

# Landscape setting

## The Project Developers View

PUBLIC

Ørsted



Hywel Roberts  
WindEurope Conference - aviation side-event  
Copenhagen 27/11/2019

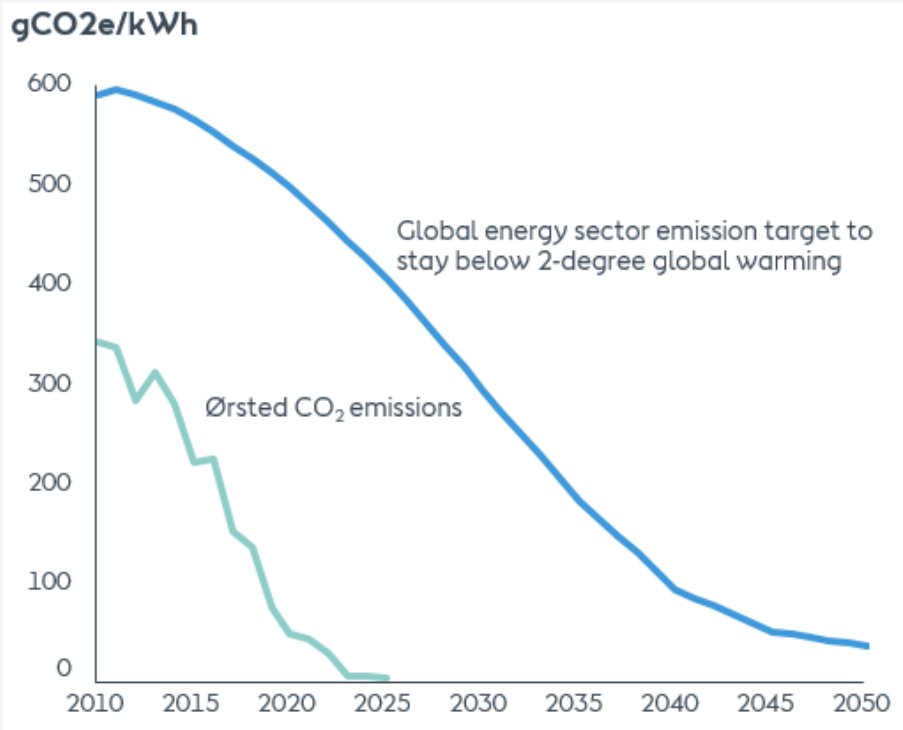
# Agenda

- Ørsted market position and outlook
- Industry outlook
- The challenge of coexistence
- UK case-study
- 2050 scenario



# The 2050 emissions curve

**Green share of power generation  
~99% in 2025,  
approximating  
zero emissions**

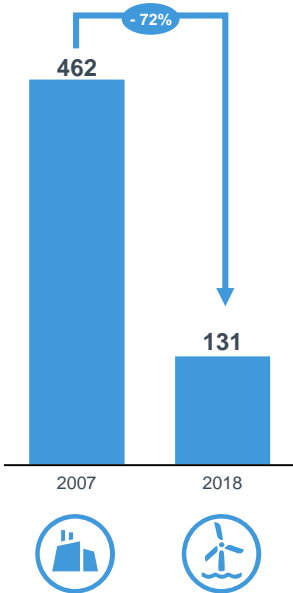


3 Note 1: Figures taken from Ørsted's Annual Report 2018

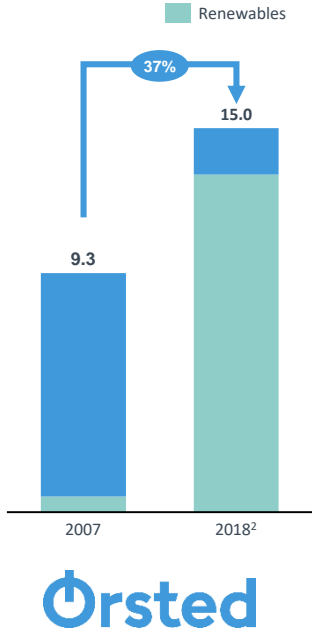
# Significant transformation of Ørsted over the past decade <sup>1</sup>

Green energy today accounts for 80% of our heat and power generation

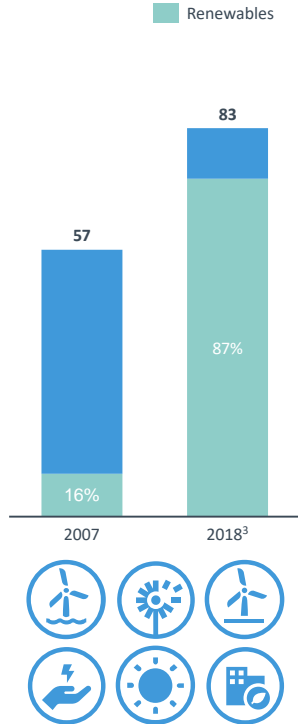
**CO<sub>2</sub> emissions reduced by almost three quarters**  
g/kWh



