green alliance…

Achieving large volume, least cost, low carbon electricity in the 2020s

What’s the role of offshore wind in the UK?

The electricity market

The UK has to enhance investor certainty and technology competition in the next decade

One of the government's central energy policy objectives is to achieve a least cost, low carbon electricity system in the 2020s.

This analysis examines the role offshore wind could play in this objective and how it could fit within the policy framework.

Given the long lead times to build energy infrastructure, and the uncertainties about costs, achieving the government's objective requires a policy framework that combines:

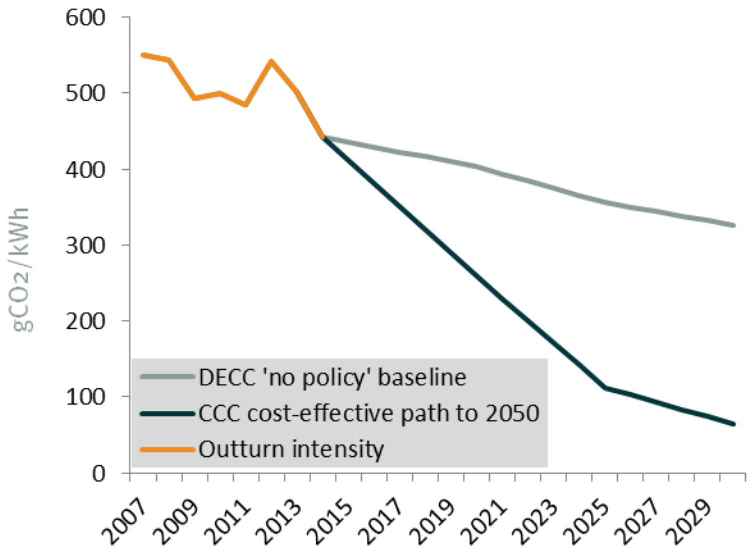
- sufficient **certainty** for a project pipeline to develop and business to invest in innovation;
- sufficient **flexibility** for consumers to benefit from future cost reduction, by avoiding blank cheque commitments;
- a route to enable **competition** between different low carbon power sources.

To 2030: demand constant, fossil fuel costs rising, zero carbon supply ramp up

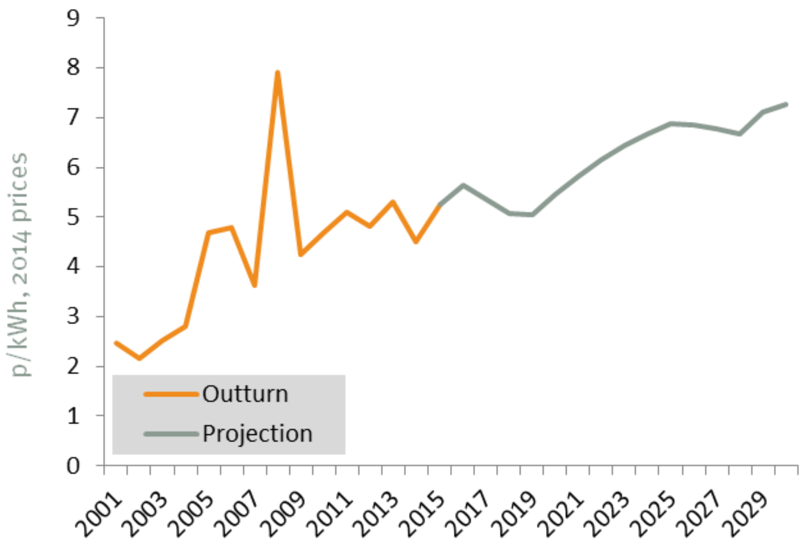
Underlying electricity demand is projected to be largely flat to 2030. During this period, CO_2e emissions should fall to 50-100gCO_2/kWh, requiring significant new investment in zero carbon power supply.

Price projections (currently being reviewed by DECC) are for a rise to 2030. This reflects expectations of the short run marginal cost of fossil generation and carbon price, but excludes the cost of electricity networks and consumer levies.

