Meeting the 2020 renewable energy targets:
Filling the offshore wind financing gap

Contents

Introduction

The UK's power utilities sector faces immense investment challenges over the coming decade. The main challenge is the part the sector needs to play in responding to climate change and protecting security of supply, whilst keeping energy affordable to the consumer.

Offshore wind generation is a key component of the renewable energy strategy, and will be critical to achieving the target to deliver over 30% of electricity generation from renewable sources by 2020. While there are a number of challenges to deliver significant volumes of offshore wind, the most significant is likely to be the availability of finance to support the construction phase of offshore wind projects.

In this report, PricewaterhouseCoopers[1] (PwC) looks at the role that offshore wind needs to play in delivering the renewable energy strategy, the investment levels required, and the constraints on securing that investment. A quantum leap in offshore wind capacity is needed and, with it, an equal leap in investment if we are to avoid a situation later in the decade where time runs out on the UK's ability to achieve the 2020 renewable energy target.

At a time when the new government will be considering the best way to respond to the considerable energy challenges facing the UK, our report outlines four solutions that could resolve the pre-construction financing constraint facing offshore wind. The solutions seek to specifically address the barrier to investment by creating mechanisms to either limit the risk associated with the construction phase or to improve short-term returns, without unduly pushing excess costs on to the consumer. These are starting points rather than final answers and we hope they will help stimulate debate on how best to attract greater offshore wind farm investment.

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1 'PricewaterhouseCoopers' refers to PricewaterhouseCoopers LLP (a limited liability partnership in the United Kingdom) or, as the context requires, the PricewaterhouseCoopers global network or other member firms of the network, each of which is a separate legal entity.

Executive summary

The UK Renewable Energy Strategy relies on investment in renewable power generation to deliver around half (49%) of its target of 15% of gross final energy consumption coming from renewable sources by 2020. Offshore wind plays a 'make or break' role. It will need to deliver some 12GW, or 45%, of the additional circa 27GW renewable generation needed to reach the 2020 renewable energy target.

To reach the target will require a rapid increase in the offshore wind construction rate. In 2009, 0.3GW of offshore wind capacity was completed in the UK. In an optimistic scenario we could still achieve the required average roll-out rate to reach the 2020 target. However, there are a number of constraints which threaten this. These include supply chain bottle necks (including people with the right skills mix), issues of obtaining consents, and access to the grid, but perhaps the most significant barrier is the difficulty that developers face in securing financing pre-construction. If this financing issue can be resolved on a large scale it would not only enable sufficient investments, but would drive confidence within the supply chain and help ease other constraints. It would also provide a strong signal to the market that the offshore wind deployment target is achievable and realistic. The danger is that, unless these limiting constraints are eased soon, we will be significantly short of the required roll-out path and targets will not be met.

The problem is that the balance of risk and returns needs to be sufficient to attract investors. Projects face considerable construction, technology, operations and maintenance (O&M), price and volume risks with many of these front-loaded with returns back-ended. Historically the large utilities have dominated the development of offshore wind. However these companies have many competing pressures for capital which may limit their ability to fund all the required offshore wind projects. A key reason why the financial constraint is an issue is that project finance to support the development phase of offshore wind projects has not been available to UK projects to date. The challenge for banks and other financial investors is to take construction risk in the absence of an engineering procurement contract ('EPC') wrap from the sponsors. Even if some project developers can overcome this challenge, there are doubts as to whether this can be resolved for all projects requiring project finance.

We believe that current incentive mechanisms, in the form of Renewable Obligation Certificates (ROCs) and the carbon price (even with a floor), while important are unlikely to address the specific challenges of offshore pre-construction financing. Using these incentives on their own to boost investment would run the risk of pushing excessive cost onto the consumer. Instead, this report outlines ways in which the incentives could be supplemented with solutions that specifically address the risk associated with the construction phase and solutions that stimulate investment by improving short-term returns.

In particular, we consider ways in which offshore wind farm development could be opened up to pension and life fund investments. The energy sector, including offshore wind, can in principle provide long term stable cash flows which are the requirement for the like of pension funds. However this will require a new way of looking at the allocation of risks amongst all the stake holders involved in developing this new industry.

We have considered four potential solutions to the issue designed to either reduce risk or improve returns for investors in offshore wind projects. These are:

Reducing risk

Solution 1 – underwriting risk by a consumer levy

Solution 2 – a regulated asset scheme

Improving returns

Solution 3 – additional ROCs for a limited period

Solution 4 – ISA bonds or an equity fund

Solutions 1 and 2 address the specific risks associated with the construction phase of offshore wind projects with a view to attract investors with a low risk appetite, such as pension and insurance funds, but also potentially open up access to project finance. We outline the type of wind farm capital structure these solutions would make possible and show how finance from the proposed Green Investment Bank could play a role alongside much larger private investments. Solutions 3 and 4 are focused on increasing the return of investments in the short term (the first few years of operation) to attract private investors who would seek a higher return in order to accept the risks associated with the construction phase, such as private equity houses, hedge funds and individuals. A summary of each proposal is given in Figure 1 and they are discussed in more detail in chapter 6.

Each has its advantages and disadvantages. We put them forward to stimulate discussion on how best to tackle the scarcity of pre-construction finance and increase offshore wind farm development to put the achievement of the 2020 renewable energy targets on a more certain footing.