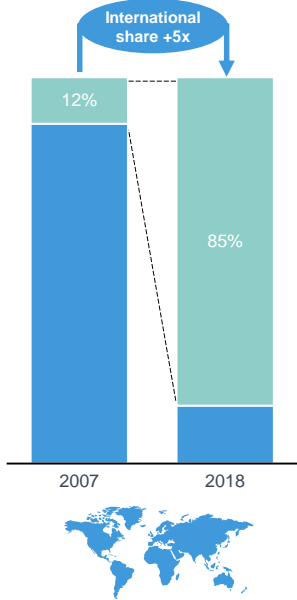
**Operating profit (EBITDA) DKK bn**



**Capital employed**  
DKK bn



**International expansion**  
Share of operating profit (EBITDA) %

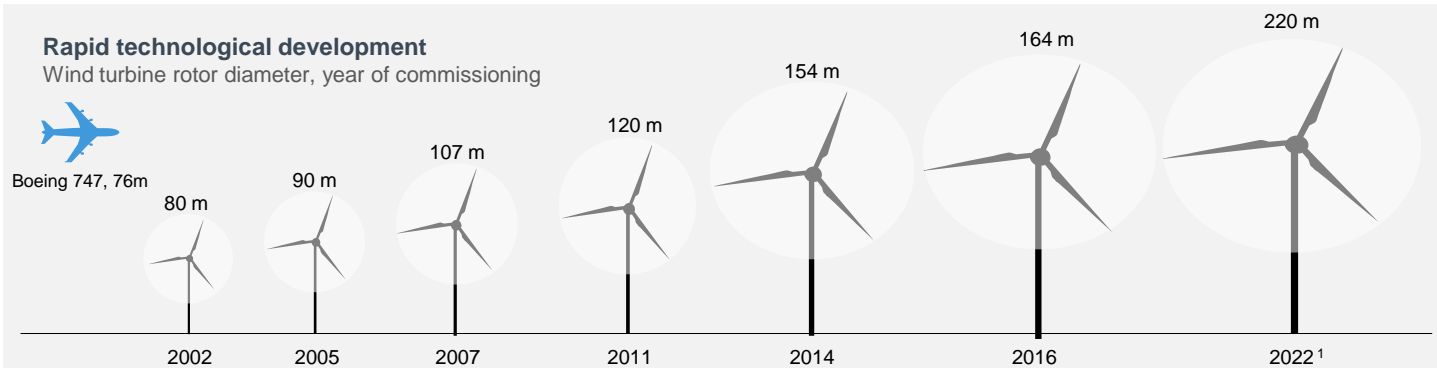


Note 1: Figures taken from Ørsted's Annual Report 2018 and Capital Markets Day 2018  
 Note 2: Excludes EBITDA contribution from new partnerships (EBITDA increased from USD 1.4 bn in 2007, to USD 2.3 bn in 2018)  
 Note 3: Capital employed increased from USD 8.6 bn in 2007, to USD 12.5 bn in 2018

# At the forefront of making the industry cost competitive

Multiple levers to drive down cost in offshore wind

1 Scale	2 Innovation	3 Industrialisation
<ul style="list-style-type: none"><li>Turbines and rotor size</li><li>Lease areas</li><li>Vessel size</li><li>Cable capacity</li></ul>	<ul style="list-style-type: none"><li>Foundation design (e.g. monopiles)</li><li>Electrical systems</li><li>Windfarm layout</li><li>Optimized installation schedules</li></ul>	<ul style="list-style-type: none"><li>Transition from single supply to multiple global suppliers</li><li>Long-term target based collaboration with key suppliers</li></ul>
✓	✓	✓

