

## Summary: Intervention & Options

<b>Department /Agency:</b> <b>BERR</b>	<b>Title:</b> <b>Impact Assessment of proposals for a UK Renewable Energy Strategy - Renewable Electricity</b> <b>URN 08/1050</b>	
<b>Stage:</b> Consultation	<b>Version:</b> 4	<b>Date:</b> 1 June 2008
<b>Related Publications:</b> UK Renewable Energy Strategy Consultation Document; [Analysis publications, to be added]		

**Available to view or download at:**

<http://www.berr.gov.uk/energy>

**Contact for enquiries:** Emily Bourne

**Telephone:** 020 7215 3002

**What is the problem under consideration? Why is government intervention necessary?**

This IA analyses options to increase the proportion of renewable electricity in order to meet the UK's share of the EU 2020 renewable energy target as part of our longer term strategy for tackling climate change and ensuring security of energy supply. Government intervention is necessary because many renewable energy technologies are less developed or deployed at a lower scale and higher cost than traditional energy technologies. Without Government support, the private sector will not invest sufficiently in innovation and deployment to meet our longer term goals.

**What are the policy objectives and the intended effects?**

To achieve an increase in renewable electricity in the UK to up to 37% by 2020, compared with 4.5% in 2006. As the target is still under negotiation, a range of options is being considered.

**What policy options have been considered? Please justify any preferred option.**

This condoc considers a range of target levels for renewable electricity (28%, 32%, 37%). A range of instruments was considered: extending the Renewables Obligation, feed-in-tariffs for large scale electricity, and a combination of feed-in-tariffs and tender process for large scale electricity. It also considers a specific feed-in tariff for micro electricity, whose costs are not included in the overall package costs. The packages have been chosen based on: cost-effectiveness; ability to deliver the required share of renewable energy by 2020; and compatibility with broader energy policy.

**When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?** Once the consultation responses have been analysed, and the EU Directive agreed Government will produce a Renewable Energy Strategy in Spring 2009, which will set out considered measures and costings.

**Ministerial Sign-off** For consultation stage Impact Assessments:

*I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.*

Signed by the responsible Minister:

.....Date:

## Summary: Analysis & Evidence

<b>Policy Option:</b> Package 1	<b>Description:</b> Measures to achieve 28% renewable electricity
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<b>COSTS</b>	<b>ANNUAL COSTS</b>	Description and scale of <b>key monetised costs</b> by 'main affected groups' Net Welfare impact (resource costs, net of cost of carbon, valued at the forecast carbon price) from £1.3 to £1.7bn pa in 2020, £21 to £25 bn lifetime to 2030. Other costs include additional £2bn onshore transmission and distribution costs over the lifetime.				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%; padding: 2px;"><b>One-off</b> (Transition)</td> <td style="width: 30%; text-align: center; padding: 2px;"><b>Yrs</b></td> </tr> <tr> <td style="padding: 2px;">£</td> <td></td> </tr> </table>		<b>One-off</b> (Transition)	<b>Yrs</b>	£	
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<p>Other <b>key non-monetised costs</b> by 'main affected groups' Cost itemised are resource costs. Costs not included are costs of other policy measures to meet the target (including costs of removing barriers in the electricity sector, other than grid costs); and indirect costs to the economy of increased energy prices, all of which could be significant.</p>						

<b>BENEFITS</b>	<b>ANNUAL BENEFITS</b>	Description and scale of <b>key monetised benefits</b> by 'main affected groups' Benefits are monetised carbon benefits from the replacement of fossil fuels in electricity generation. Carbon saved in the electricity sector is covered by the ETS and is netted off the resource costs above, valued at the carbon price. Estimated increase in renewable generation of 760 to 780 TWh by 2030.				
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<p>Other <b>key non-monetised benefits</b> by 'main affected groups' Additional benefits could include diversifying the energy mix; reducing dependence on fossil fuels; business and employment opportunities in developing and deploying renewable energy technologies.</p>						

**Key Assumptions/Sensitivities/Risks** Costs and benefits are estimated using central fossil fuel price assumptions. Estimates are based on economic modelling from Redpoint independent consultants. Range of costs reflects the different instruments used to achieve the target.

Price Base Year 2008	Time Period Years 20	<b>Net Benefit Range (NPV)</b> £ -23 to -£27bn	<b>NET BENEFIT (NPV Best estimate)</b> £ -25bn
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What is the geographic coverage of the policy/option?	UK				
On what date will the policy be implemented?	2012				
Which organisation(s) will enforce the policy?	BERR				
What is the total annual cost of enforcement for these organisations?	£ unknown				
Does enforcement comply with Hampton principles?	Yes				
Will implementation go beyond minimum EU requirements?	No				
What is the value of the proposed offsetting measure per year?	£ unknown				
What is the value of changes in greenhouse gas emissions?	£ n/a				
Will the proposal have a significant impact on competition?	Yes				
Annual cost (£-£) per organisation (excluding one-off)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Micro</td> <td style="width: 25%; text-align: center;">Small</td> <td style="width: 25%; text-align: center;">Medium</td> <td style="width: 25%; text-align: center;">Large</td> </tr> </table>	Micro	Small	Medium	Large
Micro	Small	Medium	Large		
Are any of these organisations exempt?	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Yes/No</td> <td style="width: 25%; text-align: center;">Yes/No</td> <td style="width: 25%; text-align: center;">N/A</td> <td style="width: 25%; text-align: center;">N/A</td> </tr> </table>	Yes/No	Yes/No	N/A	N/A
Yes/No	Yes/No	N/A	N/A		

