Summary: Intervention & Options

Department /Agency: DECC	Title: Summary for Heat and Energy Savings Consultation Impact Assessments	
Stage: Consultation	**Version: 4**	**Date: 9 February 2009**

Related Publications: HES Consultation IA Delivery Mechanism for Supplier Obligation, Financial Measures, District Heating: Economic Assessment and Evaluation of Evidence

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

Heating accounts for 46% of the UK's CO2 emissions. The Heat and Energy Savings Consultation Document (HES) is concerned with reducing CO_2 emissions from the generation and supply of heat. Achieving objectives requires co-ordination of diverse policies affecting changes in behaviour, financing measures, expanded contribution form Renewable Heat, promotion of Combined Heat and Power and of District Heating. We are also considering whether achievement of objectives requires introduction of new mechanisms of policy delivery. Government intervention is necessary to maintain a trajectory of carbon emission reductions in compliance with the UK's 2020 targets to reduce greenhouse gases.

What are the policy objectives and the intended effects?

The combined savings achieved through policy initiatives considered in HES aim to reduce emissions by 44 million tonnes of CO_2 in 2020, however the emissions savings from policies whose costs and benefits have been quantified to date, sum to 36 MT CO_2 in 2020; further work is required. HES' policies help reach four key objectives: meeting ambitious targets for reducing emissions and increasing use of renewable energy; helping people struggling with their energy bills; ensuring secure energy supplies and allowing the UK to make the most of the economic opportunities in the new 'green' economy.

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

Option 1: No change (i.e. continue with existing policies, and introduce Supplier Obligation (SO) and Renewable Heat Incentive (RHI)).

Option 2: As Option 1, plus Financial Measures

Option 3: Introduce new mechanism for policy delivery (Central Coordinating Body)

Option 1 would follow policies set out in Energy White Paper.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? Review dates to match calendar of carbon budget periods.

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:

Signed by the Secretary of State on 10th February 2009

Summary: Analysis & Evidence

Policy Option: Supplier Obligation – Outcome Based	Description: A cap on supply companies to limit carbon emissions associated with household energy use

[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.]

Note to reader:

"Summary: Analysis & Evidence" pages as required feature in individual Consultation Impact Assessments (Renewable Heat Incentive, Delivery Options Supplier Obligation, Financial Measures)

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Strategic Overview

1. The UK Government is committed to reducing greenhouse gas emissions by at least 80% by 2050. The heat sector accounts for 47% of UK carbon emissions and 60% of average household energy bills. The Heat and Energy Savings Consultation Document (HES) is concerned with policies that will affect the generation as well as the supply of heat.

2. HES builds on the publication of the Energy White Paper (2007) and of the Renewable Energy Strategy Consultation (June 2008) and complements measures put forward therein.[1]

3. The policies considered in HES affect supply and demand conditions in the heat market. Given these policies' diverse nature and the differing stages of policy development, individual policies are considered in separate Partial Impact Assessments. Specific Impact Assessments evaluate Delivery Mechanisms for the Supplier Obligation, the Renewable Heat Incentive, Financial Measures, Regulation, and District Heating. This Overarching Impact Assessment supplements these separate Impact Assessments by providing a synopsis of their cumulative effect.

4. Moreover, this Impact Assessment Summary (IA) reviews market failures that underpin the economic rationale across the range of HES policies. In the context of discussing market failures, it is pertinent to consider the effect of HES policies on security of supply, which although not a market failure in the strict economic sense has a high policy priority given DECC's integrated approach to climate change and energy markets. The section on market failures includes considerations of barriers that prevent market forces from allocating resources as needed to raise welfare to society. Broadly, these barriers lie in a range of inconsistencies in consumer behaviour.

5. Further sections of this IA also review the size of the market affected by proposed policies; summarise the costs and benefits of individual policy IA's (specifically, the IA's for the RHI and for the SO). This IA also sets out carbon savings, changes in demand and distributional effects.

Policy Goals

6. Policies put forward in HES aim to reduce emissions by 44 $MtCO_2$ in 2020 through policies that will affect the heat market's demand and supply conditions. For example, energy efficiency reduces energy demand whilst promotion of CHP and of District Heating diversifies energy supply. The costs and benefits of 36$MtCO_2$ of this ambition has been quantified. Further work is needed to assess the costs and benefits of the further 8 $MtCO_2$ of ambition.

7. Successful implementation will contribute to reducing market failures inherent in CO_2 emissions by reducing demand for fossil fuels overall through energy efficiency measures, by facilitating the expansion of low carbon energy supply through expansion of CHP, and by diversifying the delivery channels for provision of heat through proliferation of District Heating.

[1] The Energy White Paper (EWP) sets out four energy policy goals: "to put ourselves on a path to cutting CO_2 emissions by some 60% by about 2050, with real progress by 2020; to maintain the reliability of energy supplies; to promote competitive markets in the UK and beyond; to ensure that every home is adequately and affordably heated." Energy White Paper (2007). Source: http://www.berr.gov.uk/energy/whitepaper/page39534.html. These goals were first set out in the EWP (2003). The Renewable Energy Strategy consultation considers a number of measures that have the potential to achieve 15% of our energy consumption from renewables by 2020.

8. A second round effect is to reduce reliance on centralised sourcing of fossil fuel for heating and to diversify means for fuel delivery. The combined effect of these steps is to reduce the dependence of UK households on suppliers of fossil fuels and their exposure to risks inherent in centralised heat provision. This generates benefits in respect of security of supply.

9. A further beneficial second round effect may ensue from facilitating market innovation and levelling barriers to market entry.

