UK offshore wind in the 2020s

Creating the conditions for cost effective decarbonisation

green alliance…

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by Matthew Spencer, William Andrews Tipper and Emily Coats

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This report is published under Green Alliance's Low Carbon Energy theme, which is focused on the renewal and rapid decarbonisation of the UK energy sector.

This is an independent report. The views expressed are Green Alliance's own.

Acknowledgements
Thanks to the following for their contributions to this project: Paul Arwas, Ben Bowler, Andy Compton, Mike Hemsley, Alex Kazaglis, Matthew Knight, Danielle Lane, Ian Temperton, Mary Thorogood and Aram Wood.

We are grateful to DONG Energy, Vattenfall and Statkraft for supporting this work.

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Published by Green Alliance, November 2014
ISBN 978-1-909980-32-7

Designed by Howdy

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Executive summary

Leadership from successive UK governments has created a world leading offshore wind sector. The UK attracted £6.9 billion of offshore wind investment in the three years to 2013, and it now generates enough electricity to power 2.7 million homes. Costs have started to fall while the industrial base continues to grow and the sector supported 6,830 full time jobs in 2013.

The UK is likely to need a minimum of 25GW of offshore wind to decarbonise its power sector by 2030, and the market conditions created in the next parliament will determine both the costs and benefits of maintaining a vibrant offshore wind sector in the 2020s. If projects meet the government's aspiration of having 50 per cent UK content, deploying 25 GW on a steady pathway could generate British supply chain investment averaging in the region of £1.8 billion per year over the next 15 years.

Electricity market reform (EMR) has created an investible policy regime for offshore wind. It has also created new risks which mean that there is a high likelihood that the 2020 project pipeline will be insufficient to meet the UK's minimum needs. This analysis looks at modifications to the delivery of this framework that would address these risks, make deployment more cost effective and maximise UK supply chain investment.

The UK government and the offshore wind sector are focused on reducing costs to £100/MWh in the coming years, a challenging but achievable target if deployment rates are maintained at a level that allows rapid learning from industrial scale deployment. However, the next government will have to make decisions within in its first two years on the scale of funding for the low carbon generation market in the 2020s, ahead of full knowledge of the costs.

We conclude that a 'commit and review' approach would be better than a 'wait and see' one, in which cost reduction targets are divorced from the volumes needed to achieve them. In a commit and review process the next government can give offshore investors the confidence of a minimum market size in the next decade whilst retaining the flexibility to reduce deployment if a review in the early 2020s finds that cost milestones have not been met.

We have identified how this approach could be implemented in practice. We suggest new ways for government to ensure that offshore wind projects needed by the UK in the 2020s can continue to be brought forward. Taken together, action on the following five recommendations would increase the stability of the UK's low carbon power market, and ensure that the UK gets a stronger return on its existing investment in offshore wind.

Recommendations for cost effective development of the offshore wind sector for the 2020s

1. Set a carbon intensity target for the electricity sector

A 2030 carbon intensity target would remove considerable uncertainty regarding the UK's likely decarbonisation trajectory. Political parties could act immediately to bolster market confidence by explicitly ruling out 200gCO2/kWh in 2030, narrowing the wide range of potential future power sector scenarios.

2. Confirm the size of the next Levy Control Framework (LCF)

The decision over the next LCF needs to be taken no later than 2017 to stimulate sufficient project and supply chain development for the early 2020s.

3. Confirm the timings of future EMR allocation rounds

Confirming their frequency and timing for the remainder of the current LCF period would remove a major source of uncertainty and enable project developers to plan when and how to bring projects into the allocation process.

4. Set deployment minima for offshore wind in the 2020s

A steady deployment trajectory will avoid 'boom and bust' dynamics and create the best conditions for cost reduction and supply chain growth. This would be conditional on the costs of offshore wind coming down, which can be reviewed ahead of contracts being awarded under the next LCF in 2021.

5. Identify new ways to rebalance development risks

The balance of risks between government and developers should be reviewed, drawing on European experience, with the aim of ensuring a robust pipeline capable of delivering a steady flow of projects into the 2020s and beyond.

1
Offshore wind in the UK

Successive governments have helped to create a world leading offshore wind sector in the UK through strong renewables policy, a commitment to large scale deployment and significant funding support.

As a result the UK has now deployed 3.7GW of offshore wind, significantly more than any other country. Offshore wind delivers 3.5 per cent of total UK electricity generation, a six fold increase on five years ago.[1] Offshore wind generated 11.5 terawatt hours (TWh) of electricity in 2013, equivalent to the demand from 2.7 million homes.[2] This has been underpinned by substantial private investment. An estimated £6.9 billion was invested in UK offshore wind generation from 2010-13, nearly three times the investment in gas generation during the same period.[3]

This expansion has been driven by technological advances and the development of offshore wind projects of increasing scale and complexity. The first UK offshore wind farm in 2001 was one kilometre offshore with a capacity of 3.8MW. In contrast, the recently consented East Anglia One wind farm will be 43 kilometres offshore with a capacity of up to 1,200MW (1.2GW).[4]

There is considerable potential for further expansion. Licences for offshore sites representing well over 40GW have been issued in three licencing rounds since 2001.

Increasing deployment of offshore wind has led to more UK jobs

Employment in offshore wind more than doubled between 2010 and 2013, from 3,100 full time equivalent (FTE) jobs to 6,380. Construction and installation of wind farms represents the largest proportion of the workforce, accounting for over a third (2,503) of total employment. Site planning and development accounts for a further 1,276 jobs, and manufacturing provides 683 jobs ie around ten per cent of the total offshore wind workforce.[5]

"Employment in offshore wind more than doubled between 2010 and 2013."

