Household Energy Efficiency Delivery Model - Initial Assessment of Impacts

The following assessment is designed to accompany the discussion in the Government's document Warm Homes, Greener Homes: A Strategy for Household Energy Management, published on 2 March 2010, and in particular the sections of that document concerned with the future delivery model. It contains preliminary analysis on initial costs and benefits for the various delivery options of the strategy. This is not a formal Impact Assessment of the sort that will be produced when Government consults on, for example, specific proposals for regulatory change. At this stage, the assessment discusses in particular:

- the proposed continuation of an obligation on energy companies to deliver energy efficiency measures in the household sector;
- the potential costs, benefits, advantages and disadvantages of structuring that obligation, or possible alternatives to it, in different ways - for example, with a greater partnership between energy companies and local authorities (the Government's preferred approach); as a regional franchise; on a centralised basis; or with local authorities having lead responsibility;
- the scale of the obligation on energy companies that might need to be imposed in line with the UK's long term carbon target and Carbon Budgets, and our national energy efficiency targets; and
- the effect of an obligation of this sort of scale on fuel bills, and some of the consequences of this.

The analysis in this assessment of impacts is at an early stage, and the Government would welcome any comments which can help strengthen the evidence base. We would therefore be very happy to receive any comments on additional sources of information we could use to help refine the analyses over time.

The Government will consult on the detailed design of new delivery arrangements in due course, at which time it will publish a formal Consultation Stage Impact Assessment to help inform the consultation exercise.

Household Energy Management (HEM) overall

This Assessment of Impacts relates only to the delivery model, which is one of a suite of policies and potential policies that fall within the Government's overarching Household Energy (HEM) management programme. Other policies within the programme have been or will be subject to their own Impact Assessments at the appropriate stage. Therefore, the costs and benefits presented in this document are additional to costs and benefits calculated for the other policies and potential policies under the overarching HEM programme.

Key Government analytical documents that have recently been published include:

- Smart Meters: Impact assessment of a GB-wide smart meter roll out for the domestic sector[1]

[1] http://bis.ecgroup.net/Publications/EnergyClimateChangeDECC/EnergyMetering.aspx

- CERT extension: Consultation stage impact assessment on extending the carbon emissions reduction target to December 2012[2]
- Renewable Heat Incentive: Impact assessment of the renewable heat incentive scheme for consultation in February 2010[3]
- Zero Carbon homes: Code for Sustainable Homes: Impact assessment - December 2009[4]

[2] http://www.decc.gov.uk/en/content/cms/consultations/cert_ext/cert_ext.aspx

[3] http://www.decc.gov.uk/en/content/cms/consultations/rhi/rhi.aspx

[4] http://www.communities.gov.uk/publications/planningandbuilding/codeimpactassessment2009

Summary: Intervention & Options		
Department /Agency: DECC	**Title:** Household Energy Efficiency Delivery Model	
Stage: Initial	**Version:** 1	**Date:** 2 March 2010
Related Publications: HES partial impact assessment summary		

Available to view or download at:
http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/hem/hem.asp

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

Climate change results from the negative externalities caused by greenhouse gas emissions (GHGs). The Climate Change Act set a long term carbon target to reduce UK GHGs by 80% by 2050 relative to 1990, and a regime of legally binding Carbon Budgets, the first three of which have been set to 2022. The current policy in the household sector (CERT) will run out by the end of 2012. However, many cost-effective energy efficiency measures exist in the household sector but require Government intervention to overcome barriers to uptake including lack of information, limited time horizons, access to credit and, in the rented sector, incentive incompatibility. The Government, therefore, needs to consider the potential delivery options for installing energy efficiency measures after 2012.

What are the policy objectives and the intended effects?

1. To have contributed to reducing UK emissions by 80% by 2050 relative to 1990
2. To have contributed to meeting carbon budgets by reducing emissions from the domestic housing sector by 29% by the third carbon budget period relative to 2008 (resulting in a total of 60MtCO2 non-traded emissions in the domestic sector in 2020).
3. By 2015, to have insulated all lofts and cavities where practical,
4. By 2020, to offer advice, smart meters and the basic insulation measures, plus at least one more major measure, to up to 7 million homes by 2020, as part of a longer-term whole house approach.

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

1. 'Do Nothing' - where there would be no household energy efficiency policies implemented by Government post 2012, in addition to those already announced.
2. Supplier-Local Authority Partnership (preferred option) - suppliers would be obliged to consult Local Authorities about their plans in a particular area and, where the Local Authority has a local carbon framework covering home energy efficiency in place, to agree plans in that areas. This is our preferred option because of the benefits of partnerships at the local level that will help us to deliver the tailored approach necessary due to the complexities of delivery.
3. Supplier Obligation at a higher level - the obligation would continue, with a higher target for emissions reductions, but no LA coordination.
4. Area Franchise model – the obligation to deliver prescribed carbon emissions reductions could be auctioned to individual delivery agents on a regional basis.
5. Local Authority led - where Local Authorities would be obligated to deliver prescribed carbon emissions reduction targets through energy efficiency measures.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? The delivery options will be reviewed as part of a formal Impact Assessment at the time of consulting on the new supplier obligation and other policies mentioned with the HEM document.

Summary: Analysis & Evidence	
Policy Option: 2	**Description: Greater energy company – Local Authority Partnership**

COSTS

ANNUAL COSTS

One-off (Transition) **Yrs** 8

£

Average Annual Cost (excluding one-off)

£ 2.0bn

Description and scale of **key monetised costs** by 'main affected groups' Total costs are made up of installation costs (£9bn - £11bn), administration costs (£1bn - £3bn) and other household costs (including research, disruption, making good, loss of floor space) faced by the households receiving installations (£3bn - £11bn)

Total Cost (PV) **£ 12.9 – 24.8bn**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS

One-off **Yrs** 42

£

Average Annual Benefit (excluding one-off)

£ 0.9bn

Description and scale of **key monetised benefits** by 'main affected groups' The main savings are from energy savings to society (£7-17bn), carbon savings (£4-11bn), comfort (rebound effect) savings (£3-5bn) and air quality savings (£0.5bn).

Total Benefit (PV) **£ 14.2 – 33.2bn**

Other **key non-monetised benefits** by 'main affected groups' Improvement in energy security due to reduced energy demand; supporting innovation; helping to address fuel poverty and meeting the renewables target.

Key Assumptions/Sensitivities/Risks The profile of measures available to deliver 4MtCO2 savings in 2020 is indicative. The costs, benefits and feasible potential of measures is uncertain, so to be conservative, a reduced number of abatement measures have been analysed in the option analysis, with a fuller range of insulation measures presented in Annex 4. Energy and carbon prices have been applied as per DECC guidance. The benefits of competition between suppliers to reduce installation costs and innovate has not been monetised.

Price Base Year 2009	Time Period Years 50	**Net Benefit Range** (NPV) **£ -10.6bn – 20.3bn**	**NET BENEFIT** (NPV Best estimate) **£6.0bn**

What is the geographic coverage of the policy/option?			GB	
On what date will the policy be implemented?			January 2013	
Which organisation(s) will enforce the policy?			tba	
What is the total annual cost of enforcement for these organisations?			£ tba	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes	
What is the value of the proposed offsetting measure per year?			£ n/a	
What is the value of changes in greenhouse gas emissions?			£ 7bn	
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

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ 100,000 Decrease £ **Net Impact** **£** 100,000

Summary: Analysis & Evidence	
Policy Option: 3	**Description: Energy company delivery without LA involvement**

COSTS

ANNUAL COSTS

One-off (Transition) **Yrs** 8

£

Average Annual Cost (excluding one-off)

£ 3.0bn

Description and scale of **key monetised costs** by 'main affected groups' Total costs are made up of installation costs (£15bn - £16bn), administration costs (£2bn - £5bn) and other household costs (including research, disruption, making good, loss of floor space) faced by the households receiving installations (£3bn - £11bn)

Total Cost (PV) **£ 20.0 – 32.7bn**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS

One-off **Yrs** 42

£

Average Annual Benefit

£ 0.9bn

Description and scale of **key monetised benefits** by 'main affected groups' The main savings are from energy savings to society (£9-19bn), carbon savings (£4-11bn), comfort (rebound effect) savings (£2-4bn) and air quality savings (£1bn).

Total Benefit (PV) **£ 15.2 – 34.6bn**

Other **key non-monetised benefits** by 'main affected groups' Improvement in energy security due to reduced energy demand; supporting innovation; helping to address fuel poverty and meeting the renewables target.

Key Assumptions/Sensitivities/Risks The profile of measures available to deliver 4MtCO2 savings in 2020 is indicative. The costs, benefits and feasible potential of measures is uncertain, so to be conservative, a reduced number of abatement measures have been analysed in the option analysis, with a fuller range of insulation measures presented in Annex 4. Energy and carbon prices have been applied as per DECC guidance. The benefits of competition between suppliers to reduce installation costs and innovate has not been monetised. A stylised representation of the abatement options available has been adopted to distinguish between this option and others featuring LA involvement (see footnote below).

Price Base Year 2009	Time Period Years 50	**Net Benefit Range** (NPV) **£ -17.6 to 14.7bn**	**NET BENEFIT** (NPV Best estimate)£**-0.3bn**[5]

What is the geographic coverage of the policy/option?			GB	
On what date will the policy be implemented?			January 2013	
Which organisation(s) will enforce the policy?			tba	
What is the total annual cost of enforcement for these organisations?			£ tba	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes	
What is the value of the proposed offsetting measure per year?			£ n/a	
What is the value of changes in greenhouse gas emissions?			£ 7bn	
Will the proposal have a significant impact on competition?			Yes	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium	Large

[5] The NPV figure would be higher without the extreme assumption that energy companies, acting independently of LAs, would not install any measures in the social housing stock, which acts to significantly reduce the number of cost-effective measures available.

Are any of these organisations exempt?	Yes/No	Yes/No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)			(Increase -
Increase of £ 100,000	Decrease £	**Net Impact**	**£** 100,000

Summary: Analysis & Evidence	
Policy Option: 4	**Description: Area Franchise without LA involvement**

COSTS	**ANNUAL COSTS** **One-off** (Transition) **£**	**Yrs** 8	Description and scale of **key monetised costs** by 'main affected groups' Total costs are made up of installation costs (£15bn - £16bn), administration costs (£3bn - £6bn) and other household costs (including research, disruption, making good, loss of floor space) faced by the households receiving installations (£3bn - £11bn)
	Average Annual Cost (excluding one-off) **£ 3.0bn**		**Total Cost** (PV) — **£ 20.6 – 34.2bn**
	Other **key non-monetised costs** by 'main affected groups'		

BENEFITS	**ANNUAL BENEFITS** **One-off** **£**	**Yrs** 42	Description and scale of **key monetised benefits** by 'main affected groups' The main savings are from energy savings to society (£9-19bn), carbon savings (£4-11bn), comfort (rebound effect) savings (£2-4bn) and air quality savings (£1bn).
	Average Annual Benefit **£ 0.9bn**		**Total Benefit** (PV) — **£ 15.2 – 34.6bn**
	Other **key non-monetised benefits** by 'main affected groups' Improvement in energy security due to reduced energy demand; supporting innovation; helping to address fuel poverty and meeting the renewables target.		

Key Assumptions/Sensitivities/Risks The profile of measures available to deliver 4MtCO2 savings in 2020 is indicative. The costs, benefits and feasible potential of measures is uncertain, so to be conservative, a reduced number of abatement measures have been analysed in the option analysis, with a fuller range of insulation measures presented in Annex 4. Energy and carbon prices have been applied as per DECC guidance. A stylised representation of the abatement options available has been adopted to distinguish between this option and others featuring LA involvement (see footnote below).

Price Base Year 2009	Time Period Years 50	**Net Benefit Range** (NPV) **£ -19.1 to 14.0bn**	**NET BENEFIT** (NPV Best estimate) **-£1.2bn**[6]

What is the geographic coverage of the policy/option?			GB	
On what date will the policy be implemented?			January 2013	
Which organisation(s) will enforce the policy?			tba	
What is the total annual cost of enforcement for these organisations?			£ tba	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes	
What is the value of the proposed offsetting measure per year?			£ n/a	
What is the value of changes in greenhouse gas emissions?			£ 7bn	
Will the proposal have a significant impact on competition?			Yes	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium	Large

[6] The NPV figure would be higher without the extreme assumption that an area franchisee, acting independently of LAs, would not install any measures in the social housing stock, which acts to significantly reduce the number of cost-effective measures available.

Are any of these organisations exempt?	Yes/No	Yes/No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)			(Increase	-
Increase of £ 100,000	Decrease	£	**Net Impact**	**£** 100,000

Summary: Analysis & Evidence	
Policy Option: 5	**Description: Local Authority led**

COSTS

ANNUAL COSTS

One-off (Transition) **Yrs** 17

£

Average Annual Cost (excluding one-off)

£ 2.0bn

Description and scale of **key monetised costs** by 'main affected groups' Total costs are made up of installation costs (£9bn - £11bn), administration costs (£3bn - £6bn) and other household costs (including research, disruption, making good, loss of floor space) faced by the households receiving installations `(£3bn - £11bn)

Total Cost (PV) **£ 14.2 – 27.6bn**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS

One-off **Yrs** 42

£

Average Annual Benefit (excluding one-off)

£ 0.95bn

Description and scale of **key monetised benefits** by 'main affected groups' The main savings are from energy savings to society (£7-17bn), carbon savings (£4-11bn), comfort (rebound effect) savings (£3-5bn) and air quality savings (£0.5bn).

Total Benefit (PV) **£ 14.2 – 20.3bn**

Other **key non-monetised benefits** by 'main affected groups' Improvement in energy security due to reduced energy demand; supporting innovation; helping to address fuel poverty and meeting the renewables target.

Key Assumptions/Sensitivities/Risks The profile of measures available to deliver 4MtCO2 savings in 2020 is indicative. The costs, benefits and feasible potential of measures is uncertain, so to be conservative, a reduced number of abatement measures have been analysed in the option analysis, with a fuller range of insulation measures presented in Annex 4. Energy and carbon prices have been applied as per DECC guidance.

Price Base Year 2009	Time Period Years 50	**Net Benefit Range** (NPV) **£ -13.4 to 19.0bn**	**NET BENEFIT** (NPV Best estimate) **£4.2bn**

What is the geographic coverage of the policy/option?			GB	
On what date will the policy be implemented?			January 2013	
Which organisation(s) will enforce the policy?			tba	
What is the total annual cost of enforcement for these organisations?			£ tba	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes	
What is the value of the proposed offsetting measure per year?			£ n/a	
What is the value of changes in greenhouse gas emissions?			£ 7bn	
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

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Increase of £ 100,000 Decrease £ **Net Impact** **£** 100,000

STRATEGIC OVERVIEW AND OBJECTIVES

The Climate Change Act committed Government to reduce UK greenhouse gas emissions by at least 80% by 2050 relative to 1990. The first three carbon budgets (2008-2022) mean that UK carbon emissions must fall by at least 34% in 2020 relative to 1990 levels.

The household sector has the potential to play a big role in delivering the emissions reductions required to meet these targets cost-effectively. The energy that households use to heat their homes and water accounts for 13% of the UK's total greenhouse gas emissions[7] (and over 80% of total household energy use), and cost-effective abatement measures are available in the sector.

The Low Carbon Transition Plan (LCTP)[8] set out policies and proposals to meet the carbon budgets. With these policies and proposals, the household sector is expected to reduce its emissions by 29% relative to 2008 by the third carbon budget (resulting in 60MtCO2 non-traded emissions in the domestic sector in 2020). The Household Energy Management strategy covers all the policies and proposals that, in combination act to deliver these savings.

