BERR | Department for Business Enterprise & Regulatory Reform

RENEWABLES OBLIGATION CONSULTATION

Updated Modelling for Government Response (URN 08/555)

JANUARY 2008

Assessment of RO changes in Response to the Consultation

This document sets out the impact of the proposed changes following responses to the Government consultation on the RO. This note sets out the changes in the modelled impact of the RO changes. Full details of the decision are given in document http://www.berr.gov.uk/files/file43545.pdf.

The main change to the modelling of the ROC regime as a result of the consultation was twofold:

(i) To reflect our analysis of the requirement for a higher headroom than in our original proposals in order to mitigate the risk that unusual weather conditions (particularly high average wind speeds) would lead to over-compliance in the ROC market and a crash in the ROC price.

(ii) to introduce a new 0.5 ROC band for co-firing and sewage gas. (Details of amended ROC regime given in Annex A)

Changes were based on new submitted evidence as a result of the consultation. A summary of the reasons for these changes are given below.

Co-firing

The major criticisms levelled at the analysis which underpinned the banding proposed for co-firing related to the forms of regular biomass that can actually be used as fuels for co-firing in coal-fired stations and the capital costs for direct injection. The initial analysis had assumed that all existing co-firing capacity could make use of the cheapest available fuels – unprocessed straw and wood. Respondents to the consultation have argued that the capacity for burning these cheap fuels is a small fraction of that available. In order to make use of the existing capacity and in particular where plants have invested in direct injection technology the fuels need to meet technical specifications that allow them to be milled. This technical specification can only be met by domestic fuels such as straw and wood when they have been formed into pellets. Looking at the new fuel costs we have decided that co-firing of regular biomass should receive 0.5 ROCs per MWh. Details of updated costs used are given in Annex B.

Sewage Gas

The major criticisms from the sewage gas sector were that the Ernst and Young report only allowed for the incremental costs of fitting a generating engine to an existing anaerobic digester and that the analysis assumed that there was little scope for increased capacity. Respondents presented evidence that while most of the existing generating stations had been based on existing anaerobic digesters, future expansion was possible up to 0.8 TWh by 2010 by fitting new digesters to sewage treatment works which were not equipped with these at present.

Respondents also presented evidence as to the operating and capital costs that new installations would face. This evidence was used to estimate the levelised costs of generating electricity and compared with estimates from other studies produced either for the Department or for the EU Commission as well as by Ernst and Young. The other reports pointed to higher levelised costs than the Ernst and Young report.

Taking these additional costs into account modelling indicates that placing sewage gas in the 0.25 ROC band would fail to bring forward additional potential capacity after 2009. We therefore placed sewage gas in the 0.5 ROC band. Details of updated costs used are given in Annex B.

Headroom

A majority of respondents welcomed the move to headroom based on the number of ROCs in the market but suggested that 6% was too low. A few[1] provided some statistical analysis in support of their argument – these can be found in their published responses at http://www.berr.gov.uk/energy/sources/renewables/policy/renewables-obligation/key-stages/banding-ro/page42154.html. In short, these studies viewed the risk of weather conditions bringing about an oversupply of ROCs as unacceptably high if headroom is set at 6%, and proposed a figure of, variously, 8%, 10% or 13%. They argued that headroom should reduce the risk of a ROC market oversupply to no more than one year in ten. From the limited evidence available for annual wind variability respondents estimated that headroom of around 8% would be required to reduce the risk from wind speed variability alone to one in ten. Some respondents also argued that there needed to be additional headroom to allow for the variability from other sources such as co-firing which will depend on other external factors such as biomass prices and the contribution that coal-fired generation makes to the market.

Having studied the figures provided by consultation respondents, we have completed our own analysis of the available data. The available data are somewhat limited and consist largely of the ROCs issued between 2002/03 and 2006/07. It is clear that ROCs issued to wind farms will be the largest single contributor to weather-driven variation in the ROCs issued in a given year. Analysis of the annual variation in these figures allowed us to model the likely variation in the assumed technology mix and banding regime for 2015. Based on these figures the Government is now of the view that 8% is an appropriate figure.

Other Changes to the RO model

As well as changes to technology costs for co-firing and sewage gas, the model was updated to incorporate post EWP estimates of electricity sales. These are lower than the figures used in the modelling for the White Paper, as they take account of White Paper measures.

[1] AEP, BWEA, Centrica, EdF, E.On, REA, RWE nPower and Scottish Power

Results

Baseline (Current RO structure)

Annex B table 1 gives the new estimates of the baseline (the current RO structure).

