Assessing the Social Impacts of a Supplier Obligation

A study for Defra

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Final report

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The Project Team

This study was undertaken under contract to Defra between April 2007 and July 2007 by a CSE project team consisting:

Simon Roberts (lead author and analyst), Vicki White (statistical analysis), Ian Preston (fuel price data and data manipulation), Joshua Thumim (strategic advice and statistical support)

The project team is also indebted to Angela Druckman, Research Fellow on the RESOLVE programme at the University of Surrey (see www.surrey.ac.uk/ces) for the initial analysis and data extraction of the Expenditure and Food Survey which underpins this study.

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1. Background to this study

In order to provide more background analysis in support of the *Call for Evidence on the Household Energy Supplier Obligation from 2011*[1], Defra commissioned the Centre for Sustainable Energy (CSE) to examine the potential social implications of an obligation on energy suppliers to reduce the carbon emissions of their domestic customers. This report should therefore be read in conjunction with that Call for Evidence.

The study has deliberately examined the social impacts relating to a cap-and-trade supplier obligation. This is because such a supplier obligation would potentially create far more significant changes in energy supplier practices compared with the possible alternative of a further development of a measures-based approach [as characterised by the Energy Efficiency Commitment (EEC) and forthcoming Carbon Emission Reduction Target (CERT)].[2] Not least amongst these changes is that suppliers would be required to reduce the carbon emissions of only their *own* customers; measures-based approaches have not, to date, featured this focus.

The social implications of requiring suppliers to reduce customer energy demand or carbon emissions are also potentially more significant than requiring them to install energy saving measures. The installation of measures will almost certainly lead to social benefit (in the form of increased comfort and/or lower costs) whereas reduced demand may be associated with lower standards of warmth and energy services and thereby increased deprivation for those households already struggling to keep warm.

However, as with a measures-based approach, the distributional impact of a supplier obligation depends on the distribution across the customer base of both the costs of delivering the obligation and the benefits of reduced energy consumption (and thereby, potentially, associated lower bills).

To understand the social implications of the supplier obligation, a number of different steps are needed:

- To identify the characteristics of those customers likely to fit best with – and therefore potentially benefit from – the various activities which suppliers are anticipated to pursue in the light of a supplier obligation.[3]

- To understand the costs to suppliers of meeting the obligation (beyond those costs they have recovered directly from 'benefiting' customers), how they will choose to recover these across their customer base, and the implications for their energy prices and tariffs.

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1 http://www.defra.gov.uk/environment/climatechange/uk/household/supplier/pdf/evidence-call.pdf

2 Nevertheless, the study does include a comparison of how the social impact of a supplier obligation may compare with a measures-based approach. See Section 6.

3 As the study undertaken for Defra by NERA puts it: "*The impact also could be different for different consumers…[depending on] the extent to which desirable customer characteristics were negatively correlated with low income or wealth, the policy could have adverse distributional consequences*" (p xi) Alternatively, if the characteristics are positively correlated with low income, the policy would have distributionally progressive consequence. See http://www.dti.gov.uk/files/file38976.pdf

- To 'map' these characteristics and cost implications onto energy consumption and income and other distributional data about all UK domestic energy consumers.

Taking these steps can enable an assessment of the potential nature and scale of the social impact of the likely responses of suppliers to a supplier obligation. This social impact (positive, negative or neutral) may emerge in terms of distributional impacts of the costs and benefits of supplier responses by income or geography or through particular implications for households in, or at risk of, fuel poverty.

This study represents a first attempt to take these steps and assess the likely social impact of a supplier obligation which required energy suppliers to reduce their customers' carbon emissions and/or energy demand. It has involved extensive new analysis of energy consumption data derived from energy expenditure information within the Office for National Statistics (ONS) Expenditure and Food Survey (EFS). This enables such data to be linked to income data and potentially an extensive variety of other household characteristics gathered in the EFS.

There are a significant number of 'unknowns' which limit the certainty of any conclusions drawn by this study. These include in particular: (a) the quality and availability of data regarding both actual fuel expenditure and required fuel expenditure (to maintain adequate warmth and other energy services) and; (b) the predictability of energy supplier business strategies when faced with a supplier obligation. Even with the approach to (a) adopted here, there will remain data uncertainties.

The study assumes the introduction of a cap-and-trade supplier obligation without any specific 'social' requirements (which might, for example, direct suppliers to make specific efforts to achieve carbon emission reductions with certain types of customers, as with the measures-based EEC Priority Group). The possible approaches to addressing any adverse social impacts from a supplier obligation are examined briefly.

This report details the outcomes of the study. **Section 2** examines the possible impact of the supplier obligation on the 'desirability' to suppliers of different customer types. **Section 3** explores the possible cost implications of a supplier obligation and how these might pass through to customers depending on the strategies adopted by suppliers.

Section 4 reviews existing data on the distribution across different income brackets of energy expenditure, actual energy consumption and required energy consumption to meet warmth standards. It (together with the Appendix) describes the methodology adopted by CSE and the RESOLVE team at the University of Surrey to convert expenditure data from the EFS into actual consumption and carbon emission data.

