BWEA response to the consultation "Reform of the Renewables Obligation" Appendix A: Numerical analysis of the RO reform proposals

In order to provide evidence underpinning BWEA's response to the current consultation on reform of the Renewables Obligation, analysis was performed in two areas: project economics and guaranteed headroom. In the former, a number of member companies took a set of common assumptions and ran them on their own internal project models to assess whether the proposals as set out in detail by Government would support investment. In the latter, our knowledge of the variability of wind power from year to year is applied to assess whether a guaranteed ROC headroom of 6% provides suitable confidence to the market overall. We particularly acknowledge the assistance of Dr Graham Sinden of the Carbon Trust in this endeavour.

Project economics

Typical on- and offshore wind projects were assessed, which were assumed to enter service on 1 January 2011. Some work was also performed for projects entering service later, which underlines the result from Oxera's modelling, that less and less capacity remains economic to build as the end of the RO in 2027 approaches.

The income stream was modelled using the following assumptions. The central power price used was the one provided to Oxera by Government, which remains at or close to £40/MWh until 2027 and beyond. Income from Levy Exemption Certificates was assumed at £4.30/MWh up to 2015 in our central assessment, and then discontinued. Optimistic and pessimistic views of the Climate Change Levy, that it continues indefinitely and that it stops in 2012 respectively, were also tested. ROC income is made up of the buyout price at £34.30/MWh and a recycle value of £2.74/MWh in 2007 money, both of which increase with inflation. The recycle value is that expected from headroom at 8%, the minimum we regard as acceptable, which is assumed to be invoked from the start of the banding regime.

Onshore analysis assumptions

	Central	Optimistic	Pessimistic
Power	Oxera central	Oxera central	Oxera low
LECs	End 2015	Not removed	End 2012
ROCs	£34.30/MWh + 8% headroom	£34.30/MWh + 10% headroom	£34.30/MWh + 6% headroom
Capex	£1.173m/MW	£1.173m/MW	£1.328m/MW
Opex	£39k/MW/yr	£39k/MW/yr	£51k/MW/yr
PPA discount	15%	10%	15%
Load factor	28%	28%	28%

Our typical onshore project was assumed to be made up of 10, 2.5MW turbines, for a total of 25MW. Capital and operating costs are the central figures as set out in the Ernst & Young report. A central assumption of a 15% discount on the Power Purchase Agreement is used: this is at the higher end of likely discounts but is realistically what is on offer to independent wind farm developers.

Using these central assumptions, Internal Rates of Return were calculated for a range of capacity factors. These are shown in the table below, and indicate that for projects with a capacity factor of less than 28%, the target rate of return of 10% is not achieved. This rate is not a hard and fast hurdle; different investors will have different approaches to return, and the level of gearing will affect returns on equity, which is what investors are really interested in. However, the 10% figure is representative of the risk/reward ratio that onshore wind has. Not reaching this level will restrict investment in such projects, and so it can be seen that fewer lower wind speed sites will be developed.

Capacity Factor	IRR for a project starting 1/1/2011
26% (2280 hours)	8.58%
27% (2370 hours)	9.25%
28% (2450 hours)	9.91%
29% (2540 hours)	10.55%
30% (2630 hours)	11.19%
31% (2700 hours)	11.81%

For onshore sites being brought into service in 2016, none of the capacity factors tested for resulted in an IRR of 10%.

A set of 'optimistic' and 'pessimistic' numbers were assembled to test the upper and lower ends of possible returns for a 28% load factor wind farm – see the table above. In the optimistic case, returns are still a relatively low 13.08%, while the pessimistic case brings IRR crashing down to 4.58%. For a site constructed in 2016, even the optimistic case does not result in 10% return.

Offshore analysis assumptions

	Central	Optimistic	Pessimistic
Power	Oxera central	Oxera central	Oxera low
LECs	End 2015	Not removed	End 2012
ROCs	£34.30/MWh + 8% headroom	£34.30/MWh + 10% headroom	£34.30/MWh + 6% headroom
Capex	£1.6m/MW	£1.8m/MW	£1.8m/MW
Opex	£56k/MW/yr	£51k/MW/yr	£60k/MW/yr
TNUoS	£22k/MW/yr	£15k/MW/yr	£35k/MW/yr