Emissions intensity

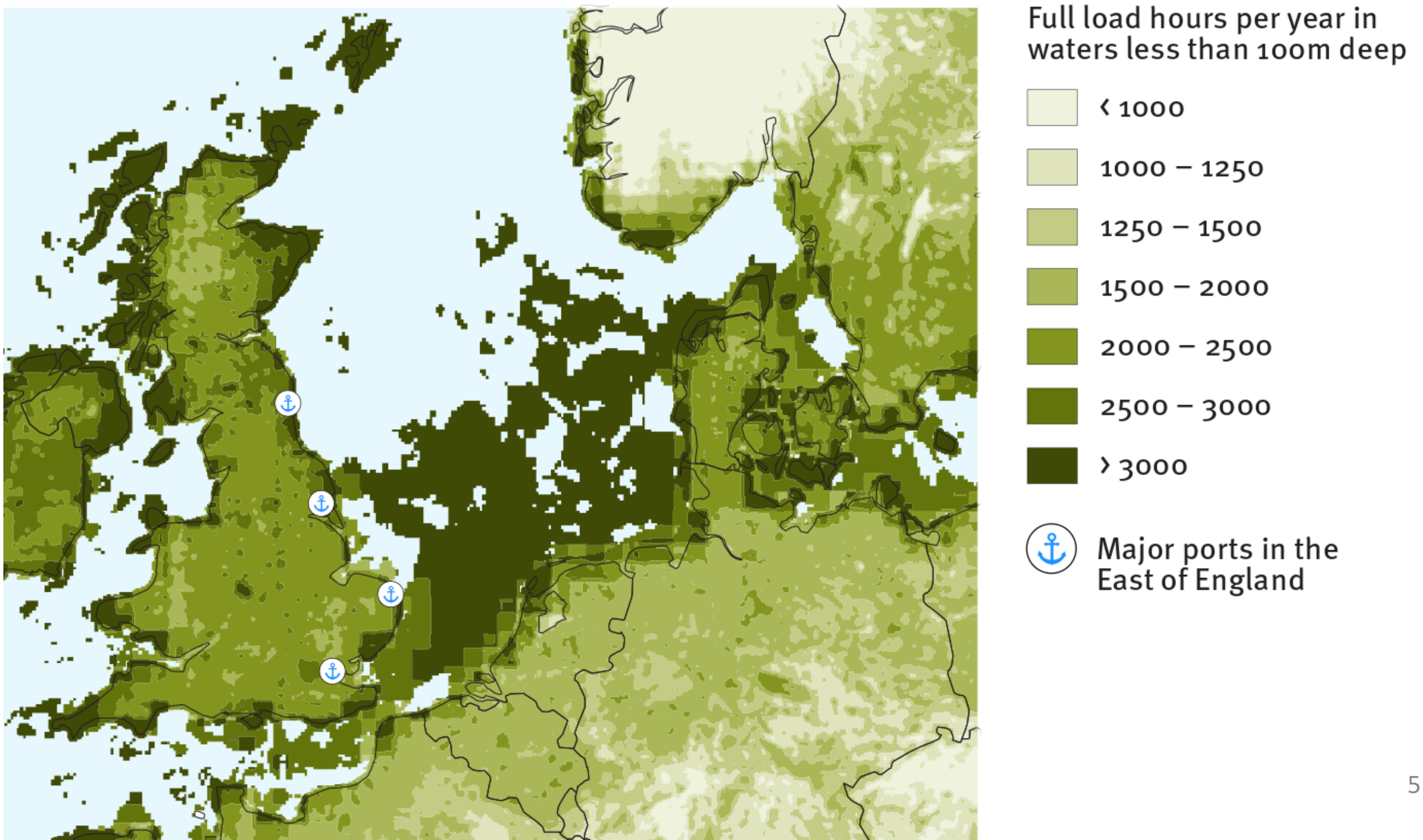


Wholesale price projections



UK's comparative advantage in the offshore market

North Sea geography and meteorology provide strong fundamentals for offshore wind in England, ie shallow, windy sites with significant grid capacity and close ports.