'A solution to address the specific risks associated with the construction phase of offshore wind projects is required to attract investors with a low risk appetite'

Figure 1: Summary of potential solutions

Solution	Description	Who bears the cost?	Impact on returns	Barriers to delivery
1 Underwritten by a consumer levy Reduces construction and technology risks	Risk sharing of construction and technology risks (over a limited time period)	Consumers directly through a levy but recouped through lower ROC level when the project is operational	Risk profile reduced and returns more certain (insurance against uncontrollable risks)	Levy based system is not easy to implement
2 Regulated Asset scheme Reduces construction technology and price/volume risks	Developer can sell at RAB value including return Risk sharing with consumer Stable long-term revenues	Suppliers and indirectly consumers through a levy in the event of a revenue short fall for the ongoing revenue stream	Reduced risks for the developer and a clear exit path Long-term operator has price and volume protection	Complex to implement given that the RAB scheme would require a completely new regulatory regime
3 Additional Rocs for a limited period Increases return	Increased number of ROCs over the first few years to provide increased returns for the investor taking the construction risk	Suppliers and indirectly consumers through increased ROC payments	Variable but potentially high returns in the short term Risk that supply chain captures higher margins instead of increased returns	Relatively easy to implement since it is an amendment to the existing regulatory structure
4 ISA Bonds or an equity fund Increases return	Make investments in off-shore wind tax free for the public	The taxpayers in the form of reduced income tax	Increased net return since free tax gains	Process to allocate funds to individual projects Clear communication to the public that it represents a potentially significant risk

Source: PwC analysis.

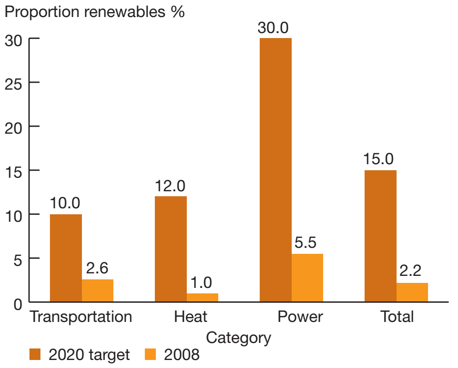
1. The UK renewable energy targets

What are the targets?

The UK Renewable Energy Strategy sets a target of 15% of gross final energy consumption to come from renewable sources by 2020, almost a sevenfold increase in the share of renewables from 2008 levels. The strategy relies on investment in renewable power generation to deliver around half of this target with transport and renewable heat in buildings providing the remainder.

These are ambitious targets across all sectors. They require 30% of power to come from renewable generation; 12% of heat to be renewable; and 10% of transport energy to be driven by renewables, (see Figure 2). The new government is yet to reconfirm the 2020 targets but it should be noted that the Liberal Democrats have stated that they would want to increase the power target to 40% for 2020 and the coalition's programme for government includes a commitment to 'increase the target for energy from renewable sources, subject to the advice of the Climate Change Committee' (section 10, The Coalition: our programme for government, May 2010).

Figure 2: Renewable energy target: 2020 target compared to 2008



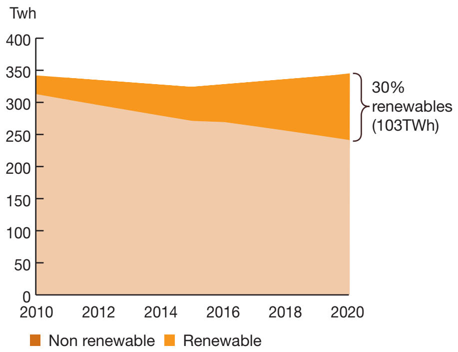
Source: The UK Renewable Energy Strategy, HM Government, 2009.

What are the implications of the renewable targets for power generation?

The exact implications of the renewable target for power generation depend on a variety of factors, most notably what happens to economic growth, and therefore electricity demand, and also the impact of energy efficiency on power consumption. The UK energy regulator, Ofgem, has developed scenarios to examine the prospects for secure and sustainable energy supplies over the next 10-15 years, based on assumptions about high or low growth. We have taken their 'green stimulus' scenario as the basis for our projections, which is a scenario whereby the renewable target is actually achieved. Key assumptions for this scenario include relatively slow economic recovery and curtailment of power demand through the successful implementation of energy efficiency measures.

Figure 3 shows how demand is forecast to evolve under this scenario. In these circumstances, the 30% renewable power target would require 103TWh of renewable power generation.

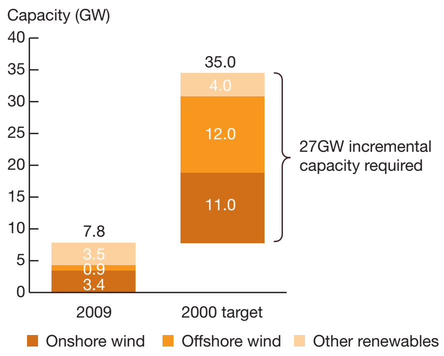
Figure 3: Ofgem Green Stimulus scenario: demand projection with illustrative renewables path, 2010-2020



Source: Ofgem Project Discovery (Oct 2009), PwC analysis.

To reach a total renewable output of 103TWh by 2020, approximately 27GW of renewable capacity needs to be developed in addition to the current level of around 8GW. The strategy to deliver this capacity will heavily depend on wind generation. In line with the Ofgem 'green stimulus' scenario the UK renewable strategy states that an additional 23GW of wind generation capacity will be needed. The split between offshore and onshore wind generation capacity is fairly equal with 12GW of offshore wind and 11GW of onshore wind (see Figure 4).

Figure 4: Renewable targets compared to current capacity



Source: PwC analysis based on Ofgem's Project Discovery (Oct 2009) and The UK Renewable Energy Strategy.

