The Costs of the Energy Company Obligation
Prepared for Energy UK

21 November 2012
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Executive Summary

Overview and Results

The Energy Company Obligation (ECO) is an obligation placed on the six largest energy suppliers to install energy efficiency measures in the homes of domestic customers. The Department of Energy and Climate Change (DECC) estimated that the ECO would cost energy suppliers £1,300 million per year (about £53 per customer per annum). Energy UK commissioned NERA to review DECC’s modelling approach and to provide an alternative estimate of the programme cost.

We built a simplified model which replicates DECC’s analysis and tests the impact of DECC’s assumptions on its cost estimate. Our analysis suggests that correcting unreliable assumptions in DECC’s modelling would raise the estimated cost of the programme to around £1,700 million per annum (ca. £69 per customer per annum).

In addition, there may be a problem with DECC’s reliance on a “stated preference” study, a form of customer research which is known to suffer from a bias in the case of environmental programmes (i.e. the “warm glow” of appearing to favour good works leads people to state that they will pay more for environmental programmes than they will pay in reality). DECC has not published the study, so it is difficult to quantify precisely the impact of any bias inherent in the answers. A simple and transparent sensitivity is to assume that respondents might have ignored the “hassle costs” that an ECO project would impose on them. Adjusting DECC’s model of customer preferences by a comparable amount raises the cost of the programme further still, to around £2,350 million per annum (ca. £94 per customer per annum), but the final cost could be much higher.

This analysis does not give upper and lower bounds for the costs of the ECO. Other risk factors and untested assumptions may cause the final cost of ECO to exceed our estimates.

Programme Components

The ECO consists of an obligation to surrender a given number of “ECO Points” between January 2013 and March 2015. Energy suppliers can earn ECO points from four (overlapping) schemes:

- **Affordable Warmth (AW):** an obligation to help customers save £4.2 billion on their “notional” energy bills using the full range of energy efficiency measures;
- **Carbon Savings Obligation (CSO):** an obligation to reduce lifetime carbon emissions from private households by 20.9 MtCO2 (20.9 million tonnes of carbon dioxide) using a restricted range of relatively expensive insulation measures (solid wall insulation and “hard to treat” cavity wall insulation);
- **Carbon Savings Communities (CSC):** an obligation to reduce emissions by 6.8 MtCO2 by insulating any housing within defined low income areas, for which suppliers may use a wide range of insulation measures; and
- **Rural Safeguard (RS):** an obligation on each supplier to meet at least 15% of its CSC obligation by serving rural households.
DECC assumes that energy companies pay the full cost of insulation installed under the Affordable Warmth scheme. Under the CSO, CSC and RS, domestic customers pay some of the costs of their insulation. However, they are eligible for the “Green Deal”, whereby they take out a loan which they repay through a surcharge on their electricity bills. Their contribution is capped at a level intended to ensure they save money overall. Energy suppliers pay the rest.

**DECC Modelling of the Costs of ECO**

DECC estimated the costs of Affordable Warmth using an “Affordable Warmth Model” and the costs of the CSO, CSC and RS carbon targets using a “Green Deal Household Model” (GDH Model). The GDH Model estimates the residual costs of the CSO, CSC and RS faced by suppliers after deducting the customer contribution. DECC assumes that energy suppliers will select opportunities to invest in order of their cost effectiveness. However, the results of both models depend crucially on assumptions about the energy suppliers’ costs of finding opportunities to invest, the cost of installing the insulation and consumers’ reactions.

DECC has not published its analysis in full, or the models used to estimate the cost of ECO. Where DECC published its assumptions, we have compared them with information available in the public domain and obtained from the energy suppliers. Our review uncovered evidence that DECC:

- *under*-estimated the costs of finding customers eligible for support under the programme;
- *over*-estimated the frequency with which customers consider whether or not to install insulation; and
- *over*-estimated opportunities for bundling insulation measures together (in particular, it may be harder to find households without loft insulation).

As a result of these three biases, DECC’s analysis under-estimates the cost of installing insulation, over-estimates the amount that customers will be willing to pay for it and, therefore, underestimates the total cost to energy suppliers of subsidising the programme. Other assumptions in DECC’s analysis are subject to a margin of error in either direction.

DECC’s estimate of the costs of the carbon targets (CSO, CSC and RS) uses a measure of customers’ “willingness to pay” for insulation in their homes derived from a stated preference study. Stated preference studies are known to over-value environmentally friendly policies, as respondents tend to be favourable towards them (a phenomenon known as the “warm glow” bias). DECC’s own consultants, Element Energy, explained that the output of the stated preference study had not been calibrated to historical data and that they “strongly recommend” the collection of further data on uptake of the programme in the real world. DECC has chosen instead to proceed on the basis of the results from this study.
Results After Correction of DECC’s Inputs

DECC has not published either the stated preference study or the models underlying its cost estimate for the ECO programme. We therefore built our own simplified version of DECC’s GDH Model and tested the impact of changing DECC’s assumptions on the cost of the CSO – by far the largest component of the ECO programme, accounting for about 60% of the total cost of the programme according to DECC.

We first examined the effect of assuming that the technical potential for insulation is systematically less than DECC assumes. Given the information in DECC’s publications, we captured a reduction in technical potential as a tightening of the definition of “hard to treat” cavity walls. This change substantially raised the cost of the programme. Other errors in modelling technical potential and participation by household type (such as over-estimating the willingness of large home owners to participate, and hence the average CO2 reduction per household) would have a similar effect.

We studied in detail the effect on the cost of the CSO of adopting more defensible assumptions (i.e. the historical figures) on customers’ “decision making frequency, the “search” costs of identifying eligible customers and the opportunity to install a “bundle” of insulation measures at one property. The other obligations (AW, CSC and RS) appear to be less responsive overall to changes in DECC’s main assumptions. In the absence of more detailed information, we assumed that the cost of these programmes was half as responsive to such changes as the cost of the CSO. We found that correcting these assumptions in DECC’s modelling would cause the cost of the ECO programme to rise to £1,700 million per annum (ca. £69 per customer per annum).

We also conducted a simple sensitivity to remove a potential bias in the stated preference survey, by assuming that willingness to pay was 10% lower. This is a simplistic adjustment, but it happens to correspond closely to assuming that respondents to the survey ignored the “hassle costs” they will face during the process of installation. If DECC’s estimate of customers’ willingness to pay for insulation ignores the cost of the “hassle” that customers face before and during installation of insulation measures, energy suppliers will have to give customers a bigger subsidy by paying more for an ECO point. Our adjustment of willingness to pay corrects approximately for the potential bias of omitting “hassle costs”. This one change raises the cost of the programme further, to £2,350 million per annum (ca. £94 per customer per annum), but the final cost could be higher still.

A reduction in technical potential (as discussed above) would raise this cost. Risks surrounding energy prices, interest rates and other untested assumptions mean that the true cost of the ECO programme could be even higher (although these risks are symmetric). A big unknown is the amount that customers will contribute towards the cost of each project. If in practice customers do not offer to finance the predicted share of project costs (directly or through the new Green Deal), the cost of the ECO programme borne by suppliers and included in customer tariffs will rise substantially.

An alternative yardstick for the cost of the ECO programme is the cost per tonne of reducing CO2 emissions. The European Union Emission Trading Scheme (EU ETS) offers the chance to purchase and sequester allowances to emit CO2, a kind of “virtual Carbon Capture and Storage” (vCCS) which also reduces emissions of CO2. The current price of these
allowances is around £6.50/tCO\textsubscript{2}.\textsuperscript{1} On this basis, DECC’s own estimated cost of the CSO is, at £77/tCO\textsubscript{2}, over 12 times as expensive as vCCS. Our estimate of the cost of the CSO programme would be even higher – between 15 and 25 times the cost of vCCS. Similarly, the cost of the AW, CSC and RS schemes would be around 10 times the cost of vCCS.

At a net cost to consumers of £94 per annum, therefore, we conclude that the ECO programme would be an expensive way to reduce emissions of carbon dioxide.

\textsuperscript{1} Source: PointCarbon, http://www.pointcarbon.com/, downloaded 6 November 2012. Converted from €8.22/MtCO\textsubscript{2} using an exchange rate of £0.80/€. Both the cost of an ECO point and the cost of vCCS represent marginal costs to society of reducing CO\textsubscript{2} emissions. ECO points are even expensive relative to the £54/tCO\textsubscript{2} value of non-traded CO\textsubscript{2} emissions in 2013 stated by DECC in \textit{A brief guide to the carbon valuation methodology for UK policy appraisal}, October 2011, p. 3.
1. Introduction

The Energy Company Obligation (ECO) is a new obligation on the six largest energy suppliers serving domestic customers in Great Britain. Under the scheme, the energy suppliers will be required to register sufficient energy efficiency and insulation projects to meet a carbon and bill-reductions target. The Department of Energy and Climate Change’s (DECC’s) Final Impact Assessment includes a central estimate for the cost of the ECO to energy suppliers of £1.3bn per annum between Jan-2013 and March-2015.² DECC ran sensitivities illustrating the possibility that components of the ECO programme could cost 1.5 times as much per ECO point as its central estimate. However, DECC failed to draw the implications for the cost of the ECO programme as a whole.³

Energy UK asked NERA to scrutinise DECC’s cost assessment and provide, if appropriate, an alternative assessment. Our analysis draws on research from data in the public domain, conversations with the energy suppliers and from a confidential and commercially sensitive survey that the suppliers completed to provide detailed alternative assumptions to calculate the cost of ECO. DECC has not published the full details of its model, so it was not possible to calculate the costs of the ECO using DECC’s exact framework. A full independent modelling exercise from the ground up is outside the scope of this report. We provide an independent assessment of the costs of ECO using a simplified model based on what we know about DECC’s own analysis.

This report proceeds as follows:

- Section 2 provides background on the Energy Company Obligation;
- Section 3 sets out how energy companies will procure ECO points in practice;
- Section 4 scrutinises DECC’s modelling assumptions and provides estimates of the costs of the components of the process of obtaining ECO points;
- Section 5 analyses the impact on the costs of the ECO of changing DECC’s modelling assumptions using alternative estimates; and
- Section 6 concludes.

Our analysis suggests that correcting unreliable assumptions in DECC’s modelling would raise the estimated cost of the programme to around £1,700 million per annum (ca. £70 per customer per annum).

In addition, there may be a problem with DECC’s reliance on a “stated preference” study, which are known to suffer from a bias in the case of environmental programmes (i.e. the “warm glow” of appearing to favour good works). DECC has not published the study, so it is difficult to quantify precisely the impact of any bias inherent in the answers. A simple and transparent sensitivity is to assume that respondents might have ignored the “hassle costs”

² DECC, Final Impact Assessment, 11 June 2012, page 84.
³ DECC ran a sensitivity to its modelling showing that the Carbon Savings Obligation component of the ECO would cost as much as 1.5 times its central estimate. DECC, Final Impact Assessment, 11 June 2012, page 59, Figure 22.
that an ECO project would impose on them. Adjusting DECC’s model of customer preferences by a comparable amount raises the cost of the programme further still, to around £2.350 million per annum (ca. £95 per customer per annum).

Even this analysis does not give upper and lower bounds for the costs of the ECO. Other risk factors and untested assumptions may cause the final cost of ECO to exceed our estimates.
2. **Background**

The Green Deal and Energy Company Obligation (ECO) are twin policies which seek to promote energy efficiency investments in Great Britain. The policies allow customers to pay for energy efficiency measures through savings in their energy bills, and to obtain subsidies to finance the installation of some these projects. The two policies are interdependent: the success of the Green Deal in financing customers’ installation of energy efficient measures is a primary driver of the costs energy suppliers will face in meeting their targets under the ECO. If the Green Deal is successful in encouraging customers to finance energy efficiency investments through their bill savings, then the resulting top-up that energy suppliers must provide will be small. Conversely, if the Green Deal does not significantly increase investment in different methods of insulation, energy suppliers will face large costs to make up this shortfall. Any costs the suppliers incur will have to be recovered through an increase in energy bills.

### 2.1. Introduction to the Green Deal

The Green Deal provides domestic and non-domestic customers with the option of financing insulation projects through a surcharge on their own energy bills.

For each property, the process of obtaining a Green Deal starts with an assessment of the potential for improving its insulation, and the customer’s estimated energy savings from installing superior insulation. In the domestic sector, energy savings will be estimated based in part on an “occupancy assessment” that informs customers whether their use is likely to be above or below the typical household. Following an assessment, customers may ask multiple insulation providers to offer them a “Green Deal Plan”. This plan sets out a quotation for installation, as well as the terms of the repayment, which takes the form of a charge added to the customer’s monthly energy bill. Charges levied under the Green Deal Plan must obey the “Golden Rule”, which requires that:

- The life of the repayment must be less than the expected life of the new installation;
- The charge in the first year must be less than the expected reduction in the bill due to the increase in energy efficiency; and
- The charge may rise no more than 2% per annum in nominal terms thereafter.

Green Deal financing is available for a broad range of measures, including all forms of loft insulation, cavity wall insulation (CWI), and solid wall insulation (SWI), without restriction.

### 2.2. Introduction to the ECO

The Energy Company Obligation (ECO) is an obligation placed on energy suppliers requiring them to fund additional insulation projects, which either cannot or will not be funded by domestic customers through the Green Deal alone. DECC proposes to divide the obligation

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between energy suppliers “on the basis of their share of the gas and electricity supplied”, with half the obligation allocated on the basis of electricity sales and half on the basis of gas sales. 6

The ECO consists of four strands, which we set out below.

- **Affordable Warmth**: an obligation to help households from low income groups, living in privately rented accommodation and identified through the benefits system. Energy suppliers face an obligation to save £4.2 billion on their customers’ “notional” energy bills by March 2015 and can satisfy the obligation using the full range of energy efficiency measures. 7

- **Carbon Savings Obligation (CSO)**: The obligation is to reduce lifetime carbon emissions from private households by 20.9 MtCO2 (megatonnes of carbon dioxide) between January 2013 and March 2015. 8 Only certain measures are eligible for recognition under the CSO including SWI and “hard-to-treat CWI”, as well as any thermal insulation measures packaged with SWI or hard-to-treat CWI. 9

- **Carbon Savings Communities (CSC)**: Energy suppliers can only satisfy the CSC by delivering insulation within defined low income areas (but not only to low income households within those areas). CSC allows energy suppliers to use the full range of insulation measures including all loft insulation and CWI. The CSC represents 20% of the total Carbon Savings Target (= CSO + CSC) and requires suppliers to reduce emissions by 6.8 MtCO2 between January 2013 and March 2015, 10 and

- **Rural Safeguard (RS)**: The Rural Safeguard is a “sub-obligation” nested within the CSC. The Rural Safeguard requires suppliers to meet at least 15% of their CSC obligation by serving rural households that are either (1) in receipt of benefits making them eligible for the Affordable Warmth subsidy or (2) in low income areas or in areas adjacent to low income areas. 11

Figure 2.1 provides an overview of these obligations and also the estimated costs of each programme, as stated by DECC.