<b>Impact on Admin Burdens Baseline</b> (2005 Prices)		(Increase - Decrease)
Increase of £	Decrease of £	<b>Net Impact</b> £

Key: Annual costs and benefits: Constant Prices (Net) Present Value

## Summary: Analysis & Evidence

**Policy Option:**  
Package 2

**Description:** Measures to achieve 32% renewable electricity

<b>COSTS</b>	<b>ANNUAL COSTS</b>		Description and scale of <b>key monetised costs</b> by 'main affected groups' Net Welfare costs (resource costs, net of cost of carbon, valued at the forecast carbon price) from £2 to £2.4bn pa in 2020, £31 to £37bn lifetime to 2030. Other costs include additional £2bn onshore transmission and distribution costs over the lifetime.
	<b>One-off</b> (Transition)	<b>Yrs</b>	
	£		
	<b>Average Annual Cost</b> (excluding one-off)		
	£ 1.8bn		<b>Total Cost (PV)</b> £ 36bn
Other <b>key non-monetised costs</b> by 'main affected groups' Cost itemised are resource costs. Costs not included are costs of other policy measures to meet the target (including costs of removing barriers in the electricity sector other than grid costs); indirect costs to the economy of increased energy prices, all of which could be significant.			

<b>BENEFITS</b>	<b>ANNUAL BENEFITS</b>		Description and scale of <b>key monetised benefits</b> by 'main affected groups' Benefits are monetised carbon benefits from the replacement of fossil fuels in electricity generation. Carbon saved in the electricity sector is covered by the ETS and is netted off the resource costs above, valued at the forecast carbon price. Estimated increase in renewable generation 990 to 1050 TWh by 2030.
	<b>One-off</b>	<b>Yrs</b>	
	£		
	<b>Average Annual Benefit</b> (excluding one-off)		
	£ n/a		<b>Total Benefit (PV)</b> £ n/a
Other <b>key non-monetised benefits</b> by 'main affected groups' Additional benefits could include diversifying the energy mix; reducing dependence on fossil fuels; business and employment opportunities in developing and deploying renewable energy technologies.			

**Key Assumptions/Sensitivities/Risks** Costs and benefits are estimated using central fossil fuel price assumptions. Estimates are based on economic modelling from Redpoint independent consultants. Range of costs reflects the different instruments used to achieve the target.

Price Base Year 2008	Time Period Years 20	<b>Net Benefit Range (NPV)</b> £ -33 to -39bn	<b>NET BENEFIT (NPV Best estimate)</b> £ -36bn
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What is the geographic coverage of the policy/option?		UK	
On what date will the policy be implemented?		2012	
Which organisation(s) will enforce the policy?		BERR and OGDs	
What is the total annual cost of enforcement for these organisations?		£ unknown	
Does enforcement comply with Hampton principles?		Yes	
Will implementation go beyond minimum EU requirements?		No	
What is the value of the proposed offsetting measure per year?		£ unknown	
What is the value of changes in greenhouse gas emissions?		£ n/a	
Will the proposal have a significant impact on competition?		Yes	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium      Large
Are any of these organisations exempt?	Yes/No	Yes/No	N/A      N/A

<b>Impact on Admin Burdens Baseline</b> (2005 Prices)		(Increase - Decrease)	
Increase of    £	Decrease of    £	<b>Net Impact</b>	£

Key:      Annual costs and benefits: Constant Prices      (Net) Present Value

## Summary: Analysis & Evidence

<b>Policy Option:</b> Package 3	<b>Description:</b> Measures to achieve 37% renewable electricity
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<b>COSTS</b>	<b>ANNUAL COSTS</b>	Description and scale of <b>key monetised costs</b> by 'main affected groups' Net welfare costs (resource costs, net of cost of carbon, valued at the forecast carbon price) from £3.3 to £3.5bn pa in 2020, £40 to £44bn lifetime to 2030. Other costs include additional £2bn onshore transmission and distribution costs over the lifetime.				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;"><b>One-off</b> (Transition)</td> <td style="width: 40%; text-align: center;"><b>Yrs</b></td> </tr> <tr> <td style="text-align: center;">£</td> <td></td> </tr> </table>		<b>One-off</b> (Transition)	<b>Yrs</b>	£	
	<b>One-off</b> (Transition)		<b>Yrs</b>			
	£					
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£ 2.2bn						
<b>Total Cost (PV)</b>		<b>£ 44bn</b>				
<p>Other <b>key non-monetised costs</b> by 'main affected groups' Cost itemised are resource costs. Costs not included are costs of other policy measures to meet the target (including costs of removing barriers in the electricity sector other than grid costs); indirect costs to the economy of increased energy prices, all of which could be significant.</p>						

<b>BENEFITS</b>	<b>ANNUAL BENEFITS</b>	Description and scale of <b>key monetised benefits</b> by 'main affected groups' Benefits are monetised carbon benefits from the replacement of fossil fuels in electricity generation. Carbon saved in the electricity sector is covered by the ETS and is netted off the resource costs above, valued at the forecast carbon price. Estimated increase in renewable generation 1060 to 1170 TWh by 2030.				
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£ n/a						
<b>Total Benefit (PV)</b>		<b>£ n/a</b>				
<p>Other <b>key non-monetised benefits</b> by 'main affected groups' Additional benefits could include diversifying the energy mix; reducing dependence on fossil fuels; business and employment opportunities in developing and deploying renewable energy technologies.</p>						

**Key Assumptions/Sensitivities/Risks** Costs and benefits are estimated using central fossil fuel price assumptions. Estimates are based on economic modelling from Redpoint independent consultants. Range of costs reflects the different instruments used to achieve the target.