Growth in the European offshore wind market offers the chance to significantly increase UK employment opportunities. European deployment of offshore wind is projected to grow nearly fourfold between 2013 and 2020, from 6.5GW to 23.5GW.[6] Servicing this market will require a significant expansion of manufacturing capacity. While offshore wind's manufacturing and supplier base remains centred on continental Europe, reflecting the industry's origins, UK offshore wind leadership means it is well placed to secure a good share of this growth. This is reflected in the decision by Siemens and ABI to open a turbine fabrication facility on the north east coast in 2016. This will employ 1,000 people and significantly increase the levels of UK-generated content in the country's wind farms.[7] UK content is now estimated to account for 43 per cent of lifetime wind farm costs.[8] With the majority of this coming from operational spending on operations and maintenance, there is a strong political and industry focus on further expanding UK manufacturing and supply chains.

Future UK industrial benefits from offshore wind will depend upon the speed and scale of deployment relative to other countries

UK supply chain growth will be highly sensitive to the speed of deployment. RenewableUK has suggested that the UK would need to retain more than 50 per cent of the total European market in 2020 to secure a second turbine manufacturing facility.[9] A lower market share would be likely to lead to turbine manufacturing investments being made into existing continental European facilities, although supply chain plans and active contract brokering could increase UK content at all levels of deployment. However, given that UK offshore wind supply chain companies are overwhelmingly small and medium sized,[10] investments into lower levels of the supply chain could also produce significant local economic benefits.

"The size of wind farms will be an important determinant of how quickly the UK is able to scale up generating capacity."

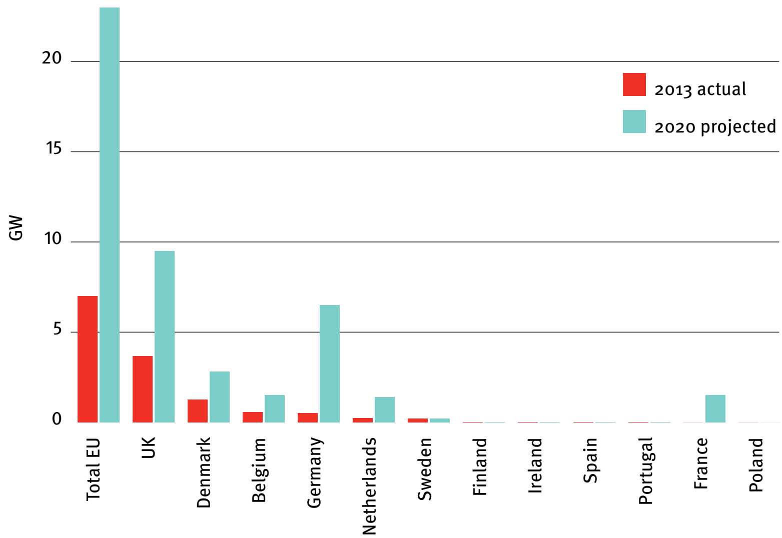
The size of wind farms will be an important determinant of how quickly the UK is able to scale up generating capacity. The third licensing round launched in 2010 sought to create industrial scale deployment zones such as Dogger Bank (see below) capable of supporting multiple wind farms of a scale of 1GW (1,000MW) or more. In contrast, the London Array, the biggest offshore wind farm in the world when it was completed in 2013, has a generating capacity of 630MW.

The potential of industrial scale wind farms[11]

Dogger Bank is the largest of the round three zones. It covers 3,343 square miles up to 180 miles off the UK coast in the North Sea. It has the potential to support six 1.2GW offshore wind farms. Analysis indicates that, if the first two of these wind farms were to be built by 2025, the benefits could be:

- Up to 2,400 full time equivalent jobs would be supported in the existing UK supply chain, rising to 4,750 if new original equipment manufacturing (OEM) facilities were built.
- Existing UK suppliers could provide 38 per cent of the content, rising to 72 per cent with new OEMs.
- Total gross value added (GVA) economic benefits for the UK would be in the region of £900 million, rising to £1.7 billion with new OEMs. The vast majority of these benefits would accrue in the north east, Yorkshire and Humber regions.

European offshore wind generation capacity by country



> **"The UK's share of the total European offshore wind market is projected to decline significantly by 2020."**

Currently, the UK's share of the total European offshore wind market is projected to decline significantly by 2020 (see above), from around 56 per cent to just over 40 per cent. This is principally due to strong projected growth in Germany, which is set to increase deployment from 0.5GW in 2013 to 6.5GW in 2020, although there will also be significant growth in Denmark, the Netherlands and France.

Offshore wind deployment needs to increase during the 2020s to decarbonise the UK's electricity supply

The Committee on Climate Change's (CCC's) projections for decarbonising the electricity sector envisage around 25GW of offshore wind in 2030. This would be consistent with a carbon intensity of 50gCO_2/kWh, which the CCC sees as the most economically efficient pathway to delivering the UK's 2050 carbon reduction goal.[12]

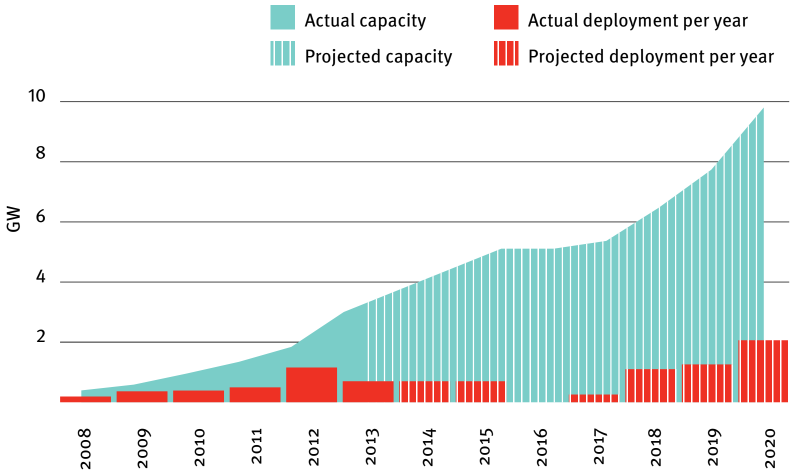
The UK is on track to deploy 9-10GW of offshore wind by 2020. In addition to the 3.7GW of existing generation capacity, a further 1.4GW is under construction, around 3GW more has received funding contracts from government, and just over 1GW more is anticipated to be delivered based on existing funding plans.