Amongst the proposals set out in the LCTP was a successor to the current supplier obligation (the Carbon Emissions Reduction Target (CERT)), running from 2011 to 2020. Options were presented in the Heat and Energy Saving Strategy (HESS)[9]. Since the publication of the LCTP and the HESS, a proposal to extend the current CERT scheme until the end of 2012 has been put out to consultation, and further details have been published on the Renewable Heat Incentive and Smart Meters. The effect of these changes has been to reduce the residual emissions savings required to reduce emissions in the sector by 29% by the third carbon budget relative to 2008 (to produce a total of 60MtCO2 non-traded emissions in the domestic sector in 2020). This initial assessment of impacts assesses the options for delivering these carbon savings over the period 2013 – 2020.

THE ISSUE

The principal Government-backed delivery arrangements for household energy efficiency that are currently in place are the CERT and the CESP schemes, which are due to come to an end at the end of 2012. The HESS consultation concerned the arrangements that will need to be put in place beyond that, and in that document[10] we presented the case for reviewing the current supplier obligation. It is clear from the analysis that once the existing policies finish, there will still be a carbon gap that needs to be filled if we are to meet the second and third carbon budgets.

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[7] DECC Emissions Release February 2010
http://www.decc.gov.uk/en/content/cms/statistics/climate_change/gg_emissions/uk_emissions/2008_final/2008_final.aspx

[8] http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

[9] The HESS consultation ran from February 2009 to May 2009 - http://hes.decc.gov.uk/supporting_documents. A summary and breakdown of responses to consultation was published in July 2009 and these responses have helped to inform the document now published and this initial assessment of impacts.

[10] 'Heat and Energy Saving Strategy Consultation' February 2009, page 68

The design of the new delivery model may also need to change from the current model to meet changing needs - for example, to ensure that we can go beyond the basic insulation measures and facilitate the delivery of the more significant measures, such as Solid Wall Insulation (SWI). We have therefore assessed a range of possible delivery options to determine what the best mechanism might be going forward. There may be opportunities to reduce total policy costs by co-ordinating installation of measures under different policies, such as RHI, FIT, smart meters and any future energy company obligation, and by co-ordinating work between numbers of homes in a particular area.

This initial assessment of impacts considers the form of delivery model that will be needed to achieve the overall goal of a 29% fall in non-traded CO_2 emissions in the domestic sector relative to 2008. As set out above, the ambition of the policy under assessment has changed since the HESS publication (7.7MtCO2e) owing to the proposed introduction of the CERT Extension, which delivers the first tranche of savings identified in the HESS, and changes to the assessments of other policies (principally Smart Meters). The ambition of the policy options considered in this assessment, has been modelled at the level we currently assess is required to deliver the overall carbon reductions set out in the Low Carbon Transition Plan for the household sector. However as the analysis of the cost-effectiveness of the options develops, and our understanding of the carbon savings delivered by policies across the household sector improves, this ambition is likely to change. The ambition of the policy options will be reappraised in the future in a formal Consultation Stage Impact Assessment. Sensitivities around the level of ambition of the policy options are presented in Annex 1. The annex discusses the potential for a 1MtCO2 increase in the level of ambition.

MARKET FAILURES

There are a range of market failures which need to be considered. The high level market failures are those associated with CO2 emissions and security of supply. More detail on these can be found in the HESS summary impact assessment published http://hes.decc.gov.uk/supporting_documents.

In addition, there are further market failures and barriers to household energy efficiency that may impact delivery programmes differently. These include[11]:

- Information asymmetry and co-ordination of information – householders do not have a full understanding of all the energy efficiency measures that could be used to decrease their bills and save carbon.

- Limited time horizon – households are generally unwilling to accept long loan periods for energy efficiency measures because of the likelihood that they will move before they can recoup the costs of their loan.

[11] For more detail on these barriers and market failures see the HEM Partial IA of delivery mechanisms for Supplier Obligation and the HEM partial IA of Financial measures published at http://hes.decc.gov.uk/supporting_documents and The Oxera Consulting Ltd. (2006) report *Policies for energy efficiency in the UK household sector*, commissioned by Defra, sets out the relevant market failures. See http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/analysis/analysis.aspx

- Credit availability does not reflect the risk associated with recouping the costs of energy efficiency measures, but the wealth of the householder. As a result some groups in society cannot access credit at the appropriate level of risk thus restricting their installation of energy efficiency measures.
- Incentive incompatibility in the private rented sector - the owner does not pay the energy bill and occupier has no interest in investing in energy efficiency measures because he or she may have moved out before any payback period.
- High effective discount rates – Households may have higher discount rates than market participants or Government.
- Consumer inertia may prevent consumers taking up worthwhile investment opportunities. Some consumers are highly averse to the risk of loss on an investment and do not appear to value the likelihood of possible benefits in the same way.
- Restrictions to competition in the energy efficiency market – These can sometimes arise as a result of market failures (e.g. entry barriers) or government failures (e.g. inefficient restrictions imposed by government regulations).

OPTIONS IDENTIFICATION

The options that have been identified for assessment are as follows:

Option 1 - 'Do nothing' scenario:

- A scenario in which no new policy would be introduced after 2012. Any energy efficiency or heat measures would only be installed if the householder were to undertake measures in the absence of policy incentives.
- This option is the counterfactual against which the costs and benefits of other options are defined. Supplier activity in installing energy saving measures in households would stop after CERT. As for private households: with the cessation of the current SO there will only be the harder to reach groups for installing insulation in lofts and cavity walls and the very expensive measures left, which are more unlikely to be installed without some form of support. So a simplifying assumption is that no independent energy efficiency investment takes place

Option 2 – Greater partnership between energy companies and Local Authorities (LA):

- Under this scenario energy companies are obliged to achieve a certain amount of carbon reductions and other social goals, with greater obligation on energy companies to work with Local Authorities. This would be framed as an obligation to consult the local authority in all cases, and, where the local authority has a local carbon framework covering home energy efficiency, the energy company would be obliged to agree their plans before being able to earn supplier obligation credits in that area. There might be some role for a central coordinating body to provide some central information and advice service.

Option 3 – **An energy company obligation**:

- Energy companies would be obliged to fulfil a carbon reduction target, as with CERT currently. It could be stipulated that a proportion is aimed at fuel poor, as a priority group,

as is being consulted on with the CERT extension currently. Energy companies would market the services available as it is in their interest to get as much up-take as possible. Under this option it is assumed that the energy companies will not work with local authorities.[12]

Option 4 – Area Franchise model:

- Under this scenario a regional tendering process for the delivery of heat and energy efficiency measures is run to win an area or local franchise to deliver carbon savings in homes and communities, with payment based on results. This option could include caveats regarding targeting of fuel poor and the provision of information and advice. Under this option it is assumed that the area franchise will not work with local authorities.
- An alternative to the area franchise is a central delivery body. In the analysis below it is assumed that a central delivery body is effectively the same as a single, unitary area franchise.

Option 5 – Local Authority (LA) led model:

- Under this scenario LAs are obliged to ensure delivery through a system of mandatory targets or budgets. All the responsibility would fall on LAs to take action, with the potential for penalties to be imposed if they do not. Central Government would assume a role of monitoring and ensuring quality assurance for the process.

[12] Under CERT some coordination between suppliers and local authorities is already taking place, however to show clear distinctions between options it is here assumed that there is no coordination with LAs in the energy company led option.

COST BENEFIT ANALYSIS OF DELIVERY OPTIONS

Costs and benefits of delivery options

The cost benefit analysis below provides an initial assessment of the impact of delivering the carbon savings required to meet the sectoral goal set out in the Low Carbon Transition Plan (LCTP) as well as the cavity wall and lofts target. Taking into account the ambition of all the other policies working towards the carbon goal (set out in the LCTP), the residual carbon saving needed from this policy is 4MtCO2 on a central case.[13]

The analysis focuses only on the non-traded sector emissions (i.e. emissions not covered by the EU ETS) and measures that might be delivered by a delivery organisation. The analysis does not deal with district heating quantitatively (see HEM for a discussion of district heating). The delivery options analysed all deliver the 4MtCO2e residual needed to meet the non-traded carbon target. They also share many of the same cost and benefit assumptions[14]. Broadly speaking, the calculation of costs and benefits for each policy option involves attaching costs and benefits to energy saving technologies, scaling them up by the estimated take up as a consequence of HEM policies and incorporating specific savings/costs from each particular delivery measure. The benefits from each delivery option are broadly similar. Thus the main cause of the difference in NPV between the delivery options is the cost. The rest of this section describes the main drivers of the differences in costs between delivery options. In summary these are:

- **Economies of scope:** Local Authorities are able to achieve lower installation costs for certain measures by carrying out bulk retrofit to LA and social landlord owned properties.
- **Admin costs:** It is assumed that suppliers benefit from lower admin costs as a result of their experience working with CERT and that Local Authorities benefit from lower search costs to find the most appropriate recipients of the measures.

To deliver the carbon savings discussed above, the remaining insulation of lofts and cavities (to be completed by 2015) will need to be installed where practicable, along with further, more expensive energy efficiency and carbon saving measures[15]. The MACC (marginal abatement cost curve) below demonstrates the level of ambition necessary to deliver 4MtCO2e of carbon savings in 2020, using the key wall and loft insulation technologies[16]. Renewable heat technologies are included for comparison. The MACC lines up the available measures depending on how cost effective to society they are; the most cost effective measures are installed first[17], i.e. heat technologies after insulation. It is based on a set of assumptions on technologically specific costs, benefits, feasible potential, learning rates and trajectories of roll out (discussed further in annex 2). This MACC includes a reduced number of abatement options This represents a conservative view of the potential benefits from energy efficiency investments.

[13] See HEM document for further discussion of the carbon gap.

[14] The assumptions used in the analysis use the best available evidence at the time, however there is a level of uncertainty, which can only improve as more information is made available.

[15] There is the potential to install further 'hard' to treat cavity wall insulation (discussed in annex 4),

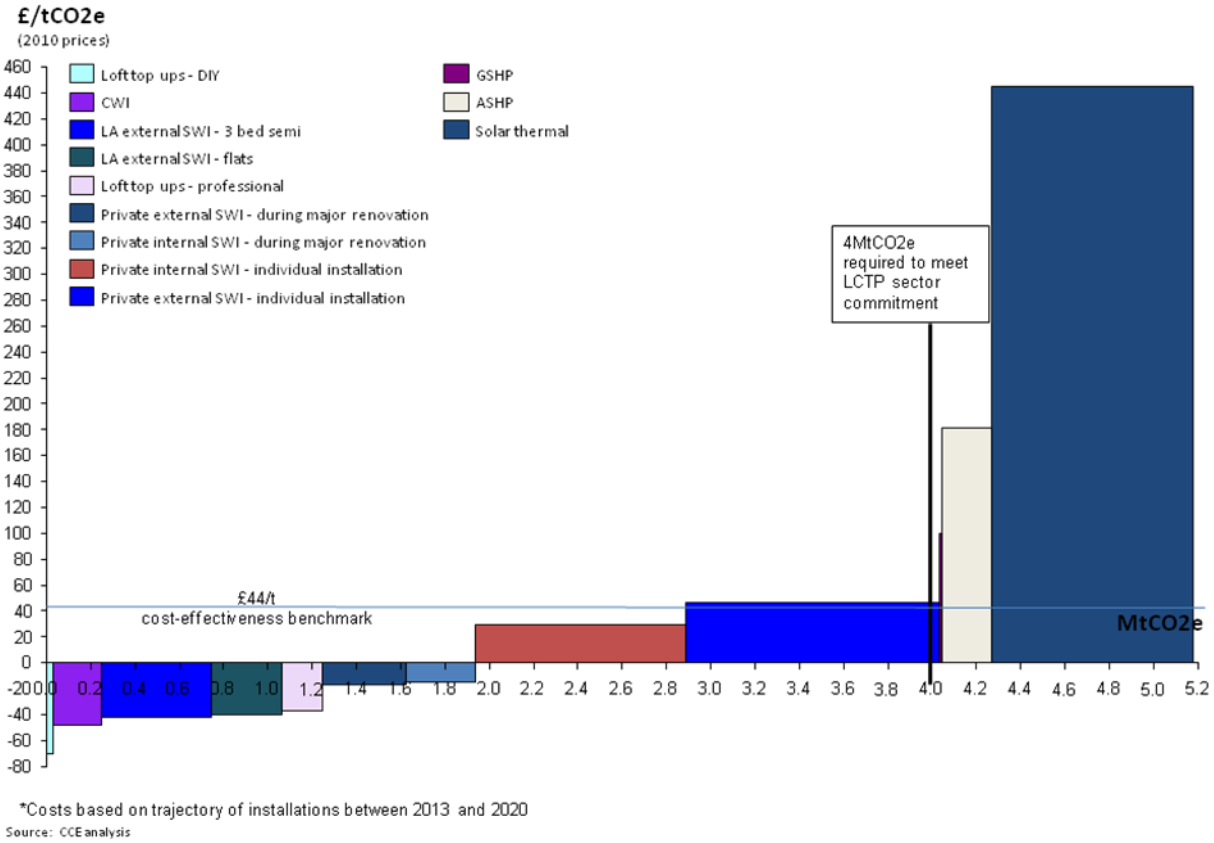
[16] See annex 4 for MAC curve containing a wider raft of measures and a full set of cost assumptions

[17] The MACC is ordered in terms of cost to society, however rational agents may face different private costs.

This is appropriate because of the potential risks and uncertainties around some of the remaining options.

An indicative level of ambition has been chosen to show how the overall policy mix can deliver the CO2 emissions target. The level of ambition finally adopted for implementation will be the subject of appraisal in forthcoming consultations. Annex 1 discusses the potential for different levels of ambition, and suggests that in some cases it will be necessary to include a greater range of energy efficiency measures to ensure that the programme remains cost effective (see Annex 4 for expanded MAC curve).

MACC in 2020 for measures needed to meet the 4MtCO2 ambition*



Annex 2 looks at the cost effectiveness of each measure; at the margin external solid wall is just cost effective relative to the weighted average discounted non-traded price.

Costs

The cost assumptions discussed below are based on a range of sources (described in the text) and analytical discussions across government departments. Costs per measure are split up into three main groups:

Installation costs –are the technology and labour costs of installing a particular measure Estimates for the installation costs of the measures discussed in the IA are from a range of sources, including the CERT extension[18](Lofts and Cavities), the Energy Efficiency Partnership

[18] http://www.decc.gov.uk/en/content/cms/consultations/cert_ext/cert_ext.aspx The CERT assumptions are based on detailed discussions with market stakeholders and feedback from a number of consultations.

for Homes report[19] (on solid wall insulation) used for CESP analysis[20] and the NERA report[21] (for renewable heat measures). The detail of the assumptions used to derive the installation costs and the sources for the data are set out in Annex 2.

These installation cost elements are assumed to be invariant across delivery options. That is to say that the assumptions in Tables 1 to 5 in Annex 2 are used in the cost/benefit calculations for each of the delivery options. The costs of installation from the above reports are in 2009/10 figures, however it is assumed that with time these costs will fall owing to technological advancements, learning by doing and economies of scale (given the large numbers of installations that we are expecting under this programme). Estimates on the learning rate for solid walls are based on the rate of decline in installation costs for cavity wall installations over a 12 year time period[22]. The NERA report provides estimates for the heat technologies. Insulation of cavities and lofts are assumed to be 'old' measures and therefore there is no learning capability for these measures. Estimates of the learning rates are set out in Tables 2a and 2b in Annex 2.

The counterfactual for the measures is taken into consideration, however it is assumed that there is no dead weight (i.e. measures being installed without the programme). In addition to the cost of the maintenance for different measures is also included (with consideration of the counterfactual). These costs have been included as an annual cost over the life time of the measure. More detail on the cost elements can be found in annex 2.