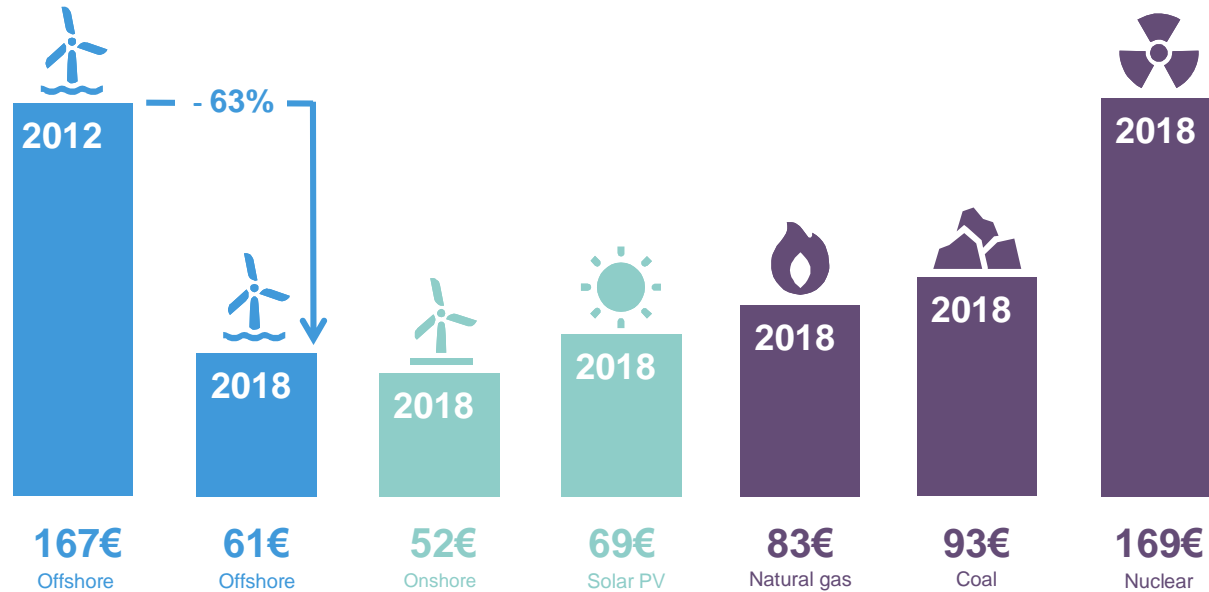


1. Ørsted selected GE Renewable Energy as the preferred turbine supplier for two of its US offshore wind farms which marks the world's first commercial deployment of GE's Haliade-X 12MW offshore wind turbine

# Levelised cost of electricity for different technologies

The rapid cost reductions in the industry, have made offshore wind power competitive relative to conventional power generation based on fossil fuels

EUR/MWh, 2018 prices, Northwest Europe



Source: Bloomberg New Energy Finance – 2H 2018 LCOE Update, current LCOE.

Onshore wind: average of DE, DK, NL and UK mid-scenarios. Solar PV, Gas: average of DE, UK mid-scenarios. Coal: DE mid-scenario. Nuclear: UK mid-scenario.

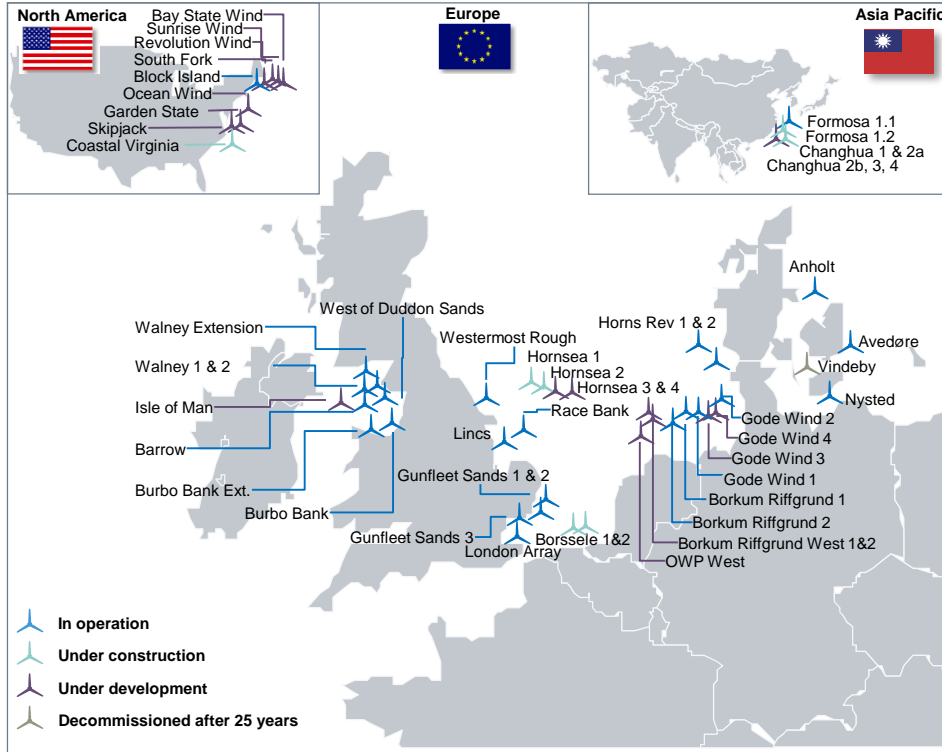
Offshore wind: 2012 generic offshore wind, Northwest Europe, FID 2012. In 2012 our goal was to reduce offshore wind costs to EUR 100 per MWh in 2020. 2018: average of relevant projects in NL, UK and DE with COD 2022-2024. NL: Hollandse Kust (zuid) I&II, UK: CfD Round 2, DE: OWP West, BRW I, BRW II. For DE and NL, additional EUR 15 per MWh assumed as transmission cost.