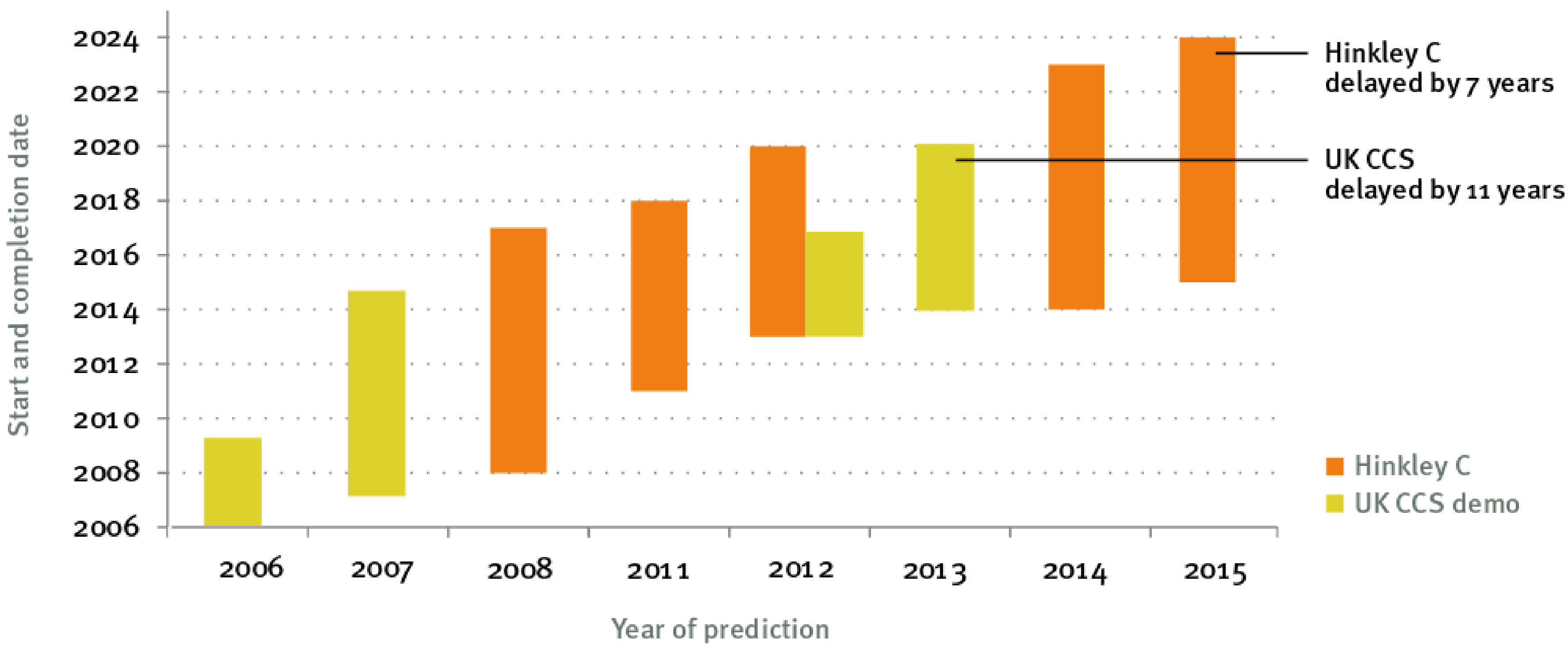
Risks to low carbon delivery

Delivery risks are high in CCS and nuclear

The UK's nuclear and carbon capture and storage (CCS) programmes have both experienced major delays. This has occurred to other nuclear and CCS projects around the world.

Tidal lagoons and large scale solar may also encounter planning delays.