10. Policy design is based on an analysis of market failures, specifically of the social cost of CO_2 emissions. Proposed measures reflect the need to overcome obstacles that prevent redress of this market failure, in this instance constraints on adjustments to behaviour of economic agents.

11. A discussion of market failures follows. Broadly, these are comprised of the social cost of CO_2 emissions and of behavioural barriers preventing efficient allocation of resources through market mechanisms.

Market Failures

CO_2 emissions

12. The fundamental market failure underlying climate change policies is the social cost of CO_2 emissions analysed in the Stern Review:

> "The climate is a public good: those who fail to pay for it cannot be excluded from enjoying its benefits and one person's enjoyment of the climate does not diminish the capacity of another to enjoy it too. Markets do not automatically provide the right type and quantity of public goods, because in the absence of public policy there are limited or no returns to private investors for doing so: in this case, markets for relevant goods and services (energy, land use, innovation, etc) do not reflect the consequences of different consumption and investment choices for the climate. Thus climate change is an example of market failures involving externalities and public goods."[2]

13. Failure to act now would jeopardise economic growth in the future. The cumulative but long-term effect of CO_2 emissions increases the urgency of policy implementation and the need to opt for policies that deliver results within a relatively tight timeframe.

14. Until the market price for energy reflects the social cost of carbon emissions, the negative externality of CO_2 emissions necessitates government intervention. Where possible, measures aim to provide a catalyst for markets to accomplish on their own internalisation of costs through explicit price signals. An explicit price signal enables economic decisions to weigh the price of carbon against the cost of abatement. An example is the EU ETS. However, in circumstances where trading is not feasible, policy options include implementation of fiscal and regulatory measures. HES considers

[2] Nicholas Stern: The Economics of Climate Change (2006), p. 27

options that can be categorised as market instruments: trading and fiscal measures, and also regulatory approaches.

15. The market for heat for the most part is outside the traded sector and hence lacks a transparent price signal to inform behaviour. Lacking a transparent price for CO_2 emissions, agents often will fail to factor in the social cost of carbon emissions.

16. Additionally, HES takes into account impediments to market efficiency that prevent policy interventions from taking effect. Such impediments in the case of HES are behavioural barriers, discussed below.

Behavioural Barriers

17. Market failures persist when economic agents do not make economically rational choices. In the heat market, there are barriers that prevent economic agents from adjusting behaviour. These behavioural barriers are manifest in many segments of the heat market. A discussion of these behavioural barriers follows.

18. For example, the mismatch between public benefit and private cost is apparent in the case of domestic energy efficiency measures, where householders often ignore the opportunity to introduce measures even when these are demonstrably in their own financial interest (e.g. using energy-efficient light bulbs). The nature of behavioural barriers may differ across the heat sector, between domestic householders and small businesses, or between property owners and tenants. Hence, addressing behavioural barriers that occur in different contexts is crucial to successful implementation.

19. Behavioural barriers are rooted in psychological factors framing individual decision-making, including particulars of hidden costs, search costs, uncertainty over prospective returns from energy efficiency investments, and misaligned incentives. Together these barriers create a 'hassle factor' for consumers that impede decisions that would be desirable.

20. Successful adoption of energy efficiency measures and reduction in demand for fossil fuels has a second round benefit, by improving the UK's security of supply.

Security of Supply

21. A range of factors may constrain security of supply, including bottlenecks in producers' investment, lack of demand elasticity in case of short-term interruptions and lack of spare storage capacity. [3] Responses of market actors may aggravate these market factors.

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[3] The DTI consulted on measures to improve the UK's gas security of supply in 2006, addressing constraints both on the supply side (reducing the risk of forced outages by timely infrastructure investment) and on the demand side (in particular the commercial and industrial sectors). Consultants modelled the probability of outages based on a 2006 Joint Energy Security of Supply Working Group Report as a 1 in 25 year base case scenario, but noted that without substantial investment in infrastructure divergent trends between projected supply and demand would lead to increased risks of outages by 2016. The probability of outages does not allow inferences of the magnitude of ensuing economic loss. As a proxy, losses were set to equal gross value added foregone because of the lack of gas as an input to production. In 2007, the discounted present value of economic loss was estimated at £ 1.26 billion for the period ending 2021. (Oxera: An assessment of the potential measures to improve gas security of supply, May 2007).

22. Constraints on optimal responses lie in demand side behaviour, specifically in that market actors do not take low-probability events into account, often tend to emulate the example of their peer group of companies or individuals, and underestimate the divergence between present and future market conditions.

23. Energy efficiency improvements will mitigate the import dependence of the EU on fossil fuels and thus affect directly the EU's security of supply position. Improved energy efficiency is a cost effective measure available to reduce import dependency significantly.

24. For a breakdown of reductions pursuant to HES in demand for coal, oil and gas pursuant to HES, see Table 7.

Size of Market

25. Provision and use of heat affects markets for energy, land use and innovation. Demand for heat is split almost equally between domestic and non-domestic demand. The importance of the domestic sector for UK energy demand is apparent from the following table, showing energy consumption by sector and end use.[4]

Energy consumption by sector and end use 2006 (Thousand tonnes of oil equivalent)

End use	Domestic	Services	Manufacturing	Transport	Total	Total excluding Transport
Space heating	26,112	8,771	3,131	-	38,014	38,014
Water heating	11,248	1,667	-	-	12,914	12,914
Process use	-	-	12,927	-	12,927	12,927
Drying/separation	-	-	2,520	-	2,520	2,520
Cooking/catering	1,274	1,949	-	-	3,223	3,223
Heat total	38,634	12,387	18,577	-	69,598	69,598
Other	6,635	5,939	7,409	59,753	79,736	19,983
Total	45,269	18,326	25,986	59,753	149,334	89,581
Percentage of total attributed to heat	85%	68%	71%	-	47%	78%

[4] UK National Emissions Inventory (2005)

26. The following table illustrates domestic energy use by fuel. Gas-fired space heating is the single most important fuel and purpose.