This suggests that at least 15GW additional capacity will need to be built during the 2020s if the UK is to decarbonise cost effectively.

"If new projects achieve 50 per cent UK content, the supply chain investment created could average in the region of £1.8 billion per year from 2015-30."

The size of the industrial prize for this level of offshore wind deployment is considerable. Our estimates suggest that if new projects achieve 50 per cent UK content, in line with the government's ambition,[13] the supply chain investment created could average in the region of £1.8 billion per year from 2015-30.[14] Achieving this level of UK content will depend, to a large extent, upon the predictability and stability of the growth trajectory to 2030.

UK offshore wind generation capacity to 2020



2
Challenges for the offshore wind sector

The UK has instituted significant reforms to its energy market. It has introduced new legislation, secured European state aid clearance and established new delivery institutions, such as the Low Carbon Contracts Company. This has created a strong investment framework for large, capital intensive, low carbon generation such as offshore wind, generating strong competition for contracts which, in turn, appears to have stimulated cost reduction.

> **"The decision not to set a carbon intensity target during the electricity market reform process means that uncertainty will remain until at least 2016."**

Our research has focused on the challenges this new framework creates for the next five to 15 years, and how the UK can lock in further cost reduction and greater supply chain investment. We conclude that, to realise the cost reduction and industrial potential of the sector, four particular challenges need to be addressed:

1. Uncertainty over the size of the future low carbon market.
2. A slowing deployment trajectory linked to cost targets.
3. Altered balance of development risks.
4. Limited public funding coupled with uncertainty over future public funding.

1. Uncertainty over the size of the future low carbon market

The government has presented 2030 scenarios for the electricity sector with carbon intensity ranging from 50gCO_2/kWh to 200gCO_2/kWh.[15] This wide range of carbon pathways has created huge uncertainty for all low carbon energy generation.

The decision not to set a carbon intensity target during the electricity market reform (EMR) process means that uncertainty will remain until at least 2016, when this decision will be reviewed.

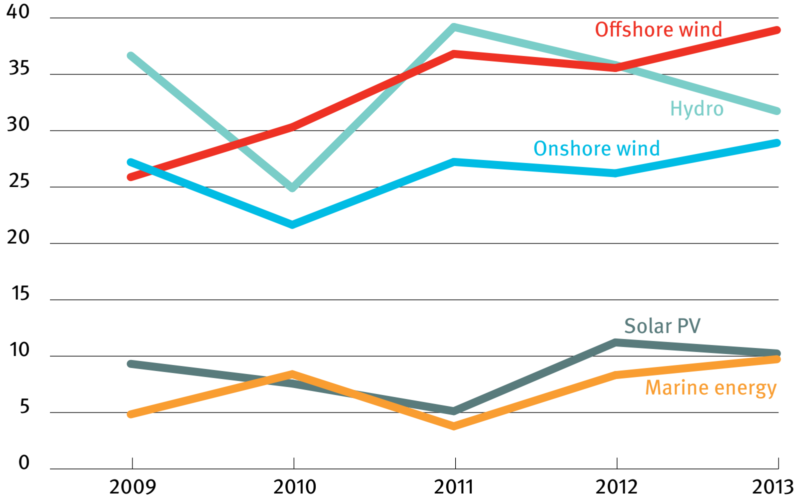
2. A slowing deployment trajectory linked to cost targets

The government's deployment ambitions for offshore wind have become more cautious and less precise. The 2011 Renewables Roadmap contained a vision for 18GW by 2020. The 2013 EMR delivery plan indicated a new expectation of around 10GW by 2020. There are no firm indications as to the government's deployment expectations after 2020. Its 2030 electricity sector carbon intensity scenarios contain offshore wind projections ranging from 12GW to 41GW.

Discussions of the sector's future have been framed by the need to reduce costs. Offshore wind remains among the most expensive forms of low carbon electricity generation, with costs of around £150/MWh in 2013.[16] Future government support for offshore wind has been made conditional on the cost of electricity generation hitting £100/MWh by 2020.

There is evidence that costs are falling. Turbines are becoming larger and are being situated further offshore, increasing the efficiency of offshore wind farms. The first electricity generated using a 6MW turbine was delivered to

Renewable energy load factors



> **"The industry is working intensively through fora such as the Carbon Trust's Offshore Wind Accelerator to deliver the innovations that will drive down costs."**

the UK in September 2014 from the Westermost Rough wind farm.[17] Contracts are in place for 8MW turbines for future UK offshore wind farms, which will reduce costs by nearly ten per cent compared to more traditional 4MW turbines.[18] Load factors (an indication of efficiency of electricity production) for offshore wind have improved by 50 per cent over five years, making it more efficient than other important renewable generation technologies.[19] The industry is working intensively through fora such as the Carbon Trust's Offshore Wind Accelerator to deliver the innovations that will drive down costs.

The rate of future cost reduction will be closely linked to the volume of deployment. It has been estimated that meeting the £100/MWh cost target would require deployment of 15GW.[20] Current projections are that there will be around 10GW in 2020. While targets can be an effective policy tool, by making cost reduction an absolute condition, with no link to volume the government could end up limiting its effectiveness by increasing the industry's uncertainty about the future.

3. Altered balance of development risks

The 2013 Energy Act has changed the balance of risks in wind farm development, reducing some significantly but increasing others. The act will phase out the current Renewables Obligation by 2017 to be replaced by a new system of contracts for difference (CfDs).

CfDs are allocated by government on the basis of competition between projects. This process contains a range of risks for generators, including:

- **Allocation risk:** in the (highly likely) situation that more projects bid for CfDs than the available budget can support, contracts will be allocated on the basis of a blind auction using sealed bids.

- **Pricing risk:** projects have no guarantee at the start of the process of the strike price they will ultimately receive if their bid is successful.
- **Contract termination risk:** within one year of securing a CfD, generators must have spent ten per cent of total project pre-commissioning costs or risk losing their CfD.