Nuclear and CCS delays: changing predictions of year of completion



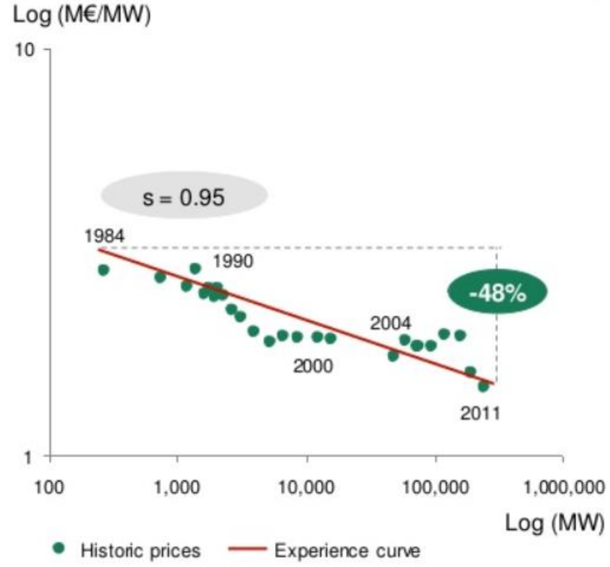
Cost risks are lowest in solar and wind

CCS and tidal lagoons are in demonstration phase and, therefore, start from a high baseline – above £140/MWh

Nuclear shows a negative learning curve, with costs rising recently, although predictions are for reductions in the next few years.

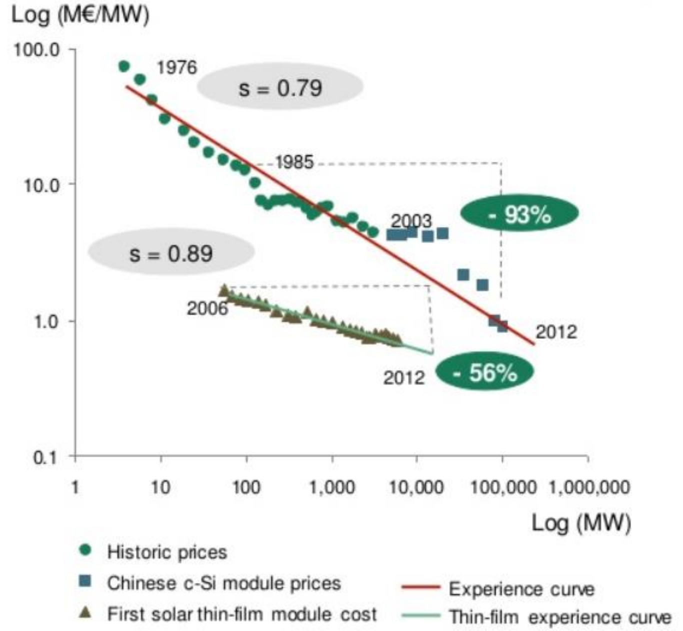
Wind and solar show strong cost reduction.

Wind turbine price index, 1984–2011



s= price index as cumulative volume doubles[1]

The Solar PV module experience curve, 1976–2012



Summary of risks and current cost performance

Technology	Cost risk & performance	Delivery risk & performance
Nuclear	• Lack of competition • Costs rising over time from a low base • Below £100/MWh	• Repeated delays to start date • Construction delays in FR, FI, CN
CCS	• Lack of competition • £140/MWh+	• Repeated delays to start date • Requires capital grants
Large scale solar PV	• Low risk: competition driving down prices • Below £100/MWh • Winter capacity challenge	• Low risk: delivered 1.5GW/year in 2014 • Land footprint will constrain future deployment potential
Tidal lagoons	• Lack of competition • £140/MWh+	• Planning risks
Offshore wind	• Medium/low risk: competition driving down price • Currently ~£117/MWh	• Very low risk: delivered 2.5GW/year in 2014

Costs of low carbon electricity supply

Offshore wind costs are now falling rapidly

UK offshore wind costs rose in the mid 2000s, due to:

- a turbine supply bottleneck caused by a lack of competition in turbine manufacturing and robust EU, US, Chinese turbine demand;
- increasing depth and distance from shore;
- low load factors (29.5%) due to gearbox, generator and cable failures;
- commodity price rises, EUR/GBP exchange rates, and cost of finance.

