DEPARTMENT OF ENERGY & CLIMATE CHANGE

Government response to the consultation on proposals for the levels of banded support under the Renewables Obligation for the period 2013-17 and the Renewables Obligation Order 2012

July 2012


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ENERGY
&CLIMATE CHANGE

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Presented to Parliament by the Secretary of State for Energy and Climate Change by command of her Majesty

July 2012

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Ministerial Foreword

I am pleased to publish the Government Response to the Renewables Obligation Banding Review consultation. The Renewables Obligation is vital in supporting the development of renewable energy, which creates job and investment opportunities in the UK as well as contributing to a more secure energy supply.

The package set out in this document will bring forward greater levels of renewable deployment at a lower cost to the consumer. As a result we will stay on track to meet the legally binding 2020 renewable energy target, and help secure the UK's position as a global leader in the renewable energy sector.

The UK renewable electricity sector is already a success story – since April 2011 alone, industry has announced over £11.3bn of investment in the renewables sector, potentially supporting around 22,000 jobs up and down the country, contributing to the Coalition Government's objective to rebalance the economy and support economic growth. Today, we build on that success.

To protect the consumer and ensure the industry is increasingly competitive we have been tough on costs – working with industry to drive down the costs of investment and ensuring the most cost-effective package for consumers. We will retain our focus on ensuring value for money while supporting new, innovative technologies, to ensure the UK has the best range of energy options to call on in the future.

Work on the Renewables Obligation will continue – there are a small number of areas where we need to consult and re-engage with industry and wider stakeholders to ensure we have precisely the right evidence to fully implement our proposals. But these will not affect the package I am announcing today, which will play a key role in securing the UK's energy security at reduced cost to consumers.

Edward Davey
Secretary of State for Energy and Climate Change

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Executive summary

Introduction

1. Renewable energy generation provided almost ten per cent of the UK's total electricity needs last year, up from 6.8% in 2010, and has the potential to contribute much more. The Coalition Government have made clear the importance of renewable technologies in reaching our long-term decarbonisation goals, making the UK more energy secure and protected from fossil fuel price fluctuations, in driving investment and jobs in the renewable energy sector and in enabling us to meet our 2020 and interim renewables targets.

2. The Renewables Obligation (RO) is currently the main financial mechanism by which the Government incentivises deployment of large-scale renewable electricity generation. Bands of support were introduced in 2009 which allowed the RO to offer varied support levels by technology, and reviews of those banding levels were set for every four years. The Government is keen to give industry certainty as far as possible ahead of the introduction of the new bands on 1 April 2013.

3. The Government consulted on the levels of banded support for renewable electricity generation for the period 2013-17, and a number of other matters relating to the draft Renewables Obligation (Amendment) Order 2012, between 20 October 2011 and 12 January 2012. This response sets out the levels of support that the Government intends to provide for the range of renewable technologies under the RO. These levels represent a careful balance between providing support at a level which will drive the renewable deployment the country needs, while increasing value for money and driving down costs to consumers.

4. As stated in the consultation document, our aims for the banding review are to:

   - Ensure that support levels under the RO will support renewables growth to help meet our 2020 and interim renewables target.
   - Drive greater value for money in the operation and support levels set under the RO.
   - Support technologies with the potential for mass deployment.
   - Ensure coordination with other DECC financial incentive schemes.
   - Contribute to the effective delivery of wider energy and climate change goals to 2050, including greenhouse gas emissions reductions, decarbonising the energy sector and ensuring energy security.

5. The decisions taken by Government following the consultation are expected to deliver increased deployment of large-scale renewable electricity from the previous 68 TWh/year which the existing bands would be expected to deliver, to around 79 TWh/year by the end of the banding review period (April 2017), while only marginally increasing RO spending by around 3% over the lifetime of the scheme (to April 2037). In the short term, this leads to a reduction in consumer bills of £6 and £5 in 2013/14 and 2014/15 respectively, with modest increases of around £3

by the end of the banding review period as greater levels of generation come forward.

Responses to the consultation

6. The consultation on the banding review closed on 12 January 2012. In total we received 3,824 responses. Of these, 281 (7.3%) were from organisations including those in the energy and renewables sector as well as in other areas of industry, Government and local authority groups, trade associations, NGOs, academia, charities and community groups. The remainder of responses (3,543; 92.7%) were submitted by individuals. 3,413 (89.3%) of all responses were in response to various campaigns.[1]

7. Through the consultation, we asked for detailed responses on the cost of all technologies, as well as issuing specific calls for evidence on some technologies. We received a range of new information, with a varying level of detailed evidence across the technologies. Post consultation, we have used the responses received to revise our assumptions underpinning our analysis as appropriate, specifically refining the technology cost and input assumptions where we received new evidence.

8. A summary of the responses to each question is provided at Annex A, with the Government's response to the various campaigns set out at Annex B and a list of all respondents (other than individuals) at Annex C. We would like to thank all those who took the time to respond to the consultation.

Banding proposals

9. The consultation responses showed substantial support for our proposals. For the most part, the new evidence submitted did not fundamentally alter our assumptions about the cost of technologies, their potential deployment or the best mix of technologies to achieve our aims as set out above. Many of our proposals remain unchanged in the light of the consultation. The main changes resulting from the consultation and key points can be summarised as follows:

   - There are no changes intended to the support levels consulted on for onshore and offshore wind. The ROC level for offshore wind will be 2 ROCs over the first two years of the banding review period, degressing to 1.9 in 2015/6 and 1.8 in 2016/7.
   - The level of support for onshore wind for the Banding Review period will be reduced to 0.9 ROCS, guaranteed until at least March 2014. A call for evidence on onshore wind industry costs will start in September and report in early 2013. If the findings of the call for evidence identify a significant change in generation costs, the Government will initiate an immediate review of onshore wind ROC levels, with any new support arrangements for onshore wind taking effect from April 2014. Given the importance of maintaining investor confidence there would

[1] Thirteen campaign responses were submitted by organisations, with the remainder submitted by individuals.

be full grandfathering and grace periods for projects already committed in the event of a change in support levels. As part of the call for evidence, we will examine how communities can have more of a say over, and receive greater economic benefit from, hosting onshore windfarms.

- **We have decided to revise our definition of Enhanced Co-Firing to allow for a stepping up approach to support levels**, reflecting that co-firing at lower percentages involves lower risk and lower investment requirements than co-firing at higher percentages or full conversion. The new enhanced co-firing band will be split into two new bands (mid-range and high-range co-firing). The minimum threshold for mid-range co-firing has been increased to using at least 50% biomass in a unit. We have also adopted a unit by unit approach for the co-firing and conversion bands.
- In response to evidence showing a much greater potential deployment of enhanced co-firing (ECF), we have changed support levels to ensure only the most economic plant comes on and that we remain within the Levy Control Framework budget for the RO scheme. We are therefore limiting the level of support for mid-range co-firing at 0.6 ROCs/MWh. Support for high-range co-firing will be set at 0.7 ROCs/MWh in 2013/14, rising to 0.9 ROCs/MWh from 2014/15. We will consult on lowering the support level for standard co-firing to 0.3 ROCs/MWh in 2013/14 and 2014/15, increasing to 0.5ROCs/MWh from 2015/16.
- In order to ensure that consumers are protected from fluctuations in generation from biomass co-firing and conversion caused by fast build times and volatile fossil fuel and biomass prices, **we propose to introduce a cost control mechanism**. This will involve a pre-notification process and the possibility of triggered reviews (see paragraphs 9.53-9.57 for more detail). **The cost control mechanism will be subject to further consultation, with the aim of introduction from 1 May 2013**.
- Following the recommendations of the Government's Bioenergy Strategy, **we retain a cautious approach to new build dedicated biomass** by setting the support levels for dedicated biomass at 1.5 ROCs/MWh, degressing to 1.4 ROCs/MWh for new accreditations and additional capacity added after 31 March 2016. The Government modelling for the consultation paper suggested only plants below 50 MW would be brought forward at this level of subsidy. However, we now understand that a substantial amount of >50 MW generation could come on as well. Given the higher cost of carbon abatement of new dedicated plants compared to other renewables, **we propose to cap the proportion of their ROCs which suppliers can source from dedicated biomass plants accredited after March 2013 to meet their Obligation**. The cap would work in the same manner as the current co-firing cap. It would be set high enough to allow consented projects that can reach financial close and start construction during the current financial year to be accommodated within the cap. **It would not apply to dedicated biomass generation with CHP. Nor would it apply to dedicated generation accredited before April 2013 (with or without CHP)**. We will be consulting on the proposals for the cap shortly.
- The consultation proposed that existing generators should not be exempted from future changes to the UK's sustainability criteria for solid and gaseous biomass.

The Bioenergy Strategy shows that if biomass electricity is to have a role in helping deliver low carbon electricity generation, it will have to meet tighter GHG standards. Recognising the importance of certainty to generators and the biomass supply chain on these criteria, **we propose to introduce limited grandfathering, with improved sustainability criteria, fixed for generators until April 2020**. Our intention is to set standards that steer ambitious yet feasible GHG improvement across the supply chain, hence allowing the market to develop and grow. **A consultation on the new GHG minimum standard will be published shortly**.

- The consultation proposed a supplier cap on bioliquid ROCs. In the light of consultation responses **we have decided to make exemptions from the cap** for electricity generated by microgenerators and by qualifying CHP stations below 1MWe installed capacity. We are also **excluding bioliquids from support under the new mid-range and high-range co-firing bands**.
- In response to new evidence showing a significantly different cost profile for **solar PV, we intend to re-consult on levels of support for this technology**. While we are disappointed that the need to re-consult will inevitably delay the provision of certainty to the solar PV sector (as the other caps mentioned above may also do in other sectors), re-consulting will allow us to take account of the new cost evidence that has emerged over the last few months and the industry's views on that evidence. It will also allow us to take account of the evidence submitted to the Feed-in Tariffs (FITs) consultation on solar PV cost control,[2] both of which should enable us to set appropriate evidence-based support levels which will enable solar PV to make a meaningful contribution to the renewables target.
- Given the cost control measures introduced to the FITs programme and the need to ensure clarity and consistency in Government support levels, **we will also consult on a proposal to exclude new solar PV generation of 5 MW and below from eligibility for the RO**, to take effect on 1 April 2013 along with the other banding changes. From that date, new installations of 5 MW or below would need to look to the FITs scheme for support. In addition to providing consistency and protecting the consumer, we believe this will aid transition to Contracts for Difference (CfD). **We will also consult on excluding from the RO other technologies of 5 MW and below that are currently eligible for support under either the RO or FITs**. Installations above 50 kW and up to 5 MW that are accredited under the RO before 1 April 2013 would be allowed to remain in the RO.
- The RO consultation proposed to reduce support for energy from waste with combined heat and power (EfW CHP) to 0.5 ROCs/MWh. However, evidence was submitted during the consultation that demonstrated that, in order to see increased deployment, support will be required at 1 ROC/MWh. **The Government has accepted this evidence and the support rate will therefore remain at 1 ROC/MWh**.

[2] Consultation on Comprehensive Review Phase 2A: Solar PV cost control. The Government response, published on 24 May 2012, is available at: www.decc.gov.uk/en/content/cms/consultations/fits_rev_ph2a/fits_rev_ph2a.aspx

- The RO consultation contained a specific call for evidence in relation to Advanced Conversion Technologies (ACTs), which recognised that there were limitations in the cost data set that had been collected due to the small size of the ACT sector. Having carefully considered new evidence provided in response to our call for evidence and responses to the other ACT questions in the consultation, which more fully reflect the characteristics of projects in the pipeline, **we will therefore set support for all new ACT generating capacity – both standard and advanced – at 2 ROCs/MWh in 2013/14 and 2014/15, reducing to 1.9 ROCs/MWh for new accreditations, and additional capacity added, in 2015/16 and 1.8 ROCs/MWh in 2016/17**.
- The RO consultation proposed to reduce support for new hydro generating capacity to 0.5 ROCs/MWh. However, on the basis of evidence received in response to the consultation, **we have decided to set support levels for hydro at 0.7 ROCs/MWh** in order to bring forward the most cost-effective deployment that the technology can offer.
- As proposed in the consultation, new landfill gas generating capacity will not receive any support from 1 April 2013. However, **new generating capacity using gas wholly from closed landfill sites will be eligible for support at 0.2 ROCs/MWh and electricity generated using new waste heat to power generating capacity will be eligible for 0.1 ROCs/MWh at both existing stations as well as new stations using gas from any landfill site**. These changes are made in the light of evidence received through the consultation, which shows support is needed to encourage the deployment on closed sites and the deployment of waste heat to power technology.
- The RO consultation proposed a positive, exhaustive list of energy crops. We have expanded that list to include some additional energy crops. However, we will not make the energy crops uplift for biomass plant available to the new enhanced co-firing and conversion bands. We will consult on removing the energy crops uplift from the standard co-firing band, but with some limited continuation of the uplift for standard co-firing stations that currently use energy crops.

10. We have also made a number of detailed technical changes to our biomass proposals. Further details are provided in the biomass electricity chapter (Chapter 9).

11. The decisions set out in this Government Response are subject to the necessary state aid clearances being obtained and Parliamentary approval. The remainder of this document describes the evidence received and the decisions taken on a technology by technology basis. It also sets out those issues where final decisions have not been taken and further consultation is proposed.

12. The tables below summarise the Government's decisions on banding levels following consideration of the consultation responses received, on the basis of:

- Those technologies where we are taking a different approach as a result of the consultation; and

- Those technologies where we are implementing the proposals in the consultation document.

a. Technologies where a different approach is being taken to that consulted on

Renewable electricity technology	Current support (2012-2013) ROCs per MWh[3]	Proposals in consultation document		Post-consultation decisions	
		Level of support (ROCs per MWh)[4]	Other proposed changes	Level of support (ROCs per MWh)	Comments and other changes
Advanced gasification **Advanced pyrolysis**	2	2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17	Proposed change to definition and merger of advanced gasification and advanced pyrolysis to create a combined 'advanced ACT' band	**2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	**One ACT band supporting 'standard' and 'advanced' ACTs at the same ROC level**
Anaerobic digestion	2	2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17		**2 in 2013.14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	**Closure of band to new projects at or below 5 MW from 1 April 2013, subject to consultation**
Biomass conversion	No current band but 1.5 ROCs under current banding arrange-ments	1	Proposal for a new band	**1**	**New band. Unit by unit approach. No energy crops uplift. Change to definition of relevant fossil fuel generating station.**

[3] Different levels of support may apply to certain types of generating station accredited before 1 April 2009. The default rate of 1 ROC/MWh applies to eligible generation that does not fall within any other banding provision.

[4] Years refer to obligation periods under the RO. For example, 2013/14 refers to the period 1 April 2013 to 31 March 2014.

Renewable electricity technology	Current support (2012-2013) ROCs per MWh[3]	Proposals in consultation document		Post-consultation decisions	
		Level of support (ROCs per MWh)[4]	Other proposed changes	Level of support (ROCs per MWh)	Comments and other changes
Biomass conversion with CHP	No current band but 2 ROCs under current banding arrange-ments	1.5	Proposal for a new band and to close this band to new accreditations from 1 April 2015.	**1.5 in 2013/14 and 2014/15**	**New band. Unit by unit approach. No energy crops uplift. Change to the definition of relevant fossil fuel generating station. Close band to new accreditatio ns from 1 April 2015.**
Co-firing of biomass (standard)	0.5	0.5 (less than 15% biomass co-firing in a station)	Changes proposed to add fossil derived bioliquids	**Solid and gaseous biomass (less than 50% biomass co-fired in a unit): 0.3 (proposed) in 2013/14 and 2014/15; 0.5 from 2015/16.** **Bioliquids (less than 100% biomass co-fired in a unit): 0.3 (proposed) in 2013/14 and 2014/15; 0.5 from 2015/16.**	**Unit by unit approach. ROC levels in 2013/14 and 2014/15 subject to further consultation**

Renewable electricity technology	Current support (2012-2013) ROCs per MWh[3]	Proposals in consultation document		Post-consultation decisions	
		Level of support (ROCs per MWh)[4]	Other proposed changes	Level of support (ROCs per MWh)	Comments and other changes
Co-firing of biomass (enhanced)	No current band but 0.5 ROCs under current banding arrange-ments	1	Proposal for a new band	**Mid-range co-firing (50-less than 85%): 0.6** **High-range co-firing (85-less than 100%): 0.7 in 2013/14; 0.9 from 2014/15**	**New band. Unit by unit approach. Excludes bioliquids (other than energy crops). Cost control mechanism to be introduced, subject to consultation**
Co-firing of biomass with CHP (standard)	1	1	Changes proposed to add fossil derived bioliquids and to close this band to new accreditations from 1 April 2015	**0.5 ROC uplift in addition to prevailing ROC support available to new accredit-ations until 31 March 2015**	**Unit by unit approach. Close band to new accreditations from 1 April 2015.**
Co-firing of biomass with CHP (enhanced)	No current band but 1 ROC/MWh under current banding arrange-ments	1.5	Proposal for a new band	**0.5 ROC uplift in addition to prevailing ROC support available to new accredit-ations until 31 March 2015**	**New band. Unit by unit approach. Close band to new accreditations from 1 April 2015.**
Co-firing of energy crops (standard)	1	1	Changes proposed to the definition of energy	**0.5 ROC uplift in addition to prevailing**	**Band to be closed, subject to consult-**

Renewable electricity technology	Current support (2012-2013) ROCs per MWh[3]	Proposals in consultation document		Post-consultation decisions	
		Level of support (ROCs per MWh)[4]	Other proposed changes	Level of support (ROCs per MWh)	Comments and other changes
			crops	**ROC support for co-firing of biomass (standard). No uplift available for mid-range or high-range co-firing.**	**ation. Unit by unit approach. Changes to definition of energy crops.**
Co-firing of energy crops with CHP (standard)	1.5	1.5	Changes proposed to the definition of energy crops and to close this band to new accreditations from 1 April 2015	**0.5 ROC uplift in addition to prevailing ROC support for co-firing of energy crops (standard). Band not available for mid-range or high-range co-firing.**	**Band to be closed, subject to consult-ation Unit by unit approach. Changes to the definition of energy crops. Close band to new accreditatio ns from 1 April 2015.**
Dedicated biomass	1.5	1.5 until 31 March 2016; 1.4 from 1 April 2016	Changes proposed to exclude biomass conversions and to add fossil-derived bioliquids	**1.5 until 31 March 2016; 1.4 from 1 April 2016**	**Introduction of a supplier cap, subject to consultation**
Dedicated energy crops	2	2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17	Changes proposed to the definition of energy crops and to exclude biomass conversion	**2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	**Changes to the definition of energy crops**

Renewable electricity technology	Current support (2012-2013) ROCs per MWh[3]	Proposals in consultation document		Post-consultation decisions	
		Level of support (ROCs per MWh)[4]	Other proposed changes	Level of support (ROCs per MWh)	Comments and other changes
Dedicated energy crops with CHP	2	2 in 2013/14 and 2014/15	Changes proposed to the definition of energy crops, to exclude biomass conversion and to close the band to new accreditations from 1 April 2015	**2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	**Changes to the definition of energy crops.**
Energy from waste with CHP	1	0.5		**1**	**Decision to retain support at current level following consultation**
Hydro-electricity	1	0.5		**0.7**	**Closure of band to new projects at or below 5 MW, from 1 April 2013, subject to consult-ation.**
Landfill gas	0.25	0		**0 for open landfill sites** **0.2 for closed sites** **0.1 for new Waste Heat to Power band at open and closed sites.**	**New bands for closed landfill sites and Waste Heat to Power.**
Onshore wind	1	0.9		**0.9**	**Closure of band to new projects at**

Renewable electricity technology	Current support (2012-2013) ROCs per MWh[3]	Proposals in consultation document		Post-consultation decisions	
		Level of support (ROCs per MWh)[4]	Other proposed changes	Level of support (ROCs per MWh)	Comments and other changes
					or below 5 MW, from 1 April 2013, subject to consultation
Solar PV	2	2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17		**Banding proposals subject to re-consultation. Closure of band to new projects at or below 5 MW, from 1 April 2013, subject to consultation.**	
Standard gasification	1	0.5	Proposed change to definition and merger of standard gasification and standard pyrolysis to create a combined 'standard ACT' band	**2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	**One ACT band supporting 'standard' and 'advanced' ACTs at the same ROC level**
Standard pyrolysis					

b. Technologies where consultation proposals are being introduced

Renewable electricity technology	Current support (2012-2013) ROCs/MWh [5]	Proposals in consultation document	
		Level of support (ROCs/MWh)[6]	Other proposed changes
Dedicated biomass with CHP	**2**	**2 in 2013/14 and 2014/15**	**Changes proposed to add fossil derived bioliquids, to exclude biomass conversion and to close this band to new accreditations from 1 April 2015**
Geothermal	2	**2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	
Geopressure	1	**1**	
Micro-generation	2	**2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	
Offshore wind	2 in 2013/14; 1.5 from 2014/15 onwards	**2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	
Sewage gas	0.5	**0.5**	
Tidal impoundment (range) – tidal barrage (<1GW)	2	**2 in 2013/14 and 2014/15; 1.9 in 2015/16 and 1.8 in 2016/17**	
Tidal impoundment (range) – tidal lagoon (<1GW)			
Tidal stream	2	**5 up to a 30 MW project cap. 2 ROCS above the cap.**	
Wave			

[5] Different levels of support may apply to certain types of generating station accredited before 1 April 2009. The default rate of 1 ROC/MWh applies to eligible generation that does not fall within any other banding provision.

[6] Years refer to obligation periods under the RO. For example, 2013/14 refers to the period 1 April 2013 to 31 March 2014.

Further consultations

13. We have set out above, and in more detail in the relevant technology chapters, our intention to re-consult on a number of areas:

- Introduction of a supplier cap for dedicated biomass.
- The level of support for standard co-firing in 2013/14 and 2014/15.
- Introduction of cost control mechanism for co-firing and biomass conversions.
- The setting of support levels for solar PV.
- Removal of the energy crops uplift for standard co-firing.

14. The commitment to re-consult is evidence of the seriousness with which the Government views these issues and our desire to engage further with industry and relevant stakeholders to understand the implication of these proposals in practice. We will seek to bring forward consultations on the above issues as quickly as possible, to enable the Government to issue its response on these outstanding issues later this year.

15. We will also consult shortly on proposals to exclude from the RO from 1 April 2013 new solar PV, AD, hydro and onshore wind installations at or below 5 MW that are currently eligible for support under either the RO or FITs scheme.

Implementation

16. Subject to state aid clearance and Parliamentary approval, the decisions described in this document will be implemented through a Renewables Obligation (Amendment) Order.

17. The next steps towards the implementation of these changes are:

State Aid Clearance process	From July 2012; final clearance date to be confirmed
Additional consultations on biomass cost control mechanisms, support levels for standard co-firing, energy crop uplift for standard co-firing, supplier cap for dedicated biomass and solar PV support levels	Summer 2012
Government response to the additional consultations	Autumn 2012
Renewables Obligation Order (covering England and Wales) laid in Parliament	Autumn 2012
Subject to Parliamentary approval and State Aid clearance, changes made by the Renewables Obligation (Amendment) Order take effect	1 April 2013

Contact details

18. If you have any questions regarding this response, please contact:

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1. Introduction

1.1 The UK has a legally binding EU target to consume 15% of its energy from renewable sources by 2020, compared with 3.8% in 2011; with interim targets for renewable energy consumption over the two-year period to 2012 and over every following two-year period to 2018. Renewable electricity will need to make up a large share of new deployment to 2020, with a need to increase to over 30% of total electricity from 9.5% in 2011.

1.2 The Renewables Obligation was introduced in 2002 to require electricity suppliers in the UK to source an increasing proportion of their electricity from renewable sources, and as such will play a major role in delivering against the EU target. The overall aim of the RO banding review is to put us on track in the most cost effective way to deliver our ambition of 108 TWh/y of large-scale renewable electricity generation[7] in 2020 consistent with achieving our EU renewables target.

1.3 The RO Banding Review is necessary to ensure that support levels are set as cost-effectively as possible and deliver good value for consumers who bear the cost of the scheme through their energy bills.

Devolution

1.4 While we refer in this document to the 'Renewables Obligation', there are in practice three complimentary Obligations: one covering England and Wales, and one each for Scotland and Northern Ireland. Decisions regarding the operation of the Obligations in Scotland and Northern Ireland are for the Scottish Government and the Department of Enterprise, Trade and Investment in Northern Ireland respectively. However, the UK Government and the Devolved Administrations understand the benefits of a consistent approach and the importance of this to many within the industry, and will seek to provide such consistency across the UK.

1.5 Both the Scottish Government and the Department of Enterprise, Trade and Investment in Northern Ireland have carried out their own RO banding consultations before finalising their policy. Scotland's consultation closed on 13 January 2012; on 3 February the Scottish Government published a summary report and a selection of the responses they had received, along with a first draft of the Order to amend their RO. Northern Ireland's consultation closed on 27 January 2012. Their responses are expected to published shortly.

1.6 The decisions set out in this document apply to the RO in relation to England & Wales, the UK territorial sea and the renewable energy zone (except for the territorial sea adjacent to Scotland and that part of the renewable energy zone in relation to which Scottish Ministers have functions).

[7] Large-scale renewable electricity generation is defined by DECC as all renewable electricity generation in the UK excluding that supported by the Feed-in Tariff for small-scale generation in Great Britain.

Feed-in Tariffs

1.7 The Feed-in Tariffs (FITs) scheme aims to make small-scale (up to 5 MW) decentralised low-carbon electricity generation widely available and affordable to electricity consumers. Support for decentralised low-carbon electricity generation technologies through FITs is intended to:

- Help reduce dependency on fossil fuels and increase security of supply; and
- promote behaviour changes leading to increased energy efficiency and reduced energy demand, supporting wider government policies.

1.8 FITs has been subject to a comprehensive review, announced by the Secretary of State in February 2011. The aim of this review has been to put the FITs on a steady and sustainable path to maximising delivery of decentralised energy at the minimum costs to consumers. The review, which included three consultations, has now concluded.[8]

1.9 The Government is keen to ensure coherence between the RO and FITs. New solar PV, AD, hydro and onshore wind generating stations at or below 5MW in size are currently able to choose between the RO and FITs. We have set out in this response our intention to consult on removing this choice for new plant, by excluding new solar PV, AD, hydro and onshore wind generating stations at or below 5MW from support under the RO.

Electricity Market Reform

1.10 The Government has also published further documentation about the introduction of Electricity Market Reform (EMR). This follows on from the EMR White Paper in 2011 which set out the principles of market reform, including the introduction of a Feed-in Tariff with Contracts for Difference (CfD) to provide stable financial incentives to invest in low carbon electricity generation and a capacity mechanism to ensure future security of electricity supply.

1.11 The draft Operational Framework, published on 22 May 2012, sets out Government expectations of how the CfD process will work, including how strike prices will be set, and how the programme will be administered. Also included in the Operational Framework are more details on the transition phase of the RO. For further details see:
www.decc.gov.uk/en/content/cms/meeting_energy/markets/electricity/electricity.aspx

[8] The Government responses to the consultations are available at:
- Phase 1: www.decc.gov.uk/en/content/cms/consultations/fits_comp_rev1/fits_comp_rev1.aspx
- Phase 2A: www.decc.gov.uk/en/content/cms/consultations/fits_rev_ph2a/fits_rev_ph2a.aspx
- Phase 2B: www.decc.gov.uk/en/content/cms/consultations/fits_rev_ph2b/fits_rev_ph2b.aspx

State Aids

1.12 The decisions set out in this document are subject to the necessary State Aid clearances being obtained. The decisions are also subject to Parliamentary approval of the Renewables Obligation (Amendment) Order.

2. Updating the analytical basis

2.1 Responses to the consultation provided a range of new information and evidence on the costs and deployment potential of all technologies. Post-consultation, this new evidence has helped inform revisions to all the assumptions underpinning the existing analysis, specifically refining the technology costs and input assumptions across all technologies.

2.2 Pöyry were commissioned to produce scenarios which modelled the uptake of renewable energy generation in response to the different banding proposals. These model runs considered the existing banding levels, the bands as proposed in the consultation and a range of different banding scenarios constructed on the basis of the new evidence. These models also took account of sensitivities such as fuel constraints, and information on these sensitivities is included in the Impact Assessment published alongside this document.

2.3 The Government tested the Pöyry modelling using an in-house DECC model to determine the range of ROCs required to incentivise the potential deployment identified. The DECC model calculates the cost-effectiveness of individual technologies to determine the overall cost-effective mix required to achieve the desired amount of deployment.

2.4 Given the considerable importance of biomass conversions and onshore wind in our cost and deployment assumptions, we have also stress-tested the evidence base. Through looking at every project we have any knowledge of in the pipeline and talking to as many developers as practicable and asking them to share their commercial in confidence projections with us, the Government has been able to produce a bottom-up analysis of how technologies are likely to respond to the banding proposals. This has provided greater confidence in, and knowledge of, the risks and sensitivities that the modelling does not necessarily highlight.

2.5 The Government has also engaged directly with some sectors where extra evidence was required. An industry event was held with CHP developers regarding the costs of their schemes, and the Government's bioenergy arms-length body held meetings with developers to refine the evidence base on Advanced Conversion Technologies (ACTs). The Government also gathered significant additional data on biomass conversions and enhanced co-firing to provide even greater confidence in the evidence base for each of these technologies.

2.6 Further details of the analytical approach that underpins the Government's decisions on the banding review are contained in the Impact Assessment published alongside this document.

3. Onshore wind

Introduction

3.1 Bringing forward appropriately sited onshore wind generation is an essential part of a responsible UK energy policy. Onshore wind is as necessary for our security of supply over this decade as aging generation closes, as it is for helping to decarbonise our energy market. Since it is also one of the cheapest renewable technologies, it minimises pressure on consumer bills and protects them from the price and availability risks of over-reliance on a limited range of fuels as we bring forward investment in energy.

3.2 The Government's ambition for onshore wind during this decade is set out in the Renewables Roadmap published last summer. This shows that up to 13 GW of capacity is needed by 2020. Much of it is already underway: in May 2012, 5 GW was in operation, nearly 6 GW had received planning consent and was waiting to be built, and a further 6 GW was in the planning system. Not all consented projects will be built, and only well designed projects will receive planning consent, but the deployment the UK needs is largely already within the planning pipeline.

3.3 The cost-effectiveness of onshore wind continues to improve. Capital and levelised costs are projected to fall over the decade, meaning that support for onshore wind can also come down. The consultation proposed reducing the level of support for new onshore wind by 10% to 0.9 ROCs/MWh from April 2013, compared to 1 ROC/MWh currently.

3.4 Modelling for the banding review estimates that this reduction will reduce the contribution of large-scale onshore wind towards the 2020 target by 0.6-0.8 TWh/y (around 0.6-0.8% of the 108 TWh/y we expect large scale electricity should contribute towards the 2020 target).

Main messages from responses

3.5 Points made by respondents include:

- Arup assessment of costs and deployment potential:
  - The capital, operating costs and significant deployment potential of community and small-scale projects (5-20 MW) and those in remote parts of Scotland have been underestimated. However, no supporting evidence or indication of scale of underestimates were provided.
  - Capex variations are primarily due to grid connection costs which vary considerably between sites.
  - The development cost range identified is too broad.
  - No consideration has been given to the critical role of exchange rates in affecting deployment levels.

- Project economics vary between regions due to differences in wind speed, which drives expected load factors, as well as transmission charge differentials and other cost differences.
- The cost of the development stage of wind projects is underestimated, particularly for projects less than 10 MW capacity.
- Many respondents agreed with aspects of Arup's assessment of costs and deployment potential.

- Proposed level of support:
  - Some respondents commented that onshore wind is already a mature technology and does not require taxpayer subsidy.
  - Onshore wind is cheaper than most other forms of renewable energy and its production should be maximised in order to reduce costs to consumers.
  - Reducing the level of ROC support would not necessarily reduce costs for consumers as additional ROCs would be issued to suppliers of more expensive technologies – such as offshore wind – to achieve the same amount of renewable electricity that 1 ROC/MWh to onshore wind would deliver.
  - If a reduction in support is to occur, it must not drop below 0.9 ROCs/MWh and some certainty must be signalled by the Government that this level of support will remain in place for an extended period of time.
  - The reduced support for onshore wind through the RO will only serve to increase the commercial risks faced by developers, especially as development costs outside developers' control are increasing.
  - The proposed level of support for onshore wind is insufficient particularly for smaller developers on smaller sites, community-owned schemes and those in some parts of Scotland. This will result in disproportionate support for large scale energy infrastructure at the expense of smaller, local scale projects.
  - If the ROC rate is cut for projects under 10 MW in scale there will be a marked drop in the number of community projects that will proceed to completion, as well as a reduction in the number of future projects developed.
  - A threshold should be set of at least 20 MW, below which RO support for onshore wind is continued at 1 ROC/MWh to encourage development of well sited smaller scale projects.

3.6 See Annex A for a summary of responses to the questions on onshore wind (questions 1 and 2). In addition, 880 campaign responses calling for the removal of support for onshore wind were received, and Annex B provides the Government's response on this issue. Evidence and views made known to DECC since the consultation have also been taken into account in decision-making.

Post-consultation decisions

Level of support

3.7 **The Government confirms its intention to reduce the level of support for onshore wind to 0.9 ROCs/MWh for new accreditations and additional capacity added in the banding review period (1 April 2013 to 31 March 2017).**

3.8 The reason for the reduction in support is the evidence of falling costs. We expect capital costs in this sector to fall by 3.6% to 2016. Our understanding of costs is strongly evidenced and is based on extensive analysis of pricing expectations by generators, manufacturers and independent third parties.

3.9 We also recognise the risk that costs could fall more or less swiftly than expected. The Government will therefore undertake a call for evidence, which is expected to start in September 2012 and report to ministers in early 2013. The call for evidence will examine onshore wind generation costs, alongside the other elements of levelised costs. Levelised costs represent the sum of all lifetime generation costs, including capital, financing and operating costs in relation to the amount of lifetime electricity generation.

3.10 If the findings of the call for evidence show that one or more of the statutory grounds for a further review exists, for example that there is a significant change in the levelised costs set out in this document, the Government will expect to initiate an immediate review of support levels for onshore wind. Any new arrangements arising from a review would not take effect before April 2014. The Government's policy on grandfathering will not change: meaning that support levels for onshore wind turbines that are already accredited under the RO before the date of the implementation of a review would not be affected.

3.11 We would also expect to protect from a fall in support levels those projects where significant financial commitments had been made. For example, support levels would be held for consented projects with a pre-existing grid connection and turbine order in place, or potentially those which had otherwise invested a significant proportion of total development costs. In the event of a review of onshore wind rates, Government would expect to consult publicly on the detail of a grace period provision following these principles. Implementation would be subject to State Aid approval.

3.12 In any review of support levels (whether resulting from the call for evidence or our ongoing monitoring of renewables costs) Government would follow the tried and tested process of public consultation. Our approach would be as rigorously evidence-based as it has been in the current banding review. We will continue to use a hurdle rate (a required rate of return) which the evidence suggests is necessary for onshore wind investment to proceed.