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7 DECC, Final Impact Assessment, 11 June 2012, page 4 and 21. We assume that this means energy bill savings will be estimated by a standard procedure for each type of investment in each type of property, rather than measured ex post.
### 2.3. DECC's Estimated Costs

DECC estimates that the ECO will cost around £1.3bn per annum. To calculate this figure, DECC first assembles a list of the technical characteristics of the insulation market in Great Britain, including:

- the number of different types of insulation projects in Great Britain;
- generic costs of these projects; and
- the expected carbon savings/energy savings from these projects.

DECC then uses two models to estimate the costs of delivery: (1) the Affordable Warmth Model for AW and (2) the Green Deal Household Model for the CSO and CSC (which includes the RS).

In addition to the costs of delivering each measure, DECC estimates the administration costs for the programme as a whole. Below, we explain how DECC estimated the costs of each programme.

#### 2.3.1. Affordable Warmth Model

The Affordable Warmth Model simulates the delivery of the wide variety of energy efficiency measures eligible under the AW scheme (including improved heating). The model assesses the technical potential for installing a range of major insulation and efficiency measures. It then estimates how much each measure would cost and ranks projects in order of cost effectiveness for delivering a reduction in CO\(_2\) emissions. Allowing for the insulation...
installed under the Green Deal and Carbon Saving Targets, AW then picks the most cost effective combination of measures which achieve the target reduction in “notional” customer bills. The model allows for multiple measures to be installed in a single property, even when some of those measures would not be individually cost effective, if the measures are cost effective when modelled as a package. According to DECC, the total cost of the AW programme will be around £350 million per annum. This programme has no target CO₂ reduction attached to it.

### 2.3.2. Carbon Saving Obligation

DECC uses the Green Deal Household Model to estimate the cost of the CSO. The Green Deal Household Model models customer behaviour and willingness to invest in insulation. In order to model household behaviour, we understand that DECC has undertaken a survey of customers’ willingness to pay for insulation projects. DECC has not published the survey in full, which makes it difficult to describe its method precisely. Instead DECC provides only a brief description of its methodology.

DECC explains that the survey offered customers a number of choices between insulation packages and financing options at random. From the customers’ responses, DECC defines a probability that any customer with a given set of characteristics would be willing to install insulation for an expected energy bill saving and at a given investment cost. We note that DECC’s brief description is insufficient to provide a detailed understanding of its method and DECC’s methodology would be clearer if it published the documentation surrounding the survey.

DECC combines the survey responses with information about the availability of insulation projects meeting the CSO’s eligibility criteria with assumptions about energy prices, energy bills and the interest rates faced by customers under the Green Deal. This allows DECC to define an “ECO Point Supply Curve”. The ECO Point Supply Curve represents the minimum subsidy that energy suppliers would have to pay in order to induce customers to install solid wall insulation and hard-to-treat cavity wall insulation for any given level of carbon emissions reduction. DECC defines three ECO point supply curves based on different assumptions about energy prices and interest rates (see Figure 2.2).

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14 DECC, Final Impact Assessment, 11 June 2012, page 84.
DECC is not clear about precisely how it forms its cases, which are defined as “low”, “central” and “high”, but also referred to as “Low, Central and High take-up”. For example, in Annex H of the Impact Assessment, DECC labels the case with a high interest rate and a high energy price as corresponding to the high case. In practice, low interest rates and high energy prices would correspond to the “highest take-up” of the Green Deal (by making insulation measures more attractive to customers). DECC’s scenarios do not therefore seem to span the entire range of possible outcomes, but to allow for some effects to offset one another.

DECC estimates that the expected cost of the CSO, in pounds per ECO point (i.e. per tonne of carbon dioxide emissions reduction or £/tCO$_2$), is as follows:

- Over £120/tCO$_2$ in its “low” case (saving less 5 MtCO2);
- Almost £80/tCO$_2$ in its “central” case (saving about 5 MtCO2);
- Around £65/tCO$_2$ in its “high” case (saving slightly more than 5 MtCO2).

These results indicate that the “low/central/high” designation relates to likely rates of take-up by customers, and not the level of all the associated variables (i.e. low energy prices may be associated with high interest rates in a “low take-up case”).

The cost per ECO point is considerably higher than the cost of reducing CO$_2$ emissions indicated by the EU Emissions Trading Scheme (ETS) over the same period. Prices in the ETS have been below £10/tCO$_2$ for some time.

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15 DECC, Final Impact Assessment, 11 June 2012, page 59, Figure 22.
2.3.3. Carbon Saving Communities

DECC also uses the Green Deal Household Model to estimate the cost of the CSC, based on a similar but separate process of modelling customer behaviour and willingness to invest in insulation. DECC’s analysis suggests that the cost of meeting the CSC obligation will be lower per ECO point than for the Carbon Savings Obligation for households in general, at around £60 per ECO point.\(^{17}\)

2.4. DECC Estimates a Cost to Suppliers of £1.3bn

DECC admits that there is uncertainty around its central estimates and that these costs are hard to quantify:

“The ECO obligations are quantity targets, requiring a given level of savings to be achieved. Until the ECO becomes operational there is uncertainty over what the market clearing price will be. The price will be determined by a range of factors including fossil fuel prices, technology costs and consumer preferences.”\(^{18}\)

DECC models costs for its low, central and high cases.

In its central case, DECC estimates that delivering the ECO measures will cost around £1.3bn pounds per annum, including the costs of the Carbon Savings Targets and Affordable Warmth. DECC also estimates that administration costs born by suppliers and green deal providers for the scheme will run to a further £16.3 million per annum and costs to the government will be £22 million.\(^{19}\)

The total costs borne by suppliers in DECC’s central case amount to around £52.50 per annum per customer (spread over approximately 25 million customers). DECC does not provide estimates for the costs of the ECO programme as a whole under its high and low case assumptions. However, costs per tCO\(_2\) under its high and low case assumptions are available for the CSO (see Figure 2.2, above), which provides the basis for some elementary sensitivity tests.

Table 2.1 shows total cost of the CSO rescaled to take account of the lower costs per tCO\(_2\) in DECC’s “high” case and the higher costs per tCO\(_2\) in DECC’s “low” case. This sensitivity causes total costs to vary over the range £1,200-1,700 million for the ECO as a whole, with the cost to energy suppliers ranging from about £48 per annum per customer in the “high (take-up)” case to about £70 per annum per customer in the “low (take-up)” case.

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\(^{17}\) DECC, Final Impact Assessment, 11 June 2012, page 58, Figure 21.

\(^{18}\) DECC, Final Impact Assessment, 11 June 2012, page 84.

\(^{19}\) DECC, Final Impact Assessment, 11 June 2012, page 88.
Table 2.1
Estimated Annual Costs to Energy Suppliers of ECO
(with Variation in the CSO only)

<table>
<thead>
<tr>
<th>Cost per CSO ECO Point (per tCO2 reduction)</th>
<th>£/tCO2</th>
<th>Low</th>
<th>Central</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO Carbon Savings Targets, of which:</td>
<td>£m</td>
<td>1,374.4</td>
<td>950.0</td>
<td>831.6</td>
</tr>
<tr>
<td>CSO</td>
<td>£m</td>
<td>1,184.4</td>
<td>760.0</td>
<td>641.6</td>
</tr>
<tr>
<td>CSC (incl RS)</td>
<td>£m</td>
<td>190.0</td>
<td>190.0</td>
<td>190.0</td>
</tr>
<tr>
<td>AW</td>
<td>£m</td>
<td>350.0</td>
<td>350.0</td>
<td>350.0</td>
</tr>
<tr>
<td>Admin costs</td>
<td>£m</td>
<td>16.3</td>
<td>16.3</td>
<td>16.3</td>
</tr>
<tr>
<td>Total</td>
<td>£m</td>
<td>1,740.7</td>
<td>1,316.3</td>
<td>1,197.9</td>
</tr>
<tr>
<td>Customers (millions)</td>
<td></td>
<td>25.0</td>
<td>25.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Cost per Customer</td>
<td>£pa</td>
<td>69.63</td>
<td>52.65</td>
<td>47.91</td>
</tr>
</tbody>
</table>

Source: NERA analysis of DECC data.20

In principle, a complete assessment of total costs of the ECO in DECC’s “high” and “low” cases would need revised cost estimates for the other components of the ECO. The Impact Assessment does not show the impact of changing these assumptions on the total cost of the CSC or AW programme.

DECC’s “high” and “low” case assumptions would have a different impact on the costs of AW and CSC than on the costs of the CSO.

DECC assumes that energy companies will fund Affordable Warmth projects without the consumer part-financing the investment via the Green Deal.21 Therefore changing the interest rate assumption does not change the cost of the AW. However, DECC measures compliance with the AW target using generic assumptions about the energy-saving benefits of projects and multiplying them by its assumption of the variable energy price.22 Lower energy prices would mean lower reductions in the notional bill and therefore require energy suppliers to undertake more energy efficiency projects to meet the AW target, at a higher cost to energy companies and ultimately consumers.

The CSC is an obligation targeting carbon reductions (like the CSO) and would be similarly affected by DECC’s “high” and “low” case assumptions. However, the CSO encompasses a broader range of technologies and a narrower customer group, which may, in principle be more or less susceptible to changes in energy prices and interest rates.

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20 DECC, Final Impact Assessment, 11 June 2012, page 84.
21 DECC, Final Impact Assessment, 11 June 2012, page 144.
22 In an earlier impact assessment as part of its consultation, DECC explains that Affordable Warmth target of a change in the energy bill is made by making generic technical assumptions about each energy efficiency measure: “These assumptions are used to estimate the energy reduced or increased by fuel type for each measure in kWh, using data from the Building Research Establishment and internal. Energy savings estimates from insulation measures are consistent with those in the GDHM. Changes in energy use are valued using the variable element of the relevant fuel price listed in the DECC IAG tool kit.” DECC, Impact Assessment, 23 November 2011, page 191.
The interactions between energy prices and the AW and interest rates and energy prices and the CSC are complicated. Defining sensitivities corresponding to DECC’s “high” and “low” cases for the AW and CSC would require detailed modelling. However, we can define “what-if” scenarios using the illustrative assumption that the combined cost of the AW and CSC is half as sensitive to DECC’s “high” and “low” case assumptions as the CSO. Under this assumption, the total cost of ECO would range between £1,140 million and £1,880 million in DECC’s “high” and “low” cases (£45.50 to £75 per customer per annum).

2.5. Customer Bills Rise By £20-£40 Under DECC’s Assumptions

DECC’s analysis assumes that energy suppliers will pass all of the costs in Table 2.1 through to customer bills. Not all of these costs of the ECO programme represent an additional cost to customers. Some of the costs of the programme are payments from energy suppliers to energy customers that reflect “economic rents”, i.e. the gap between the market price for something in scarce supply and the cost of producing it. In this case, there is a scarce supply of low cost energy efficiency measures and DECC assumes that customers with low cost opportunities will capture the benefit of these rents.

Figure 2.3 illustrates the cost to suppliers of meeting the CSO. The blue line is the supply curve for ECO points earned under the Carbon Saving Obligation. It represents the minimum subsidy required to save each additional tonne of CO₂ emissions under ECO, and hence the cost of obtaining an ECO point. These market-level payments of up to £77 per tCO₂ would be made either as a reduction in energy bills under the Green Deal financing arrangements or through direct payments to the customer (known in economics as “side payments”). The blue shaded box represents the total cost to suppliers, who will pay the market price of £77 for each ECO point they purchase (either directly to customers by installing insulation or indirectly through installers). The darker area above the cost curve is the market-level payment from suppliers to consumers who can take advantage of relatively low cost insulation projects, and who would in principle be willing to accept a subsidy of less than £77 per tCO₂ for their own insulation project to fit insulation.

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23 Variation in the cost of the CSO is -16% to +56%, assumed variation in the cost of the CSC and AW is -8% to +28% of the figures in Table 2.1.
DECC presents the results of its analysis assuming that energy suppliers make full use of the Green Deal and therefore reduce energy bills to cover these “side payments” (or, equivalently, that the results for average energy bills are shown net of any side payments). After taking account of these side payments and the reduction in energy bills due to energy efficiency, DECC concludes that the final impact on bills would range from just under £20 per annum per customer in 2013-2015 in DECC’s “high case” to just over £40 per annum per customer in 2013-2015 in DECC’s “low case” (see Figure 2.4).

This change in the average energy bill masks very different results for different types of customers.

Customers who benefit from subsidies under ECO will see their energy bills fall both due to the Green Deal or equivalent side payments and due to reduced consumption after energy efficiency improvements take effect.\(^{25}\)

Customers who do not receive subsidies under ECO will see their bills rise by the full cost of the ECO to the energy suppliers. Under DECC’s assumptions the annual energy bills of customers who do not receive any ECO subsidy will rise by £48 to £70, as set out in Figure 2.4.

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\(^{24}\) DECC, Final Impact Assessment, 11 June 2012, page 84, Figure 33.

\(^{25}\) Improvements in energy efficiency may lead customers to lower their consumption of energy or to adopt higher standards of comfort, because heating is now cheaper. DECC’s analysis allows for this “comfort taking” effect.
2.6. Conclusion

The ECO programme is split between sub-programmes aimed at reducing “notional” energy bills by a certain amount (AW: £4.2bn from January 2013 to March 2015) and sub-programmes aimed at reducing emissions of CO$_2$ (CSO: 20.9 MtCO$_2$; CSC: 6.8 MtCO$_2$; RS: contained within CSC). DECC estimates the total costs of the ECO programmes as £1.3bn per annum. This cost represents DECC’s estimate of the amount energy suppliers will have to recover from customers in general.

Source: DECC$^{26}$

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$^{26}$ DECC, Final Impact Assessment, 11 June 2012, page 67, Figure 31.
3. The Process of Collecting ECO Points

Energy suppliers and ultimately customers will pay for the measures installed under the Energy Company Obligation. Green Deal Providers (GDPs) and insulation installers will actually deliver the measures required under the ECO. Green Deal Providers are organisations that manage the customer relationship throughout the process of acquiring insulation under the Green Deal/ECO programmes. Insulation installers are organisations that fit insulation in customers’ homes. In principle, GDPs and insulation installers could be vertically-integrated units within the six large supply businesses. Alternatively, GDPs or insulation installers could be independent businesses or part of larger networks distinct from the energy suppliers.

The process of collecting ECO points for eligible measures will involve suppliers, GDPs and insulation installers:

- acquiring a potential customer;
- providing the customer with a quotation, arranging any Green Deal finance and any relevant subsidy; and
- arranging for the installation of the measure in the customer’s house or flat.

In this chapter, we set out the process that suppliers, GDPs and insulation installers will have to undertake to deliver the ECO. The roles of the supplier, GDP and installer may be slightly different across the different obligations, across suppliers or GDPs, and may evolve as the ECO is rolled out.

Throughout, we use the term “GDP” to describe an organisation that is managing the customer relationship over the course of acquiring, quoting for and installing an insulation project. In practice, the organisation may not be providing Green Deal finance (for example, DECC assumes Affordable Warmth customers do not use Green Deal finance). Nonetheless, the role of a GDP as a manager of the customer relationship would still be necessary. For ease of exposition, we explain the process of acquiring ECO points in detail including the steps necessary for Green Deal Finance. Only small adjustments to the description (and the costs) are necessary for the case where customers do not make use of Green Deal Finance (and we highlight those adjustments in the text below).

