

Half Year

Report

2018

THE GLOBAL MARKET FOR OFFSHORE WIND ENERGY

wind:research

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WIRTSCHAFTSFORUM
OFFSHORE
HELGOLAND

2. Framework conditions

2.2 Political/legal framework

» *The political and legal framework is still the main driver for renewables.
German production from offshore wind rose by almost a third in the 1st half of 2018.* «



In December 2016 the European Commission released a new renewable energy directive.

EU countries have agreed on a new 2030 framework for climate and energy, including EU-wide targets and policy objectives for the period between 2020 and 2030. Lately, new 2030-targets have been defined or discussed:

Targets for 2030

40 % → 45%

cut in greenhouse gas emissions compared to 1990 levels

27 % → 32 %

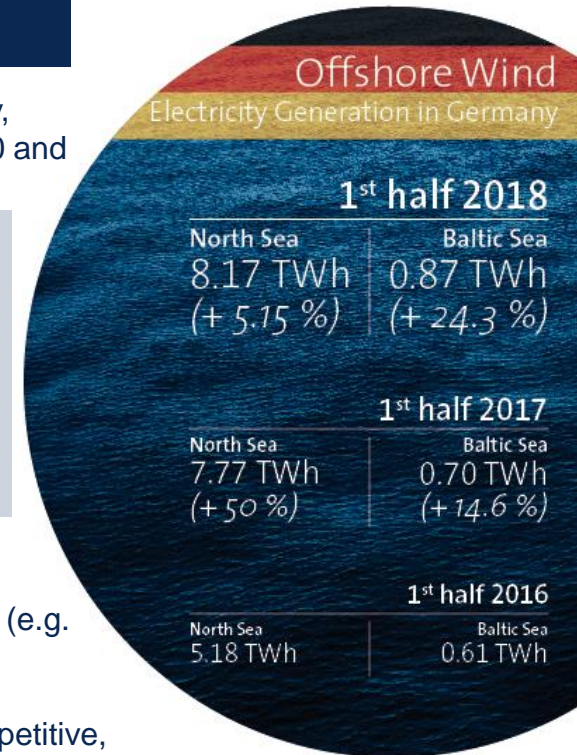
share of renewable energy consumption

At least
27 %

energy savings compared with the business-as-usual scenario

Policies for 2030: The European Commission has proposed

- A reformed EU emissions trading scheme (ETS)
- New indicators for the competitiveness and security of the energy system (e.g. price differences with major trading partners, diversification of supply, and interconnection capacity between EU countries)
- First ideas on a new governance system based on national plans for competitive, secure and sustainable energy



2. Framework conditions

2.2 Political/legal framework – Subsidy schemes

The results of the tenders especially in Germany were surprising: from 19,4 ct/kWh fit down to zero bids – and back to almost 10 ct/kWh.

	Wind farm	Inst. capacity [MW]	Tariff (orig. [ct/kWh])	Tariff (re 20 years)	Years granted	Adjusted tariff (re 20 years)	In operation (planned)
	Horns Rev 3	407	77 øre/kWh	10.31		6.18 ct/kWh	2018
	Neart na Gaoithe	450	114.39 £/MWh	13.55	15		2021
	East Anglia ONE	714	119 £/MWh	14.2	15	10.65 ct/kWh	
	Borssele 1,2	700	7.27 ct/kWh	7.27	15	5.45 ct/kWh	2020
	Kriegers Flak (DK)	600	37.2 øre/kWh	4.99	11.5	~ 3.7 ct/kWh?	2022
	Borssele 3,4	700	5.45 ct/kWh	5.45	15	< 5 ct/kWh	2023
	He dreiht	900	0.0 ct/kWh	0.0	20	0.0 ct/kWh	2025
	Borkum Riffgrund West II	240	0.0 ct/kWh	0.0	20	0.0 ct/kWh	2024
	OWP West	240	0.0 ct/kWh	0.0	20	0.0 ct/kWh	2024
	Gode Wind 3	110	6.0 ct/kWh	6.0	20	6.0 ct/kWh	2024
	Hollandse Kust Zuid 1,2	740	0.0 ct/kWh	0.0	(30)	0.0 ct/kWh	2022
	Baltic Eagle	476	6.46 ct/kWh	6.46	20	6.46 ct/kWh	2021 (?)
	Gode Wind 4	132	9.83 ct/kWh	9.83	20	9.83 ct/kWh	2024
	Wikinger Süd	10	0.0 ct/kWh	0,0	20	0,0 ct/kWh	2021
	Kaskasi 2	325	N/A	N/A	20	N/A	2022
	Arcadis Ost 1	247	N/A	N/A	20	N/A	2021 (?)
	Borkum Riffgrund West I	420	0.0 ct/kWh	0.0	20	0,0 ct/kWh	2024
	Hinkley Point C	3,340	92.50 £/MWh	10.8	35	18.9 ct/kWh	2026 (?)