The long project development timelines and high capital investment (capex) costs of offshore wind projects mean that the aggregate impact of these risks will make it harder to develop new projects. Offshore wind farms must spend years in development just to reach the stage of being able to bid for a contract. Developers must secure planning and leasing consents and put in place the supply chain contracts that would enable them to deliver the contract milestones. Projects will have to incur costs that can amount to tens of millions of pounds with no guarantee of revenue at the end of the process.

"Denmark invites generators to bid a price for sites that come with guaranteed funding support and grid connections."

This level of development risk is higher than in models used by other European countries. For example, Denmark invites generators to bid a price for sites that come with guaranteed funding support and grid connections (see below).

The Danish development model [21]

- In the government tender procedure, the Danish Energy Agency announces a tender for an offshore wind project of a specific size within a defined geographical area.
- The Danish Energy Agency invites applicants to bid a price for producing electricity in the form of a fixed feed-in tariff for a certain amount of produced electricity.
- Energinet.dk (the publicly-owned transmission system operator) constructs, owns and maintains both the transformer station and the underwater cable that carries electricity to land.

4. Limited current public funding coupled with uncertainty over future funding

The government makes money available to support deployment of low carbon electricity generation via the Levy Control Framework (LCF), which directs expenditure from income raised via a levy on energy bills. The LCF has an escalating annual cap. The current period will end in 2020-21, when the cap can be no higher than £7.6 billion.

Annual LCF budgets are divided into financial pots for 'established' and 'less established' technologies. Offshore wind projects compete for funding from the less established technology pot.

The budget for projects commissioning in 2014-15 was announced in two stages, with the original £155 million being subsequently increased by a further £80 million. It has been estimated that this will be sufficient to deliver perhaps 600MW of offshore wind. With projects of double that size

> "There are no indications regarding potential budgets for the rest of the Levy Control Framework period."

in the development pipeline, this raises questions about whether funding will be sufficient to deliver the vision of industrial scale wind farms.

There are no indications regarding potential budgets for the rest of the LCF period, nor have there been announcements as to when future allocation rounds may take place. There are also no indications as to what will follow once the current LCF has expired in 2021.

A slow start and lack of certainty about the future could slow cost reduction

The dynamics of these challenges have created a negative feedback loop. The absence of any indications regarding likely future rates of deployment mean that short term LCF budgets are currently the only guide for an industry expected to invest millions of pounds in project development.

The lower than expected 2014 budget and the lack of budget detail for the remainder of this LCF period, including frequency of allocation rounds, is encouraging industry to take a pessimistic view of the immediate future.

This pessimism will lower industry investment and delay the development of stable supply chain conditions. The impact is likely to be slower cost reduction, which could reinforce political caution on offshore wind.

Three interdependent factors determine the progress of the UK offshore wind sector

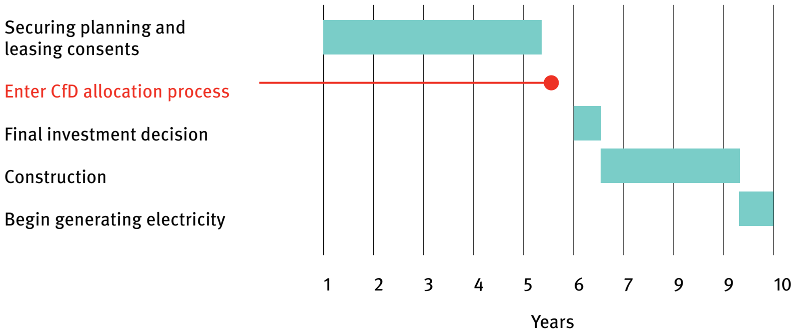
We conclude that because of the strength of the UK offshore wind sector it would be relatively straightforward to reverse the likelihood of the industry stalling due to these challenges. A positive feedback loop could instead be created in which higher deployment certainty creates stronger industry confidence, faster cost reduction and more supply chain development. We explore the conditions for this in chapter three.

The impact: strong short term competition is masking a project shortfall for the mid-2020s

The long lead in times for offshore wind farms (up to a decade) mean that the immediate pipeline of projects is substantial, due to the high number commissioned around 2010 (when the third licensing round opened). This means that competition for scarce funding in the period up to 2020 will be intense.

"A positive feedback loop could be created in which higher deployment certainty creates stronger industry confidence."

Indicative timeline for an offshore wind farm



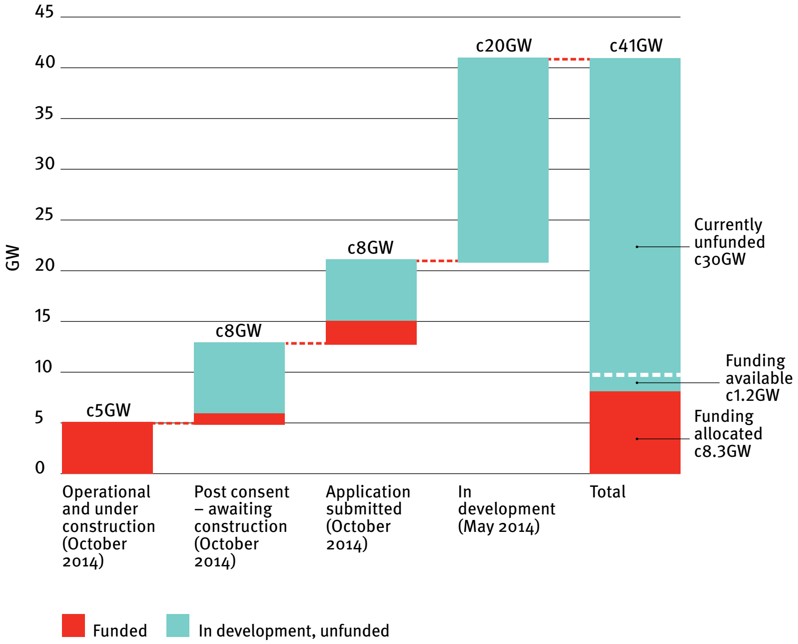
There are currently approximately 16GW of offshore wind projects that have either received planning consent and are awaiting construction, or which have submitted planning applications. Of these, approximately 3GW have already secured public funding. There is currently sufficient funding confirmed by the government to sign contracts for just over 1GW of additional new capacity, for which the remaining 13GW of projects must compete.[22]

Generators wishing to bid for funding will need to incur costs that can run into tens of millions of pounds to meet the entry conditions for CfD auctions, in the knowledge they have a poor chance of success. Those who choose to hold back for future allocation rounds will continue to incur significant costs to keep their projects extant with no knowledge about the size of funding they will ultimately be bidding for.