3.13 In this way we will ensure that pressures on household bills are kept to the absolute minimum while also ensuring that investors have the policy stability that they require to continue to invest in the UK economy.

3.14 While the majority of the public supports the growth of onshore wind in the UK, we recognise that there are concerns within communities over onshore wind deployment in their area. For this reason the call for evidence will also examine how communities can have more of a say over, and receive greater economic benefit from, hosting onshore wind farms. Community engagement could potentially be strengthened for example by measures to improve local consultation by developers, enable local businesses to participate more readily in the economic supply chain, and to provide innovative ways to reward host communities including through offsetting electricity bills if practicable.

3.15 Such measures would complement other steps that are already being taken across the UK. For example, in England the new National Planning Policy Framework encourages local authorities to plan their own positive strategies for renewables. The Government has also brought forward legislation in the current Parliamentary session to enable the business rates which apply to windfarms and other renewable energy in England to be retained locally.

3.16 The Government will shortly consult on proposals to exclude from the RO onshore wind projects of 5 MW and below that are currently eligible for support under either the RO or FITs scheme. Installations above 50 kW and up to 5 MW that are accredited under the RO before 1 April 2013 would be allowed to remain in the RO.

4. Offshore wind

Introduction

4.1 The UK has some of the best offshore wind resources in the world and these will be key to the UK meeting its low carbon objectives. Of all the renewable technologies, it is the best scalable, mass deployable option. With over ten years experience in delivering increasingly large windfarm projects, the UK is currently the world leader in offshore wind with 1.9 GW of fully installed and operational capacity. This leading role is set to continue as the UK has the biggest pipeline of projects to 2020 and beyond.

4.2 There is currently another 2.4 GW under construction and 2.4GW which has been granted development consent and is awaiting construction. Developers have also signed zone development agreements with the Crown Estate for Round 3 with potential for up to 32 GW in English and Welsh waters and around another 4.3 GW in Scottish Territorial Waters. The Crown Estate is also currently considering tender bids for a 600 MW leasing round in Northern Ireland.

4.3 The costs of offshore wind are expected to fall as the technology develops and matures and as industry benefits from learning and economies of scale. In light of this, the Government proposed adjusting the level of support for offshore wind – 2 ROCs/MWh for generating stations accrediting and additional capacity added in 2013/14 and 2014/15, reducing to 1.9 ROCs/MWh for those accrediting or adding capacity in 2015/16 and 1.8 ROCs/MWh for those accrediting or adding capacity in 2016/17. Under the current arrangements, offshore wind would receive 2 ROCs/MWh in 2013/14 and 1.5 ROCs/MWh from April 2014.[9] Since the consultation, further progress has been made on setting a path for costs to come down – in June 2012 the industry-led Cost Reduction Task Force published a report setting out an action plan to drive down the costs of offshore wind to £100/MWh by 2020.[10]

[9] In summer 2009 the Government consulted on a new band for offshore wind, and introduced support at 2 ROCs/MWh for turbines first forming part of a generating station on or after 1 April 2010. The Government proposed maintaining this level of support until 31 March 2014, with the ROC level reverting to 1.5 ROCs/MWh for turbines first forming part of a generating station after that date.

[10] See: www.decc.gov.uk/assets/decc/11/meeting-energy-demand/wind/5584-offshore-wind-cost-reduction-task-force-report.pdf

Main messages from responses

4.4 Points made by respondents include:

- Arup's assessment of costs and deployment potential:
  - The levelised cost of offshore wind is extremely project specific because of site conditions.
  - Costs will fall faster than predicted as developers find alternatives for engineering problems.
  - Offshore grid connection costs should be included in overall costs.
  - Capex costs will not fall as quickly as the modelling assumes and may go up before they fall.
- Proposed level of RO support:
  - The level of support should be considered in the context of specific sites, with sites in shallower water and nearer shore receiving a lower level of support compared to deeper water sites further away from shore, to reflect the lower costs of construction.
  - Round 3 offshore wind farms may warrant a number of ROCs but should have a capacity limit to keep the cost to the consumer down.
  - While the increase in banding from 1.5 to 2 ROCs/MWh is welcome, the proposed reduction in 2016 may be too soon because costs may not fall as quickly as expected.
  - The proposed banding strikes the right balance between the potential for UK deployment of offshore wind and the need to ensure value for money for the consumer.
  - The RO should offer support for floating offshore wind at the same level of support as marine (i.e. 5 ROCs/MWh).

4.5 See Annex A for a summary of responses to the questions on offshore wind (questions 3 and 4).

Post-consultation decisions

Level of support

4.6 **The Government has decided to set the level of support for offshore wind at 2 ROCs/MWh for new accreditations and additional capacity added in 2014/15, reducing to 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs/MWh for new accreditations and additional capacity added in 2016/17.**

4.7 The Government considers that this strikes the right balance between supporting UK deployment of offshore wind and the need to ensure value for money for the consumer. The Government does not consider that strong evidence has been provided to make a sufficient case for different levels of support based upon distance from shore or depth of water. Whilst the overall economics of an offshore wind project will depend upon a number of factors including depth of water and distance from shore, it should also be noted that sites further from shore may have better wind resource and therefore higher load factors. The Government also notes that

Round 3 projects which are in deeper waters or further from shore are unlikely to be deployed at a large scale in the banding review period.

Floating offshore wind

4.8 Floating offshore wind has the potential for use in very deep waters where fixed foundations are not practicable. Currently there is one demonstration turbine in the North Sea in Norwegian waters (Hywind), and one in the Atlantic, off the coast of Aguçadoura in Portuguese waters (WindFloat). There are also plans to explore a suitable demonstration site in Scotland.[11] In April 2012, the Government announced that it would collaborate with the US to develop this technology,[12] and the Energy Technologies Institute are developing a floating wind turbine demonstrator and investigating a demonstration site in south-west England.[13]

4.9 However, floating offshore wind is an emerging technology which has not yet been commercialised, and the Government considers that there is little prospect of significant deployment in this RO banding review period. **The Government does not consider that a sufficient case has been made for a separate higher RO band for floating offshore wind.**

[11] See: www.scotland.gov.uk/News/Releases/2010/08/16152221
[12] See: www.decc.gov.uk/en/content/cms/news/pn12_049/pn12_049.aspx
[13] See: www.eti.co.uk/technology_programmes/offshore_wind

5. Hydroelectricity

Introduction

5.1 Hydroelectricity is well developed, based on established technology and provides around 1.3% of UK electricity supply. The majority of large scale (>5 MW) schemes are based in Scotland, and there are limited opportunities for further development of large scale hydro in the UK as most of the economically attractive sites have already been exploited, and environmental concerns are limiting further development of large dams. There is, however, potential for small-scale (<5 MW) hydro schemes in locations spread across the UK.

5.2 The consultation proposed reducing the level of support for new accreditations and additional capacity added between 1 April 2013 and 31 March 2017 to 0.5 ROCs/MWh. Currently, hydroelectricity projects receive 1 ROC/MWh.

Main messages from responses

5.3 Points made by respondents include:

- Arup's assessment of costs and deployment potential:
  - The Arup report underestimates capex, opex costs and hurdle rates, and overestimates load factors.
  - The long term potential is much greater than the 38 MW estimate. One energy firm's research has estimated that there is 150 MW of potential in the 5-10 MW size band, although only about 32 MW is expected to be realisable during the banding review period.
  - The same energy firm estimates that there are around 250 MW of >10 MW schemes remaining to be developed in the UK.
- Proposed level of RO support:
  - At 0.5 ROCs/MWh very few, if any, >5 MW schemes would be developed.
  - It is likely that future potential sites will be slightly more difficult to develop and construct and will not see cost reductions due to site and construction costs.
  - Over-generous ROC support may lead to over-development to the detriment of environmental concerns, and detract from other river/stream generation technologies.
  - There should be dual banding based on capacity, with 1 ROC/MWh maintained for <5 MW schemes and 0.5 ROCs/MWh provided for >5 MW schemes.
  - The 2-5 MW capacity band is squeezed by the feed-in tariffs (FITs) scheme and the proposed ROC regime.
  - The proposed cut to the hydro ROC rate will lead to decreased development of community scale hydro developments and businesses supporting the industry would be at risk.
  - Hydro development offers a dependable and long lasting renewable energy resource and should be provided sufficient support through the RO and FITs scheme to encourage development.

- The geographically dispersed nature of hydro schemes means they contribute to job creation and retention in rural areas and have a positive impact on community benefit. A number of businesses would be at risk if a drop in the RO were to be implemented.

5.4 See Annex A for a summary of responses to the questions relating to hydroelectricity (questions 5 and 6).

Post-consultation decisions

Level of support

5.5 Having considered the responses to the consultation, **the Government has decided that the level of support for hydroelectricity should be 0.7 ROCs/MWh for new accreditations and additional capacity added in the banding review period** (1 April 2013 to 31 March 2017).

5.6 Although the Government has considered the further evidence provided by members of the hydropower industry in support of a higher ROC level, the economic modelling suggests that 1 ROC/MWh would be over-generous for the majority of projects and increase costs to consumers. Government modelling indicates 0.7 ROCs/MWh would bring on almost all of the available potential of this cost-effective technology.

Schemes at or below 5 MW

5.7 The Government's policy is for coherence between the RO and FITs scheme at the 5 MW crossover scale so as not to provide perverse incentives to downsize schemes. As set out in the FITs consultation,[14] the level of support under the RO and the evidence on costs submitted as part of the RO consultation will be taken into account when considering levels of support for hydro under the FITs scheme.

5.8 The Government will shortly consult on proposals to exclude from the RO hydro projects of 5 MW and below that are currently eligible for support under either the RO or FITs scheme. Installations above 50 kW and up to 5 MW that are accredited under the RO before 1 April 2013 would be allowed to remain in the RO.

[14] Consultation on Comprehensive Review Phase 2B: tariffs for non-PV technologies and scheme administration issues (9 February 2012). See: www.decc.gov.uk/en/content/cms/consultations/fits_rev_ph2b/fits_rev_ph2b.aspx

6. Marine technologies

Wave and Tidal Stream

Introduction

6.1 Although these are technologies at an early stage of development, wave and tidal stream have considerable potential in the UK. Studies have shown that the UK has an unrivalled abundance of tidal stream potential and is currently the world leader in developing wave and tidal stream technology. Supporting marine energy therefore allows the UK to utilise domestic energy resources while encouraging the development of a world leading UK industry.

6.2 The central scenario in the 2011 UK Renewable Energy Roadmap suggested up to 300 MW of wave and tidal stream could be deployed by 2020, providing around 0.9 TWh/y of electricity. While it will not make a major contribution to the 2020 renewable energy target it has the potential to deliver significantly in the longer term, provided costs are reduced. For this to happen the industry must deliver demonstration projects to test devices and identify cost reductions.

6.3 In order to encourage the move towards commercialisation for the sector while managing overall costs to consumers of support for the sector, the consultation proposed support at 5 ROCs/MWh for wave and tidal stream projects of up to 30 MW capacity which are installed and operational prior to 1 April 2017. Additional capacity in excess of 30 MW would be supported at 2 ROCs/MWh.

Main messages from responses

6.4 Respondents to the consultation were overwhelmingly supportive of the Government's proposal for a support level in the banding review period of 5 ROCs/MWh for electricity generated from wave and tidal stream sources up to 30 MW of installed capacity per generating station. However, a minority opposed this level of support.

6.5 Points made by respondents include:

- Further clarity is required over what constitutes a project and how the proposed 30 MW cap will operate.
- The 30 MW cap will stifle development and should be removed.
- 5 ROCs/MWh should be available to projects greater than 30 MW installed capacity.
- The proposed reduction from 5 ROCs/MWh to 2 ROCs/MWh for projects greater than 30 MW installed capacity is too steep.
- The RO should not be used to provide innovation support for technologies at the pre-commercialisation stage.
- A higher cap should apply in Scotland given the state of the industry there.

6.6 See Annex A for a summary of responses to the questions on wave and tidal stream (questions 7 to 10).

Post-consultation decision

Level of support

6.7 **The Government has decided to set the level of support for wave and tidal stream generating capacity at 5 ROCs/MWh, provided the generating capacity is installed and operational by 31 March 2017.** This level of support will only be available for up to 30 MW of installed capacity at each generating station and is only available to generating stations accrediting from 1 April 2012 to 31 March 2017, and to additional capacity added during that period. **The level of support for installed capacity above 30 MW will be 2 ROCs/MWh.** These levels of support will apply from 1 April 2013.

6.8 The 30 MW cap is designed to prevent an unexpectedly large deployment of wave and tidal stream generation as this would put pressure on the RO budget. However, it is not being introduced to incentivise smaller generating stations over larger ones and the support proposed for installed capacity above 30 MW is intended to ensure that this deployment is not discouraged. Larger stations will be able to receive 5 ROCs/MWh on up to 30 MW of installed capacity, and 2 ROCs/MWh on the rest.

6.9 Support at 5 ROCs will only be available for installed capacity that is operational before 1 April 2017. Further requirements are that the station is accredited after 31 March 2012 or the installed capacity forms part of additional capacity added after that date.

6.10 The Government considers that the UK wave and tidal stream sector is now at the point where it should be moving towards demonstrating the performance of a wide range of devices in array formation. At present the sector is not at a mature stage and there is still a large number of different technological designs for devices. Therefore the Government's intention is to ensure that a large number of different types of devices are tested in array formation and the level of support is set at a level expected to encourage this.

6.11 The lower level of support for installed capacity above 30 MW for generating stations is consistent with the Government's objective of cost-effectively encouraging renewable electricity deployment. Government analysis suggests a 30 MW cut-off point for support at 5 ROCs/MWh is appropriate for the types of deployment projected to 2017 and the cap is not therefore expected to affect the development of the industry.

6.12 The levels of support set out in chapter 20 (microgeneration) will apply to wave and tidal stream generating stations with a declared net capacity of 50 kW or less.

6.13 The level of support for the banding review period is not an indication of the level of support planned for wave and tidal stream electricity generation under EMR. Support under EMR has not yet been set for wave and tidal stream electricity, although the

Government has announced that the levels of support for different technologies will be known before the first CfDs become available in 2014.

6.14 **In response to calls for further clarity about implementation of the 30 MW cut-off point for support at 5 ROCs/MWh, the Government has decided to proceed on the basis of existing RO terminology, namely the concept of 'generating station'.** We consider that this approach provides greatest clarity to industry and the regulator as it will not introduce new terminology into the legislation or change the existing procedures and processes for accreditation.

6.15 When accrediting renewable energy projects under the RO, Ofgem takes a number of factors into account to determine whether a set of equipment constitutes a generating station, as set out in Annex 2 of the *Guidance for Generators*.[15] It will therefore be vital for developers to familiarise themselves with this guidance in order to determine the likely level of support for any particular generating station.

6.16 The Government considered implementing the 30 MW cap based on the point of connection (i.e. linked devices with one point of connection into the transmission or distribution network would receive support of 5 ROCs/MWh up to 30MW of installed capacity) but concluded this was inappropriate as grid connection is not the determining factor when establishing the boundary of a generating station.

Tidal Range

Introduction

6.17 The UK has one of the best tidal range resources in the world, with various studies estimating the UK's theoretical potential at between 25-30 GW. Several projects are under consideration but are not expected to be in operation before April 2017 as they are still at a planning stage. However, smaller prototypes of novel tidal range technologies, perhaps in the 10-50 MW range, could be deployed before 1 April 2017.

6.18 For this reason the consultation proposed retaining the current tidal range banding level of 2 ROCs/MWh for generating stations below 1 GW from 1 April 2013 to 31 March 2015, stepping down to 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs/MWh in 2016/17.

Main messages from responses

6.19 Consultation responses differed as to whether the proposed level of support was appropriate or whether it should be higher, though most responses did not specify what the higher level of support should be. In addition, respondents made the following points:

[15] Ofgem (2011) *Renewables Obligation: Guidance for Generators*. Available at: www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=271&refer=Sustainability/Environment/RenewablObl

- Support should be maintained at 2 ROCs/MWh throughout the banding review period because of the long timescales involved in developing even small pilot projects.
- The degression proposed from 1 April 2015 may risk rather than encourage tidal range UK innovation and investment.

6.20 See Annex A for a summary of responses to the questions on tidal range (questions 11 and 12).

Post-consultation decision

Level of support

6.21 **The Government has decided to set the level of support for tidal range schemes below 1 GW (barrages/lagoons etc) at 2 ROCs/MWh for new accreditations and additional capacity added in 2013/14 and 2014/15, stepping down to 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs/MWh for new accreditations and additional capacity added in 2016/17.**

6.22 This is in line with the highest level of support under the RO (with the exception of wave and tidal stream). A higher level of support would increase costs of the RO for consumers. Opinion was divided on the appropriate level of support and there is a lack of firm plans for commercial deployment in the RO period. Therefore the Government has decided to adopt the level of support proposed in the consultation on the basis that some small-scale test deployment may take place over the banding review period.

7. Geothermal and geopressure

Introduction

7.1 The UK deep geothermal power sector is at an early stage of development, with Arup's high maximum build rate scenario suggesting up to 480 MW could be deployed by 2020, increasing to 4 GW of installed capacity in 2030. This level of deployment is dependent on successful demonstration projects being in operation by 2015 and a strong market for heat in place.

7.2 The consultation proposed support for geothermal at 2 ROCs/MWh until 31 March 2015, stepping down to 1.9 ROCs/MWh for new accreditations and additional capacity added from 1 April 2015 to 31 March 2016, and 1.8 ROCs/MWh from 1 April 2016 to 31 March 2017.

7.3 In the absence of evidence suggesting that there will be any electricity deployment from geopressure during the banding review period, the consultation proposed maintaining support for geopressure at the current level of 1 ROC/MWh.

Main messages from responses

7.4 Points made by responses to the consultation included the following:

- Arup's assessment of costs and deployment potential:
  - The levelised costs, even with the higher hurdle rates demanded of geothermal, compare favourably with other renewable technologies.
  - Geothermal power can be viable without any income from heat, but heat is clearly an important extra benefit compared to some other technologies.
  - The costs of geothermal energy are significantly higher than those estimated by Arup.
  - The total potential installed capacity by 2030 is 525MW, not 4,005MW.
  - The risks and costs of deep drilling have been underestimated.
  - The Arup report underestimates the UK's geothermal potential.
- Proposed level of support:
  - Geothermal power is at a similar stage of development to wave and tidal stream, and should be given the same level of support (5 ROCs/MWh up to a 30 MW project cap and 2 ROCs/MWh above the cap).
  - The proposed level of support is too low to encourage development of the geothermal sector. A subsidy of 4 ROCs/MWh would be more appropriate. At 2 ROCs/MWh very few if any geothermal projects will be attempted in the UK.
  - The proposed step downs may risk rather than encourage geothermal innovation.
  - The proposed subsidy does not compensate for the risks and costs of deep drilling.

- The Renewable Heat Incentive (RHI) is not a suitable subsidy for geothermal because of the ban on cooling subsidy so CHP type schemes are not financially viable.
- Each site will have different challenges related to drilling and different flow and temperature characteristics. The rate of ROC reduction cannot be sensibly judged at this stage.
- Support level should remain at 2 ROCs/MWh for the full period in view of the uncertainty of the investment required.

7.5 Annex A contains a summary of responses to the questions on geothermal and geopressure (questions 13 to 15).

Post-consultation decision

Level of support

7.6 **The Government has decided to set the level of support for geothermal at 2 ROCs/MWh for new accreditations and additional capacity added in 2013/14 and 2014/15, stepping down to 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs/MWh for new accreditations and additional capacity added in 2016/17.** This is in line with the highest level of support under the RO set in the banding review (with the exception of wave and tidal).

7.7 There are substantial uncertainties around the costs and deployment potential of this technology in the UK. The Government has provided grant funding totalling around £9.5 million to support the first two demonstration power projects in Cornwall. (At the end of 2011, the planned project at Redruth received a Regional Growth Fund grant of £6m. In December 2009, the Deep Geothermal Challenge Fund awarded £1.475m to the Redruth project and £2.011m to a project at the Eden Project). However, our cost-effectiveness analysis has indicated that deep geothermal power is not necessary to meet the electricity ambition from renewable electricity of 108TWh in 2020. We agree that by encouraging geothermal power now, we may be able to reduce its costs and encourage the industry to grow, which is why we have made these specific grant awards as part of the innovation and growth agendas. But the uncertainties around the potential and costs of this technology are such that we do not consider an uplift of RO support, as called for by the deep geothermal industry responses, over the banding period would be cost-effective.

7.8 We recognise that a new report on the geothermal energy potential of Great Britain and Northern Ireland was submitted to the Department at the end of May (the RO Banding Review consultation closed on 12 January). The Department is assessing the report and will consider it alongside the existing evidence base to inform future policy-making. We have not ruled out supporting deep geothermal power in other ways, consistent with our overall objectives. In addition, the Government will consult in the autumn on the future treatment of deep geothermal heat under the Renewable Heat Incentive (it currently receives the same level of support as ground source heat pumps).

7.9 **Support for geopressure will be maintained at 1 ROC/MWh for new accreditations and additional capacity added from 1 April 2013 to 31 March 2017.** No evidence was provided to justify a different level of support.

8. Solar PV

Introduction

8.1 The consultation proposed maintaining support for solar PV at 2 ROCs/MWh until 31 March 2015, stepping down to 1.9 ROCs/MWh for new accreditations and additional capacity added from 1 April 2015 to 31 March 2016, and 1.8 ROCs/MWh from 1 April 2016 to 31 March 2017.

Main messages from responses

8.2 Consultees made the following points with regard to the proposals on solar PV:

- Arup's assessment of costs and deployment potential:
  - There is limited commercial viability in the development of large-scale solar PV installations in the UK, meaning the assessment for >5 MW growth is unachievable.
  - Grid capacity is an issue for deployment at the levels suggested by Arup of between 4.9 and 5.7 GW of solar PV capacity by 2020 in a financially unconstrained scenario.
  - Arup's high and medium capital costs are higher than industry estimates.
  - Arup's cost estimates and output estimates are too low.
  - There is too little solar irradiation in most of the UK for wide commercial development of solar PV.
  - Incorrect assumptions such as supply chain constraints, sites only being suitable in the south west of England, and the inability of costs to continue to fall mean the potential for solar PV is greatly underestimated.
  - Given the expectation of grid parity by 2020 (for domestic schemes) and competitiveness with onshore wind for export-only merchant plant the deployment profile that falls after 2020 is difficult to comprehend.
- Proposed level of support:
  - 2 ROCs/MWh should be maintained throughout the banding review period.
  - All solar-generated electricity should be supported under the RO, not just solar PV, allowing for the possible deployment of other technologies such as concentrated solar power.
  - At 2 ROCs/MWh only the very largest multi-megawatt projects, in the very sunniest parts of Britain will be beginning to look economic. The proposed support will not therefore deliver diversity in the types of projects developed.

8.3 Annex A provides a summary of responses to the questions on solar PV (questions 16 and 17).

Post-consultation decisions

Level of support

8.4 The Government aims to encourage cost-effective deployment of solar PV through the RO. However, costs have continued to fall dramatically since the consultation was published and new evidence has become available (including through the FITs consultation on solar PV tariffs)[16] which indicates that the level of support proposed in the consultation would substantially over-reward this technology.

8.5 The Government's analysis of the new evidence suggests that RO support rates should be set significantly lower than was proposed in the consultation, and ideally consistent with the rates proposed under the FITs scheme. Because such a reduction in support would represent a significant departure from the consultation proposals and would be based largely on new evidence collected through the FITs comprehensive review, which was not published until the RO consultation had closed, we consider that it is appropriate to re-consult on this issue. **The Government will shortly publish a consultation on proposals for reduced ROC support for solar PV generating stations which accredit or add additional capacity on or after 1 April 2013.**

8.6 The Government intends that this consultation will also set out proposals to exclude new solar PV installations at or below 5 MW from the RO; instead they would only be supported through the FITs scheme. The Government considers this would ensure a consistent policy approach to new developments in the 50 kW to 5 MW range and would avoid perverse incentives in choosing between schemes. It would also reduce the administrative burden on Ofgem, which currently administers both the RO and the FITs scheme.[17]

[16] See: www.decc.gov.uk/en/content/cms/consultations/fits_rev_ph2a/fits_rev_ph2a.aspx

[17] To ensure consistency across renewables technologies, we will also develop proposals to exclude from the RO other technologies eligible for FITs support (onshore wind, hydro and anaerobic digestion projects at or below 5 MW).

9. Biomass electricity

Introduction

9.1 Forty six percent of the renewable electricity generated in the UK comes from biomass, half of which is landfill gas along with sewage gas, other wastes, wood, bioliquids and animal and plant residues.

9.2 The Government considers that biomass electricity has a key role in providing secure, clean and affordable electricity to 2020 and beyond. The Government is committed to ensuring that it is sourced and used sustainably; we aim to be the first country in the EU to implement mandatory standards for eligibility for support, including a minimum greenhouse gas standard.

9.3 The Government's Bioenergy Strategy, published in April 2012,[18] sets out a framework of principles for future bioenergy policy development, including:

- Policies that support bioenergy should deliver genuine carbon reductions that help meet UK carbon emissions objectives to 2050 and beyond.
- Support for bioenergy should make a cost-effective contribution to UK carbon emission objectives.
- Support for bioenergy should aim to maximise the overall benefits and minimise costs across the economy.
- Policies should be regularly monitored and assessed to respond to the impacts increased deployment may have on other areas such as food security and biodiversity.

9.4 The Strategy concludes that biomass electricity has an important role to play as a transitional fuel to reduce carbon emissions from current coal power generation. Combined heat and power generation offers an efficient use of the biomass resources and should be promoted where possible. It reiterates the importance of ensuring that biomass is sourced and used sustainably and recommends we establish an ambitious yet achievable timeframe to improve standards. In response to the Strategy, DECC will be consulting shortly on further improvements to the greenhouse gas emissions and sustainability reporting of solid biomass.

9.5 The banding review consultation generated five campaigns on biomass issues; four of these were opposed to all or specific biomass electricity generation and one was in favour. Sustainability was the key issue which raised most concern; ensuring that our policies do not lead to environmental and social impacts around the globe, that there is insufficient domestic resource which will impact competing users, that we do not consider the impact on food prices and that the use of biomass delivers genuine greenhouse gas emission reductions. Most of these concerns relate to the use of wood and purpose grown energy crops.

[18] Available at: www.decc.gov.uk/en/content/cms/meeting_energy/bioenergy/strategy/strategy.aspx

9.6 There was a difference of opinion amongst the campaign groups as to whether domestic or imported biomass should be supported under the RO; environmental groups wished to see support for imported material removed while the wood processing industries wished to see subsidies removed from domestically sourced biomass. One campaign group called for the removal of all support for all bioenergy.

9.7 These are important issues around the wider impacts of biomass use in the power sector which we address in our Impact Assessment and our responses to the campaign replies are set out in Annex B of this document.

9.8 Alongside the growth of UK biomass generation, the Government recognises the importance of ensuring wood feedstocks continue to be available for non-energy uses. Both areas will contribute to decarbonising the UK economy by 2050.

Biomass conversion

Introduction

9.9 One of the quickest and cheapest ways to decarbonise electricity produced from coal is to co-fire with biomass. For every 10% by energy content of biomass used, a greenhouse gas emission saving of just over 60 gCO_2eq/kWh can be realised; a coal plant converted to run on 100% biomass will have roughly the same emissions as a combined cycle gas turbine (CCGT) plant. Both the Committee on Climate Change's *Bioenergy Review* and the Government's *Bioenergy Strategy* recognise the strategic importance that such decarbonisation can bring to meeting our short term climate change goals and in helping to establish sustainable feedstock supply chains.

9.10 Conversion and co-firing are also a cheaper means of producing renewable electricity compared to new build; conversion in particular extends the life of existing assets and secures a flexible low carbon electricity source so helping to maintain the security of electricity supply. However, this should only be seen as a stop-gap technology; such plants have a lower efficiency than new build, are unlikely to be able to become CHP and without significant development in carbon capture and storage (CCS) technology, emissions from such biomass plant are likely to be too high if we are to largely decarbonise the electricity sector by 2030. We expect about 5 GW of capacity to close over the next decade. This is therefore a technology for the short-term.

9.11 As in the case of other biomass generating stations, we proposed that during 2013 biomass conversions and co-firing of 1 MW capacity and above should be required to meet the sustainability criteria for solid and gaseous biomass in order to receive ROCs. Further details on our proposals for biomass sustainability standards are contained in the relevant section below.

9.12 The consultation proposed introducing two new bands to support the conversion of co-firing stations to biomass:

- **Biomass Conversion** for former fossil fuel generating stations (including co-firers) which convert, or have already converted, to generate all their electricity from biomass; and
- **Enhanced co-firing** for co-firing generators using biomass to generate at least 15% of their gross output.

9.13 The purpose of these definitions was to ensure that a generator looking to convert on a unit by unit basis until they met the definition of 'biomass conversion' would receive an adequate level of support.

9.14 The consultation sought views and made proposals on a number of issues including:

- the costs and deployment potential of biomass conversions;
- that both biomass conversion and enhanced co-firing should be supported at 1 ROC/MWh;
- a proposed definition of former fossil fuel generating stations;
- that all former fossil fuel generating stations which convert their entire generation to biomass before 1 April 2013 should be transferred to the biomass conversion band (together with those stations converting after that date); and
- that the support level for biomass conversions should be grandfathered.

9.15 The consultation also asked for evidence to determine whether the costs of conversion for autogeneration – i.e. those who generate electricity primarily for their own needs – warranted a different level of support.

Main messages from responses

9.16 The following points were made by respondents to the consultation:

- Arup's assessment of costs and deployment potential:
  - Not all costs of conversion have been considered, for example the costs of compliance with EU environmental regulation.
  - The costs and risks of conversion are higher than enhanced co-firing.
  - The costs of conversion have been overestimated.

- Level of support:
  - 1 ROC/MWh is insufficient to incentivise full conversion and does not recognise the risks associated with such a technology change.
  - 1 ROC/MWh is too high as the technology costs of biomass conversion are less than dedicated biomass.
- Definition of a former fossil fuel generating station:
  - The definition should make clear that use of fossil fuel for commissioning, ancillary and start up purposes is not included.
  - Alternative definitions should be adopted, for example based on size of plant or years of operation, to ensure dedicated biomass plants are excluded.

- Transfer of former fossil fuel generating stations to the biomass conversion band:
  - Only stations converting after 1 April 2013 should be transferred.
  - The deadline for the transfer should be 1 April 2015 rather than 2013.
- Grandfathering of support:
  - Grandfathering provides investor certainty and allows companies to invest in and develop the feedstock supply chain.
  - Grandfathering does not deliver value for money to the consumer as it does not address wood price movements.
- Other points raised:
  - A cap should be introduced to control short-term spikes in feedstock prices.
  - The definition of conversion should be changed to allow co-firing above 75% biomass by energy content.
  - Plant choosing to convert are more likely to be those opted out of the Large Combustion Plant Directive and as they will close by 2015 would not contribute to the Government's renewable energy targets.
  - The time required to contract fuel supplies and the phasing of construction mean larger plants are more likely to convert on a unit by unit basis.

9.17 Annex A provides a summary of responses to the questions on biomass conversions (questions 20 to 25).

Post-consultation decisions

Definition of biomass conversion

9.18 The Government is aware that there are clear differences in approach being taken by the major coal generators when it comes to conversion and enhanced co-firing. While some may aim to convert the entire station to biomass, others may aim to convert unit by unit, while others may aim to co-fire at varying percentages of biomass, either in response to biomass and coal prices or to reduce the risks to plant integrity, efficiency and electrical output associated with conversion.

9.19 The consultation proposed that the biomass conversion band should apply only if the entire station converted to biomass. But this would prevent generating stations with multiple units from being eligible for the band if they converted some of their units to biomass while continuing to co-fire or use fossil fuel in their other generating units. We wish to encourage the conversion of fossil fuel generating stations to biomass, whether this takes place on a unit by unit basis, or all at once across the whole generating station. Therefore, we have decided to extend the biomass conversion band so that it applies to:

- fossil fuel generating stations which convert, or have already converted, their entire station to generate all their electricity from biomass; and
- generating stations which have converted one or more units to 100% biomass, while continuing to co-fire or generate electricity from fossil fuel in their other units. By unit we mean the boiler, turbine or engine in which the biomass or other fuel is combusted in order to generate electricity. Only the electricity generated from biomass by the fully converted units will be eligible for support under the

biomass conversion band. Any renewable electricity generated by the other units will need to seek support under the co-firing bands.

9.20 As a consequence of adopting a unit by unit approach for the biomass conversion band, we intend that a generating station will be able to use up to 10% fossil fuel or waste for permitted ancillary purposes in each unit without affecting the eligibility of that unit for the biomass conversion band.

Level of support

9.21 **The Government has decided to introduce a new biomass conversion band and set the level of support at 1 ROC/MWh.**

9.22 Bioliquids, including fossil derived bioliquids, will be eligible for support under the biomass conversion band at 1 ROC/MWh when used by a former fossil fuel generating station generating wholly from biomass, or when used by a co-firing station in a unit which generates electricity wholly from biomass. **We have decided not to provide an energy crop uplift for the biomass conversion band.** This means that energy crops will get the same level of support as regular biomass when used by a former fossil fuel generating station generating wholly from biomass, or when used by a co-firing station in a unit which generates electricity wholly from biomass. **We have decided to provide the option of a CHP uplift for new accreditations and additional capacity added from 1 April 2013 to 31 March 2015.**

9.23 We are concerned that the level of conversions and co-firing that could occur between now and 2017 will risk exceeding the Levy Control Framework. We therefore propose to take steps to allow us to monitor the rate of deployment and, if necessary, take action to control spend. These are set out in more detail in paragraphs 9.53-9.57.

Transfer of former fossil fuel generating stations to the biomass conversion band

9.24 The consultation proposed that all former fossil fuel generating stations which convert (or which have already converted) to 100% biomass should be supported under the biomass conversion band. The consultation defined a former fossil fuel generating station as any station which, following its entry into commercial operation, has generated more than 15% of its electricity from fossil fuel over any six month period (ignoring any fossil fuel used for permitted ancillary purposes or waste which is a renewable source).

9.25 Early movers are eligible for the dedicated biomass band until 31 March 2013 and so are being rewarded for taking the risk. We are still of the opinion that allowing former fossil fuel generators to remain in the dedicated biomass band would lead to consumers overpaying for the generation of renewable electricity. Such generators do not face costs associated with land purchase, grid connection or major construction work.

9.26 Therefore, we confirm that fossil fuel generating stations which have used more than 15% fossil fuel over any 6 month period since they first commissioned should not be eligible for the dedicated biomass band after 31 March 2013.

