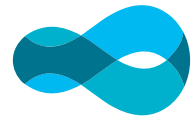
- **60 km distance to shore, 30 m water depth**
- First OWF with 5 MW class (12 turbines) → **60 MW**
- 2 turbine manufacturers (AREVA/Multibrid, REpower)
- 2 types of foundations (tripods, jackets)
- **Permits acquired by SOW in 2005**
- **Leased to DOTI end of 2006 (EWE, E.ON, Vattenfall)**
- **Construction 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
Extensive₁₅ ecological and technological R&D Program
funded by the German government (50 Mio €)





Development of Offshore Wind Energy in Germany in the past ten years: First 1 GW in 2014, >5 GW in 2018

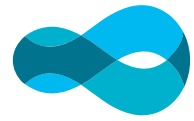




OFFSHORE WIND FARMS IN GERMANY - BY MID 2014



> 1 GW online by 2014, > 3 GW by 2015

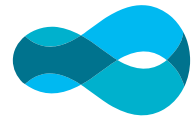


Status of Offshore Wind Energy Germany – mid 2018:

A total of 5.4 GW online (1,169 turbines)

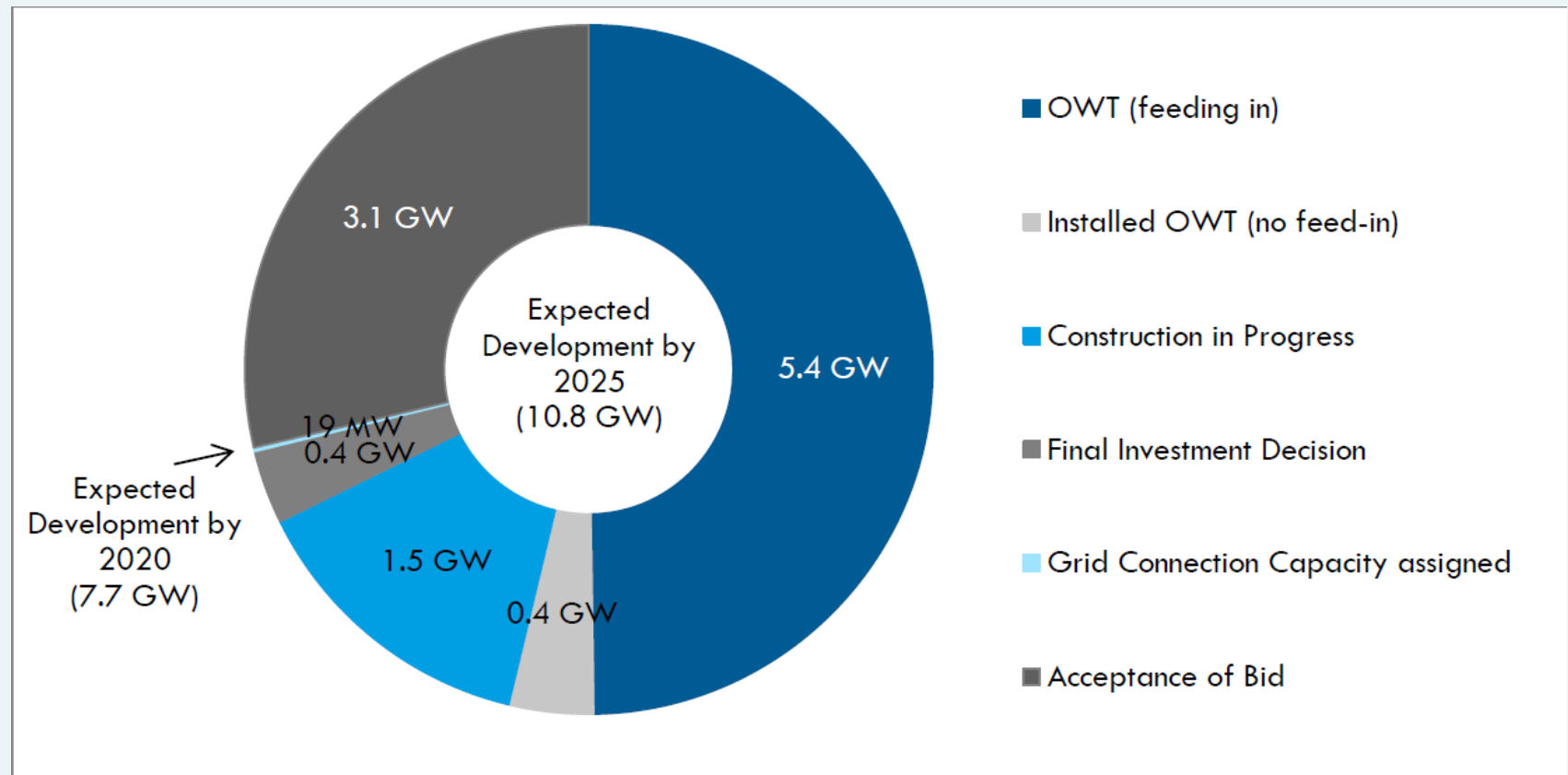
Table 1: Offshore Wind Energy Development, as of 2018-06-30