Price Base Year 2008	Time Period Years 20	<b>Net Benefit Range (NPV)</b> £ -42 to -46bn	<b>NET BENEFIT (NPV Best estimate)</b> £ -44bn
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What is the geographic coverage of the policy/option?	UK				
On what date will the policy be implemented?	2012				
Which organisation(s) will enforce the policy?	BERR and OGDs				
What is the total annual cost of enforcement for these organisations?	£ unknown				
Does enforcement comply with Hampton principles?	Yes				
Will implementation go beyond minimum EU requirements?	No				
What is the value of the proposed offsetting measure per year?	£ unknown				
What is the value of changes in greenhouse gas emissions?	£ n/a				
Will the proposal have a significant impact on competition?	Yes				
Annual cost (£-£) per organisation (excluding one-off)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Micro</td> <td style="width: 25%; text-align: center;">Small</td> <td style="width: 25%; text-align: center;">Medium</td> <td style="width: 25%; text-align: center;">Large</td> </tr> </table>	Micro	Small	Medium	Large
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<b>Impact on Admin Burdens Baseline</b> (2005 Prices)		(Increase - Decrease)
Increase of £	Decrease of £	<b>Net Impact</b> £

Key: Annual costs and benefits: Constant Prices (Net) Present Value

## Summary: Analysis & Evidence

**Policy Option:**  
Package 4

**Description:** 40p/wkh feed in tariff 'deemed' for micro-electricity.

<b>COSTS</b>	<b>ANNUAL COSTS</b>		Description and scale of <b>key monetised costs</b> by 'main affected groups' Resource costs of around £2.3bn to 2030. Costs are net of the value of carbon saved, which is included in the electricity price. Includes costs of removing barriers to take up for domestic customers.
	<b>One-off</b> (Transition)	<b>Yrs</b>	
	£		
	<b>Average Annual Cost</b> (excluding one-off)		
	£ 0.1bn		<b>Total Cost (PV)</b> £ 2.3 bn
<p>Other <b>key non-monetised costs</b> by 'main affected groups' Cost itemised are resource costs. Costs not included are costs of other policy measures to meet the target; indirect costs to the economy or increased energy prices, all of which could be significant.</p>			

<b>BENEFITS</b>	<b>ANNUAL BENEFITS</b>		Description and scale of <b>key monetised benefits</b> by 'main affected groups' Benefits are monetised carbon benefits from the replacement of fossil fuels in electricity generation. Carbon saved in the electricity sector is covered by the ETS and is netted off the resource costs above, valued at the forecast carbon price. 28 TWh additional renewable generation in total by 2030. 1.8 TWh in 2020.
	<b>One-off</b>	<b>Yrs</b>	
	£		
	<b>Average Annual Benefit</b> (excluding one-off)		
	£ n/a		<b>Total Benefit (PV)</b> £ n/a
<p>Other <b>key non-monetised benefits</b> by 'main affected groups' Additional benefits could include diversifying the energy mix; reducing dependence on fossil fuels; business and employment opportunities in developing and deploying renewable energy technologies. Additional benefits from encouraging 'energy aware' customers.</p>			

**Key Assumptions/Sensitivities/Risks** Costs and benefits are estimated using central fossil fuel price assumptions. Estimates are based on economic modelling from Element Energy independent consultants.

Price Base Year 2008	Time Period Years 20	<b>Net Benefit Range (NPV)</b> £ -2.3bn	<b>NET BENEFIT (NPV Best estimate)</b> £ -2.3bn
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What is the geographic coverage of the policy/option?				UK	
On what date will the policy be implemented?				2010	
Which organisation(s) will enforce the policy?				BERR	
What is the total annual cost of enforcement for these organisations?				£ unknown	
Does enforcement comply with Hampton principles?				Yes	
Will implementation go beyond minimum EU requirements?				No	
What is the value of the proposed offsetting measure per year?				£ unknown	
What is the value of changes in greenhouse gas emissions?				£ n/a	
Will the proposal have a significant impact on competition?				Yes	
Annual cost (£-£) per organisation (excluding one-off)		Micro	Small	Medium	Large
Are any of these organisations exempt?		Yes/No	Yes/No	N/A	N/A

<b>Impact on Admin Burdens Baseline</b> (2005 Prices)				(Increase - Decrease)	
Increase of	£	Decrease of	£	<b>Net Impact</b>	£

Key: Annual costs and benefits: Constant Prices (Net) Present Value

## Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

### Strategic Overview

1. This Impact Assessment focuses on potential measures to increase renewable electricity as part of the consultation on how to meet the UK's share of the EU 2020 renewable energy target. The costs, benefits and wider impacts of the overall package across all three sectors are set out in the general IA.

### Market Failure Analysis

2. The same analysis as in the general IA applies.

### Objectives

3. The objective of the potential measures in the electricity sector is to increase renewable electricity to up to 37% by 2020, in a cost effective way, in a way that is most compatible with our other policy objectives, and in a way that makes most sense for 2050 and beyond.

### Identification of Potential Measures

4. This IA considers the impact of measures to achieve different levels of renewable electricity. It considers:

(i) the cost of financial instruments to which could be used to incentivise a step change in renewable large scale electricity generation, to 28%, 32% and 37% renewable electricity

(ii) It also considers the impact of a feed-in tariff for micro-electricity.

5. In order for the financial incentive to work in incentivising renewable electricity, there are a number of measures that need to be taken, to address the non-financial barriers to renewable generation. These include measures to address planning constraints, grid constraints, supply chain constraints, measures to incentivise community activity, and measures to incentivise distributed electricity. These are considered below.