2. The 'make or break' role of offshore wind

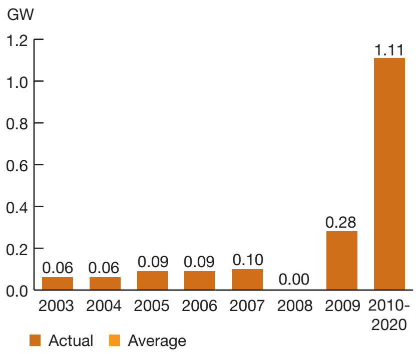
Offshore wind plays a 'make or break' role as the largest single contributor to the UK's expansion in renewable power generation. As discussed in the previous section, offshore wind would need to deliver some 12GW of the additional circa 27GW renewable generation needed to reach the 30% target.

How much needs to be built and how fast?

The amount of offshore generation needed is a quantum leap above the 1GW of total capacity that had been reached by April 2010. It will require a rapid increase in the rate of offshore wind construction. The offshore wind pipeline is healthy at close to 50GW, but the bulk of the projects are in a very early stage of the development cycle. Of the total pipeline some 32GW is attributable to the recently awarded Round 3 projects and a further circa 6GW to early stage projects in Scottish territorial waters. Nevertheless if projects could move steadily through the pipeline there are a sufficient number of projects to be able to meet the 2020 target of 12GW additional offshore wind capacity.

The problem is not the potential pipeline of projects but the roll-out rate. In 2009 0.3GW of offshore wind capacity was completed in the UK. However, the 12GW target implies an average annual roll-out rate of 1.1GW, which is significantly above the historical build rate (see Figure 5).

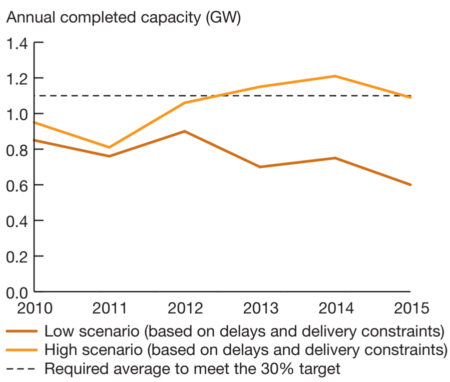
Figure 5: Required offshore average annual build rate compared to historical data



Source: PwC analysis based on RenewableUK (formerly the British Wind Energy Association) data.

RenewableUK (formerly the British Wind Energy Association) has developed a number of forecast scenarios for UK offshore wind based on potential delays and barriers affecting economic viability, connections to the grid, ability to get consents etc. Figure 6 shows the high and low scenarios respectively compared to the average required roll-out rate to meet the 30% renewable target by 2020. These forecasts exclude Round 3 as well as the recently approved extension of existing wind farm sites, potentially adding 2GW of capacity, which will not start to have an impact until 2014.

Figure 6: Offshore wind roll-out forecast



Source: RenewableUK (formerly the British Wind Energy Association), PwC analysis.

The roll-out rate forecast is set to increase significantly compared to 2009 and will be helped by the increase in the average size of offshore wind farms. In an optimistic scenario the offshore wind roll-out rate could reach the required average to meet the 2020 target before the middle of the decade. However, there is a significant risk that constraints such as financing, supply chain limitations and delays in accessing the grid will result in a roll-out rate that is well below the required average. In this scenario a significant increase would have to take place in the second half of the decade if the UK is to meet the 2020 target.

Our view is that it is highly risky to plan for a significant increase towards the second half of the decade to reach the target, particularly if it emerges that the power sector needs to deliver in excess of 30% from renewable sources. It is desirable to attain a roll-out rate in line with the high scenario outlined by RenewableUK and maintain it, since it is close to the required average and will allow for a smoother scaling up of the supply chain. To do this, it will be critical to take active steps to resolve the barriers that hamper the deployment rate. It is not a long-term issue that can wait but, rather, must be addressed now given the long lead times involved. A greater sense of urgency is needed.

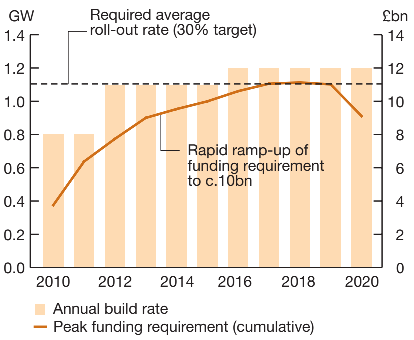
The pre-construction financing gap

There are a range of constraints on the expansion of offshore wind. They include supply chain capacity limitations, planning delays and restricted access to grid connections. However, the most significant barrier is the difficulty that developers face in securing pre-construction funding. If this could be resolved it would not only enable sufficient investment, but would drive confidence within the supply chain and help ease other constraints. It would also provide a strong signal to the market that the offshore wind deployment target is achievable and realistic.

The total investment needed is substantial. An estimated £33bn or so would be needed between now and 2020 to develop 12GW of offshore generation and a further circa £7bn is needed for the associated offshore transmission connections. The actual net funding requirement from the developer point of view would be less because completed projects would provide operating revenues during this period and expect it will be possible to refinance projects once they are operational. This cash can be reused in new projects and thus reduce net funding requirement.

What level of net funding is required to accelerate the expansion of offshore wind and avoid the high risk of leaving much of the roll-out until later in the decade? Our analysis shows that a rapid increase to a cumulative net funding requirement from a developer point of view of around £10bn would be needed for generation capacity alone to achieve the 1.1GW average annual roll-out rate we identified in the previous section. A key assumption to limit the capital requirement is that wind farms can be project financed at 70% one year after they have become operational and that the capital released can be reinvested into the pre-construction phase of new projects.