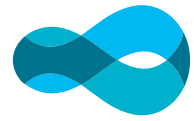
Status of the Offshore Wind Energy Development		Capacity [MW]	Number of OWT
Addition 1 st Half 2018	Installed OWTs (no feed-in)	429.5	62
	Foundations w/o OWTs		50
Cumulative (2018-06-30)	OWTs (feeding in)	5,387.4	1,169
	Installed OWTs (no feed-in)	429.5	62
	Foundations w/o OWTs		139



Outlook to 2025

From 5.4 GW today to 7.7 GW by 2020,
and 10.8 GW by 2025





EEG 2017 – a new legal framework since 2016

Allocation mechanism – tenders

Responsible authority: BNetzA (electricity regulator) organising the tenders

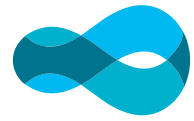
Auction volume and rounds:

- Two auction rounds organised for OWF for the transitional period (2021-25).
- Eligible projects are all OWF in Cluster area 1-9 (EEZ North Sea), and in area 1-3 (EEZ Baltic Sea) which have received a permit, or can prove an advanced application state prior to 1st August 2016. This includes those projects in coastal waters with a similar permitting status.
- The first auction in transition phase was scheduled on 1st March 2017, second one on 1st March 2018.
- Each of the two tenders had a volume of 1.550 MW to be awarded, i.e. a total of 3,100 MW tendering capacity during the five-year transitional period until 2025. On average, this is only 620 MW per year



Tender results in Germany in 2017 – a paradigm shift!

Project	Owner	Capacity	Award price (€/MWh) – Support on top of the market price	Expected commissioning date
He Dreiht	EnBW	900	0	2025
OWP West	DONG	240	0	2024
Borkum Riffgrund West 2	DONG	240	0	2024
Gode Wind 3	DONG	110	60	2024



Special reasons for ‚zero bids‘

Germany: Zero subsidy pioneer



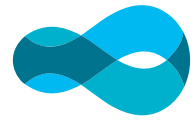
2017 round had the first ever “zero bids” based on likely “real options” view of the auction

First round (2017)

- First of two auction rounds for “existing projects” to be delivered between 2021 and 2025; bids for guaranteed floor prices
- 1,380 out of 1,490 MW at “zero subsidy” (zero floor); Ørsted had 110 MW at 60 EUR/MWh
- Only projects in the North Sea were successful; most with delivery dates towards the end of the period
- Zero floor bids likely factor in significant technological progress and increasing wholesale prices
- Long lead times until realisation and (relatively) low penalties may mean bids are viewed as “real options” → how to ensure delivery?