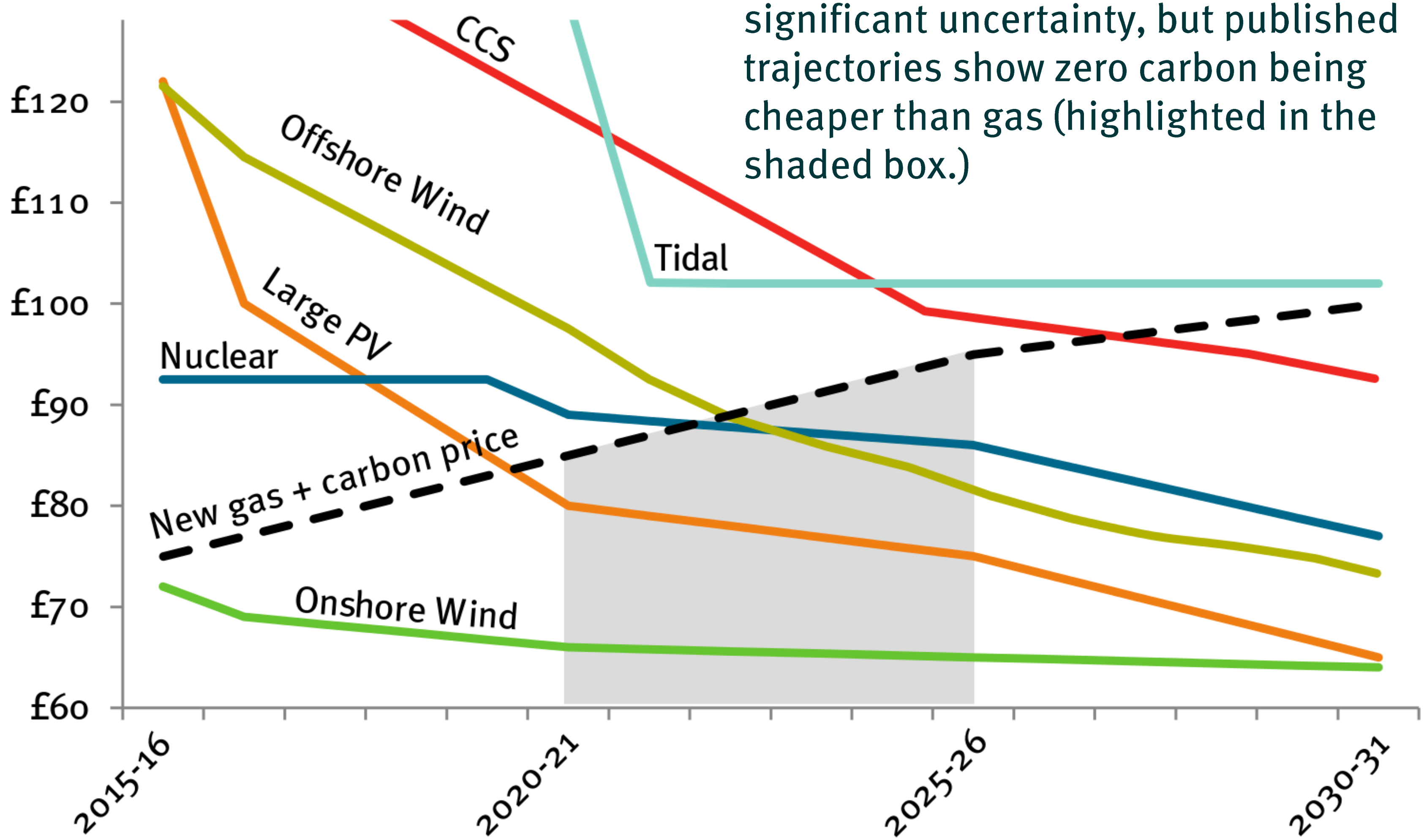
Recent cost improvements are significant:

- subsidy to UK offshore wind has fallen by 52% in the past three years*;
- Dutch auction caps are falling from €124/MWh in 2016 to €90/MWh in 2023 excluding grid and planning costs (£92 to £66/MWh);
- Innovate UK considers the UK industry on track to achieve £100/MWh in 2020 (including grid and planning costs), subject to suitable government support.