Not directly comparable (grid connection, duration (lifetime, others)!

EXAMPLES

2017 TENDER

2018 TENDER

FOR COMPARISON

3. Status Quo OWE – 1st half of 2018

3.1 Installed capacity in operation and under construction by region

» Over 88 % of the worldwide totally installed capacity of around 18 GW in the 1st half 2018 is installed in Europe (approx. 16 GW), followed by Asia (11 %, approx. 2 GW) and North America (< 1 %). «

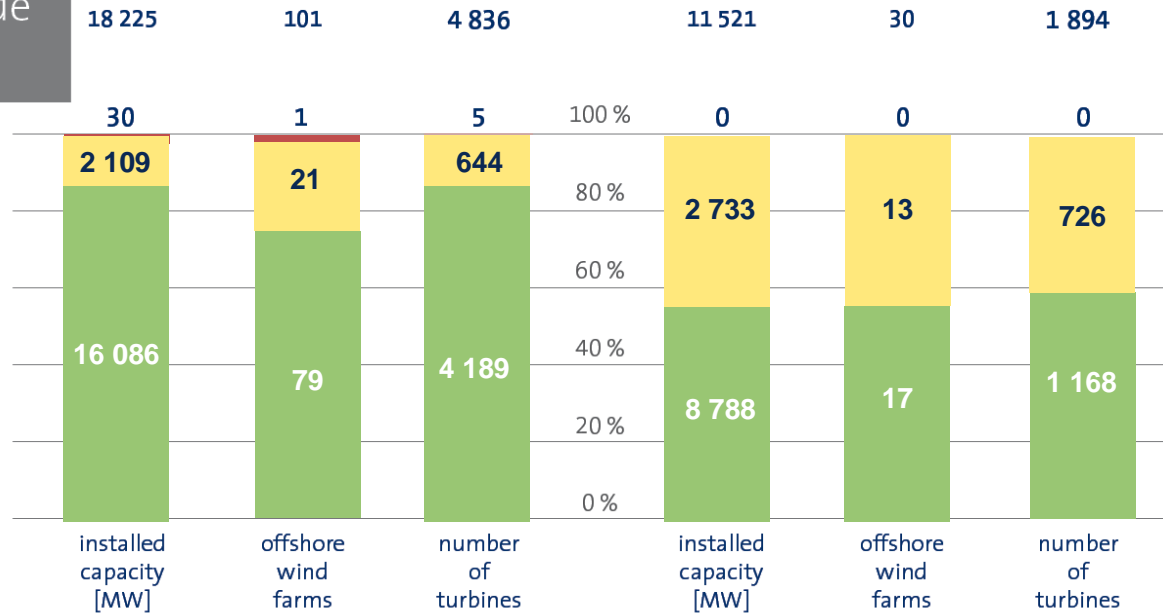
Global Market for Offshore Wind Energy worldwide – 1st half 2018