The modelling indicates that unchanged (the "do-nothing" scenario), the RO will deliver 7.9% electricity from ROC eligible renewables generation by 2010 against a target of 10% and 11.4% by 2015 and 12.0% by 2020. Under this option the level of generation does not come near to the maximum obligation level of 15.4%.

This level of generation[2] is achieved at a total subsidy cost of £21.5 billion over the lifetime of the policy. This cost is assumed to equate to the cost to consumers, the figures in the table assume 100% cost pass-through (this is likely to represent the upper limit with the true figure likely to be somewhat lower). Over the lifetime of the technologies supported through the RO, this option saves 83.8 million tonnes of carbon (MtC).

The lifetime resource cost[3] (i.e. the cost of the renewable technologies) is estimated at £13.1 billion. Assuming costs are passed through to electricity, we estimate that the RO under this option leads to increased electricity prices of around 4% in 2015. The difference between the subsidy cost and the resource cost is therefore estimated at £8.4 billion over the lifetime of the renewable technologies. This represents the 'deadweight' cost of the RO – a measure of the efficiency of the instrument.

These levels of generation and consumer costs are slightly lower than the baseline assumed in the EWP. In the EWP, consumer costs were estimated to be £23.7bn (£2.2bn higher). The reason for this is that the level of the obligation is lower (due to lower electricity sales estimates in the model).

EWP ROC Structure

We remodelled the EWP ROC structure under the new assumptions. Under the new model (using central electricity price and technology cost assumptions), the RO delivers 8.8% electricity sales from ROC eligible renewable electricity in 2010, 13.3% in 2015 and 14% in 2020.

This level of generation is achieved with a total subsidy of £22.9bn, £1.4bn higher than in the base case. The amount of deadweight in the RO reduces by £2.6bn.

As a result of the new assumptions, the level of consumer costs is lower than in the EWP estimates, due to the lower level of electricity sales assumptions. But the increase in consumer costs is greater, as headroom kicks in earlier, resulting from the lower level of the obligation. The deadweight saving (compared to the base case) is also reduced due to the lower level of the subsidy overall. A point of concern was the low level of co-firing, due to the higher costs not being sufficient to incentivise regular co-firing at the higher level of fuel costs.

[2] under central electricity price/central technology cost assumptions.
[3] under central electricity price/central technology cost assumptions.

New ROC structure

The modelling indicates that[4] this scenario would deliver 9% ROC eligible renewables generation by 2010, 13.4% by 2015 and 14.0% by 2020.

Under the assumptions for option three, the total subsidy is estimated at £23.2 billion (an increase in total subsidy of £1.7 billion compared to the baseline) over the lifetime of the RO. This option saves 96.5MtC of Carbon over the lifetime of the technologies, an increase of 13 MtC over the base case.

Resource costs under this option are estimated at £16.7 billion over the lifetime of the technologies, an increase of £3.6 billion over option one. Cost/tonne of carbon as outlined in cost effectiveness in table below is £173. The estimated lifetime deadweight cost of this option is £6.5 billion. This is a reduced deadweight cost of £1.9 billion compared to the base.

This option has slightly lower resource costs compared to the EWP banding, and higher carbon saved – leading to a lower cost/tonne of carbon saved. This is due to the banding encouraging more of the cheaper technologies, such as co-firing.

Consumer costs are higher, due to the headroom assumptions, deadweight saving is lower than under the EWP banding, due to the higher consumer costs due to headroom, and the higher level of ROCs.

[4] under central electricity price/central technology cost assumptions.

Annex A.

Amended banding regime is as follows:

Band	Technologies	Level of support ROCs/MWh
Established 1	Landfill gas;	0.25
Established 2	Sewage gas, co-firing on non-energy crop (regular) biomass	0.5
Reference	Onshore wind; hydro-electric; co-firing of energy crops; EfW with combined heat and power; geopressure; other not specified	1.0
Post-Demonstration	Offshore wind; dedicated regular biomass	1.5
Emerging	Wave; tidal stream; advanced conversion technologies (anaerobic digestion; gasification and pyrolysis); dedicated biomass burning energy crops (with or without CHP); dedicated regular biomass with CHP; solar photovoltaic; geothermal, Tidal lagoons, tidal barrages (<1GW)	2.0

Annex B – Updated Levelised Cost Assumptions

Co-firing non-energy crop existing capacity

Levelised costs (real)		**2006**	**2010**	**2015**	**2020**
£/MWh	**High**	48	50	49	46
£/MWh	**Medium**	33	34	34	31
£/MWh	**Low**	28	29	28	26