Section 5 brings together the analysis from Sections 2 and 4 to see how the more and less 'desirable' customers 'map' on to this data. Using household information gathered by the EFS, it details and compares their typical characteristics. From this, a broad-brush picture of 'winners' and 'losers' can be painted.

Section 6 compares this picture with likely social impacts arising from a continuation of a measures-based approach such as EEC/CERT.

Section 7 draws conclusions and examines possible policy responses to the study findings.

2. How a cap-and-trade supplier obligation changes the characteristics of 'desirable' customers

There are, of course, already some social impacts resulting from the current commercial practices of energy suppliers. For example, lower income households tend to pay more per unit of energy than richer households because they tend not to choose – or may not have access to – payment methods, like direct debit, or internet access, which suppliers favour with lower tariffs.

In this context, it is important to note that a supplier obligation would not be introduced into a market in which all domestic energy customers are currently equally 'desirable' or equally 'favoured' by energy suppliers. There is already a range of factors which determine the desirability of different types of customer to each supplier (such as payment reliability, loyalty, cost to serve, positive effect on cash-flow, demand volume etc).

A key (and necessary) effect of a cap-and-trade supplier obligation would be to introduce a significant new factor – the need to secure lower customer carbon emissions – into this existing complex mix of factors.

In other words, a supplier obligation would change the basis on which energy suppliers view customers as more or less desirable, to be more or less 'favoured'. It will add a new dimension into the factors shaping their marketing and customer service strategy. This is a significant departure from the existing EEC/CERT approach where suppliers can (and do) deliver energy saving measures from any household, whether or not they are their own customer.[4]

However, it is unlikely that this new dimension would dominate these other factors outlined above unless the supplier obligation was particularly demanding.

Nevertheless, it would change the desirability of different customer 'types'. For example, in very general terms, high users not willing or able to reduce consumption would probably become less desirable than at present, while persistent low users would probably become more desirable. To the extent that low users are also low income households, this may be a positive distributional effect of a supplier obligation when compared with the current situation.

Clearly, this 'desirability' is relevant only the context of a competitive energy market in which customers can change electricity or gas supplier. Energy suppliers will be keen to attract and/or retain – through offers, enticements, competitive deals – those customers who become more desirable as a result of a supplier obligation.

By contrast, the suppliers will become less attracted, and potentially distinctly discouraging (in the form of higher tariffs or an explicit lack of offers), to those customers whose characteristics make them less desirable.

While each energy supplier may adopt a different business strategy in response to a supplier obligation, it is likely that they will have in common an analysis of which types of household have become more or less desirable. And they will compete to attract and retain the more desirable customers, encouraging them to take up their offers and energy saving initiatives. These types of customers are therefore likely to receive a wider choice, better service and greater benefits as a result of this competition for market share.

4 An EEC/CERT measures-based approach therefore has little or no influence on an energy supplier's assessment of the desirability of their supply customers.

The customers who become less desirable as a result of the supplier obligation will, of course, still have an energy supplier. They may even, a result of poorly targeted marketing, be able to take advantage of offers intended for more desirable customers. However, it is likely that, over time and as a group in a competitive market, they will receive less choice, poorer service and lower benefits.

It is therefore important to understand the characteristics which can be expected to determine the desirability (or otherwise) of customers as a result of a supplier obligation.

2.1. The 'desirable' customer characteristics arising from a supplier obligation

At a simplistic level, energy suppliers with an obligation to reduce average consumer carbon emissions could characterise customers on the basis of four broad qualities: responsiveness to offers and interventions, current household emissions levels, potential for cost-effective emissions reductions, and 'willingness to pay'.

Energy suppliers are likely to be **more** attracted to customers:

- who respond readily to various energy supplier activities designed to encourage lower consumption and/or lower carbon emissions;
- who are willing to pay more themselves towards the activities which lower their consumption/emissions;
- with lower than average consumption/emissions;
- with higher than average consumption (particularly dual fuel and high electricity consumers) and with cost-effective potential – and a propensity – to reduce their consumption and thereby their emissions;
- using electricity for heating and/or hot water with potential to switch to a lower carbon alternative.

They should be **less** attracted to customers:

- whom they find difficult to persuade to modify their energy using behaviour;
- unable or unwilling to pay for interventions to reduce their demand;
- with higher than average consumption who are not responsive to encouragement to reduce demand;
- with higher than average consumption in 'hard to treat' properties (eg solid walls) where there are significant costs associated with reducing demand for heating (though not necessarily electricity demand).

The extent to which these characteristics make any individual customer more or less desirable to an energy supplier is likely to depend also on how they fit with other desirable characteristics (such as cost to serve) and the level of demand reduction required by a supplier obligation. For example, customers with a history of unreliable payment and a resulting high cost to serve are unlikely to become 'desirable' however low their consumption.

The same is true of the energy suppliers' activities to reduce demand.