For measures like solid wall installation (SWI) it is likely that there are economies of scope from making installations to a group of households at the same time. The EEPH report suggests that when external solid wall is installed in bulk (over 100 households) then this could decrease the installation cost per household by between 15 and 30 percent, whilst costs could fall by up to 36 percent per household for internal solid wall when installed in bulk.

Economies of scope have been taken into consideration in the costs for local authority external solid wall. It is assumed that installation by bulk by LAs is only likely when the delivery programme is run or coordinated with Local Authorities as they would have the capacity to allow bulk installation to proceed. It is assumed that an energy company led approach would not succeed in installing by bulk as there will be different energy customers within the group of households that might receive a bulk installation. Thus it is assumed that LA external solid wall cannot be installed if local authorities are not in partnership with the organisation. These measures are replaced by other measures further up the MACC curve for the other delivery options. The table below demonstrates the delivery options that benefit from Local authority involvement:

	EC-LA partnership	EC led	Area Franchise	LA led
LA solid wall installation	√	X	X	√

[19] http://www.eeph.org.uk/uploads/documents/partnership/SWI%20supply%20chain%20review%208%20May%2020091.pdf
[20] http://www.decc.gov.uk/en/content/cms/consultations/open/cesp/cesp.aspx
[21] http://hmccc.s3.amazonaws.com/docs/NERA%20Renewable%20Heat%20MACC%20report%20final%20revision.pdf
[22] Only the first 10 years of this series were used to consider the learning rate for solid wall insulation between 2010 and 2020.

It is also expected that district heating could also only be provided with local authority cooperation. However district heating is only considered in qualitative terms. Economies of scale are recognised (to decrease installation cost through higher bargaining power) but have not been taken into consideration due to limited evidence to differentiate across delivery options.

Administration costs – are the costs of running the delivery programme. These will include cost areas such as:

a. Planning
b. Reporting compliance
c. Setting up and managing budgets and contracts for delivery
d. Coordinating with Central Government
e. Coordinating with partners (i.e. suppliers and local authorities)
f. Marketing and Search costs (will be passed on to suppliers and LAs but often directly borne by sub contractors)

These costs will vary across delivery options. The lower these costs are in relation to the installation costs, the more efficient the programme will be. It is assumed that the energy company– local authority would face the lowest administration costs as this delivery option is likely to have lower search costs (finding appropriate recipients for measures) owing to LA involvement but would be very efficient as suppliers have the experience of working on CERT. An energy company only option will be efficient but will lack the search savings from working with LAs. The regional Franchise option will be a set of new organisations, which will mean large upfront costs and inexperience which will mean admin costs are high in the initial years, although they should fall over time as franchises become more efficient. If Local Authorities lead on their own the benefits of lower search costs are heavily outweighed by the sheer number of organisations. The assumed admin costs, as a percentage of installation costs are:

Administration costs as a percentage of installation costs	Y1	Yr5	Yr10
Supplier Led Approach	**20**	**20**	**20**
Local Authority/Supplier partnership	**18**	**18**	**18**
Regional Franchise	**30**	**25**	**21**
Local Authority	**40**	**35**	**30**

These estimates of administration costs are derived from discussions with organisations throughout the energy efficiency industry, including some international examples. However there is still a level of uncertainty surrounding these estimates. More detail on the admin cost assumptions can be found in annex 3.

It is assumed that the delivery organisation will pay all installation and administration costs in year one. Under an energy company led scheme, we assume that although the suppliers bear the costs, they pass them onto consumers' energy bills in that year. However, in practice

householders receiving the measure may bear a proportion of the cost; this is discussed further in the distributional section after the results.

Costs to households – are the costs faced by households before, during and after receiving the measure. Some of these costs can be grouped together under the heading "making good" i.e. returning the property to a reasonable state after the installation and can be represented by specific tasks that would need to be completed. Other costs to households are more difficult to estimate and include the value to householders of the time and disruption involved in the installation, and changes to the values of properties resulting from changes to their aesthetic appeal and, in some cases, their floor space. These costs will not be covered by the delivery organisation and will fall on the households receiving the measures[23]. The impact assessment published alongside the HESS consultation recognised that there are a number of costs that fall on the household when energy efficiency measures are installed, but did not quantify them.

Since the HESS IA was published there have been a range of studies that have considered this cost area (often called the hidden cost). The different reports all follow slightly different definitions of what the costs to the household (or hidden costs) might include. For example the EEPH study (only solid wall) includes costs associated with additional structural changes to the home 'make good', whilst the Ecofys[24] report also includes the time spent by the homeowner to research, oversee and tidy up after an installation. The Element Energy study[25] includes both the structural cost (called additional engineering costs) and some time costs to the householder due to 'project identification/appraisal' and disruption. Nera's work builds on the work by Element Energy and Enviros. More detail on the costs to the household assumed for each measure are included in annex 2, with household costs being reduced for some measures, if installations are made during renovations or other building works.

The range of cost areas that has been included in the different studies demonstrates the uncertainty around householder costs and therefore all these numbers will require further consideration in future formal impact assessments. However best estimates have been used to produce the MACC and the analysis.

It is not envisaged that householder costs would vary greatly between the delivery models. However, the time people spend looking for the correct measures and the support available to them could be reduced depending on effectiveness of the marketing and delivery organisation. Household costs might be greater for an area-franchise model because they will not have any previous engagement with householders.

Benefits

The household receives benefits from reduced energy use, thus lower bills and some comfort taking (the rebound effect – instead of taking the full saving households increase comfort instead). It is assumed that comfort taking (increasing the temperature of the home rather than taking the full energy savings) represents 15% of the energy savings from the insulation measures, but zero for the renewable heat measures as these measures cause fuel switching rather than energy saving. Society benefits from a decrease in the amount of energy used and

[23] Some of the make good costs may be covered by the delivery organisation for some groups in society, however we assume that these costs will generally be faced by the household.

[24] http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/analysis/analysis.aspx

[25] http://hmccc.s3.amazonaws.com/docs/Element%20Energy_final_efficiency_buildings.pdf

the equivalent carbon dioxide and air quality impact. These benefits will occur over the lifetime of the measures (see annex 2 for the energy saving and life time assumptions). All calculations of the benefits follow and are consistent with the DECC guidance on appraisal of greenhouse gas emissions policy[26].

Trajectory of rollout

The level of installation will vary per year by measure and depends on demand for insulation and on supply constraints. A total level of feasible potential installations by 2020 has been estimated for each measure taking into consideration these demand and supply factors. The starting point is taken from a best estimate of the likely increase in installations between now and 2013 (80,000 solid walls are assumed to be installed in 2013[27]). As an initial assumption, due to a lack of evidence to support alternative options, it has been assumed that the number of installations is distributed equally over the period of the programme. This is a simplifying assumption which may overly front load the installation of measures. As the analysis progresses and more information is gained understanding of the likely trajectory will develop. A different approach has been taken for cavities and lofts because it is assumed that the number of installations will be declining as the 2015 target is approached. For more detail on the feasible potential and trajectory assumptions see tables 3 and 4 in annex 2.

RESULTS

The results given below are the net present value in 2010 prices. All outputs below are the costs and benefits to society. To allow for the sensitivity of the assumptions being used in the above models a low and a high scenario have been applied. Sensitivity is applied to all of the cost elements (see annex 2 for detail on the low and high cost assumptions) and the benefits by considering the high and low estimates for future energy and carbon prices. For more detailed results see annex 5.

Energy company and local authority partnership – option 2

As previously mentioned it is assumed that the energy company and local authority partnership facilitates early stage installation of solid wall insulation into social housing, it also faces the lowest administration costs. Assuming that only the most cost effective measures are installed to meet the 4MtCO2e gap, then over the period just under 5m measures are installed. These measures are made up of the remaining lofts and cavities and solid wall installation of varying types (see annex 2 for more detail on the individual measures and annex 5 for more detail on the number of individual measures installed and a breakdown of the costs and benefits and the sensitivities).

NPV £billion 2010 prices	Low net costs	Central	High net costs

[26] http://www.decc.gov.uk/en/content/cms/statistics/analysts_group/analysts_group.aspx

[27] This figure is a result of discussions with the industry but is likely to be a high estimate. Reducing this estimate will mean a higher ramp up is necessary during the programme (2013-2020).

Total costs[28]	£12.92	£18.61	£24.80
Total benefits[29]	£33.20	£24.60	£14.19
Net benefit	£20.28	£5.99	-£10.61
Non-traded Life time carbon impact (MtCO2)	-146.30	-146.30	-146.30
Cost Effectiveness Indicator for non-traded sector	-35.13	3.72	46.04
Benchmark cost effectiveness value	(44.69)	(44.69)	(44.69)

It is assumed that energy companies will pass all costs faced onto consumer bills, however some households may be able to cover some of the costs themselves either through savings or via financing options. The impact on bills is discussed below in the distribution section; bill impacts are dependent on how much of the total installation and administration cost is covered by suppliers or individual households that are receiving the measures, either directly or through future financing mechanisms such as PAYS.

Energy company only – option 3

For the purposes of comparison in this analysis, it is assumed that an energy company led option would not install solid wall insulation into social housing (albeit in practice, even without any formal, facilitating partnership arrangements with Local Authorities of the type mentioned in the option above, suppliers might still seek to work in social housing where this was practicable and cost-effective for them). However it faces relatively low administration costs. Assuming that only the most cost effective measures are installed to meet the 4MtCO2e gap, then over the period just under 6m measures are installed. These measures are made up of the remaining lofts and cavities and solid wall installation of varying types and less cost effective measures of heat pumps and solar thermal, which are additional to the RHI.

NPV £billion 2010 prices	Low net costs	Central	High net costs
Total costs	£19.98	£25.90	£32.72
Total benefits	£34.64	£25.63	£15.15

[28] As made up of installation costs, administration costs and household costs.
[29] Benefits include energy savings, carbon and air quality savings for society, and comfort taking.

Net benefit	£14.66	-£0.27	-£17.57
Non-traded Life time carbon impact (MtCO2)	-141.62	-141.62	-141.62
Cost Effectiveness Indicator for non-traded sector	4.66	46.46	94.62
Benchmark cost effectiveness value	(44.58)	(44.58)	(44.58)

We assume for the purposes of this assessment that energy companies will pass all costs faced onto consumer bills, however some households may be able to cover some of the costs themselves either through savings or via financing options.

Area franchise – option 4

It is assumed that an energy company led option would not install solid wall insulation into social housing, it also faces relatively high administration costs. Assuming that only the most cost effective measures are installed to meet the 4MtCO2e gap, then over the period just under 6m measures are installed. These measures are made up of the remaining lofts and cavities and solid wall installation of varying types and less cost effective measures of heat pumps and solar thermal, which are additional to the RHI.

NPV £billion 2010 prices	Low net costs	Central	High net costs
Total costs	£20.62	£26.82	£34.22
Total benefits	£34.64	£25.63	£15.15
Net benefit	£14.02	-£1.19	-£19.07
Non-traded Life time carbon impact (MtCO2)	-141.62	-141.62	-141.62
Cost Effectiveness Indicator for non-traded sector	9.23	52.98	105.27
Benchmark cost effectiveness value	(44.58)	(44.58)	(44.58)

Under the area franchise it would be expected that the funding for the programme either comes via central government or from a tax on energy companies. If funding came from central government then the opportunity cost of how the funds could have been used elsewhere (i.e. health or education) would have to be taken into consideration.

If funding came from taxing energy companies then the impact on consumer bills would be similar, but slightly greater than a supplier led option.

The costs and benefits would be very similar for a central delivery body (a single area franchise). However as there will be no competition at all for this national monopoly it is assumed that the administration costs associated with an area franchise will not fall with time as there is no incentive for the monopolist to become more efficient. Thus the only difference with the area franchise is higher admin costs, which consequently affects the net impact on society, as the table below demonstrates (the carbon savings are the same).

Central Delivery:

NPV £billion 2010 prices	Low net costs	Central	High net costs
Total costs	£26.21	£27.46	£29.80
Total benefits	£34.64	£25.63	£15.15
Net benefit	£8.43	-£1.83	-£14.65
Cost Effectiveness Indicator for non-traded sector	7.30	57.48	125.70

Local Authority led – option 5

It is assumed that a local authority led option allows installation of solid wall insulation into social housing, however it faces high administration costs. Assuming that only the most cost effective measures are installed to meet the 4MtCO2e gap, then over the period just under 5m measures are installed. These measures are made up of the remaining lofts and cavities and solid wall installation of varying types.

NPV £billion 2010 prices	Low net costs	Central	High net costs
Total costs	£1424	£20.40	£27.59
Total benefits	£33.28	£24.60	£14.19
Net benefit	£18.96	£4.20	-£13.40

Non-traded Life time carbon impact (MtCO2)	-146.30	-146.30	-146.30
Cost Effectiveness Indicator for non-traded sector	-26.09	15.99	65.12
Benchmark cost effectiveness value	(44.69)	(44.69)	(44.69)

Local authorities will tend to receive their funding either via central government (ring fenced or not) or via increasing revenue instruments that they control themselves, like council tax. Therefore the only impact on consumer bills will be from the benefits received by some households. The different sources of funding available to local authorities will have different impacts on consumer reactions and the opportunity costs of the (local) government revenue will have to be considered.

Prices and bills

The impact on prices and bills is consistent with that set out in the Low Carbon Transition Plan Analytical Annex (2009)[30].

We have assumed that, under the new energy company – local authority partnership delivery option, 65% of administration and installation costs are borne by energy companies and passed through to consumer bills. Over the period 2013-2020, this represents no change to the impact on the average energy bill for those households not taking up measures as compared with that forecast under the CERT Extension.[31]

Change in prices and bills relative to BAU[32]	**2013**	**2015**	**2020**	**2025**	**2030**	**2013-20 Average**	**2013-30 Average**
Price impact (£/MWh) (excl VAT)	4	6	3	0	0	4	2
Overall change in average domestic bills (£)	41	49	-1	-39	-37	28	-8
Overall % change in average bills	7%	8%	0%	-5%	-4%	4%	-1%
Change in bills for consumers that do not receive measures (£)	45	67	40	1	1	52	24
Change in bills for average consumers receiving measures (£)	-10	-35	-136	-169	-176	-71	-126

Households that do receive a measure under the programme will see bill savings[33] (an average of £70 per year between 2013 and 2020).[34] If this is averaged over 2013 to 2030 then

[30] http://www.decc.gov.uk/Media/viewfile.ashx?FilePath=White Papers\UK Low Carbon Transition Plan WP09\1_20090727143501_e_@@_uklctpanalysis.PDF&filetype=4

[31] http://www.decc.gov.uk/en/content/cms/consultations/cert_ext/cert_ext.aspx

[32] Business as Usual as set out in the Low Carbon Transition Plan without "future SO" and including proposed CERT extension and changes announce in Renewable Heat Incentive.

households that do receive measures make average annual savings of £126.[35] Households receiving SWI would see higher average savings of around £380 a year on their gas bills between 2013 and 2020, and £430 between 2013 and 2030.

The Low Carbon Transition Plan in summer 2009[36] also considered the bill and price impacts from future supplier obligations. An average reduction in energy bills across all households of £45 in 2020 (in a dual fuel household) was projected. Under the combination of the CERT Extension to 2012 and the HEM delivery option considered here, the projected reduction in bills by 2020 is £57. £56 £1 . The increase in bill savings shown in this analysis is owing to changes in the combined ambition of the policies (see main HEM document for discussion of ambition of different policies in the household sector) and different assumptions on the trajectory for investment.[37]

It should be noted that, for the purpose of this analysis, we have assumed an obligation of the same structure as CERT, that is to say one that falls on the major gas and electricity suppliers. Other models are possible – for example, the recent Community Energy Saving Programme (CESP) applies additionally to electricity generators. However, any decision on the precise scope of the new obligation will follow full consultation on draft proposals for the design of the new scheme.