Domestic energy consumption by fuel and end use 2006

(Thousand tonnes of oil equivalent)

End use	Gas	Oil	Solid fuel	Electricity	Total
Space heating	21,848	2,435	494	1,334	26,112
Water heating	8,841	812	136	1,458	11,248
Cooking/catering	679	4	4	588	1,274
Heat total	31,368	3,251	634	3,381	38,634
Lighting and appliances	3	-	-	6,632	6,635
Overall total	31,371	3,251	634	10,013	45,269

CO_2 emissions associated with this fuel use appears below:

Domestic emissions by fuel and end use 2006 (Mt CO_2)

End use	Gas	Oil	Solid fuel	Electricity	Total
Space heating	47.0	6.9	1.7	8.7	64.4
Water heating	19.0	2.3	-	9.5	31.3
Cooking/catering	1.5	-	-	3.8	5.3
Heat total	67.5	9.3	2.2	22.1	101.0
Lighting and appliances	-	-	-	43.3	43.3
Overall total	67.5	9.3	2.2	65.4	144.4

27. These tables demonstrate the critical importance of the heat sector to the UK's emissions reduction targets. Space and water heating emit ca. 66% of the domestic sector's CO_2 balance.

When will policy be reviewed?

28. Policies affecting the heat market are aligned with the Renewable Energy Strategy and with policies concerned with carbon budgets. Evaluation of progress of heat policies will occur at the same time as evaluation of progress in respect of concurrent policies, to conclude from a comparison of their relative effectiveness whether we need to make adjustments.

29. The UK's CO_2 emissions reduction targets reach until 2050 and our policies aim to contribute to this long-term goal. Policy evaluation will take into account whether market developments validate our assumptions regarding the contribution of heat policy to long-term CO_2 reduction goals.

Saving potential for heat and energy efficiency measures

30. Various studies have estimated the potential for the measures in the heat and energy savings consultation along with the potential carbon savings that can be attributed them, these are outlined below.

Domestic sector

31. With no further climate change policies the Climate Change Committee (CCC) have estimated that the total remaining technical abatement potential in the domestic sector in 2022 would be 101.6 $MtCO_2$ per year.[5] Of these potential savings, 68.7 $MtCO_2$ (67%) are in the non-traded sector and 33.6 $MtCO_2$ (33%) are in the traded sector. The data is shown in annex 1.

32. This estimate assumes that a certain amount of carbon[6] abatement will be undertaken without further government intervention in the period between now and 2022, but it does not include carbon emissions savings achieved through the proposals included in the consultation. This therefore gives a reasonable indication of the potential carbon abatement in the domestic sector that the policies in this consultation could bring about.

Behavioural and demand side management measures

33. Enviros[7] considered the potential for behavioural and demand-side management measures to save energy and reduce carbon emissions in the domestic sector. This study does not attempt to quantify the potential carbon savings of the individual measures but does rank the potential of each as either limited potential, some potential or considerable potential. The two areas which they see as having considerable potential are:

a. Firstly heating controls such as room thermostats, electronic programmers or thermostatic radiator valves; and

b. Secondly general education of consumers and the supply chain.

[5] Savings achieved through the Supplier Obligation and the Renewable Heat Incentive are excluded.
[6] Carbon is used as short hand for carbon dioxide throughout this document.
[7] http://www.defra.gov.uk/environment/climatechange/uk/energy/energyservices/documents/decc-save-energy-implications.pdf

34. The report does estimate carbon savings of package of measures by looking at different scenarios. These scenarios estimate that savings of between 10.6 $MtCO_2$ and 20 $MtCO_2$ could be achieved by 2020.

District Heat Networks

35. District Heating does not necessarily deliver carbon savings; indeed transporting heat entails some efficiency losses, though these are offset to some extent by the efficiency gains from scale and the opportunity for heat storage. The potential carbon saving benefits of district heating come from the fuel used; i.e. the ability to use low carbon heating, including renewables and surplus heat that would not be possible at the scale of the individual home or building. District Heating also leads to carbon saving where a heat source, such as gas, can be used to displace more carbon intensive electrical heating.

36. The OCC Heat Call for Evidence[8] estimated that District Heating could reduce carbon emissions by 5–25% where individual gas boilers are replaced with CHP-based district heating; larger savings (around 40%) can be delivered where it replaces electric heating, for example in high-rise flats where gas heating has not been used for safety reasons. Even greater savings can be delivered, over 70%, if the heat source is renewable e.g. biomass.

37. District Heating could potentially supply between 4.4m to 6.5m dwellings (depending on internal estimates assuming a rate of return over 6%).They also estimate that 15.8TWh for heat could be supplied to non-domestic buildings through District Heating, which would make up around 13% of demand for space and water heating. This value should be viewed as an upper technical limit and the economically viable level is likely to be significantly lower.