Thus an approach – such as EdF's current Read, Reduce, Reward – which reduces 'cost to serve' (in this case by securing customer meter reads and establishing internet-based customer service) whilst also encouraging and rewarding demand reductions is likely to prove more attractive than one which simply rewards demand reductions.

Clearly the extent to which an energy supplier will be able to know these attributes in advance is limited by the information which energy suppliers have about their customers (and those they wish to recruit). Suppliers will certainly know about their own customers:

- Average annual consumption of the fuel they supply
- Payment method and history
- Meter accessibility
- Use of electricity for main heating (i.e. well-used Economy 7 tariff)
- Address (and therefore some socio-economic classification like ACORN and debt-risk, and potentially some basic housing-typology etc)
- Length of time as customer and recruitment method
- Responsiveness to marketing (offers/bill stuffers etc)
- Priority Service Register status (though only if on it)[5]
- Benefit status if on Fuel Direct[6]

They may also know whether customers have participated in any of their EEC schemes. They will certainly know that anyone moving into a brand new home (provided it is not enormous) is very likely to have a lower than average energy demand due to higher energy performance standards in modern building regulations.

This relatively limited knowledge will constrain the level of refinement and customer-specific targeting which suppliers will be able to execute in any apparently ideal commercial strategy.[7]

It will also constrain the extent to which suppliers will be in a position to understand for themselves the social impact of their strategies (eg a reduction in the profligate use of energy and an increase in energy deprivation will look the same to the supplier from customer meter readings). The work on data sharing announced in the Energy White Paper may help with this.

5 Domestic energy suppliers are obliged to maintain a Priority Service Register of those vulnerable households who provide details of their particular needs to guide customer services, metering and billing and credit control practices.

6 Fuel Direct is a system for direct payment of a customer's fuel bills to the energy supplier by the Benefits Agency for those households in receipt of benefits with fuel debt problems.

7 A significant implication of this observation is that suppliers are likely to become much more interested in finding out much more about their own customers – since a supplier's ability to meet its obligation could depend greatly on its ability to understand and influence its customers' lifestyles. This also represents a significant change compared with EEC/CERT.

3. The possible cost implications of a supplier obligation

The full cost implications for domestic energy consumers of a cap-and-trade supplier obligation – in terms of how it would influence energy prices and, within that, the range of energy tariffs available – are not yet clear.

It is however clear that the cost to a supplier of meeting the obligation will be highly dependent on:

- the level of the obligation (and therefore how much effort is required);
- the cost and effectiveness of various approaches and measures designed to reduce energy demand, including through behaviour change which has, as yet, not been fully tested;
- the tradability of the obligation, the terms of any buy-out option, and the extent of trading between a relatively small number of large suppliers – to ensure the resulting market drives lowest cost interventions across all suppliers;
- the extent (potentially quite limited) to which supplier profitability is affected by reduced sales volume;
- the extent to which customers can be persuaded to pay themselves for the cost of demand reduction measures (such as insulation and microgeneration);
- the readiness of the population to engage with demand reduction initiatives and trends in demand beyond 2011 (which may in turn be influenced by other, 'non-supplier' initiatives, from stronger energy efficiency standards curbing energy consumption by wasteful products to tangible, close-to-home evidence of climate change).

The distributional impact of a supplier obligation depends on the distribution across the customer base of both the costs of delivering the obligation and the benefits of reduced energy consumption (and thereby, potentially, associated lower bills).

The distribution of benefits is likely to be a function both of the potential for reducing demand AND willingness to pay.[8]

The potential for reducing demand is likely to be related to current levels of consumption (where higher consumption is more likely to indicate an opportunity to reduce). It will also be related to the existing thermal performance of the customer's dwelling and the efficiency of the energy-using appliances therein – and the ease with which they could be improved.

'Willingness-to-pay' is undoubtedly related to income, though it is arguable that only for the lowest three or four income quartile households will this be a genuine issue of affordability (as opposed to 'desirability' compared with other spending options).

In recovering the costs of delivering the obligation, the energy suppliers will have to balance their strategy between a combination of: (a) direct cost recovery from those customers who benefit from supplier efforts to reduce their emissions; (b) generalised cost recovery in which all or most customers effectively cross-subsidise those customers who benefit, and; (c) 'penalising' cost recovery which seeks to recover the cost of subsidies from a particular group of customers who are not the beneficiaries (and who may themselves have become 'less desirable').

8 This is also true of a measures-based approach like EEC/CERT, except that with this approach the potential for reducing demand is less important than the potential to install the measure and, at present in EEC, the 'willingness to pay' factor is partly over-ridden by the Priority Group requirement.

As mentioned above, some approaches to a supplier obligation which could prove successful could have very limited cost implications for the customer base as a whole or for any individual 'participating' customer. Other approaches could have quite significant cost implications for most customers.[9]

For example, tariff based approaches to stimulating demand reduction may have very few cost implications since it may be possible for suppliers to structure new tariffs to maintain revenues at pre-reduction levels (in effect recovering the cost of reducing demand through the revised tariff). Those customers on such tariffs who reduce their demand in response would benefit from lower costs; customers who do not, or can not, reduce demand would pay more.