Exchange rate EUR:USD: 0.88, YoY inflation 2017-2018: 1%.

# Ørsted Offshore overview

Global market leader in offshore wind with 25+ years of experience

## Ørsted offshore wind global footprint



## Unparalleled experience and track record

1991

25+ years of experience and track record in the offshore wind power sector

2019

25 offshore wind farms in operation

4 offshore wind farms under construction<sup>1</sup>

5.6 GW Constructed capacity

4.3 GW under construction

~ 2,450 Dedicated employees

13 million people with clean electricity

~ 1,150 turbines World's leading operator

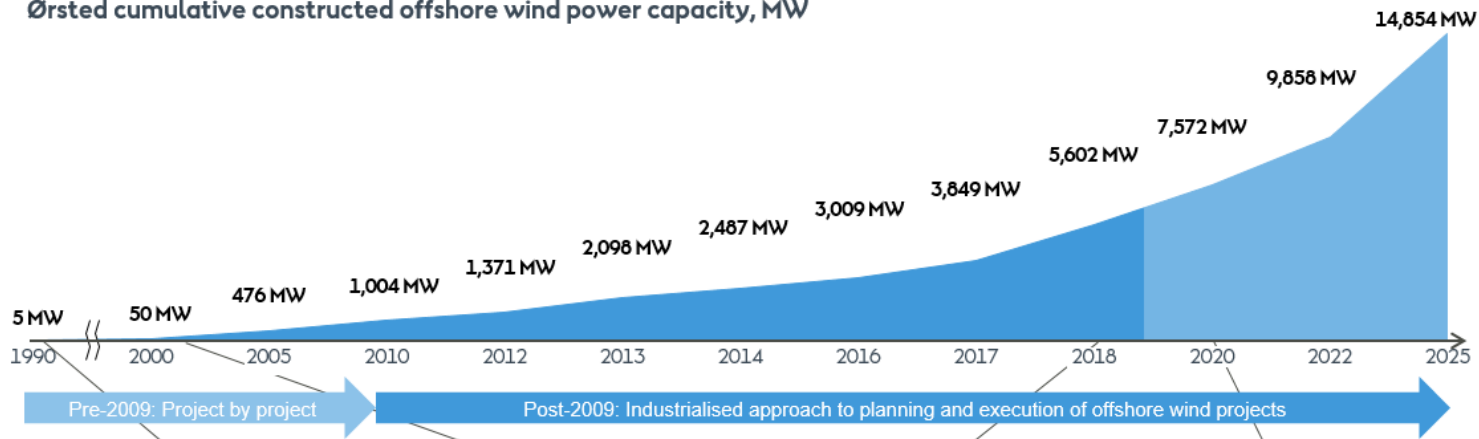
23 Partnerships

Note 1: In addition to these wind farms, Ørsted is constructing the 12MW Coastal Virginia demonstration project in the US on behalf of Dominion Energy. Further Ørsted has a 35% share in Formosa 1 in Taiwan


# Ørsted pioneered the offshore wind industry ...


Unrivalled track-record in offshore wind


Ørsted cumulative constructed offshore wind power capacity, MW




Selected projects

Vindeby	
First offshore wind farm in the world	
	
5 MW	
Turbine capacity	0.45 MW
Nr. of turbines	11
Rotor diameter	35 m
Distance to shore	1.8 km

Horns Rev 1	
First large scale offshore wind farm in the world	
	
160 MW	
Turbine capacity	2 MW
Nr. of turbines	80
Rotor diameter	80 m
Distance to shore	18 km

Walney Extension	
The largest operational offshore wind farm in the world	
	
659 MW	
Turbine capacity	7-8.25 MW
Nr. of turbines	87
Rotor diameter	154-164 m
Distance to shore	19 km

Hornsea 1	
The world's largest offshore wind farm once constructed	
	
1,218 MW	
Turbine capacity	7 MW
Nr. of turbines	174
Rotor diameter	154 m
Distance to shore	120 km

