Calculating the Level of the Renewables Obligation

The Renewables Obligation Order (ROO) 2009 introduced changes that require the Secretary of State to announce the level of the Obligation six months preceding an Obligation period. The Secretary of State has therefore announced the size of the Obligation for the 2010/11 period on 1 October 2009. This paper sets out the methodology used in calculating the size of the Obligation from 2010.

Before setting the size of the Obligation, we need to make three calculations:

A) The number of Renewable Obligation Certificates (ROCs) that would be needed for suppliers to meet a **fixed target** of 0.104 ROCs from eligible renewable sources per MWh of electricity sales from licensed suppliers in England, Scotland and Wales and 0.04 ROCs per MWh in Northern Ireland
B) The amount of renewable electricity we expect to be generated in 2010/11, and based on this the number of ROCs that we expect will be issued, uplifted by 8% (**headroom**)
C) The number of ROCs that would be issued if suppliers were to source 0.2 ROCs per MWh from eligible renewable sources – the **cap**.

The Obligation level is set as one of these calculations, determined as:

- **Fixed targets**: If fixed targets (A) is greater than headroom (B).
- **Headroom**: If headroom (B) is greater than the fixed target (A) but less than the cap (C).
- The **cap**: If headroom (B) is greater than the cap (C).

The run of the model means that Calculation B (headroom) will determine the number of ROCs to be supplied for the 2010/11 period. Calculation A sets the total obligation at 31.32m ROCs using DECC forward electricity demand figures Central scenario, compared with Calculation B which sets it at 33.43m ROCs. This means that the Supplier's Obligation is 0.111 ROCs per MWh for England and Wales and Scotland, and 0.0427 ROCs per MWh for Northern Ireland.

Contents:

1. ROO 2009: Headroom and fixed targets.

The RO imposes an obligation on licensed suppliers to provide a set number of Renewable Obligation Certificates (ROCs) to Ofgem at the end of an obligation period. The number of ROCs they need to present is calculated by them based on their electricity sales during that obligation period. Ofgem then confirm this calculation.

Previously the size of the obligation has been presented as a stated percentage. For the 2008/9 obligation period this was 9.1% for England and Wales, and Scotland, and for Northern Ireland 3.0%. The table below shows the obligation levels going forward:

Table 1: Obligation levels for 2009/10 forwards

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
England and Wales	9.7%	10.4%	11.4%	12.4%	13.4%	14.4%	15.4%
Scotland	9.7%	10.4%	11.4%	12.4%	13.4%	14.4%	15.4%
Northern Ireland	3.5%	4.0%	5.0%	6.3%	6.3%	6.3%	6.3%

As the Obligation is now set in terms of the number of ROCs (as opposed to the number of MWh of renewable electricity under the RO) these percentages now represent the Obligation levels in terms of the number of ROCs as a percentage of the number of MWh of electricity supplied by licensed suppliers.

They can also be stated as a level of ROCs per single MWh of electricity sales by licensed suppliers, e.g. England and Wales' Obligation for 2010/11 (according to the fixed targets) is 0.104 ROCs per MWh.

The RO Order 2009 introduced our policy of retaining fixed targets for the Renewables Obligation set out until 2015/16 in combination with a headroom mechanism.

Headroom is a mechanism to ensure that the size of the obligation will always be at least 8% above expected generation in that Obligation period. As deployment rates increase near the levels set out under the fixed targets in the run up to 2016, the headroom calculation will begin to determine the level of the Obligation.

Once generation levels are consistently high enough for headroom to kick in, fixed targets will become redundant, as generation is unlikely to fall.

2. Setting the Obligation and Calculations A, B, C.

Obligation periods run from 1 April to 31 March. The obligation level for the 2010/11 Obligation period was announced on 1 October 2009. In order to make this announcement the Secretary of State has carried out a number of operations.

Calculation A

Firstly, we have estimated the amount of electricity to be supplied by licensed suppliers across the UK in 2010/11 (Table 2).

Table 2- DECC Electricity Consumption Predictions

Final consumption/MWh	2008/09	2009/10	2010/11	2011/12	2012/13
Cen price, BASELINE pol,Cen MWh	324.13	325.62	318.21	315.80	317.27
Licensed Suppliers Only	311.89	312.82	305.83	303.56	304.96

This has then been apportioned between the three Obligation regions according to an assumption on their relative shares of the supply, based on the actual shares in recent years (Table 3).