Similarly, schemes which rewarded customers for reducing their demand may reduce cost to serve (through more self-servicing and lower complaints) and increase loyalty and retention, creating value to the supplier which is greater than the cost of the reward.

Energy services and performance contract approaches should focus costs tightly on the customers who benefit. The energy supplier installs demand reduction measures (such as insulation, improved metering, microgeneration etc) and recovers the cost over time from the customer. In theory at least, the supplier would have no need to recover costs of such an approach from the rest of their customers.[10]

Other approaches are more likely to result in costs being spread across a supplier's entire customer base (through tariffs) while only the targeted 'participating' customers would benefit from the services and offers.

For example, suppliers are quite likely to continue offering energy saving measures – such as insulation, more efficient appliances, lighting and heating – as they do under EEC/CERT. As with EEC/CERT, any subsidy for these 'offerings' for any customer would need to be recovered through increased costs for all customers.

The same may be true of supplier initiatives to work with housing developers and recruit the buyers of new homes as customers. These would be targeting households with low heating related emissions, a potentially attractive customer type as a result of the supplier obligation. Depending on the overall commercial value of such customers to energy suppliers and how competitive the market for these customers becomes, suppliers may seek to subsidise offers to either the developers or the new home-owners or both.

To take a cynical perspective, it is possible that in both these approaches – subsidised energy saving measures and activities with new housing – the supplier could decide to recover its costs through tariff increases targeted on customers it knows are 'loyal' and very unlikely to switch supplier. To the extent that such customers are low income and/or vulnerable, this would clearly have a detrimental social impact.

These issues are revisited in Sections 5 and 6 below.

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9 For a more detailed discussion of different approaches that may be adopted by energy suppliers in response to a supplier obligation, see Section 6 of the *Call for Evidence* (particularly pages 25-28) at http://www.defra.gov.uk/environment/climatechange/uk/household/supplier/pdf/evidence-call.pdf

10 On the other hand, even with an energy services approach, the supplier could decide to recover some of this cost from other customers through their tariffs (effectively lowering the cost to the energy services customer through, effectively, a cross subsidy). The supplier would need to believe that this would not impact negatively on their market position.

4. The distribution of energy expenditure, energy consumption & affordable warmth

In order to understand the potential social impact of a supplier obligation it is important to understand how energy expenditure, energy consumption (and its associated carbon emissions), and energy 'requirements' currently distribute by income (and other household characteristics) within the UK population.

The annual Family Spending report of the Office for National Statistics (ONS) provides data on the distribution of expenditure on electricity, gas and other fuels by household income across the UK. Derived from the national Expenditure and Food Survey (EFS), the report identifies average expenditure on each fuel by gross income decile.

However, as described below, this expenditure information is insufficient to enable a full review of possible social impacts of a supplier obligation because: (a) it hides significant and potentially highly relevant variations within income deciles; (b) expenditure is not perfectly correlated with consumption across the population because low income households tend to pay more per unit for their energy, and; (c) both expenditure and consumption will not indicate the level of energy service being obtained by a household (and therefore whether the home is warm and well lit).

There is no single dataset which meets all of these needs.[11] The EFS provides expenditure data but does not convert it into consumption. It does however provide details about payment method, thus creating some potential for converting expenditure data into consumption data if energy prices for each payment method for the region of the sample households are known at the time of survey.

The English House Condition Survey and the Scottish equivalent provide sufficient data about the housing stock and occupants' income to enable the required energy consumption and expenditure to be assessed (as it is routinely for official fuel poverty statistics). It does not however collect actual fuel expenditure data.