Heat

38. The OCC heat call for evidence also produced a marginal abatement cost curve (MACC) for technologies providing low carbon heat (see annex 2). This MACC shows that total potential carbon savings that could be achieved if all likely opportunities are exploited.[8]

Combined heat and power

39. In 2007 the Government published an analysis of the UK Potential for Combined Heat and Power[9] (CHP) which calculated that from an investor viewpoint the UK had cost-effective potential for 13.8 GWe of CHP by 2010, although only 7.5 GWe was expected to be built.

40. The largest part of this potential was estimated to be from new industrial sites, mostly in medium- to low-temperature industrial uses with potential for 5.4 GWe in 2010 rising to 6.8 GWe in 2015. Opportunities for new CHP in high temperature industries are very small (0.13 GWe) but there is increasing opportunity for CHP in other industries such as refining and LNG terminals (1.3 GWe rising to 2.3 GWe in 2015). There is also potential for a further 1.3 GWe of CHP for direct use in buildings by 2010. There is only very small potential for increased use of CHP in district heating by 2010, as this would require investment on a longer time-frame.

[8] Heat Call for Evidence, BERR, January 2008
[9] www.defra.gov.uk/environment/climatechange/uk/energy/chp/pdf/potential-report.pdf

Options

41. The level of ambition for the SO, i.e. achieving annual carbon savings of at 11-14.7 $MtCO_2$ by 2020, was announced in the Energy White Paper[10] (EWP). Therefore the carbon savings due to the SO in this consultation are not additional to those announced in the EWP. The emissions projections that were updated to incorporate the EWP measures[11] included the carbon savings from the SO (12.8 $MtCO_2$ in the central case).

42. The scenarios for incentivising renewable heat in order to meet the 2020 renewable energy targets were announced in the Renewable Energy Strategy[12]. The RHI is now the preferred mechanism for achieving this ambition. Therefore any carbon savings attributed to the RHI are also not additional.

43. With this in mind the following options are considered in this overarching IA:
    a. Option 1 - do nothing. Implementation of the SO and the RHI as outlined in the consultation document;
    b. Option 2 is as option 1 but with financial mechanisms and regulations acting as supporting mechanisms for the SO.
    c. Option 3 – introduce alternative mechanism for delivery, for example through a Central Coordinating Body.

44. The Consultation's focus on District Heating is the barriers to the uptake of DHN and community energy schemes. Addressing these barriers can be seen as a facilitating measure for unlocking the potential carbon savings through various technologies including CHP and renewable heat. However as there are currently no policy proposals for District Heating or CHP, there are no associated impacts. The economic analysis of evidence on District Heating considers the potential for District Heating and the costs and benefits of installing District Heating.

45. The RHI will achieve a proportion of its carbon savings through renewable CHP and potentially through District Heating. These savings are assigned to the RHI and are therefore included under option 1.

46. Absent policy proposals regarding business and the public sector or for behavioural issues, these sections in the Consultation do not require an IA.

Costs and Benefits

47. The table below presents a summary of the costs and benefits of options where these have been quantified. The details of how these costs and benefits were calculated are in the individual impact assessments.[13]

[10] DTI: Meeting the Energy Challenge: A White Paper on Energy, May 2007
[11] http://www.berr.gov.uk/files/file39580.pdfx
[12] http://renewableconsultation.berr.gov.uk/consultation/consultation_summary
[13] Figures related to the RHI are based the Impact Assessment for Renewable Heat published alongside the RES consultation document in June 2008 and on the NERA Renewable Heat Phase II Report (September 2008). Both document can be found on: (http://renewableconsultation.berr.gov.uk/related_documents)

48. However, for options where we have not yet carried out quantitative assessments the Consultation Impact Assessments review costs and benefits in qualitative terms. The discussion of the following options does not obviate the need to consider alternative delivery options.

Option 1

49. We have quantified two options for implementing the Supplier Obligation: cap and trade and a measures-based approach. A third option, involving a delivery by an Arm's Length Body, is not included in this quantification (this would be undertaken at a later stage pending further policy development). The benefits of the cap and trade scheme are assumed to accrue over the period of the SO only (i.e. 2011 to 2020), whereas the measures-based approach leads to benefits over the lifetime of the measures introduced. The lifetime carbon savings of the measures based approach are detailed in table 1.

Table 1 - Summary of cost and benefits of the Supplier Obligation

Costs	**SO - cap and trade**	**SO -measures based**
Deadweight loss from price increase	Not quantified	Not quantified
Administration costs	Not quantified	Not quantified
Costs of measures	n/a	£15.8 bn
Total PV of costs	-	**£15.8bn**
Benefits		
Reduced energy consumption	£5.2 bn	£17.4 bn
Reduced purchases of EU ETS allowances	£0.5 bn	£2.2 bn
Benefits of reduced carbon emissions in non-traded sector	£1.2 bn	£4.6 bn
Displaced renewable energy generation capacity	£4.1 bn	£11.8 bn
Increased comfort as a result of energy efficiency measures	-	£3.6 bn
Total PV of benefits	**£10.9 bn**	**£39.6 bn**
NPV	**£10.9 bn**	**£23.8 bn**

50. Table 2 below shows the costs and benefits of the RHI under central price scenario.

Table 2 - Summary of cost and benefits of the RHI under the central fuel price assumption

£ billion	**Resource costs**	**Carbon benefit**	**NPV**
Net welfare in 2020			
11% renewable heat	0.7	0.3	-0.4
14% renewable heat	2.1	0.4	-1.7
Net welfare 2010 – 2030 [14]			
11% renewable heat	8.9	3.2	-5.7
14% renewable heat	26.0	4.8	-21.2

[14] The benefits of renewable heat installations could continue to accrue after 2030 so this may be an underestimate particularly when compared to the measures introduced through the SO whose lifetime benefits are used.