These policy, regulatory and funding challenges mean that many developers have chosen to withdraw their projects rather than continue to invest when prospects are so uncertain. UK projects representing an additional 8.2GW of generating capacity were shelved in the 12 months to June 2014,[23] with further withdrawals taking place in the months following.

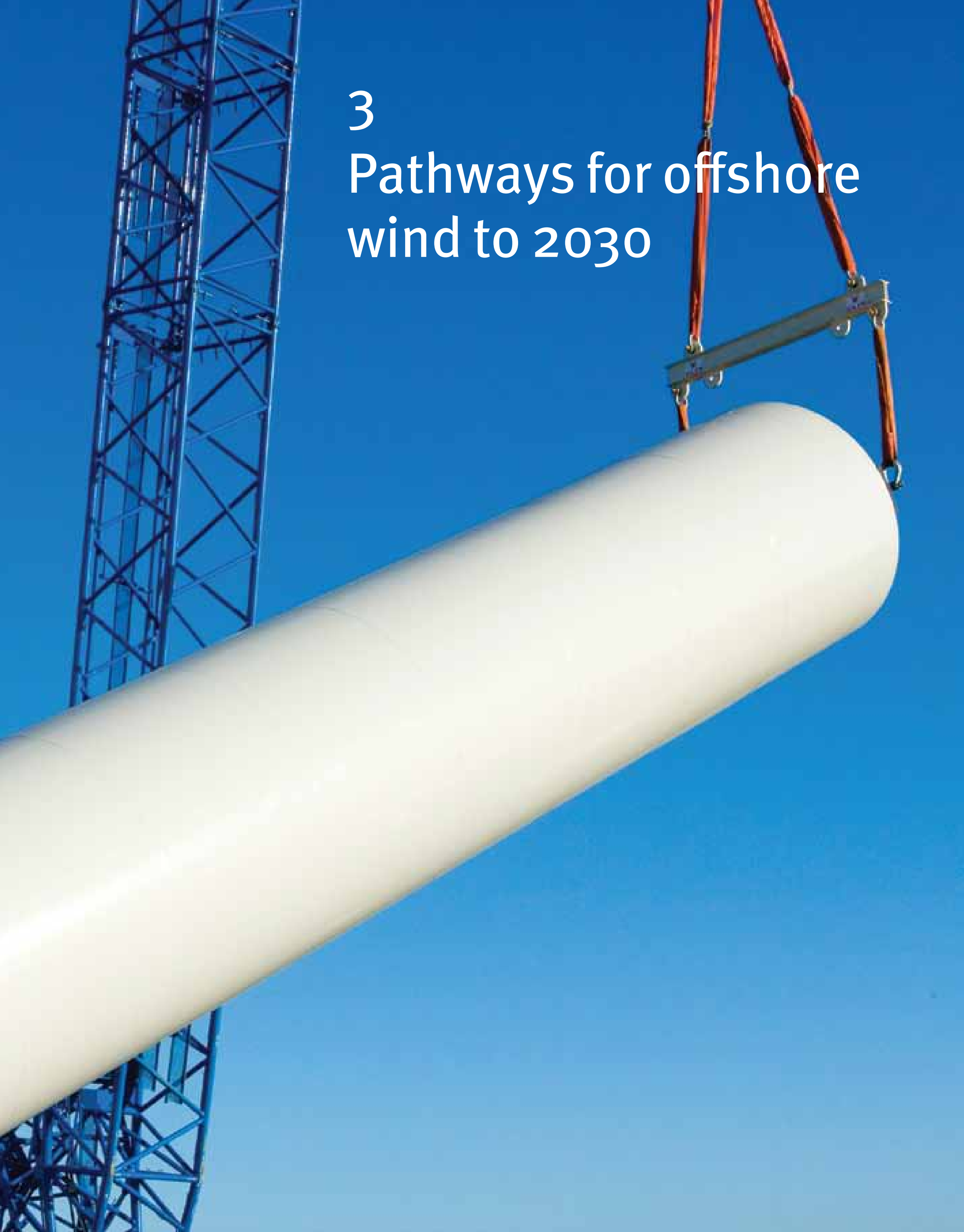
> "Policy, regulatory and funding challenges mean that many developers have chosen to withdraw their projects rather than continue to invest when prospects are so uncertain."

UK offshore wind project pipeline



There is, therefore, a strong possibility that the pipeline will continue to shrink and a risk that the UK will start the 2020s with a project pipeline too small to give confidence that it can meet its minimum requirements from offshore wind for the rest of the decade. In our final chapter, we propose a number of steps which could be taken to minimise this risk.

3
Pathways for offshore wind to 2030



To test our view of which are the key factors determining offshore wind's economic and decarbonisation impact we analysed five potential end points for the sector in 2030. These allowed us to assess the likely interplay between cost reduction, deployment and industrial benefits.

> **"Managing costs whilst maximising industrial benefits will depend upon when and how often wind farms are built."**

Managing costs whilst maximising industrial benefits will depend upon when and how often wind farms are built, not just how many there are in 2030. Our deployment pathways suggest there are five principal routes to consider:

1. **Sustained ambition:** 40GW by 2030. A fast start of 2.5-3.5GW a year is sustained throughout the 2020s.