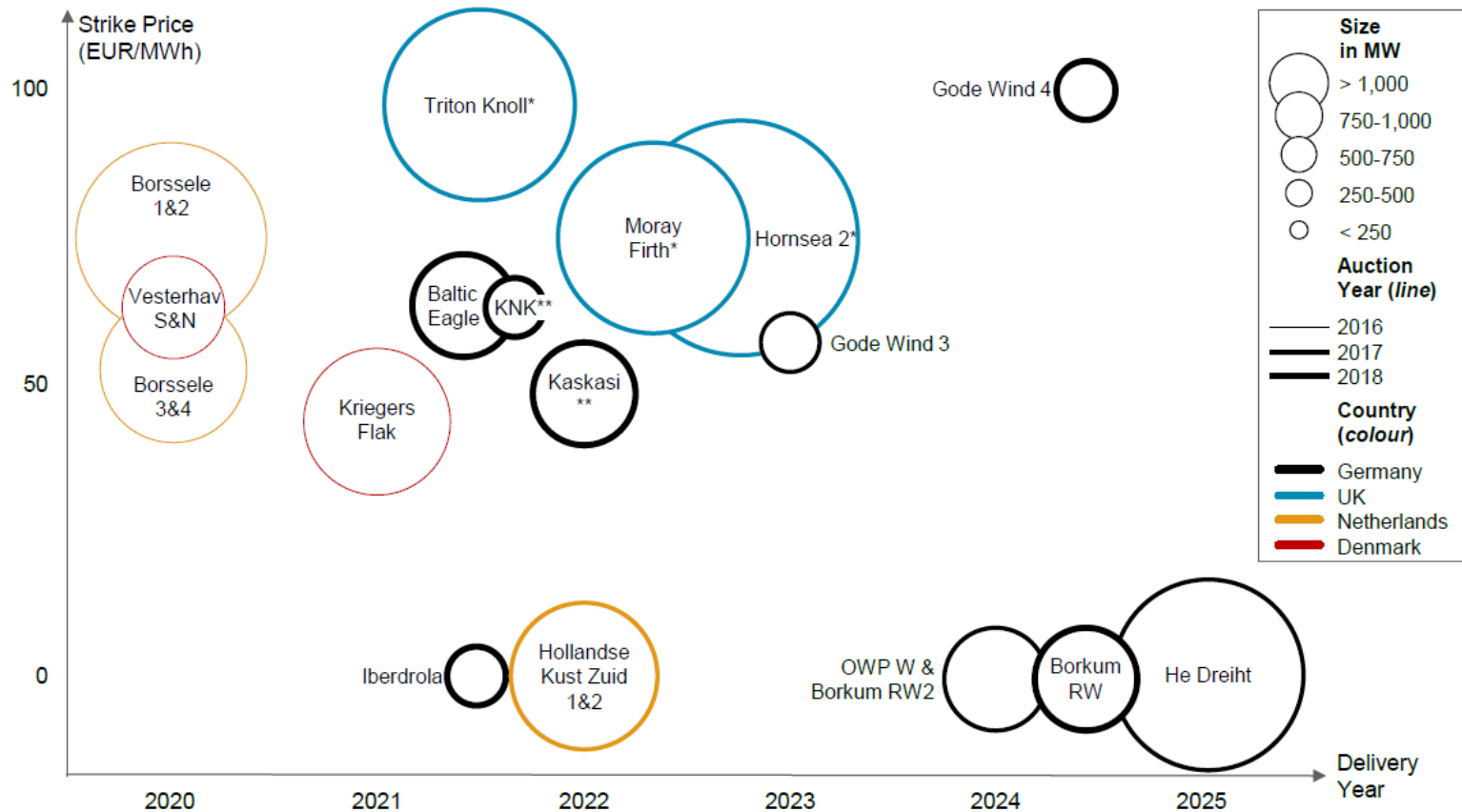
Second round (2018)

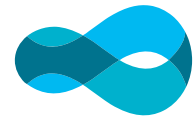
- 1,610 MW awarded to 6 winning projects owned by Iberdrola, innogy, Ørsted, and a consortium of municipal utilities
 - Larger range of successful bids (0 to 98.30 EUR/MWh) and higher average price (46.60 EUR/MWh) than in 2017*
 - Co-location with prior projects seems to hold more explanatory power than lead time / size in this round
 - No bifurcation between Baltic Sea and North Sea projects despite Baltic Sea quota
- Under current rules for the future “central model” the reference price for future auctions is fixed at zero with only a random draw to break a tie



Recent auction results across Europe reflect diversity

Plenty of variation in recent offshore wind auction results
Delivery year, auction year and local specifics hold more explanatory power than size