IN OPERATION



UNDER CONSTRUCTION



3. Status Quo OWE – 1st half of 2018

3.3 Shares by project status

» The current status of OWF in operation (25 %) and under construction is topped by a big number of planned OWF,. The size of the turbines is increasing very fast. «

Global Market for Offshore Wind Energy worldwide – shares by project status –



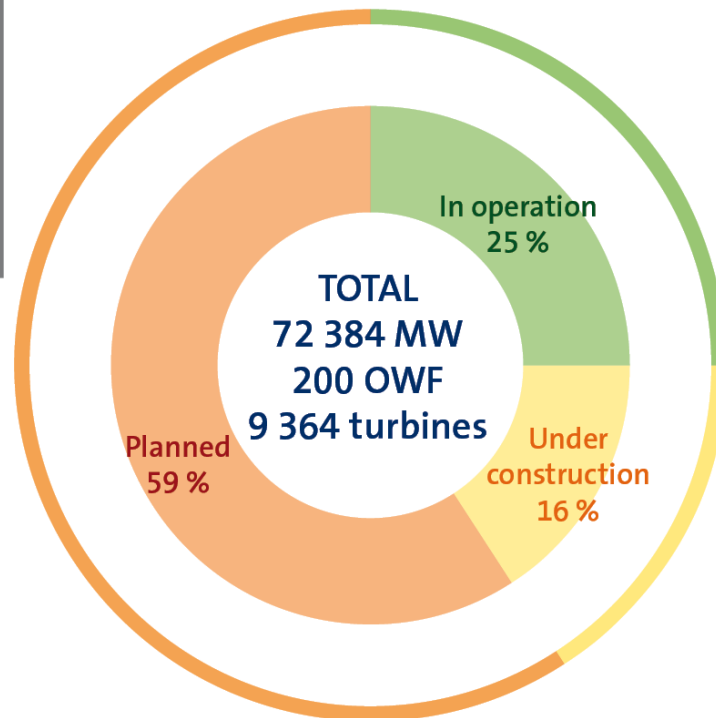
PLANNED

42 624 MW

69 OWF

2 634 turbines*

Ø 7.19 MW/turbine*



TOTAL
72 384 MW
200 OWF
9 364 turbines

IN OPERATION

18 225 MW

101 OWF

4 836 turbines

Ø 3.77 MW/turbine



UNDER CONSTRUCTION

11 521 MW

30 OWF

1 894 turbines

Ø 6.09 MW/turbine



* 2 634 turbines are confirmed (by end of June 2018). The average capacity per turbine of 7.19 MW is calculated by using only the MW of those wind farms where the number of turbines are known/ published (approx. 19 GW).

3. Status Quo OWE – 1st half of 2018

3.4 Offshore wind farms under construction

*without floating and pilot projects

» By end of June 2018 there are worldwide 30 offshore wind farms* either under construction (including those which are already partially generating) or under preconstruction. «

European wind farms		Capacity [MW]	Turbines	MW/turbine (approx.)
	Norther	370	44	8.4
	Rentel	309	42	7.4
	Horns Rev 3	407	49	8.3
	Borkum Riffgrund 2	450	56	8.0
	Merkur Offshore	396	66	6.0
	Albatros (Hohe See Extension)	112	16	7.0
	Arkona	385	60	6.4
	Hohe See	497	71	7.0
	Trianel Windpark Borkum 2	203	32	6.3
	Deutsche Bucht	269	32	8.4
	Borssele 3&4	732	77	9.5
	Walney 3&4	659	87	7.6
	Aberdeen Bay	93	11	8.5
	Beatrice	588	84	7.0
	East Anglia ONE	714	102	7.0
	Hornsea Project One	1 218	174	7.0
	Hornsea Project Two	1 386	165	8.4
17 wind farms		8 788	1 168	7.5