Table 3: UK Electricity sales by obligation region

	Total sales							*Licensed suppliers only*
	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	*2010/11*
Electricity Sales (UK)	308.72	316.92	321.65	327.87	322.83	322.50	324.13	*305.83*
Electricity Sales (England and Wales)	280.93	288.09	292.16	294.11	289.40	284.60	285.13	*269.89*
% UK sales	91.0%	90.9%	90.8%	89.7%	89.6%	88.3%	88.0%	*88.25%*
Electricity Sales (Scotland)	27.78	28.83	29.50	29.98	30.19	29.69	30.47	*28.29*
% UK sales	9.0%	9.1%	9.2%	9.1%	9.4%	9.2%	9.4%	*9.25%*
Electricity Sales (Northern Ireland)	-	-	-	8.33	8.34	8.20	8.53	*7.65*
% UK sales	-	-	-	2.5%	2.6%	2.5%	2.6%	*2.5%*

We have then calculated the Obligation with regard to the fixed targets set out in Schedule 1 of the RO Order 2009 (multiplying the fixed targets shown in table 1 above

by the sales by licensed suppliers in table 3 above). The result of these operations is Calculation A, shown in Table 4 below.

Table 4: 2010/11 Renewables Obligation levels in ROCs according to Calculation A[1]

	England & Wales	Scotland	Northern Ireland	UK
Total obligation by region	28.07m	2.94m	0.31m	31.32m

Calculation B

Secondly, we have estimated the amount of electricity which will be generated by existing stations listed on the Ofgem's Accredited Stations list[2]. We have removed from this list those coal fired stations which co-fire, as we have assumed that the co-firing cap will set the upper limit for the number of co-firing ROCs to be produced. In 2010/11 we are assuming that co-firing will account for no more than 4.18m ROCs. We have also removed those stations of <=50kW DNC in England, Wales and Scotland as these are assumed to be transferring to Feed-in Tariffs as of 1 April 2010[3].

We have then estimated the number of ROCs which may be produced by multiplying the MW capacity by 8,760 to get the total possible annual output for all stations. We have then adjusted this by using the load factor for the technology (as detailed at Annex B) and applying the relevant banding multipliers applicable to different technologies to determine the number of ROCs which will be produced. We predict this to be 22.22m ROCs in 2010/11.

Added to this are ROCs generated by those new stations coming forward between 31 June 2009 and 1 April 2010 and those coming forward between 1 April 2010 and 31 March 2011 (pro-rata'd for operational days in that Obligation Period). The list of stations is taken from the Preliminary Accreditation list provided by Ofgem, the TEC report, the RESTATs database and the BWEA database - which are not accounted for in the current Accredited Stations list. We have gone through these lists and tried to ensure there is no double counting of stations and also checked expected generation dates. Using the methodology for calculating the number of ROCs outlined above we have estimated these could bring forward an additional 4.15m ROCs.

A list of Load Factors used can be found at Annex B as well as a comparison of available load factors from the 2007 Ernst & Young Banding report, the Redpoint Study and DUKES data on load factors achieved for renewables by technology in the UK. We have determined the load factors applicable to different technologies based on actual load factors achieved from Dukes where possible.

[1] Note the calculation uses unrounded versions of the projected electricity sales from licensed suppliers by region.
[2] Version correct as at 23 September 2009.
[3] Northern Ireland does not have legislation for a Feed In tariff so generating capacity under 50kW in Northern Ireland is included

The results of these estimates has been added together and adjusted for headroom at 8% (Table 5). We have worked with industry to check generation start dates.

Table 5: New Renewables Obligation levels in ROCs according to Calculation B

ROCs generated (less co-firing ROCs) by existing Accredited Stations	22.22m
ROCs generated by expected new generation by 1 April 2010 and new generation in year	4.15m
Co-fired ROCs	4.18m
Total	30.95m
Total plus Headroom @ 8%	33.43m[4]

The result of these operations is Calculation B. The new obligation level is then split between the regions in proportion to their regional share adjusted for the size of the Obligation and the regional obligation level amended.

Calculation C

Finally, using the estimate of electricity to be supplied across the UK used for Calculation A (305.83 TWh), the Secretary of State has multiplied this by0.2 ROCs per MWh to get the result of Calculation C which sets the upper limit for the Renewables Obligation at 61.17m ROCs.

The example below shows how these three calculations have been carried out.

Example:

Calculation A

Predicted UK Licensed Electricity Sales (MWh):	305.83		
	England and Wales	Scotland	Northern Ireland
Proportion Electricity Sales by Obligation Region (%):	88.25%	9.25%	2.50%
Total Electricity Sales by Obligation Region (MWh):	269.89	28.29	7.65
Obligation Schedule 1 Percentage	10.4%	10.4%	4.0%
Supplier's Obligation ROCs per MWh of Sales (ROCs)	0.104	0.104	0.040
Total Obligation by Region (ROCs)	28.07	2.94	0.31
Total Obligation by Region as percentage of total obligation in ROCs (%)	89.63%	9.39%	0.98%

[4] Any difference is due to rounding.