9.27 However, we will make an exception for former fossil fuel generating stations which converted to 100% biomass and received dedicated biomass ROCs for electricity generated before November 2011.[19] These stations will remain eligible for the dedicated biomass band when they generate wholly from biomass. However, if they use more than 15% fossil fuel over any 6 month period after 1 November 2011, they will permanently cease to be eligible for the dedicated biomass band.

9.28 Those former fossil fuel generating stations which cease to be eligible for the dedicated biomass band will be supported under the biomass conversion band in any month in which they generate electricity wholly from biomass.

9.29 New build dedicated biomass stations (including those built on land on which a fossil fuel generating station was, or is generating) will not be moved into the biomass conversion band, as long as they do not use more that 15% fossil fuel over any 6 month period after they are first commissioned.

9.30 Fossil fuels can continue to be used for permitted ancillary purposes without counting towards the 15% limit. The Government acknowledges that there are technical difficulties in operating converted coal plant at or near 100% biomass, including around flame stabilisation, temperature control at start up and control of fouling and corrosion. It is recognised that burning small percentages of coal in a converted or high-range co-firing biomass boiler may prevent significant corrosion or fouling effects. As such, the list of permitted ancillary purposes will be amended to include the use of fossil fuel or waste for corrosion control and fouling reduction.

Grandfathering of support for biomass conversion

9.31 The Government considers that grandfathering support for conversions under the new band from 1 April 2013 strikes the right balance between recognising the significant upfront capital costs of converting to biomass, and ensuring that consumers are not overpaying for this type of renewable generation in the longer term. **The Government has decided to adopt a policy of grandfathering support for generators under the biomass conversion band at the rate set from 1 April 2013.**

9.32 Grandfathering of support under the biomass conversion band is subject to the generating station meeting the proposed advance registration requirements, set out below, that will be the subject of further consultation. A station which fails to register for the biomass conversion band by the required date, may cease to be eligible for support under that band for the following obligation period.

9.33 Furthermore, grandfathering policy for the conversion band will apply on a unit by unit basis (not a station wide basis) and it will be based on the date a unit becomes eligible for a band (not the date of accreditation). Grandfathering is also subject to the biomass meeting any applicable sustainability criteria as updated from time to time.

[19] This date was chosen because the RO banding review consultation was launched in October 2011.

Industrial autogenerators

9.34 Given the lack of evidence provided, the Government does not consider that there is a sufficiently robust case to provide a separate, higher support rate for conversion of industrial autogenerator fossil fuel plant. **We therefore intend that the biomass conversion band would also apply to former fossil fuel generating stations which generate electricity for their own use and which convert, either on a unit by unit or whole plant basis, to generate their electricity from biomass.**

Biomass co-firing (enhanced)

Introduction

9.35 Co-firing refers to the practice of generating electricity partly from renewable sources and partly from fossil fuels. Normally the fuels are combusted within the same boiler. The consultation proposed establishing a new band, which would reward levels of co-firing greater than 15% of biomass by energy content.

9.36 In establishing a new band for enhanced co-firing, the assumption was that generators would use this band to finance the conversion of their stations unit by unit. Under current banding arrangements, such generators would only have been eligible for the standard co-firing bands. This was considered unlikely to allow the financing of the upfront capital expenditure required and hence could create a potential financial barrier to full conversion. On this basis, the consultation proposed that from 1 April 2013 a new band be created for enhanced co-firing at 1 ROC/MWh.

9.37 Discussions with developers, backed by consultation responses, indicate that some generators are interested in approaches which could affect the appropriate support level: either in enhanced co-firing in its own right, looking to co-fire biomass at the minimum level to be eligible for 1 ROC support; or to co-fire at higher percentages such as 75-80% biomass.

9.38 In the case of the former, the amount of biomass co-fired would be varied depending on the economic return it offered against coal. Infrastructure investment would be low and we would have little surety over the amount of renewable electricity, so risking over-reward. In the latter case, retaining the ability to use coal at 20-25% is seen as a less risky strategy than full conversion since it reduces the costs associated with boiler, mill and feedstock infrastructure as well as reducing losses associated with changes to plant efficiency and operational expenditure due to increased corrosion and fouling.

Main messages from responses

9.39 Points made by respondents to the consultation included the following:

- The deployment potential and the fuel costs for enhanced co-firing is underestimated.
- Plant lifetime and load factors are overestimated.

- At a threshold of 15% plants would be over-rewarded; the threshold for eligibility should therefore be increased. Alternative thresholds of 20%, 40% and 50% were suggested.
- 1 ROC/MWh is sufficient as enhanced co-firing is cheaper than new build and has the advantage of extending the life of an existing asset.
- The amount of ROCs awarded should increase in proportion to the amount of biomass combusted.

9.40 Annex A contains a summary of responses to the questions on enhanced co-firing (questions 26 to 30).

Post-consultation decision

Level of support

9.41 **We have decided to revise our definition of enhanced co-firing.** We recognise that co-firing at lower percentages involves lower risk and lower investment requirements than co-firing at higher percentages or full conversion. We are reflecting this in the level of ROC support that will be provided, as set out in the table below.

Percentage co-firing in a unit	ROCs/MWh	Title of support
Under 50% biomass by energy content	0.3 (proposed) in 2013/14 and 2014/15; 0.5 from 2015/16	Standard (low-range) co-firing
At least 50%, but less than 85%, biomass by energy content	0.6	Mid-range co-firing
At least 85%, but less than 100%, biomass by energy content	0.7 in 2013/14; 0.9 from 2014/15	High-range co-firing

9.42 Those co-firing at the high range are likely to choose this approach as an alternative to full conversion. Those operating in the mid-range will have incurred some investment to enable co-firing at this level and may be doing so as a stepping stone to high-range co-firing. Those operating at less than 50% biomass are likely to either be co-firing at very low levels, as is currently the case, or looking to step up to higher levels.

9.43 We have therefore deliberately made a distinction in level of support between full conversion and co-firing to reflect both the level of investment and risk that exists between the two.

9.44 In the uppermost band, 85% biomass represents a level which allows the maximum possible biomass use while retaining boiler efficiency and minimising risk of fouling and corrosion. We recognise that for certain types of boiler this will be challenging. However, fossil fuel can continue to be used for permitted ancillary purposes (and as

described in paragraph 9.30 the list of permitted ancillary purposes will be amended to include the use of fossil fuel or waste for corrosion control and fouling reduction). The level of support offered reflects that this strategy carries lower risk than full conversion and hence lower costs.

9.45 We have also raised the minimum threshold; consultation responses indicated that our original proposal to set a threshold of 15% biomass would risk over-reward, since such a level can be achieved with little capital investment in infrastructure and would not encourage generators to maintain co-firing levels throughout the banding review period. The mid-range, therefore, represents a stepping stone to the highest level.

9.46 As in the case of conversion, generators may look to build up the level of co-firing that they carry out as feedstock supply chains are developed. We are therefore adopting a unit by unit approach.

9.47 We estimate that there is a potential 10.7 TWh of co-firing in 2013/14, rising to 14.8 TWh in 2014/15 and 15.9 TWh in 2015/16. If such a level were to occur in 2013/14, it would have serious budgetary implications and risks breaching the Levy Control Framework and our intention to control the impact of the RO on customers' bills.

9.48 **The Government will therefore:**

- **Limit support for high-range co-firing in 2013/14 only at 0.7 ROCs/MWh, with support increasing from 1 April 2014 to 0.9 ROCs/MWh.**
- **Consult on limiting support for standard (low-range) co-firing in 2013/14 and 2014/15 to 0.3 ROCs/MWh, increasing from 1 April 2015 to 0.5 ROCs/MWh.**

9.49 As set out in the bioliquids section below, bioliquids will not be eligible for support under the mid-range or high-range co-firing bands. Energy crops will be eligible for support under these bands, including liquid fuels made from energy crops. **However, we have decided not to provide an energy crop uplift for the mid-range or high-range co-firing bands. We will provide the option of a CHP uplift for new accreditations and additional capacity added from1 April 2013 to 31 March 2015. We confirm that we will adopt a policy of grandfathering support under the mid-range co-firing band from 1 April 2013.**

9.50 In order to allow stations that co-fire in the high-range in 2013/14 to benefit from the increase in support from 1 April 2014 for high-range co-firing, **we have decided to adopt a policy of grandfathering support under the high-range co-firing band from 1 April 2014, at 0.9 ROCs/MWh.** The increase in support to 0.9 ROCs/MWh will apply to all stations which co-fire in the high-range from 1 April 2014, including those stations which previously received 0.7 ROCs/MWh for high-range co-firing in 2013/14.

9.51 Grandfathering of support under the mid-range and high-range co-firing bands recognises that such levels of renewable electricity generation require significant investment and development over several years and therefore surety on return on investment over an extended period of time. Grandfathering is subject to the

generating station meeting the proposed advance registration requirements, set out below, that will be the subject of further consultation. A station which fails to register for the relevant co-firing band by the required date may cease to be eligible for support under that band for the following obligation period.

9.52 Furthermore, grandfathering policy for the mid-range and high-range co-firing bands will apply on a unit by unit basis (not a station wide basis) and will be based on the date a unit becomes eligible for the relevant band (not the date of accreditation). Grandfathering is also subject to the biomass meeting any applicable sustainability criteria as updated from time to time.

9.53 At the low-range (standard) co-firing level, it is relatively easier to vary the level of biomass used on a day to day basis, depending on coal and biomass prices. The lead time to convert or to increase levels of co-firing is also shorter than many other renewable technologies, generally less than a year, meaning that the Government will have little advance notice of a generating station's intentions. This uncertainty in terms of renewable electricity generation and level of RO spend will make it difficult to determine both budgetary pressures and the level of the yearly Obligation. The Government therefore needs to improve its foresight of plans for conversion and all levels of co-firing. **We therefore propose to introduce further cost control mechanisms under the RO for the co-firing and conversion bands. We will shortly consult on the detail of these with the intention of implementing them in time for the 2014/15 Obligation period.**

9.54 Generators wishing to have a unit supported under a co-firing or biomass conversion band will be asked to 'register' that unit for their intended band, by 1 May in advance of each Obligation period in which they expect to generate. For example, they would have to register by 1 May 2013 for generation in 2014/15. A unit which registered under the biomass conversion band would only need to be registered once unless it was intended to downgrade the unit to co-firing. Generators may also register an entire station for the biomass conversion band.

9.55 Generators will be required to provide a range of information when they register a unit, such as:

- The date conversion or co-firing is expected to start for each unit,
- The band that unit will operate within,
- For co-firers (for each unit):
  - the percentage of biomass they intend to operate at on a monthly basis (particularly relevant for those intending to gradually increase their percentage biomass to reach a higher band),
  - energy inputs (renewable and fossil fuels) to each unit, energy outputs from each unit and load factor.

9.56 Generators converting the entire plant will need to provide the same information, although on a plant-wide basis.

9.57 The Government will issue a public consultation on these proposals shortly.

Biomass co-firing (standard)

Introduction

9.58 Standard co-firing of biomass is currently eligible to receive 0.5 ROCs/MWh under the RO. For the purposes of the consultation it was assumed that standard co-firing would involve combusting no more than 15% biomass by energy content across a fossil fuel power station.

9.59 Arup's analysis shows that the costs of standard co-firing are significantly lower than for enhanced co-firing and biomass conversion, as relatively little adaptation is required to enable plant to burn small amounts of biomass alongside coal. The Arup report anticipates the cumulative installed capacity of standard co-firing to decrease from 2.2 GW in 2011 to around 1.2 GW in 2020 on the central and low scenarios, and to zero on all scenarios by 2025.

9.60 The consultation proposed maintaining support for standard co-firing at 0.5 ROCs/MWh and to maintain the policy of not grandfathering this level of support.

Main messages from responses

9.61 Respondents to the consultation made the following points:

- 0.5 ROCs/MWh is appropriate in the context of higher support for enhanced co-firing and biomass conversion.
- 0.5 ROCs/MWh is not sufficient to incentivise co-firing.
- Co-firing should not be supported under the RO due to its negative environmental impact.
- Grandfathering is required to provide investor certainty.

9.62 Annex A provides a summary of responses to the questions on standard co-firing (questions 31 to 33).

Post-consultation decision

Level of support

9.63 With the introduction of a biomass conversion band and our intention to differentiate support for different levels of co-firing, the concept of standard co-firing has necessarily changed. As set out in paragraphs 9.41, 9.42 and 9.48 above, **standard co-firing will be defined as representing combustion at less than 50% biomass by energy content in a unit and we will consult on a level of support of 0.3 ROCs/MWh in 2013/14 and 2014/15, increasing from 1 April 2015 to 0.5 ROCs/MWh.**

9.64 For the purposes of consistency, we are adopting a unit by unit approach. It is our intention that, in line with the proposed requirements set out in paragraphs 9.53 to 9.57 generators will need to register their intention to co-fire.

9.65 As set out in the bioliquids section below, bioliquids (including fossil derived bioliquids) will be eligible for support under the standard co-firing band. **We will consult on removing the energy crop uplift for this band, but with some arrangements to keep the uplift for a limited period for those stations that currently standard co-fire with energy crops**. We will provide the option of a CHP uplift for new accreditations and additional capacity added from 1 April 2013 to 31 March 2015 by a qualifying CHP generating station.

Dedicated biomass

Introduction

9.66 The Committee on Climate Change's *Bioenergy Review* recommended that there should be limited support for new build large-scale dedicated biomass and that any near-term investment via the RO should be limited to conversion and co-firing. They also recommended that the minimum greenhouse gas emissions intensity limit should be reduced from 285 to 200 gCO_2eq/kWh. The Government's subsequent *Bioenergy Strategy* recommended that our focus should be on technologies which deliver the most cost-effective carbon reduction.

9.67 The consultation proposed taking a cautious approach to the support for dedicated biomass electricity, looking to bring forward only the most cost-effective potential, setting support for dedicated biomass at 1.5 ROCs/MWh until 31 March 2016, reducing to 1.4 ROCs/MWh for new accreditations (and additional capacity added) after 31 March 2016. The Government's modelling suggested that 1.5 ROCs/MWh would bring forward only small-scale dedicated biomass plants below 50 MW. This approach was aimed at managing the risks associated with long-term lock-in of feedstock demand in this sector compared to potentially more cost-effective ways of meeting wider longer term government objectives through alternative uses of biomass.

9.68 The consultation also sought views on biomass fuel price assumptions for domestic and imported fuel, and the use of an average 10:90 domestic to imported ratio for large (>50 MW) dedicated biomass and 90:10 ratio for small (<50 MW) dedicated biomass generators.

Main messages from responses

9.69 The following points were made by respondents to the consultation:

- The costs for smaller scale (<50 MW) projects are underestimated.
- The proposed reduction in support to 1.4 ROCs/MWh would be challenging and would halt projects rather than bring them on early.
- The proposed support would only bring on the most cost-effective and advanced projects.

- The proposals would encourage more projects to look at CHP as an option.
- Support should be limited to domestic sources of biomass.
- Support for domestic biomass should be reduced.
- Respondents provided a variety of views on fuel price assumptions and the ratio of import to domestic feedstocks but there was no consensus view.

9.70 A summary of responses to the questions on dedicated biomass is provided at Annex A (questions 34 to 37).

Post-consultation decisions

Level of support

9.71 Following the advice of the CCC and the Government's *Bioenergy Strategy*, we intend to retain a cautious approach to new build dedicated biomass. The focus going forward will be on ensuring that we deliver long-term cost-effective carbon reduction from use of biomass in electricity generation. **The support levels for dedicated biomass will be set at 1.5 ROCs/MWh from 1 April 2013 to 31 March 2016, degressing to 1.4 ROCs/MWh for new accreditations and additional capacity added after 31 March 2016.**

9.72 We do not agree that support should be limited or reduced on the basis of whether the biomass is sourced domestically or internationally as this is neither practical nor effective – it would impact most heavily on small-scale projects reliant on dedicated supply chains providing locally-sourced material who do not have the option of switching to alternative, international sources of material.

New proposals for a cap on the amount of new build dedicated biomass

9.73 At 1.5 ROCs/MWh the Government considers there is still a risk that there could be more deployment than the original analysis envisaged, both risking the RO budget and our policy intentions on dedicated biomass.

9.74 **The Government therefore intends to consult on introducing a supplier cap on dedicated biomass to limit the amount of new build supported under the RO**. Legal powers already exist to put in place a cap on the proportion of their renewables obligation that suppliers can meet using ROCs issued for electricity generated from dedicated biomass.

9.75 It is not our intention to stop 'shovel-ready' projects, notably those projects that can reach financial close this year. The cap would therefore be set above a level that allows: consented projects that can reach financial close and start construction during the current financial year to be accommodated within the cap. We also recognise that setting a cap introduces uncertainty into the market and could have the effect of depressing the ROC value of dedicated biomass. We wish to avoid these impacts as much as possible. We will therefore consult on the basis that the cap would be set on the percentage of their obligation that suppliers can meet with that technology to the equivalent of 800MW-1GW new build. The cap will not apply to dedicated biomass generation accredited before April 2013.

9.76 We propose to exempt from the cap qualifying CHP plants as these are more efficient than electricity-only plants and offer greater value in terms of carbon reduction.

9.77 In order to ensure that any new build is able to deliver significant emissions savings, from 2013 **we propose to set a new minimum emissions standard of 240 gCO_2eq/kWh for new build dedicated biomass stations which use solid or gaseous biomass.** The Government is aware that the best 'shovel-ready' projects can meet this standard.

9.78 We propose that eligibility for this band for stations of 1 MWe generating capacity and above will be conditional on meeting the sustainability criteria, including the new emissions standard from 2013. Plants which are intending to use wastes and agricultural residues, such as chicken litter, straw and waste wood should be able to meet the standard. We propose that solid and gaseous wastes should be exempt from the emissions intensity standards as they are already exempt from reporting against the criteria.

9.79 We will reinforce our policy intent by consulting on a trajectory for increased emissions savings from the use of solid and gaseous biomass, with the next step due to be applied in April 2020. If it is to have a future, the biomass electricity industry needs to meet tighter emissions standards. Setting out a plan now will allow the industry to develop feedstock supply chains that can meet the new requirements.

9.80 **We will consult shortly on these proposals for a cap and for minimum GHG savings.**

Other decisions

9.81 We have decided to exclude certain former fossil fuel generating stations from the dedicated biomass band. Stations will also permanently cease to be eligible for the dedicated biomass band if they use more than 15% fossil fuel over a 6 month period. Full details are set out in the biomass conversion section above.

9.82 We have decided **to retain the energy crop uplift for the dedicated biomass band, and to provide the option of a CHP uplift for new accreditations, and additional capacity added, from 1 April 2013 to 31 March 2015** for qualifying CHP stations.

Bioliquids

Introduction

9.83 The Government's intention is to provide support for bioliquid electricity generation at a level which is unlikely to cause a significant diversion from other key sectors, such as transport, and within the limits of sustainable supply.

9.84 Evidence to date demonstrates that much of the bioliquids currently used for electricity generation are from sources such as wastes, and are making a valuable contribution to renewable energy targets. They also deliver greenhouse gas emissions savings and provide other environmental benefits. However, the use of bioliquids, when produced in an inappropriate way, may lead to unintended effects

such as loss of biodiversity and release of soil carbon from direct and indirect land use change. The Government therefore intends to take a cautious approach.

9.85 The consultation proposed that bioliquids and fossil-derived bioliquids should be supported at the same level as solid biomass under the standard co-firing, enhanced co-firing, biomass conversion and dedicated biomass bands.

9.86 The consultation also proposed that electricity suppliers may meet up to 4% of their annual renewables obligation over the banding review period using bioliquid ROCs. This is broadly equivalent to 2 TWh/year in 2017, equivalent to the Government's estimate of the amount of electricity that can be generated from bioliquids without diverting supplies from other sectors.

9.87 Support for bioliquids has not been grandfathered to date, in order to ensure that the use of bioliquids for electricity generation does not adversely affect other sectors in which renewable liquid fuels should be prioritised. The Government proposed that the levels of support for bioliquids were consistent with this aim and the consultation therefore proposed that, from 1 April 2013, bioliquids should be covered by the grandfathering policy in the same circumstances as solid and gaseous biomass.

9.88 In addition, the consultation set out additional bioliquid sustainability reporting criteria resulting from a European Commission Decision.[20]

Main messages from responses

9.89 Responses to the consultation included the following points:

- The cost of bioliquid electricity would serve to constrain the use of bioliquids in the RO without a cap.
- A cap on bioliquids is an important measure to ensure that liquid renewable fuels are prioritised in the transport sector.
- A cap will make it harder for small-scale dedicated bioliquid stations to sell ROCs at the going rate and secure finance for new builds.
- Bioliquid electricity generation can be achieved at lower cost than proposed in the original analysis, depending on the type of bioliquid used and the way in which the feedstock is collected and processed.
- 1 ROC/MWh support for enhanced co-firing would increase the types of biomass feedstocks available to co-firers and could risk a large proportion of the bioliquids cap being used by an enhanced co-firing plant.

9.90 Annex A provides a summary of responses to the questions on bioliquids (questions 38 to 43).

[20] Commission Decision of 12 January 2011 on certain types of information about biofuels and bioliquids to be submitted by economic operators to Member States (2001/13/EU). See: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:009:0011:0012:EN:PDF

Post-consultation decisions

Level of support

9.91 **The Government has decided to support bioliquids and fossil-derived bioliquids at the same level as solid biomass for the biomass conversion and dedicated biomass bands.**

9.92 The Government recognises that if a high volume of bioliquids are used in the co-firing bands, other technologies which rely on a dedicated bioliquid fuel may be disproportionately affected by the cap. This is because dedicated bioliquid suppliers will rely on those companies with a larger portfolio of renewable energy supply to meet the 4% bioliquids cap. These companies may be less willing to buy bioliquid ROCs, or pay the full price for bioliquid ROCs, in the event that they meet the bioliquid cap through co-firing, or that the cap is breached. As a consequence, it may make it harder for new dedicated bioliquid stations to get financial support.

9.93 **The Government therefore has decided that all co-fired bioliquids (other than those derived from energy crops) be supported at the standard co-firing rate. We will consult on a level of support for standard co-firing of 0.3 ROCs/MWh in 2013/14 and 2014/15, with support increasing from 1 April 2015 to 0.5 ROCs/MWh.** This means that when bioliquids are co-fired in a unit which uses less than 100% biomass, electricity generated from co-firing the bioliquid would get 0.3 ROCs/MWh in 2013/14 and 2014/15 or 0.5 ROCs/MWh from 1 April 2015, regardless of whether the unit is co-firing at a low-range, mid-range or high-range. Where the co-firing station is eligible, the 0.5 ROC uplift for CHP, in addition to prevailing ROC support, will be available to new accreditations until 31 March 2015.

Grandfathering support for bioliquids

9.94 To ensure consistency across technologies, and as proposed in the consultation document, **from 1 April 2013 the grandfathering policy will be extended to bioliquid generators under the dedicated biomass and biomass conversion bands.**

9.95 In light of our proposal to limit support for all standard co-firing of biomass at 0.3 ROCs/MWh in 2013/14 and 2014/15, with support increasing from 1 April 2015 to 0.5 ROCs/MWh, and given the context where support for standard co-firing is not grandfathered, the grandfathering policy will not be extended to cover co-firing of bioliquid in a unit.

Bioliquids cap

9.96 Although the Government understands that a cap imposes additional risks to dedicated bioliquid stations which may have an effect on the level of deployment (even if the cap is not breached), we consider that a cap on bioliquids is an appropriate additional measure to constrain the use of bioliquids in the RO. This cautious approach reflects the high level of uncertainty over the availability of bioliquids which do not have applications as transport fuels.

9.97 **We have therefore decided to impose a cap on the number of bioliquids ROCs at 4% of a supplier's annual obligation.** The Government considers that this level is appropriate as a higher cap would increase the risk that bioliquids which are better suited as transport fuels are used to generate electricity under the RO.

9.98 In addition to exemptions from the cap proposed in the consultation (relating to Energy from Waste with CHP and Advanced Conversion Technologies), the Government has identified two further exemptions to the cap – microgenerators and qualifying combined heat and power (CHP) generating stations below 1 MWe. The rationale for these decisions is explained below.

Exemption for microgenerators (50 kW or less declared net capacity)

9.99 The Government recognises that microgenerators are subject to high administrative burdens and relatively high costs. Exempting microgenerators would enable them to sell the ROCs they are issued independently of the cap constraint, thereby providing benefits to this sector.

9.100 The number of bioliquid microgenerators is currently very low and the Government does not consider this exemption would make a significant impact on sustainability or use of bioliquids in other sectors.

Exemption for qualifying CHP <1 MWe

9.101 Exempting CHP at all scales could include large-scale co-firing technologies and result in high deployment of bioliquids, which the Government considers would be inappropriate as it would undermine the aim of the cap. However, exempting qualifying CHP generating stations below 1 MWe total installed capacity should not have a significant effect on the application of the cap overall while reducing a potential barrier to deployment of this technology. To benefit from the exemption, the CHP station will need to be certified under the CHPQA.

Bioliquid sustainability audit report

9.102 In the absence of comments from consultees on this point, the Government has decided that the additional reporting requirements set out in Commission Decision 2011/13/EU will be included in the RO Order.

Sustainability criteria

Introduction

9.103 The consultation proposed that existing generators should not be exempted from future changes to the UK's sustainability criteria for solid and gaseous biomass and outlined a number of reasons to support this position, including:

- To ensure that possible future changes to the European Commission's requirements for solid and gaseous biomass sustainability can be applied equally to all biomass generators.

- To ensure a level playing field for those buying and selling biomass feedstocks if amended sustainability criteria are introduced in future.

Main messages from responses

9.104 A range of views were provided in response to the consultation question, including:

- Government needs to provide greater certainty on the specific sustainability criteria that will apply over a set timescale to support investment in biomass power and biomass supply-chains cannot happen.
- Future changes to sustainability criteria could impact generators' future income if they are committed to using feedstocks that cannot meet the new criteria.
- Sustainability criteria should be grandfathered for 20 years from the point of accreditation, with changes to the criteria only applying to new generating capacity.
- Specific feedstock contracts should be grandfathered over their contractual lifetime.
- Generators should be allowed to 'bank' greenhouse gas emission reductions achieved in addition to the target to help manage future risks.
- Government should provide the longest possible notice period for any changes to the criteria, ideally in steps (e.g. every 5 years).
- Sustainability criteria should be made wider and tougher in scope, to reflect the UK's carbon reduction ambitions to 2030 and 2050.
- Changes to criteria need to be done in a way that ensures the playing field for generators remains level and is not tilted in favour of large, early movers.

9.105 Annex A provides a summary of responses to the question on biomass sustainability criteria (question 18). In addition, Annex B provides the Government's response to the replies from campaign groups on the issue.

Post-consultation decision

9.106 The Government recognises the importance to generators and the biomass supply chain for the criteria to remain clear with any proposed changes signalled in advance. We also recognise that the criteria need to be improved over time to ensure biomass electricity helps deliver the 2050 emission reduction target in a sustainable way.

9.107 Having considered the responses to the consultation, **the Government proposes to introduce improved sustainability criteria which, to encourage a level playing field, would be applied to existing as well as new biomass generation. The improved criteria would be fixed for all generators until April 2020 – subject to any changes which need to be introduced at any time to comply with EU or international obligations.**

9.108 The Government will shortly publish a consultation which sets out details of proposed improvements to the sustainability criteria. These proposals are designed to offer increased financial certainty alongside increased environmental ambition. They include the addition of sustainable forest management criteria, enhanced monitoring and reporting and limited grandfathering.

9.109 The 'limited grandfathering' proposal entails fixing the sustainability criteria applied to biomass generation from 2013 to March 2020 and consulting to set the tighter emissions standard to apply from April 2020 to March 2025. This means that generators would not only have the increased certainty needed to sign feedstock supply contracts, but also the notice period needed to work with their supply-chains to achieve a tighter GHG target from 2020.

9.110 For all existing biomass power plants whether dedicated, co-firing or conversion and new plants that are coal to biomass conversions or standard/enhanced co-firing, we propose that a 285.12 gCO_2eq/kWh emissions standard should apply until 31 March 2020. This target equates to 60% of emissions savings compared to the EU fossil fuel average. We know some biomass generators already have feedstock contracts in place based on the 285.12 GHG target, and we do not want to unduly disrupt these. We consider an 8 year notice period should allow many of these contracts to be completed ahead of the planned tightening of the target in 2020.

9.111 However, in order to ensure that new-build dedicated biomass plant is able to deliver cost-effective emissions savings, we propose to put dedicated biomass plants with or without CHP that are accredited on or after 1 April 2013 on an accelerated trajectory of 240 gCO_2eq/kWh from 2013 to 31 March 2020. We are aware that the best shovel-ready projects can meet this standard.

9.112 The consultation will also seek evidence to help inform the setting of the tighter emissions standards that will apply between April 2020 to March 2025.

Biomass purity threshold

Introduction

9.113 Biomass is currently defined under the RO legislation as needing to be at least 90% by energy content derived from plant or animal matter.[21] This level was set based on concerns that it was not practical to achieve higher levels of purity for some types of high biomass content material and wastes which could contain small levels of fossil-based contaminants which cannot be easily removed. Where users of wastes are able to achieve this threshold, generators can be classified as a dedicated biomass plant rather than an energy from waste plant and so receive a higher commensurate level of support.

9.114 The Government has received representations from users of waste-derived biomass that the 90% rate is too high and is preventing significant quantities of high content

[21] The precise definition of 'biomass' is set out in article 4 of the Renewables Obligation Order 2009.

biomass materials, especially waste wood, from being used in energy generation. However, evidence from some generators suggests that the 90% rate is working satisfactorily and is often being exceeded. The consultation therefore asked for comments and evidence on whether the 90% biomass purity threshold is still appropriate.

Main messages from responses

9.115 The following points were made by respondents to the consultation:

- An 80% threshold is more appropriate for mechanical biological treatment.
- The threshold should be lowered to 80% for biomass conversions.
- The amount of ROCs awarded should be on a sliding scale dependent on biomass content.
- An 85% threshold is more appropriate for contaminated waste wood. Lowering the threshold would stimulate greater diversion from landfill or more difficult material and reduce costs associated with meeting purity levels.
- It is not the threshold but the tolerance levels allowed in the sampling, monitoring and reporting requirements which cause compliance issues.

9.116 Annex A contains a summary of responses to the question on biomass purity (question 19).

Post-consultation decision

9.117 Purifying wastes to a level of 90% biomass involves expense and can be a technical challenge. This is recognised by providing a commensurate level of support. The Government can see that there is some merit in considering lowering the biomass purity threshold in certain circumstances, for example to allow more category 3 and 4 waste wood. However, this must be balanced against the risk that this could encourage less re-use and re-cycling of waste wood. The Government does not consider it appropriate to lower the threshold for biomass conversions. The introduction of a sliding scale would negate the purpose of the purity threshold and would make the ROC bands very difficult to monitor and administer.

9.118 **For these reasons the Government has decided not to alter the current threshold for biomass purity.** As a consequence of the decision to support all fossil derived bioliquids under the same bands as other bioliquids, fossil derived bioliquids will not need to meet the 90% biomass purity threshold.

10. Energy from waste with combined heat and power

Introduction

10.1 The generation of energy from the biogenic content of waste through combustion with combined heat and power (EfW CHP) is a highly efficient renewable technology that offers significant carbon savings. As with dedicated biomass, it is dispatchable in that generation is controllable and predictable.

10.2 The Government sought views on the Arup assessment of costs and potential for EfW CHP and on the proposed level of support – 0.5 ROCs/MWh – for new accreditations and additional capacity added during the banding review period. EfW CHP currently receives 1 ROC/MWh.

10.3 In addition, the consultation called for evidence as to whether any other types of wastes besides municipal solid waste (MSW) could benefit from provisions deeming their biomass content, or benefit from more flexible fuel measurement and sampling procedures.

Main messages from responses

10.4 The following responses were received on each of the main issues consulted on:

- Arup's assessment of costs and deployment potential:
  - Loss of power revenue in CHP should be modelled based on an industrial heat customer.
  - The maximum build rates and waste arisings are too low.
  - Capital costs and operating costs are too low.
  - It is difficult to guarantee projected heat revenues.
  - Gate fee assumptions are too high and do not take account of additional transport costs due to being sited near a heat customer.
- Proposed level of RO support:
  - Uncertainty on the RHI means that developers prefer continued support under the RO.
  - If levels of support were dropped there would be significant additional cost to the public purse, due to compensation for local authority contracts.
  - The proposed support level will result in EfW power-only plants being built.
  - There has been little uptake of EfW CHP at 1 ROC/MWh and 0.5 ROCs/MWh will compound low deployment.
  - The level of support should be based on efficiency measures across all EfW technologies to incentivise efficiency.
  - On deeming wastes and fuel sampling respondents noted that:
  - Deeming is a useful approach for MSW as it provides plants with an effective way of ensuring the renewable content is recognised.

- Deeming should be extended further beyond MSW, for example to refuse derived fuel (especially where the fuel is derived from MSW) and to commercial and industrial waste.
- Measuring biogenic output, specifically via the carbon-14 methodology, is a more accurate way to determine the amount of renewable energy generated for the purposes of claiming ROCs rather than deeming.

10.5 Annex A provides a summary of responses to the questions on EfW CHP (questions 44 to 46).

Post-consultation decisions

Level of support

10.6 For EfW CHP a reduction was proposed from 1 ROC/MWh to 0.5 ROCs/MWh. Revised analysis based on consultation responses shows that on a relative basis in comparison to EfW power only, EfW CHP requires around 1 ROC/MWh to be economically viable. **Given the revised evidence and the desire to increase deployment of EfW CHP, the Government has decided to maintain support at 1 ROC/MWh.**

10.7 As CHP is a pre-requisite for EfW to gain support under the RO, instead of an uplift the band will remain open to new EfW CHP until 31 March 2017. At present, EfW CHP plant accredited under the RO is ineligible for support under the RHI. Existing and new EfW CHP plant which choose not to accredit under the RO may be eligible to receive support for their heat outputs from the RHI (subject to compliance with that scheme's conditions).

Deeming waste and fuel sampling

10.8 Having considered the consultation responses, the Government believes that the carbon-14 (C14) methodology would be a more effective and accurate way of measuring renewable energy output than deeming. C14 is now recognised by Ofgem as a suitable fuel sampling methodology for RO eligibility.

10.9 The Government is aware that to date there has been little interest in pursuing with Ofgem the C14 methodology. Last year, the Government undertook an initial phase of research into input and output fuel sampling methodologies. The Government will be commissioning a short research and engagement project to evaluate the findings of the feasibility trials and recommend whether there is a further role for the Government and Ofgem in providing support to bring more accurate fuel measurement techniques to market.

10.10 In response to calls for extending deeming further, the Government does not consider that sufficient evidence was provided to introduce deeming beyond MSW at this stage. In order to ensure correct levels of deeming are appropriate the Government considers there would need to be more robust evidence gathered on the levels of biogenic content in different waste streams and research on how origins of refuse-derived fuels can be accurately apportioned. Alongside the further work on fuel sampling, DECC, Defra and Ofgem will consider whether there would be merit in

dedicating resource to establish national protocols for deeming other waste streams, or whether improvements and cost reduction in fuel sampling will negate the need.