Cost not included

51. Both the SO and the RHI will incentivise significant amounts of biomass technologies. The costs above do not include the costs associated with the air quality impacts of biomass, which as noted in the partial impact assessment of the RHI, may be substantial.

52. There are a number of other costs which are not taken into account at the moment in the analysis. For example:

- We do not value the time the household needs to take to find out about energy efficiency measures, find installers and then oversee the work.
- For solid wall insulation we do not take into account the cost of redecorating if it is installed on the inside of a house, which is perhaps more likely for Victorian homes, otherwise the look of the house would change substantially.
- For ground source heat pumps we don't take into account that the garden has to be dug up and hence the work to make good afterwards.

53. A number of measures are likely to be less cost effective once we take into account these 'hidden costs'. Work is underway to look at hidden costs which may result in changes to future MAC curves.

Option 2

54. The financial mechanisms and the regulations detailed in the consultation document and in their individual IA's, are designed to support the delivery of the SO. As such there are no additional benefits in terms of carbon savings directly attributable to either of these policy proposals with the present level of ambition for the SO. The policies do though have the following benefits:

- The financial mechanisms will lead to those benefiting from the measures, particularly measures with a high up front cost such as solid wall insulation, bearing a higher proportion of the cost. Therefore the ambition of the SO could be raised without further increasing the costs to energy suppliers, and the consequent pass through to energy consumers.

- The regulatory measures proposed reduce the search costs of suppliers in finding abatement opportunities and also reduces the subsidy required by the suppliers through the SO.

55. It is not possible to quantify the potential that both of these policies have for increasing the level of ambition of the SO; this will become clearer once the details of these options have been finalised and the likelihood of households taking up the loans is clearer.

56. It is possible however to quantify some of the costs of the both policies as detailed in the two IA's. These costs savings are summarised in table 3 for the financial mechanisms.

Table 3 Economy-wide cost estimates for each of the three schemes under consideration (2008£)

Standard finance scheme	**Min, £m**	**Average, £m**	**Max, £m**
Loan approval costs	£3.6	£5.5	£7.3
Loan handling costs	£4.3	£7.4	£10.6
'Switching' costs	£7.3	£14.6	£10.9
Total incremental admin costs	**£15.2**	**£27.5**	**£28.8**
DNO finance scheme	**Min, £m**	**Average, £m**	**Max, £m**
Loan approval costs	£3.6	£5.5	£7.3
Loan handling costs	£4.3	£7.4	£10.6
Total incremental admin costs	**£7.9**	**£12.9**	**£17.9**

Option 3

57. At this stage no quantification of costs and benefits of delivery by a Central Coordinating Body has been undertaken. The Consultation Impact Assessment Supplier Obligation Delivery Options, however, considers in qualitative terms where costs and benefits may lie.

58. Benefits may ensue from accelerated take up of energy efficiency improvements when consumers are more likely to overcome inertia when receiving advice from a single entity rather than from multiple sources.

59. Where distributional impacts of climate change policies require adjustments to policy design, this will may be easier to accomplish, provided terms of the Central Coordinating Body are framed accordingly to permit government involvement.

60. Further potential benefits may ensue from establishing a Central Coordinating Body in the delivery process by encouraging the emergence of community-based approaches to energy efficiency installations and behaviour changes. For example, there may be scope to promote integrated solutions to energy efficiency within individual dwellings ("whole-house approach") as well as across neighbourhoods (as exemplified by the "Green Streets" initiative.) Further efficiencies may be achieved by promoting information-sharing across the energy sector, for example to promote District Heating.

61. Costs of alternative delivery by a Central Coordinating Body, on the other hand, may lie in learning costs. Furthermore, institutional design would need to ensure financial stability of long term budgets, either by establishing a capital base or by allocating contributions for a budget period.

Interactions between policies

62. In assessing the costs and benefits of the options it is essential to consider the interactions between the policies. These interactions consist of both the ordering in which the energy efficiency or energy supply measures are carried out and the overlaps between the policies in terms of the types of measures carried out.

Ordering

63. The ordering of the policies is important and can make a significant difference to the cost effectiveness of the policies. The overall approach is that energy efficiency improvements should be undertaken first; this will for example ensure that renewable heat systems are sized correctly and that installations incentivised by the RHI make the best use of the limited biomass resource.

64. Making sure that the ordering for energy efficiency measures and energy supply measures is correct will maximise the carbon savings that can be achieved at the same cost. If renewable heat is installed where further energy efficiency improvement could be made, then whilst there would be costs savings (from reduced use of biomass fuel for instance), there would be no additional carbon savings attributable to the energy efficiency measures.

65. This analysis has assumed that the energy efficiency measures are undertaken first as in calculating the estimates of the impact of the carbon savings from the RHI, the EWP baseline was used. Therefore at an aggregate level the benefits of the RHI take account of the predicted energy efficiency savings from the SO. Clearly for this to be the case in practice processes will need to be in place to make sure that this is true for specific projects.

66. Energy efficiency measures introduced as a result of information campaigns may have an impact on the costs or the carbon savings associated with the supplier obligation if they encourage energy efficiency improvements that would otherwise have been undertaken through the supplier obligation.

67. The assessment of the case for CHP or District Heating does not currently take account of reduced heat loads due to energy efficiency improvements. Work is ongoing to look at these interactions.