Figure 7: Hypothetical build scenario and peak funding requirement



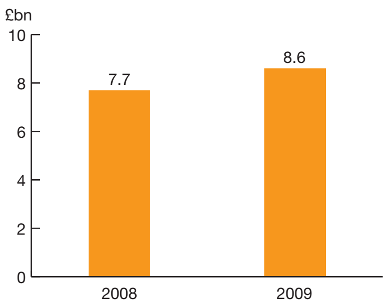
Source: PwC analysis.

Competition for funding

Offshore wind faces immense competition for funding. Ofgem has estimated that the combined power and heat sector needs to make investments approaching £200bn over the coming decade. This is based on a lower economic growth scenario and includes investment areas, such as renewable and conventional power generation, renewable heat, transmission, but also investments in energy efficiency measures and smart meters. It is estimated that meeting the renewable targets will require an additional circa £100bn in investment in comparison to a business as usual scenario whereby the focus remain on conventional power generation technologies like gas turbines.

The £200bn or so required is an average of about £17bn per annum. This is double the annual capital expenditure programmes of the big utilities combined which, taking the biggest six and National Grid together, totalled £8.6bn in 2009. Independent developers will also play a role in offshore wind development but the lion's share of development will need to come from the big utility companies in the absence of project finance or new sources of equity.

Figure 8: Total UK Capex by the Big 6 utilities and National Grid

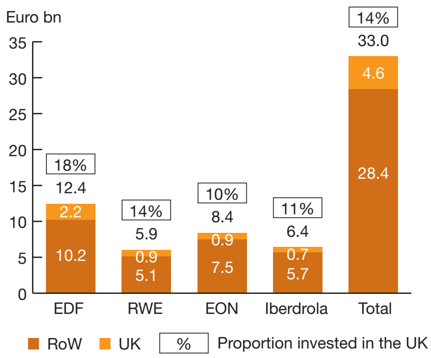


Source: Company annual reports and presentations, PwC analysis.

‘UK offshore wind investment not only has to compete with a range of other pressing power industry investment demands, but also has to make its case in an international corporate investment context’

The big utility companies have a significant international footprint. Our analysis of the four utilities with a predominant focus outside the UK shows that their UK capital spending accounted for just 14% of their total capital expenditure (see Figure 9). Thus, UK offshore wind investment not only has to compete with a range of other pressing power industry investment demands, such as nuclear and gas storage, but also has to make its case in an international corporate investment context in which geopolitical factors have to be considered alongside financial returns.

Figure 9: 2009 capital expenditure by company and territory



Source: Company annual reports and presentations, PwC analysis.

Constraints on funding

The issue of competition for funds outlined in the previous section is compounded by the risks associated with offshore wind power and the continuing sub-optimal banking and investment climate. So far there has been no availability in the UK of project finance to support the development phase of offshore wind projects pre-construction. This is in contrast to onshore wind projects where project finance is available if the project is of sufficient scale.

Offshore wind developers have only been able to finance new projects once an existing farm has an operational track record. An example of this is Centrica’s re-financing of the Lynn and Inner Dowsing and Glens of Foudland wind farms. However, this model creates an inherent time lag and as described above will not be able to support the required development rate to meet the 30% renewable power target.

The tight funding and banking climate has been of little help, but the main reason for the inability to project finance offshore wind farms pre-construction is that the risk is deemed to be too high (see panel opposite) for the banks to take onboard. The project sponsors would need to provide some form of guarantee to cover construction risks before banks will consider lending pre-construction. Even if some project developers can overcome this challenge, there are doubts as to whether this can be resolved for all projects requiring project finance.

The result is that offshore wind developers must finance offshore wind projects largely from their balance sheets or wait to roll over financing once projects become operational which, as discussed above, has its limitations. However, even the large utility companies are not in a position to countenance funding to the scale of the required offshore wind investment from their balance sheets and, as we have seen in the previous section, the level of investment implies a doubling of current capital expenditure.

Offshore wind risks

Construction risk
Untested construction techniques, unpredictable weather conditions, and the potentially severe consequences of accidents all create a high level of construction risk for offshore wind projects. The projects that are currently being developed are relatively close to shore and in relatively shallow waters. Much of the offshore wind expansion will be in deeper waters and as far as 200km out at sea.

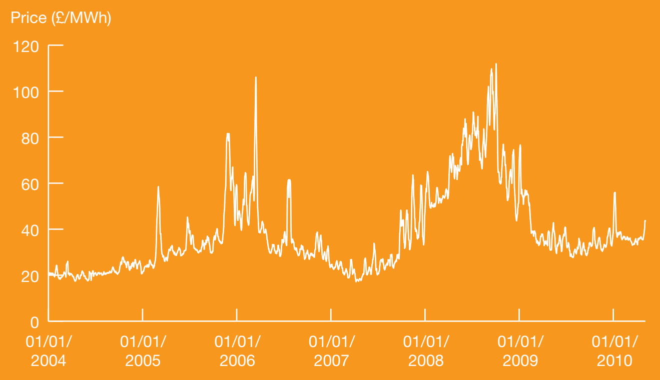
Technology risk
The current technology platform, based on 3.6MW turbines (and to a lesser extent 5MW), is starting to develop an operational track-record, reducing the technology risk for projects based on the same technology. However the next generation turbines will have an increased capacity greater than 5MW, which is untested and will heighten the technology risk.

Operations and Maintenance (O&M) risk
There is uncertainty about the required operations and maintenance costs over the life time of an offshore wind farm project. This cost is related to the technology risk since the reliability determines the required O&M costs, but it also depends on the impact of adverse weather conditions and the availability of required equipment and vessels. Operators are starting to get a better understanding for the O&M costs through their early offshore projects, but as the technology evolves and farms are deployed further out at sea, the risk will increase.