3.1. Acquiring a Potential Customer

Box A of Figure 3.1 illustrates the process of making initial contact with customers. GDPs have to begin by identifying likely (or, for some programmes, eligible) customers. Data on potential customers will be available from several data sources. For the CSO, the CSC and the RS, GDPs or suppliers will be making use of the processes in Box A1. The Homes Energy Efficiency Database (HEED) is an online source for data on the housing stock, heating systems and installed installation. See http://www.energysavingtrust.org.uk/Organisations/Local-delivery/Free-resources-for-local-authorities/Homes-Energy-Efficiency-Database/Introduction-to-HEED.
customers, will be a method of identifying customers that can then be targeted by phone, mail, or door to door marketing. To qualify for ECO measures under the Affordable Warmth scheme, customers must be in receipt of certain means-tested benefits. To identify this group, a GDP may be able to make use of data from the Department of Work and Pensions (DWP) as illustrated in Box A2. An alternative route to market could involve building links with organisations or local government. For example, the GDPs or energy supply companies may market to the Citizens Advice Bureau (CAB), Local Authorities (LA) and or membership organisations such as the National Trust, as illustrated in Box A3.

For the process to proceed to the next stage, a potential customer must agree to talk on the phone or otherwise respond to the initial contact they have received. At this stage, there will be an inevitable rate of attenuation from customers who are not interested in further contact with a GDP. This process is illustrated in Box B of Figure 3.1.

Those customers who do respond by some means to the initial contact from a GDP can then be followed up by phone to discuss their personal circumstances, their need for ECO measures, and their eligibility. This process is illustrated in Box C of Figure 3.1.

At this stage, the GDP should be able to determine that a proportion of the customers that it has followed up are not eligible, typically because their property is not suitable for fitting an ECO measure. (See Box D in Figure 3.1) Moreover, even if customers are found to be eligible and living in a dwelling with the technical potential for an energy efficiency installation, there is a further stage of attenuation as customers may not agree to the site visit which is a precursor to providing a quotation. Only if to the customer agrees to such a visit will the GDP be able to progress to the next stage, as illustrated in Box E of Figure 3.1.

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28 We understand from conversations with the suppliers that discussions about whether DWP databases will be available are still ongoing.
Figure 3.1
Acquiring a Potential Customer

A1
- HEED Database
- Customer database

Contact customers mass mailshot, phone or door to door

A2
- DWP Database
- Identify customers using benefits system & contact them

A3
- Marketing to LA, CAB, Membership organisations
- Referral from Local Authority/CAB

B
- Customer agrees to talk on phone or responds to mailshot
  - No? X%
  - Yes? Y%

C
- Follow Up Phone Call to discuss customer details
  - Occupancy and eligibility assessment

D
- Is property suitable for ECO?
  - No? X%
  - Yes? Y%

E
- Customer agrees to site visit
  - No? X%
  - Yes? Y%
  - Providing a quotation

Key:
- Supplier
- Customer
- GD Finance
- Surveyor
- GDP
- Data
- Process
- Decision
- Offpage
- Alternate Process

Source: NERA analysis of information from various candidate GDPs.
3.2. Providing a Quotation

Having acquired an eligible customer that is willing to agree to a visit to their dwelling, a GDP must then assess the suitability of the property for ECO measures. This process is illustrated in Box F of Figure 3.2. The site-visit will typically be carried out by a surveyor, or “Green Deal Advisor”, which will require the customer to remain at home for the duration of the visit. The document produced by the surveyor or advisor, an Environmental Performance Certificate (EPC), may then be registered with Landmark, a company that maintains a register of EPCs on behalf of the government.29 A certain proportion of customers will not agree to have their EPC published in this manner.

The process in Box F will differ slightly depending upon whether the customer requires Green Deal Finance. If a customer is self-financing or the installer or energy supplier is financing the project without using Green Deal finance, the energy supplier may complete the steps in Box F1 and skip the steps in Box F2. If the customer wishes to use Green Deal finance, the GDP would have to undertake all of the steps in Box F1 and F2.

If the customer wishes to use Green Deal Finance, the GDP must design a Green Deal Plan as part of providing a quotation. The Green Deal Plan will ensure that the project is financeable using Green Deal Finance. This will involve identifying the subsidy (if any) required, accounting for costs of financing through the Green Deal, and ensuring that the “Golden Rule” – that bill savings in the first year must exceed repayments, and rise by no more than 2% p.a. subsequently – is followed. This will allow the GDP to provide a Green Deal report and quotation, including a credit check under the Consumer Credit Act (CCA).

As Box G of Figure 3.2 illustrates, some customers will already have received a quotation from another GDP and may seek a new quotation. These customers represent additional sources of insulation opportunities for other GDPs.

Following the provision of a quotation, customers will probably compare their quotation to other deals available. The customer may then decide to install an ECO measure, but only a certain proportion of these customers will do so by accepting the quotation provided by the GDP. The remaining customers will seek an alternative provider. Therefore, only after these further stages of deliberation and possible rejection by the customer will an eligible measure be installed, as illustrated in Box H of Figure 3.2.

29 See https://www.epcregister.com/home.html.
Figure 3.2
Providing a Quotation

F1
- Acquiring a Potential Customer
- Assess Suitability for Insulation
- Site visit to assess Insulation potential
- EPC Report
- Customers research alternative deals
- Customer remains home for site visit
- Customer decides to install insulation
- Yes? X%
- No? X%
- Customer accepts GDP’s quotation
- Yes? X%
- No? X%
- Provide Quotation inc. CCA Check
- Customer decides to publish EPC
- No? X%
- Yes? X%
- Design Green Deal Plan
- Provide GD report
- Provide Quotation inc. CCA Check
- Register EPC in Landmark
- END

G
- Customer already with quotation asks for new quotation from GDP

H
- Customer decides to install insulation
- Yes? X%
- Customer accepts GDP’s quotation
- Yes? X%
- No? X%
- Customer selects alternative GDP
- Installing Insulation

Key:
- Supplier
- Customer
- GD Finance
- Surveyor
- GDP
- Document
- Data
- Process
- Decision
- Offpage
- Alternate Process

Source: NERA analysis of information from various candidate GDPs
### 3.3. Installing Insulation

Having provided a quotation that was acceptable to the customer, a GDP will now have to arrange Green Deal finance with a suitable provider for the project. This will involve the calculation of the repayment schedule, loan duration, and interest rates applicable. The GDP will then have to arrange a date and time for the installation which, depending on the complexity of the installation to be carried out, will require considerable logistical effort by both parties. In particular, for complex measures such as wall insulation, the customer will have to remain at home for much of the duration of the works.

Installing the ECO measure may also necessitate an upfront payment from the customer to the GDP, the size of which will be determined by the quotation provided and the Green Deal finance available. Upon completing the installation, the GDP must register for the relevant ECO points. Energy suppliers require these points to fulfil their obligation, and the market for the transfer of these points encompasses three methods. Transfers can be arranged by bilateral agreement between the GDP and energy supplier, a transfer between vertically integrated entities (if the GDP is ultimately owned by an energy supplier), or by using an ECO brokerage as an intermediary. The result will be that an energy supplier purchases the ECO points and surrenders them to fulfil part of their obligation. This is illustrated in Box H of Figure 3.3.

If the customer is paying for the installation using Green Deal Finance, the energy supplier will also carry out the role of collecting Green Deal finance payments, as these are tied to the customer’s electricity meter. This process is illustrated in Box I of Figure 3.3. Having been informed by the GDP of the finance arrangements the customer has entered into, the energy supplier will amend the unit rate on the meter to include the necessary repayments. The energy supplier remits the additional payments it collects from the increased unit rate on the meter to the Green Deal finance provider.
Figure 3.3
Installing Insulation

I
- Providing a quotation
- Arrange GD Finance with finance provider
- Arrange date/time for installation
- Customer remains home for works
- Install insulation

J
- Register installation for relevant ECO points
- Collect upfront payment
- Decide how to transfer ECO points

K
- Collect Payment for GD finance provider
- Pay GD finance provider

L
- Bilateral
- V. Integration
- ECO Brokerage

Supplier purchases ECO points & surrenders them

Key:

Supplier  Customer  GD Finance  Surveyor  GDP
Document  Data  Process  Decision  Offpage  Alternate Process

Source: NERA analysis of information from various candidate GDPs
3.4. Summary

In summary, the process a supplier, GDP and/or insulation installer must undergo to successfully collect ECO points is complicated, involving search, transaction and administration costs at various stages to all parties involved.

Acquiring a customer involves the cost of searching for potential eligible households, making contact with them through physical or electronic means, and securing their agreement to talk further about the installation of eligible measures. Following up expressions of interest from potential customers, and determining whether their dwellings are indeed eligible for ECO measures, involves further overhead costs.

The surveys that must be undertaken in the house before beginning any works increase the costs of completing an installation. Customers may choose not to install an ECO measure with the GDP after obtaining an initial quotation, and GDPs may bear some or all of the costs of these unused quotations. The proportion of unsuccessful assessments (which DECC estimates to be two out three) leads to increased transactions costs.\(^{30}\)

Finally, there are costs both to the GDP and the customer of completing an installation. Customers must be willing to invest logistical effort and, where appropriate, take time off work to oversee an installation. GDPs must facilitate Green Deal finance for the project, inform the energy supplier of the appropriate repayments to collect, and finally participate in the ECO market to sell the points they have collected. There are also ongoing administration costs incurred by the Green Deal finance provider and the energy supplier in collecting repayments.

In Chapter 4 we discuss DECC’s treatment of the cost items we have identified in the process of collecting ECO points.

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\(^{30}\) DECC, Final Impact Assessment, 11 June 2012, page 56.
4. Errors and Omission in DECC’s Modelling

In this chapter, we review the assumptions feeding into DECC’s methodology. We list the assumptions and draw comparisons with DECC’s estimates where information in the public domain or held by the energy suppliers was significantly different from DECC’s assumptions. Where DECC’s estimates were broadly in line with the information held by suppliers, or that information was subject to a wide range of uncertainty, we have listed the results of our investigation in Appendix B. We note that these cost items still represent significant risks to the energy suppliers.

This chapter proceeds as follows:

- Section 4.1 describes DECC’s “stated preference” methodology for assessing a customer’s willingness to pay that is used in the GDHM;
- Section 4.2 draws out the principal criticisms of DECC’s stated preference approach from the economics literature;
- Sections 4.3 demonstrates that DECC’s assumptions concerning technical potential may not be accurate, in particular for Hard-to-Treat Cavity Wall Insulation (HTT CWI);
- Section 4.4 explains that DECC may have overestimated the number of customers who consider fitting insulation in any given year;
- Section 4.5 explains that DECC’s estimates of search costs are substantially below suppliers’ expectations for ECO based on past experience;
- Section 4.6 shows that DECC has assumed that suppliers will be able to bundle a higher proportion of measures together than the suppliers believe will be possible;
- Section 4.7 compares suppliers’ estimates of the mix of insulation measures and properties with DECC’s; and
- Section 4.8 concludes.

Our analysis shows that DECC has made a number of assumptions which may understate the costs of the ECO. Evidence in the public domain and held by suppliers suggests that the costs of the programme will be higher than DECC anticipates.

4.1. “Stated Preference Exercise” Methodology

To model the supply of insulation opportunities in the Green Deal Household Model (GDHM), DECC use a “stated preference exercise”, also known as a “Willingness to Pay” (WtP) study. In this exercise, 2,023 homeowners and private tenants were asked to make a forced choice between different pairs of possible Green Deal packages, differentiated according to their bill savings, costs of assessment and installation, and type of measure. Following this choice, the respondents were then asked whether they would be willing to take up the measure they had stated a preference for.
“Consumer behaviour in the GDHM is based on the results of the choice experiment ... it therefore reflects not only the financial benefits of the packages of measures but also consumers’ perceptions of hidden costs, preferences for particular measures and attitudes to the finance mechanism itself.”

DECC splits survey respondents into two different sub-groups; a low-income and vulnerable group, and a non-vulnerable group. The purpose of this is to estimate the differences in preference between customers eligible under the Affordable Warmth programme, and the resulting difference in subsidy necessary. Since the purpose of the modelling exercise is to ascertain a level of subsidy needed for consumers to install insulation under the Carbon Obligations, DECC uses its estimates of non-vulnerable consumers to produce its forecast.

DECC uses what appears to be standard modelling techniques to infer the relative value customers place on different measures. Since the costs of installation and assessment are included in the measures, this implicitly defines customers’ “willingness to pay” for different types of insulation.

4.2. Criticisms of Stated Preference Approach

DECC does not publish the survey it used to conduct its stated preference exercise, so we are not able to give a detailed critique of their survey methodology. However, stated preference studies are subject to several standing criticisms from economists.

Firstly, stated preference exercises suffer from the central flaw that people’s hypothetical behaviour often differs from their actual behaviour, which economists term their “revealed preference”. This problem, as summed up in a recent study, is that “most research finds significant divergence between stated and actual behaviours”. When answering hypothetical questions that concern some publicly valuable good (e.g. reduced emissions), respondents frequently state a preference for socially optimal behaviour (e.g. facing personal costs to reduce emissions). A leading review of the stated preference methodology termed this the “warm glow” bias: survey responses may not reflect an actual willingness to pay for a particular measure, but instead act as signals of approval for the environmental programme in general.

33 A “logit” utility model is used. This is a well-established class of model for manipulating “binary dependent variables” – binary in the sense that the data either takes the form of “accept the measure” or “decline it”. A “logit” model uses maximum likelihood methods to estimate coefficients for the different factors respondents consider when making their choice (cost, repayment period, etc.). Once estimated this model can assign a probability between 0-100% that, for a given measure with certain attributes, a representative household will accept it. This therefore defines market demand as equal that of the representative household, scaled to the actual number of relevant households.
However, in real life situations people’s behaviour frequently diverges from their optimistic self-assessment. Since DECC does not use experiments or historical data to calibrate its survey results, its estimated preferences may incorporate exactly this sort of bias. As a result, customers’ willingness to pay for ECO measures is likely to be overstated, and the resulting subsidy necessary to induce them to install these measures understated.

This problem has not gone unnoticed by Element Energy, the consultants DECC commissioned to analyse the assumptions underlying its stated preference model. Element Energy agree that, without validation against actual data on customer choices, DECC’s modelling approach is entirely hypothetical, and hence potentially misleading.

“Additionally, due to the innovative nature of the Green Deal policy and the lack of historical data for calibration, it has not been possible to validate the consumer choice coefficients used in the uptake model against real-world data. We therefore strongly recommend that further data are collected on real-world uptake of Green Deal measures, perhaps through the on-going trials by the energy companies, to allow calibration of the consumer behaviour within the Green Deal model.”

Another commonly advanced criticism is that, without a well designed survey, respondents may struggle to evaluate the relative costs and benefits of each choice. In the face of difficult questions, such as comparing the upfront costs of a measure with the discounted stream of future bill savings, respondents are known to engage in “satisficing”. Following this process, respondents cease to evaluate their options as soon as enough information has come to mind to make a judgement. Such behaviour is similar to following a “rule of thumb” decision-making procedure. Since DECC do not publish their survey, it is not possible to determine whether their survey is sufficiently clear to have avoided this problem.