11. Anaerobic digestion

Introduction

11.1 The Government is committed to increasing the deployment of energy from waste through anaerobic digestion (AD). The technology is currently under-developed mainly due to relatively high capital costs and to the challenges of securing feedstocks and finance.

11.2 In order to continue bringing forward larger scale AD plants under the RO, the consultation proposed maintaining support for AD at 2 ROCs/MWh until 31 March 2015 and then to reduce it to 1.9 ROCs/MWh for new accreditations (and additional capacity added) in 2015/16 and to 1.8 ROCs/MWh in 2016/17.

Main messages from responses

11.3 The following responses were received on each of the main issues consulted on:

- Arup's assessment of costs and deployment potential:
  - AD plants' costs vary greatly according to size and whether they process food or farm waste.
  - Costs will not degress over time as predicted.
  - Gate fees are expected to fall significantly over time and could reach zero.
  - Deployment figures are too low as they are based only on manures and food wastes and do not take account of agricultural residues, grasses and purpose-grown crops.
- Level of support:
  - There should be no degression, in order to stimulate development of an immature market.
  - Support should be aligned with support levels in Northern Ireland.
  - AD with CHP should receive a 0.5 ROC/MWh uplift.
  - The proposed support level is too high as AD is rapidly becoming an established technology and support is disproportionate to its costs.
  - No ROCs should be available until improved sustainability criteria are enforced.
- Other main comments:
  - Support should not disincentivise the use of specific types of feedstock, or mix of feedstocks.
  - AD should focus on the use of waste materials.
  - The Government should create a positive regulatory environment for source-segregated collection of food waste for AD.
  - The Government should encourage AD to produce biomethane for injection into the gas grid.

11.4 Annex A provides a summary of responses to the consultation questions regarding AD (questions 47 and 48).

Post-consultation decisions

Level of support

11.5 The Government sees an important role for AD as part of the renewable energy mix and **has decided to set support for AD at 2 ROCs/MWh in 2013/14 and 2014/15, reducing to 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs/MWh for new accreditations and additional capacity added in 2016/17.**

11.6 The Government does not consider that there was enough evidence provided to justify increasing the support for AD nor to further decrease support levels given the relative immaturity of the market. AD will receive support in line with the highest level of support offered under the RO (with the exception of wave and tidal stream). Therefore, AD with CHP will not be eligible for extra support under the RO (i.e. no CHP uplift). However, in some cases the heat output from AD with CHP may be eligible for support under the RHI (subject to compliance with that scheme's conditions and limits).[22]

11.7 Due to the lack of robust data for different types and sizes of plant, separate support bands for different feedstocks and different sizes of plants have not been calculated. However, the FITs scheme does provide separate support bands to bring on the smaller plants, with different tariffs for plants up to 250 kW, between 250 to 500 kW, and those up to 5 MW.

11.8 The Government will shortly consult on proposals to exclude from the RO new AD projects of 5 MW and below that are currently eligible for support under either the RO or FITs scheme. Installations above 50 kW and up to 5 MW that are accredited under the RO before 1 April 2013 would be allowed to remain in the RO.

Feedstocks

11.9 The Government has a commitment to increase the generation of energy from waste through AD and wants limited publicly funded incentives to prioritise the use of this abundant feedstock. Support for AD is not restricted to the use of waste and the Government recognises that some purpose-grown crops may be necessary to improve the efficiency, stability, and in some cases the viability, of digesters using mainly slurry and manures. However, there are concerns about the potential for localised impacts from such crops due to, for example, soil and fertiliser run-off and habitat loss.

11.10 The Government is therefore working with industry and environmental groups to agree a voluntary code of practice for AD operators using purpose grown crops, with the aim of avoiding or mitigating these environmental risks. However, if evidence

[22] Under the current RHI arrangements, only biogas combustion installations with a capacity under 200 kWth are eligible for support and this is recognised as a potential issue. In September 2012 DECC will launch a consultation containing proposals on the expansion of the RHI to include forms of renewable heating which currently receive no support.

emerges that this voluntary approach is not achieving its aims, the Government will evaluate other options including a regulatory approach which may include limiting future eligibility for RO support to AD plants that treat wastes. This is in line with similar commitments given under the FITs scheme.

Food waste supply chains

11.11 The Government is clear that landfill should be the last resort for most waste. Our long term vision is that no food waste should go to landfill. Source segregated collection could help increase the amount of food waste available for AD and the number of such collections is increasing. The Waste Resources and Action Programme have set up a £500,000 challenge fund to demonstrate to business the advantages of food waste collections. Government, the Devolved Administrations and the hospitality and food service sector launched a voluntary agreement on 27 June 2012 to prevent waste and to manage the waste that does arise more sustainably. Both of these initiatives have the potential to increase the amount of feedstocks available for AD. However, whether local authorities wish to collect food waste separately is a matter for them, taking into account local circumstances such as local logistics, the characteristic of the area and providing the services that people in their locality want.

Biomethane

11.12 The Government is keen to facilitate the injection of biomethane into the national gas grid, although there are a number of barriers to take-up, as acknowledged in the *Anaerobic Digestion Strategy and Action Plan* and the *UK Renewables Roadmap*, which set out the actions being taken to tackle these barriers.[23] The Government is looking to simplify the regulatory regime by introducing an exemption from holding a gas transporter licence for AD operators and will work with Ofgem to address the recommendations set out by Energy Market Issues for Biomethane Injection Group.[24] Together, these measures should encourage biomethane injection through the RHI which provides support for injection at all scales.

[23] Defra (2011) *Anaerobic Digestion Strategy and Action Plan.* available at: www.defra.gov.uk/publications/files/anaerobic-digestion-strat-action-plan.pdf.
DECC (2011) *UK Renewable Energy Roadmap.* Available at: www.decc.gov.uk/assets/decc/11/meeting-energy-demand/renewable-energy/2167-uk-renewable-energy-roadmap.pdf
[24] See: www.gasgovernance.co.uk/emib/report.

12. Advanced conversion technologies (gasification and pyrolysis)

Introduction

12.1 Advanced conversion technologies (ACTs) have the potential to deliver more efficient generation in the long term and have the potential to deliver further benefits beyond renewable electricity generation.

12.2 The consultation proposed replacing the current calorific value (CV) based standard and advanced pyrolysis and gasification bands with two new ACT bands ('standard ACT' for steam-cycle technologies and 'advanced ACT' for internal combustion technologies). Standard ACTs would receive 0.5 ROCs/MWh for new accreditations and additional capacity added over the banding review period while advanced ACTs would receive 2 ROCs/MWh for new accreditations and additional capacity added between 1 April 2013 to 31 March 2015, falling to 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs/MWh in 2016/17. The consultation also proposed widening the range of fuels eligible for the ACT bands.

12.3 The Government also sought evidence from consultees on:

- The generation costs, deployment potential and gate fees for the proposed new bands.
- The nature and scale of actual or potential air emissions produced in the generation of electricity from pyrolysis oil.

Main messages from responses

12.4 The following responses were received on each of the main issues consulted on.

- The main reasons for preferring the proposed definitions are that they:
  - Are more straightforward for administration and investment purposes.
  - Reduce the cost of compliance compared to the existing definitions.
  - Better encourage efficient plants than the existing definitions.
  - Would not encourage use of plastics to increase the input material's CV, unlike the existing definitions.
- The main reasons for disagreeing with the proposed definitions are that they:
  - Do not necessarily support more efficient plants as some steam cycle processes can have higher efficiency than some gas engine processes;
  - Could impact on jobs and damage a nascent industry as they have been implemented in too short a timescale;

- Do not allow for innovative technologies like fuel cells.

- Other suggestions on definitions:
  - The Government should consider an efficiency-based classification.
  - The Government should differentiate between the type of waste processed, rewarding those taking more biogenic content.

- Arup's assessment of costs and deployment potential:[25]
  - Capex and opex are too low.
  - Gate fees are based on raw municipal solid waste (MSW) when most ACTs need a more refined fuel with lower gate fees.
  - Deployment rates and waste arisings are too low.

- Levels of support:
  - Degression could be an issue for advanced processes given the immaturity of the technology.
  - There should be equal support for all ACTs.
  - There should be no support for ACTs as they are only a partially renewable technology.
  - Standard ACTs should be supported at the same level as biomass.

12.5 See Annex A for a summary of responses to the questions on ACTs (questions 49 to 53).

Post-consultation decisions

Level of support

12.6 Having considered responses to the consultation, the Government recognises that the analysis underpinning the consultation proposals was based on limited cost data that did not fully reflect the characteristics of projects in the pipeline. **In the light of the consultation responses, and additional evidence provided on costs and deployment potential, the Government has decided to introduce a single band for new ACT generating capacity. Support under the ACT band will be 2 ROCs/MWh for new accreditations and additional capacity added in 2013/14 and 2014/15, reducing to 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs/MWh for new accreditations and additional capacity added in 2016/17.**

12.7 ACTs will receive support in line with the highest level of support offered to other technologies under the RO (with the exception of wave and tidal stream). Therefore, ACTs with CHP will not be eligible for extra support under the RO (i.e. no CHP uplift); however, in some cases the heat output from ACTs with CHP may be eligible

[25] To take account of these issues, an entirely new set of project data for 42 projects was submitted during the consultation process, collated and analysed by the National Non-Food Crop Centre.

for support under the RHI (subject to compliance with that scheme's conditions and limits).[26]

Definitions for the new ACT band

12.8 The Government considered whether to introduce the proposed standard 'steam cycle' and advanced 'gas engine' definitions. Analysis by the National Non-Food Crops Centre (NNFCC), based on energy balance information provided, showed that on average steam cycle processes are less efficient than gas engine processes even taking into account the parasitic load required for the use of plasma (although the Government recognises the issues in measuring efficiency fairly across different processes).

12.9 Based on project information, it is also clear that several plants currently using steam cycle generation can reach high efficiencies and be considered innovative and, with improvements in syngas clean-up, have the potential to progress to gas engines without the need for plasma, as well as deliver a wider range of low carbon energy outputs beyond power generation. The Government therefore believes that, based on both cost data and policy aims, there is not a strong rationale for adopting the 'standard ACT' and 'advanced ACT' bands proposed in the consultation.

12.10 The Government considered whether to retain the existing CV-based definitions. It was felt that there could be a risk of perverse incentives (e.g. increasing CV with higher plastic content, which could replace biogenic content and encourage deviation from the waste hierarchy, or use of additional oxygen blown process that could unnecessarily increase parasitic load) without any net benefit to renewable generation.

12.11 As all projects that the Government is aware of could meet the CV threshold and qualify for the advanced band without increasing renewable generation, it is felt that the criteria is not helpful in meeting policy aims. It can also add significant cost of compliance for industry. Therefore, the Government believes there is not a strong rationale for continuing with a CV-based measure to differentiate between standard and advanced ACTs for new stations.

12.12 On a proposed efficiency-based measure the NNFCC undertook a feasibility assessment in order to inform the Government's position.[27] The report shows that it would be difficult to introduce a system that could work fairly for waste technologies because of issues on setting the fuel input and output boundaries, particularly on accounting for waste pre-treatment and the impact of variable waste streams. It would also take 10-12 months to implement and would be costly to both set up and

[26] Support is not available under the RHI for heat produced using liquid fuels. Under the current RHI arrangements, only biogas combustion installations with a capacity under 200 kWth are eligible for support and this is recognised as a potential issue. In September 2012 DECC will launch a consultation containing proposals on the expansion of the RHI to include forms of renewable heating which currently receive no support.

[27] The feasibility assessment is published alongside this Government response.

administer. In addition, the Government believes that the award of ROCs should themselves encourage efficient generation.[28]

12.13 Whilst the post-consultation assessment concludes that it is currently too early in the maturation stage of the industry to treat technologies differently, a further assessment of ACTs will be undertaken in preparation for the introduction of the Electricity Market Reform (EMR) programme. The Government will work with stakeholders to ensure that ACTs are defined to further incentivise cost-effective deployment of the most innovative, efficient and renewable generation under the EMR CfD regime.

12.14 In accordance with the Government's grandfathering policy, generating capacity receiving support before 1 April 2013 under the existing standard gasification and standard pyrolysis bands will continue to be supported under those bands at 1 ROC/MWh. Likewise, generating capacity receiving support before 1 April 2013 under the existing advanced gasification and advanced pyrolysis bands will continue to be supported under those bands at 2 ROC/MWh.

Fuels eligible for support under the new and existing ACT bands

12.15 In line with the consultation proposals, the Government has decided to expand the range of fuels eligible for support under the new and existing ACT bands by removing the minimum CV requirements. CVs will still be used to distinguish between the standard and advanced gasification and pyrolysis bands for generating capacity accredited before 1 April 2013 and for additional capacity added before that date.

12.16 Liquid and gaseous fuels will be eligible for support under the new and existing ACT bands even if further processing or transportation took place after the gasification or pyrolysis stages of production of the fuel.

Air quality and pyrolysis oil

12.17 No data was submitted in response to the call for evidence on the air quality impacts of generating electricity by burning pyrolysis oil. Defra have, however, commissioned a report into the air quality impacts of pyrolysis liquid fuels.[29] The Government acknowledges the finding of the report, based on the sparse data available, that emissions will be dependent on the nature and coherence over time of feedstock used in individual cases, although any installation burning pyrolysis oil will need to comply with all the relevant environmental legislation, including, where appropriate, the current Environmental Permitting Regulations. The Government will continue to work on reconciling the potential benefits of pyrolysis liquid fuels with the need to minimise air quality impacts.

[28] Developers should also be aware that any plant incinerating more than 3 tonnes/hour of waste will need to demonstrate, as part of their application for an Environmental Permit from the Environment Agency, that the plant represents Best Available Techniques (BAT) in terms of energy recovery. BAT is a site-specific assessment reflecting a requirement under the Integrated Pollution Prevention and Control Directive. Further details can be found on the Environment Agency's website: www.environment-agency.gov.uk.

13. Landfill gas

Introduction

13.1 Landfill gas is a mature and cost-effective renewable technology which delivers renewable electricity and significantly reduces greenhouse gas emissions from the waste sector. Sites closed after 2001 are subject to controls in the Landfill Directive, and are under a legal duty to capture and use, where possible, landfill gas. Based on the amount of ROCs issued to the sector, landfill gas electricity generation provided 4,834 GWh in 2009/10.

13.2 The consultation proposed that RO support for landfill gas should end for new generating stations that are accredited and additional capacity added on or after 1 April 2013. The current band for landfill gas is 0.25 ROCs/MWh.

13.3 The consultation also invited respondents to provide evidence – including on the costs, potential and viability – regarding new technologies that can increase the technical potential of landfill gas in the UK, particularly from older landfill sites.

Main messages from responses

13.4 The following responses were received on each of the issues consulted on.

- Arup's assessment of costs and deployment potential:
  - Capital costs can be higher than stated and sites can need capital reinvestment to maintain generation.
  - The composition of landfill gas is changing and it now needs more pre-treatment, which increases operating costs.
  - Generation on sites can take place for longer than the 20 years envisaged.
  - Many engines run at part load, to match the amount of available gas. Rather than run at 5080 hours per annum, as suggested in the report, they run at part load for a base load of 8000+ hours.
- Level of support:
  - Landfill gas recovery is an established technology that does not need support, and support should be focused further up the waste hierarchy.
  - Support is still required to encourage investment to tackle the changing composition of landfill gas and cost of export to grid.
  - Removing support will result in a global warming dis-benefit as operators flare gas instead of using it to generate electricity.
  - Smaller engines should be given increased ROCs as they can be used on both smaller sites and closed sites.

[29] AEA (2012) *Air quality impacts of the use of Pyrolysis liquid fuels*. Available at: www.defra.gov.uk/industrial-emissions/files/pyrolysis-oil-report-temporaryhome.pdf

- Support for biomethane injection to the grid from landfill gas should be provided by the RHI.

- New technologies proposed include:
  - Waste heat to power (WH2P) technologies, which increase the efficiency of landfill gas electricity generation.
  - A process that uses pulverised fuel ash to cap historic landfill sites to capture methane.
  - Microturbines, which have the ability to generate electricity with lower emissions than conventional generation from sites with lower methane levels.

- Closed sites:
  - Older landfill sites (with declining and lower calorific value gas) are riskier investments with a reduced period to recover investment.
  - They face higher costs as technological modifications to conventional engines or new technologies may be needed to treat lower grade methane.
  - They are no longer accepting waste for disposal and have no income to cover set up costs, in particular grid connection.
  - Generating from closed sites will require full-time attendance of sites and specific administration charges by the Environment Agency where a gas engine is in place.

13.5 Annex A provides a summary of responses to the questions on landfill gas (questions 54 to 56).

Post-consultation decisions

Level of support

Open landfill sites

13.6 Given the absence of specific, additional evidence on costs that differ from the ranges in the Arup report, the Government does not consider it appropriate to support new generating capacity using gas from open landfill sites. **The Government therefore confirms its decision to reduce support to 0 ROCs for generating stations accrediting or additional capacity added from 1 April 2013 which use gas from an open landfill site.**

Closed landfill sites

13.7 The Government believes that there is a case for continued support to improve methane collection and electricity generation at closed landfill sites, based on the additional costs for closed sites. However, this needs to be balanced with Arup's original cost evidence that shows current landfill gas engines need no support and the current band of 0.25 ROCs/MWh. **As such the Government has decided to provide support at 0.2 ROCs/MWh for generating stations accrediting or additional capacity added from 1 April 2013, which use gas from closed landfill sites only.**

13.8 While there was insufficient evidence to set a higher band specifically for microturbines, the level of support set out in chapter 20 (microgeneration)[30] will apply to landfill gas generating stations with a declared net capacity of 50 kW or less for technologies which use gas from any landfill site. In addition, DECC, Defra and the Environment Agency are funding a bid for a demonstration of innovative gas capture and utilisation technologies at closed landfill under the EU Life+ programme (ACUMEN). This will look to demonstrate new techniques and technology such as microturbines that can mitigate and use the methane emissions from landfill sites that are no longer operational.

Waste heat to power

13.9 Waste heat to power (WH2P) generates further electricity through an organic Rankine cycle process, giving up to 10% higher efficiency. It is particularly suited for sites such as landfill where CHP is not an option as there is no local heat customer. From a policy perspective the fitting of WH2P on new and existing landfill sites could be a cost-effective way of contributing to the UK's renewables target, and would also make most efficient use of landfill gas resource.

13.10 The Government has considered the project finance data for WH2P provided by companies to see what level of support, if any, would bring on WH2P deployment. Based on the limited cost data provided, analysis showed that the addition of a WH2P unit to a landfill gas station makes negligible difference to its overall economics with 0-0.1 ROCs/MWh required to ensure there is an incentive to install the kit. **As such, given the policy benefits of more efficient landfill gas generation and lack of deployment to date, the Government has decided to introduce support at 0.1 ROCs/MWh for electricity generated by new WH2P from landfill gas. This support will be available to WH2P fitted after 31 March 2013 on both existing stations as well as new stations using gas from any landfill site.**

[30] 2 ROCs/MWh in 2013/14 and 2014/15, reducing to 1.9 ROCs/MWh in 2015/16 and 1.8 ROCs/MWh in 2016/17.

14. Sewage gas

Introduction

14.1 Sewage gas is a mature technology that uses the biogas produced by the anaerobic digestion (AD) of sewage sludge. The process is widely used in the water industry where around two-thirds of sewage sludge is treated with AD.

14.2 The consultation proposed support be maintained at its current level, 0.5 ROCs/MWh, throughout the banding review period. The Government also sought further evidence from consultees on new technologies that can increase the technical potential of renewable electricity from sewage gas in the UK, and the potential for co-digestion.

Main messages from responses

14.3 Respondents to the consultation made the following points:

- Arup's assessment of costs and deployment potential:
  - The capital costs for new thermal hydrolysis plants can be higher than assumed.
  - The potential for growth in energy generation from the sector is underestimated.
  - The lack of certainty beyond 2017 is a concern for water companies that work on five-year investment cycles.
- Level of support:
  - 0.5 ROCs/MWh does not incentivise development of CHP and smaller scale projects in rural or semi-rural locations.
  - 0.5 ROCs/MWh is too low for new thermal hydrolysis plants.
  - The level of support should be the same as for AD as sewage treatment facilities use the same technology.
- New technologies:
  - Fuel cells can generate electricity more efficiently and with reduced emissions.
  - Sewage plants should be encouraged to use biogas for biomethane grid injection as this is a more efficient use of sewage waste.
- Regulation and co-digestion
  - Sewage treatment should be removed from the regulated water sector and placed in the waste sector to fulfil its potential.

- The environmental and economic regulation of sewage and other organic waste should be aligned, as recommended by the Office of Fair Trading in September 2011.[31]
- There is already genuine potential for co-digestion but this will require additional expenditure on capital plant to segregate packaging and contaminants from the non-sewage sludge element.

14.4 See Annex A for a summary of responses to the questions and call for evidence on sewage gas (questions 57 to 59).

Post-consultation decisions

Level of support

14.5 **The Government believes that continued support of 0.5 ROCs/MWh is an appropriate level for sewage gas generation.**

14.6 The Government recognises that this may not be enough for the most advanced thermal hydrolysis plants but there was insufficient evidence provided to justify the introduction of separate bands within the sewage gas sector. In addition, there was not enough cost evidence to provide a CHP uplift under the RO for sewage gas, although it may be eligible for support under the RHI (subject to compliance with that scheme's conditions and limitations)[32].

14.7 Regarding the lower level of support for sewage gas compared to other AD technologies, the Government considers this is justified due to the relative maturity of the sewage gas industry in comparison to commercial AD generation. However, sewage gas installations are able to claim support under the Anaerobic Digestion band on a pro-rata basis for the co-digestion of organic matter other than sewage sludge.

14.8 The Government recognises the effect the lack of clarity post-2017 on levels of support can have for the water industry investment cycle. The Government is considering treatment of sewage gas under the Electricity Market Reform (EMR) programme and intends to give the industry as much early certainty as possible on eligibility and contracts. The draft EMR Operational Framework was published in May 2012, with further details to follow in autumn 2012.

Potential for new technologies

14.9 The Government does not have enough evidence to provide fuel cells with their own level of support for use in sewage treatment facilities. However, electricity produced from fuel cells which use gas formed by the anaerobic digestion of sewage will be eligible for the 0.5 ROCs/MWh support.

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[31] Office of Fair Trading (2011) *Organic Waste: An OFT Market Study*. Available at: www.oft.gov.uk/shared_oft/market-studies/oft1372.pdf

[32] Under the current RHI arrangements, only biogas combustion installations with a capacity under 200 kWth are eligible for support and this is recognised as a potential issue. In September 2012 DECC will launch a consultation containing proposals on the expansion of the RHI to include forms of renewable heating which currently receive no support.

14.10 The Government is keen to facilitate the injection of biomethane into the national gas grid though there are a number of barriers to take-up as acknowledged in the *Anaerobic Digestion Strategy and Action Plan* and the *UK Renewables Roadmap* which set out the actions being taken to tackle these barriers.[33] The Government is looking to simplify the regulatory regime by introducing an exemption from holding a gas transporter licence for AD operators and will work with Ofgem to address the recommendations set out by Energy Market Issues for Biomethane Injection Group.[34] Together, these measures should encourage biomethane injection through the RHI which provides support for injection at all scales.

Regulation

14.11 The Government recognises the importance of addressing economic and environmental regulation of sewage sludge treatment. In terms of environmental regulation, the Government is keen that there is consistent and coherent legislation that protects human health and the environment and treats different materials fairly and in proportion to the risks that they pose. The *Government Review of Waste Policy in England 2011* recognised that the management of organic wastes is a fast developing area where overlapping regulatory frameworks could apply. Defra and the Environment Agency are therefore looking at the consistency and integration of policy and regulation as it applies to all materials spread to land. In addition, further to the publication of their *"Future Price Limits – statement of principles",* Ofwat will publish their response to the Office of Fair Trading recommendations on economic regulation in Summer 2012[35].

[33] Defra (2011) *Anaerobic Digestion Strategy and Action Plan.* available at: www.defra.gov.uk/publications/files/anaerobic-digestion-strat-action-plan.pdf.
DECC (2011) *UK Renewable Energy Roadmap.* Available at: www.decc.gov.uk/assets/decc/11/meeting-energy-demand/renewable-energy/2167-uk-renewable-energy-roadmap.pdf
[34] See: www.gasgovernance.co.uk/emib/report.
[35] Ofwat (2012) *"Future Price Limits – statement of principles",* http://www.ofwat.gov.uk/future/monopolies/fpl/pap_pos201205fplprincip.pdf

15. Renewable combined heat and power

Introduction

15.1 Generators of renewable combined heat and power (CHP) plants receive additional support – 'the CHP uplift' – under some of the current RO bands. The consultation considered extending the CHP uplift to a number of other bands.

15.2 The introduction of the RHI presents an opportunity to differentiate support for heat and electricity. The consultation therefore proposed to end the CHP uplift for new stations accredited on or after 1 April 2015 and support new build CHP henceforth through a combination of the RO and RHI. New accreditations and additional capacity added between 1 April 2013 and 31 March 2015 would have a choice between power-only RO bands plus RHI or the RO CHP band.

15.3 The consultation also proposed that the CHP uplift for eligible projects should be grandfathered from 1 April 2013.

15.4 As part of the consultation, the Government issued a call for evidence through which industry could provide further cost and performance data from their projects with which to inform subsequent analysis. A workshop was held jointly with the CHP Association (CHPA), and a proforma was issued to facilitate this. This evidence was considered alongside the initial Arup data, additional data from the CHPA and consultation responses to determine revised renewables costs and technical characteristics. This evidence will also be used to inform the appropriate level of support that renewable CHP requires under the RHI, and whether a higher rate might be justified. The Government will be publishing the results of that analysis as part of the RHI consultation planned for September this year.

Main messages from responses

15.5 A range of views were expressed by respondents to the consultation. These include:

- The CHP uplift should be available to 2017.
- The CHP uplift should be granted to all renewable technologies with CHP, regardless of the 2 ROC/MWh ceiling.
- The CHP uplift should be more than 0.5 ROCs/MWh.
- The CHP Quality Assurance (CHPQA) criteria should be grandfathered.

15.6 Annex A provides a summary of responses to each of the consultation questions on renewable CHP (questions 60 to 68).

Post-consultation decisions

Levels of support

15.7 The Government confirms its decision to offer the choice between a CHP uplift of 0.5 ROCs/MWh, or support under the RHI, for new accreditations and additional capacity added in the period 1 April 2013 to 31 March 2015 for the technologies listed in the table below. The option of support under the RHI will only be available to those stations that can meet any eligibility criteria imposed under the RHI. The option of RHI support for those technologies is also subject to the RHI consultation planned for September 2012, and Parliamentary approval and State Aids clearance for the resulting changes to the RHI.

15.8 Generating stations which are accredited on or after 1 April 2015 and additional capacity added from that date will not be able to opt for a CHP uplift if RHI support is, or was, available for the heat element of their energy generation.

15.9 The option of the CHP uplift will be extended to the new biomass conversion and enhanced co-firing bands. This approach will ensure a consistent approach to CHP across co-firing, dedicated biomass and biomass conversion bands. The CHP uplift is subject to the generating station meeting CHPQA requirements. Support for stations receiving the CHP uplift is capped at 2 ROCs/MWh (falling to 1.9 ROCs/MWh in 2015/16 and 1.8 ROCs/MWh in 2016/17 for any stations accredited and any additional capacity added in those periods that, by exception, is able to opt for the CHP uplift).

15.10 To minimise the costs of administering the RO, any generating station that has opted for support under the CHP uplift will not be able to subsequently switch to support under the RHI, and vice versa. For the same reason, if a generating station opts for the CHP uplift on any generating capacity accredited or added between 1 April 2013 and 31 March 2015, that choice will automatically apply to all of the generating capacity of the station which is accredited or added during that period. This means that stations opting for the CHP uplift between 1 April 2013 and 31 March 2015 will not be able to claim the RHI for any capacity accredited or added before 1 April 2015.

15.11 Any generating stations accredited or adding capacity on or after 1 April 2015 will no longer be able to choose the CHP uplift. There is an exception for generating stations using the technologies listed in the table below if they accredit or add capacity on or after 1 April 2015 and RHI support is still not at that time available for the heat generated by the station.

Technology	Level of ROC support for stations accrediting or additional capacity added between the following dates;	
	1 April 2013 – 31 March 2015	1 April 2015 – 31 March 2017
Dedicated biomass with CHP	2 ROCs/MWh or 1.5 ROCs/MWh plus RHI	1.5 ROCs/MWh plus RHI (1.4 ROCs/MWh plus RHI in 2016/17)
Standard co-firing of biomass with CHP	0.8 ROC/MWh Or 0.3 ROCs/MWh plus RHI (proposed)	0.5 ROCs/MWh plus RHI
Standard co-firing of energy crops with CHP[36]	1.3 ROCs/MWh or 0.8 ROC/MWh plus RHI (proposed)	1 ROC/MWh plus RHI
Biomass conversions with CHP	1.5 ROCs/MWh or 1 ROC/MWh plus RHI	1 ROC/MWh plus RHI
Enhanced (mid-range and high-range) co-firing of biomass with CHP	Prevailing RO support[37] plus 0.5 ROC/MWh uplift or Prevailing RO support plus RHI	Prevailing RO support plus RHI

Grandfathering policy

15.12 **As proposed in the consultation, the Government will grandfather the CHP uplift (0.5 ROCs) for generating capacity receiving the uplift from 1 April 2013.** However, the CHPQA qualification criteria are not being grandfathered. Therefore, CHP stations will still need to be annually certified as Good Quality under the CHPQA programme in order to qualify for the CHP uplift. The CHPQA qualification criteria will be examined as part of the consultation on the review of CHPQA that the Government intends to publish later this year. It is the Government's intention that the CHPQA criteria will continue to allow for the support of highly efficient CHP plants whilst ensuring value for money to the consumer.

15.13 The Government may therefore update references to the CHPQA in the RO Order to take account of any changes to the CHPQA Standard and accompanying Guidance Notes following consultation.

RHI support

15.14 As stated in the consultation, the introduction of the RHI presents an opportunity to differentiate support for electricity and heat, thereby providing an incentive to

[36] We are proposing to consult on removing the energy crop uplift for standard co-firing.
[37] Mid-range co-firing (50-<85 biomass co-firing in a unit) receives 0.6 ROCs/MWh; high-range co-firing (85-<100% biomass co-firing in a unit) receives 0.7 ROCs/MWh in 2013/14 and 0.9 ROCs/MWh from 2014/15.

generators to recover as much heat as possible, which will help to increase the efficiency of their plants.

15.15 The Government is mindful of industry's concern that the current tariffs for large scale biomass under the RHI will not incentivise Good Quality CHP development. That is why we issued a further call for evidence alongside the RO consultation, for data that could be used to inform the appropriate level of support CHP requires under the RHI, and whether a higher rate might be justified. The Government will publish the results of that analysis as part of the RHI consultation, planned for September 2012.

16. Energy crop uplift

Introduction

16.1 The RO provides support for purpose-grown crops that can substitute for woodfuel. Perennial energy crops such as Miscanthus, willow and poplar are one of the few sources of biomass where production can be expanded significantly. They have the advantage over forestry of being quicker to grow and of providing greater yields per hectare. In the UK, there is land available to grow up to 3.63 million hectares without impacting on food production.[38]

16.2 However, the market is immature; these crops take three to five years to establish and require additional infrastructure and development costs compared to established forestry and to annual crops used in biofuel production. For these reasons the RO currently offers an extra 0.5 ROCs/MWh where such energy crops are used either in co-firing or in dedicated biomass, up to a ceiling of 2 ROCs/MWh total support.

16.3 The consultation proposed that, whilst there is merit in continuing to provide the uplift this should only apply to non-food crops – the definition of energy crops should be tightened so as to ensure that crops which do not need extra support, such as annual crops or crops normally grown for food, are excluded. The consultation also asked whether the energy crop uplift should be extended to the new biomass conversion and enhanced co-firing bands. In the absence of data on the costs and deployment potential of biomass conversion and enhanced co-firing with energy crops, the consultation sought evidence from consultees on this area. It also asked whether support for energy crops, based on the proposed new definitions, should be grandfathered.

Main messages from responses

16.4 Points made by respondents to the consultation include:

- Respondents were broadly split on whether the list should contain eligible energy crops, or whether it should set out species that are not to be considered energy crops.
- The list should be widened to include any crop or residue that could be used for energy.
- Food crops or biofuels crops should not inadvertently be supported or diverted from other uses.

[38] NNFCC (2012) *Domestic Energy Crops Potential and Constraints Review*. Available at: www.decc.gov.uk/assets/decc/11/meeting-energy-demand/bio-energy/5138-domestic-energy-crops-potential-and-constraints-r.pdf

- The proposed list of energy crops is too narrow and will stall research and development into new energy crops.
- Retaining support for standard co-firing of energy crops at 1 ROC/MWh throughout the banding review period introduces a disparity with support for dedicated energy crops which degresses in April 2015.
- Extending the energy crop uplift to the new biomass conversion and enhanced co-firing bands will encourage investment in the energy crop supply chain.
- Biomass conversion and enhanced co-firing are adequately supported and do not require the energy crop uplift.
- Grandfathering the energy crop uplift will provide the necessary certainty to stimulate long-term investment.

16.5 Annex A contains a summary of responses to the questions relating to the energy crop uplift (questions 69 to 73).

Post-consultation decisions

16.6 Having considered responses, in particular those regarding the definition of energy crops, the Government does not agree that the definition should be widened to include any crop or residue used for energy. This would not support our policy intent and would provide support where none is needed, such as in the case of annual crops and harvesting and processing residues from agriculture, forestry and food and drink production. The Government also does not agree that non-food vegetable oils suitable for use in transport should be supported, as this could divert resources needed in that sector.

16.7 The Government considered whether to change the definition from a positive list of what can be included to a negative list of generic exclusions. While both approaches have merits and drawbacks, the positive list provides greater control over which energy crops may be supported and reduces the risk that at a later date support would need to be withdrawn from a crop which did not match our policy intent. This would be made more difficult if such support were grandfathered.

16.8 The Government agrees, however, that the list can usefully be expanded to include further non-food, perennial energy crops under development. The Government will therefore modify the proposed definition of energy crops to include:

- *Arundo donax*;
- Pennisetum (with the exception of *P. glaucum* (pearl millet) which is edible, and the invasive weed species *P. setaceum* (Fountain Grass), *P. clandestinum* (Kikuyu Grass) and *P. villosum* (Feathertop Grass)); and
- the Bambuseae (bamboos).

16.9 It has been suggested that Eucalyptus species should be included; however, as suitable species are already being grown commercially around the world and at

considerably lower cost than crops such as miscanthus, the Government does not consider that additional support is justified to bring this commercial crop to market.