Total Obligation according to Calculation A	31.32		
Calcualtion B			
Predicted Total Number of ROCs Generated (ROCs)	30.95		
plus Headroom at 8% (ROCs)	33.43		
	England and Wales	Scotland	Northern Ireland
Total Obligation by Region (ROCs)	29.96	3.14	0.33
Supplier's Obligation (Percentage)	11.10%	11.10%	4.27%
Supplier's Obligation ROCs per MWh of Sales	0.111	0.111	0.043
Total Obligation according to Calculation B	33.43		
Calculation C			
20% Limit	61.17		
Total Obligation according to Calculation C	61.17		

Taking the results of these calculations the Secretary of State determines which calculation will be used to set the Obligation. If Calculation A is greater than Calculation B then the total for that Obligation period is Calculation A; otherwise the Obligation will be set by Calculation B unless Calculation B is greater than Calculation C.

In summary, calculation of the Obligation is determined by:

- (A) Fixed targets: If fixed targets (A) is greater than headroom (B).
- (B) Headroom: If headroom (B) is greater than the fixed target (A) but less than the cap (C).
- (C) The cap: If headroom (B) is greater than the cap (C).

ANNEX A – Detailed Assumptions

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1. Predicting supply.

In predicting the level of total electricity supply for Calculations A and C we looked at DECC electricity consumption models, National Grid Maximum Demand Modelling and a Random Walk model.

As we expect that the level of demand will drop due to the recession we decided not to use a Random Walk model which presumes a set rise on the level of the electricity supply year on year.

We have used the DECC electricity consumption predictions. These have been worked out by taking the UEP predictions published quarterly by DECC which take into account Government policies affecting electricity consumption and adjusting these on the basis of historic figures for the difference between total supply and that proportion of it due to licensed suppliers. This suggests that licensed suppliers will provide 305.83TWh of electricity in 2010/11 giving an Obligation of 31.32m ROCs. See Table 4 above.

In order to check these figures we also ran them against National Grid Total Annual Electricity Requirements adjusted to account for Licensed Electricity Supply. These figures gave us a range for the Obligation level for 2010/11 which was similar to that reached by using DECC electricity consumption figures (Table 8)

Table 6- National Grid results

Year	Annual Electricity Requirements (TWh) Low Scenario	Annual Electricity Requirements (TWh) Base Scenario	Annual Electricity Requirements (TWh) High Scenario	Total Annual Electricity Sales Obligation (TWh) Low Scenario	Total Annual Electricity Sales Obligation (TWh) Base Scenario	Total Annual Electricity Sales Obligation (TWh) High Scenario
2008/09 Prov	*310.6*	*310.6*	*310.6*	28.3	28.3	28.3
2009/10	*296.3*	*299.8*	*303.8*	28.7	29.1	29.5
2010/11	*289.9*	*297.2*	*303.5*	30.1	30.9	31.6
2011/12	*286.7*	*297.3*	*306.4*	32.7	33.9	34.9
2012/13	*282.9*	*297.2*	*308.6*	35.1	36.8	38.3
2013/14	*279.6*	*298.7*	*311.7*	37.5	40.0	41.8
2014/15	*277.2*	*299.7*	*315.6*	39.9	43.2	45.4
2015/16	*274.5*	*299.6*	*319.2*	42.3	46.1	49.2

2. Predicting technology capacity and resource availability.

In order to predict how many ROCs will be generated in any given year it is necessary to predict the capacity that will come forward and the availability of resource.

Availability Assumptions

Baseload or selectively available technologies
Baseload technologies are assumed to be run all of hours they are able, while for "selectively available" technologies, e.g. for those which can choose whether to run, the decision to run will be based on the electricity price.

Examples of baseload technologies include wave and tidal, solar PV, onshore and offshore wind, and hydro[5]. It is likely that once developed Advanced Combustion Technologies will also fall within baseload, but the technology needs to develop further before they can be classed as such.

Examples of selectively available technologies are mainly biomass technologies[6]. In biomass plants, biomass generation levels are determined by the cost of biomass and the carbon price and levels of co-firing[7] are driven by the price of the fossil fuel, the biomass and the carbon price. In both cases the decision to run would be an economic decision, though co-firing levels are more price sensitive than biomass. However, for the purpose of this model it would be too complicated – and subject to too much uncertainty - to attempt to model this, so the assumption is that they will be running all the time as dictated by their availability as described by the accepted load factor in the same way as baseload. One possible advantage of this (and equally a risk) is that this couold mean that we have over-predicted the number of ROCs from these.