Uncertainties

It has been suggested that energy companies may have a stronger capacity to achieve cost reductions in negotiation with contractors as they are private companies and have a strong bargaining power, as compared to LAs and also regional franchises, which may be too new to have established a credible bargaining power. It can also be argued that market based delivery may lead to more investment in innovation to reduce the cost of measures or improve their performance. Due to lack of detailed evidence these impacts have not been included in the cost benefit analysis.

Reducing energy demand will improve the country's security of supply as the dependence on fuel imports will decrease. It should be noted that the increase in electricity from installation of heat pumps is taken into consideration in the total energy savings.

As part of the EU climate and energy package, the UK has agreed to a renewable energy target. This target requires an increasing proportion of UK final energy consumption over the period 2011 to 2020 to be from renewable sources, reaching 15% by 2020. For comparison, 2.7% of UK final energy consumption was from renewable sources in 2008.

At the margin, the costs of meeting the renewable energy target are likely to be significant. Changes in the level of UK final energy consumption can reduce the level of renewables that are required to be installed and so reduce the additional costs of the renewable energy target. These cost savings have not been evaluated.

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[33] assuming all measures are installed in gas heated homes, and the cost on bills is taken into consideration.

[34] All price and bills analysis has been made taking all other policies (including the CERT extension) in the LCTP into consideration. Therefore these price changes are additional to the changes in other policies.

[35] Costs of measures are front-loaded but benefits are spread out over the lifetime of the measures; therefore the impact on bills changes over time. For a longer-tem view, bill-impacts for the period ending 2030 give a more representative picture.

[36] http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

[37] A flatter trajectory between 2013 and 2020 for the level of investment leads to greater bill savings in 2020.

Risk across measures - The risk of the installations going wrong is likely to be similar among all delivery options. However there is likely to be different levels of risk that the delivery options do not fulfil the overall objective of reduced household CO2. Monitoring costs (of the programmes and CO2 savings) will need to be considered, as some delivery organisations maybe better placed and have better incentives to continue the monitoring phase. It is also likely that a separate organisation may be necessary to ensure quality and standards, the cost of providing this service will depend on the number of delivery organisations involved and the level of involvement necessary. Linked to this is the consolidation of information, there are potential benefits from pooling information via a central conduit.

EQUALITY IMPACT ASSESSMENT

As discussed in the market failures section earlier in the document, there will be a negative impact on equality without further action to mitigate. There are different aspects to equality, in terms of geographical area, socio-economic group, age, gender and disproportionate increases in energy bills. Here we will assess how the delivery options will impact on these aspects.

Distributional Impacts

If we assume that energy companies will pass through 100% of the costs of delivering energy efficiency and heat measures will be spread across all customers. However, not everyone will incur the same increase in their energy bills as it is likely that these increases will be linked to increases in unit charges[38] for electricity and will therefore be proportional to use.

This will have a number of consequences. Those who use the most energy will incur the biggest increases in energy bills, those who enjoy an improvement in the energy efficiency of their homes will enjoy not only energy bill savings but also incur less of the pass through costs. However, there is the risk of the increased charges pushing some people into fuel poverty that would not have before, but this would only be until they enjoy an improvement in the energy efficiency of their homes.

Without a caveat to ensure fuel poor groups are targeted, it is likely that there would be a negative impact as it is generally not as cost-effective because of search costs and disruption. Therefore, a delivery mechanism would need to be able to target such groups as effectively as possible to ensure those who would suffer the most from the pass-through costs enjoy energy bill savings. The proposed new supplier obligation is intended to be structured in such a way as to ensure this. Further details will be provided at the time of consultation.

Fuel poverty impact

By far the largest potential impact for the policies contained within HEM relate to the fuel poor. This category cuts across a number of equalities areas including disability, race and age. Separate consideration of each of these equalities issues is provided below.

As of 2007, over 90% of the fuel poor were in the lower three income deciles[39] and 41% were living in F&G rated homes. Energy prices rose sharply in 2008 leading to upward pressures on fuel poverty, so the incidence of fuel poverty amongst each group is likely to be higher now. As such, there is a huge opportunity to bring many of the lowest performing homes up to a band E at little cost, saving householders money on energy bills.

The options outlined as part of this initial assessment of impacts have the potential to bring many of these households out of fuel poverty through targeted policies that improve the efficiency of a household. However, they also have the potential to impact disproportionately on those on low incomes if poorly targeted as any supplier obligation is passed on to consumers and will therefore hit those already in fuel poverty the hardest.

[38] http://www.decc.gov.uk/en/content/cms/consultations/open/cesp/cesp.aspx

[39] English House Condition Survey 2007 (http://www.communities.gov.uk/documents/statistics/pdf/1133548.pdf)

As of 2007, 33% of fuel poor households lived in homes built before 1919 and 43% of the fuel poor households lived in homes without cavity wall insulation (defined as cavity walls in less than half the dwelling), it is likely that a large proportion of fuel poor households will fall into the 'hard to treat' category. HEM will begin to deliver in 2013 on the back of a supplier obligation largely focused on loft and cavity wall insulation. Due to the distribution of fuel poor households towards the harder to treat properties it will therefore be important to ensure that those policies focused on these measures target the fuel poor. Future policies under HEM will continue to ensure the fuel poor receive a greater level of support to ensure they benefit from the policies rather than suffer. The current Community Energy Saving Programme (CESP) pilots are testing just such an approach through supplier led partnerships with local authorities, targeted at those areas with the highest income of multiple deprivation (IMD).

Forthcoming policies on fuel poverty will set out the direct benefits to the fuel poor in more detail.

In consulting in due course on the detailed design of the future energy company obligation, the Government will discuss different options for the targeting of the scheme, and include information on potential fuel poverty impacts as part of the accompanying Impact Assessment.

Rural Proofing

The characteristics of rural housing are different to those found in urban areas. This, coupled with the generally lower density of properties in rural areas compared to urban, present a different set of challenges to any delivery approach.

Under the current schemes, suppliers have tended to target the most cost-effective areas, which tend to be dense urban areas. Therefore, rural areas have generally not been targeted to the same extent.

With approximately 33% of rural properties having solid walls (compared to 26% for urban), any delivery mechanism to complete solid wall insulation and other more significant measures also needs to be geared up to deliver in rural communities.

The delivery mechanisms discussed in this document have some opportunities for rural proofing :

A LA-led package would have the advantage of ensuring national coverage because all geographic areas would be covered and LAs could use their specialist knowledge of their local areas to target these groups. An Area-Franchise model and the supplier obligation could both be designed to stipulate a priority group for rural areas. An energy company LA partnership approach would be able to capitalise on the advantages LA's hold, in having specialist knowledge of their areas, and the ability of energy companies to deliver in an efficient manner to ensure that delivery was well coordinated and targeted in rural areas.

Age Impact

The elderly form a large proportion of those in fuel poverty (52% of fuel poor households contain somebody aged 60 or over and 44% somebody aged 65 or over) and as such will continue to be a key target group for the policies in the strategy. Evidence suggests older people are in

general more vulnerable to detrimental health impacts if they are fuel poor or live in homes which are not adequately heated, compared to the average healthy adult of working age[40].

Households with families are also expected to benefit from the measures outlined in this IA. Children who are fuel poor or live in homes which are not adequately heated suffer from many of the same health risks as older people[41], including respiratory illness[42], developmental problems[43] including poor weight gain. Infants in fuel poor households are also at 30% greater risk of admission to hospital or primary care facilities when other contributory factors have been accounted for.

Impact on the disabled and sick

Although there are no policies directly targeted at the disabled or long term sick, with 38% of fuel poor households containing someone who is registered disabled or long term sick we would expect the policies outlined in HEM to improve the quality of life for these households.

Race Impact

The policies in the HEM are not expected to impact disproportionately on any one ethnic group. However, we recognise that there are some ethnic groups that are strongly represented in inner city, poor quality housing. .

Gender Impact

It is not anticipated that there will be any disproportionate impact on gender as a result of these policies.

Human Rights

There are no human rights issues associated with the assessments in this document.

[40] http://whqlibdoc.who.int/euro/ehs/EURO_EHS_31_part2.pdf

[41] http://whqlibdoc.who.int/euro/ehs/EURO_EHS_31_part2.pdf

[42] Howden-Chapman, P. et al., (2007). Effects of insulating houses on health inequality : Cluster randomised study in the community. *British Medical Journal*, doi:10.1136/bmj.39070.573032.80

[43] Barnes, M. et al., (2008). *The Dynamics of Bad Housing : The Impacts of Bad Housing on the Living Standards of Children.* London : National Centre for Social Research

POLICY ISSUES

Sustainable Development

Whichever delivery mechanism is chosen, it should result in the same overall outcome. This will have a positive impact on sustainable development because the UK housing stock will have reduced its carbon emissions, helping to mitigate climate change therefore ensuring a strong and healthy society and living within our environmental limits; the energy needed to heat our homes will be reduced or will come from renewable sources making it more self-sufficient, which will also result in a sustainable security of supply as will not be reliant on one type of fuel that can be subject to political issues. By conserving and creating a mix of energy sources, it will create a more sustainable economy.

The use of local partnerships or a local approach would help communities to develop in a sustainable way by bringing them together to create communities and living spaces they can enjoy.

Other Environment and Health

The result of reduced emissions from the improved housing stock will inevitably result in an improved environment as it will help to mitigate the impacts of climate change. This will also have positive health impacts because of improved air quality. This impact is likely to be particularly marked in those households containing the elderly or young children (this is considered in more detail below)

Carbon Assessment

Discussed throughout document.

Competition and Small Firms Impact Assessment

Current mechanisms (CERT and CESP) put obligations on categories of companies of a certain type, and are not considered to have any unfair impacts on particular individuals within a category. Additionally, these schemes operate thresholds to ensure that small firms are not discouraged from growing, or new entrants hindered from entering the market, because of any additional burden.

The detailed design of the new energy company obligation will be subject to consultation in due course, but the Government currently envisages continuing with principles on these lines.

The number of jobs that the whole HEM programme may create could be up to 65,000. This is a conservative estimate as it does not take into account the fact that programmes can also stimulate further jobs down the supply chain.

Legal Aid

There are no legal issues associated with the assessments in this document.

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	
Small Firms Impact Test	Yes	
Legal Aid	Yes	
Sustainable Development	Yes	
Carbon Assessment	Yes	
Other Environment	Yes	
Health Impact Assessment	Yes	
Race Equality	Yes	
Disability Equality	Yes	
Gender Equality	Yes	
Human Rights	Yes	
Rural Proofing	Yes	

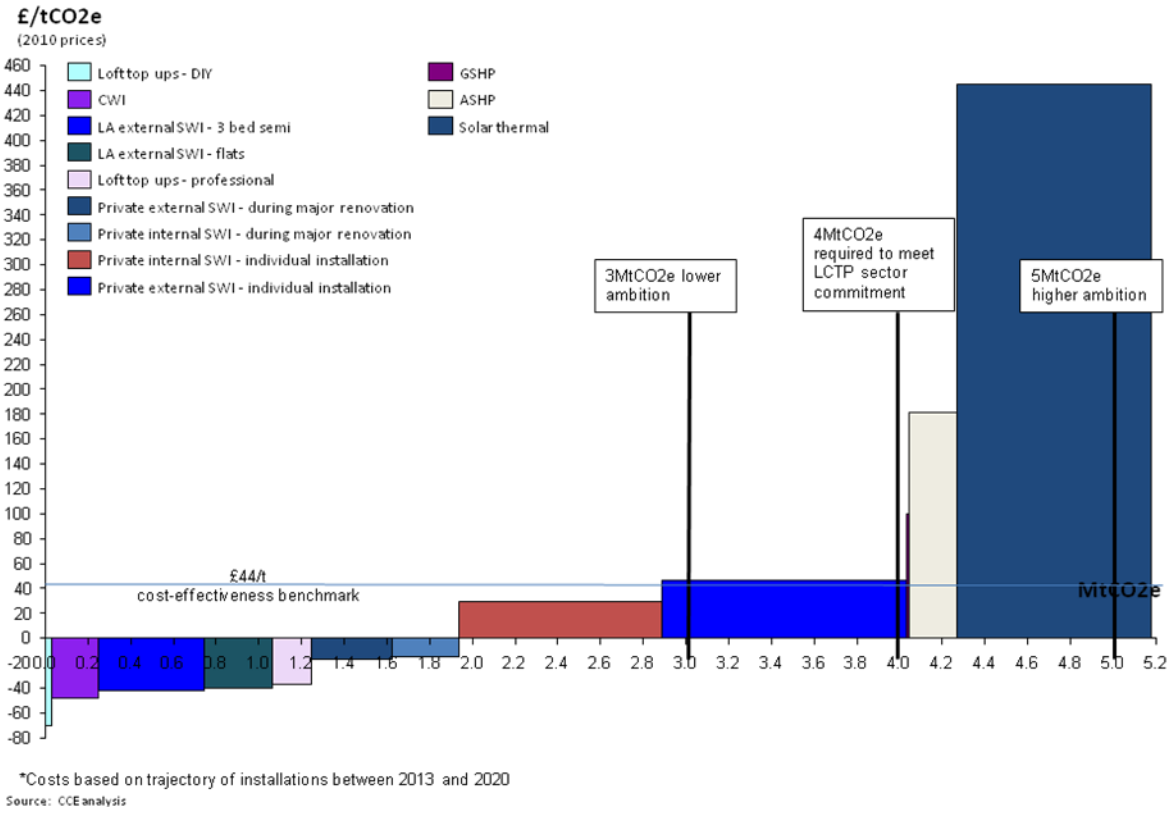
Annex 1: Sensitivity around the carbon target

The 4MtCO2 ambition of this document assumes that all other policies in the household sector achieve their current estimated savings. However there is a risk that other policies may under or over achieve their individual ambitions. If this is the case then the target of a 29% reduction of non-traded carbon in the domestic sector (total emissions of 60MtCO2 in 2020)will either not be achieved or may go beyond the aim but through cost ineffective policies. Consequently the HEM delivery option will need to deliver either a higher or lower level of carbon saving in 2020 then the 4MtCO2 discussed in the document. To allow for some of the risk of such possibilities this annex investigates a level of sensitivity around the carbon target. The analysis and results below consider a low sensitivity of 25% fewer necessary carbon savings in 2020 and a high sensitivity of 25% more necessary carbon savings in 2020. However, it does so on the basis of a limited range of abatement measures covering loft insulation and various types of wall insulation. Renewable heat measures are presented for comparison.

	Low	Central	High
Carbon ambition for the delivery option	3MtCO2	4MtCO2	5MtCO2

The MAC curve below, used for the supplier – local authority partnership and local authority led options, demonstrates that, if only 3MtCO2 savings are required, then fewer private external solid walls would need to be installed. Using the limited range of options presented in the MAC curve below, if 5MtCO2 savings were necessary more expensive measures (renewable heat) would be needed. A MAC curve with a larger set of insulation measures is presented at the end of this annex (p.33) and shows that cost-effective insulation measures are expected to exist at higher levels of ambition.