Asian wind farms (including near shore farms)		Capacity [MW]	Turbines	MW/turbine (approx.)
	Fuqing Xinghua Bay 1 ¹⁾	79	14	5.6
	Guodian Zhoushan Putuo	252	63	4.0
	Longyuan Putian Nanri Island 1 ¹⁾	200	40	5.0
	SPIC Binhai North Phase 2	400	100	4.0
	Jiangsu Longyuan Chiang Sand	300	75	4.0
	Laoting Bodhi Island	300	75	4.0
	Longyuan Jiangsu Dafeng	200	80	2.5
	Zhuhai Guishan	120	37	3.2
	Dongtai Four	302	75	4.0
	SPIC Jiangsu Dafeng	300	75	4.0
	Southwest Offshore Demonstration	60	22	2.7
	Formosa OWF Phase 1&2 ¹⁾	120	20	6.0
	Khai Long Phase 1 ¹⁾	100	50	2.0
13 wind farms		2 733	726	3.9

¹⁾ near shore wind farm

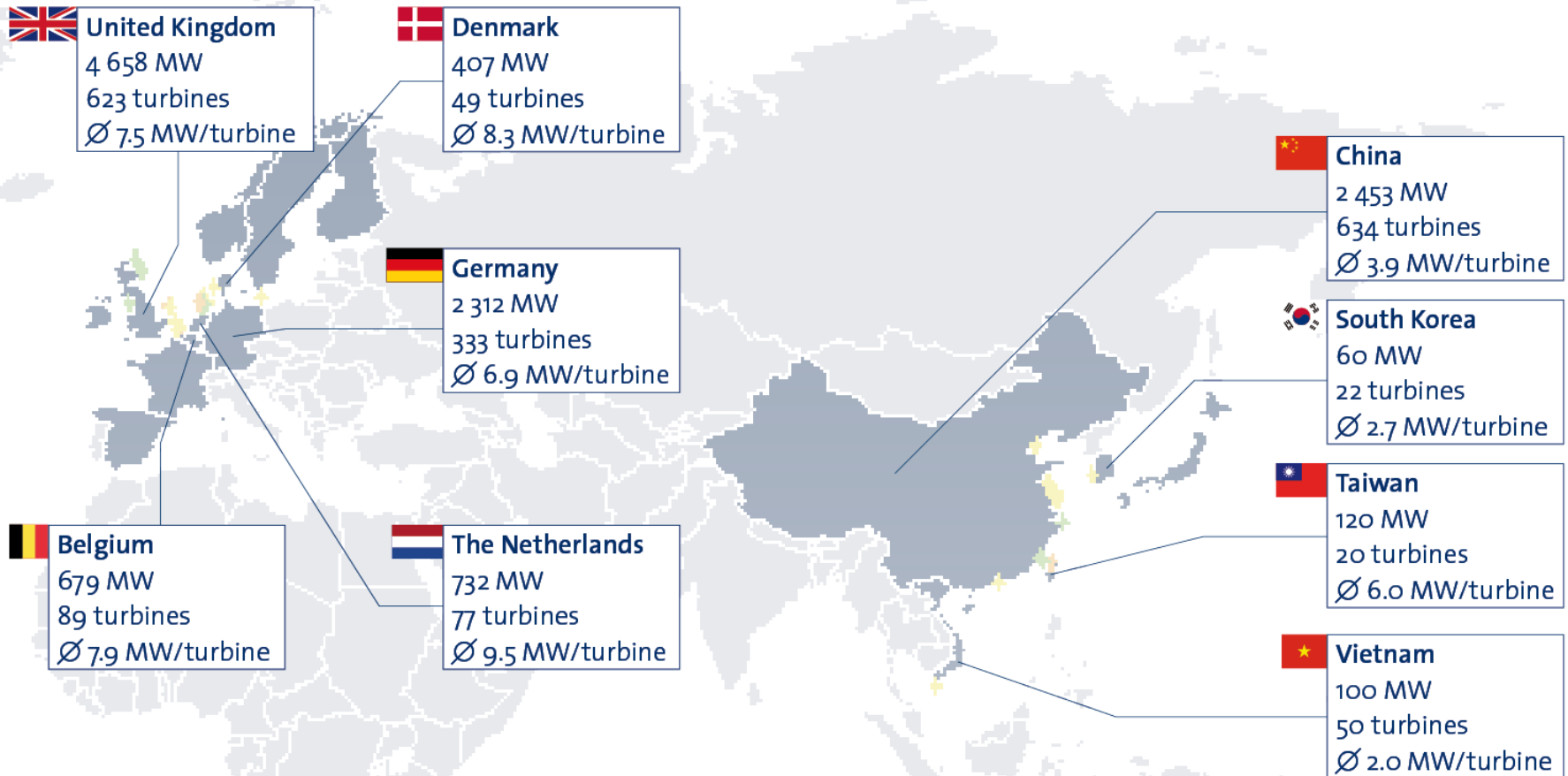
	partially generating		under construction		pre-construction
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3. Status Quo OWE – 1st half of 2018