Overlaps in scope

68. There is an overlap between the SO and the RHI as the SO includes a number of measures that are also incentivised by the RHI. The extent of this overlap is complex and depends to some extent on the assumptions made in the research. As the aim of RHI is to incentivise renewables rather than achieve carbon savings, in principle it does not matter whether the renewables are incentivised through the SO or the RHI. There are however significant implications:

    a. the carbon savings claimed by one policy will displace those claimed by the other;
    b. there are distributional impacts as the SO is targeted at priority groups whereas there is no equivalent targeting under the RHI;
    c. the level of support given to the technologies under each scheme should be equivalent to avoid competition between the schemes;

d. The interaction between the SO and the RHI will also be dependent on the delivery mechanism that is chosen.

69. With these issues in mind the overlaps between the SO and the RHI will be investigated further to inform the final proposals. The carbon savings attributed to each scheme will need to be adjusted once this work has been completed.

70. Overlaps in scope would change if government-led delivery were to be introduced. Further work would be required to assess the implications for overlaps.

Inconsistency in the studies

71. The various studies referred to in the impact assessments for the individual policies have been undertaken at different times and by what were, before the formation of DECC, different Departments.[15] As a result there is a degree of inconsistency in the assumptions that were used in the analysis. These inconsistencies mostly arise in the work done to inform the RHI and SO IA's; for example, different seasonal coefficients of performance have been used in estimating the benefits of heat pumps. There is ongoing work to identify and explain these inconsistencies and reach a common understanding.

Carbon savings

72. The predicted carbon savings under option 1 are shown in table 5 below for the period between 2011 and 2020. As previously discussed, at present option 2 will not result in any further carbon savings though it will potentially facilitate further carbon savings through the SO. Also as previously mentioned these carbon savings are not additional in that they have already been announced in the EWP and the RES.

73. The total predicted savings in 2020 are 36.3 $MtCO_2$ per year with an RHI scenario of 14% and the SO measures based approach. Of these carbon savings, 24.6 $MtCO_2$ per year by 2020 are in the non-traded sector and are therefore additional. The number of measures carried out per year increases in the period between 2011 and 2020 so the carbon savings are weighting heavily towards the end of the period.

Table 4 – profile of the carbon savings for Option 1 ($MtCO_2$ per year)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Carbon savings in traded sector										
RHI (11% scenario)	0.13	0.3	0.52	0.82	1.28	1.76	2.4	3.26	4.41	6.01
RHI (14 % scenario)	0.1	0.3	0.5	0.9	1.3	1.8	2.4	3.3	4.8	6.7
SO measures based	0.0	0.6	1.1	1.7	2.2	2.8	3.3	3.9	4.4	5.0
SO cap and trade	0.3	0.6	0.9	1.3	1.6	1.9	2.2	2.5	2.8	3.2
Total[a]	**0.1**	**0.9**	**1.7**	**2.5**	**3.5**	**4.6**	**5.7**	**7.2**	**9.3**	**11.7**
Carbon savings in non-traded sector										
RHI (11% scenario)	0.34	0.77	1.34	2.09	3.08	4.09	5.33	6.86	8.73	11.15
RHI (14 % scenario)	0.4	0.9	1.5	2.4	3.6	4.8	6.5	8.6	12.7	17.0
SO measures based	0.0	0.8	1.7	2.5	3.4	4.2	5.1	5.9	6.8	7.6
SO cap and trade	0.9	1.9	2.8	3.8	4.7	5.7	6.6	7.6	8.5	9.5
Total[a]	**0.4**	**1.7**	**3.2**	**4.9**	**7.0**	**9.1**	**11.5**	**14.5**	**19.5**	**24.6**

[15] These were BERR and DEFRA.

[a] - (SO measures based and RHI 14 % scenario)

74. The principal difference in the benefits between the outcome and input based supplier obligation arise from the number of measures installed in the period 2011-2020. An input based scheme would ensure the installation of measures during that period that would continue to have lifetime benefits beyond 2020. Conversely, an outcome based scheme that reduced emissions through price impacts, would not deliver the same lifetime benefits, but would instead only deliver benefits during the period of the policy.

75. This analysis does not account for the electricity required to run heat pumps, which would result in a reduction in the predicted carbon savings. Further analysis is currently being undertaken to inform our thinking on this alongside a review of other assumptions. This will be informed by responses to this consultation.

76. This analysis excludes consideration of the likely savings derived from introduction of Smart Meters. A forthcoming Consultation Document and Impact Assessment refer.

77. All of the carbon savings for the SO will be in the domestic sector. The table below gives a breakdown of the carbon savings for the RHI by sector under the 14.% scenario.

Table 5– breakdown of carbon savings for the RHI by sector

	Total carbon savings		**Carbon savings in traded sector**		**Carbon savings in non-traded sector**	
	$MtCO_2$/year	%	$MtCO_2$/year	%	$MtCO_2$/year	%
Large commercial	2.7	12%	0.2	3%	2.5	15%
Small commercial	0.7	3%	0.3	5%	0.4	2%
Domestic	16.3	69%	2.2	33%	14.1	83%
Industrial	3.9	17%	3.9	59%	0.0	0%
Total	23.7	100%	6.7	100%	17.0	100%

78. Our projection of carbon savings at this stage of gathering evidence does not quantify further carbon savings that introduction of Financial Measures, Regulation, and alternative Delivery mechanisms discussed in this Consultation Document may yield. However, it is reasonable to factor into our expectations that additional measures would augment aggregate carbon savings. The OCC Carbon Budgets project[16] carried out initial analysis of additional carbon savings from accelerated rollout of measures, for example, if we assume all homes taking up renewable options are offered a comprehensive treatment, including solid wall insulation for those that need it, we might adjust assumptions regarding Solid Wall Installations to an annual rate of 120,000 in 2015, increasing to 500,000 in 2020. This would save 3.8 $MtCO_2$ in 2020, and based on this and additional ambition from other measures, we may find additional savings potential of up to 8 $MtCO_2$ in 2020. The costs and benefits of this incremental 8 MtCO2 are not quantified in the accompanying impact assessments. This analysis will be developed before the Government's proposals are finalised.