MACC in 2020 for measures needed to meet the 4MtCO2 ambition*

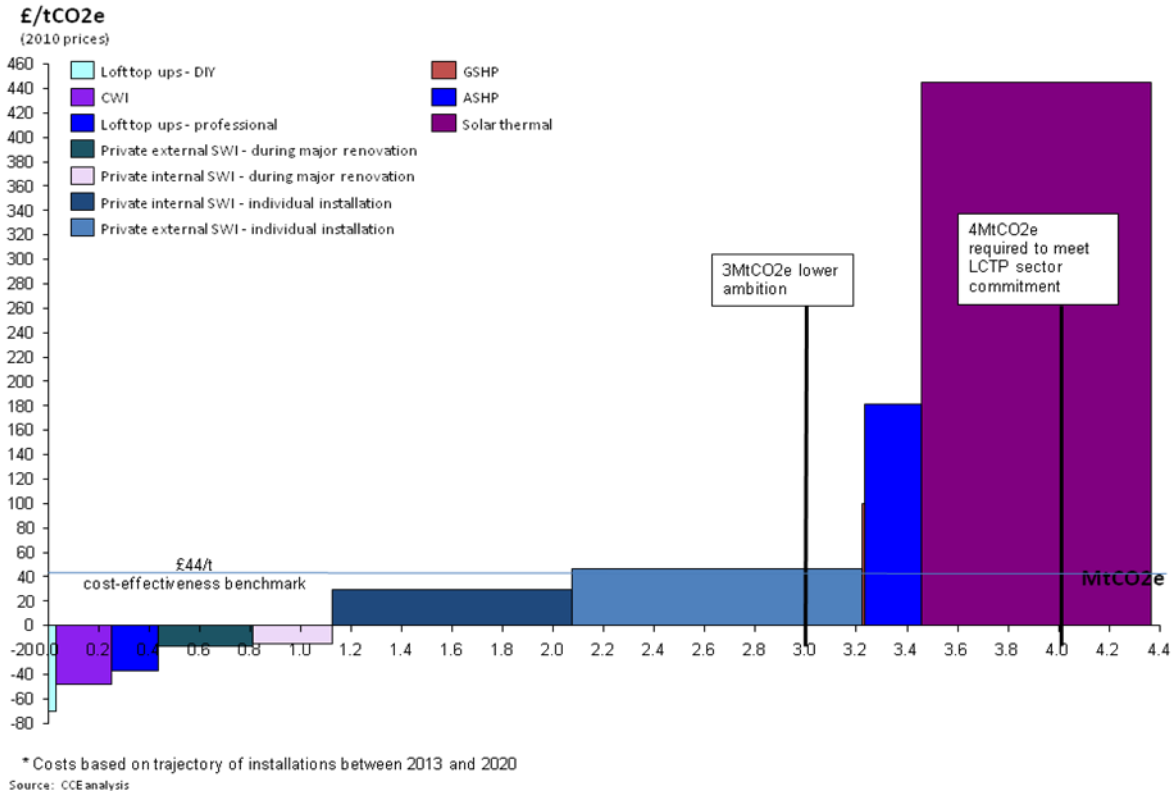


*Costs based on trajectory of installations between 2013 and 2020

Source: CCE analysis

The MAC curve below for the supplier only and regional franchise approaches (no LA external solid wall) demonstrates that, with a lower ambition of only 3MtCO2, the majority of installations will be cost effective. However, there are not enough feasible potential measures to reach 5MtCO2. This suggests that more measures would be needed. Consideration of the MAC curve with a greater range of measures below (including LA external SWI) demonstrates that a greater number of measures would be needed to ensure that the programme remains cost- effective if the carbon target is higher.

MACC in 2020 for measures to meet the 4MtCO2 ambition, without local government involvement*



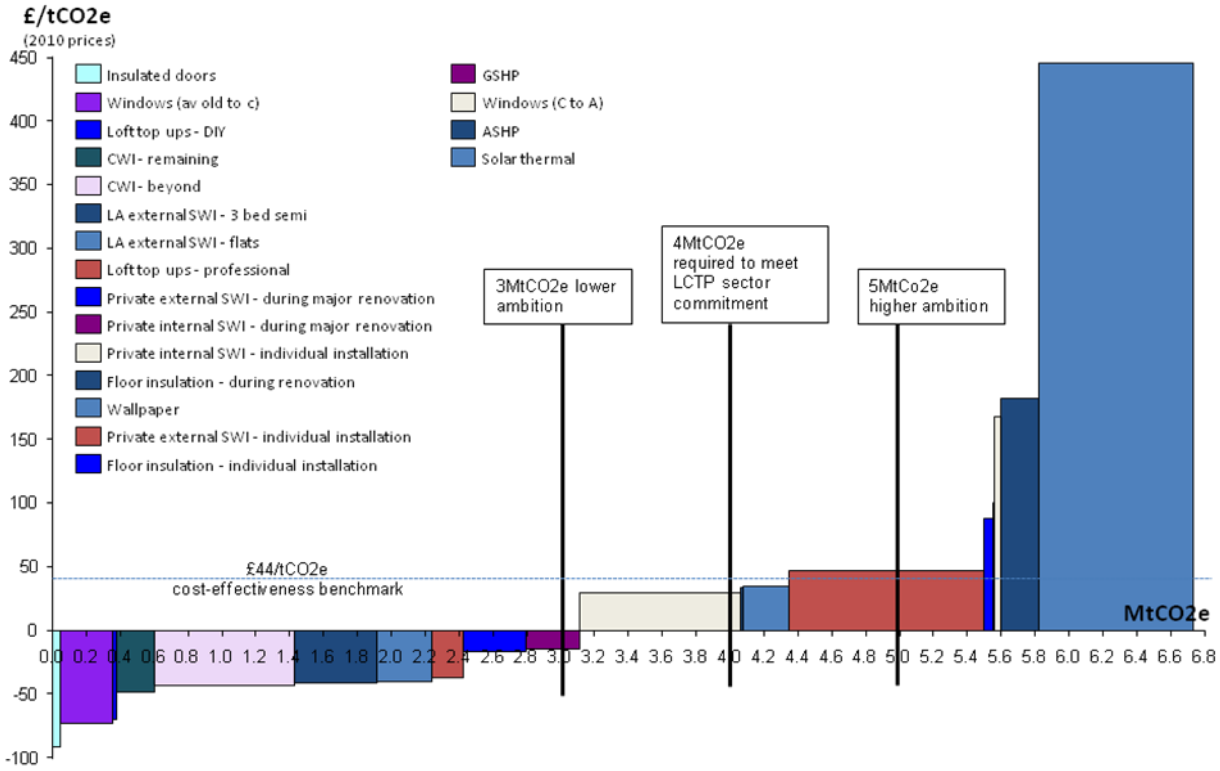
* Costs based on trajectory of installations between 2013 and 2020

Source: CCE analysis

The MAC curves demonstrate the most cost effective scenario of measures that could be employed post 2012 under the different policy options discussed in this document and are stylised interpretations of the measures that would be available. The first MAC curve includes all measures that could be employed under policy options 2 and 5, supplier local authority partnership delivery and local authority led delivery. Therefore this includes local authority led external solid wall insulation.

The second MAC curve includes all measures that could be employed under policy options 3 and 4, supplier led delivery and area franchise. This MAC curve does not include local authority led external solid wall insulation as an appropriate measure as this would only be feasible with local authority participation in the delivery. The difference between the curves reflects the importance of being able to access the abatement available in the local authority sector. If the larger MAC curve, presented at the end of this annex and incorporating more measures, were to be used as the basis of the analysis, the difference between the options would be less stark.

MACC in 2020 for greater range of measures that could be included in delivery*



*Costs based on trajectory of installations between 2013 and 2020

Source: CCE analysis

Annex 2: assumptions and cost effectiveness of individual measures

This annex sets out the background to the costs and benefits presented in this document and the summary sheets. The costs have been calculated using a purpose built model, which considers the feasible number of installations of each measure that could be installed in each year of the policy (see tables 3 and 4) and the total costs of installing these measures in each year. These costs, i.e. the input assumptions (see table 1), include installation costs, which decrease as learning occurs within the industry (see table 2a and 2b), admin costs and the 'make good', disruption and time costs likely to be experienced by households. This gives the total costs for each measure for the period 2013 to 2020. The benefits are calculated using the inter-departmental analysts group (IAG) tool kit developed by DECC[44] which uses the assumed kWh energy savings for each measure to monetise the energy savings to society as well as the carbon, air quality and comfort savings. The total costs and benefits are presented in Table 5.

List of tables and figures:

- Table 1: Input assumptions –The table presents the assumptions that have been used to calculate the costs and benefits of each measure. The costs presented are for 2010, however, as mentioned above installation costs should decrease with time through learning by doing and innovation, see table 2a and 2b. Counterfactuals are taken into consideration for all measures (what would happen anyway). The numbers presented in these tables are the central estimates, sensitivity tables are presented at the end of the annex (Table 7).
- Tables 2a and 2b: Learning rates by measure – This table considers the fall in costs associated with learning; either via learning by innovation or learning by doing. Table 2a shows the learning rate for each measure for the period 2010 to 2020 and Table 2b shows the installation cost for each of the measures taking about of the learning rates in each year. The learning rates are only applied to installation costs, not admin or household costs. Annex 3 gives more detail on how Admin costs may vary.
- Table 3: Feasible potential installations table – the table aims to illustrate the total number of installations that may be achievable during the 2013 to 2020 period. Foot notes describe how these numbers were decided upon.
- Table 4: Trajectories for installation – this table presents estimates for the rate of installation of the different measures over the period of the programme.

[44] http://www.decc.gov.uk/en/content/cms/statistics/analysts_group/analysts_group.aspx

- Table 5: Indicative illustration of measures tables – The table presents the total costs and benefits of delivering the number of installations considered in the feasible potential assumptions table, over the period 2013 to 2020 as suggested in the trajectories table, for each measure. Thus the results are not for an individual measure but the feasible potential over the period. All prices are discounted back into 2010 prices using a discount rate of 3.5%. It is assumed that the capital costs are faced in the year of installation of the measure[45] whilst the benefits continue for the life time of the measure. The carbon cost effectiveness indicator (CEI) in the tables demonstrates how much it would cost per measure to save one tonne of carbon in the non-traded sector, this takes into consideration the cost of the measure and any additional benefits. The CEI will be used to compare the different measures and to create an efficient scenario.
- MAC curve's of the feasible insulation measures to meet the carbon target. MAC curves show for each measure; the potential for abatement in the year in question (2020 in this case); and the net cost to society of delivering a tonne of abatement (which can be compared to the published benchmark values to determine cost-effectiveness – around £44/t).
- Table 6: Sources of assumptions table – these tables offer more information on the sources used for the input assumptions.
- Table 7 and 8: Sensitivity analysis tables

It should be noted that this is only an indicative view on the type of measures that may be installed and the 'bundle' of measures may be very different in reality. Additionally the costs, benefits and feasible potential are the current best estimate for each of the measures, with time these estimates may change as more information and evidence is gained.

The total costs and benefits presented in table 5 are used to calculate the carbon cost effectiveness of the main measures that are available to households to improve the energy efficiency and carbon output of their home. These cost effectiveness calculations are used to produce the marginal abatement cost curve (MACC) which demonstrates the most efficient scenario of measures that could be employed under the post 2012 delivery option obligation (moving from the left of the MACC to the right). The analysis of this annex feeds into the main document which discusses the different delivery options.

[45] The maintenance costs will continue over the life time of the measures and it assumed that all household costs are spread over a ten year payback period, with a cost of capital of 10%.

Input assumptions

Installation costs have been given in 2010 estimates, but the learning table below explains how these costs may fall over time. Explanations and sources for these assumptions are either included in foot notes or in a separate table below which details the studies used. The cost assumptions below do not take into consideration the potential for lower costs from installing more than one measure at once and therefore estimates are erring on the side of caution. It is assumed that installations go into an 'average' household (unless otherwise stated), which is taken to be an semi-detached property. The benefits given are for houses with a gas heating system, however when considering more than one property the assumed fuel mix of its existing heating system is; 88% gas, 8% electric, 4% oil and 0% coal.

Table 1: Input assumptions

Central assumptions[46]	LA external SWI		Private external SWI to U=0.35 W/m2K		Private internal SWI to U=0.35 W/m2K		Loft top ups		CWI	GSHP[47]	ASHP[48]	Solar thermal
	3 bed semi	Flats	During major renovation[49]	Individual installation	During major renovation	Individual installation	Professional	DIY	Hard[50]			
Life time (yrs)	36	36	36	36	36	36	42	42	42	23	18	20
Installation cost (£)[51]	4800	3160[52]	7600	7600	5000	5000	282.8	128	1620[53]	11688	10580	4194

[46] These are just the central assumptions being used – sensitivity analysis will be undertaken to assume high and low bounds for the cost elements.
[47] The split between fuels replaced for ground source heat pumps is assumed to be (consistent with the RHI) 13% gas and 87% oil.
[48] The split between fuels replaced for air source heat pumps is assumed to be (consistent with the RHI) 31% gas, 43% electricity and 26% oil.
[49] This assumes that there will be no 'make good' or other other household costs (including research, disruption, making good, loss of floor space) costs. There may be an impact on the installation costs, especially in homes that have scaffolding in place, however we have assumed that installation costs remain consistent with individual installation levels.
[50] It is assumed that the remaining cavities will either be technically hard to treat or strong laggards who refuse to receive the measure, thus costs will be much higher. Technically hard to treat cavities have some additional problem which makes them more expensive to treat. A more-than-4 storey flat block would be a good example, as this requires scaffolding which is expensive but otherwise the cavity is normal. Likewise tiling or other covering on most/all of the surface of the building – but where the cavity is standard to treat. The formal BRE definitions are here; hard to treat are category 3: http://www.communities.gov.uk/documents/statistics/pdf/1072658.pdf p248

Maintenance costs (£)	0	0	38[54]	38	0	0	0	0	0	-125[55]	-124	45
Admin costs (% of installation)	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%
Household costs (£)[56] of which:	**1500**	**1000**	**0**	**5210**	**3400**	**6866**	**126**	**165**	**170[57]**	**2163**	**525**	**525**
'make good'	1500	1000	0	5000	0	2000						
Household time cost			0	200	0	552			125			
Disruption			0	10	0	914						
Loss of floor space[58]			0	0	3400	3400[59]						
Estimate of annual energy saved, after correction for underperformance of	**11386**	**7401[61]**	**11386**	**11386**	**11386**	**11386**	**704**	**704**	**3604**	**16229[62]**	**14425[63]**	**2337**

[51] See learning table (below) for detail on the cost of installation for solid wall and renewable heat with time. In addition the counterfactual for external collide wall is that walls will receive a re-rendering when appropriate whether solid wall installation has been installed or not.

[52] Based on the EEPH Purple report [http://www.eeph.org.uk/uploads/documents/partnership/SWI%20supply%20chain%20review%208%20May%2020091.pdf] 2 bed terrace/ flats are assumed to have at least a 33% lower cost than a 3-bed semi-detached

[53] This is based on bids received from LAs and RSLs under the SHESP programme (more details of SHESP here: http://www.homesandcommunities.co.uk/energy-saving-programme), these bids have then been scaled up to represent an average home (3 bed semi-detached) using the ratios between size and economies of scope similar to those used in the EEPH work.

[54] Maintenance costs assumed to be 0.5% of the total (2010) costs per year for external solid wall insulation. Although some maintenance is included in the counterfactual most solid wall houses are brick or masonry finish, not rendered, so having to re-render solid wall insulation is additional to the counterfactual maintenance.

[55] The maintenance cost for heat pumps will be lower than the maintenance costs for the counterfactual boiler.

[56] These costs are derived from the ECOFYS report [http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/analysis/analysis.aspx] for the majority or measures, although separate assumptions for 'making good' are taken from the EEPH Purple report.

[57] This is the 'high' estimate from the ECOFYS report

[58] Loss of floor space, time and disruption costs may not be a physical cash impact but are a valuation of the impact that maybe undertaken by the individual and a possible impact to the future value of the home.