3.4 Offshore wind farms under construction

*without floating and pilot projects

» Breakdown by country shows, that turbine sizes differ, especially to “mature” markets. «



4. Opportunities and risks

» *The global market for offshore wind energy is less fraught with risk than 2 – 3 years before, but still dominated by political and technological risks* «

Opportunities (overview)

- ✓ Technological developments (higher turbine output, new foundation types, ...)
- ✓ Increase of further cost reduction potentials
- ✓ Sector coupling, wind2power, e-mobility, other sectors
- ✓ Rising electricity prices and CO₂-certificate prices
- ✓ Growth opportunities of the global offshore wind market
- ✓ M&A opportunities due to consolidation
- ✓ Growth opportunities in „following“ markets, e.g. O&M
- ✓ On the long run: Repowering and Dismantling
- ✓ Green PPA potentials

Risks (overview)

- Political frameworks, especially regarding subsidy schemes, targets and grid extension
- Auctions with a high number of speculative parameters such as electricity and CO₂-prices in 10 to 30 years etc.
- Delayed withdrawal from energy production from fossil fuels or nukes
- Rising water depths and distances from the shore, higher O&M-costs
- Competitive pressure due to consolidation/concentration
- Increasing interest rates
- Missing/delayed market maturity of the technological developments

5. Conclusion: Trends and Outlook

» *The global Offshore Wind market is (still) in a strong upturn. The installed total capacity amounts to 18.2 GW in 1st half 2018 – increase of 2.1 GW compared to 2017.* «

- **Political framework:**
 - Still depending on the political targets, grid connection and extension (off- and onshore) as well as environmental regulations
 - Tenders changed the European markets in 2017 dramatically, resulting in zero bids
- **Technologies:**
 - Industry is focusing competition on the first turbine over 10 MW (e.g. GE with first announced 12-MW-turbine Haliade X, MHI Vestas with first 8 MW turbine operating in a commercial wind farm (Borkum Riffgrund 2))
 - New or „reborn“ foundation types like suction bucket, gravity, or floating foundations are challenging the „old“ foundation industry
 - Greater water depths an important driving factor
- **Challenges:**
 - Political stillstand is leading to less workload and therefore problems up to solvency challenges
 - Many smaller market participants have left the market during the last 12 months, returning to their roots or other businesses or just giving up

5. Conclusion: Trends and Outlook

» *The main topic of the last year cost reductions forced by the “zero bids” are still a key topic. The industry tries to develop international markets outside of Europe.* «

- **Costs and consolidation:**
 - The industry turned its focus to their O&M expenditures
 - Particularly important for wind farms with high distances to the coast and in greater water depths
 - As bidder still an enormous need for cost effective structures (production, transport, installation) and a good track-record to be successful.
- **Outlook:**
 - The Best-Case-Scenario still assumes a high market dynamic up to 250 - 300 GW in 2030
 - Premises among others cost reduction potentials, (further) emerging and developing of new markets
 - e.g. Taiwan, Japan, USA etc
 - new technologies or applications like P2G, P2L, sector coupling, storage solutions
 - Further premises rising energy prices, phase out of nuclear and coal, new ETS
 - Green PPA part of the game, leading the industry to an ordinary market