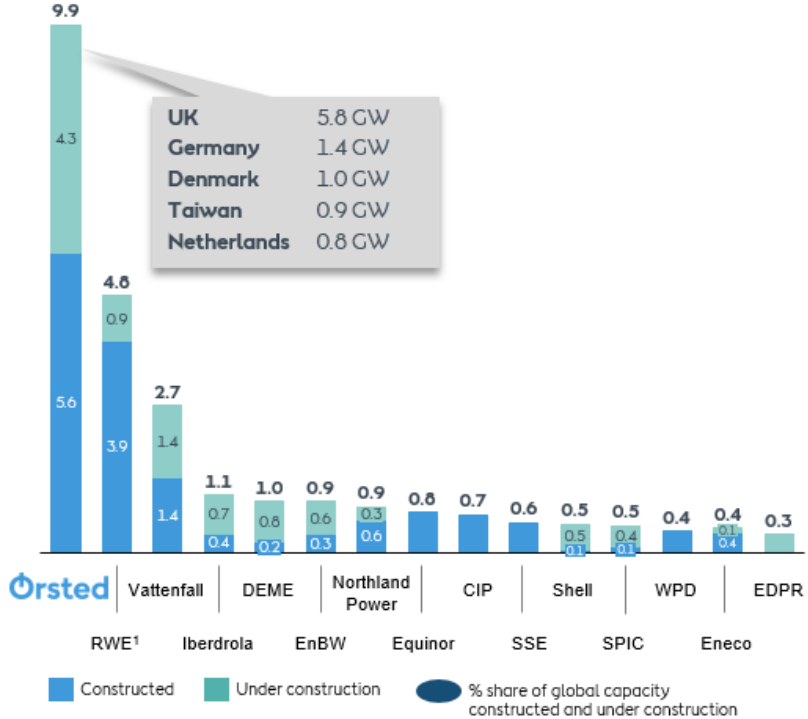


# ... and is today the global leader

share of global constructed and under constructed capacity in gigawatts

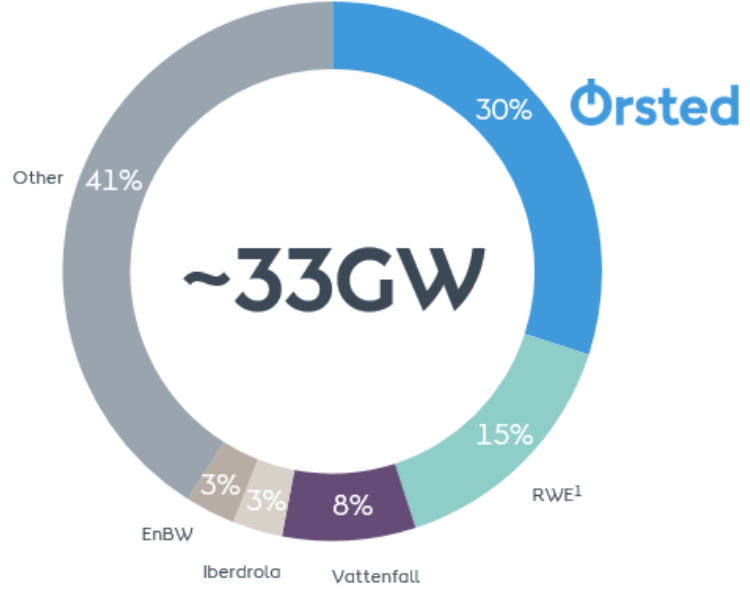
## Largest offshore wind power player globally today