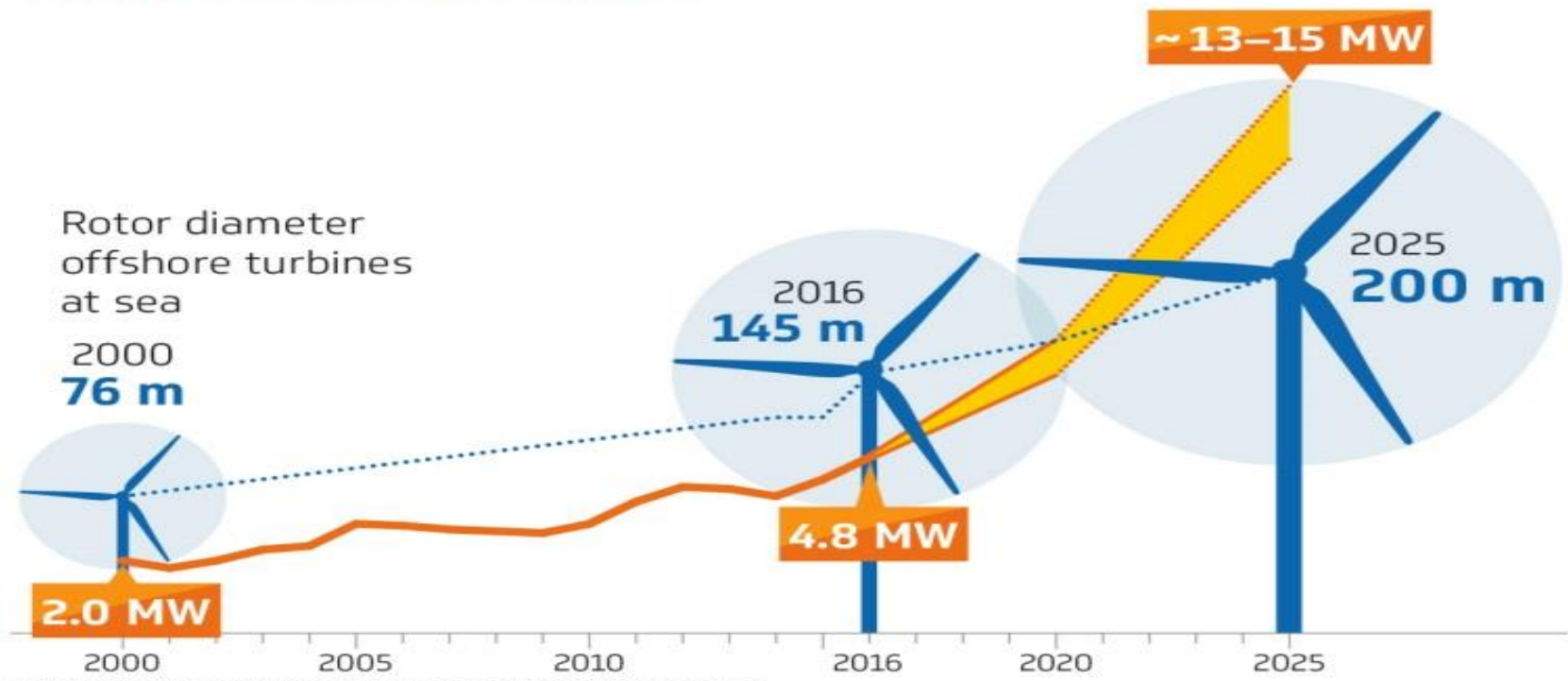




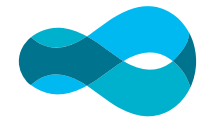
Reasons for cost reductions

Technological developments

A GROWTH IN CAPACITY

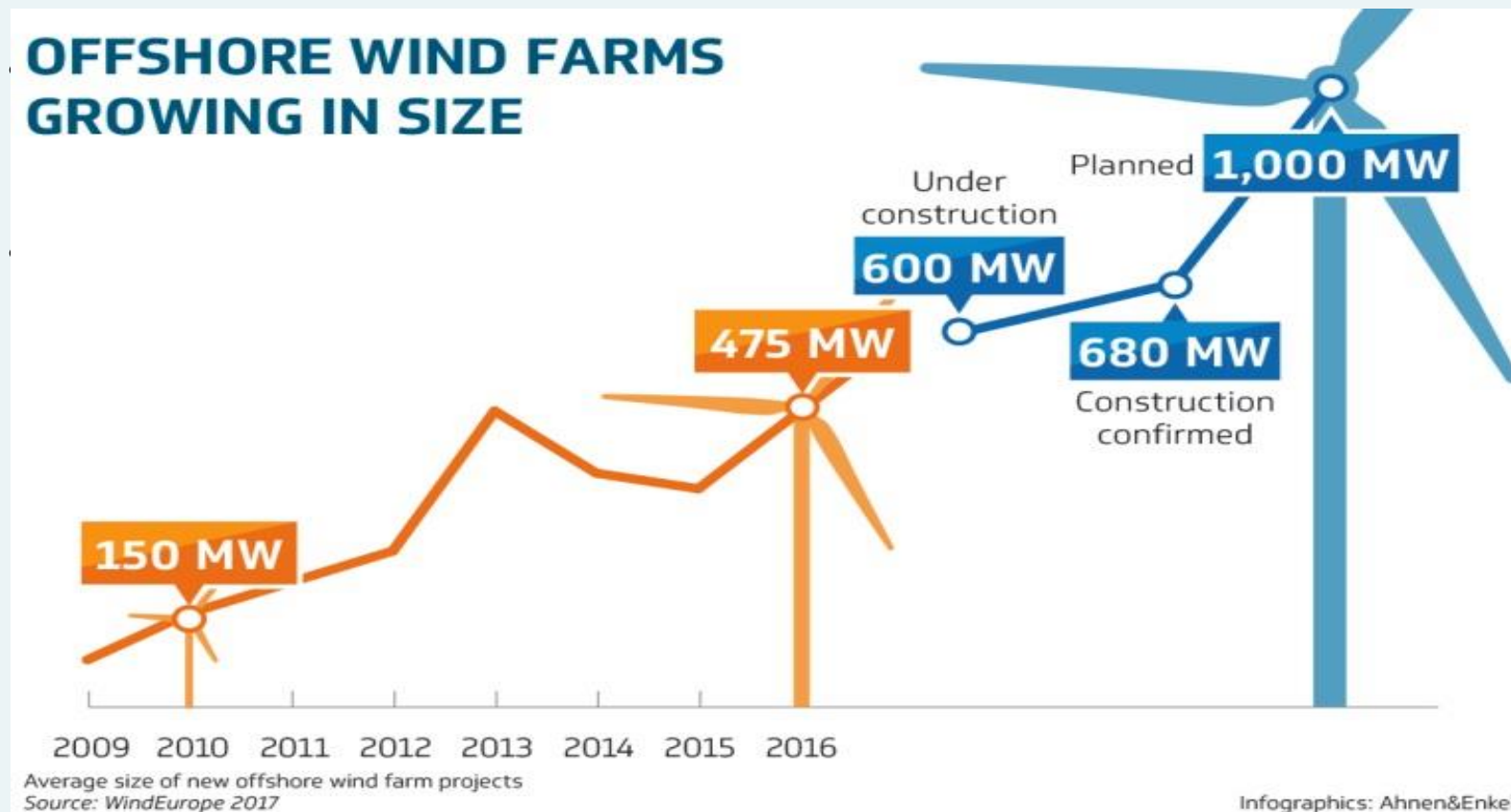


Average installed capacity of new wind turbines in Europe (in megawatts);
Forecasts by manufacturers and operators up to 2025