### Financial Instruments (large-scale electricity generation)

6. In order to assess the cost and impact of financial measures which would incentivise up to 37% renewable electricity through large scale generation, BERR employed Redpoint consultants to consider a range of financial instruments. After some initial qualitative assessment of a wider range of options, and some consideration of international evidence, it was decided to model in detail the impact of the following measures:

(i) an extended Renewables Obligation (RO);

(ii) a feed-in tariff system (FITs) for large scale generation, and

(iii) a feed in tariff system combined with a tender for further from market technologies (offshore wind and wave/tidal).

7. The key criteria to consider in the design of an incentive mechanism to promote renewable electricity are:

- Effectiveness of the policy in incentivising take-up of renewable electricity opportunities, both to 2020 and beyond
- Cost-effectiveness
- Compatibility of the policy with the electricity market
- Effect of the policy on investor confidence in the renewable electricity market.

8. Details of the modelling assumptions and results from research conducted by Redpoint et al (2008). Here we present a summary of the findings.

***Definitions/Assumptions:***

9. Costs are measured against a 'status quo', which is the counterfactual for assessing the impact of the different support schemes. It represents 'business as usual', where renewables policy follows the Energy Bill proposals, with banding of the RO, and an upper limit on the obligation size of 20% by 2020.

10. The modelling makes a number of simplifying assumptions about the design of the different measures, in order to illustrate the difference between the 2 schemes. Details are set out in Redpoint et al (2008), but in summary:

- a. For the RO it is assumed that it will start in 2010 and run until 2037. The size of the Obligation is related to the renewable target – assuming a linear increase between the starting year and the required 2020 level without the use of the headroom mechanism envisaged in the current reforms of the RO. Bands are assumed to be reviewed in 2013 and 2018, and are adjusted according to the cost evolution of the technologies.
- b. It is assumed that the FITs will start in 2012, and run until 2022. Tariffs are assumed to be all-in tariff, which is invariable to the wholesale electricity price. Tariffs are set to cover the cost of the technologies, taking into account the premium for different types of investors in the renewables market. A key feature of the FITs compared to the RO, is that the cost of capital under the FITs is assumed to be lower than under the RO because of for the more fixed level of subsidy over time.
- c. The FITs/Tender was modelled as a combination of a feed in tariff system for on-shore technologies, with tenders for offshore technologies. This introduced a more market-based approach to reveal the cost of further from market technologies. A simplifying assumption made in modelling the FITs/tender was that tenderers bid at their own levelised costs using a cost of capital commensurate with their own perceived risk of the project, meaning that there is no opportunity for investors under this model to earn additional rents.

11. Levels of generation were chosen with reference to external research by Sinclair Knight and Merz (SKM) consultants, who analysed barriers to renewable electricity, and estimated possible scenarios of build of renewable technologies to meet the 2020 target. 28% renewable electricity uses the SKM 'medium' build rates 32% uses 'high' build rates. 37% uses 'high' build rates, and assumes that a barrage or lagoon, such as one of the projects considered in the River Severn, which would be operational post 2020 in this scenario, counts towards the renewable energy target. Further details of assumptions under these build conditions can be found in SKM (2008a).

12. Table 1 below gives the overall net welfare cost, and percentage of renewable electricity generated under a range of policy instruments, and underlying assumptions.

**Table 1: Cost/Benefit analysis of Measures to increase Renewable Electricity**

Table 1a: NPV Net Welfare in 2020

NPV 2020 £bn	Renewables Obligation	Feed in Tariffs	Feed in Tariffs/ tender
28% renewable electricity central fuel prices	-1.7	-1.3	-1.6
32% renewable electricity central fuel prices	-2.4	-2.0	-2.3
37% renewable electricity central fuel prices	-3.5	-3.3	-3.5
37% renewable electricity, low fuel prices	-4.0	-3.8	-4.2
37% renewable electricity, high fuel prices	-3.2	-2.6	-2.9
37% renewable electricity, high high fuel prices	-2.7	-2.1	-2.4
37% renewable electricity, high capital costs	-3.6	-2.0	-3.8
37% renewable electricity, low capital costs	-3.5	-3.1	-3.2
37% renewable electricity, central build rates	-2.4	-1.9	-2.2

Table 1b: NPV Net Welfare, Cumulative 2008 to 2030

NPV 2008 to 2030 £bn	Renewables Obligation	Feed in Tariffs	Feed in Tariffs/ tender
28% renewable electricity central fuel prices	-23.4	-21.0	-24.7
32% renewable electricity central fuel prices	-35.4	-31.0	-36.6
37% renewable electricity central fuel prices	-43.5	-39.7	-44.2
37% renewable electricity, low fuel prices	-48.3	-51.3	-55.9
37% renewable electricity, high fuel prices	-35.2	-26.4	-31.1

37% renewable electricity, high high fuel prices	-30.5	-20.1	-24.6
37% renewable electricity, high capital costs	-42.4	-23.8	-48.2
37% renewable electricity, low capital costs	-43.0	-36.8	-40.4
37% renewable electricity, central build rates	-29.6	-18.4	-23.9

Table 1c: Percentage Renewable Electricity in 2020

Percentage renewable generation in 2020	Renewables Obligation	Feed in Tariffs	Feed in Tariffs/ tender
28% renewable electricity central fuel prices	28.3	27.6	28.0
32% renewable electricity central fuel prices	31.8	32.0	32.1
37% renewable electricity central fuel prices	36.8	36.9	37.0
37% renewable electricity, low fuel prices	34.0	37.0	36.6
37% renewable electricity, high fuel prices	37.5	37.2	36.9
37% renewable electricity, high high fuel prices	38.1	37.2	37.0
37% renewable electricity, high capital costs	34.6	26.4	33.5
37% renewable electricity, low capital costs	37.6	37.2	37.4
37% renewable electricity, central build rates	26.6	27.4	27.6

Source: Redpoint et al (2008) (net welfare estimates adjusted to UK costs). Figures exclude costs of grid reinforcement. Costs are at 2008 prices, discounted.