PPA discount	15%	10%	15%
Load factor	38%	40%	36%

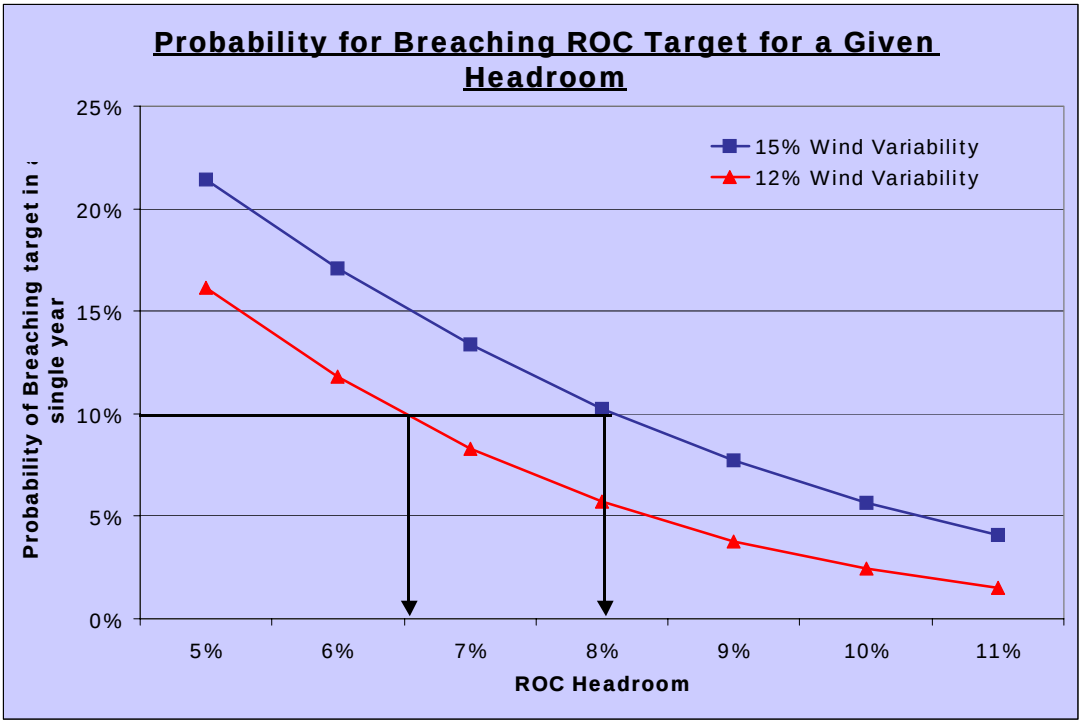
For offshore, our typical project is 200MW in 2011, with a capital cost of £1.6m/MW, as per E&Y. This is excluding the capital cost of the cabling, which is assumed to be paid for under the regulated grid regime, resulting in higher TNUoS charges than onshore generators would see. Our central assumption for TNUoS is £22,000/MW/yr, the lower end of the range quoted by E&Y. Other operating costs are also consistent with E&Y, at £56,000/MW/yr. A PPA discount of 15% is applied. A capacity factor of 38% is assumed, which is certainly optimistic for projects so far, but should be attainable in the medium term.

On these central assumptions, a return of 11.86% is calculated. We would regard a project return of 12% to be acceptable given the risks inherent in offshore wind development over onshore, though the exact level of acceptability will depend on the debt to equity ratio for the financing and therefore the equity return. Thus a project would have to be slightly better than typical to justify investment on our central case. We have also tested a set each of 'optimistic' and 'pessimistic' assumptions (see table above). The capital cost for both is set at £1.8m/MW, which, though higher than the E&Y central figure, is in our opinion more likely to reflect costs out to 2010. In the optimistic case, returns are 13.25%, while in the pessimistic, 5.73%.