Lastly, DECC assumes a “representative consumer” framework, which means that preferences vary across the population only randomly. In practice, customers’ preferences may depend partly on the type of house they live in. For example, a customer living in a large house may require larger bill savings to install insulation to overcome the transactions or hassle costs of installing insulation. In principle, using a representative consumer could bias DECC’s results in either direction. However, DECC’s method is likely to understate the cost of the ECO programme if consumers in larger houses require bigger subsidies to overcome transactions or hassle costs. The largest houses offer the largest CO$_2$ savings and therefore suppliers would have to undertake more, smaller projects to meet their obligations under ECO. Undertaking more, smaller projects would increase the search and administrative costs of the ECO programme.

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38 DECC does publish the results of a preliminary survey, see http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/3502-green-deal-consumer-survey-findings.pdf.
4.3. Technical Potential

Technical potential refers to the amount of housing stock that is suitable for installing energy efficient measures in Great Britain from January 2013. The technical potential for each energy efficiency measure is important in understanding the costs of the ECO because, if the technical potential is larger, then energy suppliers will find it less costly to locate suitable projects and achieve a greater number of successful completions.

DECC estimates the technical potential in Great Britain for the different eligible measures using published statistics from September 2011, and updates these for the likely installations under CERT since then.39 DECC’s estimate of the housing stock eligible for subsidy under the CSO is of particular interest. DECC estimates in 2013 there will be 6,900,000 solid wall insulation opportunities and 5,779,000 cavity walls opportunities, of which 3,171,000 will be “hard to treat”, 54.9% of the total. We understand from conversations with the energy suppliers that DECC has not yet defined “hard to treat” cavity walls precisely.

We have examined DECC’s estimates of hard to treat cavities by comparing them to published estimates from the English Housing Survey (EHS). The EHS relies on surveys of the English housing stock in 2010.40 We have concentrated our attention on the EHS estimate of “easy” or “less problematic” cavity walls. According to the EHS, there is a total stock of 6,959,000 houses with cavity walls in England, of which 4,963,000 were “easy” or “less problematic”. This implies that there were 1,996,000 houses with “problematic” cavity walls in England in 2010, 28.7% of the total.

If the eventual definition of “hard to treat” cavities were the same as the EHS definition of “problematic” cavities, the number of “hard to treat” cavity walls would fall dramatically compared to DECC’s assumptions. By applying the EHS proportion of “problematic” cavities to DECC’s estimated total stock, in Table 4.1, it can be seen that DECC risks over estimating the insulation opportunities that are eligible for the CSO target. We estimate this difference to be 1,513,429 properties in 2013. The result of this possible overestimation will be to raise the costs suppliers face to meet the CSO target, as a lower technical potential will increase the market price of ECO points.

Fewer “hard to treat” cavity walls would increase the costs of the ECO for two main reasons. Firstly, the supply and demand balance for insulation projects would tighten. Secondly, the search costs of finding projects eligible for support would also increase. (We examine the impact of DECC’s assumptions about technical potential on the costs of ECO in section 5.2).

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40 Survey results from 2010 on 16,670 houses were used. See http://www.communities.gov.uk/publications/corporate/statistics/ehs2010homesreport.
Table 4.1
DECC May Overestimate the Availability of HTT Cavities

<table>
<thead>
<tr>
<th>Source:</th>
<th>%</th>
<th>HTT Cavities (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECC</td>
<td>54.9%</td>
<td>3,171.0</td>
</tr>
<tr>
<td>EHS (Rescaled)</td>
<td>28.7%</td>
<td>1,657.6</td>
</tr>
</tbody>
</table>

Source: DECC; EHS.41

4.4. Decision Making Frequency

The “Decision Making Frequency” (DMF) represents the proportion of households per year which make a decision about whether or not to install insulation.42 In its analysis of the costs of the ECO, DECC assumes a the DMF be 10% for SWI and 26% for CWI (its central case).43

In fact DECC’s assumptions are high relative to the available data on the DMFs of households. DECC derives its initial estimates of the DMF from the result of its consumer survey. DECC’s initial estimates are that 26% of households with cavity walls and 6% of households with solid walls make a decision about whether to install insulation in a year.

DECC does not provide any evidence to support its assumptions on the DMF. Alternative data on the DMFs of domestic customers are available from published findings, which also do not provide any support for DECC’s assumptions.44 (Note however, these sources are not directly comparable as they (1) do not consider solid and cavity walls separately, and (2) were conducted before CERT and CESP increased the visibility of insulation.) DECC also assumes that 100% of customers are aware of the Green Deal and the ECO. In practice without significant advertising expenditures a large proportion of consumers may not know about Green Deal and ECO.45

Since DECC assumes that the DMF is above the level suggested by historic evidence and that all consumers are fully informed about the Green Deal, DECC may have overstated the true DMF likely to be observed, especially over the period until March 2015. In general, the higher the DMF, the lower the cost of the ECO programme as more customers consider installing insulation each year and suppliers and GDPs can deliver more insulation projects at lower cost. DECC’s DMF assumption is therefore likely to understate the costs of the programme if the DMF under ECO turns out to be similar to historic levels. (We examine the impact of DECC’s DMF assumption on costs in section 5.3).

41 DECC, Final Impact Assessment, 11 June 2012, pages 102-107; EHS, Homes Report, Table 7.4.
42 Or as DECC puts it “rate at which households are presented with the same choices presented to the respondents to the Green Deal consumer survey [i.e. choice between insulation packages]” DECC, Final Impact Assessment, 11 June 2012, page 126.
4.5. Search/Transactions Costs

Green Deal providers face costs before any installation of energy efficiency measures is made. The first of these are “search costs”, which are the administrative and overhead costs of identifying, contacting, and determining the eligibility of each customer. DECC notes “as remaining abatement potential declines, these delivery costs [including search costs] rise even if installation costs are stable”.46 “Transaction costs” are the costs to GDPs of assessing a potentially eligible house, providing a quotation, and setting up any Green Deal or other financial arrangements.

4.5.1. DECC has no separate treatment of search costs

In its modelling process, DECC explicitly assumes that consumers are fully aware of the Green Deal.47 This is likely to reduce the search costs faced by Green Deal Providers. DECC also makes the assumption in its modelling work that “there will be three assessments for every successful Green Deal” on average.48 It notes that the cost of these failed assessments is likely to add to the cost of Green Deal delivery.49 We therefore believe the assessment and set up costs stated in DECC’s analysis may not reflect this significant extra burden energy suppliers must bear.

However, DECC does not treat search costs as a separate item, arguing that they are already included in the installation costs consumers face, and therefore factored in to their model.50 In a separate document, DECC states that these and other costs are 10-15% of total installation costs.51 This assumption, while suitable for a market such as double glazing where there is pre-existing demand from customers, is not appropriate to a market where energy suppliers are compelled to find eligible customers to satisfy their ECO obligation. Since only a small proportion of customers (e.g. with hard to treat cavity walls, or in a low income group) are eligible, the search costs are likely to be considerable. (We provide estimates of the search costs associated with the ECO in Table 4.2).

4.5.2. Suppliers have recorded search costs under CERT

Energy suppliers have provided us with data on the cost of search for a “lead” (potential customer) and the rate at which these customers subsequently agree to an installation. For CERT this is historical data, from which suppliers have formed forecasts for the ECO. We have used the data that suppliers provided us as part of the confidential survey on each step of the process of acquiring a customer to calculate the costs of search.

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47 “Estimates assume 100% awareness of the Green Deal; if awareness levels are lower, then uptake levels will be lower” DECC, Final Impact Assessment, 11 June 2012, page 131.
50 “Thirdly, the measure installation costs presented in annex A already reflect part of the price of failed assessments; the search costs in the EEPH Call for Evidence include costs for unsuccessful bids for business” DECC, Final Impact Assessment, page 173.
For example, under CERT we take the cost of each initial contact made by suppliers, by mailshot, phone call, door to door, and targeted marketing through the local authority or DWP. For each contact method, we then use the average rate of response by customers to each method to give a cost per customer response. We use the average historical proportion of customers who are found to be suitable following this response (74.0%) and the percentage of those who then agree to a site visit (49.75%) from the responses we collected from supplies. We then calculate a “cost of acquiring a customer” using each method. We then calculate the average cost of acquiring a customer to reflect the actual mix of contact methods used by suppliers. This gives a historical search cost of £104.21 for CERT, as shown in Table 4.2. 52

However, this figure disguises the fact that for targeted obligations, such as the Super Priority Group, suppliers report that they have been forced to pay up to £500 for a “hot lead” i.e. an eligible customer contact likely to lead to an installation. 53

By using the historical rate of conversion of site visits to installations under CERT, we show that the cost of search under the CERT programme has been approximately £230 per successful installation.

<table>
<thead>
<tr>
<th>Programme</th>
<th>Cost of Acquiring a Customer</th>
<th>Conversion Rate After Site Visit</th>
<th>Search Cost per Installation</th>
<th>Measures Rolled Out in 2013</th>
<th>Total Search Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERT</td>
<td>£104.21</td>
<td>45.33%</td>
<td>£229.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSO</td>
<td>£167.11</td>
<td>32.00%</td>
<td>£522.21</td>
<td>281,185</td>
<td>£146.84</td>
</tr>
<tr>
<td>CSC</td>
<td>£142.96</td>
<td>50.00%</td>
<td>£285.92</td>
<td>99,730</td>
<td>£28.52</td>
</tr>
<tr>
<td>AW</td>
<td>£168.93</td>
<td>75.00%</td>
<td>£225.24</td>
<td>111,097</td>
<td>£25.02</td>
</tr>
</tbody>
</table>

Source: NERA analysis of submissions by energy suppliers and DECC data. 54

4.5.3. Suppliers forecast high search costs based on historic experience

Using the estimated cost of acquiring a customer and estimated conversion rates, we have calculated suppliers’ forecasts of search costs under the different ECO obligations. (See Table 4.2.) The “cost of acquiring a customer” is uniformly higher than under CERT, as fewer contacts will be eligible under the policy. CSC search costs are lower than under the CSO, as suppliers foresee these customers being easier to identify.

52 Submissions from energy suppliers, October 2012.
53 Submissions from energy suppliers, October 2012.
54 Submissions from energy suppliers, October 2012. “Measures Rolled Out in 2013” are taken from DECC, Final Impact Assessment, page 166, Table 62.
Suppliers agreed with DECC that, under the CSO, the number of Green Deal Assessments per successful installation (the “conversion rate after site visit”) will be about three to one.\textsuperscript{55} The suppliers’ estimate of the transaction costs associated with each Green Deal Assessment are therefore very similar to DECC’s estimate. Suppliers are more optimistic about the conversion rate for the CSC and AW than for the CSO, presumably because these measures impose a lower cost on each participating household. As a result, the cost of search per successful installation is lower under the CSC (£285.92) and AW (£225.24) than under the CSO (£522.21). (See Table 4.2.)

As noted above, DECC has estimated that search costs will be 10-15\% of installation costs.\textsuperscript{56} DECC foresees that the total number of ECO eligible installations in 2013 will be:

- CSO: 281,185;
- CSC: 99,730; and
- AW: 111,097.\textsuperscript{57}

If each installation is made in a different house,\textsuperscript{58} these figures imply a total cost of search to suppliers of £146.84 million for the CSO, £28.25 million for CSC and £25.02 million for AW. Table 4.3 compares these estimates with the total installation costs implied in 2013 for the whole programme. The resulting ratio lies in the range 20-25\% for ECO programme as a whole.

#### Table 4.3

DECC May Significantly Understate Search Costs

<table>
<thead>
<tr>
<th>Programme</th>
<th>Total Costs (2013)</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[S] = Search Cost</td>
<td>[I] = Installation</td>
</tr>
<tr>
<td></td>
<td>£ million</td>
<td>£ million</td>
</tr>
<tr>
<td>CSO</td>
<td>£146.84</td>
<td>£566.88</td>
</tr>
<tr>
<td>CSC</td>
<td>£28.52</td>
<td>£178.85</td>
</tr>
<tr>
<td>AW</td>
<td>£25.02</td>
<td>£97.20</td>
</tr>
<tr>
<td>Total</td>
<td>£200.38</td>
<td>£842.93</td>
</tr>
</tbody>
</table>

*Source: NERA analysis of submissions from suppliers and DECC data.*\textsuperscript{59}

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\textsuperscript{55} DECC, Final Impact Assessment, page 56. Suppliers also believe an assessment will cost £108.50 compared to DECC’s £112.50.

\textsuperscript{56} DECC, “Setting the ECO Carbon Targets”, Steering Group Presentation, page 9.

\textsuperscript{57} DECC, Final Impact Assessment, page 166, Table 62.

\textsuperscript{58} DECC discusses the potential for “bundling”, i.e. for carrying out more than one measure in a house, and suggests that under the CSO and CSC 80\% of solid wall insulation cases may lead on to the installation of loft insulation as well, through customers’ “preference factor”. However, this ratio is not feasible given the low numbers of loft insulation cases that DECC predicts under the CSO and CSC. Even if all loft insulation cases were bundled with solid wall insulation, the total number of households served would only drop by 3.6\%. DECC, Final Impact Assessment, 11 June 2012, page 137, Table 48.

\textsuperscript{59} DECC does not publish their estimated total installation costs in 2013. Instead, we calculate it as follows. Installations in 2013 are broken down by type and obligation in page 166, Table 62 of DECC’s Final Impact Assessment. Typical
We therefore think it likely that, at least in the case of the CSO and AW, DECC has understated the costs to energy suppliers of searching for eligible customers by as much as half. In 2013, the difference between the total search costs implied by DECC (evaluated at 12.5% of installation costs) and our estimates (at 23.8%) is £95.01 million.

4.6. Bundling Assumptions

DECC’s analysis emphasises the “whole house” approach to insulation, under which energy efficient measures are bundled together in a single package.\(^{60}\) DECC makes an assumption on the uptake of these bundles, which reduces the cost of the ECO by lowering search and administration costs necessary to locate each opportunity.

DECC provides its “bundling” assumptions for SWI installations. For example, DECC estimates that 27% of households have the potential for solid wall and loft insulation based on surveys of technical potential. Of these households, DECC assumes that 80% would choose take up the combined bundle of loft and solid wall insulation.\(^{61}\) The 80% figure is an entirely hypothetical “preference factor” that DECC does not justify with reference to any empirical data on insulation measures.

The suppliers have provided us with their own estimates of the proportion of houses with technical potential for both solid wall and loft insulation who take up joint measures. The supplier’s estimates show that:

- Over the course of CERT and CESP between 20.5% and 29.0% of customers with technical potential for both loft and solid wall insulation installed both insulation types;\(^{62}\) and
- Under ECO, suppliers forecast a wide range from 5.0% to 37.5% of customers.\(^{63}\)

These estimates of bundling are substantially below DECC’s figure and reflect the likelihood that, if a household is considering an energy efficiency investment as significant as SWI, then they are likely to already have installed loft insulation. We estimate the impact of changing DECC’s bundling assumptions to the suppliers estimates in section 5.5, below.