Security of supply

79. Demand reduction through energy efficiency will improve security of supply. Table 7 shows that these policies will result in a reduction of approximately 12% of gas demand

[16] http://www.occ.gov.uk/activities/carbonbudgets.htm

by 2020 compared to predicted consumption in 2010, an equivalent 6% reduction in oil consumption and a 46% reduction in coal consumption. There is also a 5% reduction in electricity consumption, which will have an associated reduction in primary fuel consumption. The policy will also lead to a 116% increase in biomass consumption largely as a result of the RHI though a small amount will be due to the measures introduced in the SO.

Table 6 - Changes in fuel and energy demand per year by 2020 (all figures are a reduction other than biomass)

Policy	***TWh***				
	Gas	**Oil**	**Coal**	***Electricity***	***Biomass (increase)***
SO measures based	26.7	3.0	4.3	9.0	0.4
RHI: 10.5% of final energy demand for heat from renewables	34.0	23.8	6.1	6.9	37.7
RHI: 14% of final energy demand for heat from renewables)	47.1	34.5	9.3	7.0	37.7[17]
Total (14% heat scenario and SO measures based)	**73.8**	**37.5**	**13.6**	**16**	**38.1**
Total UK demand in 2010	597	627	29	346	32.8
% reduction / increase	**12%**	**6%**	**46%**	**5%**	**116%**

Unintended Consequences

80. Unintended consequences may emerge from imposition of regulatory interventions on buildings. In a soft property market where borrowers are highly leveraged many households may prefer to delay efficiency investments, or require accelerated paybacks from investments. The effect would be to reduce investments into energy efficiency.

81. Expansion of District Heating, depending on framework, may impact on competition and on consumer protection. District Heating is an alternative business model to the prevailing industry structure relying on centralised provision of gas to achieve favourable economies of scale. The proliferation of District Heating contracts the franchise of large energy companies. As regards consumers, the interaction between corporate structure of District Heating and regulatory framework needs to be careful to avoid detriment to consumer welfare (for example, arising from lock-in contracts).

82. Financial measures may lead to a crowding out of other financial borrowing and thus a possible reduction in disposable income available for consumption. There may be issues arising from the need to train suppliers to provide financial advice and to set fair rates for borrowers.

Distributional Effects

83. Measures to save energy and reduce CO_2 emissions are usually paid for by all consumers. The costs and benefits of these measures may fall unequally on different

[17] Same as 10.5% scenario because of the supply constraint imposed on biomass

income groups. This distributional impact on bills is particularly acute for sections of the population on lower incomes. Work to improve our evidence regarding distributional impacts across all income groups is progressing and will be made available in due course.

84. However, at this stage we have analysed evidence of the impact of policies on average bills. The following table shows the impact on average householders' bills resulting from the SO and the RHI. The table illustrates there will be step change in impact on bills from 2015. The RHI will add to bills, whilst the SO will result in a net reduction in bills due to reduced demand for energy following installation of energy efficiency measures.

Table 7: Impact on average domestic gas bills

	2015		*2020*	
	£	*% of base*	*£*	*% of base*
Impact of increase in price from SO	£25	3.6%	£37	5.2%
Impact of drop in demand from SO	-£24	-3.4%	-£64	-9.0%
Impact of increase in price from RHI	£25	3.6%	£176	24.8%
Overall impact on bills	£25	3.8%	£149	21.0%

Table 8: Impact of SO on electricity bills

	2015		*2020*	
	£	*% of base*	*£*	*% of base*
Impact of increase in price	£25	7.0%	£37	9.9%
Impact of drop in demand	-£27	-7.7%	-£70	-18.5%
Overall impact on bills	-£3	-0.8%	-£32	-8.6%

Specific Impact Assessments

Impact on Public Spending

85. The budgets for RHI and the SO require considerable financial resources. Costs, however, will be borne by consumers through their energy bills. Possible implications for public spending may ensue from delivery models that involve government action directly. The IA Delivery Options refers.

Fuel Poverty Impact

86. The distributional impacts of climate change policies are potentially regressive. The Supplier Obligation mitigates the adverse impact of increases to fuel bills by setting express targets for installation of energy savings measures in priority group households.

87. We are carrying out further research to reach better understanding how individual policies raise energy bills for consumers across the spectrum of incomes.

Competition Assessment

88. The Energy White Paper set out the government's intention to change the structure of energy markets. Certain HES policies will potentially promote market entry by ESCO's, such as new delivery options. The RHI has the potential to promote technological innovation in energy efficiency measures.

Small Firms Impact Test

89. Opportunities for small firms may emerge in District Heating, where opportunities may exist for energy companies to operate at small without dependence on centralised provision of heat.

Race and Gender Equality

90. Our policies have a neutral effect on race and gender equality.

Rural Proofing

91. We are aware that the RHI may potentially favour installation of energy efficiency measures in types of dwellings that are typically located in conurbations rather than in the countryside. Further research is in hand to gather evidence enabling policy design to mitigate this potential shortcoming.

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.