Global offshore wind capacity, GW



## Offshore wind share of global capacity

Constructed and under constructed capacity, GW



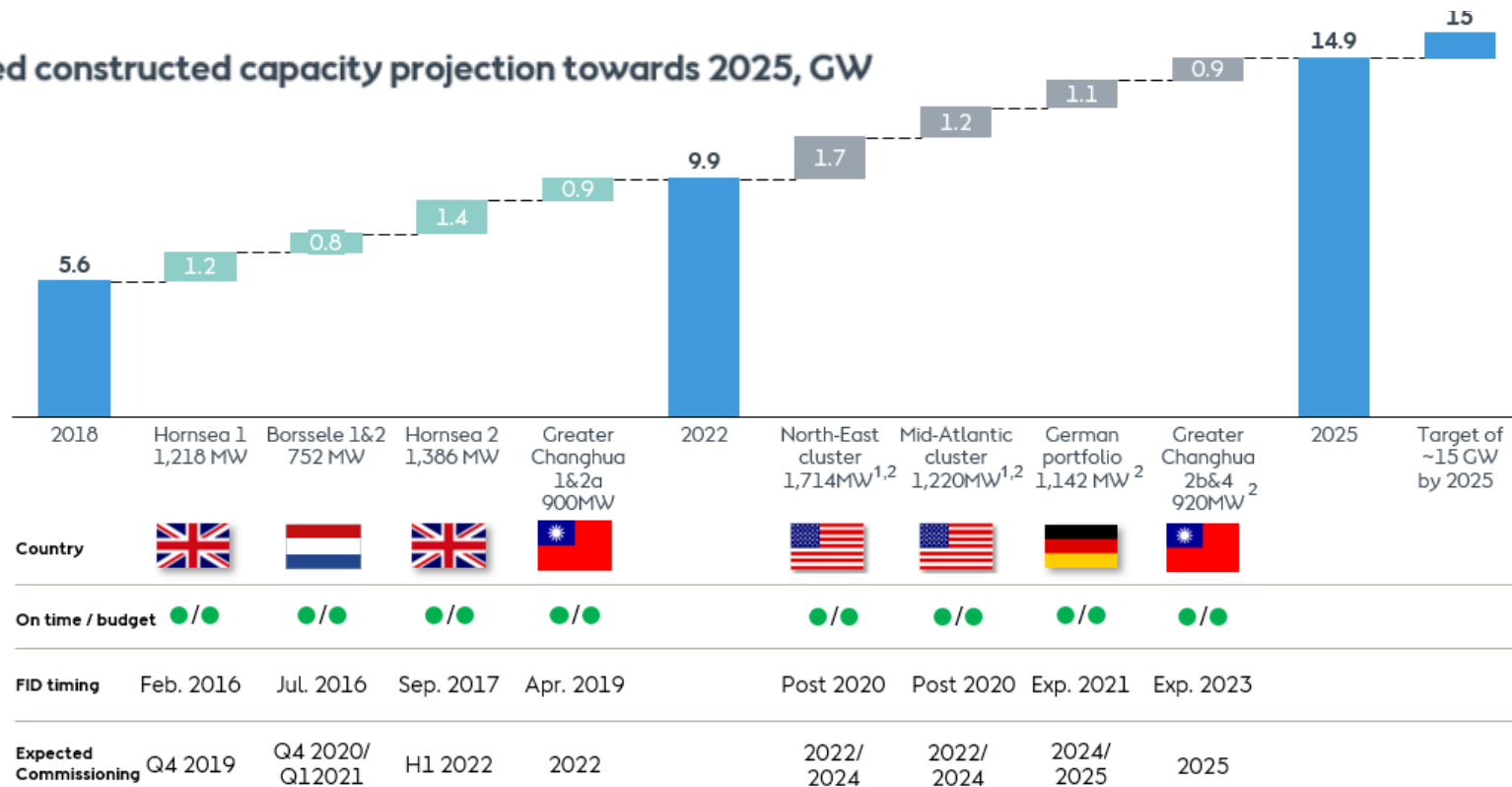
Source: Bloomberg New Energy Finance, 4C Offshore, Ørsted analysis, August 2019

Note 1: RWE capacity based on combined Innogy and E.ON offshore wind portfolio

# Ørsted's robust and highly visible offshore wind build-out plan

14.9 GW pipeline secured with an ambition of 15 GW set towards 2025








## Ørsted constructed capacity projection towards 2025, GW









1. Subject to award of the Construction and Operations Plan (COP)  
 2. The projects are subject to Final Investment Decision (FID) by Ørsted

# 2030 political commitments for offshore wind<sup>1</sup>

## Targets in existing footprint markets

-  UK: The UK government has a CfD roadmap with bi-yearly auctions of 2-4GW towards 2030 to reach 30GW
-  DE: Target of 15GW offshore wind by 2030 expected to increase to 20GW
-  NL: Offshore Wind Energy Roadmap: 11.5GW by 2030 through 1GW per annum post 2023
-  US: MA 2027 (2030) target: 1.6 (3.2) GW. VA 2026 target: 2.5GW  
NJ 2030 target: 3.5GW. NY 2030 (2035) target: 2.4 (9.0) GW  
MD 1.6 GW (requiring COD by 2030) CT 2.3 GW target (no target date)
-  TW: 2025 target of 5.5GW and 10GW target post 2025
-  DK: Outlined plan for three 800MW (2.4GW) offshore wind projects before 2030 by the Danish Government leading to a total of 5GW in 2030
-  BE: plans for offshore wind targets of 2.2GW by 2020 and 4GW by 2030

## Targets in next horizon markets

-  JP: 2030 target of 10GW for wind power (incl. onshore). New legislation in 2018 to develop offshore wind.
-  SK: Total wind target of 18GW by 2030 of which 12GW is allocated to offshore wind
-  IN: Target of 5GW before 2022 and 30GW by 2030
-  FR: New target of 10GW by 2028
-  PL: 8GW offshore wind target in 2030 and 10.3GW target in 2040
-  IR: New target of 3.5GW by 2030

Americas Asia Pacific Europe



Source: Bloomberg New Energy Finance (BNEF), 1H 2019 offshore wind market outlook

Note 1: Defined by a country's public offshore wind target by 2025/2030

# Global Offshore Wind Energy potential areas

Today offshore wind generation capacity amounts to 0.3% of global power generation.