Note: The net welfare estimate is the resource costs of generating electricity, including changes in investment costs, fuel costs, variable and fixed operating costs, over and above the cost in the status quo, net of the value of CO<sub>2</sub> abated, calculated at the carbon price. A negative number indicates a reduction in overall net welfare.

Fuel price assumptions are the low, central, high, and high high fossil fuel price scenarios, published <http://www.berr.gov.uk/files/file46071.pdf>

## Analysis of Results:

13. In general, across the measures, the feed in tariffs lead to lower net welfare costs, due to the assumption that under feed in tariffs, firms will face lower capital costs, which result from the lower hurdle rates they face.
14. Consumer costs are also generally lower under feed in tariffs than in the RO – in particular in the early years, which reflects the lower resource costs. Post 2020 rents incurred under the RO reduce significantly as the ROC price falls, reducing the cost to consumers.
15. Results presented are compared to a status quo with the same fuel prices. Fuel price sensitivities affect the level of renewables build, although the high scenarios are constrained by overall build rates. The RO is more sensitive to low fuel prices than feed in tariffs – under low fuel prices, the level of generation does not meet the target in the RO case. Net welfare costs are lower under the high fuel prices, and even lower under high high fuel prices, since incremental resource costs are lower – the opposite is the case in the low fuel price case.
16. Under central build rate assumptions, both the RO and the feed in tariff systems fail to meet the target, but the cost to consumers is higher in this instance under the RO, as the scheme as modelled incurs high rents through the high ROC price.
17. Under the feed in tariff system the risk to meeting the target is greater if capital costs are higher than expected – under the RO this effect is ameliorated through the ROC price increasing.

## Impact on electricity prices

18. Impact on energy prices is covered in depth in the general IA. An increase in renewable electricity will affect electricity prices, as the consumer costs identified above are passed through into prices and bills. The impact on bills will not necessarily be as high as in the table below, if increased prices incentivise a reduction in electricity use. In summary, the impact on prices is as given in Table 2 below:

**Table 2a: Impact on Domestic Electricity Bills**

% increase in Domestic Prices (Bills)	32% renewable electricity – central fuel prices		37% renewable electricity – central fuel prices		37% renewable electricity – high high fuel prices	
	RO	FITs	RO	FITs	RO	FITs
2010-2014	1 to 4 % (£4 to £13)	-1 to 2% (£-3 to £7)	1 to 4% (£4 to £15)	-1 to 2% (£-4 to £7)	1 to 2% (£6 to £11)	-1 to 0% (£-5 to £2)
2015-2019	3 to 5% (£10 to £19)	1 to 4% (£3 to £12)	3 to 6% (£12 to £22)	2 to 5% (£7 to £17)	0 to 1% (£1 to £6)	- 4to -3% (£-22 to £-15)
2020-2024	12 to 15%	9 to 11% (£32 to	9 to 12% (£34 to	9 to 12% (£33 to	5 to 6% (£24 to	3 to 4% (£14 to

	(£43 to £53)	£41)	£44)	£44)	£29)	£20)
2025-2029	10 to 12% (£33 to £42)	11 to 14% (£38 to £48)	17 to 20% (£57 to £67)	16 to 19% (£54 to £65)	2 to 3% (£7 to £12)	3 to 4% (£12 to £18)
2010 to 2030	7 to 9% (£23 to £33)	6 to 9% (£20 to £30)	8 to 11% £29 to £39	7 to 10% £24 to £35	2 to 3% £9 to £14	0 to 2% £0 to £7

**Table 2b: Impact on Industrial Electricity Bills**

% increase in Industrial Prices (Bills 000s)	32% renewable electricity – central fuel prices		37% renewable electricity – central fuel prices		37% renewable electricity – high high fuel prices	
	RO	FITs	RO	FITs	RO	FITs
2010-2014	1 to 4% (£5 to £19)	-1 to 2% (£-4 to £9)	1 to 5% (£6 to £22)	-1 to 2% (£-5 to £11)	1 to 3% (£8 to 15)	-1 to 0% (£-6 to 3)
2015-2019	3 to 6% (£14 to £28)	1 to 4% (£4 to £18)	4 to 7% (£17 to £32)	2 to 5% (£10 to £26)	0 to 1% (£1 to £9)	-5 to -3% (£-32 to £-23)
2020-2024	13 to 16% (£64 to £78)	10 to 13% (£46 to £61)	10 to 14% (£49 to £65)	10 to 13% (£48 to £64)	6 to 7% (£34 to £41)	3 to 5% (£20 to £29)
2025-2029	11 to 14% (£48 to £62)	12 to 16% (£56 to £70)	19 to 22% (£83 to £99)	18 to 21% (£79 to £95)	2 to 3% (£9 to £16)	3 to 5% (£16 to £25)
2010 to 2030	7 to 11% (£34 to £48)	6 to 10% (£29 to £44)	9 to 13% (£42 to £57)	8 to 11% (£35 to £51)	2 to 3% (£13 to £20)	0 to 2% (0 to £9)

19. Price increases are estimated above the status quo using the same price assumptions. In the high high fuel price case, price increases above the status quo are smaller than in the central case.