Type of testing undertaken	*Results in Evidence Base?*	*Results annexed?*
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

Annex 1 – CCC domestic MACC data

Abatement Measure	**Abatement potential**	**Abatement cost**	
	(MtCO2e)	**(£2006,m)**	**Cost effectiveness**
Displaced emissions in the non-traded sector			
Reduce heating for washing machines [a]	0.70	-137.70	-197.46
A rated ovens [a]	0.13	-21.99	-170.16
Reduce household heating by 1 C	5.54	-542.21	-97.88
A-rated condensing boiler 0 [c]	0.67	-56.21	-84.18
Glazing - old double to new double	0.36	-24.31	-67.29
Glazing - single to new	0.82	-54.84	-67.26
Insulated doors	0.90	-60.25	-67.19
A-rated condensing boiler 1 [c]	0.13	-8.03	-60.16
Insulate primary pipework	0.13	-7.08	-53.36
Uninsulated cylinder to high performance	0.06	-2.94	-52.14
Pre76 cavity wall insulation	1.98	-78.24	-39.55
DIY floor insulation (susp. timber floors)	1.12	-41.35	-37.07
A-rated condensing boiler 2 [c]	0.13	-4.83	-36.14
Glazing - single to future double	1.10	-36.52	-33.15
Loft insulation 25 - 270mm	0.01	-0.46	-32.06
76-83 cavity wall insulation	0.14	-3.70	-26.49
Loft insulation 50 - 270mm	0.09	-1.70	-18.95

A-rated condensing boiler 3 [c]	0.13	-1.62	-12.11
Loft insulation 75 - 270mm	0.23	-1.16	-5.16
Post '83 cavity wall insulation	0.07	-0.30	-4.06
Glazing - old double to future double	0.70	-2.50	-3.56
Installed floor insulation (susp.TFs)	1.12	3.71	3.33
Solid wall insulation	12.71	45.81	3.61
Loft insulation 100 - 270mm	0.33	2.25	6.86
A-rated condensing boiler 4 [c]	0.13	1.59	11.91
Improve air tightness	0.18	2.93	16.31
Loft insulation 125 - 270mm	0.13	2.30	17.03
A-rated condensing boiler 5 [c]	0.13	4.80	35.94
Loft insulation 150 - 270mm	0.17	6.49	37.14
Residential biomass (off gas grid)	21.51	1057.14	49.16
Room thermostat to control heating	0.16	8.97	55.31
Urban retrofit DH [b]	5.61	380.78	67.88
Glazing - new double to future double	3.03	214.12	70.56
Thermostatic radiator valves	0.12	9.26	75.70
Paper type solid wall insulation	0.25	24.75	97.32
Modestly insulated cyl to high performance	0.12	15.97	132.74
Heat pumps	2.29	411.19	179.80
Solar water heating	5.57	2293.99	411.98
Hot water cylinder 'stat	0.02	18.05	1,150.13
Displaced emissions in the traded sector			
ICT products	1.61	-375.79	-233.96
Electronic products	2.45	-572.68	-233.87
Reduced standby consumption	0.34	-72.67	-216.57
Turn unnecessary lighting off	0.08	-16.17	-197.46
A+ rated wet appliances	0.71	-134.35	-189.64
A++ rated cold appliances	1.43	-252.27	-176.38
A rated ovens	0.13	-21.99	-170.16
Induction hobs	0.18	-15.91	-89.38
Efficient lighting	0.31	-27.24	-88.40
mini wind turbines	3.33	536.20	161.19
Micro-CHP Fuel cell	1.45	299.88	206.64
Photovoltaic generation	20.24	4787.09	236.47
micro wind turbines	1.33	1072.16	805.79

[a] – also displaces emissions in the non-traded sector depending on the type of washing machine or oven

[b] - also displaces emissions in the non-traded sector as a proportion of the DH will replace electric heating in high rise flats

[c] – the figure at the end refers to when the existing boiler is replacement, e.g. 'A-rated condensing boiler 4' means that the boiler would be replaced four years before the end of its life.

Annex 2 - abatement potential in Heat (from OCC Heat Call for Evidence)

Type of Technology	Abatement Cost (£/tCO2)	Abatement Potential 2020 (MtCO2)	Cumulative Abatement Potential (MtCO2)
District heating in city centre schemes	-110.64	0.04	0.04
Residential biomass relative to electricity	-101	1.52	1.56
Heat pumps relative to electric heating	-86	0.12	1.68
Solar thermal relative to electric heating	-54	0.29	1.97
Conversion of electric heating to district heating	-48.62	0.42	2.38
Industrial CHP	-34.99	9.64	12.03
Conversion of electric district heating to CHP	-16.65	0.58	12.6
Commercial biomass relative to oil	-4.9	0.49	13.09
Surplus heat from industry	-3.27	3.3	16.39
District heating in dense residential areas	-1.63	0.08	16.47
Industrial biomass relative to oil	1.1	1.89	18.36
District heating in new build housing	6.82	0.03	18.39
AD CHP	8.45	0.51	18.9
Industrial biomass relative to gas	10	0.34	19.24
Commercial biomass relative to electricity	26	0.27	19.51
Industrial biomass relative to electricity	26	1.03	20.54
Commercial biomass relative to gas	41	0.08	20.62
Residential biomass relative to gas	55	0.5	21.12
Residential biomass relative to oil	60	2.78	23.9
Solar thermal relative to oil	135	0.22	24.12
EfW CHP	160	0.55	24.67
Solar thermal relative to gas	177	0.32	24.99
Heat pumps relative to oil	260	0.1	25.09