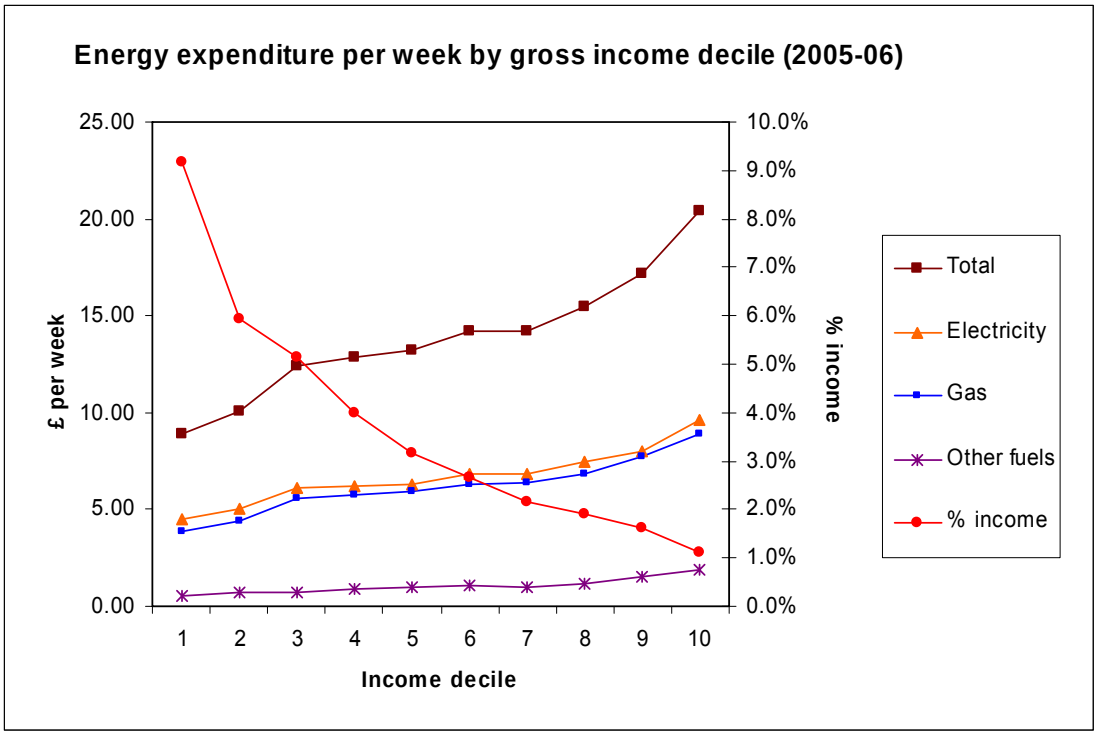
This section describes the process used by CSE, with significant assistance from the RESOLVE programme at the University of Surrey, to begin to address these information deficiencies without resorting to extensive further household surveys.

4.1. Energy expenditure

The graph in Figure 1 is based on the Family Spending report for 2006 which reports on the EFS for 2005-06.

11 The English House Condition Survey used to do this for England but since 1996 has not collected actual expenditure information). It is hoped that the proposed new Integrated Household Survey will correct this.

Figure 1



Source: Table A8, Family Spending 2006, Dunn E and Gibbins C, Office for National Statistics

Notes:
- Other fuels includes coal, bottled gas, heating oil, LPG etc. It does not include transport fuels.
- % gross income shown here is in relation to the median level of each decile band

As with data from previous years, the graph clearly demonstrates:

a. the higher levels of energy expenditure associated with higher household income; the poorest 10% of households spend, on average, less than half that spent by the richest 10% of households;

b. the highly regressive nature of energy expenditure; the poorest 10% of households spend at least 8 times as high a proportion of their gross income on energy as the richest 10%;

c. that average expenditure on electricity and gas by decile each have very similar relationships with income (both increasing at similar rates with growth in income).

The immediate and 'broad brush' implications of this in relation to the discussion above are that: (a) lower income consumers with lower than average consumption may become more desirable to energy suppliers than at present (though see also discussion at Section 5.2 below); (b) any increase in average energy prices as a result of a supplier obligation is likely to be highly regressive, and; (c) the distributional impacts of an energy or a carbon-based obligation may be rather similar (since electricity and gas expenditure have very similar relationships with income).

However, as outlined above, this data is of only limited assistance to the task of assessing the distributional impact of a supplier obligation. Not least of these is that it shows only average fuel expenditure by income deciles, whereas there are known to be significant variations within income decile as well as between them. More importantly, it relates to expenditure, not to fuel consumption or its associated carbon emissions. A supplier obligation would be

focused on reducing consumption of delivered energy or emissions, not on reducing expenditure.

That said, knowing the proportion of household income being spent on fuel is an important factor within an assessment of social impact. The issue is revisited later in this section.

4.2. Energy consumption and carbon emissions

As mentioned earlier, fuel expenditure does not equate directly with energy consumption or energy-related carbon emissions. This is because low income households tend to use more expensive payment methods (prepayment and standard credit) than higher income households. They therefore, on average, obtain less energy for every pound spent, potentially 10-15% less. In addition, homes without access to mains gas typically pay more 'per unit' for heating fuels: oil, solid fuel or LPG.

In order to understand the distributional impacts of a supplier obligation focused on reducing energy consumption, we need to understand the distribution of energy consumption, not energy expenditure, by income. Furthermore, previous research by Dresner and Ekins (2004)[12] indicates a large variation within income deciles, suggesting that the decile averages mask some low income households with very high consumption levels and some high income households with very low consumption levels. This indicates value in examining the distribution of consumption within income deciles as well as between them in order to understand how target customer 'segments' for suppliers (eg low consuming households) might cut across income bands.

To address these data needs, CSE worked with the RESOLVE research team at the University of Surrey to link the raw fuel expenditure data from the 2004-05 EFS (which includes reported household fuel payment methods) and fuel price data sourced from DTI, SALKENT, BRE and energywatch. This approach has enabled the energy expenditure data to be converted to energy consumption data. Existing carbon coefficients for gas, grid electricity and other fuels enable this to be converted to carbon dioxide emissions.[13]

This approach, together with the sample weightings provided within EFS[14], can thereby provide a detailed picture of the distribution of energy consumption and carbon emissions by income deciles and, importantly, within each income decile. It thereby enables – as detailed in Section 5 – a more accurate and fine-grained assessment of potential distributional impacts of different strategies adopted by energy suppliers in response to an obligation to reduce energy demand and/or emissions.