Volume risk
The volume risk relates to the unpredictability of the load factor that a particular wind farm will be able to achieve. The average load factor is dependent on the prevailing conditions applicable to a site, but also on annual variations due to weather patterns. This risk can be better understood, but not eliminated, by surveying the wind patterns at a site prior to commencing construction.

Price Volatility risk
The revenues that a wind farm operator is able to secure on a per MWh basis have three components – the MWh output, the wholesale power price and the value of Renewable Obligation Certificates (ROCs). As depicted in Figure 10 the electricity price in the wholesale spot market is highly volatile. It is possible that the volatility will increase over time since a higher proportion of variable output wind generation could result in very low or even negative wholesale prices when the wind output is high and high prices when there is limited wind generation.

Figure 10: UK wholesale power spot price (weekly rolling average)



Source: Elexon, PwC analysis.

Based on the experience from project finance-backed onshore wind farms, independent operators typically do not sell output on the spot market, but through a Power Purchase Agreement (PPA) with an off-taker. However such agreements typically have the power price linked to the market price, or at best only locked for a shorter time period, and the developer therefore will have an exposure to the market price.

The ROC component of the revenue stream is currently based on two ROCs per MWh produced and split out into two parts:

- A fixed amount that is RPI indexed over time (‘buy-out price’)
- A variable component that is dependent on the overall number of ROCs that are presented to Ofgem by the UK suppliers compared to the target (‘recycled benefit’)

The introduction of a ROC ‘headroom mechanism’ will lead to the buy-out price being viewed as a floor price.

A cap and collar mechanism or a feed in tariff are ways to mitigate the price risk and were discussed as potential options by the previous government.

3. Resolving the pre-construction financing issue

In the previous chapter we saw that a much faster acceleration in offshore wind development is needed to avoid a situation where time runs out on the achievement of the 2020 renewable energy target. But pre-construction funding is unlikely to come forward quickly enough to deliver the scale of roll-out needed to put offshore wind on course to deliver its 45% share of the renewable power generation target. In this section we look at solutions to address the problem of the scarcity of pre-construction financing.

Who could invest?

Figure 11 reviews the various potential sources of funds available and their attitude to the risks inherent in offshore wind generation. Banks, although they have some availability of capital, are unwilling to provide project finance pre-construction due to the associated construction and technology risks unless as a minimum there is a clearly articulated contingency plan to manage risks or at best there are parent guarantees from the sponsors. However, the sponsors are not keen to provide the EPC wrap which makes project financing by banks difficult. Other investors, such as pension and insurance funds, potentially have ample capital available, but also are not willing to assume the associated risks.

Private investors, for example private equity houses, hedge funds and individuals, would potentially be willing to accept the risk provided that the returns available are commensurate with the risk profile. However, at the moment there is a mismatch – the risk is high but the returns available are only in line with a utility-type return.

Figure 11: Availability of funds and attitude to risk by source of funds

Source of funds	Availability of funds	Investment profile	Attitude to specific risk currently present for offshore wind: Construction	Technical	Price	Volume
Developer equity	L	Willing to invest as long as return in line with risk (has control of projects)	A	P	P	P
Pension funds	H	Requires lower but certain returns	UA	UA	UA	P
Insurance funds	H	Requires lower but certain returns	UA	UA	UA	P
Infrastructure funds	M	Low to medium risk depending on fund profiles (risk spreading key)	UA	UA	P	P
Private investors	M	Can accept a range of risks provided that the return is appropriate	P	P	P	P
Project finance (banks)	M	Risk adverse	UA	UA	UA	P

L Limited M Medium H High   UA Unacceptable P Possible A Acceptable

Source: PwC analysis.

A ‘Green Investment Bank’

The new coalition government has decided to proceed with the plan to create a ‘Green Investment Bank’ (GIB), although no detailed proposals have yet been published. The GIB outlined by the previous Labour government assumed a capitalisation of around £2bn which potentially could be more significant if gearing is possible. However, it would not be sufficient to plug the pre-construction funding gap, nor is it clear under what premises a GIB will seek to invest. If the investment criteria are not vastly different to those used by commercial banks, it would restrict the ability to fund offshore wind projects pre-construction, although smaller stakes in individual projects may be possible to spread the risk through a portfolio approach.

Issues with the existing support mechanisms.

What would make them invest?

To attract investments, the risk and reward profile between type of funds available and the investment must be aligned. Current market mechanisms, including ROCs and the carbon price, fall short of an effective solution because they do not address the different risk profiles over the project life cycle. They increase the return available over the project life, which is attractive to utilities but not to more risk-averse investors or investors with shorter investment horizons.

The benefit of ROCs and the carbon price are only realised once a project is operational leaving investors exposed during the construction phase. If the number of ROCs and the carbon floor were raised to higher levels, private investors would at some point find the prospect of these future returns attractive enough to accept the risk and inject pre-construction phase financing. However, the cost to the consumer would be substantial.

In short, ROCs and the carbon price are too blunt an instrument. Instead, solutions are needed that specifically address the risk associated with the construction phase or which improve short-term returns without unduly pushing excess costs on to the consumer. We look at possible options in the next chapter.

Attracting pension and life fund investment

The stable and predictable annual cashflows of infrastructure investments are attractive to pension and life companies. Demographic trends heighten the need for this type of investment. With an ageing population, more pension assets have to move from accumulation stage into an annuity or payment stage and there is an accompanying need to shift from long-term investments like equities, to investments with regular and certain returns. The energy sector, including offshore wind, is a good match to the investment needs of such funds provided that the construction risk is understood and steps taken to either insure or transfer it.