*Subsidy is defined as the difference between administrative strike price, CfD auction prices and new entrant CCGT (from £79 to £41/MWh of subsidy)

A range of technologies could be cheaper than gas by the mid 2020s

All projections are subject to significant uncertainty, but published trajectories show zero carbon being cheaper than gas (highlighted in the shaded box.)

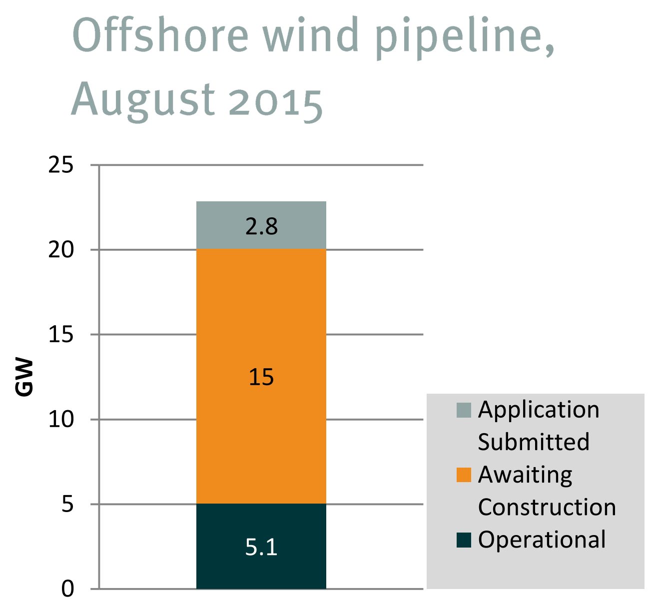


Offshore wind: delivery and market

There is still a healthy pipeline, despite consolidation

Industry effectiveness

- Construction times average 3.9 years from consent to operation, with 7.5% of projects being abandoned.
- 15GW of consented projects are available, subject to CfD allocation, ie at least six years worth of supply.
- Siemens' Hull factory is set to produce 1.5GW of turbines per year alone.



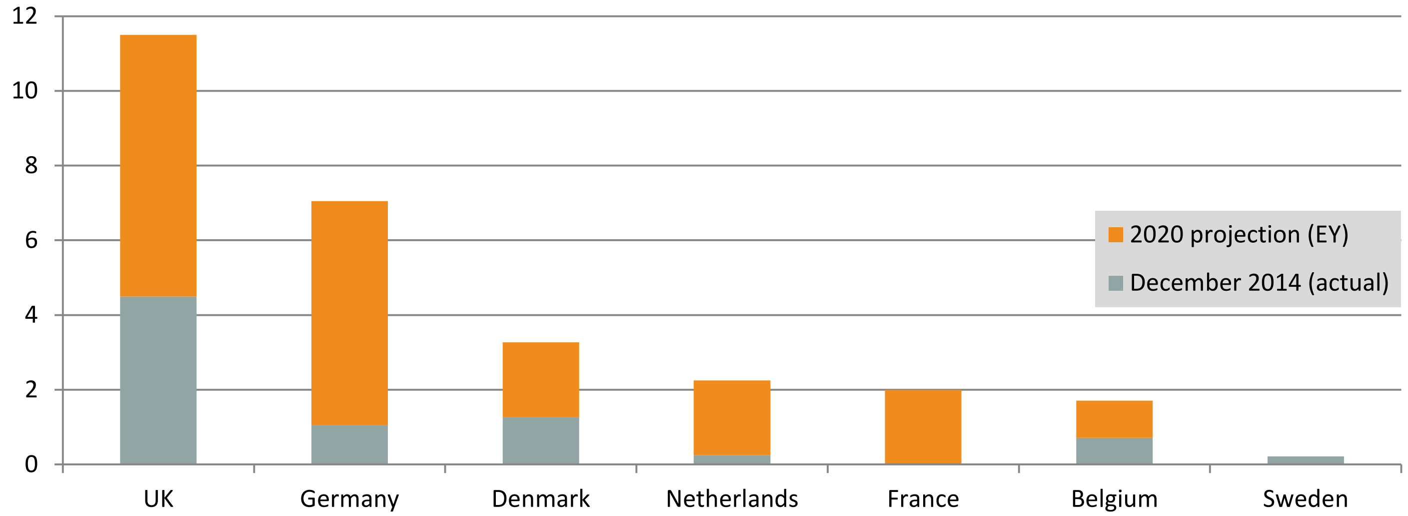
Technology effectiveness

- Load factors have increased from 29.5% for Round 1 sites to 48.7% for Walney 2, with the newest half of UK offshore wind farms achieving over 40%.
- Ernst and Young projects that new wind farms will achieve load factors of 55%, and be available 91% of the time.