In order to provide some reasonably simple outputs from this complex analysis, the information is presented graphically. The energy consumption data is shown by both income decile and energy consumption decile. In the same way that income deciles are created by dividing the weighted sample into 10 groups with equal numbers of households in them (starting with the lowest income household in decile 1), so the sample was used to create 'energy consumption deciles'. This takes the same 'deciling' approach but uses energy

12 Dresner S and P Ekins (2004) The distributional impacts of economic instruments to limit greenhouse gas emissions from transport, Policy Studies Institute, London, 2004

13 See Appendix to this report for a more detailed methodology. There are a range of factors – including sampling errors within the EFS and in the payment method matching methodology employed here - which impact on the accuracy of the data presented here. This means that it would not be appropriate, without significant sensitivity checking, to use the analysis to draw conclusions about very small groups of households.

14 These sample weightings are calculated by ONS to enable the EFS sample of nearly 7,000 households to be converted into a 'representative' sample of all households in the UK.

consumption instead of income (so energy decile 1 has the 10% of the total population using least energy – see Table 1 on page 13 for median values for energy consumption deciles).

The data is presented as a series of 'bubble charts'. The X axis in each represents the income decile. The Y axis represents the energy use (or carbon emission) decile. The size of the bubble (strictly speaking its diameter unless stated otherwise) represents the number of households which have that energy use and that income.

Figure 2

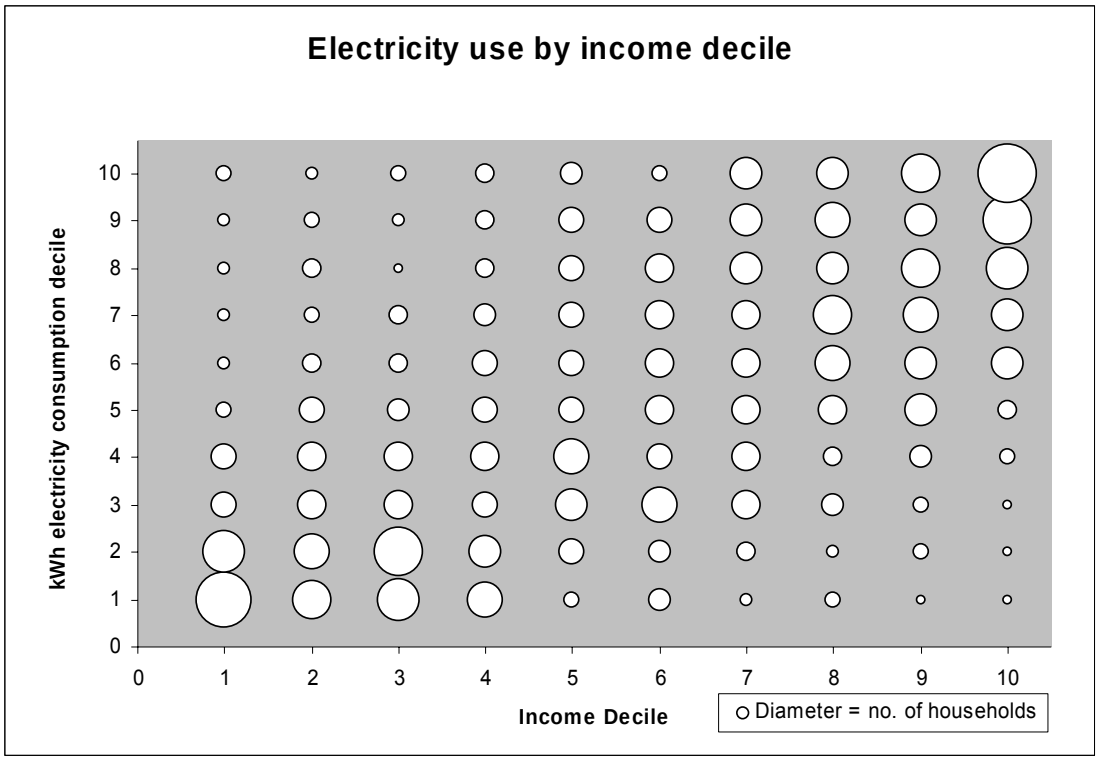


Figure 2 shows this for electricity consumption, revealing that the largest group of lowest income households have lowest electricity consumption (the large 'bubble' at 1,1), with the opposite being true of highest income and highest consumption (the large 'bubble' at 10,10).

Figure 2 demonstrates graphically a relationship between income and electricity consumption (as with expenditure). Lower income households tend to consume less electricity. However, because of the significant variation within income deciles (see the smaller bubbles at 1,10 and 10, 1), the overall correlation between income and electricity consumption in the dataset is only modest (R = 0.222).