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\(^{60}\) DECC, Final Impact Assessment, 11 June 2012, page 136.

\(^{61}\) DECC, Final Impact Assessment, 11 June 2012, page 137, Table 48. The 80% refers to the percentage of houses that have the technical potential for both measures, 26.9% of the total.

\(^{62}\) Submissions by energy suppliers, October 2012.

\(^{63}\) Submissions by energy suppliers, October 2012.
4.7. Mix of Technologies Rolled Out

DECC foresees a variety of energy efficiency packages being rolled out over the lifetime of the ECO. Table 4.4 breaks down this forecasted roll-out by the obligation under which each measure falls, for the period January 2013 – March 2015. It can be seen that over this period, DECC predicts extensive uptake of SWI by households receiving ECO subsidy (107,485 in total). Loft insulation is predicted to be a minor component of meeting the March 2015 target, with only 127,849 installations.

Table 4.4
DECC Foresees A Variety of Measures Rolled Out By 2015

<table>
<thead>
<tr>
<th>Year</th>
<th>SWI (ECO)</th>
<th>CWI (ECO)</th>
<th>LI top-up (ECO)</th>
<th>SWI (ECO)</th>
<th>CWI (ECO)</th>
<th>LI top-up (ECO)</th>
<th>Affordable Warmth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>12,001</td>
<td>77,606</td>
<td>10,123</td>
<td>29,787</td>
<td>169,374</td>
<td>78,445</td>
<td>169,374</td>
</tr>
<tr>
<td>2014</td>
<td>20,036</td>
<td>83,423</td>
<td>14,952</td>
<td>59,144</td>
<td>164,555</td>
<td>89,012</td>
<td>22,247</td>
</tr>
<tr>
<td>Q1 2015</td>
<td>7,034</td>
<td>20,412</td>
<td>3,963</td>
<td>18,554</td>
<td>39,154</td>
<td>22,247</td>
<td>1,271</td>
</tr>
<tr>
<td>Total</td>
<td>39,071</td>
<td>181,441</td>
<td>29,038</td>
<td>107,485</td>
<td>373,083</td>
<td>189,704</td>
<td>373,083</td>
</tr>
</tbody>
</table>

Source: NERA analysis of DECC data.

Energy suppliers take a contrasting view to DECC on the mix of technologies necessary to meet the ECO targets. Some of this disagreement is due to scepticism over the lifetime emissions savings that different measures will achieve. DECC has published estimates of the lifetime savings in CO2 emissions attributable to each measure, when implemented in a gas-fired, 3-bedroom, semi-detached house. (See Table 4.5.) Suppliers were not able to estimate energy savings according to such a granular housing classification, and remain uncertain about the emissions that will be saved by each measure. Even for the type of houses most closely aligned to DECC’s definition, the range of figures quoted by suppliers vary widely, from far below DECC’s figures to well above DECC’s figures. Suppliers seem to be most optimistic about the degree to which loft insulation will reduce lifetime emissions, with an estimated range that lies above DECC’s.

Table 4.5
Comparison of Carbon Savings by Measure

<table>
<thead>
<tr>
<th>Measure</th>
<th>DECC (tCO2)</th>
<th>Suppliers (tCO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWI</td>
<td>39.85</td>
<td>10.43 - 62.39</td>
</tr>
<tr>
<td>CWI</td>
<td>20.21</td>
<td>15.10 - 45.07</td>
</tr>
<tr>
<td>LI</td>
<td>3.77</td>
<td>4.00 - 13.36</td>
</tr>
</tbody>
</table>

Source: NERA analysis of DECC data and survey response from energy suppliers.

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64 DECC, Final Impact Assessment, 11 June 2012, page 166. Data for Q1 2015 is 25% of uptake stated for 2015.

65 Suppliers estimates were collected in response to a survey carried out in October 2012, where they were asked to estimate the energy savings in a gas fuelled “semi detached” house. DECC does not formally state a lifetime reduction.
The net result of these differences in the technological mix is that suppliers believe achieving the March 2015 targets will require a higher overall number of installed measures. Suppliers also believe that meeting the target will necessitate a greater concentration on SWI, the most expensive measure. This is evident from Table 4.6, where we compare the aggregate number of measures that suppliers believe to be necessary with DECC’s forecasts for the period January 2013 – March 2015. Suppliers believe an extra 121,828 SWI installations will be needed to meet the CSO target, as well as 50,856 more to meet the CSC target. (One supplier also suggested that it would be necessary to adopt SWI to meet the AW target, even though it is more expensive than other measures, due to inefficiencies in the market.)

In contrast to DECC, energy suppliers do not believe that cavity wall insulation (CWI) will be an important part of the mix, even though it is relatively cheap. For example, energy suppliers estimate that 253,458 fewer cavity wall insulations will be counted towards the CSO target than DECC does. This reflects, in part, a scepticism over the number of measures that will be installed without subsidy (“easy to treat” cavity walls), and the wide range of uncertainty around lifetime emissions reductions such insulation will account for.

### Table 4.6
Suppliers Disagree With DECC’s Estimated Technological Mix

<table>
<thead>
<tr>
<th>Source:</th>
<th>CSC</th>
<th>SWI</th>
<th>LI</th>
<th>Affordable Warmth</th>
<th>SWI</th>
<th>LI</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECC</td>
<td>39,071</td>
<td>181,441</td>
<td>29,038</td>
<td>0</td>
<td>85,812</td>
<td>89,810</td>
</tr>
<tr>
<td>Suppliers (agg.)</td>
<td>89,927</td>
<td>129,828</td>
<td>88,221</td>
<td>10,301</td>
<td>145,488</td>
<td>161,326</td>
</tr>
<tr>
<td>Difference</td>
<td>50,856</td>
<td>-51,613</td>
<td>59,183</td>
<td>10,301</td>
<td>59,677</td>
<td>71,516</td>
</tr>
</tbody>
</table>

Source: NERA analysis of DECC data and survey responses from energy suppliers.  

The suppliers’ uncertainty over the emissions reductions that eligible insulation technologies will achieve is exacerbated by the relative novelty of SWI. It is possible that DECC has optimistically estimated the potential of different insulation measures to reduce CO₂ emissions. The implication of this overstatement is that many more measures will be necessary for energy suppliers to meet their obligations under the ECO, and the costs of the programme are likely to be correspondingly higher. These higher costs will comprise the extra search and administration costs required to reach a greater number eligible customers, installation costs for fittings under Affordable Warmth, as well as the increased cost of the subsidy necessary to incentivise households to take up CSO eligible measures.

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for each measure. We calculate this using data drawn from the Final Impact Assessment. Table 30, page 111, states the “energy saving before comfort taking” for a three bed semi detached house. Table 58, page 159, states the asset life of each different type of insulation. Assuming savings are constant over time, these two are multiplied together to give a lifetime reduction in kWh. In Table 37, page 116, DECC states the emission intensity of gas, which is 0.18 kgCO₂/kWh over the entire asset lifetime. This is multiplied by the lifetime energy saving to give a lifetime CO₂ reduction.

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66 DECC, Final Impact Assessment, 11 June 2012, page 166. Where data is incomplete, aggregate data is estimated by scaling up suppliers’ estimates using their market share.
4.8. Conclusion

We have shown that there are clear omissions or understatement of costs in DECC’s analysis. Firstly, DECC does not support its “stated preference exercise” with any data from pilot studies or real-world evidence that might “reveal” customers true preferences for insulation. This is likely to have understated the subsidy needed to meet the targets under the ECO.

DECC also significantly understates the likely costs of searches that Green Deal Providers will incur. We estimate in section 4.3 that this understatement may total £95 million pounds between January 2013 and March 2015. Ambiguity over the number of Hard-to-Treat cavity walls may have resulted in an understatement of the costs of the CSO (although this may in turn decrease the costs of the CSC).

Our survey of energy suppliers has shown that they do not agree with DECC’s optimistic assessment of the technologies which will be necessary to meet the March 2015 interim targets. Suppliers believe the actual CO$_2$ reduction delivered by many measures will be lower than DECC estimates, and that a far greater number of installations will be needed as a result. Suppliers are also forecasting that these installations will be more costly than DECC expects, due to a far greater need to use SWI to meet the interim targets.
5. Scenario Analysis

DECC has not published the Green Deal Household Model or the Affordable Warmth Model that it uses to estimate the uptake of insulation measures. As a result it is not possible to quantify precisely the impact of the errors and omissions in DECC’s assumptions identified in Chapter 4. In this chapter, we carry out a set of sensitivity tests informed by public or third party data instead, including submissions from the energy suppliers. First, we use a simplified version of the Green Deal Household Model to simulate the take-up of insulation under the CSO from January 2013 to March 2015. Then, we test the sensitivity of DECC’s cost estimates to the errors in its assumptions and omissions from its analysis.67 We also draw lessons for the costs of the CSC and AW programmes.68

This chapter proceeds as follows:

- Section 5.1 sets out our model’s structure;
- Section 5.2 considers the impact of changing DECC’s assumptions of technical potential to confirm to account for the range of uncertainty around HTT CWI (see Section 4.3);
- Section 5.3 examines the impact of changing the “Decision Making Frequency” (see Section 4.4);
- Section 5.4 shows the impact of including additional search costs ignored by DECC (see Section 4.5);
- Section 5.5 considers the impact of changing DECC’s estimates of bundling potential to conform to the energy suppliers’ own estimates (see Section 4.6);
- Section 5.6 outlines the impact of perturbing customers’ Willingness to Pay to reflect the uncertainty surrounding stated preference models and potential optimism bias (see Section 4.2);
- Section 5.7 contains scenarios that show the effect of combining changes to DECC’s assumptions;
- Section 5.8 calculates the total costs for the CSO; and
- Section 5.9 draws lessons for the total costs of the Carbon Savings Communities and Affordable Warmth.

Our analysis shows that relatively small changes in DECC’s assumptions, which correct for inconsistencies with third party data or omissions in DECC’s methodology, can make significant changes to the expected cost of the ECO programme. Our assessment shows that the cost of the CSO may double as a result of plausible changes in these assumptions.

67 DECC, Final Impact Assessment, 11 June 2012, page 124, Annex B.
68 The Green Deal Household Model is described in DECC, Final Impact Assessment, 11 June 2012, page 38.
5.1. Model Structure

DECC models the probability of a consumer taking up insulation based on an estimate of the “utility” that a representative consumer derives from taking up a particular measure. DECC defines the utility of the representative consumer by a formula which consists of:

- coefficients that its consultants estimate from a stated preference study; \(^69\) and
- the attributes of a specific project (e.g. repayment term, bill saving, type of measure etc.).

Our simplified despatch model follows the same approach as DECC:

- first, we estimate the probability that a representative consumer will take up a particular energy saving measure for a given level of subsidy using the same formula as DECC;
- second, we multiply this probability by a “Decision Making Frequency”, which represents the proportion of consumers who will actually consider an upgrade each year; and
- finally, we apply the resulting proportion to the stock of potential houses that can be insulated to give a level of uptake per year, and hence the level of carbon reduction.

Our model follows DECC’s approach and results in a greater roll-out of insulation at a higher level of subsidy. We ran our model for different levels of subsidy, rising from zero to £200/t\(\text{CO}_2\). The results show the quantity of insulation that would be installed for different levels of subsidy and combining the results plots out an “ECO Point supply curve” (see Figure 5.1). The curve predicts the amount of subsidy (i.e. the price per ECO point) that energy suppliers must pay to achieve different levels of \(\text{CO}_2\) reduction in tonnes (ECO points). The insulation measures that get commissioned in this framework are not necessarily the cheapest measures to install from a technical perspective. As in DECC’s own analysis, the measures that get commissioned are those that require the minimum subsidy from the energy suppliers. A fuller description of the modelling, and its assumptions, is provided in Appendix A.

Using DECC’s assumptions, our model achieves the lifetime reduction target for the Carbon Saving Obligation by March 2015 of 20.9 Mt\(\text{CO}_2\) at the same price as DECC’s model at approximately £77/t\(\text{CO}_2\) (see Figure 5.1).\(^70\) By adjusting any of the following key input variables, we can examine the resulting change in the price of ECO points:

- The existing “technical potential” for insulation, especially HTT CWI opportunities;
- DECC’s estimates of customer preferences;
- The “decision making frequency” with which customers are assumed to make a decision;
- The proportion of SWI installation projects bundled with loft insulation; and
- The contribution of search costs to installation costs.

\(^{69}\) DECC, Final Impact Assessment, 11 June 2012, pages 128-129.

\(^{70}\) DECC, Final Impact Assessment, 11 June 2012, page 39, Figure 22; page 187, Table 73.
5.2. Sensitivity To Mis-measured Technical Potential

In Section 4.3 we noted that DECC’s assumption about the technical potential in the housing stock has a greater proportion of Hard to Treat Cavity Walls (HTT CWI) than the proportion of cavity walls that the English Housing Survey describes as “problematic”. We note that the definition of a HTT cavity is unclear and may or may not be compatible with the definition of a “problematic” CWI project published by the English Housing Survey. However, any difference between these definitions would be difficult to explain. We therefore chose to examine how sensitive the price of ECO Points is to this difference.

5.2.1. “Hard to treat” walls are hard to identify

DECC has not set out a clear definition of an HTT cavity wall and so it is unclear which projects are eligible for a CSO subsidy. Energy suppliers have expressed concern over the definition, which encompasses the width and composition of a wall, and over the subsequent uncertainty over the potential stock of projects. Our scenario using EHS data examines the effect of adjusting this definition to correct for overestimation of the eligible housing stock in DECC’s analysis.
In Table 5.1 we illustrate the effect that reducing the proportion of HTT cavities within the housing stock has on the price of ECO Points. After rescaling DECC’s total stock for Great Britain to bring it into line with the English Housing Survey, our model predicts a 43% rise in the price of ECO points to £110.27/tCO$_2$. This would raise the cost of the CSO programme by £309 million per year above DECC’s estimate.71

<table>
<thead>
<tr>
<th>Source of HTT Cavities</th>
<th>Technical Potential (000s)</th>
<th>Subsidy (£/tCO$_2$)</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECC</td>
<td>3,171</td>
<td>77.00</td>
<td>0%</td>
</tr>
<tr>
<td>EHS (Rescaled)</td>
<td>1,658</td>
<td>110.27</td>
<td>43%</td>
</tr>
</tbody>
</table>

Source: NERA analysis.

The uncertainty surrounding the difficulty of treating cavity walls in the housing stock is an important risk factor in DECC’s estimates, rather than an omission or bias in DECC’s modelling. Neither DECC nor the suppliers have access to accurate assessments of the numbers of “hard to treat” cavity walls in the housing stock and the rules for inclusion in the CSO are not yet complete.72 Nonetheless, our modelling suggests that the costs of the CSO could rise sharply if the number of cavity walls eligible for support under the CSO turns out to be smaller than DECC expects and in line with other estimates.