Guaranteed headroom

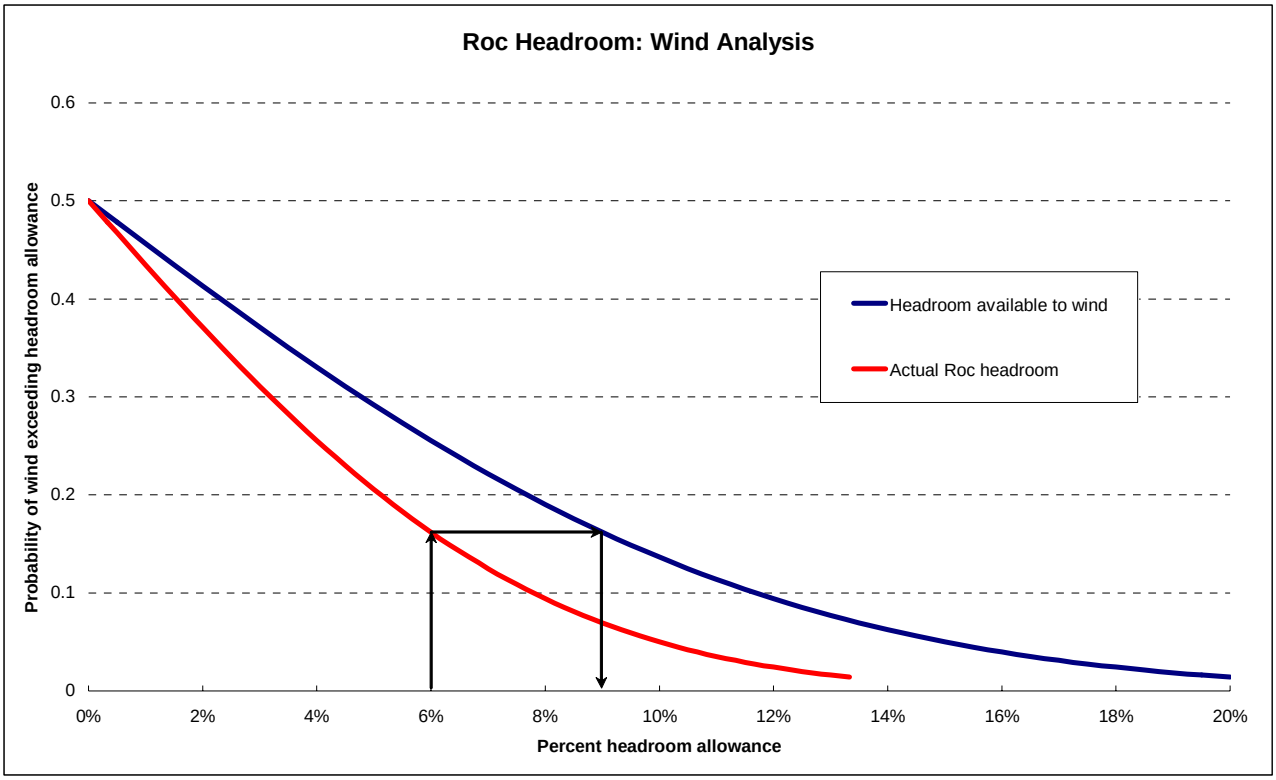
BWEA's primary concern regarding the proposed level of headroom is that the natural variability of the wind and hydro resource will lead to oversupply of ROCs in some years, and that if this is too frequent then the market will face considerable disruption on a regular basis. In our judgment, if the probability of oversupply is reduced to 1 year in 10, then this will represent an acceptable risk. At this level of probability, the amount of any oversupply is likely to be low, allowing the mechanism of banking to effectively manage it without the need to invoke the ski-slope mechanism.

Two analysis approaches indicate that 6% ROC headroom will not achieve this benchmark. Results from a model constructed by Centrica Energy for 2015 which has 72% of the ROC-eligible energy generated from on- and offshore wind are shown below. Two example levels of wind variability are shown: 15%, which is the range usually assumed for single wind power sites, and 12%, which assumes some smoothing of this year-to-year variability due to geographical spread of wind generation. The output of the rest of the renewables portfolio is assumed to be perfectly forecasted, which it will not be, though the probability of deviation from forecast is difficult to predict. With a 15% variability of wind output, then a headroom of 8% will achieve the required 1 in 10 objective. However, if the variability is assumed to be less, then 6.5%, not much greater than that proposed by Government, would achieve the desired target.



To address the issue of geographical smoothing, we asked Graham Sinden of the Carbon Trust to use the database of wind speed data he collected for the DTI report 'Wind Power and the UK Wind Resource'[1]. This Met Office data was collected from over 60 locations throughout the UK during the period 1970 to 2004. Using this data set, the probability that a portfolio of renewables, providing 15% of the UK's power – with wind normally expected to provide 10% – of exceeding a 6% ROC headroom would be roughly 1 in 6. The correlation between the probability of ROC oversupply and headroom is shown in the graph below, which indicates that for a 1 in 10 probability, the headroom would have to be set at 8%. With the portfolio modelled, this would mean a 1 in 10 chance of wind power providing 12% more than the long-term expected average (the blue line in the graph). Again, this assumes perfect forecasting for all other elements of the portfolio and thus the actual variation will be larger.

[1] www.eci.ox.ac.uk/publications/downloads/sinden05-dtiwindreport.pdf



Given this analysis, BWEA recommends that the headroom should be set to at least 8% of forecast ROC generation at a bare minimum. In our response to the preliminary consultation on RO reform, we recommended a ROC headroom of 10%, and we continue to believe this higher level would provide the required degree of confidence to the market given the difficulty in accurately predicting both wind and non-wind renewable output. We look forward to working with Government to establish the optimum headroom figure so as to ensure our common objectives are reached.