16.10 It was also suggested that the intention to remove edible species means that it would no longer be necessary to provide evidence that the crop had only been grown for energy purposes and had been planted after 1989. The Government agrees that this requirement is superfluous, with the exception of the Bambuseae where it remains necessary so as to prevent direct sourcing from the wild.

16.11 The **Government intends to retain the energy crop uplift for the dedicated biomass band, such that qualifying plants will receive 2 ROCs/MWh from 1 April 2013, degressing to 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs/MWh for new accreditations and additional capacity added in 2016/17**.

16.12 The extra support for energy crops was provided to help development of the supply chain and to overcome cost hurdles faced during establishment. Therefore, **we have decided to adopt a policy of grandfathering the energy crop uplift for dedicated biomass as from 1 April 2013**.

16.13 No new cost evidence was received to support the provision of the energy crop uplift for the biomass conversion and enhanced co-firing bands. As biomass conversions and enhanced co-firing will receive support above the level provided to standard co-firing, we do not consider that the addition of an energy crop uplift for these new bands is sufficiently justified on the cost evidence or in line with the aim of keeping costs down for consumers. Therefore, **we will not provide an energy crop uplift for the biomass conversion and enhanced co-firing bands**.

16.14 This brings into question whether the energy crop uplift should continue to be provided for the standard (low range) co-firing band. **We propose to remove the energy crop uplift for standard co-firing**. However, we recognise energy crops are currently being used by co-firers who will have committed to long-term contracts for feedstock supply. We will therefore bring forward proposals for the energy crop uplift to continue for a limited period of time for standard (low range) co-firers that currently use energy crops. We will shortly bring forward a consultation on these proposals.

17. Co-firing cap

Introduction

17.1 Currently suppliers may only meet up to 12.5% of their annual obligation via co-fired ROCs. In light of the proposed enhanced co-firing band, the consultation proposed removing the co-firing cap.

Main messages from responses

17.2 Responds raised a number of issues including:

- Removing the co-firing cap will distort the biomass market and increase price inefficient use of biomass.
- Removing the cap will increase the volatility of ROC prices.
- Concern regarding how the obligation will be set annually if the level of the cap is not known.
- There will be an impact on the buy-out fund if enhanced co-firers drop below the proposed 15% threshold into the standard co-firing band.
- Removing the cap could require generators to notify their intention regarding the extent of co-firing a year in advance.

17.3 Annex A provides a summary of responses to the questions on the co-firing cap (questions 74 to 76).

Post-consultation decision

17.4 **We have decided to remove the co-firing cap.** As set out in chapter 9 on Biomass, we will be consulting on cost control mechanisms for the co-firing and conversion bands, which should give an indication of future levels of co-firing and so should assist with the setting of the obligation in the absence of a co-firing cap.

18. Grandfathering policy

Introduction

18.1 Grandfathering is a policy to maintain a fixed level of support for the full lifetime of a generating station's eligibility under the RO, from the point of accreditation. In the case of additional capacity, grandfathering policy applies as from the point at which the additional capacity forms part of the station. Currently the only areas not covered by the grandfathering policy are co-firing of biomass, biomass conversions. bioliquids, the CHP uplift and the energy crop uplift. The consultation proposed extending grandfathering to each of these technologies – with the exception of standard co-firing – as well as to the new biomass conversion and enhanced co-firing bands.

Post-consultation decisions

18.2 The **Government has decided to extend its grandfathering policy to include the biomass conversion and the mid-range co-firing bands as from 1 April 2013 and the high-range co-firing band as from 1 April 2014**. This is subject to meeting the advance registration requirements that will be the subject of further consultation. A generating station which fails to register by the required date, may cease to be eligible for support under the relevant band for the following obligation period.

18.3 Furthermore, once the grandfathering policy applies to the conversion and enhanced co-firing bands it will apply on a unit by unit basis (not a station wide basis) and it will be based on the date a unit becomes eligible for a band (not the date of accreditation).

18.4 The **Government has decided to extend its grandfathering policy to include the CHP uplift as from 1 April 2013**. This is subject to the generating station continuing to meet the CHPQA requirements as they may be updated from time to time. In the case of standard co-firing with CHP, only the CHP uplift element of the support is covered by the grandfathering policy.

18.5 The **Government has decided to extend its grandfathering policy to include the energy crops uplift for dedicated biomass as from 1 April 2013**. Grandfathering will apply to the new definition of energy crops as set out in this Government response.

18.6 The **Government has decided to consult on removing the energy crop uplift for standard co-firing** and so grandfathering policy will not apply to the uplift for those stations.

18.7 The **Government has decided to extend its grandfathering policy to cover bioliquids as from 1 April 2013, except when they are used for co-firing**. Standard co-firing is not grandfathered and bioliquids are not eligible for the enhanced co-firing bands (with the exception of energy crops).

18.8 All types of biomass must meet any applicable sustainability criteria as updated from time to time in order to be eligible for support.

18.9 For further details see the relevant technology chapters.

Stations accredited before 1 April 2013

18.10 Subject to the exceptions set out below, the accredited capacity of generating stations accredited before 1 April 2013, and additional capacity added before that date, will continue to receive their existing bands under the RO (subject to continuing to meet the eligibility criteria), and the new bands set out in this document will apply only to new accreditations and additional capacity added on or after 1 April 2013.

18.11 Wave and tidal stream generating stations are covered by our grandfathering policy. But in order not to cause delays to deployment, wave and tidal stream generating stations accrediting after 1 April 2012, or adding additional capacity after that date, will be able to benefit from the new bands set out in this document from 1 April 2013 (in respect of generating capacity that meets the eligibility criteria). In accordance with our grandfathering policy, the accredited capacity of wave and tidal stream generating stations accredited before 1 April 2012, and additional capacity added before that date, will not be moved up to the new bands set out in this document.

18.12 Any generating capacity accredited and additional capacity added before 1 April 2013 (i.e. existing generating capacity) which was supported under the dedicated biomass, dedicated biomass with CHP, dedicated energy crops or dedicated energy crops with CHP bands, will be moved to the biomass conversion or biomass conversion with CHP bands, if it falls within the eligibility criteria for those bands.

18.13 Any existing generating capacity which was supported under the co-firing of biomass or co-firing of energy crops bands, will be moved into the relevant standard co-firing, mid-range co-firing, high-range co-firing of biomass or biomass conversion bands (subject to meeting any registration requirements for those bands).

18.14 Any existing generating capacity which was supported under the co-firing of biomass with CHP or co-firing of energy crops with CHP bands, will be moved into the relevant standard co-firing, mid-range co-firing, high-range co-firing of biomass with CHP or biomass conversion with CHP bands (subject to meeting any registration requirements for those bands).

18.15 As from 1 April 2013, fossil derived bioliquids will be supported at the same banding level as other bioliquids, including when used by stations accredited before 1 April 2013.

18.16 We are introducing a single new band for ACT. In line with our grandfathering policy, generating stations accredited (and additional capacity added) before 1 April 2013 will continue to receive support under the standard gasification and standard pyrolysis (1 ROC) or advanced gasification and advanced pyrolysis (2 ROCs) bands, provided they meet the eligibility requirements for those bands. However, the minimum calorific values for the standard gasification and standard pyrolysis bands

will be abolished, and the standard pyrolysis band will be widened to include liquid fuels.

18.17 The new narrower definition of energy crops will apply as from 1 April 2013, to all generating stations claiming the uplift, including those accredited before 1 April 2013. We will consult on removing the energy crop uplift for standard co-firing. However, we will consult on proposals for the energy crop uplift to continue for a limited period of time for standard co-firers that currently use energy crops.

19. Grace periods

Introduction

19.1 The consultation proposed limited grace periods for new generating stations where RO support will decrease from 1 April 2013, and which are expected to deploy before 31 March 2013 but are unable to do so due to two distinct circumstances:

- Delays to grid connection, and/or
- Delays to radar upgrades.

19.2 The Government considered these are the construction delays most likely to be beyond developers' control; they are outside normal recognised and managed business risk and would therefore unduly penalise developers in terms of reduced support. The proposal was to be limited to six months from 1 April 2013 to enable a period for delays in these circumstances to be resolved.

19.3 To ensure that the grace period policy is robust, the consultation proposed a set of qualifying criteria that projects must meet by 31 March 2013 in order to be eligible. This included demonstrating that:

- They have a signed grid connection date that would have enabled the generating station to have been connected and subsequently commissioned on or before 31 March 2013.
- In the case of radar installation/upgrade, they have a signed agreement for the installation/upgrade that would have enabled the generating station to be commissioned on or before 31 March 2013.

19.4 It was also proposed that where a generating station takes advantage of this grace period, the 20 year time limit for RO support for the station would start from 1 April 2013.

Main messages from responses

19.5 Responses received included the following points:

- Grace periods should be available for other reasons that delay accreditation, for example planning delays and adverse weather conditions.
- The grace period should be extended beyond 6 months, for example to 1 year, 2 years or determined on a case by case basis.
- RO support for generating stations eligible for the grace period should begin at date of accreditation, not 1 April 2013.
- A similar grace period is needed from the date support is reduced later in the banding review period, or when the RO is closed to new accreditation from 1 April 2017.

- Given the long lead in times for some technologies, ROCs should be provided at the level which applied when a generating station received pre-accreditation provided they are accredited within the banding review period.

19.6 Annex A provides a summary of responses to the question on grace periods (question 76).

Post-consultation decisions

Grace period eligibility

19.7 The proposal was intended to cover the two specific construction risks identified that are outside normal managed business risk and developers' control, that is completion of radar installation or upgrades and grid connections. The Government does not consider that other suggested causes put forward by respondents to the consultation for eligibility for grace periods, such as discharging planning conditions, weather or the time taken to identify and agree technical solutions to resolve radar interference, are of the same nature. The Government considers these issues are part of normal business risk which the developer would be expected to manage.

19.8 For that reason **the Government does not intend to introduce grace periods for other causes of delay.**

19.9 Similarly, the Government does not propose to introduce similar grace periods for technologies whose support degresses later in the banding review period, as project developers have longer notice of the future degression to plan around any delay.

19.10 The Government will consult nearer the time on arrangements for closure in 2017 of the RO to new projects.

Qualifying criteria

Grid connection

19.11 In order for a generating station to be accredited under the RO it must have been commissioned. For stations that are to export electricity to the network, connecting such stations to the network is an inherent part of the commissioning process. The consultation proposed that where a planned connection dates slip beyond 31 March 2013, and this was not the fault of the operator, a grace period should apply.

19.12 The consultation proposed that generators must provide written evidence from the network operator that the delay to grid connection was not due to any action or inaction by the generator or developer of the generating station.

19.13 The Government has reconsidered this aspect of the criteria as it creates risk for the network operator. Instead, **we have decided that confirmation should be provided that the delay was not due to any breach of the connection agreement by the operator or developer of the generating station.**

19.14 We intend to retain the requirement for generators to provide a copy of the connection agreement. This will need to show an estimated grid connection date of no later than 31 March 2013. The generator will also need to make a declaration

that, to the best of their knowledge, the generating station would have been commissioned on or before 31 March 2013 if the connection had been made on or before that date. The network operator will need to confirm that the grid connection was made after 31 March 2013 and before 1 October 2013.

Radar upgrades

19.15 Similarly, the consultation proposed that operators must provide evidence from the Ministry of Defence (MoD) or the relevant civil aviation organisation that the delay to the completion of the radar installation or upgrade was not due to any action or inaction by the generator or developer of the generating station. **We have decided to replace this with a requirement for confirmation that the delay was not due to any breach of the agreement for the radar installation/upgrade. Similarly, the other evidence requirements will mirror those for grid connections.**

Additional grace period criteria

19.16 The consultation sought views on a list of additional criteria that must be met for developers to be eligible for the grace period. In the light of the qualifying criteria outlined above, and the 6 month limit to the grace period described below, **the Government considers additional criteria are not necessary for generating stations to be eligible for the grace period.**

Duration of grace periods

19.17 In light of the consultation responses proposing grace periods of longer than six months, the Government has consulted with National Air Traffic Services (NATS) and the MoD, as well as National Grid and Distribution Network Operators (DNOs), to better understand the likelihood of projects being delayed by longer than six months due to grid connection or radar upgrade issues specified.

19.18 In terms of grid connection delays, the proposal to extend grace periods until 30 September 2013 should allow any slippages to grid connections in winter/spring 2012/13 to be completed during the following summer months. Although the Government recognises agreements with radar operators on optimal radar solutions can take longer than six months, the grace period provision is not being introduced to cover this issue.

19.19 **Therefore we have decided to introduce a 6-month grace period.** This means that grace periods will only be available for generating stations that meet the qualifying criteria outlined above and which commission between 1 April 2013 and 30 September 2013. In addition, generating stations seeking a grace period will need to apply for accreditation before the end of that 6 month period and they will need to submit their request for a grace period before Ofgem has made its decision to accredit the station. To minimise the burden of administering the RO, it will not be possible for a generating station to seek a grace period after it has been accredited.

Starting point of RO support for grace period generating stations

19.20 A number of consultation responses pointed out that the proposed 1 April 2013 start date for RO support unfairly penalises grace period generating stations by effectively reducing the period of support by up to six months. In light of this, the Government

has reconsidered its position and considers that a fairer approach would be to provide 20-years of support from date of accreditation of the generating station.

19.21 **The Government has decided that the 20 year period of RO support for a grace period generating station should begin on the date of accreditation.**

20. Microgeneration technologies

Introduction

20.1 Microgeneration technologies are defined as those with a declared net capacity of 50 kW or less. Since 1 April 2010, the Feed-in Tariffs (FITs) scheme in England, Wales and Scotland has provided support for anaerobic digestion, hydro, solar PV and wind projects at or below 50 kW. These technologies are not eligible for support under the RO, though other sub-50 kW technologies are.

20.2 The consultation proposed that microgeneration technologies eligible for support under the RO should receive 2 ROCs/MWh until 31 March 2015, 1.9 ROCs/MWh for new accreditations and additional capacity added in 2015/16 and 1.8 ROCs in 2016/17. The level of support for microgenerators under the RO is currently 2 ROCs/MWh.

Main messages from responses

20.3 The following points were made by respondents to this part of the consultation:

- The proposed support levels are appropriate as long as tariffs under the FIT are appropriate. Government should ensure that microgeneration technologies are receiving appropriate support from both mechanisms.
- All microgeneration technologies should be supported under FITs given the additional administrative complexity of the RO compared to FITs.
- The proposed reduction below 2 ROCs/MWh will deter investment as any cost reductions in the period to 2017 are out of the control of the industry.
- The RO should balance the development of a centralised, large-scale energy system needed to ensure we meet our carbon targets with a small scale, decentralised system which utilises countryside-friendly technologies.

20.4 See Annex A for a summary of responses to the question on microgeneration (question 77).

Post-consultation decision

Level of support

20.5 **The Government has decided to introduce support at the level proposed in the consultation** – 2 ROCs/MWh until 31 March 2015, 1.9 ROCs/MWh for new accreditations and additional capacity added from 1 April 2015 to 31 March 2016 and 1.8 ROCs/MWh for new accreditations and additional capacity added from 1 April 2016 to 31 March 2017. Limited additional evidence was provided by respondents to the consultation and the support levels for microgeneration under the RO will be in line with the highest level of support provided under the RO (with the exception of wave and tidal stream).

Annex A: Summary of responses

Introduction

1. In total 3,824 responses were received. Of these, 281 (7.3%) were from organisations including those in the energy and renewables sector as well as in other areas of industry, trade associations, NGOs, academia, charities and community groups, Government organisations and local authority groups. The remainder of responses (3,543; 92.7%) were submitted by individuals. 3,413 (89.3%) of all responses were in response to various campaigns.[39]

2. The data quoted in this chapter are in relation to the non-campaign responses. See Annex B for the Government's response and statistics relating to campaign responses.

Onshore wind

Question 1. Do you agree with the Arup assessment of costs and deployment potential for onshore wind? Please explain your response with evidence.

3. 152 responses were received. Of these, 30 (20%) agreed or agreed with qualifications; 122 (80%) disagreed.

4. Of those who agreed or agreed with qualifications, several respondents considered that the potential deployment could be greater than anticipated if the planning landscape, grid connectivity and radar solutions improve. One respondent, who broadly agreed with the capex and opex costs in the Arup report, did not agree with the downward trajectory for levelised costs to 2030.

5. A number of respondents noted that capex costs are sensitive to foreign currency exchange rate movements and that the exclusion of these from Arup's assessment affects the overall cost assumptions.

6. Of those that disagreed, a number of respondents raised concerns regarding the costs of small-scale community wind projects; for example one respondent stated that the costs of wind projects in the 0.5-1.5 MW range have been significantly under-estimated.

Question 2. Do you agree with the proposed level of support of 0.9 ROCs/MWh for onshore wind? Please explain your response with evidence.

7. 187 responses were received, of which 33 (18%) agreed or agreed with qualifications and 154 (82%) disagreed with the proposal.

[39] Thirteen campaign responses were submitted by organisations, with the remainder submitted by individuals.

8. Of those who agreed or agreed with qualifications, a number of respondents explained that while they understood the reasons for seeking to limit costs to the consumer, the level of support should not be further reduced as it would jeopardise a number of projects in development and the Government's ability to meet the 2020 target.

9. Of those who disagreed, one NGO replied that the proposed reduction in support would disproportionately advantage large-scale energy infrastructure at the expense of smaller-scale players. One respondent considered that a threshold should be set whereby generating stations below 20 MW should continue to receive 1 ROC/MWh.

10. A large number of respondents felt that onshore wind should not receive any ROC subsidy given its status as an established technology.

Offshore wind

Question 3. Do you agree with the Arup assessment of costs and deployment potential for offshore wind? Please explain your response with evidence.

11. 120 responses were received. Of these, 31 (26%) agreed or agreed with qualifications; 89 (74%) disagreed.

12. Of those who agreed or agreed with qualifications, one industry respondent noted that certain restrictive conditions in European Directives on seabed development may affect build rates. Another respondent was of the view that even the Arup low scenario for deployment rates is optimistic. A trade association responded that they believe there will be a smoother delivery profile, with the amount of capacity installed in 2015 slightly lower than the Arup assessment (around 5 GW compared to Arup's assessment of around 7.5 GW).

13. One industry respondent believes that a critical mass of projects will need to be developed before significant cost reductions can be realised and the easing of the supply chain is crucial in allowing the full economic benefit – including in terms of jobs in the sector – to be achieved.

14. Of those who disagreed, a large number of respondents did not provide relevant reasons explaining why they did not consider the Arup analysis to be correct.

15. Among other responses, one consultancy respondent stated that costs will fall faster than predicted as developers find alternatives for engineering problems. One industry respondent considered that there is the potential for a reduction in capex given an expected easing in supply chain constraints, but probably not to the extent assumed by Arup by 2015.

16. A number of respondents noted the importance of floating offshore installations in terms of reducing the costs and increasing the deployment potential of offshore wind.

Question 4. Do you agree with the proposed level of support of 2 ROCs/MWh for offshore wind, stepping down to 1.9 ROCs in 2015/16 and 1.8 ROCs in 2016/17? Please explain your response with evidence.

17. 130 responses were received. Of these, 35 (27%) agreed or agreed with qualifications; 95 (73%) disagreed.

18. Of those who agreed or agreed with qualifications, a number of respondents considered that the proposed level of support would be sufficient to encourage investment in the sector. Consultees felt that the reduction in support is the right approach as the technology matures to encourage efficiency.

19. Several respondents noted that the proposed support rates were consistent with the aim of achieving £100/MWh by 2020. For example, one trade association respondent stated that:

> 'The stepping down of support in the way proposed in this consultation is consistent with a cost trajectory that results in costs of £100/MWh by 2020. This is a challenging objective and care needs to be taken that there is some certainty that projects are feasible given these reductions in support. In addition, too steep a reduction in support in the period from 2017 to 2020 compared to 2015 to 2017 could serve to drive costs up.'

20. A number of respondents were concerned that in light of the uncertainties over cost reductions in the sector during the banding review period, the reductions in support proposed were too soon and too aggressive. This could stall development and prevent the economies of scale required to see the cost reduce as expected. One industry respondent stated that:

> 'We consider that the timing and scale of the proposed reduction in support rates materially increases the risks attached both to the Government's ambitions for meeting the 2020 renewables target and to the developments needed to bring long term costs down. A less aggressive reduction in support would undoubtedly present lower risks.'

21. On the other hand, several respondents considered that the proposed level of support was too high. For example, one academic/professional institute stated that:

> 'We believe that the level of support should be reduced to 1.4 ROCs for Round 1 and Round 2 type offshore, near shore and shallow depth wind farms. [...] Round 3 offshore wind farms, like the other more expensive renewables such as solar and marine, may warrant a higher number of ROCs, but should have a capacity (MW) limit to keep the cost to the consumer down.'

22. A large number of private individuals felt that the support rate should be reduced to zero, given the impact of subsidies on consumers' electricity bills.

Hydro-electricity

Question 5. Do you agree with the Arup assessment of costs and deployment potential for hydro-electricity? Please explain your response with evidence.

23. 88 responses were received. Of these, 44 (50%) agreed or agreed with qualifications; 44 (50%) disagreed.

24. Of those who agreed or agreed with qualifications, one industry respondent noted that the range of costs for <5 MW hydro schemes will be larger than >5 MW schemes due to variations in layout and technology used by small-scale schemes. Another industry respondent suggested that small scale hydro power may be better serviced by the FITs scheme. Over half of those who agreed did not provide any further comments.

25. Of those who disagreed, a number of respondents flagged up the following concerns with the Arup report: the load factors are considerably higher than experienced in practice; the deployment potential is underestimated; capital and operating costs are underestimated. Over one-third of those who disagreed did not provide additional comments.

Question 6. Do you agree with the proposed level of support of 0.5 ROCs/MWh for hydro-electricity? Please explain your response with evidence.

26. 105 responses were received. Of these, 38 (36%) agreed or agreed with qualifications; 67 (64%) disagreed.

27. Of those who agreed or agreed with qualifications, one industry respondent agreed that the proposed reduction in support is appropriate as hydro is a mature technology with limited opportunities for expansion. A number of respondents made the case that as <5 MW hydro is able to choose between the RO and FITs, the reduction in support would not affect deployment. Over half of those who agreed did not provide additional comments.

28. Of those who disagreed with the proposed reduction in support, common themes emerging included that there is little scope for further cost reductions due to the maturity of the technology; future sites are likely to be more expensive to develop; grid connections and environmental regulation costs have increased.

29. One Local Government respondent made the point that:

> ‘In addition to providing low carbon electricity at a low overall cost to the consumer, hydro should also be assessed by the qualities it brings to the GB system in terms of balancing, storage and frequency response in which it will play an increasingly important role as the UK moves towards a higher penetration of renewables.’

30. A number of respondents pointed out that the proposed reduction would have a negative impact on jobs. This would affect a range of businesses including civil engineers, environmental and engineering consultants, and turbine and electrical component manufacturers.

31. A considerable number of respondents thought hydro should not receive any support under the RO.

Marine technologies

Wave and tidal stream

Question 7. Do you agree with the analysis on wave and tidal stream by Arup (2011) and their primary source Ernst & Young (2010)? Please explain your response with evidence.

32. 87 responses were received. Of these, 52 (60%) agreed or agreed with qualifications; 35 (40%) disagreed.

33. Of those who agreed or agreed with qualifications, a number of respondents raised the speculative nature of build rates cited in the Arup report. One industry respondent noted that:

> 'The actual build out rate is dependent on the rate of technology development and cost reductions achieved by industry which will not be known until after the first demonstration arrays are installed in 2013/14.'

34. One developer noted that while they broadly agree with the Arup and Ernst & Young conclusions, the fast pace of developments in the industry means analysis from 2009 could already be argued to be out of date. Around one-third of those who agreed did not provide any further comments.

35. Of those who disagreed, one industry respondent was of the view that:

> 'Technology will not be adequately commercialised until closer to 2020, and advances in technology and efficiency in turbines will equate to sustained growth in this sector until 2040 as hurdle rates fall and technology allows for development further offshore.'

36. Around 40% of those who disagreed did not provide additional comments.

Question 8. Do you agree with the proposed level of support of 5 ROCs/MWh for each project up to a limit of 30 MW for wave and tidal stream (and 2 ROCs/MWh above that limit)? Please explain your response with evidence.

37. 115 responses were received. Of these, 66 (57%) agreed or agreed with qualifications; 49 (43%) disagreed.

38. Several respondents agreed with the proposed 5 ROCs/MWh support but were concerned about the proposed drop to 2 ROCs/MWh once the project cap was reached. A number of respondents felt that the proposed 2 ROCs/MWh for >30 MW installations was too severe and would artificially limit projects to 30 MW or less. Some respondents stressed the need for further clarity regarding the likely level of support under the EMR, post 2017

39. Of those who disagreed, several respondents considered the proposed level of support was too high, pointing out that it is above the 2 ROCs/MWh ceiling that applies to other technologies. For example, one industry respondent stated:

> 'We do not support the principles of a 5 ROC level as an incentive to bring forward new and emerging technology, even if this is for a specified short period only, given that it is significantly above the norm of the 2 ROC level.'

40. Several respondents felt that wave and tidal stream should not receive RO support.

Question 9. Do you agree that 30 MW is an appropriate level for the project cap? Please explain your response with evidence.

41. 96 responses were received. Of these, 48 (50%) agreed or agreed with qualifications; 48 (50%) disagreed.

42. Of those who agreed or agreed with qualifications, a considerable number thought the level of the cap was appropriate as installations deployed in England and Wales during the banding review period are unlikely to exceed 30 MW capacity. Several respondents were concerned that the discretion available to Scotland and Northern Ireland to introduce their own project caps could jeopardise the RO budget and lead to measures which affected the sector's development in England and Wales. For example, one trade association stated:

> 'We would plea for clarity on how the UK Government is approaching limiting the overall cost of wave and tidal in the context of the discretion available to Scotland and Northern Ireland to set this parameter. Sudden changes to policy could be highly damaging to this still-emerging industry. For instance, if there is a danger of 'overdelivery' of wave and tidal due to a higher project cap in Scotland and DECC's response is to limit development in England and Wales in an emergency review, this would endanger much development work in promising areas for these technologies such as the South-West.'

43. Among those who disagreed, a key concern was that the cap would stifle development of the sector. A number of respondents felt the cap should be higher so as not to disincentivise projects greater than 30 MW capacity. For example, one NGO respondent said:

> 'We consider a project level cap of 30 MW for enhanced support to be inappropriate and are concerned that this will jeopardise the development of the UK wave and tidal sector by dis-incentivising the development of larger projects, which are required if wave and tidal technologies are to mature.'

44. Other respondents thought a cap was not required due to various natural barriers which will prevent projects greater than 30 MW being deployed during the banding review period. Similarly, several respondents felt the cap should be lower to reflect the expected capacity of demonstration projects deployed between now and March 2017. Several respondents called for clarity over how a 'project' will be defined to ensure industry is clear on how the cap will be applied. One developer raised the possibility of the cap introducing perverse incentives, stating that:

> ‘Setting any cap may have perverse effects by incentivising the build of projects which only have this size as an ambition (totally capacity), and therefore not scaling up projects to achieve the most efficient use of technology available. Allowing for projects built up to any size MW for a fixed period of time, or up to a fixed MW cap per year/banding period, would incentivise the most ambitious and cost effective schemes, creating longer term benefits.’

45. Around one-third of those who disagreed did not provide any additional comments.

Question 10. Do you agree that the proposed level of support will help to drive deployment for the pre-commercial and early commercial deployment phases? Please explain your response with evidence.

46. 91 responses were received. Of these, 65 (71%) agreed or agreed with qualifications; 26 (29%) disagreed.

47. Of those who agreed or agreed with qualifications, a number of respondents supported the proposed level of support but considered that early clarity post-2017 was key to ensuring longer-term growth in the sector.

48. Several respondents considered that the level of support provided by the RO may not be sufficient on its own and further capital support may be required. For example, one trade association noted that the proposed level of support:

> ‘... is key to establishing the industry in the UK. However, a market pull mechanism is needed in conjunction with a market push mechanism, such as the proposed MEAD funding and any funding from the Scottish Government.’

49. Over one-third of those who agreed did not provide additional comments.

50. Of those who disagreed, a number of respondents did not consider that the sector should receive public subsidies. For example, one charity/community group responded that ‘installations could go ahead without further subsidy using technology already proven’. Several respondents considered the proposed level of support would not be sufficient to drive deployment and additional sources of funding would be required to unlock the sector’s potential. Around 40% of those who disagreed did not make any further comments.

Tidal Range

Question 11. Do you agree with the analysis on tidal range by Arup (2011) and their primary source Ernst & Young (2010)? Please explain your response with evidence.

51. 54 responses were received. Of these, 29 (54%) agreed or agreed with qualifications; 25 (46%) disagreed.

52. Of those who agreed or agreed with qualifications, around 90% of respondents did not provide any further comments. One supplier agreed that the analysis indicated support in line with the proposed 2 ROCs/MWh.

53. Nearly half of those who disagreed did not make any additional comments.

54. Among other respondents one academic organisation noted that the Severn Barrage scheme, which they expect could potentially make a significant contribution towards the Government's renewables target, was not considered in any detail in either report. One consultancy stated that capex costs are likely to be higher than those contained in the Ernst & Young report, while one trade association stated that:

> 'There has been no detailed analysis of the capital expenditure projections for tidal range in either the Ernst and Young (2010) or the Arup (2011) report. There is, therefore, a high level of uncertainty in the forecast in the Ernst and Young levelised cost.'

55. One company highlighted the limitations of analysing general capex and opex costs for tidal range, particularly on a per megawatt basis, due to the unique characteristics of the limited number of sites available.

Question 12. Do you agree with the proposed level of support of 2 ROCs/MWh for tidal range, stepping down to 1.9 ROCs in 2015/16 and 1.8 ROCs in 2016/17? Please explain your response with evidence.

56. 74 responses were received. Of these, 29 (31%) agreed or agreed with qualifications; 51 (69%) disagreed.

57. Of those who agreed or agreed with qualifications, a few respondents noted that the level of support was appropriate given its alignment with support proposed for the marginal technology. One respondent warned that the proposed degression could jeopardise innovation and investment in the technology. Around half of those who agreed with the proposal did not provide any further comments.

58. Of those who disagreed, a considerable number of respondents felt the technology should receive no RO support. By contrast, several respondents felt the proposed level of support was not high enough to bring forward development. In addition, a number of respondents thought the support should be offered beyond 2017 given projects' long lead-in times.

59. One developer felt that 2 ROCs/MWh throughout the banding review period would be essential for the development and funding of a tidal lagoon project they are involved in. Around one-quarter of those who disagreed did not provide additional comments.

Geothermal and geopressure

Question 13. Do you agree with the Arup assessment of costs and deployment potential for geothermal and geopressure? Please explain your response with evidence.

60. 52 responses were received. Of these, 23 (44%) agreed or agreed with qualifications; 29 (56%) disagreed.

61. Of those who agreed or agreed with qualifications, the majority did not provide any further comment. Of those that did, one trade association noted that:

> 'The levelised costs, even with the higher hurdle rates demanded of geothermal, compare favourably with the other renewable technologies as detailed in the UK Renewable Energy Roadmap.'

62. Of those who disagreed, a considerable number of respondents did not provide relevant comments to support their position. One individual stated that the Arup report is not reliable as they are active in the geothermal sector.

63. Among industry groups, one respondent considered that the deployment potential is not accurate as the focus is on deep geothermal in the south-west of England. Another industry respondent stated that the risks and costs of deep drilling have been substantially underestimated.

Question 14. Do you agree with the proposed level of support of 2 ROCs/MWh for geothermal, stepping down to 1.9 ROCs in 2015/16 and 1.8 ROCs in 2016/17? Please explain your response with evidence.

64. 69 responses were received. Of these, 24 (35%) agreed or agreed with qualifications; 45 (65%) disagreed.

65. Of those who agreed or agreed with qualifications, a couple of respondents considered that the glide path to 1.8 ROCs/MWh may need extending given the hurdles and timescales that will affect most renewables projects. A majority of respondents who signalled their agreement did not provide further comment.

66. Of those who disagreed, there was a divergence of views between those who considered the RO support was too high and those who considered it was too low to bring on development. A number of respondents were concerned about the proposed regression. For example, a consultancy noted that:

> 'If 2.0 ROCs is needed to stimulate development now, the prospect of reducing the banding prematurely is counterproductive as it will only deter investment due to the financial risk it brings.'

Question 15. Do you agree with the proposed level of support of 1 ROC/MWh for geopressure? Please explain your response with evidence.

67. 52 responses were received. Of these, 18 (35%) agreed or agreed with qualifications; 34 (65%) disagreed.

68. Of those who agreed or agreed with qualifications, around 90% did not provide further comments.

69. Of those who disagreed, the majority thought that there should be no support under the RO for geopressure. One individual respondent stated that the proposed level of support was not high enough, while one charity/community group felt that 1.5 ROCs/MWh throughout the banding review period should be offered for geopressure.

Solar PV

Question 16. Do you agree with the Arup assessment of costs and deployment potential for solar PV? We would particularly welcome UK-specific evidence on costs and deployment potential.

70. 63 responses were received. Of these, 19 (30%) agreed or agreed with qualifications; 44 (70%) disagreed.

71. Of those who agreed or agreed with qualifications, a considerable number did not provide any additional comment. Of those who did, one individual suggested that 'the logical way to support PV generation would be a one off subsidy for installation to help residents to make their homes as carbon neutral as possible'. A couple of individuals noted that solar PV is less intrusive on the environment than other types of renewables. One individual respondent pointed out that the Arup report did not consider technological developments in the sector, such as photosynthetic membranes, which has the potential for much greater efficiency and outputs.

72. In terms of those who disagreed with the Arup assessment of the costs of solar PV, a number of respondents noted that costs move quickly in the sector, and two industry respondents considered this meant the analysis is already out of date. Although one industry respondent considered the cost estimates are too low, several others felt they were too high.

73. Several respondents thought the Arup assessment of deployment potential was too low. Conversely, one industry respondent thought the Arup assessment of >5 MW potential was unachievable, as:

> 'There is limited commercial viability in the development of large-scale solar (particularly PV) installations in the UK. Limited sites, unreliable weather conditions, lack of sufficient government backing and highly competitive micro-scale schemes have contributed to a relatively high hurdle rate, and an uncompetitive LCOE [levelised cost of energy] which is unlikely to undergo rapid change in the short term.'

Question 17. Do you agree with the proposed level of support of 2 ROCs/MWh for solar PV, stepping down to 1.9 ROCs in 2015/16 and 1.8 ROCs in 2016/17? Please explain your response with evidence.

74. 81 responses were received. Of these, 25 (31%) agreed or agreed with qualifications; 56 (69%) disagreed.