2. **Fast start, tailing off:** 25GW by 2030. A fast start of 2.5-3.5GW per year before falling back to closer to 1GW per year for the second half of the decade.

3. **Steady deployment:** 25GW by 2030. Smooth deployment of around 1.5GW each year throughout the 2020s.

4. **Slow start, late acceleration:** 25GW by 2030. A slow start with minimal deployment in the early 2020s, before substantial increase to around 3GW per year in the second half of the decade.

5. **Stagnation:** 12GW by 2030. A slow start with minimal deployment in the early 2020s, with no deployment to speak of in the second half of the decade.

1. Sustained ambition (40GW)

Low carbon, high jobs, but volatile

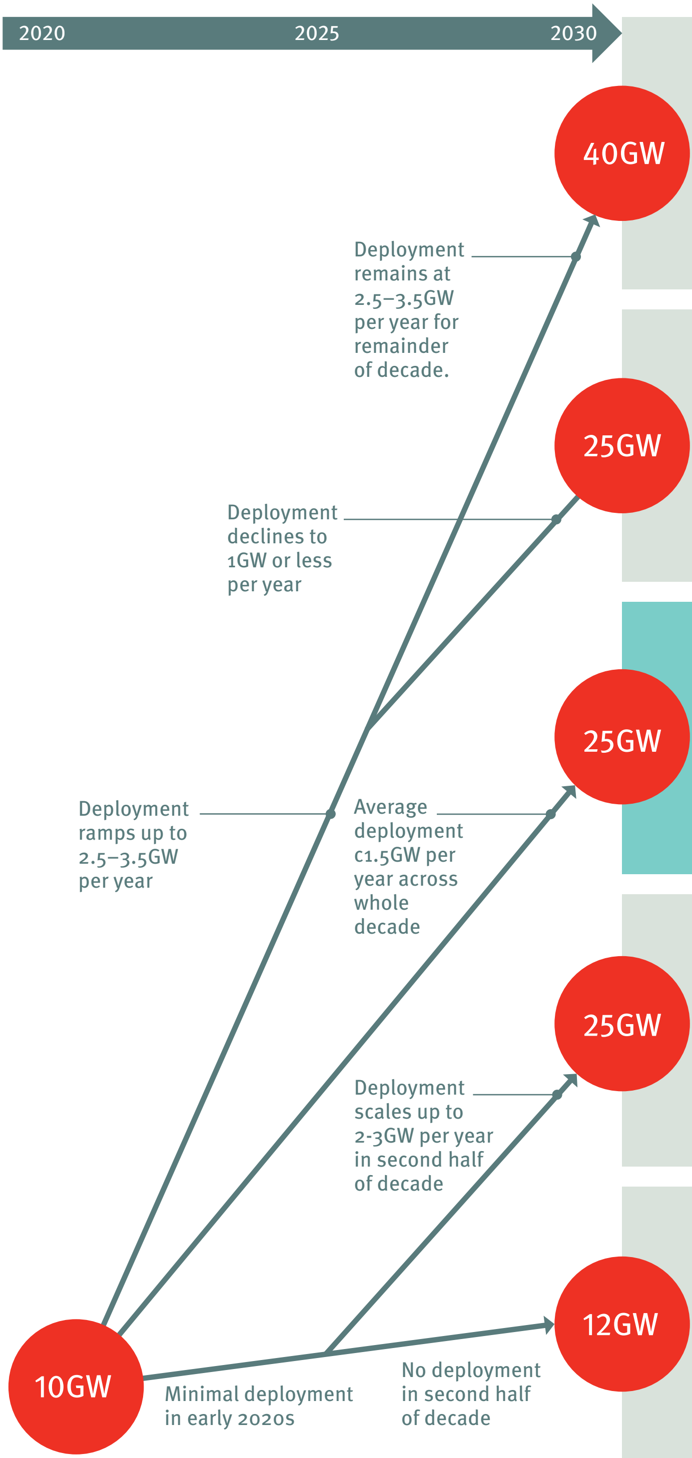
This should enable a power sector carbon intensity of 50gCO_2/kWh in 2030 with opportunities for significant further decarbonisation post-2030.

Supply chains could be transformed. The UK would be, by some distance, the dominant European player, attracting significant inward investment. This level of deployment implies two, if not three, turbine manufacturing facilities in the UK. One study has estimated that 37GW by 2030 would support 62,000 direct jobs and generate a positive net balance of trade for the UK of £18.82 billion.[24]

However, this approach also comes with supply chain risks. Scaling up manufacturing capacity to meet this level of demand could create bottlenecks, and bubbles may occur where prices are inflated by supply shortages.

The rate of cost reduction could, therefore, be volatile. On the one hand, acceleration of industrial scale projects further offshore would lower costs of electricity generation. Higher wind speeds can lead to a 40 per cent increase in energy production from a given turbine.[25] On the other hand, competition for scarce investment capital will create upward cost pressure due to the increased costs of borrowing.[26] It has been estimated that a rapid

Potential deployment pathways to 2030



1. Sustained ambition

Big potential upside in terms of decarbonisation and employment impacts.

Cost reduction effect uncertain: sustained ramp-up risks bubbles due to supply chain and funding bottlenecks.

2. Fast start, tailing off

'Boom and bust' approach unlikely to deliver sustained cost reduction or strong supply chain.

Early ramp-up in deployment creates risk of bubbles caused by supply chain and financing bottlenecks.

3. Steady deployment

Predictable and consistent deployment gives the best chance of supporting supply chain development and sustained cost reduction.

4. Slow start, late acceleration

Low early deployment will shrink the pipeline. There may be insufficient projects available to meet high demand in the late 2020s.

Demise of UK supply chain capacity in the early 2020s is likely to lead to higher costs.

5. Stagnation

Few, if any, additional energy, carbon or industrial benefits.