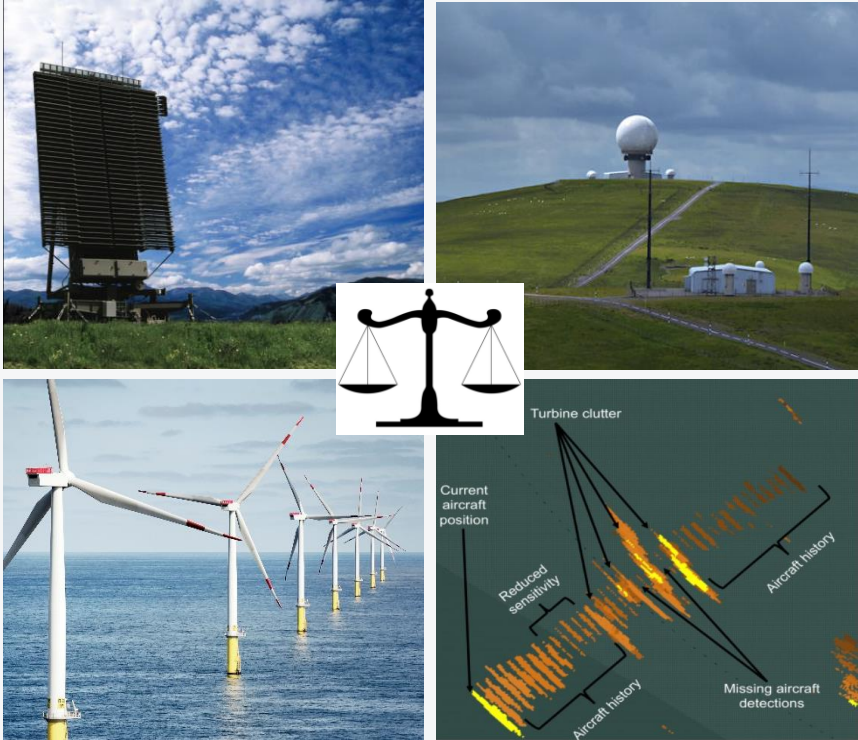
According to IEA *Offshore Wind Outlook*, offshore wind has the potential to supply more than the total amount of electricity consumed worldwide today.



- Current OWE areas
- Potential future geographies for OWE

# Overcoming challenges and achieving coexistence

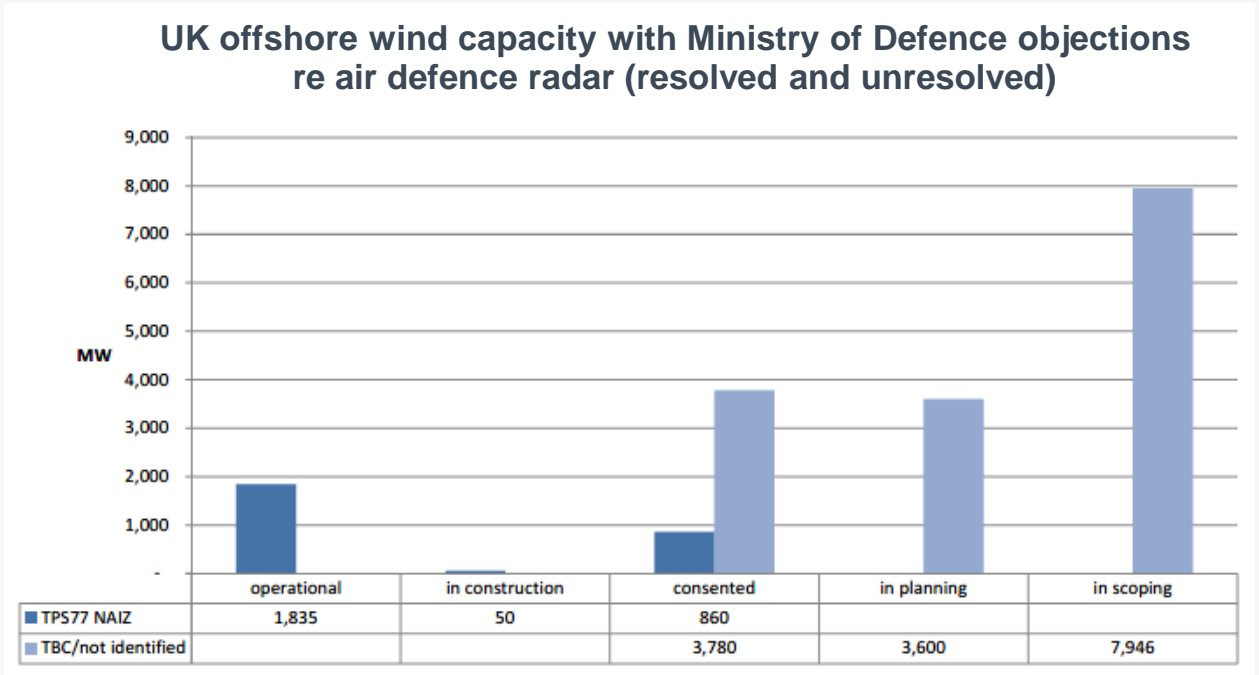
- Complex clutter, desensitisation and impairment of tracking function
- Co-existence requires credible mitigation options:
  - Operational
  - Technical
- Competing national policies (aviation, defence and energy) make this is a challenge for society
- Resolution can only be achieved with:
  - Early engagement
  - Cooperation
  - Collaboration