75. Of those who agreed or agreed with qualifications, around half did not provide further comments. Of the remainder, several respondents noted that it was appropriate that support for solar PV should not exceed that of the marginal technology (offshore wind) as to do so would not represent value for money. One respondent considered the proposed 2 ROCs/MWh support 'will become a target the industry can aim at' but stressed that the proposed degression 'must be taken in the context of the significant FIT changes [...] and any band changes must allow the continued growth' of solar PV technology. In addition, one respondent considered the proposed support would only

be sufficient for large-scale projects in the south west of England which provide power for industrial loads, and that:

> 'This level of support will not provide enough encouragement for stand-along PV projects, where electricity is fed back into the grid and industrial load projects in much of the UK.'

76. Of those who disagreed, several respondents were against the proposed degression due to the negative effect it would have on development of the sector. An academic/professional institute called for regular reviews of the support level in relation to cost reductions, rather than predicting at this stage what would happen in future. Two respondents thought the level of support should be higher, while three respondents felt the support level proposed was too high.

77. One trade association stated that in some parts of the country solar PV may well become the marginal renewable technology within the next few years and called for the UK Renewables Roadmap to be reviewed with solar PV added as the ninth technology, to ensure it plays its full part in the UK's future energy mix.

78. In addition, eleven respondents felt there should be no support for solar PV while a further twelve did not provide further comments.

Biomass electricity

Sustainability

Question 18. Do you agree that we should not exempt existing generators from future changes to the UK's sustainability criteria for solid and gaseous biomass? Please explain your response with evidence.

79. 125 responses were received. Of these, 71 (57%) agreed or agreed with qualifications; 54 (43%) disagreed.

80. Of those who agreed or agreed with qualifications, several respondents stated that the proposed approach would ensure a level playing field for all generators. In addition, a significant number of industry respondents made the point that clarity will be required over what the criteria will be in future – for example, so as not to undermine long-term biomass supply contracts.

81. Of those who disagreed, a number of respondents considered that the proposal would increase uncertainty and could jeopardise new investment in biomass projects. A number of alternative proposals were put forward by respondents, including the view that sustainability criteria should be grandfathered from the point of accreditation, and the suggestion that the sustainability standards should be grandfathered for all fuel supply contracts in place on 1 April 2013.

82. In addition, several respondents considered that the important issue is not whether the sustainability criteria are grandfathered, but whether they are robust enough. For example, one NGO said:

> ‘Not exempting existing generators will not address the issue of sustainability, since the future changes to the UK’s sustainability criteria outlined are not fit for purpose. They do not include full lifecycle carbon emissions, Indirect Land Use Change, carbon debt, human rights abuses, land grabs, food security and food sovereignty issues, pesticide issues, virtual water importation, all soil and water issues, most habitat & biodiversity loss.’

Biomass purity threshold

Question 19. Do you consider that the 90% biomass purity threshold is still appropriate? Please explain your response with evidence.

83. 100 responses were received. Of these, 62 (62%) agreed or agreed with qualifications; 38 (38%) disagreed.

84. Of those who agreed or agreed with qualifications, several respondents noted that a 90% threshold would allow sufficient flexibility, for example to use different biomass fuels or in case of possible contamination or natural variation in fuel composition. Other respondents thought that a lower threshold would allow non-biomass wastes to be used. Around one-third of those who agreed did not provide further comments.

85. Several respondents highlighted concerns about a threshold below 90%, including the impact on the availability of wood feedstock and the opportunities for generators to use less pure biomass sources. A number of respondents proposed graduated scales based on the biomass content of fuels, whereby the closer to 100% the greater amount of ROCs provided per MWh.

86. Of those who disagreed, a number of industry respondents felt the threshold should be 85% due to concerns over biomass supplies. One industry respondent explained that:

> ‘Although we are confident of managing within the 90% purity threshold currently, future changes to processing and segregation of the waste streams could lead us to take more contaminated biomass sources as fuel in the future. This appears a better option in terms of biomass resource use than for us to seek to compete for virgin wood if the recycled wood market becomes tight. Hence we support a reduction to an 85% purity threshold as this would allow us greater flexibility over fuel sourcing.’

87. Conversely, one industry respondent and one private individual considered that the threshold is too low as it allows generators to use unsustainable binders or other additives.

88. Several respondents, including a community group and an NGO, stated that the level of the threshold is irrelevant as biomass should not be supported under the RO because it is unsustainable at large scale.

Biomass conversion

Question 20. Do you agree with the Arup assessment of costs and deployment potential for biomass conversion? Please explain your response with evidence.

89. 79 responses were received. Of these, 35 (44%) agreed or agreed with qualifications; 44 (56%) disagreed.

90. Of those who agreed or agreed with qualifications, a number of respondents noted that the wide range of costs is reflective of the site-specific nature of conversions. One industry respondent queried how the analysis addressed particular issues, including whether the capex costs include the intrinsic value of the existing station and the cost of compliance with the Industrial Emissions Directive. One industry respondent noted that the deployment potential will depend on whether the generator can source sufficient volumes of fuel that meet the sustainability criteria, while a trade association pointed out that deployment and build rates need to be considered alongside those for enhanced co-firing since there is likely to be a transition route from one to the other. In addition, a considerable number of respondents did not provide further comments.

91. Of those who disagreed, a number of industry respondents noted that the Arup costs assessment does not consider foreign currency exchange movements which are expected to affect biomass fuel costs. Respondents in the wood industry expressed concern that the RO proposals do not consider the shortfall between domestic supply and the volume of biomass fuel required, and the negative effect the proposals will have on wood processing industries.

92. A number of NGOs and private individuals remarked that the analysis did not consider sustainability and environmental concerns.

Question 21. Do you agree that 1 ROC/MWh is an appropriate level of support for biomass conversions? Please explain your response with evidence.

93. 109 responses were received. Of these, 40 (37%) agreed or agreed with qualifications; 69 (63%) disagreed.

94. Of those who agreed or agreed with qualifications, around half did not provide any further comments. One industry respondent agreed with the proposed level of support but did not agree with the exclusion of fuel produced by gasification, while another industry respondent stressed that dedicated biomass plant which temporarily do not meet the proposed 90% biomass purity threshold (see question 19) should not be subject to this band.

95. Of those who disagreed, six industry respondents stated the proposed level of support was too low, while one industry respondent felt it was too high.

96. In addition, around 40% of respondents who disagreed with the proposal stated that there should be no subsidy for biomass, of whom over one-third cited sustainability concerns.

Question 22. Do you agree with our proposal for what should constitute a former fossil fuel generating station? Please explain your response with evidence.

97. 63 responses were received. Of these, 43 (68%) agreed or agreed with qualifications; 20 (32%) disagreed.

98. Of those who agreed or agreed with qualifications, around two-thirds did not provide further comments. In addition, two industry respondents qualified their agreement with the need for clarity regarding the applicable new plant standards under the Industrial Emissions Directive for installations which have opted out of the Large Combustion Plant Directive and re-accredit as new dedicated biomass plants. Another industry respondent agreed with the proposal, provided the permitted ancillary purposes referred to include fossil fuel used for start-up or flame stabilisation.

99. Of those who disagreed, around three-quarters did not provide comments or further evidence, or their comments did not directly address the question.

Question 23. Do you agree that all former fossil fuel generating stations which convert their entire generation to biomass before April 2013 should be transferred to the biomass conversion band? Please explain your response with evidence.

100. 80 responses were received. Of these, 48 (60%) agreed or agreed with qualifications; 32 (40%) disagreed.

101. Of those who agreed or agreed with qualifications, nearly half did not provide further comments. A number of respondents noted that the proposal would ensure a level playing field and represent value for money for consumers. One academic/professional institute agreed with the principle but thought the deadline for transfer to the biomass conversion band should be 2015 rather than 2013. In addition, one consultancy raised the concern that some operators may have begun signing contract for biomass supplies which would extend beyond April 2013 but would not be economic when support reduces to 1 ROC/MWh.

102. Of those who disagreed, around one-third did not provide further comments. Two NGOs noted that biomass conversions produce higher emissions than if the plant had remained a fossil fuel plant. One industry respondent questioned why a different approach was being taken for biomass conversions compared to new stations:

> ‘As long as both existing and new dedicated biomass stations comply with all quality, logistics and standards from a sustainability perspective, they serve the same purpose and as such should be rewarded in the same way without discrimination.’

103. In addition, two industry respondents considered the proposal amounted to a retrospective change which contradicted the grandfathering policy, while one industry respondent was concerned that the proposal could result in large plants soaking up the subsidies available which would stifle the growth of smaller more environmentally benign renewables technologies.

Question 24. Do you agree that support under the biomass conversion band should be grandfathered at the rate set from 1st April 2013? Please explain your response with evidence.

104. 89 responses were received. Of these, 50 (56%) agreed or agreed with qualifications; 39 (44%) disagreed.

105. Of those who agreed or agreed with qualifications, a significant number referred to the certainty and stability grandfathering provides.

106. Of those who disagreed, a number of respondents were concerned that grandfathering support would not deliver good value for money for consumers given wood price movements. Several respondents felt that support should not be grandfathered as biomass generation is not a long-term sustainable solution. Another group of respondents felt that biomass generation should not receive any support under the RO.

Question 25. We would welcome evidence on the differential in generation costs, the costs of making biomass conversion economically viable for industrial auto-generators, and deployment potential for auto-generating coal to biomass conversion.

107. While twelve responses were received, no costs evidence was provided. Of these, two respondents called for clarity regarding the definition of auto-generators. Two respondents from the chemical industry considered that industrial consumers generally face higher costs than some power generators. For example, one of them stated:

> 'Cost of capital and required returns are usually significantly higher for industrial consumers that for generators or vertically integrated energy companies.'

108. A consultancy firm noted that smaller plants may be cheaper to convert due to the different combustion technologies compared to larger units, however this may be offset 'by the need to deliver lower cost energy in a highly secure manner.' Two respondents pointed out that the question does not consider environmental costs and impacts.

Enhanced co-firing

Question 26. Do you agree with the Arup assessment of costs for enhanced co-firing? Please explain your response with evidence.

109. 59 responses were received. Of these, 28 (47%) agreed or agreed with qualifications; 31 (53%) disagreed.

110. One trade association stated that although they generally agree with the Arup assessment of costs for enhanced co-firing, the levelised fuel costs were below expectations. Two industry respondents drew a link between the costs of enhanced co-firing and the costs of biomass conversion, where in each case the wide range of

costs presented reflects the unique characteristics of such projects. Over 40% of those who agreed did not provide further comments.

111. Of those who disagreed, one generator considered that biomass fuel costs were underestimated as the cost of processing both domestic and imported biomass fuels had not been considered. Two NGOs disagreed as they considered the assessment did not consider environmental costs. Around 40% of those who disagreed did not provide further comments.

Question 27. Do you agree that 1 ROC/MWh is an appropriate level of support for enhanced co-firing? Please explain your response with evidence.

112. 92 responses were received. Of these, 32 (35%) agreed or agreed with qualifications; 60 (65%) disagreed.

113. Of those who agreed or agreed with qualifications, nearly half did not provide any further comments. Among those who did provide comments, one industry respondent noted that support should be higher than standard co-firing, one respondent agreed that support be aligned with the biomass conversion band, while one suggested that the support should be slightly reduced so as to maintain the incentives for moving to full conversion. One industry respondent suggested that higher support should be provided where the amount co-fired is more than 50%.

114. Of those who disagreed, several respondents considered the level of support was too high and would not represent value for money for consumers. For example, one industry respondent stated:

> 'We believe that 1ROC/MWh is an unduly generous level of support for what is an entirely conventional technology. Whilst we agree that there is a need for capital expenditure to complete such conversions the differential associated with crossing the 15% threshold is, in our view, likely to be marginal.'

115. By contrast, one industry respondent thought the level of support proposed was too low and 1.1 ROCs/MWh would be required to ensure sufficient switching of coal to biomass takes place .

116. In addition, a number of respondents considered enhanced co-firing was not a sustainable generation technology and a further group believed it should not be supported under the RO.

Question 28. Do you agree that generating stations should generate at least 15% of their electricity from biomass in order to qualify for the enhanced co-firing band? Please explain your response with evidence.

117. 89 responses were received. Of these, 34 (38%) agreed or agreed with qualifications; 55 (62%) disagreed.

118. Several respondents agreed with the proposal as reaching the 15% threshold would require generators to make adjustments to their plants and the additional support under the enhanced co-firing band would incentivise this investment. Over one-third of those who agreed did not provide further comments.

119. Of those who disagreed, a number of respondents thought biomass electricity should not be supported under the RO. Several respondents stated that the 15% threshold was too low and could be open to gaming, while one respondent thought it should be lower. A number of respondents reiterated general concerns around use of biomass while around one-quarter of respondents who disagreed with the proposal did not provide any further comments.

Question 29. Do you agree that generators should meet this minimum 15% threshold on a monthly averaged basis? Please explain your response with evidence.

120. 74 responses were received. Of these, 35 (47%) agreed or agreed with qualifications; 39 (53%) disagreed.

121. Of those who agreed or agreed with qualifications, a number of respondents referred to the consistency with current monthly reporting requirements. One industry respondent agreed provided that a generator not meeting the threshold in one month would not permanently place them in the standard co-firing band. Two industry respondents thought the proposal would help develop sustainable biomass supply chains by preventing generators from ceasing biomass electricity generation at certain times of the year. Nearly half of those who agreed did not provide further comments.

122. Of those who disagreed, several respondents felt a different time horizon should be introduced – one industry respondent considered it should be based on a rolling three-month calculation as this recognises that it will not be possible to meet the threshold exactly each month; another respondent though it should be done on an annual basis.

123. In addition, one industry respondent suggested that as a monthly system could result in perverse incentives regarding planning unit shutdowns, a better approach would be to allow biomass plants ‘to claim ROCs on the basis of expected annual biomass burn, paid monthly, with a semi-annual reconciliation’.

124. Around one-third of those who disagreed did not provide further comments.

Question 30. Do you agree that support under the enhanced co-firing band should be grandfathered? Please explain your response with evidence.

125. 74 responses were received. Of these, 45 (61%) agreed or agreed with qualifications; 29 (39%) disagreed.

126. Of those who agreed or agreed with qualifications, around 40% noted that grandfathering provides necessary certainty and stability to the industry and investors. Around one-third of those who agreed did not provide further comments.

127. Of those who disagreed, several respondents thought that enhanced co-firing should not be supported under the RO and therefore grandfathering was not necessary. Two industry respondents considered that grandfathering support would lock the UK in to inefficient coal generation at the expense of more efficient biomass CHP. In addition, a number of respondents raised the environmental impacts that grandfathering support would have. For example, one NGO stated:

'Grandfathering would fail to take into account future supply and demand conditions that could alter sustainability of supplies.'

128. Nearly 40% of those who disagreed did not provide any further comments.

Biomass co-firing (standard)

Question 31. Do you agree with the Arup assessment of costs and generating potential for standard co-firing of biomass? Please explain your response with evidence.

129. 53 responses were received. Of these, 25 (47%) agreed or agreed with qualifications; 28 (53%) disagreed.

130. Of those who agreed or agreed with qualifications, around 80% did not provide any further comments. One industry respondent pointed out that the actual level of investment will depend on how much biomass is intended to be burnt while another noted that it will be difficult to determine what the level of co-firing will be for any given year as this depends on other factors beyond level of RO support including the station's running regime, biomass prices and carbon prices.

131. Of those who disagreed, half of respondents did not provide any further comments. Five respondents pointed out that the Arup assessment does not adequately consider environmental and sustainability issues. Two industry respondents considered that the assumptions are incorrect; one of these further specified that it is incorrect to assume that imports do not affect local supply of biomass.

Question 32. Do you agree with the proposed level of support of 0.5 ROCs/MWh for standard co-firing of biomass? Please explain your response with evidence.

132. 93 responses were received. Of these, 43 (46%) agreed or agreed with qualifications; 50 (54%) disagreed.

133. Of those who agreed or agreed with qualifications, around 40% did not provide further comments. Several respondents agreed 0.5 ROCs/MWh was appropriate in the context of higher support for enhanced co-firing and biomass conversions. A number of respondents agreed with the proposal but suggested adjustments including: that 0.5 ROCs/MWh should apply up to a 35% threshold that all co-firing should receive 0.5 ROCs/MWh; standard co-firing should be reduced by 0.1 ROCs/MWh from April 2016 to mirror the proposals on dedicated biomass.

134. Of those who disagreed, a number of respondents considered that co-firing should not be supported under the RO due to its negative environmental impacts. There was also disagreement as the proposed level of support was not considered sufficient to incentivise co-firing. Several respondents raised the impact co-firing has on other wood users in the UK. One industry respondent thought that co-firing was over-compensated compared to dedicated biomass. In addition, around 20% of respondents stated that there should be no subsidies.

Question 33. Do you agree that standard co-firing of biomass should continue not to be grandfathered? Please explain your response with evidence.

135. 73 responses were received. Of these, 48 (66%) agreed or agreed with qualifications; 25 (34%) disagreed.

136. Of those who agreed, several respondents pointed out that as standard co-firing requires no significant investment, support should not be grandfathered. A number of respondents agreed on the basis that grandfathering support may act as a barrier to generators moving to higher levels of co-firing. Nearly half of those who agreed did not provide additional comments.

137. Of those who disagreed, over half did not provide additional comments. Several respondents thought standard co-firing should be grandfathered as it would provide revenue certainty to operators and help guard against a supply gap.

Dedicated biomass

Question 34. Do you agree with the Arup assessment of costs and deployment potential for dedicated biomass? Please explain your response with evidence.

138. 82 responses were received. Of these, 38 (46%) agreed or agreed with qualifications; 44 (83%) disagreed.

139. Of those who agreed, a number of respondents pointed out that economies of scale mean opex costs will be relatively higher for smaller dedicated biomass plants, while a few respondents noted that certain costs – such as land and initial biomass feedstocks – are not factored in to the analysis. Several respondents thought the deployment potential stated was overly optimistic. Over one-third of respondents did not provide further comments.

140. Of those who disagreed, a number of respondents raised concerns over assumptions about biomass supply – whether in light of the fact that the impact on other users of UK woody biomass have not been considered, or from the perspective of biomass sustainability issues. Two industry respondents consider the cost assumptions are incorrect, resulting in the deployment potential for dedicated biomass being over-estimated. One trade association respondent stated that the levelised costs should be based on plant life of 20 years, rather than 25 years, as this reflects the period of support under the RO and it will not be economic to procure feedstock without RO support.

Question 35. Do you agree with the biomass fuel price assumptions for domestic and imported fuel from AEA, and the use of a 10:90 domestic to imported ratio for average fuel costs for large (>50MW) dedicated biomass and 90:10 for small (<50MW) dedicated biomass based on the Arup report? Please explain your response with evidence.

141. 78 responses were received. Of these, 33 (42%) agreed or agreed with qualifications; 45 (58%) disagreed.

142. Of those who agreed or agreed with qualifications, several respondents noted that the location of the plant – whether coastal or inland – would have an impact on the source of the feedstock used. For example one industry respondent stated:

> 'Port based projects, regardless of size, will predominantly use the port facilities for delivery of feedstock. This may be imported or could be coastal traffic from elsewhere in the UK. Inland projects, particularly those < 50MW, are unlikely to import any feedstock in the core business case due to the additional transportation costs.'

143. One industry respondent thought the 10:90 and 90:10 ratios should be seen as indicative only and be compared with a 25:75 and 75:25 ratio, while another respondent thought that a 100 MW threshold should be used to distinguish between large and small generators. Over one-third of those who agreed did not provide any further comments.

144. Of those who disagreed, a few respondents thought the fuel cost assumptions were considerably underestimated. Several respondents thought that as a result of the lower costs of domestic wood compared to imports, generators will source as much as possible domestically before turning to imports.

145. A number of respondents raised concerns over the environmental and sustainability implications of importing large quantities of biomass feedstocks. One respondent thought the 90:10 ratio for small plants is desirable but unlikely to be realised. Nearly one-third of those who disagreed did not provide any further comments.

Question 36. Do you agree with the proposed level of support of 1.5 ROCs/MWh for dedicated biomass until 31 March 2016, reducing to 1.4 ROCs/MWh from 1 April 2016? Please explain your response with evidence.

146. 108 responses were received. Of these, 34 (31%) agreed or agreed with qualifications; 74 (69%) disagreed.

147. Of those who agreed or agreed with qualifications, around one-third agreed with the level of support of 1.5 ROCs/MWh but did not agree with the proposed reduction to 1.4 ROCs/MWh from April 2016. Over one-third of those who agreed did not provide any additional comments.

148. Of those who disagreed, a number of respondents felt the proposed degression to 1.4 ROCs/MWh from 1 April 2016 does not give a positive message to investors and would impact on deployment as it would allow only the most efficient plant to be developed. Several respondents thought that as costs would not reduce by 2016 the proposed reduction in support could not be justified. For example, one industry respondent stated:

> 'We do not expect the capital cost of plants to fall over the remainder of the RO and see the proposed reduction in funding by the RO as unnecessarily punitive to later projects, particularly given the predicted increase in fuel costs over the interim period.'

149. A number of respondents felt that dedicated biomass should not receive support under the RO; some thought this as there are limited supplies of sustainable biomass feedstocks, while others did not provide a reason for their view.

Question 37. Do you agree that the support level proposed for dedicated biomass manages the risk of locking supplies of feedstock in to this sector? Please explain your response with evidence.

150. 90 responses were received. Of these, 27 (30%) agreed or agreed with qualifications; 63 (70%) disagreed.

151. Around half of those respondents who agreed did not provide any further comments. Two industry respondents agreed as they did not consider that the proposed level of support for dedicated biomass will bring forward new dedicated biomass projects. One industry respondent thought alternative uses of biomass will not be threatened by the proposals, stating:

> 'The consultation figures suggest that biomass conversions, enhanced co-firing and new build might consume around 240 PJ [petajoule] of biomass, which is less than 15% of the headline availability figure.'

152. Of those who disagreed, several respondents did not consider that the proposals for dedicated biomass meant there was a risk to be managed in terms of feedstock supplies. Another group of respondents thought that the proposals on dedicated biomass did not avoid the risk of lock-in, and were concerned about the impact this would have on other wood users.

153. One NGO noted that the proposals would not avoid lock-in as they do not affect biomass projects currently in the pipeline, the majority of which are large scale plants.

Bioliquids

Question 38. Do you agree with the Arup assessment of generation costs and deployment potential of bioliquids, and the bioliquid fuel prices as set out in the Impact Assessment? Please explain your response with evidence.

154. 49 responses were received. Of these, 20 (41%) agreed or agreed with qualifications; 29 (59%) disagreed.

155. Of those who agreed, over two-thirds did not provide any further comments. One industry respondent agreed that the costs are higher for bioliquids than for solid biomass.

156. Of those who disagreed, several respondents pointed out that the analysis did not take account of environmental or social considerations. A number of respondents considered that some of the assumptions were wrong but it was difficult to comment directly on the analysis as it did not contain a sufficient amount of detail. For example, one industry respondent stated:

‘The data in the Arup assessment is very difficult to assess as there seems to be a very wide range of project size included in the calculations as well as a lack of detail generally.’

157. Around half of those who disagreed did not provide any additional comments.

Question 39. Do you agree that support for bioliquids should be the same as for solid and gaseous biomass under the dedicated biomass, biomass conversion, enhanced co-firing and standard co-firing bands? Please explain your response with evidence.

158. 65 responses were received. Of these, 37 (57%) agreed or agreed with qualifications; 28 (43%) disagreed.

159. Of those who agreed or agreed with qualifications, a key theme emerging was that the proposal would ensure a fair and simple approach which improves clarity for investors. One trade association welcomed the proposals but called for further clarity on whether bioliquids would be eligible for the Renewable Heat Incentive (RHI) as the current uncertainty is holding back development of bioliquid CHP plants. Over 40% of those who agreed did not provide any additional comments.

160. Of those who disagreed, nearly half of respondents thought that bioliquids should not be supported under the RO. These respondents were broadly split between those who cited environmental and sustainability concerns, and those who were against public subsidies for electricity generation. Two industry respondents thought the level of support should be higher to encourage development of the bioliquids sector.

161. Around one-third of those who disagreed did not provide any further comments.

Question 40. Do you agree that ‘fossil-derived bioliquids’ should receive the same level of support as other bioliquids? Please explain your response with evidence.

162. 55 responses were received. Of these, 28 (51%) agreed or agreed with qualifications; 27 (49%) disagreed.

163. Several respondents agreed with the proposal, provided that the sustainability criteria are met. Another group of respondents noted that the proposed approach would provide consistency. Around half of those who agreed did not provide any further comments.

164. Of those who disagreed, several respondents did not agree that fossil-derived bioliquids should receive support but did not give a reason why. One industry respondent felt that as fossil-derived bioliquids are a mature product they should receive a lower level of support, while another respondent consider them to be an inefficient way to produce bioliquids in terms of their carbon footprint that should not receive the same support as other bioliquids. Around half of those who disagreed did not provide any additional comments.

Question 41. Do you agree that a cap should be put in place on the amount of electricity generated from bioliquid that suppliers can use to meet their renewables obligation? Please explain your response with evidence.

165. 68 responses were received. Of these, 31 (46%) agreed or agreed with qualifications; 37 (54%) disagreed.

166. Of those who agreed or agreed with qualifications, a large number of respondents noted that the proposed cap would protect against high levels of bioliquid deployment in the electricity sector which would reduce the availability of bioliquids in the transport and heat sectors, or impact on sustainability. Two respondents agreed with the proposal, provided that it did not cause distortions in the market. Over 60% of those who agreed did not provide any further comments.

167. Of those who disagreed, a number of respondents thought the proposal would create distortions in the market. Several respondents did not agree with RO support for bioliquids due to sustainability and environmental concerns. A few respondents thought the rationale for the cap was not clear, while two respondents stated that the cap should not apply to those bioliquids which cannot be used in the transport sector.

168. Around one-quarter of those who disagreed did not provide additional comments.

Question 42. Do you agree with the level of the cap being set at 4% of each supplier's renewables obligation, broadly equivalent to a maximum level of generation of 2TWh/y in 2017? Please explain your response with evidence.

169. 66 responses were received. Of these, 22 (33%) agreed or agreed with qualifications; 44 (67%) disagreed.

170. Of those who agreed or agreed with qualifications, one respondent thought it should be possible to pool between suppliers while another respondent felt the level of the cap should be reviewed when it is achieved in case there were compelling reasons to increase it. Over three-quarters of those who agreed did not provide any additional comments.

171. Of those who disagreed, several respondents reiterated their responses under question 41, that the cap would create market distortions or that bioliquids should not be supported under the RO for sustainability and environmental reasons. A number of respondents were concerned that if another fuel source became available the cap may not be sufficient. These respondents also had concerns that the cap could be used up by large enhanced co-firers, at the expense of small dedicated bioliquid generators and called for clarity on how the cap will be administered.

Question 43. Do you agree that from 1 April 2013, bioliquids should be treated in the same way as solid and gaseous biomass for the purposes of our grandfathering policy? Please explain your response with evidence.

172. 62 responses were received. Of these, 39 (63%) agreed or agreed with qualifications; 23 (37%) disagreed.

173. Of those who agreed or agreed with qualifications, a large number considered that the proposal would ensure a consistent approach across the RO and provide certainty to investors. Nearly half of those who agreed did not provide further comments.

174. Of those who disagreed with the proposal, several respondents felt bioliquids should neither be supported under the RO nor have support grandfathered. A number of respondents disagreed due to environmental and sustainability concerns. For example, one NGO stated:

> 'Bioliquids should not be grandfathered [...] as this not only guarantees revenue for generators but also ensures continuation of environmental and social abuses.'

175. Nearly half of those who disagreed did not provide any additional comments.

Energy from Waste with Combined Heat and Power (CHP)

Question 44. Do you agree with the Arup analysis on costs and potential on EfW with CHP, including the estimates of gate fees used? Please explain your response with evidence.

176. 64 responses were received. Of these, 18 (28%) agreed or agreed with qualifications; 46 (72%) disagreed.

177. Of those who agreed or agreed with qualifications, one consultancy respondent made the point that:

> 'We have been involved in a number of CHP schemes including EfW and generally agree with Arup's conclusions, but the hidden costs and complexities of adding CHP always seem to render it unattractive. This is as much about the challenges of securing heat load; overcoming misconceptions; physical installation of piping etc as it is about the pure economics.'

178. A local authority agreed with Arup's assessment but not on the conclusions drawn from it by DECC. More than two-thirds of those who agreed did not provide further comments.

179. Of those who disagreed, there was concern about the costs and potential deployment. Several respondents were concerned that Arup's analysis did not fully consider the capital and operating costs associated with construction and operation of the technology. One consultancy noted that:

> 'The Arup report does not include any cost data on EfW without CHP and the calculation of 'levelised costs' specifically excludes the costs of any infrastructure outside the site.'

180. The estimates of gate fees were also queried with views expressed that they were both higher and lower than that stated in the consultation.

Question 45. Do you agree that 0.5 ROCs is an appropriate support level for EfW with CHP? Please explain your response with evidence. We would particularly welcome evidence relating to levels of gate fees received by generators and additional capital costs relating to heat offtake.

181. 85 responses were received. Of these, 19 (22%) agreed or agreed with qualifications; 66 (78%) disagreed.

182. Of those who agreed or agreed with qualifications, one industry respondent thought the level of support is appropriate as the main driver for most EfW, with or without CHP, is mass and volume reduction of waste prior to landfill rather than efficient resource use. Nearly three-quarters of those who agreed did not provide any additional comments.

183. Of those who disagreed, several respondents felt it unlikely that a significant number of projects would be developed under the reduced level of support because the evidence was that the current support is insufficient. One consultancy respondent stated that:

> 'Without significant benefits to overcome the site hurdles, developers will opt for the cheaper and easier option of no CHP, thereby losing the substantial benefit of renewable CHP. The reduction in the band for EfW with CHP is of particular concern because of the recently announced reduction in the large scale biomass tariff under the RHI.'

184. There were calls from some NGOs that there should be no RO support for EfW as according to the Renewables Directive, waste is not a renewable energy.

Question 46. In addition to municipal solid waste, do you consider that there are any other types of wastes which could benefit from provisions deeming their biomass content or benefit from more flexible fuel measurement and sampling procedures? If so, please specify and provide evidence on how we might determine accurately the renewable content of these wastes.

185. 33 responses were received and a variety of suggestions were made on the types of other wastes which could benefit from the provisions, including commercial wastes, industrials wastes, solid recovered fuels, biosolids and sludge. For example, one trade association suggested that any waste with organic material should be eligible for support, with support scaled to reflect the renewable component. It was suggested that the Good Quality CHP scheme provides an example of how such a scheme could work. One industry respondent believed the definition of municipal solid waste should be as wide as possible to be consistent with European legislation.

186. One trade association stated that proving the biogenic content is a costly and complicated process and there should be a more pragmatic approach to fuel measurement and sampling where the cost is proportional to the benefit.

187. Suggestions on how to determine accurately the renewable content of these wastes included national protocols which would negate the requirement for site-specific measurement. It was stated that the monitoring of biogenic/fossil carbon by analysis of

the carbon contained in emissions could be undertaken now that Ofgem had used it, and this would help address the cost hurdles.

Anaerobic digestion

Question 47. Do you agree with the Arup analysis on costs and potential on AD and AD with CHP, including the estimates of gate fees used? Please explain your response with evidence.

188. 50 responses were received. Of these, 19 (38%) agreed or agreed with qualifications; 31 (62%) disagreed.

189. Of those who agreed or agreed with qualifications, over two-thirds did not make any additional comments. Among those that did, there was a consensus that the Arup analysis was fair. For example, one private company stated that:

> 'It conformed to a growing body of evidence based on operational experience.'

190. Of those who disagreed, there were questions over the assumptions used and concerns that the analysis had not looked at all of the potential models of AD. For example, one trade association stated that:

> 'For farm based AD, the costs seem reasonable. However, for industrial facilities, requiring significant de-packaging infrastructure and able to accept wider range of materials, the capex figures in particular appear low.'

191. There was concern that the assumed gate fees were inaccurate and fail to predict future trends. For example, one local authority respondent suggested that:

> 'While the initial Arup medium cost per MWh analysis appears to be credible, the reduction in gate fees shown over time suggests the costs of capital and/or capital expenditure are understated. Between 2010 and 2011, the gate fee of £50/t quoted by WRAP fell to £36 per tonne and could well be expected to reduce further over time.'

192. Nearly 40% of those who disagreed did not provide any additional comments.

Question 48. Do you agree with the proposed level of 2 ROCs/MWh for Anaerobic Digestion, stepping down to 1.9 ROCs in 2015/16 and 1.8 ROCs in 2016/17? Please explain your response with evidence.

193. 84 responses were received. Of these, 33 (39%) agreed or agreed with qualifications; 51 (61%) disagreed.

194. Of those who agreed or agreed with qualifications, there was support in principle for maintaining the level of support for AD at 2 ROCs/MWh and stepping down support to 1.8ROCs/MWh in 2016/17. Around half of those who agreed did not make any further comments.

195. Of those who disagreed, several respondents felt that there is currently not enough incentive for AD facilities to be viable and further reducing this incentive would increasingly hinder deployment in the UK. It was felt that current investor confidence displayed by the market should not be undermined by reducing the level of support. It was suggested that accelerating the uptake of more efficient energy conversion technologies such as fuel cells that are capable of delivering additional power per unit of biogas required support to remain at its current level. This would ensure that a technology base and supply chain was established. One respondent felt that because the development of AD projects of this scale will always be a bespoke process, it meant that development would not benefit from the mass manufacture that is expected to be seen in other technologies. A contrary view to maintaining support at 2 ROCs/MWh was that the current level of support was disproportionately high relative to the low efficiency of power generation and to the modest environmental value of the digestate for use on land.

196. It was noted by one respondent that whilst AD is a useful method of producing limited amounts of energy, robust sustainability criteria for source materials are required to prevent adverse LUC effects through energy crops being grown to feed digesters.

Advanced conversion technologies (gasification and pyrolysis)

Question 49. Do you agree with the proposal to replace the standard and advanced pyrolysis and gasification bands with two new ACT bands? Please explain your response with evidence.

197. 70 responses were received. Of these, 30 (43%) agreed or agreed with qualifications; 40 (57%) disagreed.

198. Of those who agreed or agreed with qualifications, a number of respondents thought the proposed approach would improve clarity and should encourage development of more efficient processes. Around one-third of those who agreed did not make any further comments.

199. Of those who disagreed, the majority felt that the bands and specifically the eligibility criteria should remain unaltered, to allow the development of this sector to continue on its current path, and to allow existing project pipelines to be developed. For example, one trade association disagreed with the proposal because:

> 'It represents a complete change of approach from the policy developed in this area in the 2009 Banding Review. The market for ACTs continues to develop, with companies developing project pipelines based on the requirements regarding calorific value introduced in the 2009 Banding Review. Current proposals will pull the rug out from under the feet of such existing project pipelines, rendering investment in them to date completely worthless.'

200. Several respondents felt that ACTs should not be supported under the RO as they do not have any benefits over incineration. Nearly one-third of those who disagreed did not provide additional comments.

Question 50. Do you agree with the eligibility criteria for the new standard ACT and advanced ACT bands? Please explain your response with evidence.