[59] The Ecofys report assumed that there would be a loss of floor space cost of £6800 for both the low case and the high case, however the text suggests that they had chosen to leave this cost out of the total household cost calculation, as a result it has been assumed that although the loss of floor space could cost as much as £6800 in the high case, the low case should assume a zero cost. The central case uses the average of the low and high estimates, however it is currently unknown as to whether solid wall installation will have a negative impact on the value of the property, it is just as likely that it could have a positive impact. This impact depends on consumer behaviour and other government policies.

insulation but before comfort correction – Gas heated home (kWh/year)[60]												
Electricity consumed										**-6219**	**-7767**	
Comfort taken (%)	15	15	15	15	15	15	15	15	15	0	0	0

Cost assumptions for solid wall taken from the EEPH Purple report: http://www.eeph.org.uk/uploads/documents/partnership/SWI%20supply%20chain%20review%208%20May%2020091.pdf, whilst energy saved is calculated within DECC. Cost and energy savings for renewable heat technologies are from the NERA report http://hmccc.s3.amazonaws.com/docs/NERA%20Renewable%20Heat%20MACC%20report%20final%20revision.pdf

Learning rates

When a product moves from infancy to a mature product in design and in the market, one would expect a certain level of cost reduction due to learning, either through innovation or through learning by doing. The table below presents estimates of what these learning rates may be for the technologies under consideration. The renewable heat technologies are based on the learning rates assumed in the NERA report for heat pumps, solar thermal and district heating. Solid wall insulation learning rates are based on the learning rates witnessed by cavity wall insulations over a 12 year period[64]. Technologies that have a strong market position already are assumed to no longer have learning improvements.

[61] Assume that a flat of 50m2 uses 35% less heating than a 80m2 semi-detached house, as according to Lowe(2007) Technical options and strategies for decarbonising UK housing. Building Research & Information 35, 412–425.

[62] This is the energy saved assuming oil is the fuel replaced as the assumption is that the majority installations will go into homes with oil boilers – for all the other measures the assumed fuel for the estimates annual energy saved is gas.

[63] This is the energy saved assuming electricity is the fuel replaced as the assumption is that the majority installations will go into homes with electric heating – for all the other measures the assumed fuel for the estimates annual energy saved is gas.

[60] The annual energy saving is given for gas centrally heated homes, unless otherwise stated, however the saving may vary across fuel types. Using these estimates the impact of smart meters has been taken into consideration (this reduces the average heating consumption and thus average savings by about 1.5% a year per measure). The kWh savings presented vary over time due to the assumed improved efficiency of boilers over time. The savings presented are for 2020 and are lower for earlier years (due to lower boiler efficiency) but consistent post 2020.

[64] The numbers in the table only reflect the first 9 years of this period

Table 2a: Learning rates

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Cavity wall insulation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Loft insulation professional (from > 60mm)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Solar thermal	1.00	0.97	0.94	0.91	0.88	0.85	0.84	0.83	0.82	0.81	0.80
SWI external	1.00	0.94	0.87	0.85	0.83	0.81	0.79	0.77	0.73	0.72	0.71
SWI internal	1.00	0.94	0.87	0.85	0.83	0.81	0.79	0.77	0.73	0.72	0.71
Internal SWI – with major renovation	1.00	0.94	0.87	0.85	0.83	0.81	0.79	0.77	0.73	0.72	0.71
Ground source heat pumps	1.00	0.97	0.94	0.92	0.89	0.86	0.84	0.82	0.81	0.79	0.77
Air source heat pumps	1.00	0.97	0.94	0.92	0.89	0.86	0.84	0.82	0.81	0.79	0.77
LA ESWI 3 bed semi	1.00	0.94	0.87	0.85	0.83	0.81	0.79	0.77	0.73	0.72	0.71
LA ESWI flat	1.00	0.94	0.87	0.85	0.83	0.81	0.79	0.77	0.73	0.72	0.71
External SWI – with major renovation	1.00	0.94	0.87	0.85	0.83	0.81	0.79	0.77	0.73	0.72	0.71

Table 2b: Learning rates applied to installation costs

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Cavity wall insulation	375.5926	375.5926	375.5926	375.5926	375.5926	375.5926	375.5926	375.5926	375.5926	375.5926	375.5926
Loft insulation professional (from > 60mm)	282.8061	282.8061	282.8061	282.8061	282.8061	282.8061	282.8061	282.8061	282.8061	282.8061	282.8061
Solar thermal	4194	4068.18	3942.36	3816.54	3690.72	3564.9	3522.96	3481.02	3439.08	3397.14	3355.2

External SWI	7600	7106	6612	6457.72	6307.04	6159.876	6016.145	5875.768	5548	5478.65	5410.167
Internal SWI	5000	4675	4350	4248.5	4149.368	4052.55	3957.99	3865.637	3650	3604.375	3559.32
Internal SWI – with major renovation	5000	4675	4350	4248.5	4149.368	4052.55	3957.99	3865.637	3650	3604.375	3559.32
GSHP	11687.5	11360.25	11033	10705.75	10378.5	10051.25	9840.875	9630.5	9420.125	9209.75	8999.375
ASHP	10580	10283.76	9987.52	9691.28	9395.04	9098.8	8908.36	8717.92	8527.48	8337.04	8146.6
LA ESWI 3 bed semi	4800	4488	4176	4078.56	3983.394	3890.448	3799.671	3711.012	3504	3460.2	3416.948
LA ESWI flat	3160	2954.6	2749.2	2685.052	2622.401	2561.211	2501.45	2443.083	2306.8	2277.965	2249.49
External SWI – with major renovation	7600	7106	6612	6457.72	6307.04	6159.876	6016.145	5875.768	5548	5478.65	5410.167

Feasible potential for installation of measures

The feasible potential table below provides estimates of the total number of installations of the different measures that could be achieved over the period of the policy (2013 to 2020). These assumptions are based on the remaining potential for lofts and cavities, the CCC report[65] for solid wall installation and NERA's report on renewable heat technologies. The two reports aim to take into consideration the supply and demand factors that might influence the feasible level of installation in the market as compared to the technical potential.

Table 3: Feasible Potential

	LA external SWI		**Private external SWI to U=0.35 W/m2K**		**Private internal SWI to U=0.35 W/m2K**		**Loft top ups**		**CWI**	**GSHP**	**ASHP**	**Solar thermal**
	3 bed	**Flats**	**During major**	**Individual**	**During major**	**Individual**	**Profes**	**DIY**	**Hard**			

[65] http://www.theccc.org.uk/reports/progress-reports

	semi		renovation	installation	renovation	installation	sional					
Feasible potential 2013 – 2020	**0.3m**	**0.3m**	**0.23m**[66]	**0.70m**	**0.19m**	**0.58m**	**2.0m**	**0.3m**[67]	**0.47 m**[68]	**0.002**	**0.12m**	**2.3m**

Installation trajectories – Cumulative

The level of installation will vary per year for different measures. The rate of installation depends on supply and demand factors. However detailed supply and demand information for most of the measures under consideration is unavailable. Consequently an indicative assumption has been made that the level of installation is averaged over the period of the programme. Although this is a simple assumption, which may over estimate the number of installations in earlier years, there is currently little information to better inform the installation trajectory. An alternative could be a 'back loaded' trajectory, i.e. where the rate of growth is increasing over the appraisal period. The estimates presented in the following table for the heat technologies are additional to the number of installations assumed under the RHI lead growth scenario. As these installations are assumed to be additional to the RHI, there is no double counting in the costs and benefits of the two policies. However, it is currently uncertain whether heat technologies installed under the HEM delivery model will be eligible for the RHI subsidy. This issue will continue to be discussed as the HEM and RHI policies continue to develop.

[66] The CCC suggest an extended ambition of 2.3m solid walls by 2022 and a stretch ambition scenario of 3.3m solid walls installations by 2020 (40% of the technical potential). The numbers above are split across the different solid wall types; 2/3rd external solid wall and 1/3rd internal solid wall, (this is consistent with the current split); 0.6m of the external solid wall is then installed in social housing; the split for private installations is ¼ during major renovation and ¾ not. The split between during major renovation or not is based on work by CLG that considers the amount of renovations undertaken each year for amending part L of the building regulations: http://www.communities.gov.uk/documents/planningandbuilding/doc/1295086.doc Assuming that solid wall could be installed during extensions, conservatory installations and other renovations then a total of 0.42m is an upper estimate.

[67] DIY loft insulation has had a high score in CERT 2011-12, because it has been assumed that a reasonable number of empty lofts remain. However, these are likely to be filled in the near future, and the DIY figure has been reduced to the same savings as professional top ups..

[68] There is the potentially for 3.5m 'hard' to treat cavities, the feasible potential of this group is unknown and therefore it is assumed that no more cavities are filled above the remaining number to reach the 'where practicable' target of 75% of all cavities.

[69] Renewable heat feasible potentials are additional to the number of installations assumed under the RHI lead growth scenario, this is based on work by Nera to consider the potential uptake of renewable measures. As these installations are assumed to be additional to the RHI, it is assumed that there is no overlap between the two policies for the time being.

Table 4: Cumulative installation trajectories for all measures

(Millions)	2013	2014	2015	2016	2017	2018	2019	2020
Cavity wall insulation	300,000	400,000	470,000	-	-	-	-	-
Loft insulation professional (from > 60mm)	1,000,000	1,500,000	2,000,000	-	-	-	-	-
Solar thermal	287,500	575,000	862,500	1,150,000	1,437,500	1,725,000	2,012,500	2,300,000
External SWI	10,000	108,571	207,143	305,714	404,286	502,857	601,429	700,000
Internal SWI	8,000	89,714	171,429	253,143	334,857	416,571	498,286	580,000
Internal SWI – with major renovation	2,000	28,857	55,714	82,571	109,429	136,286	163,143	190,000
GSHP	250	500	750	1,000	1,250	1,500	1,750	2,000
ASHP	13,750	28,929	44,107	59,286	74,464	89,643	104,821	120,000
LA ESWI 3 bed semi	50,000	100,000	150,000	200,000	250,000	300,000	-	-
LA ESWI flat	50,000	100,000	150,000	200,000	250,000	300,000	-	-
External SWI – with major renovation	3,000	35,429	67,857	100,286	132,714	165,143	197,571	230,000
CWI hard	100,000	250,000	500,000	750,000	1,000,000	1,250,000	1,500,000	1,750,000
DIY loft >60mm	100,000	200,000	300,000	-	-	-	-	-

Indicative illustration of measures

The table below presents the total costs and benefits of delivering the number of installations considered in the feasible potential assumptions table, spread over the period (2013 – 2020) as suggested in the trajectories table, for each measure. Thus the results are not for an individual measure but the feasible potential over the period. Assumptions discussed on cost and benefit inputs, learning rates, feasible potential and installation trajectories are run through a model built by DECC, as described above. All the numbers in the table below are in 2010 prices (future numbers have been discounted back using a discount rate of 3.5%). Using all

the costs and benefits the carbon cost effectiveness for installing the feasible potential of each measure can be calculated. The cost effectiveness indicator and the annual carbon saved in 2020 are used to produce the MACC.

Table 5:Total costs and benefits of measures

(2013-20, **£m** 2010 prices)	**LA external SWI**		**Private external SWI to U=0.35 W/m2K**		Private internal SWI to U=0.35 W/m2K		**Loft top ups**		**CWI**	**GSHP**	**ASHP**	**Solar thermal**
	3 bed semi	**Flats**	**During major renovation**	**Individual installation**	**During major renovation**	**Individual installation**	**Professional**	**DIY**	**Hard**			
Costs (2013-20, **£m** 2010 prices)												
Installation costs	£955	£629	£1,209	£3,680	£578	£1,765	£497	£33	£675	£13	£691	£7,760
Administration costs	£172	£113	£218	£662	£104	£318	£90	£6	£121	£2	£124	£1,397
Household costs[70]	£353	£235	£0	£2,622	£483	£2,976	£210	£41	£67	£3	£48	£917
Total costs[71]	**£1,480**	**£977**	**£1,401**	**£6,888**	**£1,164**	**£5,059**	**£797**	**£80**	**£864**	**£18**	**£863**	**£10,074**
Society Benefits (2013-20, **£m** 2010 prices)												
Energy savings for society (non-traded)	£1,227	£797	£900	£2,739	£743	£2,269	£519	£77	£629	£13	£322	£1,504
Energy savings for society (Traded)	£409	£266	£303	£923	£237	£725	£177	£26	£213	-£14	-£207	£344
Carbon savings (Non-traded)	£792	£515	£606	£1,843	£500	£1,527	£344	£51	£416	£8	£165	£740
Carbon savings (Traded)	£66	£43	£49	£148	£38	£116	£27	£4	£32	-£3	-£44	£73
Total air quality impact	£49	£32	£37	£112	£30	£92	£21	£3	£26	£3	£47	£51
Comfort	£470	£305	£345	£1,049	£280	£856	£338	£50	£409	£0	£0	£0

[70] Includes the 'make good' costs and disruption costs and loss of floor space

[71] The total cost may not equal the above costs as some of the costs are spread over different numbers of years and therefore the adding them all together affects the NPV differently.

Total benefits	**£3,013**	**£1,958**	**£2,239**	**£6,814**	**£1,830**	**£5,587**	**£1,425**	**£212**	**£1,725**	**£7**	**£283**	**£2,713**
Net benefit (2013-20, **£m** 2010 prices)	£1,533	£981	£837	-£73	£665	£528	£628	£131	£861	-£11	-£580	-£7,361
CEI for non-traded sector (£)	**-41.70**	**-40.38**	**-17.10**	**46.45**	**-14.74**	**29.23**	**-37.30**	**-70.54**	**-48.29**	**99.99**	**181.68**	**445.02**
	(44.53)	(44.53)	(44.67)	(44.67)	(44.67)	(44.67)	(45.06)	(45.04)	(45.08)	(41.28)	(40.33)	(40.63)
Non-traded Carbon impact in 2020 (MtCO2)	-0.49	-0.32	-0.38	-1.15	-0.31	-0.95	-0.18	-0.03	-0.22	-0.01	-0.23	-0.91
Traded Carbon impact in 2020 (MtCO2)	-0.10	-0.07	-0.08	-0.24	-0.06	-0.19	-0.04	-0.01	-0.05	0.01	0.09	-0.14
Non-traded Life time carbon impact (MtCO2)	-17.78	-11.56	-13.56	-41.26	-11.20	-34.19	-7.63	-1.14	-9.22	-0.19	-4.10	-18.20
Traded life time carbon impact (MtCO2)	-2.21	-1.44	-1.59	-4.83	-1.24	-3.80	-0.92	-0.14	-1.11	0.10	1.58	-2.57

The above table was used to produce the MAC curves presented in Annex 1.