### **Impact on electricity generation market**

20. There are a number of impacts on the electricity generation market that we have considered:

- a. Additional reserve and response requirements: the System Operator (National Grid in the case of Great Britain) will need to manage more short term fluctuations in the supply-demand balance and will therefore need more generating capacity and/or demand side flexibility to be available at short notice. There are costs associated with this.
- b. Additional pressure on other plant: conventional capacity is likely to have to run more flexibly than it has previously done, with possible implications for its efficiency and reliability, in order to balance the variability of output from renewable sources. In the future renewables will need to be complemented by flexible generating plant and it is worth noting that much conventional generating

plant is flexible to deal with normal variations in demand. While there are likely to be additional costs, there will be a market for flexible conventional capacity.

- c. Additional capacity requirements: a greater total absolute amount of capacity will be needed to maintain a sufficient surplus of supply over demand when there is a higher proportion of variable capacity in the mix. Since much of this capacity will not get to generate very often (only when demand is high and/or when wind output falls), it will need high prices on occasion (at peak times) in order to earn returns on investment.

21. BERR commissioned two studies which considered the impact on the electricity market of the renewable energy target. BERR commissioned research from SKM (2008b) which considered the impact on the grid of different renewable electricity scenarios. It concluded that the scale of reinforcement needed onshore, over and above current investment plans, may be relatively modest, although there is a degree of uncertainty about the type, volume and location of renewable generation developments. The majority of new investment will be needed to bring offshore generation to the most suitable (not necessarily the nearest) connection point to the main onshore network.
22. Redpoint et al (2008) modelled the impact on the electricity market of different levels of renewable generation. They estimated that, under scenarios which increased renewable electricity to around 32%, around 30 GW of additional renewable capacity was required by 2020, and around a further 15 GW of conventional capacity. Net Welfare figures presented in Table 1 above include the costs of this additional capacity, (over and above levels assumed in the status quo), costs of additional offshore connection and the cost of balancing the electricity market. Costs of additional grid reinforcement identified by SKM (2008b) are included in the net welfare costs presented in the summary tables above.
23. Redpoint et al (2008) also sets out the impact on other new forms of generation post 2020. Under the higher renewables target level, wholesale prices for electricity fall, which leads to investment in new nuclear generation at a lower level, between 2020 and 2025. This effect is more marked under the FITs than the RO, as wholesale prices are lower in the longer term, due to a higher level of renewable generation post 2020 under the FITs (due to the extension of the FIT to 2022). In higher price scenarios this impact is reduced – in the high high scenario there is little impact on new nuclear build.
24. More detail on price impacts, and the impact on security of supply are given in the general impact assessment to this consultation.

## **Conclusion**

25. The results should be treated with caution, as they are based on a number of (in some cases) highly uncertain assumptions which are outlined in Redpoint et al (2008). The assessment of the pros and cons of an obligation system against a feed in tariff system is finely balanced. While the analysis shows that FITs are likely to lead to lower resource and net welfare costs due to lower cost of capital assumptions, the risk to achieving the target under the FITs is greater where capital costs exceed expectations. Renewable investment is unaffected by fuel price assumptions under the FITs, while under the RO there is a risk to investment under low fuel prices, with higher fuel prices stimulating

additional investment (subject to supply constraints). Given the tight timing of the renewable energy target, the uncertainties of transitioning to a new subsidy regime could cause additional costs and place additional risk to meeting the renewable energy target.

## **Financial Instrument for micro-electricity generation**

26. Bringing electricity generation closer to the public and involving people as producers of energy, as well as consumers, means that people at all levels can make an active contribution to our energy and climate change goals. As such there is a strong political desire to increase take up of micro and small scale generation technologies.
27. One of the key barriers to increased uptake is the high costs of micro and small scale generation technologies. Small scale electricity technologies are typically expensive and can take a long time to provide a significant return on initial investment. In addition, much of the potential uptake of microgen would be within the domestic sector. Households typically have relatively short time horizons, not taking full account of financial costs and benefits occurring into the future. In order to reduce the impact that this has on take-up of microgen technologies – which involve substantial up-front capital cost but ongoing fuel cost savings – it is necessary to consider how a policy can be designed to channel the financial support to the microgenerator up-front. This need for up-front financial support needs to be balanced with the goal of relating support provided to actual generation, and ensuring that microgenerators have ongoing incentives to ensure their equipment is in good working order if they have already been paid the subsidy reflecting the expected level of output from the installation.
28. To tackle the cost barrier to further microgeneration uptake, whilst recognising the issues specific to this market, we propose looking at methods of providing additional financial support to these technologies.

### **Feed in Tariff at 40p/kWh**

29. Evidence from other European countries, such as Germany, suggests that providing a fixed financial reward for each kWh of electricity generated (a feed-in tariff) alongside other measures, such as soft loans, can lead to substantial take up of micro and small scale generation technologies, as long as the financial support is sufficiently generous. Cost and impact estimates are based on analysis undertaken by Element Energy independent consultants, including the report: 'The growth potential for microgeneration in England, Wales and Scotland'. Ref: <http://www.berr.gov.uk/energy/microgenerationresearch>
30. There are options for how such a system could be implemented. For example, electricity suppliers could be obliged to provide the reward that microgenerators would be entitled to through their existing relationship with the customer. The cost of providing this reward could then be redistributed across all electricity suppliers to ensure that no supplier is disadvantaged by having a high proportion of small scale generators within its customer base – essential in ensuring that energy suppliers act in a way which encourages microgen take-up. It would probably also be necessary to tackle the high upfront costs of small scale generation technologies by anticipating the generation of an installation over its life and paying the reward for that generation up front – 'deeming'.