Europe is dominant, but US, China and Japan are growing fast

Europe

- 28GW by 2020, across the following countries:



Rest of world

- US: 54GW target by 2020 (though delivery is likely to be lower)
- China: 10GW by 2020
- Japan: 37GW target by 2050. The feed-in tariff announced in March 2014 is the most generous in the world at JPY 36/kWh (£196/MWh)

Visibility and a route to competition are critical to success

Visibility into the 2020s:

- commit and review: government commits to a minimum market size on condition that industry meets its 2020 cost reduction target. This would be reviewed before contracts were committed;
- auction size: 1GW minimum, 1.5GW/year to meet cost reduction trajectory;
- frequency: annual auctions, with auction size set two auctions in advance;
- transparency: over assumptions behind spent and uncommitted LCF budgets.

The route to a level playing field:

- competition: conditions for technology neutral auctions in the mid 2020s;
- carbon price: include HMT's social cost of carbon in assessments of all plant;
- benchmark: since no new plant can be built using wholesale power prices alone, there is a need to benchmark against the cost of new entrant CCGT (£76/MWh);
- balancing: use a system analysis of balancing costs, rather than assuming new generation must invest in dedicated back up.

Conclusions

1

Offshore wind's delivery record and cost reduction trajectory suggest it could provide high volume, low cost, low carbon electricity.

Record: offshore wind will grow from 1% to 10% of electricity supply between 2011 and 2020

It has proven that it can scale at 2.5GW/year already, so it represents a useful hedge to achieve decarbonisation goals if other capacity is unable to proceed.

Costs: offshore wind subsidy has halved since 2011 and could be zero by 2025

Up to 12.5 GW of subsidy free offshore wind could be deployed between 2025 and 2030, if the industry meets its cost reduction targets and government provides suitable support to the end of the 2nd levy control framework period.

2

The government can meet its objective using ‘commit, review and compete’.

Commit:

Commit to a minimum market size if the industry hits its targets on cost reduction. This creates a incentive for industry to invest in innovation and at scale.

Review:

Review costs at an agreed date in the future, and only contract if they are on track. This protects consumers from higher than expected costs.

Compete:

Set out the route to technology neutral competition for subsidy free CfDs by 2025. This rewards success.

Timelines and scenarios showing how this framework could work are laid out in *UK offshore wind in the 2020s*

Endnotes

Slide 4

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- A note on future balancing costs for solar and wind: large scale solar is likely to be very cheap by the mid 2020s, but its winter capacity factor is low, necessitating expensive interseasonal storage if deployed at very large scale. Offshore wind storage requirements are expected to add less than £10/MWh, even if combined on and offshore wind deployment reaches 59GW by 2030, based on Pöyry, March 2011, *Analysing technical constraints on renewable generation to 2050*, www.theccc.org.uk/archive/aws/Renewables%20Review/232_Report_Analysing%20the%20technical%20constraints%20on%20renewable%20generation_v8_0.pdf DECC is updating its analysis of these costs, so further information should be available shortly.

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- Cost estimates based on forthcoming Green Alliance analysis of levelised costs of generation in the 2020s. These costs exclude system reinforcement costs for all technologies, and decommissioning and accident/storage liability for nuclear and CCS. These costs are well studied but depend heavily on context and system choices, so there will be different views about what constitutes the 'cheapest' technology.

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- ‘Subsidy free’ calculation based on a benchmark of new entrant CCGT plus the carbon price as setting the ‘subsidy free’ level, minus a high estimate of balancing costs to account for offshore wind variability.

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By Dustin Benton, Emily Coats and Matthew Spencer

Green Alliance

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