Table 6: Sources and assumptions for the insulation measures estimates presented above

Central assumptions	LA external SWI*		Private external SWI*		Private internal SWI*		Loft top ups+		CWI+	GSHP	ASHP	Solar thermal
	3 bed semi	**Flats**	**During major renovation**	**Individual installation**	**During major renovation**	**Individual installation**	**Professional**	**DIY**	**Hard**			
Life time (yrs)	Consistent with CERT insurance lifetime plus 20%	Consistent with CERT insurance lifetime plus 20%	Consistent with CERT insurance lifetime plus 20%	Consistent with CERT insurance lifetime plus 20%	Consistent with CERT insurance lifetime plus 20%	Consistent with CERT insurance lifetime plus 20%	Consistent with CERT insurance lifetime plus 20%	Consistent with CERT insurance lifetime plus 20%	Consistent with CERT insurance lifetime plus 20%	**Nera report**	**Nera report**	**Nera report**
Installation cost (£)	EEPH report: cost of EWI materials and installation for 100 plus properties	EEPH report: 100 plus properties cost reduced by 33% (cost difference for flats and terrace)	EEPH report: Cost of EWI materials and installation for a single property.	EEPH report: Cost of EWI materials and installation for a single property.	EEPH report: Cost of EWI materials and installation for a single property	EEPH report: Cost of EWI materials and installation for a single property	CERT extension	CERT extension	CERT extension	**Nera report compared to new combi-boiler as a counterfactual**	**Nera report Compared to new combi-boiler as a counterfactual**	**Nera report compared to new combi- boiler as a counterfactual**
Maintenance costs (£)										**Nera report compared to new combi-boiler as a counterfactual**	**Nera report compared to new combi boiler as a counterfactual**	**Nera report compared to new combi- boiler as a counterfactual**
Admin costs (% of installation)	Assumed admin cost for supplier-LA	Assumed admin cost for supplier-LA	Assumed admin cost for supplier-LA	Assumed admin cost for supplier-LA	Assumed admin cost for supplier-LA	Assumed admin cost for supplier-LA	Assumed admin cost for supplie	Assumed admin cost for supplier-LA	Assumed admin cost for supplier-LA	Assumed admin cost for supplier-LA partnership	Assumed admin cost for supplier-LA partnership	Assumed admin cost for supplier-LA partnership

	partnership	partnership	partnership	partnership	partnership	partnership	r-LA partnership	partnership	partnership			
Household costs (£)of which:							ECOFYS report: Average of the high and low total hidden cost estimates	ECOFYS report: High estimate	ECOFYS report: High estimate	**Nera report**	**Nera report**	**Nera report**
'make good'	EEPH report: low end of 100 plus estimate	EEPH report: 33% less than 3 bed semi estimate	Assumed already part of major works	EEPH report: Mid-point 'make good' cost for a single property	Assumed already part of major works	EEPH report: Mid-point 'make good' cost for a single property						
Household time cost			Assumed already part of major works	ECOFYS report: Mid-point between the high and low estimates reported for household time.	Assumed already part of major works	ECOFYS report: Mid-point between the high and low estimates reported for household time.						
Disruption			Assumed already part of major works	ECOFYS report: mid-point. Includes financial costs behind survey, protective covers and temporary	Assumed already part of major works	ECOFYS report: mid point. Includes financial costs behind survey, protective covers and temporary						

				accommodation costs		accommodation costs						
Loss of floor space					ECOFYS report: mid-point between zero cost impact on floor space and max estimate	ECOFYS report: mid-point between zero cost impact on floor space and max estimate						
Annual Energy saved (kWh)	**DECC calculations**	**DECC calculations**	**DECC calculations**	**DECC calculations**	**DECC calculations**	**DECC calculations**	**DECC calculations**	**DECC calculations**	**DECC calculations**	**Nera report**	**Nera report**	**Nera report**
Energy consumed (kWh)										**Nera report**	**Nera report**	
Comfort taken (%)	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT	Consistent with CERT

Assumptions for sensitivities

Table 7: Low estimates

Central assumptions underlying the table	**LA external SWI**		**Private external SWI to U=0.35 W/m2K**		**Private internal SWI to U=0.35 W/m2K**		**Loft top ups**		**CWI**	**GSHP**	**ASHP**	**Solar thermal**
	3 bed semi	**Flats**	**During major renovation**	**Individual installation**	**During major renovation**	**Individual installation**	**Professional**	**DIY**	**Hard**			
Life time (yrs)	**36**	**36**	**36**	**36**	**36**	**36**	**42**	**42**	**42**	**23**	**18**	**20**

Installation cost (£)[72]	**4500**	**3000**	**7000**	**7000**	**4500**	**4500**	**268**	**100**	**1500**	**7346**	**9400**	**4194**
Maintenance costs (£)[73]												
Admin costs (% of installation)[74]												
Household costs (£) of which:	1200	800	0	3000	0	1077	31	150	150	2163	525	525

Table 8: High estimates

Central assumptions underlying the table	**LA external SWI**		**Private external SWI to U=0.35 W/m2K**		**Private internal SWI to U=0.35 W/m2K**		**Loft top ups**		**CWI**	**GSHP**	**ASHP**	**Solar thermal**
	3 bed semi	**Flats**	**During major renovation**	**Individual installation**	**During major renovation**	**Individual installation**	**Professional**	**DIY**	**Hard**			
Life time (yrs)	**36**	**36**	**36**	**36**	**36**	**36**	**42**	**42**	**42**	**23**	**18**	**20**
Installation cost (£)[75]	**5100**	**3320**	**8200**	**8200**	**5500**	**5500**	**297**	**156**	**1740**	**16030**	**11760**	**4194**
Maintenance costs (£)												
Admin costs (% of installation)												
Household costs (£) of which:	**1800**	**1200**	**0**	**7020**	**6800**	**12654**	**221**	**180**	**190**	**2163**	**525**	**525**

[72] See learning table, later in this document, for detail on the cost of installation for private solid wall with time. In addition the counterfactual for external collide wall is that walls will receive a re-rendering when appropriate whether solid wall installation has been installed or not.

[73] Maintenance costs are assumed to be the same across sensitivities

[74] See administration annex for sensitive's around admin costs

[75] See learning table, later in this document, for detail on the cost of installation for private solid wall with time. In addition the counterfactual for external collide wall is that walls will receive a re-rendering when appropriate whether solid wall installation has been installed or not.

Annex 3 – Administration costs

The administration costs associated with the policy options are extremely uncertain, with very little evidence available to inform this analysis. However, the options are sufficiently different in terms of their administrative characteristics to warrant an approach that distinguishes between them. The table at the end of this annex presents the figures used in this initial assessment of impacts. It is preceded by a discussion of the approach used to calculate them.

The administration costs account for:

- Planning
- Reporting compliance
- Setting up and managing budgets and contracts for delivery
- Coordinating with Central Government
- Coordinating with partners (i.e. suppliers and local authorities)
- Marketing and Search costs (will be passed on to suppliers and LAs but often directly borne by sub contractors)

Evidence and assumptions made in previous assessments

Eoin Lees[76] identified administration and search costs faced by Suppliers in respect of administering the EECs scheme. A figure of 18% is quoted in a presentation made to Ofgem in 2009.[77] A reasonable assumption based on anecdotal information is that most of these are in respect of the head office administrative burden, e.g. managing contracts, reporting compliance. So a minority would be likely to be from marketing and search and other costs. It is important to note that another set of marketing and search costs are being borne by subcontractors and local authorities, however, no reliable estimate exists of these.

Some evidence from the UK and US (not published) suggests that a regional franchise could face initially high overheads up to 40%, possibly falling with experience to a lower level similar to the figure quoted in Eoin Lees.

The Cert Extension Impact Assessment[78], published on 21 December 2009, uses an estimate of £2.2 Billion for Energy Suppliers overhead costs, this represents a proportion of 18.5% on top of the other costs faced by suppliers. No estimate of overheads of subcontractors is made.

[76] Eoin Lees Energy: Sustainable Energy Consultant

[77] http://www.ofgem.gov.uk/Sustainability/Environment/Policy/EnvAdvGrp/Documents1/Eoin%20Lees%20EEC2%20evaluation%20presentation.pdf

[78] http://www.decc.gov.uk/en/content/cms/consultations/cert_ext/cert_ext.aspx

Discussion of approach used in this initial assessment of impacts

The scale of overheads would most likely remain highly significant with a supplier obligation or alternative mechanism in place to 2020.

Arguably, the size of search and coordination costs will decline in direct proportion to the increasing value of the installations under consideration (installations will be much more expensive in the future – by a factor of ten or more). On the other hand, more analysis and preparation may be required before each potential installation can be deemed feasible and go ahead – (as each installation will be significantly more complex). The effort required to find suitable targets is likely to increase to the extent that consumers may need to commit to larger measures with greater disturbance costs.

Current published data is not very helpful in quantifying total overhead costs, the Eoin Lees work mentioned above is likely to be an underestimate of the total because it excludes overhead costs experienced by subcontractors and LAs working with suppliers. However, in the absence of further evidence it is advised that, as a central estimate, we assume this continues (at 18% overhead costs - on top of other costs facing suppliers) in the case of the partnership.

Given the degree of uncertainty around them, adopting a sensitivity approach to overhead costs has been taken. A 50% upper and 25% lower sensitivity (around the central estimates) is presented in the table below. An asymmetric approach is taken because the central estimates are based on a value (from the Eoin Lees work) that excludes parts of the costs.

Energy company – local authority partnership model – It is assumed that LAs will not be mandated to take part (which would probably increase costs). It is reasonable to assume that overhead costs are similar to those believed to pertain under the existing arrangements, although they could be lower owing to reduced search costs.

Energy company only option (no LA involvement) – There would not be start up costs (to build up experience) with this approach, because energy companies are already very experienced in implementing existing arrangements in the sector. However, energy companies, working on their own, would be expected to face higher search costs than they might in combination with LAs.

Regional Franchise (no LA involvement) – New franchisees would be expected to face high initial costs that would diminish with time. We might expect a drive to reduce costs, e.g. by mass roll out of particular measures, but the monopoly nature of the arrangement could counteract this trend to some extent.

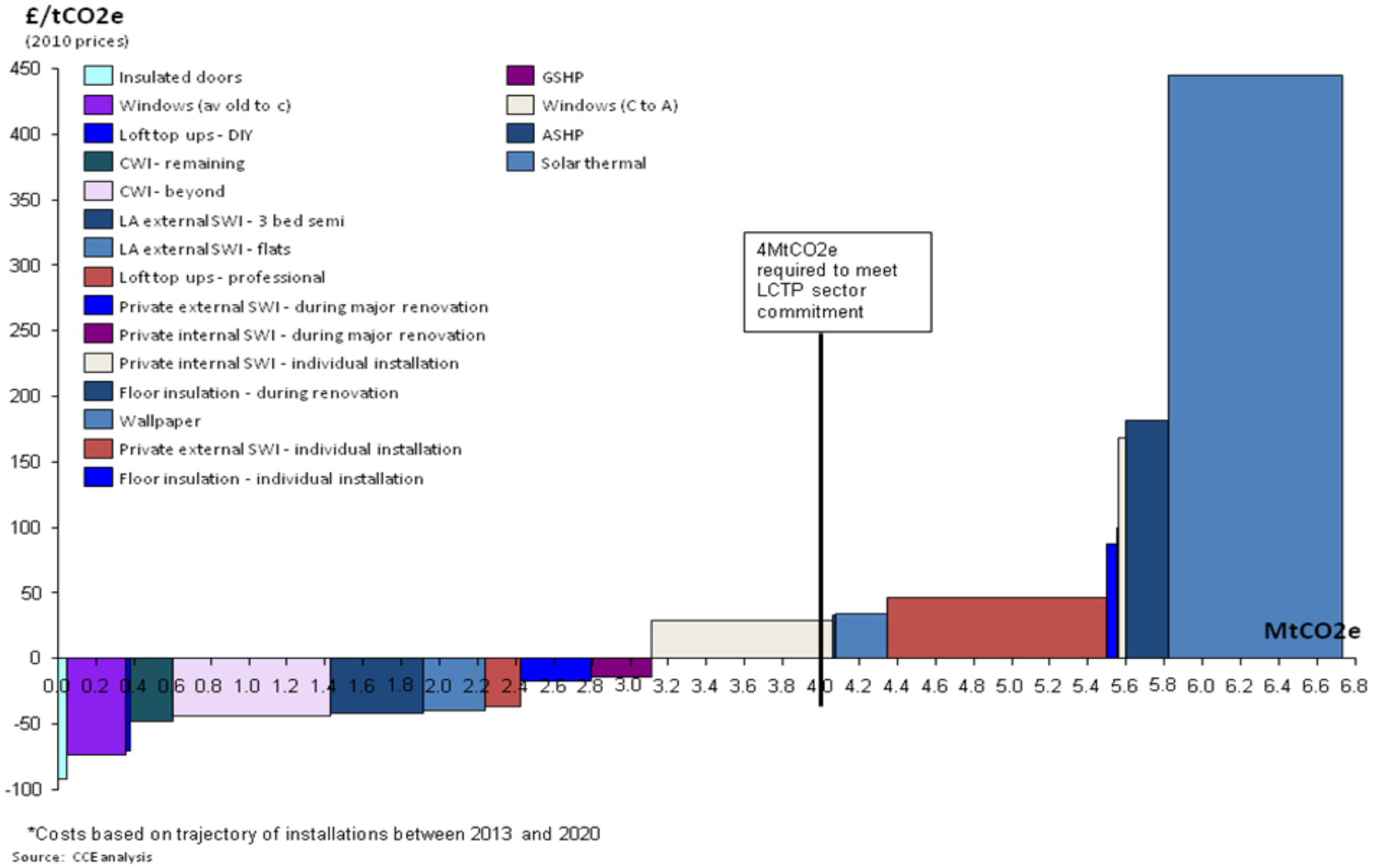
Local Authority only approach – In the table below, the main driver of the costs is the assumption that there are very large extra costs associated with nearly 400 LAs carrying

out their own planning, reporting, managing and coordinating – compared with a situation led by the 6 large energy suppliers, or around ten regional franchises. Initial costs are assumed to be higher than costs later on because most LAs will probably need to set up an energy-efficiency delivery-operation from scratch, and so will face a steep learning curve. Costs would be expected to be modified by reduced search costs; control of local housing would allow greater economies in identifying suitable properties for the delivery of energy efficiency investments, and local knowledge might reduce search costs in finding appropriate installations in the private sector stock too.

Recommended Overheads for February IA (% of installed cost of measures)			
	Y1	Yr5	Yr10
Energy company Led Approach – Upper	30	30	30
Energy company Led Approach – Central	**20**	**20**	**20**
Energy company Led Approach – Lower	15	15	15
Local Authority/company partnership – Upper	27	27	27
Local Authority/company partnership – Central	**18**	**18**	**18**
Local Authority/company partnership – Lower	13	13	13
Regional Franchise – Upper	45	38	32
Regional Franchise – Central	**30**	**25**	**21**
Regional Franchise – Lower	22	19	16
Local Authority Led – Upper	60	53	45
Local Authority Led – Central	**40**	**35**	**30**
Local Authority Led – Lower	30	28	22

Annex 4 – MACC for additional measures

MACC in 2020 for greater range of measures that could be included in delivery*



*Costs based on trajectory of installations between 2013 and 2020

Source: CCE analysis

Input assumptions

Central assumptions[79]	Wall paper	Insulated doors	Party walls	Floor	Floor during renovation	Windows (C to A rated)[80]	Windows (old average to C)	CWI – beyond target
Life time (yrs)	**36**	**30**	**42**	**36**	**36**	**20**	**20**	**42**
Installation cost (£)[81]	**2000**	**40**	**unknown**	**800**	**800**	**212**	**450**	**1620**
Maintenance costs (£)	0	0	0	0	0	0		0
Admin costs (% of installation)	18%	18%	18%	18%	18%	18%	18%	18%
Household costs (£)[82] of which:	**1500**	**75**	**170[83]**	**355**	**0**	**35**	**35**	**170**
'make good'	1500							
Household time cost								
Disruption								
Loss of floor space								
Estimate of annual energy saved, after correction for underperformance of insulation but before comfort correction – Gas heated home (kWh/year)[84]	**3707**	**592**	**911**	**954**	**954**	**250**	**2147**	**3604**

[79] These are just the central assumptions being used – sensitivity analysis will be undertaken to assume high and low bounds for the cost elements.
[80] The counterfactual is that new double glazed windows are being installed, this saving considers the impact of installing an A rated window rather than a C rated window.
[81] See learning table (below) for detail on the cost of installation for private solid wall with time. In addition the counterfactual for external collide wall is that walls will receive a re-rendering when appropriate whether solid wall installation has been installed or not.
[82] These costs are derived from the ECOFYS report [http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/analysis/analysis.aspx] for the majority or measures, although separate assumptions for 'making good' are taken from the EEPH Purple report.
[83] The hidden costs is assumed to be the same as hard cavity wall insulation
[84] The annual energy saving is given for gas centrally heated homes, unless otherwise stated, however the saving may vary across fuel types.