Costs remain high while jobs are largely limited to operations and maintenance of existing wind farms.

scaling up of deployment could create a capital shortfall of £7-22 billion up to 2020 due to intense demand from multiple projects.[27]

2. Fast start, tailing off (25GW)

'Boom and bust' undermines cost reduction

This should enable a carbon intensity of 50gCO_2/kWh in 2030 with opportunities for significant further decarbonisation post-2030. As part of a portfolio of low carbon technologies, it keeps post-2030 decarbonisation options open.

This route would not offer ideal conditions for cost reduction. The fast start (2.5-3.5GW per year) would facilitate deployment of industrial scale wind farms further offshore, which can generate electricity at lower cost. However, it would also be likely to create short term funding and supply chain bottlenecks, potentially raising costs. Tailing off in the middle of the decade could also lead to wasted supply chain investments in the face of massively reduced demand.

This suggests that costs in this route would be likely to be above the central cost estimate of £108/MWh for projects commissioning in 2023 indicated in modelling done for the CCC.[28]

"Stability avoids the variations in demand which the Crown Estate has shown to be incredibly damaging for cost reduction."

3. Steady deployment (25GW)

Stability and predictability create positive conditions

This route should also enable an electricity carbon intensity of 50gCO_2/kWh in 2030 with opportunities for significant further decarbonisation post-2030.

Steady deployment should create very positive conditions for bringing down costs. Consistent annual deployment of around 1.5GW would enable the supply chain to confidently size itself in the light of predictable market demand, encouraging competition and efficient working of markets. Stability avoids the variations in demand which the Crown Estate has shown to be incredibly damaging for cost reduction, as it outlined in 2012:

"In order to realise cost reductions, the single most important prerequisite is a steadily increasing market for offshore wind power, together with a predictable set of project timings…increased levels of cost reduction are possible in a larger market, but this needs to be coupled with predictability and permanence of the market in order for cost reductions to be maximised…It is crucial to avoid lulls in demand. These are toxic for almost all cost reductions; increasing perceptions of risk, decreasing the appetite to invest and destroying the opportunity for learning."[29]

Similarly, this route's stable demand makes it well suited to supporting supply chain growth and cost reduction. As consultants E C Harris have stated:

"Securing investor certainty will be critical in building the supply chain to deliver the offshore wind programme cost effectively. Workload profiles

> **"Steady deployment's stable demand makes it well suited to supporting supply chain growth and cost reduction."**

with a relatively low peak and long stable tail are best configured to deliver this investor certainty."[30]

It has been estimated that deploying 14.6GW by 2023, in line with this route, could lead to 9,853 direct FTE jobs, an increase of over 50 per cent within a decade.[31]

1.5GW per year also allows for deployment of large scale round three wind farms, increasing efficiency of electricity generation and hence the cost effectiveness of offshore wind. This suggests that costs could be in line with the central estimate of £108/MWh for projects commissioning in 2023, comparable with other low carbon generation sources.

4. Slow start, late acceleration (25GW)

High cost decarbonisation with low industrial benefits

This pathway's slow start (minimal deployment in the early 2020s) would make scaling up deployment later in the decade highly challenging. A slow start would encourage further attrition in the pipeline, in the light of increasing pessimism that projects would be able to realise a return on investment. Minimal domestic demand is likely to see the UK supply chain dwindle in the early part of the decade, making deployment in the mid to late 2020s reliant on imported products and labour.

Assuming this demand could be met, the challenges inherent in scaling up deployment by an order of magnitude over a period of a few years with a depleted industrial base could end up making it significantly more expensive.

5. Stagnation (12GW)

Wasted investment with minimal energy, carbon or industrial benefits

This pathway would generate little or no return on investments already made by the UK into offshore wind. Costs of electricity generation would remain at or very near current levels. There would be no economies of scale or technological advancements beyond innovation driven by deployment in other markets.

Jobs would decline once deployment stops. The main remaining jobs would be in operations and maintenance, which currently represent under 20 per cent of jobs in the sector, some support services (14 per cent) and eventually in decommissioning (one per cent). This represents a reduction of 65 per cent from current levels.[32]

This pathway would rule out reaching 50gCO_2/kWh. Achieving 100gCO_2/kWh would rely on rapid development and deployment of carbon capture and storage (CCS) and new nuclear power stations.

Options for the government

	Deployment	Political implications
Sustained ambition	40GW	Considerable potential upside for the UK from industrial development. Comes with higher cost risk if offshore wind cost reductions aren't realised.
Fast start, tailing off	25GW	Potential upside from stimulating UK supply chain growth in the early 2020s. However, reduced deployment in second half of the decade could lead to overall employment reduction, unless the overall European market develops more quickly than foreseen.
Steady deployment	25GW	Can provide flexibility to an 'all of the above' energy strategy, whilst securing tangible employment benefits from offshore wind.
Slow start, late acceleration	25GW	High possibility that, in spite of relatively high levels of deployment, the UK would fail to realise meaningful employment and manufacturing benefits. Risk that loss of pipeline projects in the early 2020s would make this hard to achieve.
Stagnation	12GW	High risk pathway. Closes down decarbonisation options for the 2020s. Would require rapid and cost effective deployment of CCS and new nuclear power stations.

4 Conclusions

The UK has a world leading offshore wind sector. It can continue to benefit economically from its early investment and accelerate cost reduction by providing more certainty for the sector.

Our research has led us to two main conclusions:

1. The next government will need to take decisions about support for offshore wind before costs are fully known

Crucial decisions on decarbonisation and the next LCF will have to be taken in 2016 and 2017, before offshore wind has had time to meet its £100/MWh target. If the next government takes a 'wait and see' approach based on cost reduction targets, but provides no new confidence on market growth, then progress towards cost reduction is likely to stall, the UK is likely to get a poor return on the investment it has already made in the sector, and offshore wind may not be able to play the role envisaged for it in 2030 power sector decarbonisation.

2. A new 'commit and review' approach would combine stability for industry with flexibility for government

The next government could grow the offshore market without locking-in a higher cost for power sector decarbonisation if it takes a 'commit and review' approach. This would require it to commit to a minimum level of market growth, whilst retaining the power to reduce this commitment if cost reduction criteria are not met by a certain date. By linking cost reduction to minimum volumes government would increase investor confidence and create a positive feedback loop.