Ofgem ROC Register – Accredited Stations

We have developed a simple predictive model of output using:

1. For existing capacity: Ofgem accredited stations (latest version attached correct as of 23 September 2009) data.
2. For capacity predicted to start generating within the Obligation period: Stations given Preliminary Accreditation in the Ofgem Accredited Station list, the National Grid TEC report, RESTATs Planning Database and BWEA Database

[5] Pumped Storage Hydro would qualify as selectively available but is not included within the RO.
[6] Excluding Advanced Combustion Technologies, see above.
[7] In this instance co-firing is mainly coal fired stations using solid biomass.

Assumptions about categorising new stations

In categorising the new stations for the model our assumptions about which band new plant will be placed in have erred on the side of generosity. Similarly to the decision on baseload versus selectively available technologies above this provides some padding to the figures which provides both costs and benefits.

We have erred on the side of caution in awarding ROCs to technologies which will receive CHP ROCs assuming that they will always produce Good Quality CHP and therefore qualify for the maximum. We will need to look at whether we need to introduce a correction factor for this in future runs.

Variation in co-firing output

For co-fired stations we have made two assumptions:

(i) That the co-firing cap will set the maximum number of co-fired ROCs which will be produced; and
(ii) That regular biomass is the most likely fuel to be burnt. We to take account of use of energy crops using predictions for energy crops being produced by Economists and Bioenergy. As energy crops supply chains are developed we will need to consider whether we need to increase this.

Banked ROCs

Historically banked ROCs used in subsequent compliance periods have not been greater than 2.31% of the total (Table 7). However, as we can assume that ROCs banked from the 2009/10 period to be used in the 2010/11 Obligation period are unlikely to be greater than those banked in the 2010/11 Obligation period to be used in the 2011/12 Obligation Period we have assumed that these amounts will balance each other out and so we need not include any additional banked ROCs for the calculation for 2010/11. Depending on the trend, banked ROCs may need to be included in the calculation in the future.

Table 7: Banked ROCs historically

	2003/4	2004/5	2005/6	2006/7	2007/8
Number of ROCs from previous period	0.13	0.59	0.11	0.50	0.16
Total Obligation	13.63	15.76	18.03	21.63	25.55
Percentage of Total Obligation	**0.95%**	**0.37%**	**0.59%**	**2.31%**	**0.61%**

Annex B

Technology	***Load Factor Used***	***Actuals taken from DUKES Table 7.4***[8]	***Ernst & Young 2007 Report***	***Redpoint***
Onshore Wind	27.3%	Average 27.3% Trend 26.3%	Large (>10MW) High Wind 31% Small (<=10MW) High Wind 31% Large (>10MW) Low Wind 26% Small (<=10MW) Low Wind 26%	High 29% Medium 27% Low 21%
Offshore Wind	31.6%	Average 27.2% Trend 31.6%	35%	35-45%
Hydro	33.7%	Average 33.7% Trend 38.0%	Large (1.25MW to 20MW) Scale 36% Small (<=1.25MW) Scale 40%	
Wave	30%		30%	30%
Tidal Stream	35%		35%	35%
Tidal Range	25%		35%	25%
Solar PV	16%		16%	
Biomass Regular	55.5%	Average 60.8% Trend 55.5%	80%	80%
Biomass Energy Crop	55.5%	Average 60.8% Trend 55.5%	80%	80%
Biomass CHP	55.5%	Average 60.8% Trend 55.5%	80%	80%
Plant Biomass	32.9%	Average 28.0% Trend 56.7% Average over last 3 years 32.9%		
Animal Biomass	59.2%	Average 63.9% Trend 59.2% Average over last 3 years 59.1%		
Biowaste	73%			73%
Biogas	61%			61%
Landfill Gas	63.7%	Average 63.7% Trend 62.5% Average over last 3 years 60.4%	61%	4.9TWh/annum in 2010
Sewage Gas	39.1%	Average 44.5% Trend 33.9% Average over last 3 years 39.1%	80%	0.7TWh/annum in 2010
EfW CHP	63.8%	Average 67.2% Trend 52.6% Average over last 3 years 63.8%	83%	
AD CHP	83%		83%	
Gasification/Pyrolysis	83%		83%	
Co-firing Regular	90%		90%	
Co-firing energy Crops	90%		90%	

[8] Where there is an apparent trend for a technology, we have used the linear trend projection. Where there is no apparent trend, we have used the longer-term average, except where it is markedly different than the average over the last three years, in which cases we have used the latter