5.3. Taking Account of Customer Inertia Increases ECO’s Costs

The “Decision Making Frequency” (DMF) represents the proportion of households per year which decide whether or not to install insulation.73 As described in Section 4.4, DECC derives its initial estimates of the DMF from its consumer survey. DECC’s initial estimates are that 26% of households with cavity walls and 6% of households with solid walls make a decision about whether or not to install insulation in a year. In its analysis of the costs of ECO, DECC disregards the DMFs it obtains from the consumer survey in favour of higher frequencies for customers eligible for solid wall insulation. DECC assumes that, as consumer awareness of SWI rises over time, the decision making frequency will rise to 10% (its central case).74 DECC does not provide any evidence to support this assertion.

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71 (£110.27/t - £77.00/t) x 20.9Mt = £695 million, which is £309 million per annum over 2.25 years. This method is used from now on to calculate per annum figures.

72 See, for example, DECC’s recent statistical release in which it revised up the number of insulated cavity walls in Britain from 8.7m to 10.0m due to difficulty in conducting accurate surveys. [http://www.decc.gov.uk/assets/decc/11/stats/energy/energy-efficiency/6472-stats-release-estimates-home-ins-jul2012.pdf](http://www.decc.gov.uk/assets/decc/11/stats/energy/energy-efficiency/6472-stats-release-estimates-home-ins-jul2012.pdf)

73 Or as DECC puts it “rate at which households are presented with the same choices presented to the respondents to the Green Deal consumer survey [i.e. choice between insulation packages]” DECC, Final Impact Assessment, 11 June 2012, page 126.

DECC therefore assumes that the DMF is above the level suggested by historic evidence and also that all consumers are fully informed about the Green Deal. Neither assumptions is likely to be valid in the short term. DECC may therefore have overstated the true DMF likely to be observed, especially over the period of the ECO programme, which only runs until March 2015.

We examined the effect of historical DMF remaining unchanged on the take up of SWI using our model of the ECO Point supply curve and show the results in Table 5.2. NERA has received data from suppliers suggesting that they have installed just over 1,000 internal SWI measures, all under the CESP programme. We calculate that consumers classified as “able to pay” under the CERT programme accounted for only 9% of the roughly 36,000 external SWI measures installed. Historically, only a small fraction of customers with solid walls consider upgrading them in any one year, if not targeted for free insulation by suppliers.

### Table 5.2

<table>
<thead>
<tr>
<th>Source of DMF</th>
<th>DECC Forecast</th>
<th>DECC Survey</th>
<th>NERA Mid-Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWI (%)</td>
<td>26%</td>
<td>26%</td>
<td>26%</td>
</tr>
<tr>
<td>SWI (%)</td>
<td>10%</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Price (£/tCO2)</td>
<td>77.00</td>
<td>107.00</td>
<td>90.15</td>
</tr>
<tr>
<td>Change vs. baseline</td>
<td>0%</td>
<td>39%</td>
<td>17%</td>
</tr>
</tbody>
</table>

**Source:** NERA analysis.

The DMF assumed by DECC in the Green Deal Household Model is high compared to the levels seen under previous programmes, or even compared to DECC’s latest survey results. After we have corrected DECC’s DMF assumption to fit with the survey data, the costs of meeting the CSO target rise. Using survey data increases the necessary price of ECO Points by 39% in our simple model. Even if we make the assumption that DMF does rise over the period to 8%, the shortfall against DECC’s assumption of 10% would raise the cost of the CSO programme by £122 million per annum.

### 5.4. Correcting for Understated Search Costs

In Section 4.3, we estimated that DECC had understated the costs of search per installation project for the CSO by as much as half. Since GDPs, and ultimately energy suppliers, must recover these costs from customers, it is possible to examine the effect on our model of passing through extra search costs into the costs of installation.

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75 Submissions from energy suppliers, October 2012.
76 The mean of DECC’s 10-15% estimate of search costs as a proportion of installation cost is 12.5% and well below our estimate of 25.9% of DECC’s forecast installation costs.
5.4.1. **Search costs are unrelated to the costliness of a measure**

To implement this scenario, it is not possible simply to increase the installation costs of each measure by some percentage figure. This is because the cost of identifying opportunities for solid wall insulation opportunity is not necessarily greater than identifying opportunities for loft insulation, despite the vast difference in installation cost. Our approach (set out in Table 5.3) consists of two steps:

- Firstly, we find the difference between the suppliers’ estimate of search costs and DECC’s implied search costs at (12.5% of the total cost of installations and suppliers’ estimates); and
- Secondly, we allocate this difference equally among all projects that are part of the CSO in 2013.

Our analysis examines the implication of this £270.20 being passed on to customers in its entirety.

<table>
<thead>
<tr>
<th>CSO cost items</th>
<th>Source</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Installation Costs (£m)</td>
<td>DECC</td>
<td>£566.88</td>
</tr>
<tr>
<td>Total Search Costs (£m)</td>
<td>DECC, 12.5% of Installation Costs</td>
<td>£70.86</td>
</tr>
<tr>
<td>Total Search Costs (£m)</td>
<td>GDPs</td>
<td>£146.84</td>
</tr>
<tr>
<td>Difference (£m)</td>
<td></td>
<td>£75.98</td>
</tr>
<tr>
<td>Total installations</td>
<td>DECC</td>
<td>281,185</td>
</tr>
<tr>
<td>Difference per installation (£)</td>
<td></td>
<td>£270.20</td>
</tr>
</tbody>
</table>

*Source: NERA analysis of DECC data and submissions from suppliers.*

5.4.2. **Pass through of search costs raises the price of ECO Points**

If suppliers pass through their additional search costs, the price of a tonne of CO₂ reduction will rise in our framework (see Table 5.4). To recover their costs of finding eligible customers for the CSO (or indeed the other components of the ECO), energy suppliers may pass some or all of these costs directly on to their customers (with the remaining percentage borne by all customers). If 50% of the costs of search that DECC ignores are passed through, the price of an ECO Point will rise by 9%. This change in the price of ECO Points would result in an increase of £63 million per annum in the cost of meeting the 2015 CSO target.

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77 DECC, Final Impact Assessment, page 66, Table 62; page 108, Table 27 and 28; “Setting the ECO Carbon Targets”, Steering Group Presentation, page 9; submissions from suppliers, October 2012.
Table 5.4
Pass Through of Search Costs Increases the Price of ECO Points

<table>
<thead>
<tr>
<th>% of Search Cost Passed</th>
<th>0%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (£/tCO2)</td>
<td>77.00</td>
<td>80.42</td>
<td>83.82</td>
<td>87.21</td>
<td>90.58</td>
</tr>
<tr>
<td>Change vs. baseline</td>
<td>0%</td>
<td>4%</td>
<td>9%</td>
<td>13%</td>
<td>18%</td>
</tr>
</tbody>
</table>

Source: NERA analysis.

5.5. Correction for Overestimate of Bundling Potential

As described in Section 4.6, DECC’s analysis emphasises the “whole house” approach to insulation, under which energy efficient measures are bundled together in a single package. DECC makes an assumption on the uptake of these bundles, which reduces the cost of the ECO by lowering search and administration costs necessary to locate each opportunity. DECC assumes that 80% of all households with technical potential for solid wall and loft insulation would prefer the bundled package.

Suppliers’ forecasts for SWI bundled with loft insulation under the ECO ranges from 5.0% to 37.5% of those houses with technical potential for both insulation types, which reflects the historic rate. Our model does not include an ad hoc “preference factor” for bundles, so it is not possible to replicate exactly the effect of changing this assumption. To introduce this factor into our model, we rescale the technical potential for the SWI and LI bundle accordingly. For example, to run the scenario where the SWI and LI bundling percentage is 37.5%, compared to DECC’s 80%, we reduce the supply of these installation opportunities in our model to 46.9% (=37.5%/80%) of DECC’s original figure.

Table 5.5 shows the result of this analysis. In our model, the effect of reducing DECC’s bundling assumption raises the price of ECO Points by between 11% and 19%. This increase in the price of ECO Points would raise the cost to suppliers of meeting the CSO target by £78-138 million per annum.

Table 5.5
Less Bundling Raises the Cost of the ECO

<table>
<thead>
<tr>
<th>Takeup of SWI and LI under ECO</th>
<th>% of bundled projects</th>
<th>Subsidy (£/tCO2)</th>
<th>Change vs. baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum estimate</td>
<td>5.0%</td>
<td>91.82</td>
<td>19%</td>
</tr>
<tr>
<td>Maximum estimate</td>
<td>37.5%</td>
<td>85.42</td>
<td>11%</td>
</tr>
</tbody>
</table>

Source: NERA analysis.

5.6. Adjusting for the “Warm Glow” Bias Increases ECO’s Costs

In Section 4.2 we highlighted how the “stated preference” methodology can overstate the degree to which customers are willing to pay for environmental measures, including, for example, installing insulation. In the absence of historical data or data from pilot studies, it is not possible to ascertain the extent of this so-called “warm glow” bias. Using our model of the ECO Point supply curve, we examine the possible effect of small changes in the willingness to take up insulation using a possible estimate of “warm glow” bias.

5.6.1. “Warm glow” bias is expressed in “consumer choice coefficients”

DECC’s stated preference study presented respondents with a choice between different packages of insulation with different characteristics. DECC (or DECC’s consultants) then estimated coefficients representing the impact on each of these characteristics on customers’ utility. We examined the potential impact of the mismeasurement of customers’ willingness to take up insulation measures caused by the “warm-glow” bias. To do so, we adjusted two of DECC’s coefficients as follows:

- “Savings – fixed interest rate (£)” is a coefficient which estimates the value customers’ place on net bill savings in the DECC model. DECC notes there is little difference between preference for fixed rate or variable rate savings, and hence adopt the former. If customers overstate their willingness to pay for insulation measures due to a “warm glow” bias, then this coefficient will be overestimated.

- “Bias” is DECC’s label for a coefficient specific to each measure that values customers’ dislike of the “impact on the house and living space in terms of changes in appearance or usable floor area, along with additional household time or hassle that may be experienced during installation”. If customers have overstated their willingness to pay for insulation measures, then this coefficient is likely to be understated.

5.6.2. Adjusting for the “warm-glow” bias raises the price of carbon

DECC has not published the confidence intervals associated with its estimated consumer choice coefficients. As a result, it is not possible to define alternative scenarios using “standard errors”, a statistical measure of the likely range of the coefficients. In any case, standard errors would not take account of the systematic bias in the stated preference approach. Instead, we apply the simple test of examining the effect of correcting the coefficients in the direction of the possible bias by different percentage values, shown in Table 5.6. The effect of correcting this bias is large. Increasing the negative value that customers place on the hassle costs associated with installation by 20% increases the price per tCO₂ necessary to achieve the CSO target by 35%.

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80 DECC, Final Impact Assessment, 11 June 2012, pages 129-130, Table 46.
The cumulative effect of adjusting both coefficients is even larger: adjusting both by 10% raises the per ECO point by 32% to over £100/tCO₂ in our model. Under this adjustment, the cost of purchasing the 20.9 million ECO Points required to meet CSO targets by March 2015 would rise by £227 million per annum.

### Table 5.6
Adjustment for Possible “Warm Glow” Bias Has a Large Effect

<table>
<thead>
<tr>
<th>Change in coefficient</th>
<th>-10%</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>&quot;Bias&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price (£/tCO₂)</td>
<td>64.01</td>
<td>77.00</td>
<td>89.72</td>
<td>103.88</td>
<td>131.02</td>
</tr>
<tr>
<td>Change vs. baseline</td>
<td>-17%</td>
<td>0%</td>
<td>17%</td>
<td>35%</td>
<td>70%</td>
</tr>
<tr>
<td><strong>&quot;Savings - fixed interest rate (£)&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price (£/tCO₂)</td>
<td>69.00</td>
<td>77.00</td>
<td>86.86</td>
<td>99.72</td>
<td>130.31</td>
</tr>
<tr>
<td>Change vs. baseline</td>
<td>-10%</td>
<td>0%</td>
<td>13%</td>
<td>30%</td>
<td>69%</td>
</tr>
<tr>
<td><strong>Both coefficients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price (£/tCO₂)</td>
<td>56.89</td>
<td>77.00</td>
<td>101.40</td>
<td>204.55</td>
<td>-</td>
</tr>
<tr>
<td>Change vs. baseline</td>
<td>-26%</td>
<td>0%</td>
<td>32%</td>
<td>166%</td>
<td></td>
</tr>
</tbody>
</table>

*Source: NERA analysis.*

The costs of monitoring the installation of insulation, contracting with installers and allowing contractors onsite represent significant costs of time and effort incurred by consumers (“hassle costs”). One source of the “warm glow” bias in DECC’s survey data is that consumers may not have taken into account the full hassle costs of installing insulation projects.

DECC provides estimates of the hassle costs faced by consumers in its impact assessment depending on the technology type, from £19 for draft proofing to £4,937 for internal SWI. We tested the impact of including hassle costs into consumers’ willingness to pay by increasing the cost of each insulation measure by DECC’s estimate of the hassle costs incurred by consumers. Adding DECC’s estimated hassle costs to the costs of the insulation measures increased the cost of ECO to £110 per ECO point in our model. Perturbing both “bias” and “savings” coefficients by 10% has a similar (but smaller) impact on the model as accounting for the hassle costs of installations and provides an approximation of impact of excluding hassle costs on the CSO programme (see Table 5.6).

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82 Under the 30% combined adjustment the model does not converge to a solution for any finite level of subsidy.

5.7. Effect of Combining Adjustments to DECC’s Model

We used data from energy suppliers and data from independent sources to define five assumptions that DECC has made which either:

1. are not supported by alternative sources of data; or
2. cannot justify be justified in the absence of data from other sources.

In the preceding sections we have shown the resulting price of ECO Points which results from adjusting our model for each of these assumptions separately, and the increase in the cost of purchasing the necessary ECO Points by March 2015. Here we present four scenarios in which these effects are compounded and compare them to the result derived using DECC’s assumptions. As explained in Section 5.2, since we consider the proportion of “problematic” cavity walls a risk factor, rather than an omission, so our cumulative scenario analysis does not include any adjustment for this factor. The other adjustments are intended to correct for omissions and biases in DECC’s assumptions. We illustrate the effect on the ECO point supply curve in Figure 5.2.

- **Scenario 1 – Correcting for inertia in SWI uptake**: DECC has not justified its decision to inflate the SWI “decision making frequency” above the survey rate of 6%, as described in Section 5.3. In this scenario, we examine the effect of applying a smaller decrease in inertia, raising the DMF to 8%, mid-way between the survey result of 6% and DECC’s assumption of 10%. Even this compromise raises the price of ECO Point to £90.15.

- **Scenario 2 – Correcting for inertia and additional search costs**: By not systematically accounting for search costs, DECC may have ignored a large cost item that affects the marginal costs of insulation and will hence be passed through to consumers. We applied the search costs we estimate from energy suppliers’ submissions, described in Section 5.4, and apply a 100% pass-through rate to each project, in line with DECC. Adding this adjustment to the lower DMF in Scenario 1 gives an ECO Point price of £104.02.

- **Scenario 3 - Correcting for inertia, omitted search costs, and overestimated bundling**: we have argued that DECC’s assumed 80% rate of bundling of SWI with LI projects greatly overestimates the technical potential available in the housing stock. Instead, we use the most optimistic projection received from energy suppliers, of 37.5% bundling rate, as outlined in Section 5.5. When added to Scenario 2, this adjustment gives an ECO Point price of £110.67.