The historical model

Previously, low risk investors such as pension funds and life companies invested in infrastructure or asset-backed securities through investment grade rated bonds or securities. Some higher ratings were achieved by wrapping (in effect insuring) the unrated or lower rated securities through monoline insurers. With the higher AAA ratings guaranteed, investors did not need to assess the risks associated with the underlying asset.

The sub-prime crisis and ensuing credit crunch, led to a downgrade of the monoline sector. It is no longer viable to insure infrastructure asset-backed securities to achieve a AAA rating. The balance sheets of monoline companies are weak and they are not in a position to write policies. Historically, the insurance was mispriced based on too optimistic a view of the risk and, even if monoline insurance was to be offered today, it would be much more expensive.

What is needed in the future?

Given that the asset cannot be insured at acceptable cost, the pension or life company must now take a more direct interest in the underlying asset and understand the associated risk. Some pension funds have already started to think about building teams with infrastructure and energy expertise to be able to assess the risk but it represents a significant investment and, therefore, will not happen in the short term. Even if they develop their own internal expertise, the specific construction and technical risks in offshore wind are too high for them to consider investing unless they were underwritten or transferred.

However, if the construction/technology risks could be underwritten or transferred, this would open up offshore wind to pension and life company investors. Solutions 1 and 2 in the next chapter outline two possible ways in which this could be done. Having pension or life company investment available from the pre-construction phase would be of enormous benefit to offshore wind developers as it could provide finance for the 20 years+ duration of the project, providing an end-to-end solution that avoids the uncertainty and cost of having a bridging finance solution.

In turn, with the assurance of the underwriting or transfer of construction stage risk, pension and life companies would be attracted by the regular and low risk cashflows post-development. The attraction would be all the greater because of the shortage of long dated sterling assets of 20 or 30 years in duration that can provide the kind of stable and predictable annual cash flows they are looking for. In the next chapter, we look at solutions that could open up this opportunity for pension and life companies and the kind of offshore wind project capital structure that could be made possible.

4. Moving forward – solutions to boost pre-construction financing

Solutions to reduce construction phase risk

Solution 1: Underwriting construction and technology risks by a consumer levy

The principle of this solution is that construction and technology/O&M risks are shared between the developer and the consumer. The consumer is represented through a government body that acts as the scheme administrator. Prior to commencing construction the developer would need to register the project with the administrator. As a prerequisite the administrator must approve the following:

- The general ability and financial strength of the developer
- Key supplier and sub-contractor agreements (assuring appropriate transfer of risk)
- Agreements with the financiers
- Availability of funding in the event of additional capital required

Only the generation component of the project would be included in the scheme. The offshore transmission would be handled through the Offshore Transmission Network Owners (OFTO) scheme.

Underwriting of project risk

If unforeseen construction or technology issues affect the project during the construction phase leading to cost overruns, the developer would be compensated. There would be an element of risk sharing between the administrator and the developer. A fixed cap would limit the level of overrun costs that would be covered. For example, the fixed cap might be set to 10% of the total project cost.

An absolute cap at the appropriate level would be necessary to provide the required comfort for lower risk investors who need to understand what the worst case scenario could be. Similarly during the initial operating phase, or interim operating phase, the administrator will cover under the same cap any unforeseen costs and revenue losses due to operational issues.

Within a defined period of interim operation the wind farm should have demonstrated its operational stability and the farm will enter its full ongoing operating phase. At this point the administrator would no longer cover for unforeseen costs and revenue losses. The lower risk investor that invested in the pre-construction phase could either exit or stay on, given that the risk profile is significantly reduced once the project is fully proven and operational.

Project life-cycle risk

Figure 12 outlines who will bear the various risk elements through the life cycle of the project.

Scheme financing

The scheme would be financed through a levy on all electricity consumers on a usage basis, but potentially recouped through a reduced number of ROCs available to developers who elect to participate in the scheme. If projects participating in the scheme suffered overruns of 20% on average and the developer exposure is capped at 10%, the number of ROCs could be reduced proportionally for the consumer to recoup the cost.

In effect, part of the benefit of ROCs is brought forward and transferred into the risk-underwriting scheme in the event that overruns have to be funded. The overall return to a developer should, on average, be the same but the developer is able to go ahead with the project knowing they face a much lower level of construction and commissioning risk.

Figure 12: Underwriting through consumer levy: Risk taker through the project life cycle

	Pre-construction (1)	Construction	Interim operations (2)	Ongoing operations
Consenting risk	Developer	N/A	N/A	N/A
Construction risk	N/A	Shared between Developer & Consumer	N/A	N/A
Technology/ O&M risk	N/A	Shared between Developer & Consumer	Shared between Developer & Consumer	Operator
Price risk	N/A	N/A	Developer	Operator
Volume risk	N/A	N/A	Developer	Operator

1. Decision point whether to enter the scheme or not
2. The underwriting scheme ends after c.1 year of operations and the Operator continues to receives a reduced number of ROCs as a trade-off to have had the construction risk and technology risks underwritten through the duration of the project

Source: PwC analysis.