> **"The next government could grow the offshore market without locking-in a higher cost for power sector decarbonisation if it takes a 'commit and review' approach."**

Wait and see Continue with cautious or neutral approach in policy and funding decisions	No certainty for offshore wind sector on future market size or implications of meeting – or not meeting– the 2020 cost target. Supply chain unlikely to scale up in light of reduced opportunities. Fewer projects likely to be brought into development, given small chances of securing CfD. Capital cost and availability unlikely to significantly change in absence of pipeline of investment opportunities.	**High risk of locking-in to a 12GW pathway in the absence of signals to scale-up**
Commit and review Strong support for offshore wind in policy and funding decisions	Likely to trigger positive feedback loops, as expectations of deployment drive investment and cost reductions. Scale of deployment is a driver for UK supply chain growth. Link between cost reduction and deployment is a driver for investment into R&D and innovation. High deployment drives creation of a strong pipeline of projects. The strength of the pipeline creates more opportunities for investors.	**Creates the conditions to scale up deployment to deliver either 25GW or 40GW**

5
Recommendations

Realising the full benefits for the UK from offshore wind will be most effectively delivered by creating the following conditions:

- **Visibility** Clear policy and funding commitments for the early 2020s.
- **Stability** Defined deployment minima indicating market opportunities into the 2020s.
- **Investibility** An appropriate balance between risk and reward for the development of new offshore wind farms.

In return for creating greater certainty, the government should expect a sustained reduction in the cost of electricity generation and continued growth in investment and UK jobs from offshore wind.

We have identified five ways in which these three conditions could be created:

> **"In return for creating greater certainty, the government should expect a sustained reduction in the cost of electricity generation and continued growth in investment and UK jobs."**

Visibility

1. Set a carbon intensity target for the electricity sector

A 2030 carbon intensity target would remove considerable uncertainty regarding the UK's likely decarbonisation trajectory. This should be set at 50gCO_2/kWh, identified by the Committee on Climate Change as likely to be the most economically efficient pathway. Political parties could act to bolster market confidence in 2015 by explicitly ruling out 200gCO_2/kWh in 2030, narrowing the range of potential future scenarios.

2. Confirm the size of the next Levy Control Framework

Lack of clarity over the likely scale of funding for low carbon energy after the current LCF expires in 2021 is one of the major risks undermining all renewable energy investments. The decision over the next LCF needs to be taken no later than 2017 to stimulate sufficient project and supply chain development for the early 2020s. The total funding cap should be in line with the advice of the CCC.

3. Confirm the timings of future electricity market reform allocation rounds

There are no further CfD allocation rounds scheduled beyond the upcoming 2014-15 round. Confirming their frequency and timing for the remainder of the current LCF period (ie up to 2021) would remove a major source of uncertainty and enable project developers to plan when and how to bring projects into the allocation process.

Stability

4. Set deployment minima for offshore wind in the 2020s

The CCC has set out evidence that cost effective electricity decarbonisation will require a minimum deployment of 25GW of offshore wind by 2030. Our analysis has highlighted that a steady deployment trajectory will avoid 'boom and bust' dynamics and create the best conditions for cost reduction and supply chain growth. This suggests that government should commit to make sufficient funding available to support deployment of a minimum of 1.5GW of offshore wind per year for the duration of the next LCF period. The concept of deployment minima to encourage commercialisation of less developed low carbon technologies is contained in the CfD Allocation Regulations and already applies to wave and tidal stream. This commitment could be made in principle at the point when the next LCF is agreed in 2016-17.

This commitment should be conditional on the costs of offshore wind coming down. The government should indicate target ranges of costs it is looking for in 2017. These would then be specified in detail in the next EMR delivery plan in 2018, which will set strike prices for 2019-20 to 2023-24.

Progress should be reviewed in 2020 ahead of budgets being set for the first allocation round under the next LCF in 2021-22. If enough projects are able to submit bids that meet the strike price, sufficient LCF funding should be made available to deploy a minimum of 1.5GW that year. If costs have not come down as hoped or if too few projects bid at the necessary level then this deployment minima should not apply. This process should be repeated for each year of the next LCF period.

Investibility

5. Identify new ways to rebalance development risks

Project developers are now expected to commit very large sums of money to enter a competitive CfD allocation process that, by definition, most cannot win. This seems likely to exacerbate shrinking of the pipeline as planned projects are withdrawn rather than incur additional costs, and no new projects come forward to replace them. The balance of risks between government and developers should be reviewed with the aim of ensuring a robust pipeline capable of delivering a steady flow of projects into the 2020s and beyond.

"The balance of risks between government and developers should be reviewed with the aim of ensuring a robust project pipeline."

Two options should be considered. First, greater co-ordination of how and when projects enter CfD allocation rounds. This could have the major benefit of eliminating the need for multiple projects to incur huge costs entering auctions they have little chance of winning. This could involve greater collaboration between government and developers, or greater collaboration or consolidation amongst developers themselves.

Second, DECC should review funding allocation models used in other European markets to determine whether there are elements that could be adopted to mitigate some of the risks in the UK system.

‘Commit and review’ timeline for government decisions

2015-16	Set a 2030 carbon intensity target of 50gCO_2/kWh for the electricity sector.
2016-17	Specify the funding level for the post-2021 Levy Control Framework.
2017-18	Commit to making enough money available under the post-2021 Levy Control Framework to deploy 1.5GW of offshore wind annually.
2018-19	Set strike prices for 2019-20 to 2023-24 in the next five year electricity market reform delivery plan. On the basis of these strike prices the government specifies the funding minima necessary to deploy 1.5GW of offshore wind per year.
2019-20	
2020-21	Review cost reduction progress ahead of confirming budgets for the next round of CfD allocation in 2021-22. If costs remain too high it rescinds commitment to minimum deployment.
2021-22	The next Levy Control Framework begins.

Endnotes

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