- **Scenario 4 - Correcting for inertia, omitted search costs, overestimated bundling, and possible “warm glow” bias**: in our previous scenarios, we assumed that DECC’s model is a fundamentally accurate assessment of the market for insulation, but excludes some relevant cost items. In our final scenario we call into question this assumption, by accounting for the “warm glow” bias consumers may have exhibited when answering DECC’s stated preference survey. As in Section 5.6, we give an indication of this effect by perturbing the relevant consumer choice coefficients by 10%, to account for likely

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84 DECC, Final Impact Assessment, 11 June 2012, page 85.
differences between actual behaviour under the ECO and hypothetical answers given to survey questions. This combined scenario gives an ECO Point price of £160.18.

Scenarios 3 and 4 place a plausible range on the likely price of ECO Points during the first phase of the CSO. We note that additional risks surrounding energy prices and the development of the market for ECO points mean that the price of ECO points could rise higher than the upper limit or fall below the lower limit of this range. Scenario 3 incorporates adjustments to cost items that are understated or assumptions that do not accord with historical data or the evidence available. Scenario 4 builds in a further adjustment of customers’ demand for insulation measures. This adjustment reflects the likely difference between what customers say they will do in a hypothetical survey, and what their actual behaviour is likely to be. These two scenarios suggest a range for the additional cost of ECO Points needed to satisfy the 2015 CSO target of £310–770 million per annum.

Source: NERA analysis.

5.8. Conclusions on Impact on the CSO Programme

We used a version of DECC’s Green Deal Household Model to examine the effect of adjusting input assumptions that may have been misstated or erroneous in the original analysis. We found that adjusting these inputs had a large effect on the subsidy customers require to install insulation, and hence the cost of ECO Points under the CSO.
We conducted a scenario analysis which examined the effect of including several of these adjustments in a single run of the model. We summarise our findings in Table 5.7:

### Table 5.7
**Modelling The Increased Costs of Meeting The CSO Target**

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Cost of Individual Adjustment £/tCO2</th>
<th>Cumulative Scenario</th>
<th>Cost of Cumulative Adjustment £/tCO2</th>
<th>Increased Cost of CSO £ million p.a</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECC</td>
<td>£77.00</td>
<td>Baseline</td>
<td>£77.00</td>
<td>£0.00</td>
</tr>
<tr>
<td>Customer Inertia</td>
<td>£90.15 (1)</td>
<td></td>
<td>£90.15</td>
<td>£122.15</td>
</tr>
<tr>
<td>Search Costs</td>
<td>£90.58 (2)</td>
<td></td>
<td>£104.02</td>
<td>£250.99</td>
</tr>
<tr>
<td>Bundling</td>
<td>£85.42 (3)</td>
<td></td>
<td>£110.67</td>
<td>£312.76</td>
</tr>
<tr>
<td>&quot;Warm Glow&quot; Bias</td>
<td>£101.40 (4)</td>
<td></td>
<td>£160.18</td>
<td>£772.65</td>
</tr>
</tbody>
</table>

*Source: NERA Analysis.*

#### 5.9. Impact on the Cost of ECO as a Whole

Our analysis has focused on the effect on the CSO of altering unsupported assumptions and methodological biases in DECC’s Green Deal Household Model. These inputs also have implications for the cost of the other two obligations, the CSC and the AW. The scope of this report does not extend to addressing the impact on the other two obligations in a formal modelling framework. However, we can infer from our understanding of DECC’s modelling framework the likely direction and relative magnitude of the effects of revising the same unsupported assumptions and methodological biases (see also Table 5.8):

1. **Customer Inertia:** DECC assumes that suppliers will use Solid Wall Insulation to hit the CSC target. As customers must bear some of the costs of installing these SWI measures, inertia is likely to increase the required subsidy in a similar way to the CSO. DECC does not foresee that SWI will be rolled out under the AW (due to its expense), and so there is no likely effect on this programme.

2. **Additional Search Costs:** In Table 4.3, we showed that our estimate of search costs for the CSC was 15.9% of installation costs, which lies only slightly above DECC’s mid-point estimate of 12.5%. However, in the case of the AW, we estimated search costs would comprise 25.7% of the installation costs. The effects on the cost of the programme are therefore likely to be smaller than the CSO for the CSC but similar to the CSO for AW.

3. **SWI Bundling Rate:** DECC’s modelling suggests that suppliers and GDPs will roll out roughly one third as many SWI projects under the CSC as under the CSO. Consequently, the effect of a reduced rate of bundling of SWI with LI will probably be lower. DECC does not expect that suppliers and GDPs will install SWI to meet the AW target, so lower SWI & LI bundling assumptions would have no impact on DECC’s estimates of the costs of the programme.
4. **“Warm Glow” Bias:** If customers are less willing to install energy efficiency measures in their homes the costs all the ECO programmes would increase. DECC assumes that customers will co-finance insulation under the CSC and the likely impact of changing consumer preferences is the same as under the CSO. In the case of the AW, a higher proportion of eligible customers live in social housing and DECC assumes that customers will not co-finance insulation. Since customers’ may not co-finance insulation projects, the overall impact of changes to consumers’ preferences on the total costs of the AW programme may be lower than for the CSC or the CSO.

In practice, each of DECC’s unsupported assumptions and methodological biases appears to have a similar or smaller effect on the other components of the ECO. For illustrative purposes, we assume that the costs of the CSC and AW will rise half as much proportional to their value as the CSO. Under these assumptions, the total cost of the ECO programme would rise to between £1,700 million and £2,350 million, which we indicate in Table 6.1.

### Table 5.8
**Qualitative Assessment of Likely Impact of CSC and AW**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>ECO Points (£/tCO2)</th>
<th>Likely Effect Relative To CSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Customer Inertia</td>
<td>£90.15</td>
<td>Similar</td>
</tr>
<tr>
<td>(2) Search Costs</td>
<td>£104.02</td>
<td>Lower</td>
</tr>
<tr>
<td>(3) Bundling</td>
<td>£110.67</td>
<td>Lower</td>
</tr>
<tr>
<td>(4) &quot;Warm Glow&quot; Bias</td>
<td>£160.18</td>
<td>Similar</td>
</tr>
</tbody>
</table>

*Source: NERA Analysis*
6. Conclusion

DECC will be introducing a new obligation on energy suppliers, known as the Energy Company Obligation (ECO), in January 2013. The ECO will work in tandem with the Green Deal, which allows customers to finance energy efficiency measures through their energy bills. The ECO will oblige electricity and gas suppliers to achieve a target for CO\textsubscript{2} reduction by March 2015 of 27.8 MtCO\textsubscript{2}. It will also oblige suppliers to achieve a £4.2 billion “notional” bill reduction for their most vulnerable clients by installing insulation and other measures.

We reviewed the inputs into the model that DECC uses to project the costs of the ECO. These inputs include: actual installation costs of the different insulation types, a measure of customer’s “willingness to pay” for insulation, the frequency with which customers consider whether to install insulation, the potential supply of insulation opportunities in the housing stock, the rate at which different projects will be bundled together, and the search costs suppliers face in locating eligible customers.

We present evidence that DECC’s assumptions are likely to understate the costs of the ECO. By conducting a simplified modelling exercise, we replicate DECC’s analysis of the costs of the major element of the ECO, the Carbon Saving Obligation (CSO). We show that, when analysing a scenario in which all the apparent errors or omissions in DECC’s analysis are adjusted, the cost of ECO Points required to hit the March 2015 target may be substantially higher. Our final scenario suggested a price of £160.18/tCO\textsubscript{2}, more than double DECC’s estimate of £77/tCO\textsubscript{2}. This would imply an increase in the cost of meeting the CSO of £773 million per annum.

In practice, each of DECC’s unsupported assumptions and methodological biases appears to have a similar or smaller effect on the other components of the ECO. For illustrative purposes, we assume that the costs of the CSC and AW will rise half as much proportional to their value as the CSO. Under these assumptions, the total cost of the ECO programme would rise to between £1,700 million and £2,350 million, as we illustrate in Table 6.1. In line with the conclusions we drew in Table 5.8, we assume no read across of increased costs for AW in Scenario 1 or Scenario 3, and a 50% proportional rise in costs otherwise.

<table>
<thead>
<tr>
<th>Table 6.1</th>
<th>Implications for the Cost of the ECO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost per CSO ECO Point (per tCO2 reduction)</td>
<td>DECC</td>
</tr>
<tr>
<td>£/tCO2</td>
<td>£m</td>
</tr>
<tr>
<td>ECO Carbon Savings Targets, of which:</td>
<td>950.0</td>
</tr>
<tr>
<td>CSO</td>
<td>£m</td>
</tr>
<tr>
<td>CSC (incl RS)</td>
<td>£m</td>
</tr>
<tr>
<td>AW</td>
<td>£m</td>
</tr>
<tr>
<td>Admin costs</td>
<td>£m</td>
</tr>
<tr>
<td>Total</td>
<td>£m</td>
</tr>
<tr>
<td>Customers (millions)</td>
<td>25</td>
</tr>
<tr>
<td>Cost per Customer</td>
<td>£pa</td>
</tr>
</tbody>
</table>

Source: NERA Analysis.
The ECO is an inefficient policy response to reduce carbon emissions because the costs of ECO exceed the costs of other carbon abatement measures. For example, The EU ETS gives a transparent price for traded carbon emissions of around £6.50/tCO\textsubscript{2}.\textsuperscript{85} Under DECC’s central case, the cost of carbon traded via ECO Points would be roughly twelve times greater than the EU ETS price. Under our scenario analysis, this multiple may be as great as 15 to 25 times.

The cost of carbon under the ECO also significantly exceeds DECC’s estimated “shadow cost” of carbon.\textsuperscript{86} DECC estimates the short term non-traded cost of carbon in 2020 as £60/tCO\textsubscript{2} (in 2007 pounds). We have shown that the cost of carbon under the ECO significantly exceeds £60/tCO\textsubscript{2}, under DECC’s central case or our scenario analysis.

\textsuperscript{85} See http://www.pointcarbon.com/. Downloaded 09 November 2012, converted using £0.80 per euro.

Appendix A. Our Simplified Version of the GDHM

In Chapter 5, we use a simplified version of the Green Deal Household Model (GDHM) to simulate the effect of correcting various errors and omissions in DECC’s analysis. The GDHM works as follows:

- “[DECC] divide the British housing stock into 3,886 house types which reflect the permutations of size, heating fuel, tenure and existing loft and wall insulation.”
  - NERA’s model assumes all houses in the stock are of a uniform size – 3 bed semi detached. We consider only two fuel types, electricity and gas, and assume 83% of houses are fuelled by gas (in line with recent estimates by the OFT that 15% of customers are “off grid”). We use six different insulation categories. Therefore, our model only considers twelve different house types.

- “[DECC use] the characteristics of the different properties to determine which measure they are eligible for and what costs and energy savings would be.”
  - Since our model only considers 3 bed semi detached homes for tractability, we use DECC’s estimates of energy savings for this property type. We do this separately for gas and electricity fuelled houses. Since DECC do not present separate estimates for the energy saved in houses using different fuel types, we assume that each measure is equally effective in every house it is installed in.
  - We use cost estimates for a three bed semi detached house stated by DECC. Again, this is performed separately for gas and electricity fuelled houses. Houses fuelled by electricity can make considerably larger savings and therefore are more likely to install insulation.
  - DECC do not provide explicit guidance on which measure of emission savings will be used to determine emission savings for each measure: Standard Assessment Procedure (SAP) levels, SAP levels net of deductions for in-use factors, or SAP levels net of deductions for in-use factors and “comfort taking” by consumers. By contrast,

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89 Internal SWI, external SWI, HTT CWI, HTT CWI and loft, internal SWI and loft, external SWI and loft. We assume that the houses with the potential for loft insulation noted in DECC, Final Impact Assessment, 11 June 2012, page 104, Table 24 are not a subset of those mentioned in Tables 21 and 23, as DECC do not provide any explicit guidance on this point. Revising this assumption would considerably reduce the stock of houses suitable for insulation, and running the model under this assumption raises the price of an ECO Point from £77/tCO2 to £105.11/tCO2.
90 We do not make a distinction between houses suitable for different “types” of SWI insulation (see DECC, Final Impact Assessment, 11 June 2012, page 104, Table 23). Instead, we assume that SWI “Type 1” is dispatched in every case. Therefore, we assume that all houses in the stock suitable for SWI are able to achieve the maximum potential emission savings. If we run the model to despatch “Type 2” SWI, which has less lifetime emission saving potential, then the price of an ECO Point rises from £77/tCO2 to £94.27/tCO2 in our model.
91 DECC, Final Impact Assessment, 11 June 2012, page 111, Table 30.
93 “Comfort taking” involves a 15% increase in energy use by consumers, which is financed from the savings they have made from energy efficiency installations.
customers are assumed to assess the bill savings they will accrue before any “comfort taking” has taken place.\textsuperscript{94} We therefore make the assumption that emission savings should similarly be assessed as SAP levels net of deductions for in-use factors, but not including the effect of “comfort taking”.

- “Each year a certain number of households consider taking out a Green Deal.”
  - This is what DECC terms the “decision making frequency” (DMF). In our baseline model we use a DMF of 26\% for cavity walls and 10\% for solid walls, in line with DECC.\textsuperscript{95}
- “The GDHM uses consumer preferences derived from the Green Deal survey to estimate the probability that each of these household takes up a measure.”
  - Without access to DECC’s original survey data we are not able to estimate coefficients independently, so adopt those stated by DECC.\textsuperscript{96}
- “Only measures that meet the Golden Rule without any additional or upfront payment by the consumer are taken up.”
  - Our model only allows consumers to take up an insulation measure when the Golden Rule is met, i.e. bill savings in the first year exceed costs. For simplicity, we assume a flat nominal charge is levied each year.
- “The probability of uptake is determined by the net bill savings (bill saving minus repayments), the level of upfront capital and assessment cost, the length of the Green Deal plan and the type of measure offered. The net bill savings are determined by energy prices, cost of measures, the interest rate of the Green Deal plan and the amount of ECO subsidy available.”
  - DECC use a “logit” model to determine the probability of uptake of insulation, which we follow. We use DECC’s estimate of assessment costs (£112.50), setup costs (£16), and annual maintenance costs (£8 p.a.), as well as their estimate of installation costs to work out the entire costs of the project.\textsuperscript{97} In our baseline model we also use DECC’s stated interest rate of 7.5\% to work out the present value of the project.\textsuperscript{98} This is calculated over the repayment life of the project (20 years for SWI and 10 years for CWI).\textsuperscript{99}
  - DECC are very opaque over their calculation of the “future value of net bill savings”. Despite stating they use a “quasi-hyperbolic discount rate”, our analysis suggests this is not consistently applied in the model.\textsuperscript{100} As such, we merely follow DECC’s stated

\textsuperscript{94} DECC, Final Impact Assessment, 11 June 2012, page 111, Table 30.
\textsuperscript{95} DECC, Final Impact Assessment, 11 June 2012, page 126.
\textsuperscript{96} DECC, Final Impact Assessment, 11 June 2012, page 127.
\textsuperscript{97} DECC, Final Impact Assessment, 11 June 2012, page134, Table 47.
\textsuperscript{99} DECC, Final Impact Assessment, 11 June 2012, page 138, Table 49.
\textsuperscript{100} DECC, Final Impact Assessment, 11 June 2012, page 133.
method of valuing future bill savings, applying a coefficient of 1.52930 to 2013 savings to measures with a 20 year repayment life and 1.3890 to measures with a 10 year repayment life. We also apply a coefficient of 1.19610 to 2013 payment levels for 20 year repayments and 1.07980 to 10 year repayments.\textsuperscript{101} It is deeply unclear why DECC believe that costs and benefits in the future are discounted at different rates - \textit{net} savings should be calculated, and then a discount rate applied, quasi-hyperbolic or otherwise.