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» *The global offshore wind industry is facing its next step towards maturity*



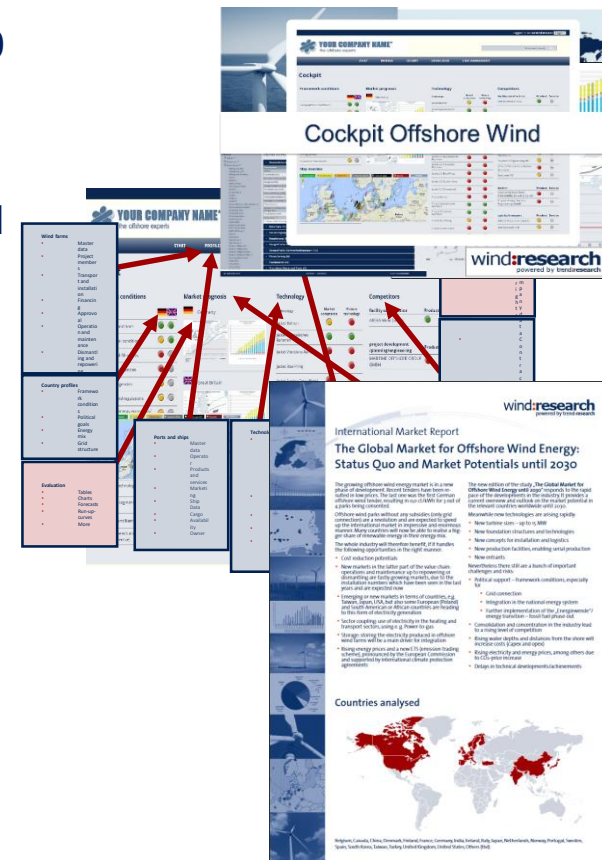
1. Introduction/Methodology
2. Framework conditions Offshore Wind Energy
3. Status Quo Offshore Wind Energy – 1st half of 2018
4. Opportunities and Risks
5. Conclusion: Trends and Outlook

1. Introduction/Methodology

1.1 Methodology and sources

» The following studies and database provide the basis for this presentation. «

- Cockpit offshore wind: approx. 900 wind farms worldwide, over 350 criteria per farm, 32 country and 1.600 company profiles
- Various own studies, e.g.:
 - The Global Market for Offshore Wind Energy: Status Quo and Market Potentials until 2030
 - The market for operation & maintenance in the offshore wind industry until 2030
 - Cost reduction potentials for the offshore wind energy in Germany
 - The market for founding structures in offshore wind energy in Europe until 2030 (2nd ed.)
- Background: wind:research/trend:research
 - since 1997 in the energy sector
 - over 680 studies
 - more than 1.100 references, over 90 % market coverage.



2. Framework conditions

2.1 Infrastructural framework – grid connections

» This map shows a comprehensive illustration of the transmission system network. «



Sea cables are required which carry considerable power capacities over distances of 100 km and more.

The DC technology has significantly lower power losses at longer distances and outputs and can carry more power per cable (see green lines).

- Lines
- 750kV
 - 500kV
 - 380–400kV
 - 300–330kV
 - 220kV
 - 132–150kV
 - 110kV
 - DC
 - 2 or more circuits
 - Line under construction

Image source: entso-e, 2018

3. Status Quo OWE – 1st half of 2018

3.2 Installed capacity development

» The global market for offshore wind is still developing rapidly. Over 5 GW new installed capacity result in a new world record for 2018 (first half year). «

Cumulative offshore wind capacity [MW]
worldwide 2010 - 2018