The same picture is true of gas (only including those households using a gas supply) (R = 0.228), as shown in Figure 3 below.

By converting the electricity and gas consumption figures into carbon emissions, these can be combined (and set into carbon emission deciles) to produce the picture when the focus is carbon emissions rather than energy consumption. This is shown in Figure 4. The correlation between income and carbon emissions remains modest (R = 0.25) owing to the level of variation amongst households with similar incomes.

However, as with the highly regressive nature of fuel expenditure, the poorest 10% are causing just 45% of the level of carbon dioxide emissions generated by the richest 10% from energy use in their homes.

Figure 3

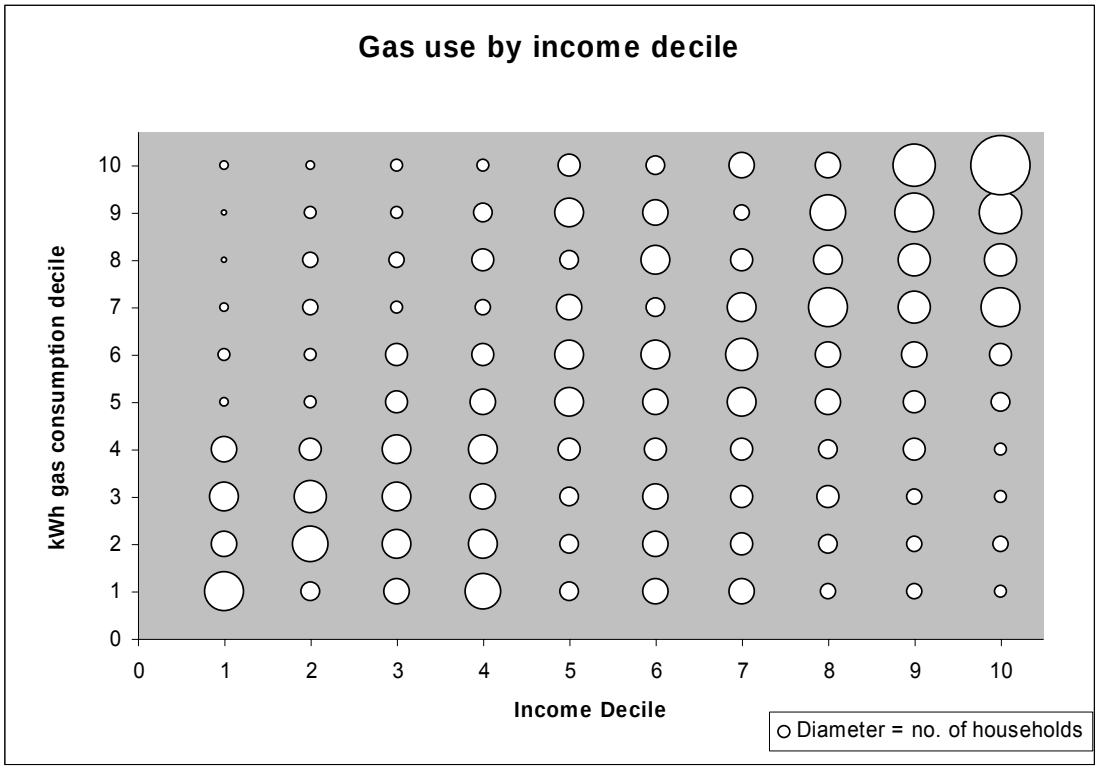
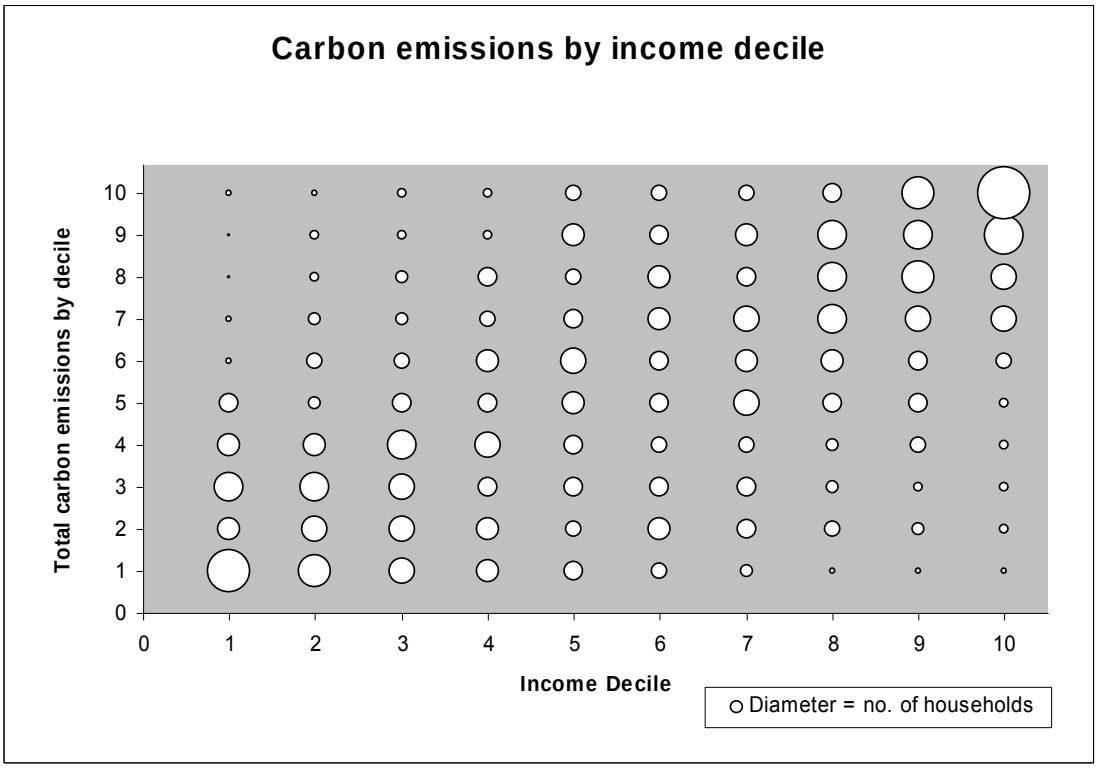