31. Analysis suggests that providing feed-in tariffs at 40p/kWh for all new microgeneration installed by 2020, and making the payment upfront would produce 28TWh of additional renewable generation by 2030, at a cost of around £2.3bn. Energy suppliers would be expected to recoup the cost of providing the incentive to microgenerators through customer bills. Assuming that this is all recouped from domestic bills (as domestic customers would account for the majority of qualifying generation) this is predicted to have an impact on domestic bills of at least £8-12 in 2020 (an increase of 2.5-3.5%), with higher impacts of up to £27-40 if the suppliers recoup the costs of a scheme offering upfront support immediately rather than spreading these over the lifetime of the installation.

## **Amendments to the RO**

32. We also have the option of making further modifications to the Renewables Obligation which already provides support to small scale electricity generators. We have already announced that we will band microgeneration in the highest 2 ROCs per MWh band under the current proposed revisions to the RO. Further modifications suggested are: introducing higher banding for microgeneration technologies; making RO payments upfront – equivalent to ‘deeming’; and banding the RO so that microgenerators received a substantial number of ROCs very early on after installation.

33. In order to provide microgenerators with a similar level of financial reward as under the 40p/ kWh FIT discussed above it would be necessary to pay around 12 ROCs per MWh of generation – a 6-fold increase on the proposed banded level.

34. Any modification to the RO system to better reward small and micro generators will lead to a less cost-effective RO. The more successful the uptake of small and micro generation the greater will be this reduction in cost-effectiveness. Accordingly, it is hard to envisage modifications to the scheme that would simultaneously substantially increase uptake of microgeneration and have little impact on the cost effectiveness of the RO. The overarching intention would not be to destabilise the RO by trying to incentivise small scale generation.

35. Modifications to the RO such as deeming and providing a large number of ROCs upfront can be assumed to be similar to providing capital grants. Analysis from Element Energy shows that providing a 25% capital subsidy at the point of installation would bring forward 45 GWh of renewable electricity in 2020, and a 50% subsidy would bring forward 332 GWh in 2020. For PV this would imply the up-front award of 68 ROCs and 136 ROCs respectively.

## **Non-Financial Measures**

### **Planning: summary of costs and benefits of potential measures**

36. The potential measures considered in this consultation to improve the delivery of renewable electricity through planning regimes are:

#### **Table 1: List of potential measures to address planning constraints**

a. Setting ambitious regional targets for renewable energy and using these to shape local strategies
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b. BERR to run a programme of Practitioner Workshops for planning officials, councillors and planning inspectors in England
c. National Renewables Advisory Service for local planning community and developers with small phone-based central team
d. Some smaller local projects could be fast-tracked through a local development order

37. The likely costs of these measures would be:

- These measures would involve resource costs to Government. Measure a would also involve resource costs for regional planning bodies and/or LAs. Measure b would involve resource costs to BERR.
- Measure c could involve a significant cost including costs of employing staff, though there are a range of options as to how this measure could be implicated, with different associated costs. Again this could reduce costs for businesses applying for planning permission.
- None of these measures would involve direct costs on business.

35. The likely benefits from these measures would be:

- These are enabling measures – improve delivery of renewables development.

### **Government regulation barriers: summary of costs and benefits of potential measures**

36. The potential measures considered in this consultation to address Government regulation barriers to renewable electricity are:

**Table 2: List of potential measures to address Government regulation constraints**

a. DFT to ensure a dataset of current shipping patterns and predictions for growth is made available
b. Make wider use of enhanced marine traffic management in relation to offshore renewables
c. Increase resources and timeliness of advice of the Maritime and Coastguard Agency's Navigational Safety Branch
d. Ensure the availability of resource and timeliness of Search and Rescue advice from MCA throughout site selection, consultation process and beyond
e. Further work within Government and between Government and statutory agencies and with the EC and EU partners, to consider whether process and guidance on environmental legislation can be improved
f. Further investment in environmental skills in those involved in the planning process, including statutory advisers.

37. The likely costs of these measures would be:

- Measure a could involve a cost to Government in formatting the data provided to enable its use to inform decisions on offshore renewables development.
- Measure b could involve significant costs. Government could further explore the most appropriate types of marine vessel traffic management options available to suit offshore renewables developments and to determine potential solutions. These options would then need to be considered with regard to facilitating any potential frameworks for meeting any necessary costs (currently costs of marine

traffic management systems are met by ports, developers or other users of the sea, according to local circumstances).

- Measures c, d, and e could involve a staff cost to relevant bodies.

38. The likely benefits of these measures would be:

- These are enabling measures – to remove barriers to renewable development.

### **Grid infrastructure barriers: summary of costs and benefits of potential measures**

39. The potential measures considered in this consultation to address Grid infrastructure barriers to renewable electricity are:

**Table 3: List of potential measures to address grid infrastructure barriers**

a. Delivering a reformed grid access regime intended to make more efficient use of the network and facilitate sharing between renewable and conventional generation.
b. Making an early start on delivering infrastructure needed to support high levels of renewable penetration.
c. Ensuring that system planning standards (GBSQSS) are fit for purpose given the nature of renewable technologies and the prevailing access regime.