Implementation considerations

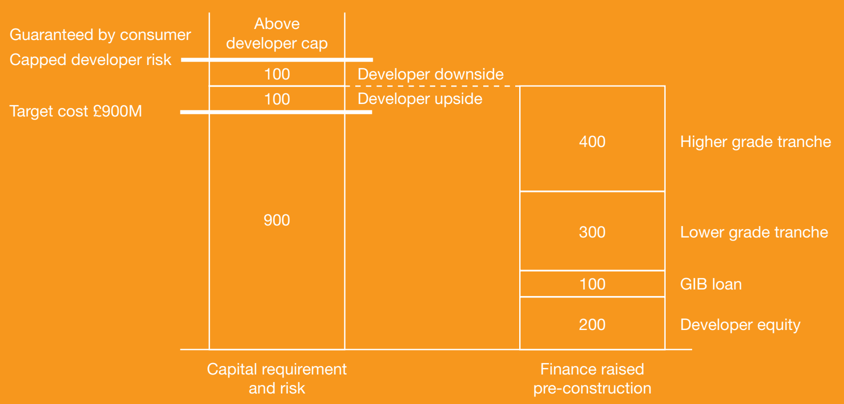
We would envisage that such a scheme would be in place for a limited time up until a point where the market has been sufficiently derisked to be able to self-sustain the required pre-construction financing. To speed up the overall derisking of the market, participants in the scheme could be required to share project development knowledge on certain pre-agreed topics with other developers participating in the same scheme.

This type of levy-based scheme is not unique. Carbon capture and storage demonstration plants are, for example, intended to be financed in a similar way. However, the challenge of implementing this scheme in a timely fashion and managing it in an efficient manner should not be underestimated. A significant advantage of this scheme is that the cost impact to the consumer will potentially be neutral compared to the current market mechanisms in place.

Offshore wind project capital structure

Solutions 1 and 2, by underwriting or transferring construction phase risk, potentially open up offshore wind farm development to low risk investors, such as pension funds. We illustrate below the capital structure this might create.

Figure 13:



Source: PwC analysis.

- Low risk investors, such as pension funds, could invest in the higher grade tranche but possibly also the lower grade tranche which would have a higher yield.
- On a case by case basis the capital structure could be split into multiple tranches that represent different levels of risk.
- For example, the higher grade tranche could be backed by the 'buy-out' ROC component that is indexed at P90 output levels.
- Higher risk levels would be based on wholesale revenues (excluding ROCs), the 'recycled benefit' proportion of ROCs and higher load factors.
- The role of the proposed GIB could be to provide a mezzanine or high yield loan facility, representing a small proportion of the total capital requirement. In this way, the available GIB fund of £2bn would be sufficient to finance the funding requirement for offshore wind.
- The developer would raise more finance than required in the project plan, providing an upside incentive if the plan is achieved.

Solution 2: Regulated asset regime

The second solution is based on bringing offshore wind farms into a regulated asset scheme. The risk sharing principle would be in line with that described for the levy-funded underwriting scheme. It would also be on a voluntary basis and regulated by a scheme administrator. Participation in the scheme would be subject to the same prerequisites outlined under solution 1 above and, like that solution, the transmission element of the project would continue to be managed through the OFTO regime.

The developer would share construction and commissioning risk with the administrator and indirectly with consumers. Once the wind farm has demonstrated operational stability after an agreed period of operation it would be auctioned off. The price would be set to the regulated asset base (RAB) value and the winning bidder would be the one offering the lowest required return on the capital. This ongoing capital return might be reviewed every five years by the administrator, similar to other regulated assets.

The administrator would assume responsibility for the off-take and any potential short-fall in selling to the market would be covered through a consumer levy.

Determining the regulated asset base (RAB)

The RAB would include five cost elements, each reviewed and approved by the administrator:

1. Pre-construction costs – benchmarked and adjusted for specific circumstances.
2. Construction costs based on plan.
3. Overruns based on a risk sharing mechanism (the developer liability would be capped at perhaps 10% of the total cost as for the levy-based underwriting solution).
4. Capital costs – based on agreed return rates for allowed costs.
5. Interim operating phase overruns.

Auction and ongoing revenue determination

The winner of the auction at the end of the interim operating phase would pay the RAB value and receive an ongoing return on the capital to manage the asset. If the operator fails to maintain the agreed availability, financial penalties would be imposed. At a regular interval, perhaps five years, the administrator would re-adjust the ongoing revenue stream based on a determination process. The logic for this review would be that the costs were highly uncertain at the start of the scheme but, over time, actual costs and the potential for efficiency gains would become known.

Project lifecycle risk

Figure 14 below demonstrates who is assuming the various risk elements for the duration of the project lifecycle.

Scheme financing

The administrator would control all output from the wind farm and sell it primarily through the wholesale market on a bilateral basis and, to some extent, on the spot market. The revenue stream would include a reduced number of ROCs, to compensate the consumer for the risks assumed during the construction risk in very much the same way as under solution one.

The market price risk is transferred to the consumer and any potential shortfall in the required revenue streams to the wind farm operators would be covered through a levy on all consumers on a per MWh basis. Any surplus would either be retained in a fund to cover for other potential shortfalls, be given to the Treasury or transferred back to the consumer.

If the auction is competitive, and on the basis that the operator could expect to become more efficient over time in managing the asset, the net result could be cost neutral compared to the two ROCs currently received.

Figure 14: Regulated asset model: Risk taker through the project life cycle

	Pre-construction (1)	Construction	Interim operations (2)	Ongoing operations (3)
Consenting risk	Developer	N/A	N/A	N/A
Construction risk	N/A	Shared between Developer & Consumer	N/A	N/A
Technology/ O&M risk	N/A	Shared between Developer & Consumer	Shared between Developer & Consumer	Shared between Developer & Consumer
Price risk	N/A	N/A	Consumer	Consumer
Volume risk	N/A	N/A	Consumer	Shared between Developer & Consumer

1 Decision point whether the asset should be managed as a regulated asset

2 The asset is auctioned off to a operator who pays the RAB value and bids required revenues p.a.

3 The scheme Administrator determines the level of ongoing revenues p.a. for example every five years

Source: PwC analysis.