- “The probability that a house type will take up a measure is multiplied by the stock of houses it represents to provide an estimate of total uptake. “

We follow DECC here using our simplified housing stock.

We make one other important simplification to DECC’s model, by assuming that the decision to install each different type of insulation measure is made independently. Without this simplification, we risk double counting houses suitable for SWI that can install either external or internal, but not both, and so on. To implement this simplification, we assume a certain proportion of DECC’s published technical potential is suitable for internal insulation, and a certain proportion is suitable for external insulation. The split we assume is 75%, which is consistent with DECC’s estimated uptake figures for 2013.\textsuperscript{102}

We follow DECC’s approach of balancing the supply of insulation opportunities with demand for ECO Points by assuming for simplicity that uptake is constant each year. In practice we recognise that the profile of installations could vary over time due to a number of different factors. For example, installations could ramp up over time as customers awareness improves, or decrease over time if suppliers front-loaded their delivery of the programme. In order to calculate the carbon reduction by March 2015, we multiply the implied lifetime carbon reduction in 2013 by the number of years of the delivery period (January 2013 to March 2015, 2.25 years).

Under these simplifications, the model returns £77/tCO2 as the equilibrium level of subsidy needed to equate demand for carbon reduction (ECO Points) of 20.9 MtCO2 in 2015 with the supply of ECO Points. Since this equilibrium level of subsidy is endogenous to the model i.e. it is set to whatever level is necessary to hit the target, we are able to analyze how this changes when input assumptions are altered, as we do in Chapter 5.

\textsuperscript{101} DECC, Final Impact Assessment, 11 June 2012, pages 129-130, Table 46.

\textsuperscript{102} DECC, Final Impact Assessment, 11 June 2012, page 166, Table 63.
Appendix B. Comparison of DECC’s Cost Estimates

In this appendix, we present the results of further comparisons of DECC’s reported cost estimates to publicly available data. These comparisons demonstrate that there is still a considerable range of uncertainty surrounding DECC’s reported costs, which may increase the estimated costs of the ECO.

B.1. Energy Costs

DECC’s analysis of the savings that will accrue to households, and thus the value of measures installed under the Green Deal, is contingent on the price of the electricity and gas customers no longer need to heat their homes i.e. customers are more willing to adopt energy efficiency measures if, all else being equal, energy prices are higher.

B.1.1. DECC forecasts future electricity and gas prices

DECC therefore forecasts future electricity and gas prices. DECC bases its modelling of demand for insulation on assumptions about future energy prices for retail customers, stating that its assumptions about future energy retail prices are “consistent with DECC’s published fossil fuel price scenarios”.\(^\text{103}\) DECC does not refer to a specific document, but the most recent forecast available on the DECC website is dated 12 November 2011.\(^\text{104}\) Figure B.1 shows that DECC’s “retail” price assumptions are similar in pattern and lie above DECC’s wholesale price projections for gas in November 2011.

DECC is opaque over how customers value the reduction in their bills. The social benefit of bill savings is valued at the “variable price for each unit of energy saved”, which is the p/kWh of an extra unit of energy consumption excluding any standing charge.\(^\text{105}\) However, DECC states that when consumers evaluate the private benefit of future bill savings, they use the evolution of the “retail price” of energy.\(^\text{106}\) DECC refers to this again when it discusses the private value customers place on extra warmth in their homes.\(^\text{107}\) We therefore follow DECC in taking the “retail” price of energy to evaluate bill savings. We note that DECC’s approach is not consistent and retail customers will be able to save via only the variable component of their tariffs from reduced consumption.

B.1.2. DECC’s forecasts lie above market expectations

We show in Figure B.2 that DECC’s “central” forecast of wholesale prices lies 10-20% above market expectations, as inferred from long-dated contracts at the National Balancing Point. Since we have shown DECC’s forecast of retail gas prices is directly related to this

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\(^{103}\) DECC, Final Impact Assessment, 11 June 2012, page 55.


\(^{105}\) DECC, Final Impact Assessment, page 158.

\(^{106}\) DECC, Final Impact Assessment, page 133.

\(^{107}\) DECC, Final Impact Assessment, page 158. DECC discusses how vulnerable customers value the extra warmth in their home when “comfort taking”.
wholesale forecast, it follows that its projection of retail gas priced at over 5 p/kWh by 2015 similarly exceeds these expectations.

Figure B.1
DECC’s Retail Price Assumptions Are Derived From Wholesale Forecasts

Source: NERA analysis of DECC data.
In the case of household electricity prices, which we examine in Figure B.3, the comparison is more difficult to draw out because DECC does not publish estimates of wholesale electricity prices. We are therefore only able to compare forecast retail prices with market expectations for the price of wholesale electricity derived from power exchange UKPX. DECC’s estimated scenarios for retail electricity lie above the expected wholesale price. In the absence of DECC’s assumed wholesale price data we cannot quantify whether this difference is due to their forecast of wholesale prices, or due to the markup necessary to cover the additional costs of retail over wholesale.
It seems clear that, at least in the case of houses fuelled by gas, DECC has potentially overstated future energy prices (relative to market expectations) by 10-20%. It seems likely that this is also the case for retail electricity prices. This overstatement of energy prices, therefore, has lead to an understatement of the costs of the ECO.

**B.2. Interest Rates**

In its modelling of the net present value of schemes financed under the Green Deal, DECC uses a central assumption that interest rates from Green Deal providers will be 7.5%. With other things being equal, there will be greater uptake of energy efficiency measures if interest rates are lower, since this reduces the cost to the consumer of a Green Deal.

In Figure B.1, we present DECC’s central and high forecast for Green Deal interest rates against possible comparators. The British Gas “Home Energy Plan”, launched in mid 2011, offered customers loans specifically for energy saving upgrades to their house. Energesa is a company offering loans for the financing of domestic solar panels, with income from Feed-In-Tariffs used to make repayments. Finally, we also include two loans from major providers for the purpose of general home improvement, Halifax and Tesco Bank.

This analysis suggests that DECC’s central projection of interest rates lies at the lower end of currently available market loans. This may reflect an assumption by DECC that, since Green Deal repayments are linked directly to a house’s energy meter, this secure stream of
payments requires a lower risk premium than unsecured loans. However, given the large volume of customers that fall into debt (over 300,000 customer accounts are currently indebted according to a recent Ofgem statement), it is not clear that Green Deal providers will view this income stream as more secure, albeit that credit checks may provide additional comfort. DECC’s assumption of lower interest rates may, therefore, be unjustified, implying greater repayment costs and lower financeability of Green Deal measures.

### Table B.1
DECC Assumes Interest Rates With A Low Risk Premium

<table>
<thead>
<tr>
<th></th>
<th>DECC Central</th>
<th>DECC High</th>
<th>British Gas Home Energy Plan</th>
<th>Energesa Solarloan</th>
<th>Halifax Home Improvement</th>
<th>Tesco Bank &lt;£5,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical APR</td>
<td>7.5%</td>
<td>9.5%</td>
<td>6.9%</td>
<td>7.9%</td>
<td>8.8%</td>
<td>15.9%</td>
</tr>
</tbody>
</table>

Source: DECC and loan providers.

#### B.3. Administration Costs

Energy supplies will incur administrative costs of running the ECO programme, in addition to the search and transaction costs discussed above. These administrative costs relate to the “monitoring and reporting structures” required to run the ECO itself, and include both the fixed costs of suppliers familiarizing themselves with the obligation and setting up reporting structures, as well as variable costs related to running the programme.

DECC estimates that total ECO administrative costs will amount to £16.3 million in present value terms. The breakdown by cost components is shown in Table B.2. DECC assumes that the administration costs of the two Carbon Obligations (CSO and CSC) have a present value of £933,000, and are comprised of the following cost items:

- **Monitoring/reporting set up costs** which involve setting up the necessary infrastructure (i.e. new software) and other reporting procedures; DECC estimates these to be 25% of the CERT set-up costs or £27,000;

- **Familiarization costs** associated with staff understanding the new framework and explaining it to senior management. DECC estimates that these costs as the overhead cost of management time and associated costs, amounting to £16,000; and

- **Recurring administration costs**, which include the annual cost of reporting, have been assumed to be similar to those of the CERT programme. DECC assumes these stand at

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108 “The risk might be expected to be small as charges will be attached to electricity bills where default loss is low (1.5%-2%).” DECC, Final Impact Assessment, 11 June 2012, page 202.

109 Ofgem, Press Release, 23 September 2012 - “energy debt remains a problem, with more than 315,000 electricity, and 320,000 gas prepayment meters in debt”.

£64,000 per year, equivalent to the 2012 value of the assumed administration costs of the CERT assessment. DECC has also added fifteen days of work per company, related to administrative duties associated with the carbon targets, which amounts to £43,000 per year, at an hourly rate of £21. The annual estimated cost according to DECC therefore amounts to £107,000, or £890,000 in present value over the life of the project.

According to DECC’s estimates, the Affordable Warmth Obligation will cost £15.3 million, broken down as follows:

- **Fixed Costs** estimated at £7.9 million, and intended to cover the costs of managing and administering the Affordable Warmth Obligation measures; and

- **Variable Costs** estimated at £7.4 million, and intended to cover the associated costs with handling calls from customers who wish to claim eligibility for participation in the programme.

### Table B.2

<table>
<thead>
<tr>
<th>DECC's Estimates of ECO Administrative Costs, by Category</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carbon obligations</strong></td>
</tr>
<tr>
<td>Monitoring/reporting setup costs</td>
</tr>
<tr>
<td>Familiarisation costs</td>
</tr>
<tr>
<td>Recurring administration costs</td>
</tr>
<tr>
<td><strong>Affordable Warmth obligation</strong></td>
</tr>
<tr>
<td>Fixed costs</td>
</tr>
<tr>
<td>Variable costs</td>
</tr>
<tr>
<td><strong>Total ECO administrative costs</strong></td>
</tr>
</tbody>
</table>

*Source: DECC.*

Finally, DECC also estimates that the cost to the Government of setting up an ECO Administrator will stand at £22.1 million in present value terms. These will include a one-off set-up cost of £1.3 million, based on the set-up costs of the CESP programme, and an annual operating cost fee of around £2.5 million, or £20.8 million over the life of the project. DECC thus estimates that the aggregate administrative costs from the ECO project, incurred both by electricity suppliers and the government, will amount to about £38.4 million.

### B.4. Installation Costs

Installation costs are the major component of an investment in energy efficient measures, and are shared between the customer and energy supplier according to the subsidy available for each measure. Installation costs cover the time, materials and labour needed, but exclude additional “hassle costs” such as required refurbishment. Installation is the largest single cost

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111 DECC, Final Impact Assessment, 11 June 2012, page 86, Table 17. DECC state the “Total ECO administrative costs” as £16.3 million, presumably due to rounding up.
element accruing under the ECO, with DECC estimating costs of £10,121 million over the entire period.\textsuperscript{112}

DECC makes an estimate of the installation costs for different measures, which we present in Table B.3 for a three bedroom semi-detached house. DECC assumes these costs incorporate search and other overheads (10-15\% of total), which are therefore directly passed through to customers in DECC’s analysis.\textsuperscript{113}

DECC also makes several assumptions on how these costs will evolve over the period of the ECO, especially in the “immature” SWI market. For example, it assumes that significant economies of scale can be achieved, up to 40\% when installing SWI in multiple flats.\textsuperscript{114} It also assumes that SWI installation costs will fall 15\% over the period covered by the ECO as installation techniques improve.\textsuperscript{115}

**B.4.1. There is little data on the costs of untried technologies**

Comparing DECC’s estimates to independent sources presents a challenge, as for some measures generic quotes are not available. For well established technologies, such as condensing boilers and cavity wall insulation, DECC’s estimates appear to be broadly in line with currently available quotes (see Table B.3). For example, a condensing boiler purchased from Tesco, which provides a free installation service, costs £2,349, close to DECC’s estimate of £2,500. Some of the insulation projects in Table B.3 appear to have lower installation costs from the public domain estimates than DECC’s own estimates. We understand from Energy UK, but were unable to confirm independently, that the prices some of the quoted in the installation costs in the Table already include an element of subsidy under existing programmes.

However, in the immature market for SWI DECC’s estimates seem optimistic, reflecting its assumption of significant cost reductions. DECC’s estimate of the installation costs of external solid wall insulation is more than £500 less than that of the Energy Savings Trust. Since DECC assumes uptake of SWI will reach 957,000 by 2022, this understatement of cost is likely to seriously affect the overall estimated costs of the ECO to suppliers.\textsuperscript{116}

\textsuperscript{112} DECC, Final Impact Assessment, 11 June 2012, page 8.  
\textsuperscript{113} DECC, “Setting the ECO Carbon Targets”. Steering Group Presentation, page 9.  
\textsuperscript{114} DECC, Final Impact Assessment, 11 June 2012, page 109.  
\textsuperscript{115} DECC, Final Impact Assessment, 11 June 2012, page 109.  
\textsuperscript{116} DECC, Final Impact Assessment, 11 June 2012, page 164.
### Table B.3
#### Installation Costs

<table>
<thead>
<tr>
<th>Measure</th>
<th>DECC</th>
<th>Energy Saving Trust (Mid-range)</th>
<th>Tesco</th>
<th>Purple Market Research (2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal SWI</td>
<td>£5,806</td>
<td>£7,000</td>
<td>-</td>
<td>£5,250</td>
</tr>
<tr>
<td>External SWI</td>
<td>£10,650</td>
<td>£11,200</td>
<td>-</td>
<td>£7,980</td>
</tr>
<tr>
<td>CWI - easy to treat</td>
<td>£500</td>
<td>£350</td>
<td>£323</td>
<td>-</td>
</tr>
<tr>
<td>CWI - hard to treat</td>
<td>£1,875</td>
<td>£600</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Loft top up</td>
<td>£300</td>
<td>£225</td>
<td>£358</td>
<td>-</td>
</tr>
<tr>
<td>Condensing gas boiler (G t)</td>
<td>£2,500</td>
<td>-</td>
<td>£2,349</td>
<td>-</td>
</tr>
<tr>
<td>Floor insulation</td>
<td>£400</td>
<td>£770</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Double glazing</td>
<td>£4,500</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Draft proofing</td>
<td>£100</td>
<td>£20</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Source: NERA analysis of various sources.¹¹⁷*