Comfort taken (%)	15	15	15	15	15	15	15	15

Feasible potential for insulation measures

	Wall paper	Insulated doors	Party walls	Floor	Floor during renovation	Windows (C to A rated)	Windows (av old to C rated)	CWI – beyond target
Feasible potential 2013 – 2020	**0.5m[85]**	**0.5m[86]**	**Unknown[87]**	**0.385m[88]**	**0.12m[89]**	**1m[90]**	**1m**	**1.75m[91]**

Learning rates

Only wall paper is assumed to have a cost reduction with time due to learning (this is the same as the learning rate for SWI). The other measures are assumed to have a strong market position already and therefore there are no longer any learning improvements.

Indicative illustration of measures

[85] The number of installations depends on government incentives and consumer up take. Provisionally this is assumed to be the same as the internal SWI during major renovations.

[86] There is the technical potential to install 20m, however it is assumed that this installation may only be done whilst installing windows.

[87] There is currently the technical potential of 5m installations, but at the moment a market does not exist (and so we have no cost estimates) therefore the feasible potential cannot be estimated.

[88] Currently 10,000 floors are insulated a year, these measures tend to be quite unpopular. However there is the technical potential for 10m installations. If we assume that the appropriate incentives are put in place to ensure that this type of insulation is followed whilst undergoing major renovations to a home then a similar number of installations could be completed as private internal SWI.

[89] based on the annex 3 of the building regs IA which suggests that 15,000 floors are replaced each year – this maybe an underestimate that does not consider simple things like replacing a carp

[90] The technical potential to upgrade insulated windows from a C to an A is 20m, however installations will only be made when someone is already replacing their windows and they are incentivised to upgrade this replacement so that A rated windows are installed rather than C rated windows. Therefore the feasible potential is a proportion of the existing window replacement rate

[91] There are potentially 3.5m 'hard' to treat cavities, however it is unknown at the moment what the distribution of hard to almost impossible is for this group and therefore the feasible potential could be significantly lower. It is assumed that the same annual installation rate for the remaining 'easy' cavities continues with 'hard' between 2015 and 2020.

The table below suggests the total costs and benefits of delivering the number of installations considered in the feasible potential assumptions table, spread over the period (20013 – 2020) as suggested in the trajectories table, for each measure. Thus the results are not for an individual measure but the feasible potential over the period. Assumptions discussed on cost and benefit inputs, learning rates, feasible potential and installation trajectories are run through a model built by DECC. The costs are calculated using the number of installations each year as set out in the trajectories table and the input costs, including changes with time for installation costs as suggested in the learning rates table. The benefits are calculated using the kWh energy savings, which are inserted into the inter-departmental analysts group (IAG) tool kit developed by DECC[92] to monetise the energy savings to society as well as the carbon, air quality and comfort savings. All the numbers in the table below are in 2010 prices (future numbers have been discounted back using a discount rate of 3.5%). Using all the costs and benefits the carbon cost effectiveness for installing the feasible potential of each measure can be calculated. The cost effectiveness indicator and the annual carbon saved in 2020 are used to produce the MACC.

(2013-20, **£m** 2010 prices)	**Wall paper**	**Insulated doors**	**Party walls**	**Floor**	**Floor during renovation**	**Windows (C to A rated)**	**Windows (av old to C rated)**	**CWI – beyond target**
Costs (2013-20, **£m** 2010 prices)								
Installation costs	£626	£16		£270	£77	£170	£361	£2,239
Administration costs	£113	£3		£49	£14	£31	£65	£403
Household costs[93]	£570	£28		£113	£0	£27	£27	£222
Total costs[94]	**£1,309**	**£47**		**£431**	**£91**	**£227**	**£453**	**£2,864**
Society Benefits (2013-20, **£m** 2010 prices)								
Energy savings for society (non-traded)	£582	£93		£140	£40	£60	£514	£2,031
Energy savings for society (Traded)	£179	£29		£44	£13	£17	£150	£695

[92] http://www.decc.gov.uk/en/content/cms/statistics/analysts_group/analysts_group.aspx

[93] Includes the 'make good' costs and disruption costs and loss of floor space

[94] The total cost may not equal the above costs as some of the costs are spread over different numbers of years and therefore the adding them all together affects the NPV differently.

Carbon savings (Non-traded)	£348	£56		£93	£26	£29	£253	£1,411
Carbon savings (Traded)	£32	£5		£7	£2	£4	£32	£108
Total air quality impact	£23	£4		£6	£2	£2	£19	£85
Comfort	£219	£35		£53	£15	£23	£194	£1,319
Total benefits	**£1,383**	**£221**		**£342**	**£98**	**£135**	**£1,161**	**£5,648**
Net benefit (2013-20, **£m** 2010 prices)	£74	£173		-£89	£7	-£92	£708	£2,784
CEI for non-traded sector	**34.03**	**-91.77**		**87.64**	**33.16**	**167.74**	**-73.22**	**-43.73**
	(43.27)	(43.27)		(44.62)	(44.62)	(40.63)	(40.63)	(44.93)
Non-traded Carbon impact in 2020 (tonnes CO2)	-0.27	-0.04		-0.06	-0.02	-0.04	-0.31	-0.82
Traded Carbon impact in 2020 (tonnes CO2)	-0.05	-0.01		-0.01	0.00	-0.01	-0.06	-0.18
Non-traded Life time carbon impact (tonneCO2)	-8.04	-1.28		-2.08	-0.59	-0.72	-6.22	-31.40
Traded life time carbon impact (tonnesCO2)	-1.06	-0.17		-0.23	-0.07	-0.13	-1.12	-3.51

Annex 5 – detailed results

Energy company and local authority partnership

	Measures installed (millions)
CWI easy	0
Loft insulation professional (from > 60mm)	2
Solar thermal	0
External SWI	0.68
Internal SWI	0.58
Internal SWI – with major renovation	0.19
GSHP	0
ASHP	0
LA ESWI 3 bed semi	0.3
LA ESWI flat	0.3
External SWI – with major renovation	0.23
CWI hard	0.47
DIY loft >60mm	0.3

£bn	Low	Central	High
Costs (NPV £bn 2010)			
Installation costs	£9.12	£9.91	£10.70
Administration costs	£1.19	£1.78	£2.89
Household costs[95]	£2.61	£6.91	£11.21
Total costs[96]	**£12.92**	**£18.61**	**£24.80**
Society Benefits (NPV £bn 2010)			
Energy savings for society (non-traded)	£12.96	£9.82	£5.09
Energy savings for society (Traded)	£4.36	£3.25	£2.26

[95] Includes the 'make good' costs and disruption costs and loss of floor space

[96] The total cost may not equal the above costs as some of the costs are spread over different numbers of years and therefore the adding them all together affects the NPV differently.

Carbon savings (Non-traded)	£9.81	£6.54	£3.27
Carbon savings (Traded)	£0.74	£0.52	£0.27
Total air quality impact	£0.40	£0.40	£0.40
Comfort	£4.93	£4.07	£2.90
Total benefits	**£33.20**	**£24.60**	**£14.19**
Net benefit (NPV £bn 2010)	**£20.28**	**£5.99**	**-£10.61**
Cost Effectiveness Indicator for non-traded sector	**-35.13**	**3.72**	**46.04**
	(44.69)	(44.69)	(44.69)
Non-traded Carbon impact in 2020 (tonnes CO2)	-4.00	-4.00	-4.00
Traded Carbon impact in 2020 (tonnes CO2)	-0.84	-0.84	-0.84
Non-traded Life time carbon impact (tonneCO2)	-146.30	-146.30	-146.30
Traded life time carbon impact (tonnesCO2)	-17.13	-17.13	-17.13

Energy companies only (no LA involvement)

	Measures installed (millions)
CWI easy	0
Loft insulation professional (from > 60mm)	2
Solar thermal	1.79
External SWI	0.7
Internal SWI	0.58
Internal SWI – with major renovation	0.19
GSHP	0.002

ASHP	0.12
LA ESWI 3 bed semi	0
LA ESWI flat	0
External SWI – with major renovation	0.23
CWI hard	0.47
DIY loft >60mm	0.3

£bn	Low	Central	High
Costs (NPV £bn 2010)			
Installation costs	£14.80	£15.60	£16.40
Administration costs	£2.22	£3.12	£4.92
Household costs	£2.95	£7.16	£11.38
Total costs	**£19.98**	**£25.90**	**£32.72**
Society Benefits (NPV £bn 2010)			
Energy savings for society (non-traded)	£12.46	£9.42	£5.03
Energy savings for society (Traded)	£6.93	£5.15	£3.57
Carbon savings (Non-traded)	£9.47	£6.31	£3.16
Carbon savings (Traded)	£1.15	£0.80	£0.42
Total air quality impact	£0.61	£0.61	£0.61
Comfort	£4.03	£3.33	£2.37
Total benefits	**£34.64**	**£25.63**	**£15.15**
Net benefit (NPV £bn 2010)	**£14.66**	**-£0.27**	**-£17.57**
Cost Effectiveness indicator for non-traded sector	**4.66**	**46.46**	**94.62**

	(44.58)	(44.58)	(44.58)
Non-traded Carbon impact in 2020 (tonnes CO2)	-4.00	-4.00	-4.00
Traded Carbon impact in 2020 (tonnes CO2)	-1.27	-1.27	-1.27
Non-traded Life time carbon impact (tonneCO2)	-141.62	-141.62	-141.62
Traded life time carbon impact (tonnesCO2)	-26.41	-26.41	-26.41

Regional franchise

	Measures installed (millions)
CWI easy	0
Loft insulation professional (from > 60mm)	2
Solar thermal	1.79
External SWI	0.7
Internal SWI	0.58
Internal SWI – with major renovation	0.19
GSHP	0.002
ASHP	0.12
LA ESWI 3 bed semi	0
LA ESWI flat	0
External SWI – with major renovation	0.23
CWI hard	0.47
DIY loft >60mm	0.3

£bn	Low	Central	High
Costs (NPV £bn 2010)			

Installation costs	£14.80	£15.60	£16.40
Administration costs	£2.87	£4.04	£6.43
Household costs	£2.95	£7.16	£11.38
Total costs	**£20.62**	**£26.82**	**£34.22**
Society Benefits (NPV £bn 2010)			
Energy savings for society (non-traded)	£12.46	£9.42	£5.03
Energy savings for society (Traded)	£6.93	£5.15	£3.57
Carbon savings (Non-traded)	£9.47	£6.31	£3.16
Carbon savings (Traded)	£1.15	£0.80	£0.42
Total air quality impact	£0.61	£0.61	£0.61
Comfort	£4.03	£3.33	£2.37
Total benefits	**£34.64**	**£25.63**	**£15.15**
Net benefit (NPV £bn 2010)	**£14.02**	**-£1.19**	**-£19.07**
Cost effectiveness indicator for non-traded sector	**9.23**	**52.98**	**105.27**
	(44.58)	(44.58)	(44.58)
Non-traded Carbon impact in 2020 (tonnes CO2)	-4.00	-4.00	-4.00
Traded Carbon impact in 2020 (tonnes CO2)	-1.27	-1.27	-1.27
Non-traded Life time carbon impact (tonneCO2)	-141.62	-141.62	-141.62
Traded life time carbon impact (tonnesCO2)	-26.41	-26.41	-26.41

Central Delivery

	Measures installed (millions)
CWI easy	0
Loft insulation professional (from > 60mm)	2
Solar thermal	1.79
External SWI	0.7
Internal SWI	0.58
Internal SWI – with major renovation	0.19
GSHP	0.002
ASHP	0.12
LA ESWI 3 bed semi	0
LA ESWI flat	0
External SWI – with major renovation	0.23
CWI hard	0.47
DIY loft >60mm	0.3

£bn	Low	Central	High
Costs (NPV £bn 2010)			
Installation costs	£15.60	£15.60	£15.60
Administration costs	£3.43	£4.68	£7.02
Household costs	£7.16	£7.16	£7.16
Total costs	**£26.21**	**£27.46**	**£29.80**
Society Benefits (NPV £bn 2010)			
Energy savings for society (non-traded)	£12.46	£9.42	£5.03
Energy savings for society (Traded)	£6.93	£5.15	£3.57

Carbon savings (Non-traded)	£9.47	£6.31	£3.16
Carbon savings (Traded)	£1.15	£0.80	£0.42
Total air quality impact	£0.61	£0.61	£0.61
Comfort	£4.03	£3.33	£2.37
Total benefits	**£34.64**	**£25.63**	**£15.15**
Net benefit (NPV £bn 2010)	**£8.44**	**-£1.83**	**-£14.65**
Cost effectiveness indicator for non-traded sector	**7.30**	**57.48**	**125.70**
	(44.58)	(44.58)	(44.58)
Non-traded Carbon impact in 2020 (tonnes CO2)	-4.00	-4.00	-4.00
Traded Carbon impact in 2020 (tonnes CO2)	-1.27	-1.27	-1.27
Non-traded Life time carbon impact (tonneCO2)	-141.62	-141.62	-141.62
Traded life time carbon impact (tonnesCO2)	-26.41	-26.41	-26.41

Local authority led

	Measures installed (millions)
CWI easy	0
Loft insulation professional (from > 60mm)	2
Solar thermal	0
External SWI	0.68
Internal SWI	0.58

Internal SWI – with major renovation	0.19
GSHP	0
ASHP	0
LA ESWI 3 bed semi	0.3
LA ESWI flat	0.3
External SWI – with major renovation	0.23
CWI hard	0.47
DIY loft >60mm	0.3

£bn	Low	Central	High
Costs (NPV £bn 2010)			
Installation costs	£9.12	£9.91	£10.70
Administration costs	£2.51	£3.58	£5.81
Household costs[97]	£2.61	£6.91	£11.21
Total costs[98]	**£14.24**	**£20.40**	**£27.59**
Society Benefits (NPV £bn 2010)			
Energy savings for society (non-traded)	£12.96	£9.82	£5.09
Energy savings for society (Traded)	£4.36	£3.25	£2.26
Carbon savings (Non-traded)	£9.81	£6.54	£3.27
Carbon savings (Traded)	£0.74	£0.52	£0.27
Total air quality impact	£0.40	£0.40	£0.40
Comfort	£4.93	£4.07	£2.90
Total benefits	**£33.20**	**£24.60**	**£14.19**
Net benefit (NPV £bn	**£18.96**	**£4.20**	**-£13.40**

[97] Includes the 'make good' costs and disruption costs and loss of floor space

[98] The total cost may not equal the above costs as some of the costs are spread over different numbers of years and therefore the adding them all together affects the NPV differently.

2010)			
Cost Effectiveness Indicator for non-traded sector	**-26.09**	**15.99**	**65.12**
	(44.69)	(44.69)	(44.69)
Non-traded Carbon impact in 2020 (tonnes CO2)	-4.00	-4.00	-4.00
Traded Carbon impact in 2020 (tonnes CO2)	-0.84	-0.84	-0.84
Non-traded Life time carbon impact (tonneCO2)	-146.30	-146.30	-146.30
Traded life time carbon impact (tonnesCO2)	-17.13	-17.13	-17.13

Annex 6: Supply side constraints

It should be noted that there may be supply side constraints in the insulation and renewable heat industries as the above estimates for installation represent large increases on the current installation rates for the more expensive measures. The capacity of this market is currently unknown and therefore we cannot assess the limit of the market. If the Government obligates action that involves more measures than the industry can currently provide then (if the increase in demand is pushed up rapidly) the costs of installing the measures may need to increase to entice more companies into the market. Such constraints are unlikely to be so problematic for the loft and cavity supply chain as the annual installation levels will begin to decrease as the remaining lofts and cavities (where practical) are filled. However it is assumed that the remaining cavities will be more costly to fill as they will either be physically more problematic or more difficult to engage the householders to address.