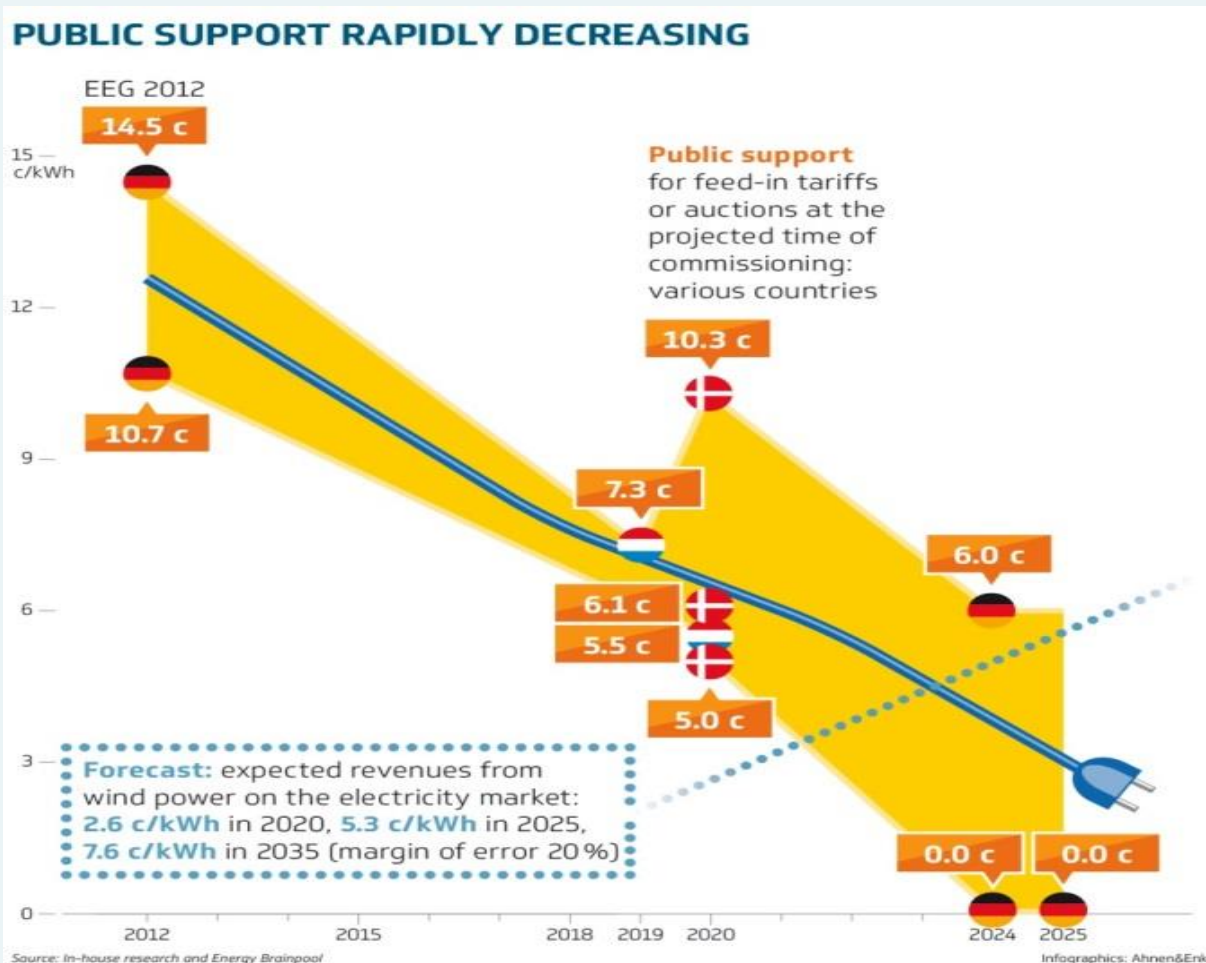
Reasons for cost reductions

Economies of scale



Reasons for massive price reductions in auctions

Electricity market price development assumptions



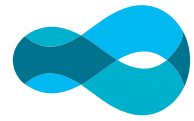
Experts forecast an electricity market price of 5.3 ct/kWh in 2025 and 7.6 ct/kWh by 2035.

Average wholesale price in Germany was at 3 ct/kWh during 2017, increasing to 4,5 ct. in 2018 (compared to 8 ct/kWh in 2011)

First Tender results in Germany: Conclusions and Industry Requests

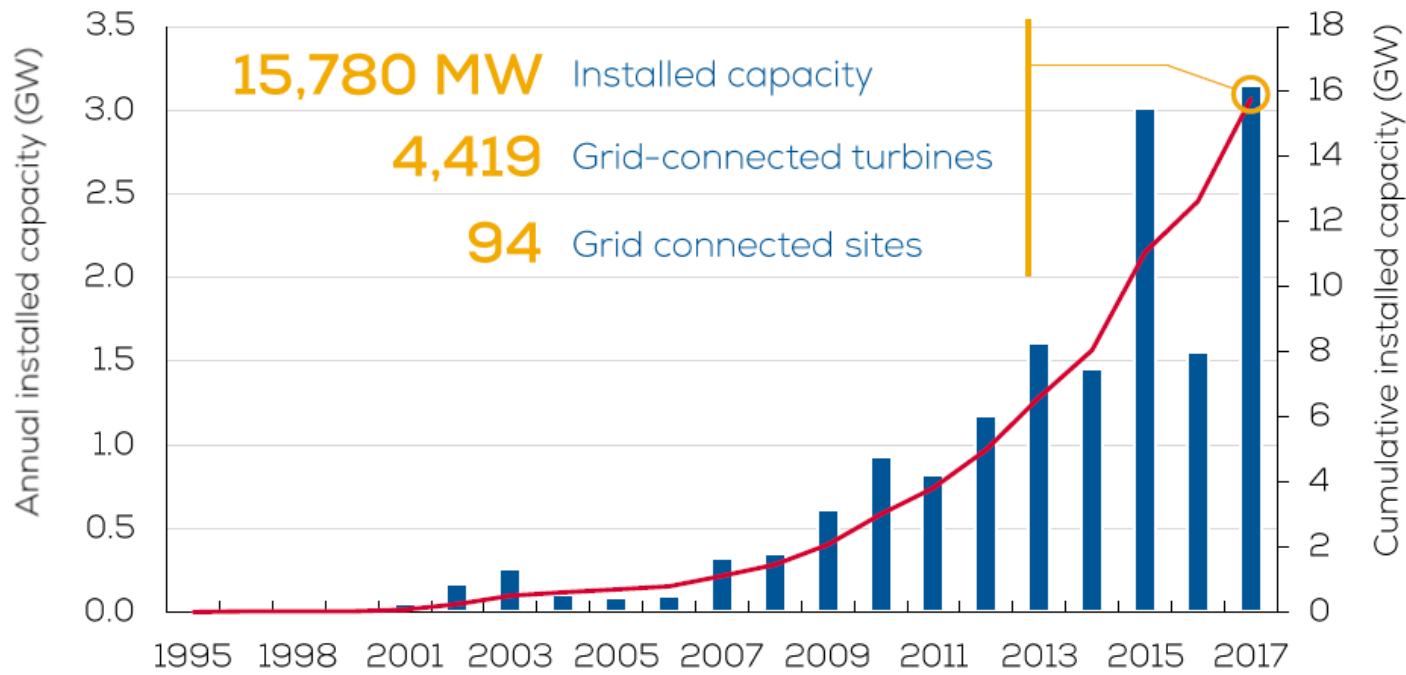
- The dramatic drop in prices in German auctions reflects, above all, the rapid cost reduction achieved through industrialization and a steep learning curve
- **The new federal government should increase the targets for offshore wind energy: We are calling for at least 20 GW by 2030 and 30 GW by 2035**
- Bold measures for **grid expansion** and implementation of **sector coupling (electrification, PtX)** must be taken now to take advantage of the now clear positive prospects of offshore wind energy
- Offshore wind has proven to be at the core of a low-cost and sustainable energy transition