40. The likely costs of these measures are:

- Access reform: detailed arrangements are for industry groups to resolve. The costs of alternative access models will depend on the relationship of generation connection to investment (i.e. generation connecting ahead of investment will lead to additional constraint costs) and the extent to which those costs are socialise or met by generators.
- Infrastructure: the exact scale and locations of system extensions and reinforcements is uncertain and dependent on system planning standards. Initial estimates for onshore and offshore network costs are around £13bn-£16bn. Work to develop infrastructure ahead of commitments from generators (but in the light of known resources and potential developments) carries stranded asset risks. Most of this work will be relatively low cost system planning and design activity.
- Accelerated deployment: generation capital cost are already envisaged by higher renewable targets. Reformed access arrangements and faster infrastructure build will bring forward those costs (time-value of money)

41. The likely benefits from these measures would be:

- Accelerated deployment delivers the overall benefits (carbon savings etc.) of higher renewable targets at an earlier date.
- Access reform will in the medium to long term mean lower investment requirements, because more efficient use is made of the present and future network.
- Efficient and early delivery of infrastructure leads to lower constraint costs and maximises the amount of renewable electricity that can be supplied

### **Supply chain barriers: summary of costs and benefits of potential measures**

42. The potential measures considered in this consultation to address supply chain barriers to renewable electricity are:

#### **Table 4: List of potential measures to address supply chain constraints**

- |  |
|--|
| a. Encouraging new entrants to markets in which there are supply chain constraints                       |
| b. BERR work with the RDAs, UKTI and other bodies to develop a strategy to address supply chain barriers |

43. The likely costs of these measures would be:

- Measure a would involve addition resource costs within Government
- Measure b could involve additional pressure on existing UKTI resources, or additional resources. There would be different options as to how far this could be taken.

44. The likely benefits from these measures would be:

- Measure b would increase businesses access to information and support.

#### **Community benefits: summary of costs and benefits of potential measures**

45. The potential measures considered in this consultation to address supply chain barriers to renewable electricity are:

#### **Table 5: List of potential measures to encourage community benefits**

- |   |
|---|
| a. Establish a single benchmark for local community benefits and produce best practice guidelines which could be integrated in future planning policy |
| b. Provide mechanisms that will enable communities to benefit financially from the development of community energy assets                             |
| c. Consider the particular needs and circumstances of the renewable sector in developing the detailed design of the Community Infrastructure Levy     |

46. The likely costs of these measures would be:

- Measures a would involve small resource costs to Government.
- Measure b, dependent upon the preferred mechanism and the scale of the benefit offered could have a more material resource cost to Government or renewable developers.
- Measure c could potentially have a significant cost to developers of renewable projects, depending on how it was implemented, and could also have resource costs for Local Authorities.

47. The likely benefits would be:

- These measures are enablers, to encourage more development by countering some of the public opposition to renewables. Measures b and c could potentially result in significant benefits for communities, and as a result greater deployment of renewables.

#### **Non-financial barriers to renewable distributed electricity: summary of costs and benefits of potential measures**

48. The potential measures considered in this consultation to address non-financial barriers to renewable distributed electricity and microgeneration are:

**Table 6: List of potential measures to encourage renewable Distributed Energy**

a. Government could establish an online DE information hub under the Act on CO2 brand. This will bring together and signpost to information relevant to the use of energy from distributed sources and to the establishment of DE schemes
b. Government to support community outreach activity to identify potential for DE in existing landscape
c. Working with appropriate best practice partners, devise and deliver a training programme for Local Authority/Regional Development Agencies planners, decision-makers, architects, developers and investors, which presents clear information on DE potential, options and solutions
d. Maximise the potential of the post-2011 Suppliers' Obligation to support DE

49. Government is carrying out work to assess the potential and costs of measures to incentivise Distributed Energy.

### **Non-financial measures: summary of costs and benefits**

50. This IA has identified the non financial measures, but has not provided cost estimates. This is further work needed for the full impact assessment.

### **Small Firms Impact Test**

51. All small firms will be impacted through increased energy bills. It is likely thought that Small businesses will benefit from the growth in business opportunities due to the growth in renewables.

### **Risks**

52. There are a number of risks that the measures set out in the consultation document might not deliver the amount of renewable energy required to reach 15% of overall energy use by 2020 – or that electricity may not deliver its required share. These include the risk that it will not be possible to implement the measures proposed in the consultation by 2020; that policies will not prove sufficient to overcome the barriers; that the response from the investment community and individuals will not be sufficient to meet our targets; that costs will turn out to be greater than we have identified; and the risk that other constraints, supply side barriers, or unidentified impacts will emerge. It should also be recognised that given the EU negotiations on the Renewable Energy Directive are not yet complete, there are risks of changes that will require amendments to the final strategy.

53. We will seek to mitigate these risks by undertaking a full consultation and maintaining ongoing dialogue with stakeholders, including industry and investors, in order to identify any further constraints or issues.

### **Implementation and Monitoring and Evaluation**

54. This document sets out potential measures to increase renewable electricity to around 30 to 35%, as part of a wider set of measures to meet the UK's share of the EU 2020 renewable energy target. The measures to increase renewable electricity will be set out in the Renewable Energy Strategy, which will be published in spring 2009 and will set out which measures we will implement and how we would do so. Monitoring and evaluation of progress towards the target is set out in the general IA.

### **Specific Impact Tests**

55. Specific impact tests are covered in the general IA.

## Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

**Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.**

<b>Type of testing undertaken</b>	<b><i>Results in Evidence Base?</i></b>	<b><i>Results annexed?</i></b>
Competition Assessment	Yes/No	Yes/No
Small Firms Impact Test	Yes/No	Yes/No
Legal Aid	Yes/No	Yes/No
Sustainable Development	Yes/No	Yes/No
Carbon Assessment	Yes/No	Yes/No
Other Environment	Yes/No	Yes/No
Health Impact Assessment	Yes/No	Yes/No
Race Equality	Yes/No	Yes/No
Disability Equality	Yes/No	Yes/No
Gender Equality	Yes/No	Yes/No
Human Rights	Yes/No	Yes/No
Rural Proofing	Yes/No	Yes/No

## Annexes

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