It is assumed that low and medium costs apply to a max of 43% existing capacity

Co-firing Energy Crop

Levelised costs (real)		**2006**	**2010**	**2015**	**2020**
£/MWh	**High**	72	75	73	69
£/MWh	**Medium**	67	70	68	64
£/MWh	**Low**	49	51	50	47

Co-firing new capacity

Levelised costs (real)		**2006**	**2010**	**2015**	**2020**
£/MWh	**High**	70	73	71	66
£/MWh	**Medium**	64	67	66	62
£/MWh	**Low**	59	62	61	57

Sewage Gas

Levelised cost		**2006**	**2010**	**2015**	**2020**
£/MWh	**High**	83.3	83.3	83.3	83.3
£/MWh	**Medium**	63.1	63.1	63.1	63.1
£/MWh	**Low**	42.1	42.1	42.1	42.1

Annex C: Updated costs of the RO

Base Case (current RO structure), new Assumptions	2015[1]			Lifetime		
	Low	Central	High	Low	Central	High
Resource Cost £bn	0.7	0.7	0.8	13.1	13.1	14.6
Carbon Saved MtC	3.1	3.5	4.2	73.9	83.8	102.8
NPV Cost-Benefit £bn (cost+/benefit-)	0.5	0.4	0.4	7.4	6.7	6.8
Cost-Effectiveness £/tC				177	156	142
RO Deadweight Cost £bn	0.5	0.5	0.5	8.4	8.4	7.1
Distributional Analysis						
Exchequer Cost £bn	0.1	0.1	0.1	1.5	1.7	2.1
Firms Cost £bn	0.7	0.7	0.7	12.5	12.4	13.8
Consumer Cost £bn	1.2	1.2	1.2	21.5	21.5	21.7

EWP structure new Assumptions	2015[1]			Lifetime		
	Low	Central	High	Low	Central	High
Resource Cost £bn	1.0	1.0	1.0	17.6	17.2	18.1
Carbon Saved MtC	3.7	4.1	4.8	83.6	95.9	116.3
NPV Cost-Benefit £bn (cost+/benefit-)	0.7	0.6	0.7	11.1	9.9	9.3
Cost-Effectiveness £/tC				210	179	156
RO Deadweight Cost £bn	0.2	0.3	0.5	3.9	5.7	7.9
Distributional Analysis						
Exchequer Cost £bn	0.1	0.1	0.1	1.8	2.1	2.4
Firms Cost £bn	1.0	1.0	1.0	16.8	16.4	17.2
Consumer Cost £bn	1.2	1.3	1.6	21.5	22.9	26.1

New RO structure, new Assumptions	2015[1]			Lifetime		
	Low	Central	High	Low	Central	High
Resource Cost £bn	1.0	1.0	1.0	16.8	16.7	17.6
Carbon Saved MtC	3.6	4.2	4.9	82.3	96.5	118.1
NPV Cost-Benefit £bn (cost+/benefit-)	0.7	0.6	0.6	10.5	9.3	8.7
Cost-Effectiveness £/tC				204	173	149
RO Deadweight Cost £bn	0.3	0.4	0.6	4.7	6.5	8.7
Distributional Analysis						
Exchequer Cost £bn	0.1	0.1	0.1	1.7	2.0	2.4
Firms Cost £bn	0.9	0.9	0.9	16.1	15.9	16.7
Consumer Cost £bn	1.2	1.3	1.6	21.5	23.2	26.3

Annex D – Renewables Build Under Modelling

Twh

Baseline (current ROC)	Other	Cofiring	Landfill	Onshore wind	Offshore wind	Wave and tidal
2007/08	5.0	2.7	4.3	4.0	0.8	0.0
2008/09	5.3	3.2	4.4	4.7	1.2	0.0
2009/10	5.7	3.6	4.6	5.8	2.9	0.0
2010/11	6.2	4.0	4.8	6.9	3.5	0.0
2011/12	6.4	2.8	4.7	8.0	4.7	0.0
2012/13	6.6	3.0	4.6	9.3	5.4	0.0
2013/14	6.9	3.3	4.5	10.8	6.3	0.0
2014/15	7.2	3.5	4.4	12.4	6.8	0.0
2015/16	7.4	3.7	4.3	13.9	7.5	0.0
2016/17	7.5	1.4	4.2	15.0	7.5	0.0
2017/18	7.6	1.5	4.0	15.8	7.5	0.0
2018/19	7.7	1.7	3.9	16.6	7.5	0.0
2019/20	7.7	1.8	3.7	17.5	7.5	0.0
2020/21	7.7	2.0	3.6	18.1	7.5	0.0
2021/22	7.7	2.0	3.5	18.1	7.5	0.0
2022/23	7.7	2.0	3.3	18.1	7.5	0.0
2023/24	7.7	2.0	3.2	18.1	7.5	0.0
2024/25	7.7	2.0	3.0	18.1	7.5	0.0
2025/26	7.7	2.0	2.9	18.1	7.5	0.0
2026/27	7.7	2.0	2.8	18.1	7.5	0.0
2027/28	7.7	2.0	2.6	18.1	7.5	0.0