Development of offshore wind in Europe

Installed capacity



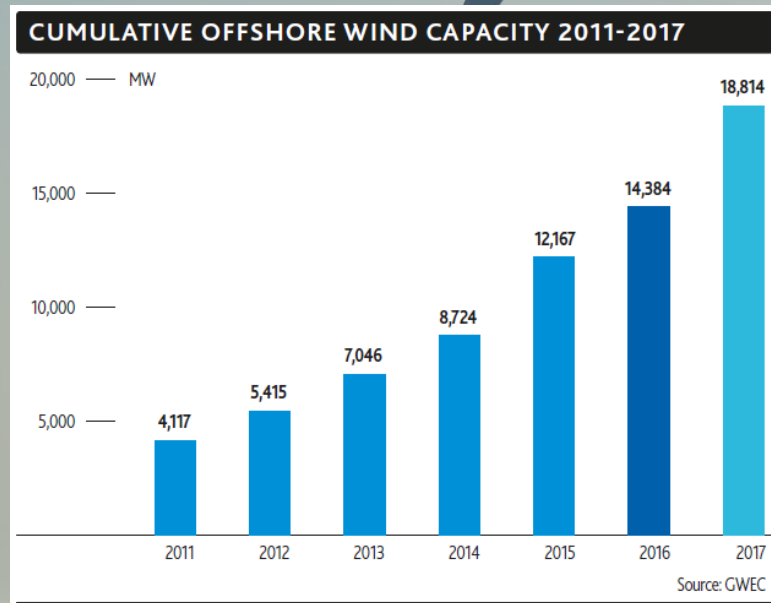
15,780 MW Installed capacity

4,419 Grid-connected turbines

94 Grid connected sites

Global Rollout

Today, 90 per cent of global offshore wind capacity installed in European waters



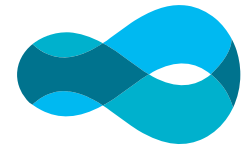
2050: 521 GW
(IRENA, 2018b)

... with the US, China, Japan, South Korea, Taiwan, Poland and more to follow soon in the 2020s ... including Turkey



Lessons Learned – Key Take-Aways for Turkey

1. Facilitate and streamline the planning and permitting process;
2. Carry out initial site inspection and measurements for projects
3. Provide a **long-term visibility** on the pipeline for offshore wind projects, i.e. set **ambitious but realistic and reliable targets** with milestones;
4. Provide an attractive **revenue stabilisation mechanism** to investors, most importantly for the first offshore wind projects;
5. Engage international institutions for **financing** offshore wind projects;
6. Ensure enough grid capacity (offshore and onshore) for all projects, incl. clear offtake rules;
7. **Invest in enabling infrastructure**, local supply chains and skills;



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Thank you very much for your attention!



**OFFSHORE WIND –
SUSTAINABLE, ECONOMIC,
SAFE & DOMESTIC POWER**

**Unlocking the
full potential!!**

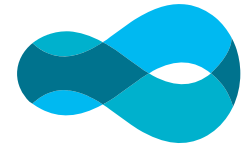
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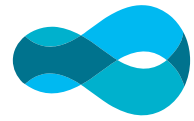


Backup



Development of offshore wind energy in Europe





Status quo Europe: New capacity of 3,148 MW in 2017, Driver are UK and German markets

Construction summary

2017

VS 2016

3,148 MW	Grid connected capacity	↑ X2
560	Grid-connected turbines	↑ +66%
612	Turbines erected	↑ +70%
414	Foundations installed	↓ -26%