201. 83 responses were received. Of these, 28 (34%) agreed or agreed with qualifications; 55 (66%) disagreed.

202. Of those who agreed or agreed with qualifications, a common view was that the definitions needed some clarification. One industry respondent stated that 'replacing the calorific value of the gas as an eligibility criteria in favour of the type of equipment used for power production is an improvement.' Another industry respondent suggested that the eligibility criteria should also have minimum calorific values (CV) and cleanliness levels or engine manufacturers would simply de-rate their engines to take low CV and dirty gas and not provide the benefits intended. Nearly 40% of those who agreed did not provide any further comments.

203. Of those who disagreed, there was some concern that the proposed change would undermine investor confidence and eligibility resulting in planned facilities becoming financially unviable, preventing the development of the ACT market. For example, one industry respondent stated that:

> 'The radical change proposed is damaging to developer/investor confidence in new projects, due to the greater degree of uncertainty attached to other future changes.'

204. One local authority respondent considered that the present eligibility classifications provide for greater flexibility for ACT project developers to choose the most efficient and bankable technologies for delivery. One trade association noted that if the intent is to incentivise more efficient forms of gasification, using efficiency as the deciding factor between standard and advanced gasification is a more logical approach. It was also suggested that the RO should not pick technologies, but instead encourage all technologies to be more efficient. For example, one consultancy respondent stated:

> 'The eligibility criteria should be technology neutral. It is best to leave it to the market to decide the best way forward to deliver the ACT process with the highest energy conversion efficiency. This will help spur genuine innovation in ACTs.'

Question 51. Do you agree with the proposed levels of support for the new standard ACT and advanced ACT bands? Please provide evidence on the relevant technology capital and operating costs (including levels of gate fees) to support your comments).

205. 85 responses were received. Of these, 29 (34%) agreed or agreed with qualifications; 56 (66%) disagreed.

206. Of those who agreed or agreed with qualifications, the levels of support were considered sufficient to encourage development but there was some concern about the reduction in support for advanced ACTs from 2015/16. Over one-third of those who agreed did not provide further comments.

207. Of those who disagreed, the majority felt the proposed support levels were insufficient and any decrease in ROC support would render the majority of projects unviable in the current market and lead to a decline in the development of ACT projects. The project cycle for these developments can be around 4-5 years and introducing another stipulation will result in projects that are in planning/scoping having to alter their design, process and business plan causing further delays and additional cost. For example, one industry respondent stated that:

> 'The proposals make investment in ACT look very questionable and damage the propensity for us to continue investing in R&D.'

208. A number of industry respondents stated that Arup's assessment of gate fees for standard and advanced ACTs were completely wrong and provided their own evidence.

Question 52. We would welcome evidence on the generation costs, deployment potential and gates fees for the ACT technologies falling within the two new ACT bands proposed above.

209. 28 responses were received but the majority of these did not provide any evidence. Those that did, provided evidence about generation costs and gate fees for ACT technologies on a confidential basis.

Question 53. We would welcome information on the nature and scale of actual or potential air emissions produced in the generation of electricity from pyrolysis oil.

210. Seven responses were received but little evidence was provided on the nature and scale of air emissions. One manufacturer stated that to their knowledge, there is insufficient industry experience to provide this information, but that it is not expected that the emissions from the engine combustion of pyrolysis oil would exceed current emissions limits (using appropriate engine after treatment technology), if the pyrolysis oil is produced from relatively clean biomass.

211. In addition, one industry respondent suggested that:

> 'The emissions from the combustion of pyrolysis oil would be a function of several variables, including the feedstock from which the pyrolysis oil was derived, the pyrolysis process itself, the associated pyrolysis oil upgrading undertaken, the nature of the combustion plant and the flue gas treatment systems that might be fitted to it. As with any combustion plant it is simply inappropriate to correlate emissions with the type of fuel, and we advise against trying to do this. Any fuel has the potential to cause unacceptable pollution; it depends upon the combustion system, the conditions of its operation and the flue gas treatment system.'

Landfill gas

Question 54. Do you agree with the Arup assessment of generation costs and deployment potential of landfill gas, and the gate fee assumption of zero? Please explain your response with evidence.

212. 46 responses were received. Of these, 17 (37%) agreed or agreed with qualifications; 29 (63%) disagreed.

213. Of those who agreed, the vast majority did not provide further comments.

214. Of those who disagreed, a number of industry and trade association respondents stated that the assumptions are simplistic and do not reflect operational practicalities. Whilst they agreed that the landfill gas resource is currently at or near its peak they disagreed with the decline which should be based on waste tonnage information and not on the assumed economic life of plant.

215. It was also felt that the operating costs are understated for new build plant because as the composition of the waste changes it now requires pre-treatment before use. As the organic content of the waste sent to landfill declines further, this problem will be exacerbated. Other industry respondents felt the assessment did not take into account commercially available new technology for tackling older, closed sites.

216. No comments were received on the gate fee assumption. Around 40% of those who disagreed did not provide any further comments.

Question 55. Do you agree that RO support for new landfill gas generation should end from 1 April 2013? Please explain your response with evidence.

217. 57 responses were received. Of these, 28 (49%) agreed or agreed with qualifications; 29 (51%) disagreed.

218. Of those who agreed or agreed with qualifications, around half did not provide further comments. Among those who did, one local authority respondent supported the removal of support as they consider it is perverse to support the process at the bottom of the waste hierarchy in this way, particularly as operational sites and those closed since 2001 are under a legal duty to capture and utilise landfill gas where possible.

219. Of those who disagreed, many recognised that landfill gas utilisation is a mature operation but is still a significant greenhouse gas contributor and every effort should be put in place to ensure capture and utilisation wherever possible. One statutory authority stated that withdrawing financial incentives for sites without infrastructure in place would not help with their aims of preventing methane emissions from these sites.

220. Several industry and trade association respondents noted that whilst larger sites do not need support, smaller projects have already stalled since the introduction of the 0.25 ROCs/MWh band. It was suggested that support of 1 ROC/MWh should be limited to projects under 500 kW in order to unlock the potential that is currently not being developed.

221. One trade association noted that removal of support would serve to constrain the development of landfill gas schemes because the composition of landfill gas is changing which requires substantially more pre-treatment increasing the costs of delivery. It was stated that a technology challenge remains and a level of support is still needed to encourage investment in the area.

Question 56. We would welcome evidence on new technologies that can increase the technical potential of landfill gas in the UK, particularly from older landfill sites. Information on the costs, potential and viability of new technologies would be particularly valuable.

222. 12 responses were received and the following technologies were suggested:

- Waste heat to power technologies using the Organic Rankine Cycle or steam cycle.
- Microturbines which are able to generate electricity from low methane content gas, including fuel cells.

223. In addition, the use of biogas for biomethane upgrade was noted as being more efficient than electricity generation and an RHI tariff for landfill gas was proposed. One respondent noted that there is not an economic case for accessing methane flows from badly run pre-1990 sites where most of the gas has vented.

Sewage gas

Question 57. Do you agree with the Arup assessment of generation costs and deployment potential for sewage gas, and the zero gate fee used in the analysis? Please explain your response with evidence.

224. 35 responses were received. Of these, 17 (49%) agreed or agreed with qualifications; 18 (51%) disagreed.

225. Of those who agreed or agreed with qualifications there was broad agreement with the capital costs and limited deployment potential. However, it was noted that it was very difficult to assess the gate fee. Around two-thirds of those who agreed did not make any additional comments.

226. Of those who disagreed, more than two-thirds did not provide further comments. Of those that did, one industry respondent noted that the Arup assessment does not take into account any evidence on fuel cell technologies that can increase power production.

Question 58. Do you agree that 0.5 ROCs/MWh is an appropriate level of support for electricity generated from sewage gas? Please explain your response with evidence.

227. 52 responses were received. Of these, 24 (46%) agreed or agreed with qualifications; 28 (54%) disagreed.

228. Of those who agreed, nearly two-thirds did not provide further comments. Among those who did, one respondent stated that 0.5 ROCs/MWh remains an appropriate level of support with water companies already receiving funding via the Ofwat

regulatory structure, while one respondent noted that costs had not changed significantly over the last few years.

229. Of those who disagreed, several respondents felt the proposed support was not an incentive for the deployment of smaller scale rural projects. From one water company's experience of commissioning new plant they felt the figure of 0.5 ROCs/MWh was too low but did not suggest what the figure should be. It was also noted that the water industry had previously argued against the reduction from 1-0.5 ROCs/MWh. One respondent noted that additional support to advance digestion technologies is required if they are to provide any future growth from sewage gas. One consultancy noted that as sewage gas is a source of energy which can be operated on demand it is of higher value than intermittent sources and should be rewarded with higher ROC support.

Question 59. We would welcome evidence on new technologies that can increase the technical potential from sewage gas in the UK. We are also interested in whether there is potential cogeneration. Information on the costs, potential and viability of new technologies would be particularly valuable.

230. 13 responses were received and the following technologies were put forward to increase the technical potential from sewage gas:

- Advanced anaerobic digestion (thermal hydrolysis).
- Anaerobic digestion with a preliminary acid phase, which has shown the potential to yield about 20% more biogas for CHP.
- Innovative high efficiency conversion technologies such as fuel cells which can generate electricity from gas with a low methane content.

231. In addition, practical experience was given of using microbial fuel cells in the UK which bypass the biogas gas production stage. It was suggested that support should be available to encourage companies to switch from conventional sewage gas CHP to advanced anaerobic digestion of sewage. The opportunity for biomethane injecting into the gas grid was noted, as was piping sewage gas to advanced gasification plants fired by solid recovered fuel.

Renewable CHP

Question 60. Do you agree with the Arup assessment of generation costs and deployment potentials for CHP technologies, and with the fuel prices used in the analysis? **Please explain your response with evidence.**

232. 54 responses were received. Of these, 20 (37%) agreed or agreed with qualifications; 34 (63%) disagreed.

233. Of those who agreed around three-quarters provided no further comments. Two industry respondents agreed with the Arup assessment of generation costs, deployment potential and fuel prices and supplied technical evidence on a confidential basis to support this.

234. Of those who disagreed, there was concern that the data used for the assessment was not sufficient, accurate or representative. The capital and operating costs were questioned and one trade association believed the operating costs were a little low and estimated most projects would be in the upper range. One industry respondent felt the deployment potential for renewable CHP had been significantly underestimated. Another industry respondent did not agree with the assumption that dedicated biomass crops will fall in price because this was counter to observed evidence of increasing commodity market prices across the world in all land grown products.

Question 61. Do you agree that 2 ROCs/MWh is an appropriate level of support for dedicated biomass with CHP? Please explain your response with evidence.

235. 80 responses were received. Of these, 44 (55%) agreed or agreed with qualifications; 36 (45%) disagreed.

236. Of those who agreed, it was felt that the enhanced level of support offered was a sufficient incentive to develop CHP where appropriate. Those who agreed with qualifications suggested that that the CHP uplift should be retained given the uncertainties that exist over the future support for large projects under RHI which was not considered an adequate replacement. For example, one industry respondent stated that:

> 'The RO uplift provides a robust revenue stream which can support investment to deliver renewable heat infrastructure which would otherwise not be delivered.'

237. Around one-third of those who agreed did not make any further comments.

238. Of those who disagreed, many respondents thought maintaining the uplift was essential to finance the additional capital costs of a biomass CHP project. For example, one trade association noted that the uplift reflected the risk associated with the heat market, which is a non-traded market unlike electricity. Another industry respondent pointed out that the Arup report was at odds with the DECC recommendation and that investment in small-scale biomass CHP was uneconomical at the proposed rate. Some respondents stated that support should be 2.5 ROCs/MWh but provided no supporting evidence.

239. One individual agreed that maximising overall efficiency through the use of CHP should be incentivised, but had concerns about biomass:

> 'The large scale use of biomass for energy generation was inappropriate and unsustainable. Government should not be encouraging such damaging generation methods and certainly not subsidising them, so no ROC support is appropriate.'

Question 62. Do you agree that 2 ROCs/MWh is an appropriate level of support for dedicated energy crops with CHP? Please explain your response with evidence.

240. 68 responses were received. Of these, 29 (43%) agreed or agreed with qualifications; 39 (57%) disagreed.

241. Of those who agreed, several respondents felt that support was required to encourage both the energy crop supply chain and the development of CHP. For example, one consultancy respondent stated that:

> 'Both CHP and energy crops should be encouraged as they have great underdeveloped potential at the moment.'

242. In addition, one industry respondent noted that there was little evidence that significant volumes of energy crop capacity have been developed for the purpose of energy production and there was therefore no justification for reducing the level of support.

243. Around two-thirds of those who agreed did not provide any further comments.

244. Of those who disagreed, a number of respondents argued that there should be an uplift for energy crop use as this is more expensive than ordinary biomass. One industry respondent suggested that the appropriate rate should be 2.5 ROCs/MWh or 2 ROCs/MWh plus RHI.

245. Several respondents were concerned with the expense and environmental impacts of energy crops. For example, one academic respondent stated that:

> 'Energy crops make for extremely expensive electricity, as well as having land-use/environmental concerns and should be a last resort choice unless these issues can be resolved and costs substantially reduced.'

246. Similarly, one individual felt that where the energy crops are imported or the project is large-scale the Government should not be subsidising such a damaging method of electricity generation.

Question 63. Do you agree that 1 ROC/MWh is an appropriate level of support for standard co-firing of biomass with CHP? Please explain your response with evidence.

247. 59 responses were received. Of these, 23 (39%) agreed or agreed with qualifications; 36 (61%) disagreed.

248. Of those who agreed or agreed with qualifications, nearly three-quarters of respondents did not provide any further comments. Of those that did, one individual agreed that if a power station is able to achieve the good quality CHP level then it should be eligible for the additional half ROC uplift. One industry respondent agreed with the proposal on the grounds that 0.5 ROCs/MWh is sufficient for standard co-firing and all biomass generation faces the same additional costs in developing sources of energy crops.

249. Another industry respondent welcomed the CHP uplift but suggested there was an inconsistency as standard co-firing with CHP would receive the same level of support as enhanced co-firing without CHP which effectively removes the incentive for co-firers to invest in CHP at their plants.

250. Of those who disagreed, a variety of reasons were put forward as to why no support should be given or the level should be reduced. For example, one industry respondent did not believe that an additional 0.5 ROCs/MWh was justified where the heat element existed prior to the commencement of co-firing, while another industry respondent suggested that this type of technology did not allow efficient or effective use of wood fuel and should not be encouraged with subsidy support. In addition, one industry respondent noted that it was unreasonable for support to be provided for biomass co-firing in existing plants under the RO but not to provide similar support for existing renewable heat under the RHI.

251. A considerable number of respondents did not consider that standard co-firing of biomass with CHP should receive support due to sustainability and environmental concerns or due to general opposition to subsidies.

Question 64. Do you agree in principle that 1.5 ROCs/MWh is an appropriate level of support for standard co-firing of energy crops with CHP? It would be helpful if you could provide evidence on costs and deployment potential to inform our decision.

252. 59 responses were received. Of these, 21 (36%) agreed or agreed with qualifications; 38 (64%) disagreed.

253. Of those who agreed, around 80% did not provide further comments. One industry respondent noted that in their experience energy crops had been very difficult to source and thought that a higher level of support could enable preferential pricing of energy crops over standard biomass.

254. Of those who disagreed many felt that no support should be given – whether for environmental reasons or due to general opposition to subsidies – or that the level of support should be reduced. For example, one industry respondent stated:

> '1.5 ROCs/MWh is an excessive level of support for standard co-firing of energy crops with CHP taking into consideration the low level of additional capital costs required for co-firing and the potential consequence of diverting energy crops away from more efficient use, such as liquid biofuel production for transport.'

Question 65. Do you agree with the arrangements for transition from the CHP uplift to RHI support as set out in this chapter (i.e. no RHI for projects accrediting under the RO; one-off choice between RHI and CHP uplift for projects accrediting between April 2013 and March 2015; no CHP uplift for projects accrediting after that date, unless the RHI is unavailable for that technology on 1 April 2015)? Please explain your response with evidence.

255. 68 responses were received. Of these, 26 (38%) agreed or agreed with qualifications; 42 (62%) disagreed.

256. Of those who agreed or agreed with qualifications, there was support to extend the current transition arrangements from 2013 to 2015. However, whilst some respondents agreed in principle to replace the uplift with support offered under the RHI

there were concerns that RHI support was insufficient and excluded bioliquids. It was also suggested that the CHP uplift should be extended beyond 2015 to March 2017.

257. Nearly half of those who agreed did not provide further comments.

258. Of those who disagreed there was strong opposition to the transition away from the CHP uplift under the RO to support under the RHI. It was considered that the recent changes to the RHI large scale biomass support rate meant that the RHI effectively provided little or no support for CHP.

259. There was support for offering projects the option of two funding arrangements for the heat element until 2017. It was also felt that a two year window was too short for complex schemes to be completed and commissioned. For example, one trade association expressed a view that was shared by a number of other respondents, stating that:

> 'The proposed CHP policy could encourage larger, less CHP efficient installations, rather than ones sized for optimal efficiency. The recent reduction in the RHI makes it unattractive to build CHP under that tariff and plants may not be built. CHP can contribute in both renewable electricity and heat targets. Government needs to give projects long enough to build and commission with the 0.5 ROC uplift.'

Question 66. Do you agree that we should adopt a policy of grandfathering the CHP uplift for eligible projects from 1 April 2013? Please explain your response with evidence.

260. 66 responses were received. Of these, 46 (70%) agreed or agreed with qualifications; 20 (30%) disagreed.

261. Of those who agreed there was a consensus that the grandfathering of support was essential. It was suggested that without such a provision uncertainty would undermine investor confidence and harm the chances of projects coming forward. For example, one consultancy respondent stated that:

> 'Deployment is totally dependent on investor confidence and without an assurance of grandfathering investors will have no assurance of future revenue levels.'

262. One trade association noted that this was particularly relevant given the current uncertainty around the RHI.

263. Of those who disagreed, around half did not provide any reasons. Several respondents felt that the CHP uplift should not be grandfathered since this subsidises environmentally damaging means of energy production and because heat generation by means of CHP is already under the RHI.

Question 67. Do you agree in principle that we should consider extending the CHP uplift to the new biomass conversion and enhanced co-firing bands until 31 March 2015? It would be helpful if you could provide evidence on costs and deployment potential to inform our decision.

264. 52 responses were received. Of these, 29 (56%) agreed or agreed with qualifications; 23 (44%) disagreed.

265. Of those who agreed, around half did not provide further comments. Several respondents agreed that the uplift should be extended to the new biomass conversion and enhanced co-firing bands but argued the uplift should be available to 2017. For example, one industry respondent thought this was especially relevant as RHI support for large scale biomass has been reduced and no longer equates to the 0.5 ROCs/MWh CHP uplift as originally envisaged.

266. In addition, one industry respondent believed that the uplift should only apply to new schemes as converting an existing fossil fuelled CHP scheme to biomass does not change the economics of the heat element of the plant and additional support is not justified.

267. Of those who disagreed, around half did not provide reasons. Among those who did, the majority felt these technologies should not be supported under the RO, whether on environmental grounds or because of general opposition to subsidies.

Question 68. Do you consider it would be appropriate to introduce a CHP uplift into the RO for ACTs? If so, please provide evidence on capital and operating costs of plant operating in CHP mode, together with likely deployment potential between now and 2020 and, if possible, 2030?

268. 49 responses were received. Of these, 25 (51%) agreed or agreed with qualifications; 24 (49%) disagreed.

269. Of those who agreed or agreed with qualifications, a number of respondents noted that this approach would be consistent with the uplift available to other types of renewable generation with CHP. Several respondents agreed in principle with the division of support for heat and power under the RHI and RO respectively, but noted that current capacity limits for RHI support could disincentivise developments. Around 40% of those who agreed did not make further comments.

270. Of those who disagreed, over half did not provide reasons. Of those that did, one industry respondent noted that heat output for CHP applications should be rewarded through the RHI and not the RO. Another industry respondent did not think the uplift would represent value for money for the consumer, noting that:

> ‘It would not be appropriate to introduce a CHP uplift into the RO for ACTs as this would take the support level to 2.5 ROCs/MWh which exceeds the marginal cost of 2 ROCs/MWh set by DECC in the consultation.’

Energy crop uplift

Question 69. Do you agree that we should narrow the definition of energy crops to limit its scope to only the short rotation coppice and perennial grass species as described above? Please explain your response with evidence.

271. 91 responses were received. Of these, 32 (35%) agreed or agreed with qualifications; 59 (65%) disagreed.

272. Of those who agreed or agreed with qualifications, several respondents welcomed the narrowing of the definition as the previous definition included plantation crops such as eucalyptus and palm oil and the new approach would prevent food crops being eligible.

273. However, there was some concern expressed that the new definition would still allow the combustion of biomass that has negative environmental and social impacts, such as the replacement of natural ecosystems with water-intensive monocultures.

274. Over half of those who agreed did not provide further comments.

275. Of those who disagreed, while there was agreement about the importance of removing food crops from the definition there was concern that the proposed definition was too tight and could restrict the use of innovative energy crops in the future.

276. Respondents noted that the proposed new approach would require a change in the legislation to add a new crop to the list which could take a significant amount of time and this was seen as a significant barrier to organisations investigating the potential of new crops. A number of industry respondents suggested that if the proposed definition was to be kept, the ability to demonstrate that crops not on the list are able to qualify, as per the existing legislation was essential. Several suggestions were made on how to amend the proposed definition or to tighten the existing definition, as were suggestions on additional crops to be included in the proposed list.

277. One charity/community group thought that no energy crops should qualify for RO support. A consultancy respondent noted that growing a food crop for fuel ought to be acceptable if it is a good biomass fuel, but a problem arises when land that is needed to meet rising demand for food is used for fuel. They considered the proposal to limit species does not address this problem since they could be grown on land that would be suitable for food production.

Question 70. Do you agree that we should grandfather the energy crop uplift from 1 April 2013, but only for those crops meeting the new definition? Please explain your response with evidence.

278. 67 responses were received. Of these, 36 (54%) agreed or agreed with qualifications; 31 (46%) disagreed.

279. Several respondents agreed with the proposal as they considered it would guarantee returns and make energy crops attractive to investors - this is considered particularly important as developing energy crops takes a long time. A number of respondents

agreed with the proposal to grandfather the uplift but did not agree it should only apply to those crops meeting the new definition. One industry respondent agreed with the proposal provided it is possible to add crops or to extend the list of eligible crops. Over one-third of those who agreed did not provide any further comments.

280. Of those who disagreed, several respondents were concerned that grandfathering would allow environmental problems associated with bioliquids to continue. One industry respondent thought the proposal would discourage the development of other energy crops, while two respondents thought the uplift should be available for all types of energy crop. Nearly 40% of those who disagreed did not make any additional comments.

Question 71. Do you agree with the proposed level of 2 ROCs/MWh for dedicated energy crops, stepping down to 1.9 ROCs in 2015/16 and 1.8 ROCs in 2016/17? Please explain your response with evidence.

281. 69 responses were received. Of these, 27 (39%) agreed or agreed with qualifications; 42 (61%) disagreed.

282. Of those who agreed or agreed with qualifications, several respondents noted that it is appropriate to align support with the marginal technology. A number of respondents did not agree that support should be reduced from 2015/16; respondents cited the lead times to develop energy crops and the negative effect that degression could have on further innovation and investment. Around half of those who agreed did not provide any further comments.

283. Of those who disagreed, a number of respondents thought that the energy crop sector is not sufficiently developed to justify support on the basis of the marginal technology. These respondents considered that the proposal would not stimulate development. Another group of respondents did not think that energy crops should receive any support under the RO, whether due to environmental concerns or because of opposition to subsidies in the energy market. Around one-quarter of those who disagreed did not make any additional comments.

Question 72. Do you agree with the proposed level of 1 ROC/MWh for standard co-firing of energy crops? Please provide evidence on costs and deployment potential.

284. 62 responses were received. Of these, 28 (45%) agreed or agreed with qualifications; 34 (55%) disagreed.

285. Of those who agreed or agreed with qualifications, two respondents noted that this proposal would ensure a consistent approach across biomass technologies. Over three-quarters of those who agreed did not provide any additional comments.

286. Of those who disagreed several respondents noted environmental and sustainability concerns around energy crops. For example, one consultancy stated:

> ‘It is unclear as to the extent of the area that is realistically and sustainably available in the UK for such crops. There is a need to protect food production capacity, particularly in high grade agricultural land and areas of environmental value more broadly, including for biodiversity [...] [Energy

crops] need to be sited appropriately to ensure their low carbon and sustainability credentials.'

287. One industry respondent felt that, to ensure consistency with the proposed level of support for dedicated biomass, support for co-firing of energy crops should be reduced by 0.1 ROC/MWh from April 2016. One industry respondent thought 1 ROC/MWh was insufficient given the embryonic nature of the energy crop market and supply chain. Around one-third of those who disagreed did not add any further comments.

Question 73. Do you consider that we should extend the energy crop uplift to the new biomass conversion and enhanced co-firing bands? It would be helpful if you could provide evidence on costs and deployment potential to inform our decision.

288. 62 responses were received. Of these, 36 (58%) thought the energy crop uplift should be extended to the new biomass conversion and enhanced co-firing bands; 26 (42%) disagreed with the extension to these bands.

289. Of those who agreed or agreed with qualifications, several respondents made the point that extending the energy crop uplift to the conversion and enhanced co-firing bands would ensure a consistent approach. A number of respondents thought extending the uplift would encourage investment in and development of the energy crop market.

290. Two respondents considered that the additional capital costs associated with the use of energy crops meant the uplift was justified for conversions, although one of these respondents did not think it necessary for the enhanced co-firing band. Around 60% of those who agreed did not provide further comments.

291. Of those who did not agree with the extension of the energy crop uplift, several respondents cited environmental and sustainability concerns around the use of energy crops. A number of respondents thought there should be no subsidies, while one respondent stated that:

> 'The support being proposed to biomass conversions and enhanced co-firing is sufficient to allow the purchase of energy crops.'

292. Half of those who disagreed did not make any additional comments.

Co-firing cap

Question 74. Do you agree that the co-firing cap should be removed completely from 1 April 2013? Please explain your response with evidence.

293. 76 responses were received. Of these, 40 (53%) agreed or agreed with qualifications; 36 (47%) disagreed.

294. Of those who agreed or agreed with qualifications, a number of respondents stated that it was sensible to remove the cap given the proposals for a new enhanced co-firing band. Several respondents signalled their agreement provided there is a suitable mechanism for calculating the obligation ahead of each compliance period. Two

respondents agreed with the proposal but did not consider there would be much co-firing at 0.5 ROCs/MWh. Around half of those who agreed did not provide any additional comments.

295. Of those who disagreed, a number of respondents thought the removal of the cap would lead to difficulties in calculating the level of the obligation and may lead to the risk of gaming by large enhanced co-firers or dedicated biomass plants. Another group of respondents disagreed with the removal of the cap as they considered enhanced co-firing of biomass would lead to environmental and sustainability reasons. For example, one NGO said:

> 'RO bands should assign different levels of support to feedstocks according to a sustainability hierarchy. Bioliquids and imports of overseas wood should not receive support under the RO. We therefore believe that until bioliquids and imports of overseas wood have been placed in 0 ROC band the co-firing cap should remain in place as a measure to limit demand for unsustainable biomass.'

296. In addition, one industry respondent thought the cap should remain in place with the enhanced co-firing band exempted from it and one industry respondent stated that the cap should be retained to guard against the possibility of co-firers and biomass conversion plants out-competing dedicated biomass and energy crop power stations for a finite supply of biomass.

Question 75. If you think that the cap should be increased (i.e. to allow more co-firing) or restricted to standard co-firing of biomass, please state what an appropriate level for the cap would be and why? Please support your response with evidence.

297. Nine responses were received. Of these, six respondents favoured an increased cap and two favoured retaining a restricted cap. In addition, one respondent proposed an alternative mechanism for the cap which addressed their concerns over market manipulation which they considered removing the cap could bring about.

298. Of the additional points made by those in favour of an increased cap, two respondents favoured an unrestricted cap to ensure security of supply. One respondent thought that retaining it at a higher level would reduce the possibility of enhanced co-firers and dedicated biomass plant dominating finite biomass supplies at the expense of dedicated biomass and energy crop power stations. One respondent felt that the proposed enhanced co-firing band brought in a de facto 15% cap, another respondent thought a 20% cap would be appropriate, and a further respondent thought it should be increased, as this would 'allow generators to operate at optimum levels which will change as technology and operating methods evolve.'

299. Of the respondents who were in favour of retaining a restricted cap, one thought it should be 0% due to the environmental and sustainability concerns of biomass co-firing while the other thought it should exclude enhanced co-firing.

Grace periods

Question 76. Do you agree with our proposals for a time-limited and strictly defined grace period as described above, including scope, time limit and criteria? If you wish to suggest a different scope, time limit or criteria, please explain why. Please support your response with evidence.

300. 82 responses were received. Of these, 43 (52%) agreed or agreed with qualifications; 39 (48%) disagreed.

301. Of those who agreed or agreed with qualifications, respondents generally agreed with the principle of grace periods but thought that they should apply for longer periods and/or be available in additional circumstances, for example where banding levels reduce later in the banding review period and when RO support for new accreditations ceases from 1 April 2017. Over half of those who agreed did not make any further comments.

302. Of those who disagreed, a number of respondents thought the amount of ROCs awarded should be determined at the time of pre-accreditation or final investment decision rather than when the project gets commissioned, due to the length of time risk of unavoidable delays for many types of project between commitment of capital and reaching commercial operation. Several respondents proposed additional criteria that they considered should necessitate a grace period, including delays caused by planning and legal consideration or financial institutions' due diligence work.

Microgeneration technologies

Question 77. Do you agree with the proposed level of support of 2 ROCs/MWh for those microgeneration technologies eligible for support under the RO, stepping down to 1.9 ROCs in 2015/16 and 1.8 ROCs in 2016/17? Please explain your response with evidence.

303. 61 responses were received. Of these, 26 (43%) agreed or agreed with qualifications, and 35 respondents (57%) disagreed.

304. Among those who agreed or agreed with qualifications, two respondents stressed the importance of read-across between the RO and the FITs scheme; one respondent considered that Organic Rankine Cycle microgeneration should be included, and one respondent agreed with the proposal on the condition that only larger local schemes should benefit from support. Two respondents agreed with the level of support but did not agree with the proposed degression – one considered the costs would not fall in real terms, and one felt that as the costs are out of the control of industry this would deter investment. Over 60% of those who agreed did not provide any additional comments.

305. Of those who disagreed, a number of respondents called for the removal of support for microgeneration under the RO; three respondents felt microgeneration was not an efficient means of generating electricity, and one respondent considered all

microgeneration should only be supported under the FITs scheme. Nearly one-third of those who disagreed did not provide further comments.

EMR transition/other issues

Question 78. In addition to the specific questions asked throughout this consultation document, do you have any other comments on any aspect of our proposals? In each case, please explain your response with evidence.

306. Responses were received on a range of issues covering the Government's Electricity Market Reform (EMR) programme and the RO transition and a range of miscellaneous issues not addressed elsewhere in the consultation which largely focused on suggestions for how the operation of the RO could be improved.

EMR and RO transition

307. Whilst there was support for change in principle there was a consensus that more detail on the proposed contracts for difference (CfD) regime was required as soon as possible to help with investment certainty and confidence. Some respondents felt there should be no significant step change in support in EMR in order to maintain stability; others noted that the new regime needed to be more financially attractive than the current RO to provide incentives to adopt the new regime and avoid any investment hiatus.

308. Concern was expressed that small scale projects should not be disadvantaged under the new regime. There was a suggestion that if there was a delay in passing the necessary legislation this should not impact on the length of the transition period; it was also noted that significant progress on the development of the CfD mechanism was required before industry would accept with confidence the proposed ending of RO support for new generation in 2017. It was also suggested that there was not enough time for EMR to become sufficiently embedded before the RO is withdrawn.

309. Other respondents commented on the need for certainty on how the ROC will be treated post-2027 and the need to bring forward the date of the fixed ROC. It was suggested that to avoid future distortion of the marketplace, any proposals for market reform should be developed so as to give a strong element of ongoing competition in renewables, along with all other low carbon technologies, to protect consumers.

Miscellaneous issues

310. It was suggested that confirmation of the level of RO support should be brought forward to an earlier stage of the project development cycle, as regulatory uncertainty is a serious barrier to securing investment and currently RO support is only confirmed at commissioning which adds to that risk.

311. There was a view that the RO is a non-competitive process as support levels are set for four years without clawback for consumers if developers obtain lower build costs. It was felt that the reductions proposed are too modest. Several respondents believed the banding of support for renewable energy technologies does not recognise the widely varying contribution various technologies make to reducing carbon, or fully

consider sustainability issues. The effectiveness of different technologies in delivering net carbon savings should be factored into the level of rewards for developers of that technology.

312. Another respondent suggested that emerging and early stage technologies are likely to require more than the default 1 ROC/MWh and recommended development of an assessment process whereby new technologies could apply to a new technologies banding, with a final decision on RO support taken on a case by case basis based on standard efficiency criteria.

313. One respondent suggested that an alternative to the RO would be an energy tax coupled to a CO_2 emissions tax validated by sound science and peer review. Another respondent suggested that the investment framework will only be stable when the economic incentives offered by mechanisms like the RO and EMR align directly with the environmental ambitions underpinning the scheme. Another respondent commented that the RO is an arbitrary hypothetical guesstimate. One respondent felt that a clear explanation of exactly how much each consumer is paying towards the RO is provided in their electricity bills.

314. The delay in publication of the consultation was raised and several respondents stressed the need to ensure that final clarity on the next RO period be made public without any further delay. One respondent requested a joined-up approach from DECC and DfT on supply chain issues common to this consultation and the Office of Rail Regulation's consultation on track access charges for rail haulage.

315. Comments were received on grid constraints and costs. For example, one respondent questioned the assumption that National Grid and other key UK stakeholders such as Distributed Network Operators have programmes in place to deliver the necessary improvements at a high enough rate that does not significantly restrict deployment. Concerns about constraints payments to wind power generators were also expressed.

Annex B: Campaign responses

Onshore wind campaigns

In recent months there has been an increasing debate over the Government's approach to onshore wind energy. This interest has been reflected in the 880 campaign letters and emails received commenting on the onshore wind proposals as part of the RO Banding Review consultation.

These responses covered a wide range of issues including subsidies, efficiency of onshore wind, economic and environmental impacts, health, carbon savings and tourism.

Government response

The following sets out the Government's response, its approach to onshore wind and the reasons for it, so that the debate is as well-informed as possible.

The facts:

- There is now 5 GW of onshore wind operational in the UK.[40]
- There is a further 6 GW of onshore wind development that already has planning consent, although not everything consented will be built.[41]
- A further 6 GW is awaiting a planning decision, of which only well-designed proposals will go forward.[42]
- The *UK Renewable Energy Roadmap* outlined a projection of 13 GW total installed capacity of onshore wind required by 2020 in order to meet our renewables target.[43]
- In 2011 onshore wind farms produced over 10 TWh of renewable electricity,[44] which is enough to meet the average electricity needs of almost 2.4 million households.