Twh

EWP ROCs	Other	Cofiring	Landfill	Onshore wind	Offshore wind	Wave and tidal
2007/08	5.0	3.6	4.3	4.0	0.8	0.0
2008/09	5.3	4.8	4.4	4.6	1.0	0.0
2009/10	5.7	3.1	4.6	5.5	4.2	0.0
2010/11	6.5	3.4	4.7	6.4	7.5	0.1
2011/12	6.9	3.3	4.6	7.3	8.7	0.1
2012/13	7.2	3.6	4.5	8.4	10.1	0.1
2013/14	7.6	3.5	4.4	9.8	11.9	0.2
2014/15	7.8	3.5	4.3	11.0	13.6	0.2
2015/16	8.0	3.5	4.2	12.2	14.9	0.3
2016/17	8.0	3.4	4.1	12.7	15.2	0.3
2017/18	8.1	3.3	4.0	13.2	15.4	0.3
2018/19	8.2	3.2	3.8	13.7	15.5	0.3
2019/20	8.3	3.1	3.7	14.3	15.7	0.3
2020/21	8.4	3.0	3.5	14.8	15.7	0.3
2021/22	8.4	3.0	3.4	14.8	15.7	0.3
2022/23	8.4	3.0	3.3	14.8	15.7	0.3
2023/24	8.4	3.0	3.1	14.8	15.7	0.3
2024/25	8.4	3.0	3.0	14.8	15.7	0.3
2025/26	8.4	3.0	2.8	14.8	15.7	0.3
2026/27	8.4	3.0	2.7	14.8	15.7	0.3
2027/28	8.4	3.0	2.6	14.8	15.7	0.3

Twh

New RO structure, new Assumptions	Other	Cofiring	Landfill	Onshore wind	Offshore wind	Wave and tidal
2002/03	1.4	0.4	2.7	1.1	0.0	0.0
2003/04	2.5	0.8	3.2	1.2	0.0	0.0
2004/05	3.4	2.1	3.7	1.7	0.3	0.0
2005/06	3.5	3.4	4.0	2.6	0.5	0.0
2006/07	3.7	2.2	4.1	3.5	0.7	0.0
2007/08	4.5	3.6	4.3	4.0	0.8	0.0
2008/09	4.8	4.8	4.4	4.6	1.0	0.0
2009/10	5.2	5.0	4.6	5.5	4.2	0.0
2010/11	5.8	4.4	4.7	6.4	7.1	0.1
2011/12	6.2	5.0	4.6	7.3	8.3	0.1
2012/13	6.5	5.0	4.5	8.4	9.8	0.1
2013/14	6.9	3.5	4.4	9.8	11.6	0.2
2014/15	7.1	3.5	4.3	11.0	13.2	0.2
2015/16	7.3	5.0	4.2	12.2	14.6	0.3
2016/17	7.3	5.0	4.1	13.2	14.9	0.3
2017/18	7.4	5.0	4.0	13.6	15.2	0.3
2018/19	7.5	3.2	3.8	14.2	15.3	0.3
2019/20	7.6	3.1	3.7	14.7	15.5	0.3
2020/21	7.7	3.0	3.5	15.2	15.5	0.3
2021/22	7.7	3.0	3.4	15.2	15.5	0.3
2022/23	7.7	3.0	3.3	15.2	15.5	0.3
2023/24	7.7	3.0	3.1	15.2	15.5	0.3
2024/25	7.7	3.0	3.0	15.2	15.5	0.3
2025/26	7.7	3.0	2.8	15.2	15.5	0.3
2026/27	7.7	3.0	2.7	15.2	15.5	0.3
2027/28	7.7	3.0	2.6	15.2	15.5	0.3