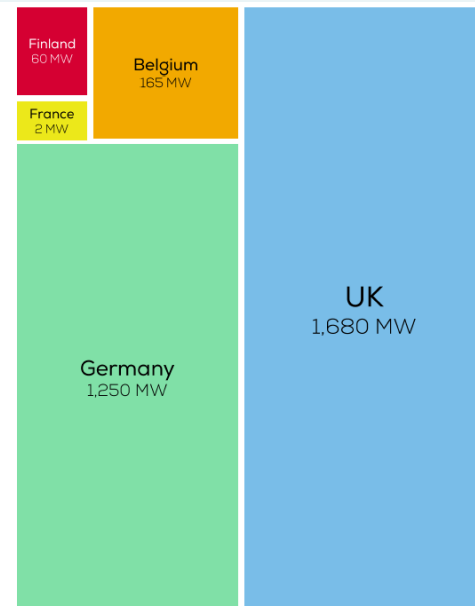
Construction summary

2017

Work carried out in
25 offshore wind
farms

13 offshore wind
farms were grid
connected

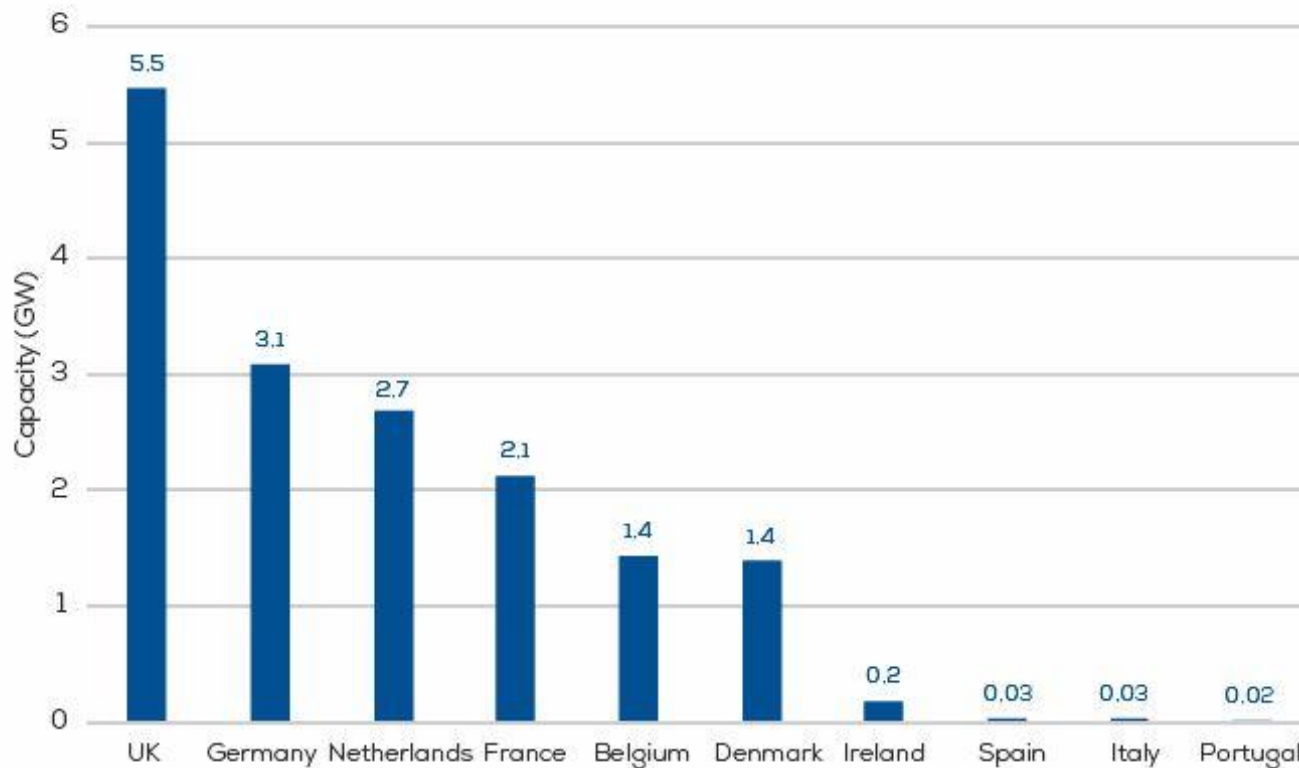
One site was fully
decommissioned





Outlook 2022: Installations per country - UK to remain the largest offshore market

5-year offshore gross installations (2018-2022) per country – WindEurope's Central Scenario



Source: WindEurope