The Government's approach to onshore wind is part of its wider policy framework to ensure that the UK has the energy security it needs to support the economy. A responsible energy policy for this decade and beyond requires a diverse mix of electricity generation, including nuclear, renewables and fossil fuels. This ensures security of supply, and protection for consumers against price volatility from over-dependence on any one form of energy.

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[40] DECC RESTATS Progress Data Sheet, May 2012. Available at: https://restats.decc.gov.uk/app/reporting/decc/datasheet
[41] Ibid
[42] Ibid
[43] DECC (2011) *UK Renewable Energy Roadmap.* Available at: www.decc.gov.uk/assets/decc/11/meeting-energy-demand/renewable-energy/2167-uk-renewable-energy-roadmap.pdf
[44] DECC (2012) *Energy Trends June 2012*. Available at: www.decc.gov.uk/assets/decc/11/stats/publications/energy-trends/5627-energy-trends-june-2012.pdf

While the Government recognises that wind power is intermittent, it believes that onshore wind has a role to play in the energy mix. It is a mature, affordable low-carbon technology, and uses a free, indigenous and limitless source of fuel, with an average load factor in 2011 of 27%. Wind turbines save carbon emissions by displacing carbon emitting fossil fuel generation from our electricity supply. DECC estimates that the net savings from wind power in 2010 were 6 million tonnes of carbon dioxide. This is based on an assessment of the weighted average carbon dioxide emissions of the fossil fuel mix in that year. It takes account of the effect of intermittency on the efficiency of plant used for back-up during times that wind-power was not available.

There are also wider benefits from investment in wind – a recent report for DECC and RenewableUK produced by BiGGAR economics shows that in 2011, onshore wind supported around 8,600 jobs and was worth £548 million to the UK economy.[45]

The Government notes the concerns that have been raised over the impact of onshore wind power on consumers' bills. The Government is keenly aware of the importance of minimising the impact on electricity bills. But while there are costs to consumers of onshore wind, as one of the cheapest large-scale renewable energy sources, it is also a really important protection against price and availability risks of over-reliance on a limited range of fuels.

In 2010/11, through the Renewables Obligation subsidy, onshore wind added around £6 to an average household bill, and this is expected to rise to around £14 by 2016/17. By contrast, if the UK objectives were met through building other renewable technologies instead of new onshore wind, the cost in 2016/17 could increase average household bills by an amount higher than this. To ensure that the costs of onshore wind to consumers are kept to the absolute minimum and reflect that costs of onshore wind technology are falling over time, the Government has applied a 10% reduction in the level of support for new onshore wind from April 2013. This will help secure the capacity that the UK needs while incentivising for only the most affordable projects to be brought forward.

The Government is also aware of concerns raised over the impact on communities of the siting of wind turbine development. Across the UK, steps are being taken to ensure that planning policy includes real and meaningful community engagement. This includes noise, health and other environmental impacts continuing to be an important consideration within the planning process. In England, the Government's new National Planning Policy Framework is clear about the importance of protecting the natural environment including visual impacts, while supporting the delivery of appropriately-sited renewable and low carbon energy. The new Localism Act will also ensure that Local Plans, produced by local people in line with their own aspirations, will really mean something.

Alongside this, the Government is working to ensure that local communities benefit from – and have more of a stake in – hosting renewable developments. The industry has led this by establishing a Community Benefits protocol, ensuring that host communities receive at least £1,000/MW from local wind developments in England. The Government is also

[45] Report by BiGGAR Economics for DECC and RenewableUK (2012): *Onshore Wind: Direct & Wider Economic Impacts*. Available at: www.bwea.com/pdf/publications/Onshore_Wind_Direct_and_Wider_Economic_Impacts.pdf

delivering on its commitment to enable Local Authorities in England to retain business rates from new renewable energy developments to benefit local communities.

There is no compelling evidence to suggest that wind farms have a negative impact on tourism. For example the UK's first commercial wind farm Delabloe in Cornwall received 350,000 visitors in its first 10 years of operation, and the visitor centre at Whitelee wind farm near Glasgow attracts 100,000 visitors per year. Similarly, whilst the Government accepts that views on the aesthetics of wind turbines are a matter of personal taste, the results from the first wave of DECC's public attitudes tracking survey showed that the majority of people surveyed (66%) support onshore wind in the UK.[46]

In conclusion, the Government will remain committed to an appropriate level of wind deployment in the UK's energy mix, to maintain energy security and, looking forward to 2050, to help decarbonise electricity supply. We would be doing this even without the legal obligation to provide 15% of energy from renewable sources by 2020.

Policies must be pitched at a level to bring forward the right amount of appropriately sited development to deliver the energy security that is needed and at the lowest price. The Government will ensure that this is achieved in a way that protects consumers from rising energy bills, gives communities a real say in shaping the development of their local areas, and drives the economic growth that this country needs.

[46] See: www.decc.gov.uk/en/content/cms/statistics/public_att/public_att.aspx

Biomass campaigns

We received letters and emails associated with four campaigns raising concerns over the use of biomass for electricity generation and one campaign in support of the Government's policy.

The **Biofuelwatch campaign** (566 responses) asked for the removal of subsidies for biomass, bioliquids and energy from waste (though not all campaigners agreed that the energy from waste should not be supported). They raised a number of specific concerns, including:

- Subsidies were driving deforestation, releasing carbon and leading to human rights abuses, loss of habitat for endangered species and undermining conservation efforts.
- Use of biomass and bioliquids increases carbon emissions rather than reducing them.
- Biomass power stations cause pollution harmful to health.
- We need to prioritise reducing our energy consumption.

The **Roc-off campaign** (76 responses) was concerned about the use of biomass for electricity generation and made a number of specific points, including:

- Sustainability standards should address both direct and indirect factors to ensure that support only goes to better performing biomass generation with regard to carbon emissions.
- Support for biomass should not be grandfathered.
- That they supported CHP and conversion and enhanced co-firing over dedicated biomass.
- Dedicated biomass and use of energy crops should not be supported.
- The Government should prioritise support for local, domestically produced biomass.

The **RSPB campaign** (135 responses) made a number of specific points, including:

- Renewable energy is essential in helping avert climate change but all forms of renewable energy, including bioenergy must deliver significant reductions in greenhouse gas emissions over fossil fuels.
- Public money must not be used to support large scale electricity –only plants using imported biomass. Only small-scale projects should be supported.
- The UK sustainability criteria are insufficient to ensure significant greenhouse gas savings and to prevent deforestation and indirect land use change.

The **Friends of the Earth campaign** (1,238 responses) also raised concerns over use of imported wood and bioliquids calling for support to be stopped and raised a number of specific issues, including:

- Deforestation with loss of land by indigenous peoples.
- Greater levels of subsidies for biomass than onshore wind with proposed reduction for onshore wind harming small-scale and community projects.

The **Back Biomass campaign** (518 responses) asked for continued support under the RO for the UK biomass power and CHP industry and made a number of specific points, including:

- Continued backing biomass generation will stimulate further employment and expansion in the biomass sector, reducing dependence on fossil fuel.
- Support for ensuring the sustainable use of UK and global biomass resources.
- Welcoming the incoming mandatory sustainability criteria for biomass.

Government Response

We do not agree with all the campaign proposals. The Government considers that bioenergy has a strategically important role to play if the UK is to meet its renewable energy and carbon targets. We recognise that there are risks and uncertainties associated with the use of biomass for energy and agree that bioenergy must deliver significant reductions in greenhouse gas emissions over fossil fuels but we do not agree that only domestically sourced biomass can deliver this. Biomass fuel production has its place in agricultural and economic growth but its expansion should not be detrimental in its impact on local communities, on their food security or on the environment. The Government believes that food production must remain the primary goal of agriculture and the production of biomass for bioenergy must not undermine food security, in the UK or internationally.

The Government's response to the consultation takes these issues into consideration and reflects the bioenergy principles set out in the Government's Bioenergy Strategy:

- We have already introduced reporting against a minimum greenhouse gas emissions standard for solid and gaseous biomass. We propose to make the standard mandatory as a requirement for RO support, so as to ensure the use of biomass delivers genuine carbon savings. We will consult shortly on tightening that standard for new dedicated biomass plant, reflecting the Government's *Bioenergy Strategy*.
- We also intend to consult on the introduction of sustainable forest management criteria for woodfuel use; we propose to base our approach on the UK public procurement policy for timber which would help address concerns on deforestation and social issues such as land use rights.
- Other proposed elements for the consultation to improve our biomass sustainability criteria includes formally linking meeting the criteria with eligibility

for ROC support and a new requirement for larger power plants to provide independent verification in support of their sustainability report.

- The rates of support for new dedicated biomass are expected to bring forward only limited deployment; Instead we are focusing our support on the most cost- and carbon-effective biomass technologies, namely conversion and enhanced co-firing.
- We are proposing to cap new build dedicated biomass electricity-only generation through a supplier cap so as to minimise costs across the economy. We propose to exclude CHP from such a cap as it offers better value for money and better resource efficiency.
- We have opted for conservative levels of support and a cap which will limit the potential deployment of bioliquids in electricity generation and reduce the impact on key sectors that use similar feedstocks. Our policies support bioliquids from sustainable sources such as waste, which will create useful energy from substances that may otherwise be disposed of. The sustainability requirements for bioliquids under the Renewable Energy Directive have been implemented, and Government will continue to push for additional measures to mitigate the effects of indirect land use change.

In considering support for renewable electricity technologies the Government must take into consideration all the statutory factors set out in Section 32D(4) of the Electricity Act 1989 (as amended by the Energy Act 2008); support is set on a technology by technology basis reflecting these considerations and other issues; it is not based purely on feedstock or capital costs, for example.

We are working to ensure that increased use of biomass does not lead to detrimental effects on air quality. Abatement measures are currently in place to control the impacts of bioenergy on air quality. Energy plant over 20 MW is subject to pollution control regulation.

Regarding the reduction of energy consumption, the intention of the Green Deal and Energy Company Obligation (ECO) is to empower consumers and give them new ways of funding energy efficient home improvements, thus creating a new market which could draw in overall greater funding for energy efficiency than in the past. In this way, it will help reduce carbon emissions from the domestic and non-domestic building stock, which is essential if the UK is to meet its statutory carbon budgets. Improving household energy efficiency is also a key strand of our strategy to help address the needs of low income and vulnerable customers from 2012 and to make further progress on our statutory obligation to tackle fuel poverty. In addition, energy efficient buildings reduce energy use and demand on fossil fuel, helping the UK become less dependent on the use of fossil fuel.

Annex C: List of respondents

2020 Renewables Ltd
2OC
350 Strategy
Accreditrade Ltd
Advanced Plasma Power Ltd
AEE Renewables plc
AFC Energy plc
Agri Energy
Air Products
Alde Valley Food Adventures
The All-Party Parliamentary Group for the Wood Panel Industry
Alstom
AMEC
Anaerobic Digestion and Biogas Association
Anglesey Against Wind Turbines
Anglian Water Services
Aquamarine Power
AS Graanul Invest
ASH design+assessment Ltd
Associated British Ports
Association of Electricity Producers
ATCO Power
Atlantis Resources Corporation
Babcock International Group
Banks Group
Berwickshire Civic Society
Biofuelwatch (corporate response)
Biofuelwatch (open letter signed by 81 organisations)
Biomass Power Ltd
Biomass Power Projects Ltd
Biossence Ltd
BNP Paribas Clean Energy
Breakaway Activity Holidays Ltd
The Breathe Clean Air Group
The Bristol Port Company
British Furniture Confederation
British Hydropower Association
British Sugar
BSW Timber Ltd
Buccleuch Bioenergy Ltd
C Spencer Ltd

Caerau Gardens
Cambrian Mountains Society
Campaign to Protect Rural England (CPRE)
Carbon Free Developments Ltd
Carbon Impacts Ltd
Caterpillar – Energy and Power Systems Research Europe
Centre for Energy and the Environment, University of Exeter
Centrica plc
Chantler Solutions Ltd
Chemical Industries Association
Combined Heat and Power Association (CHPA)
Clean Thermodynamic Energy Conversion Ltd
ClientEarth
Clipper Windpower Ltd
Collison and Associates Ltd
Communities Against Turbines Scotland (CATS)
Community Energy Scotland
Confederation of Paper Industries
Confor
Conservation of Upland Powys (CUP)
Coolfin Partnership
The Co-operative Group
Cornwall Council
Country Guardian
Country Land and Business Association
Covanta Energy
CPRE Durham Branch
CPRE Northamptonshire
Dalkia
Darley & Associates
Daventry District Council
David Lock Associates
Dolgead Hall Caravan Park Ltd
DONG Energy
Doosan Power Systems
Drax Power Ltd
DS Smith Paper, E.ON Energy from Waste UK Ltd and Wheelabrator Technologies Inc

E.ON
E3 Foundation
Eco2 Ltd
Ecobiotec Holdings Ltd
EcoGen Ltd
Ecolateral Ltd
Ecotricity (The Renewable Energy Company Ltd)
EDF Energy
EDF Trading
EDP Renewables/Repsol Nuevas Energias
Eggborough Power Ltd
EGS Energy Ltd
Element Power
Elephant Family
Eneco Wind UK
ENER-G Holdings plc
Energia Capital LLC
ENERGOS
Energy Developments UK Ltd
Energy Power Resources Ltd (EPRL)
Energy Technologies Institute
Environment Agency
Environmental Services Association
Estover Energy
The European Marine Energy Centre Ltd (EMEC)
European Pellet Council
Evelogen Ltd
Farlington Wind Turbine Action Group
Fichtner Consulting Engineers
Fife Energy Ltd
FlexEnergy
Fluor Ltd
Forth Energy
Fred.Olsen Renewables Ltd
Freetrader Society
Freightliner Heavy Haul Ltd
Friends of Eden, Lakeland & Lunesdale Scenery (FELLS)
Friends of the Clash
Friends of the Earth
Gaia Power Tees Valley Ltd
GALAR
GB Renewables Investments Ltd
GE Energy
General Biofuels Development LLC
Geothermal Engineering Ltd
Gilkes
GMB47
Good Energy
Greater Manchester Waste Disposal Authority
Green Energy Parks
Green2Go
Greenbank Terotech Ltd
GVAG (Green Valley Action Group)
Hamsterley Parish Council and Teesdale District Council (Tourism sub-group)
Hargreaves Services Group/Rocpower
Heatcatcher Ltd
Helius Energy plc
HES Biopower Ltd
Highlands and Islands Enterprise
Honeywell Performance Materials & Technologies
Humber Chemical Focus Ltd
INEOS Bio Ltd
INEOS ChlorVinyls Ltd
Infinis
Institute for European Environmental Policy (IEEP)
Institution of Civil Engineers
Institution of Civil Engineers Yorkshire and Humberside Region
Institution of Mechanical Engineers
International Power
Isle of Anglesey County Council
Isle of Wight AONB Partnership
ITI Energy Ltd
ITP (formerly IT Power)
John Gordon & Son Ltd
Keld Energy Ltd
Kronospan Ltd
KTI Energy Ltd
Lahti Energia
Lichen Renewal
Llandrinio Community Council
Local Government Association
Local Government Association Coastal Issues Special Interest Group

[47] Separate responses were received from GMB and GMB members within RWE.

London Waste and Recycling Board
Longcliffe Quarries, Transcycle and Vital Earth
Longma Clean Energy Ltd
Low Carbon Developers
Manchester Airports Group
MAREN EU Interreg Atlantic Area Project, Cardiff University
Marine Current Turbines Ltd
Marine Energy Pembrokeshire
Metso Power Oy
MeyGen Ltd
MGT Power
Ministry of Defence
Mochdre Action Group
Morris Lubricants
MVV
National Pig Association
New Earth Solutions Group Ltd
Nexterra Systems Corp.
No Oil Palm Energy (NOPE)
No Tiree Array
Norbord Ltd
North Hambleton Wind Farm Action Group
North London Waste Authority
Northumbrian Water Ltd
O2N Ltd
Offshore Wave Energy Ltd
Ofgem
Ofwat
O-Gen UK
Omega Power Ltd
Orchid Environmental Ltd
Origin Renewable Energy
Parkinson's UK Montgomeryshire Branch
Partnerships for Renewables
Peel Energy Ltd
Peel Environmental Ltd
Pelamis Wave Power Ltd
Plasco Energy Group Inc
Pontbren Partnership
Positive Outcome Consultancy Ltd
Power Capital
Prenergy Power Ltd
Prima Bio
Progressive Energy Ltd
Project & Energy Management
Partnership
Prospect
Prowind (UK) Ltd
Pulse Tidal Ltd
QinetiQ
Radnorshire Branch of the Campaign for the Protection of Rural Wales
Ramblers Association
REG Bio-Power Ltd
ReGen Energy Ltd
Renewable Energy Association
Renewable Resources (Energy Solutions) Ltd
RenewableUK
RES Group
Resource Efficiency Pathway
Rio Tinto Alcan
Rio Tinto Alcan (Lochaber Smelter & Power)
Royal Institution of Chartered Surveyors
RSPB
RWE UK
Santander Global Banking & Markets
SCFI Group
Scotch Whisky Association
Scotia Gas Networks
Scott Bros Holdings Ltd
Scottish Environment Protection Agency
Scottish Hydrogen Fuel Cell Association
Scottish Natural Heritage
Scottish Renewables
Scottish Water
ScottishPower
Sembcorp Utilities
Severn Trent Water
Sheffield Campaign Against Climate Change
Siemens Financial Services
Signal Graphic Design
Silvex Energy UK AB
Society for Underwater Technology
Solena Fuels LLC
Sorath Partnership
South West Devon Waste Partnership
South West Water Ltd
SSE
States of Guernsey Department of Commerce & Employment

Statkraft
Statoil ASA
Sumatran Orangutan Society
Suzano Energia Renovável Ltda
SWATT (South Wales Alternative to Turbines)
Teal Energy Ltd
Tees Valley Unlimited
Tesco
Thames Water
Tidal Energy Ltd
TPSCo
Trannon Residents Against Power Plans
UK Hydrogen and Fuel Cell Association
UKFPA
Unity ICT Ltd
Vale Europe Ltd
Vattenfall
Verus Energy Ltd
Vestas Celtic
VIASPACE Inc
Viridor Waste Management Ltd
Voith Hydro Wavegen Ltd
VTG Rail UK Ltd
VTT Technical Research Centre of Finland
WAMTECH
Waste2Tricity Ltd
Welsh Government
Welsh Power Group
West Coast Energy Ltd
Western Riverside Waste Authority
Wood Panel Industries Federation
Yorkshire Water Services
Zilkha Biomass Fuels

Annex D: Updated levelised costs and key assumptions

Renewable levelised costs using a 10% hurdle rate[48]

10% discount rate, 2011 project start at projected EPC prices

10% discount rate, 2011 project start at projected EPC prices	Dedicated biomass >50MW	Dedicated biomass 5-50MW	Offshore R2	Offshore R3	Onshore > 5 MW	Co-firing Conventional	Co-firing Enhanced & Conversion	Biomass CHP
Pre-development	1	2	4	6	2	0	2	2
Construction	37	51	80	92	77	5	10	61
Fixed O+M	14	16	40	49	19	4	12	24
Variable O+M	4	5	2	0	3	1	1	10
Fuel	62	39	0	0	0	77	79	113
Carbon	0	0	0	0	0	0	0	0
Steam Revenue	0	0	0	0	0	0	0	0
Additional Costs	0	0	0	0	0	0	0	-48
Total Levelised Cost	**118**	**113**	**126**	**146**	**101**	**88**	**105**	**161**

10% discount rate, 2011 project start at projected EPC prices	Dedicated energy crops 5-50MW	Dedicated energy crops >50MW	Bioliquids	Bioliquids CHP	Hydro (Standard)	Hydro (Storage)	Geothermal	Geothermal CHP
Pre-development	2	1	5	5	2	1	3	3
Construction	51	37	20	20	104	86	68	74
Fixed O+M	16	14	21	21	16	8	13	14
Variable O+M	5	4	5	5	6	6	11	10
Fuel	92	78	261	261	0	0	0	0
Carbon	0	0	0	0	0	0	0	0
Steam Revenue	0	0	0	0	0	0	0	0
Additional Costs	0	0	0	-38	0	0	0	-70
Total Levelised Cost	**166**	**134**	**313**	**276**	**128**	**101**	**94**	**30**

10% discount rate, 2011 project start at projected EPC prices	EfW CHP	EfW	ACT standard	ACT advanced	ACT CHP	Sewage Gas	Landfill	Co-firing Standard CHP

[48] These estimates use a hurdle rate of 10%, and reflect the revised estimates of costs which are set out in Annex A of the Impact Assessment. They cannot be compared to the levelised cost estimates which were published in the consultation, which use different start dates and technology specific hurdle rates.

Pre-development	0	0	6	7	2	0	3	0
Construction	92	91	82	102	98	67	39	60
Fixed O+M	40	42	58	59	67	18	9	31
Variable O+M	29	29	24	13	24	0	9	2
Fuel	-115	-95	-26	-23	-31	0	0	60
Carbon	0	0	0	0	0	0	0	0
Steam Revenue	0	0	0	0	0	0	0	0
Additional Costs	-35	0	0	0	-25	0	0	0
Total Levelised Cost	**11**	**66**	**144**	**158**	**136**	**85**	**60**	**154**

Case 2: 10% discount rate, 2017 project start at projected EPC prices

10% discount rate, 2017 project start at projected EPC prices	**Dedicated biomass >50MW**	**Dedicated biomass 5-50MW**	**Offshore R2**	**Offshore R3**	**Onshore >5 MW**
Pre-development	1	2	4	6	2
Construction	36	50	70	76	74
Fixed O+M	14	16	40	49	19
Variable O+M	4	5	2	0	3
Fuel	62	39	0	0	0
Carbon	0	0	0	0	0
CO_2 Capture and Storage	0	0	0	0	0
Decommissioning and waste	0	0	0	0	0
Steam Revenue	0	0	0	0	0
Additional Costs	0	0	0	0	0
Total Levelised Cost	**117**	**112**	**115**	**130**	**98**

Capital and operating cost assumptions used in Banding Review analysis for selected years

- Capex include construction costs and predevelopment costs
- Future cost projections assume that steel prices remain constant in real terms.

The costs as set out below are used in both Pöyry's modelling and DECC's in-house analysis.

<50MW biomass		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	5106	4965	4863	4817	4771
£/kW	Median	3623	3523	3451	3418	3386
	Low	2537	2466	2416	2393	2370
Fixed opex						
£/MW/y	Median	110,550	107,596	105,494	104,582	103,678
Variable opex						
£/MWh	Median	5	5	5	5	5
Insurance						
£/MW/y	Median	16,416	15,977	15,665	15,530	15,396
Connection and UoS charges						
£/MW/y	Median	1,584	1,542	1,512	1,498	1,486

>50MW biomass		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	4537	4412	4322	4280	4239
£/kW	Median	2447	2379	2331	2309	2286
	Low	2016	1960	1920	1902	1884

Fixed opex						
£/MW/y	Median	94,889	92,353	90,550	89,767	88,991
Variable opex						
£/MWh	Median	4	4	4	4	4
Insurance						
£/MW/y	Median	14,090	13,713	13,446	13,329	13,214
Connection and UoS charges						
£/MW/y	Median	1,359	1,323	1,297	1,286	1,275

Onshore wind > 5MW		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	1928	1843	1781	1735	1690
£/kW	Median	1555	1486	1436	1399	1363
	Low	1204	1151	1112	1083	1055
Fixed opex						
£/MW/y	Median	29,468	29,527	29,586	29,645	29,704
Variable opex						
£/MWh	Median	3	3	3	3	3
Insurance						
£/MW/y	Median	6,314	6,145	6,025	5,973	5,922
Connection and UoS charges						
£/MW/y	Median	9,912	9,647	9,459	9,377	9,296

Onshore wind < 5MW		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	3500	3345	3233	3150	3068
£/kW	Median	1750	1672	1617	1575	1534
	Low	1194	1141	1103	1074	1047
Fixed opex						
£/MW/y	Median	24,553	24,602	24,652	24,701	24,751
Variable opex						
£/MWh	Median	3	3	3	3	3
Insurance						
£/MW/y	Median	5,261	5,272	5,282	5,293	5,303
Connection and UoS charges						
£/MW/y	Median	8,259	8,276	8,292	8,309	8,325

Offshore wind R2		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	3298	2682	2323	2121	1968
£/kW	Median	2790	2269	1965	1794	1666
	Low	2345	1907	1652	1508	1400
Fixed opex						
£/MW/y	Median	69,261	56,359	48,827	44,596	41,414
Variable opex						
£/MWh	Median	2	2	1	1	1

Insurance						
£/MW/y	Median	12,734	10,362	8,977	8,199	7,614
Connection and UoS charges	High		-	-	-	-
£/MW/y	Median	50,608	41,180	35,677	32,585	30,260
	Low		-	-	-	-

Offshore wind R3		**Financial close**				
		2014	**2015**	**2020**	**2025**	**2030**
Capex	High	3431	3279	2685	2373	2166
£/kW	Median	2825	2699	2211	1954	1784
	Low	2400	2293	1878	1660	1515
Fixed opex						
£/MW/y	Median	72,765	63,946	54,061	48,581	44,618
Variable opex						
£/MWh	Median	-	0	0	0	0
Insurance						
£/MW/y	Median	33,681	29,599	25,023	22,487	20,653
Connection and UoS charges						
£/MW/y	Median	62,195	54,657	46,208	41,524	38,137

AD		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	7884	7543	7303	7199	7097
£/kW	Median	4185	4004	3877	3822	3767
	Low	1794	1717	1662	1638	1615
Fixed opex						
£/MW/y	Median	290,000	290,871	291,745	292,621	293,500
Variable opex						
£/MWh	Median	30	30	30	30	30
Insurance						
£/MW/y	Median	56,000	56,168	56,337	56,506	56,676
Connection and UoS charges						
£/MW/y	Median	8,359	8,384	8,409	8,434	8,460

Geothermal		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	7966	5936	5814	5653	5501
£/kW	Median	5502	4100	4016	3904	3799
	Low	2726	2032	1990	1935	1883
Fixed opex						
£/MW/y	Median	34,547	34,650	34,754	34,859	34,964
Variable opex						
£/MWh	Median	11	11	11	11	11

Insurance						
£/MW/y	Median	69,077	69,285	69,493	69,702	69,911
Connection and UoS charges						
£/MW/y	Median	1,956	1,961	1,967	1,973	1,979

Standard co-firing		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	174	167	162	161	159
£/kW	Median	126	121	118	116	115
	Low	42	40	39	39	38
Fixed opex						
£/MW/y	Median	9,779	9,808	9,837	9,867	9,897
Variable opex						
£/MWh	Median	1	1	1	1	1
Insurance						
£/MW/y	Median	889	892	894	897	900
Connection and UoS charges						
£/MW/y	Median	8,890	8,916	8,943	8,970	8,997

Biomass conversion		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	806	776	754	745	736
£/kW	Median	495	476	463	458	452
	Low	323	311	302	299	295
Fixed opex						
£/MW/y	Median	39,500	39,619	39,738	39,857	39,977
Variable opex						
£/MWh	Median	1	1	1	1	1
Insurance						
£/MW/y	Median	1,245	1,249	1,252	1,256	1,260
Connection and UoS charges						
£/MW/y	Median	16,850	16,901	16,951	17,002	17,053

Landfill gas		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	3508	3457	3422	3410	3397
£/kW	Median	2121	2090	2069	2062	2054
	Low	1033	1018	1008	1004	1000
Fixed opex						
£/MW/y	Median	57,509	57,653	57,797	57,942	58,087
Variable opex						
£/MWh	Median	9	9	9	9	9

Insurance						
£/MW/y	Median	1,267	1,270	1,273	1,276	1,279
Connection and UoS charges						
£/MW/y	Median	4,923	4,935	4,947	4,960	4,972

Sewage gas		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	5914	5694	5541	5476	5412
£/kW	Median	3618	3484	3389	3350	3310
	Low	2287	2202	2143	2118	2093
Fixed opex						
£/MW/y	Median	97,055	97,347	97,639	97,932	98,226
Variable opex						
£/MWh	Median	-	0	0	0	0
Insurance						
£/MW/y	Median	-	0	0	0	0
Connection and UoS charges						
£/MW/y	Median	8,359	8,384	8,409	8,434	8,460

Hydropower >5MW (Storage)		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High		0	0	0	0
£/kW	Median	3052	3062	3072	3082	3092
	Low		0	0	0	0

Fixed opex						
£/MW/y	Median	23,915	24,005	24,095	24,185	24,276
Variable opex						
£/MWh	Median	6	6	6	6	6
Insurance						
£/MW/y	Median	886	889	892	896	899
Connection and UoS charges						
£/MW/y	Median	7,086	7,113	7,139	7,166	7,193

Hydropower >5MW (Standard)		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High		0	0	0	0
£/kW	Median	2802	3093	3415	3426	3436
	Low		0	0	0	0
Fixed opex						
£/MW/y	Median	42,000	42,158	42,316	42,475	42,635
Variable opex						
£/MWh	Median		0	0	0	0
Insurance						
£/MW/y	Median		-	-	-	-
Connection and UoS charges						
£/MW/y	Median		-	-	-	-

Hydropower <5MW		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	13329	13373	13417	13462	13507
£/kW	Median	4609	4625	4640	4655	4671
	Low	2109	2116	2123	2130	2137
Fixed opex						
£/MW/y	Median	15,071	15,128	15,185	15,242	15,299
Variable opex						
£/MWh	Median	0	0	0	0	0
Insurance						
£/MW/y	Median		-	-	-	-
Connection and UoS charges						
£/MW/y	Median		-	-	-	-

EfW CHP		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	6800	6663	6567	6529	6492
£/kW	Median	6100	5977	5891	5857	5824
	Low	5400	5291	5215	5185	5155
Fixed opex		-	-	-	-	-
£/MW/y	Median	260,000	260,651	261,303	261,957	262,612
Variable opex		0	0	0	0	0
£/MWh	Median	29	29	29	29	29
		0	0	0	0	0
Insurance						
£/MW/y	Median		-	-	-	-

Connection and UoS charges						
£/MW/y	Median		-	-	-	-

EfW		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	6476	6346	6254	6218	6183
£/kW	Median	5810	5692	5610	5578	5546
	Low	5143	5039	4966	4938	4910
Fixed opex		-	-	-	-	-
£/MW/y	Median	260,000	260,651	261,303	261,957	262,612
		-	-	-	-	-
Variable opex		0	0	0	0	0
£/MWh	Median	29	29	29	29	29
		0	0	0	0	0
Insurance						
£/MW/y	Median		-	-	-	-
Connection and UoS charges						
£/MW/y	Median		-	-	-	-

Bioliquids		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	2898	2813	2753	2727	2701
£/kW	Median	973	944	924	915	907
	Low	507	492	481	477	472
Fixed opex		-	-	-	-	-
£/MW/y	Median	118,450	117,132	116,250	116,005	115,761

Variable opex						
£/MWh	Median	5	5	5	5	5
Insurance						
£/MW/y	Median	4,777	4,724	4,688	4,678	4,669
Connection and UoS charges						
£/MW/y	Median	11,734	11,604	11,516	11,492	11,468

ACT Advanced		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	7867	7527	7288	7184	7102
£/kW	Median	7187	6876	6658	6563	6488
	Low	5254	5027	4867	4798	4743
Fixed opex						
£/MW/y	Median	417,000	397,766	379,419	361,919	345,225
Variable opex						
£/MWh	Median	13	12	12	11	11
Insurance						
£/MW/y	Median	22,000	20,985	20,017	19,094	18,213
Connection and UoS charges						
£/MW/y	Median	5,600	5,342	5,095	4,860	4,636

ACT Standard		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	11132	10650	10312	10166	10021
£/kW	Median	5962	5704	5523	5444	5367

	Low	1092	1045	1012	997	983
Fixed opex						
£/MW/y	Median	428,000	408,259	389,428	371,466	354,332
Variable opex						
£/MWh	Median	24	23	22	21	20
Insurance						
£/MW/y	Median	22,000	20,985	20,017	19,094	18,213
Connection and UoS charges						
£/MW/y	Median	5,600	5,342	5,095	4,860	4,636

ACT CHP		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	11689	11183	10828	10674	10522
£/kW	Median	6260	5989	5799	5717	5635
	Low	1147	1097	1062	1047	1032
Fixed opex						
£/MW/y	Median	428,000	408,259	389,428	371,466	354,332
Variable opex						
£/MWh	Median	24	23	22	21	20
Insurance						
£/MW/y	Median	22,000	20,985	20,017	19,094	18,213
Connection and UoS charges						
£/MW/y	Median	5,600	5,342	5,095	4,860	4,636

Bioliquids CHP		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	2992	2905	2843	2816	2790
£/kW	Median	1012	983	962	953	944
	Low	530	515	504	499	494
Fixed opex						
£/MW/y	Median	118,450	117,132	116,250	116,005	115,761
Variable opex						
£/MWh	Median	5	5	5	5	5
Insurance						
£/MW/y	Median	4,777	4,724	4,688	4,678	4,669
Connection and UoS charges						
£/MW/y	Median	11,734	11,604	11,516	11,492	11,468

Geothermal CHP		Financial close				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	8619	6423	6292	6116	5953
£/kW	Median	6071	4524	4431	4308	4193
	Low	3079	2294	2247	2185	2126
Fixed opex						
£/MW/y	Median	33,010	33,109	33,209	33,308	33,408
Variable opex						
£/MWh	Median	10	10	10	10	10
Insurance						
£/MW/y	Median					

		74,446	74,669	74,894	75,119	75,344
Connection and UoS charges						
£/MW/y	Median	1,869	1,874	1,880	1,885	1,891

Biomass CHP		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	4978	4841	4742	4696	4660
£/kW	Median	3878	3771	3694	3659	3631
	Low	2778	2701	2646	2621	2601
Fixed opex						
£/MW/y	Median	147,500	143,558	140,755	139,538	138,331
Variable opex						
£/MWh	Median	10	9	9	9	9
Insurance						
£/MW/y	Median	25,000	24,332	23,857	23,650	23,446
Connection and UoS charges						
£/MW/y	Median		-	-	-	-

AD CHP		**Financial close**				
		2010	**2015**	**2020**	**2025**	**2030**
Capex	High	7884	7725	7613	7570	7526
£/kW	Median	4409	4320	4258	4233	4209
	Low	1891	1853	1826	1816	1806
Fixed opex						
£/MW/y	Median					

		351,000	352,054	353,112	354,172	355,236
Variable opex						
£/MWh	Median	20	20	20	20	21
Insurance						
£/MW/y	Median	56,000	56,168	56,337	56,506	56,676
Connection and UoS charges						
£/MW/y	Median	8,359	8,384	8,409	8,434	8,460

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