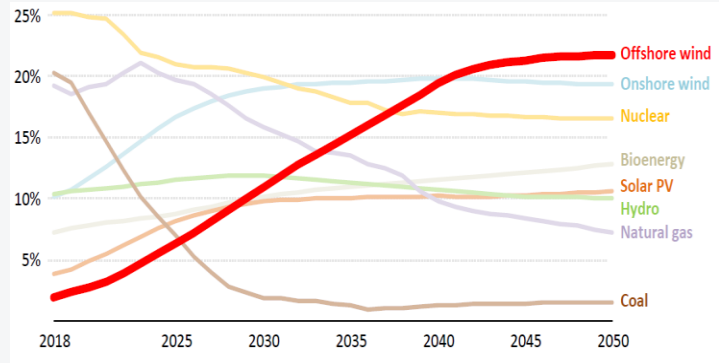
# UK case-study: air defence radar (contd.)

- UK developers reaching out to understand and resolve challenge (Market Survey)
- Simultaneously striving to deliver low-cost electricity to consumers
- 'Aviation Task Force'
  - Offshore Wind Industry Council and Ministry of Defence
  - 2020 Trial & Evaluation
- Collaboration has been, and will be, key



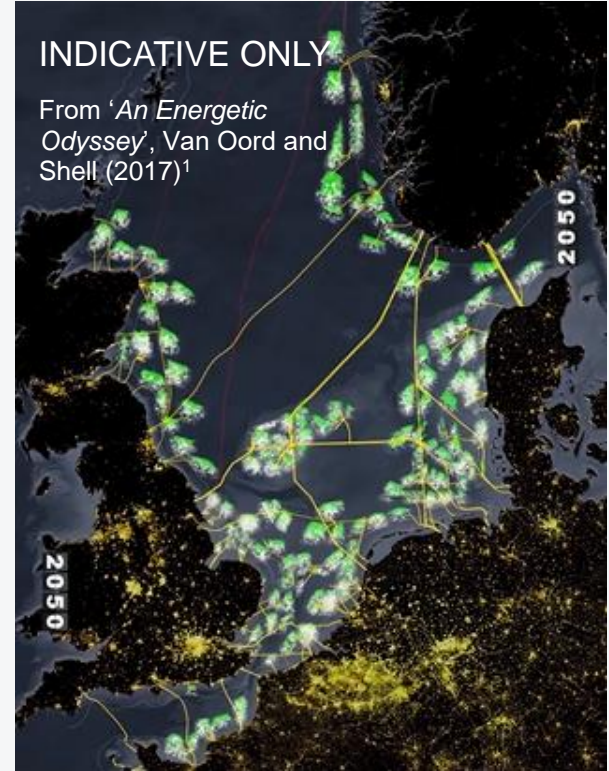
# Critical national infrastructure

COUNTRY/AREA	CAPACITY (GW)
UK	80
Netherlands	60
France (excl. Mediterranean)	40
Germany	36
Denmark	35
Norway	30
Poland	28
Ireland	22
Sweden	20
Finland	15
Belgium	6
Lithuania	4
Latvia	3
Estonia	1
<b>Total</b>	<b>380</b>
Rest of Mediterranean	31
France (Mediterranean)	17
Spain	13
Portugal	9
<b>Total</b>	<b>70</b>



*“Offshore wind will be the number one source of power generation in a carbon neutral Europe by 2050.”*

Faith Birol, IEA Executive Director



INDICATIVE ONLY

From 'An Energetic Odyssey', Van Oord and Shell (2017)<sup>1</sup>



# Q&A

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