A low risk investor, for example a pension fund, could participate as financier in the pre-construction phase of the project and remain as such for the duration of the asset life. Once the farm is operational and it is auctioned off the finance arrangement would roll over to the operator acquiring the asset. Effectively the operator would pay the developers equity proportion and potentially chose to refinance some of the lower grade tranches of the capital structure.

Implementation considerations

As with solution one, the RAB scheme could be put in place for a limited period of time until the market for offshore wind development has been derisked sufficiently to attract the required investments. Alternatively, it could be viewed as a more permanent solution more in line with the already established Offshore Transmission Network Owners (OFTO) regime. A RAB scheme as a concept is not something new. The OFTO regime and that of similar arrangements in other sectors could provide a useful guide to how to structure the offshore wind scheme.

A potential downside of the regulated asset regime would be that the implementation time frame could be lengthy. It might require thorough consultation processes and is administratively complex to implement. Another downside that may affect the willingness to invest is the risk that insufficient investors would be willing to participate in the auctioning of a project given that, potentially, a large number of projects would be coming to the market at the same time.

Solutions to increase return in the short-term

Solution 3: Additional ROCs for a limited period

This solution boosts the short-term return by increasing the number of ROCs available for offshore wind farms in the first couple of years of operation. An investor who invests under this scheme would assume the full construction and technology/O&M risks. However, the increased return is intended to compensate for the additional risk. The main principles of this scheme are illustrated in Figure 15.

Investments and returns

The required capital to commence construction would be invested on an equity basis, split 50:50 between the developer and the private financial investor. For private individuals this type of investment would have to be managed through an intermediary such as an equity fund managed by a commercial bank. The construction phase would be expected to last for two to three years.

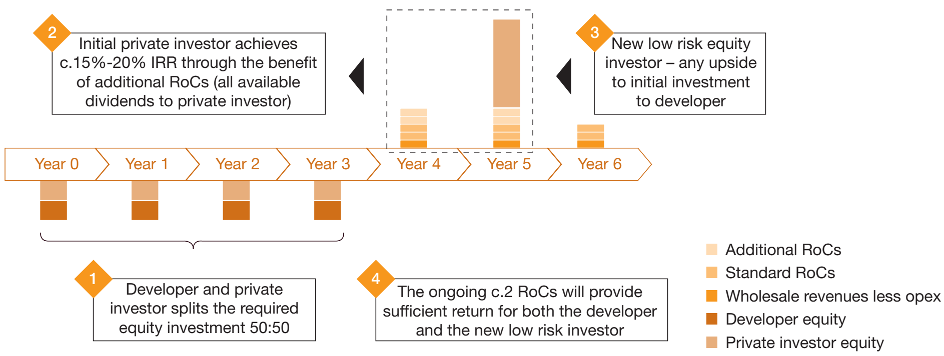
Under this scheme the wind farm would be entitled to, for example, four ROCs rather than two during the first two years or so of the operational phase. The entire dividend payable during this period is paid to the private investor. At the end of the initial two year period the project can be refinanced and the private investor is repaid the initial equity stake. Any potential equity upside is retained by the developer in compensation for not receiving any dividend in the first couple of years of commercial operation.

Depending on the precise configuration of the scheme private investors could achieve an IRR of up to 20% if the project is delivered on time and budget. However, developers may find it difficult to invest half of the required capital. If this is the case, the proposed Green Investment Bank (GIB) could support the developer to finance its part of the investment. In this way, this scheme could help the GIB leverage private funds and, thus, make a substantial contribution.

Implementation considerations

The additional ROCs scheme would be relatively easy to implement given that it would build on the existing ROC scheme and not require a substantial restructuring of the market. As a consequence the scheme could make an impact in the short-term and put the UK on track to achieve the 2020 renewable target.

Figure 15: Illustrative: Model to attract a private investor with an attractive return and exit within 5 years



Source: PwC analysis.

A potential downside of the scheme is that the supply chain might absorb a significant proportion of the incremental revenues generated by the additional ROCs. This is because there are constraints in the supply chain and suppliers might be able to push through higher prices if they know that additional revenues are available. The result would be reduced returns to the private investors and, with it, the danger of lack of interest from the private investors in anticipation that this supply chain squeeze could happen. Another downside is that the cost of enabling the increased investor returns would need to be absorbed in full by consumers through increased electricity prices.

Solution 4: ISA bonds or equity fund

To attract investments from private individuals to fund the construction phase of projects, investments in the offshore wind sector could be made tax free through an extension of current ISA allowances for individuals. This could either be in the form of a five year 'renewable ISA bond' or a renewable equity fund. The capital raised through such schemes would be funnelled to appropriate projects by the commercial bank managing the investment or through the GIB. These schemes would require the capital to be tied up for a minimum period covering construction and commissioning of the asset and would only offer returns after this minimum period. Cost and timing overruns would continue to be borne by the developer.

Developers would either seek an equity investment from the renewable equity fund or raise the required finance through bond financing. The bank managing the fund would screen and select projects and the scheme would be monitored by a regulator. The return for private investors would need to be commensurate with alternative investments products. It should be noted that the scheme would not suit all private investors, for example private equity houses who would find that the risk associated with the investment would prevent them being able to get the leverage on their investment that they need.

Implementation considerations

This scheme would be relatively straightforward to implement. It would, however, be important to inform the public about the level of risk of investing in the scheme. The management and marketing of the bond/equity funds would be managed by commercial banks and their expenses would need to be paid from investment returns. The ultimate cost of providing the additional return to attract the investment would be borne by the taxpayer in the form of reduced tax revenues for the treasury.

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