Figure 4



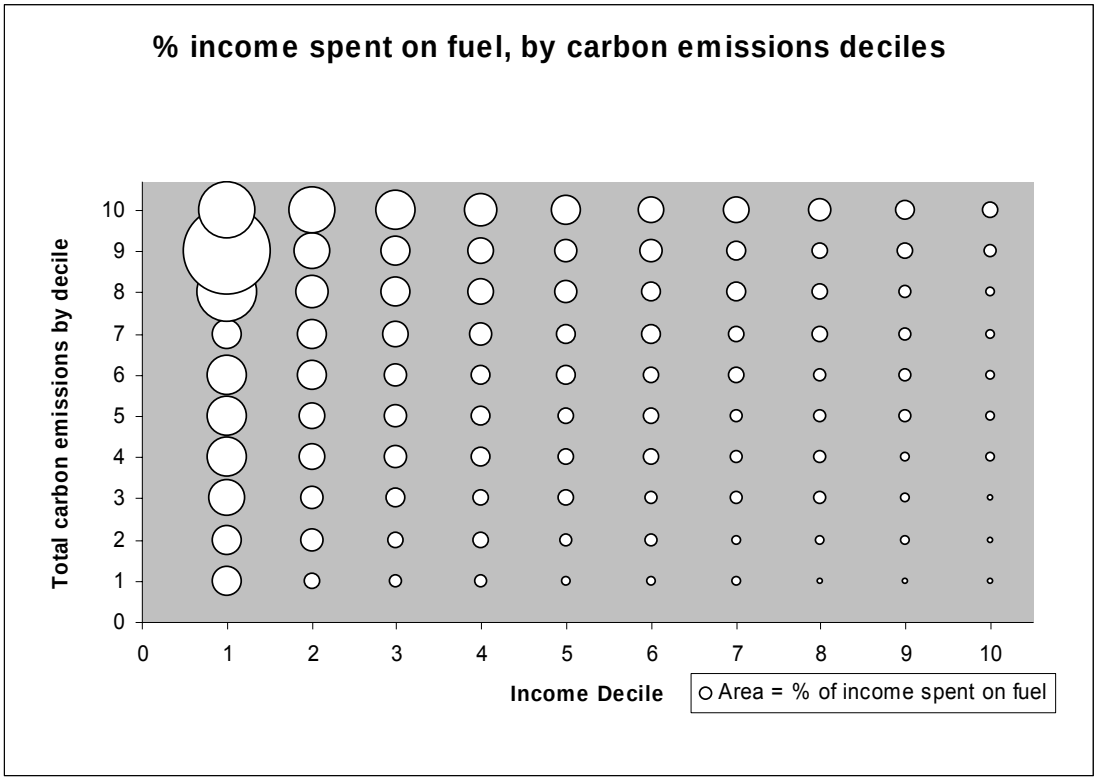
For information, the median values for each of the deciles for electricity and gas consumption and energy-related carbon emissions are shown below in Table 1.

Table 1: Median values for energy/carbon deciles in Figures 2, 3 and 4

	Electricity (kWh)*	Gas (kWh)^	CO_2 total* (kg CO_2)
Decile	Median	Median	Median
1	1,799.74	6,049.48	1,640.72
2	2,610.98	11,192.51	2,861.02
3	3,180.08	14,609.06	3,811.14
4	3,695.79	17,084.60	4,631.27
5	4,199.46	19,408.98	5,331.52
6	4,785.39	22,119.27	6,079.56
7	5,494.46	24,706.69	6,871.65
8	6,355.55	28,497.31	7,978.18
9	7,694.84	33,911.80	9,530.63
10	11,086.32	47,221.45	12,881.29

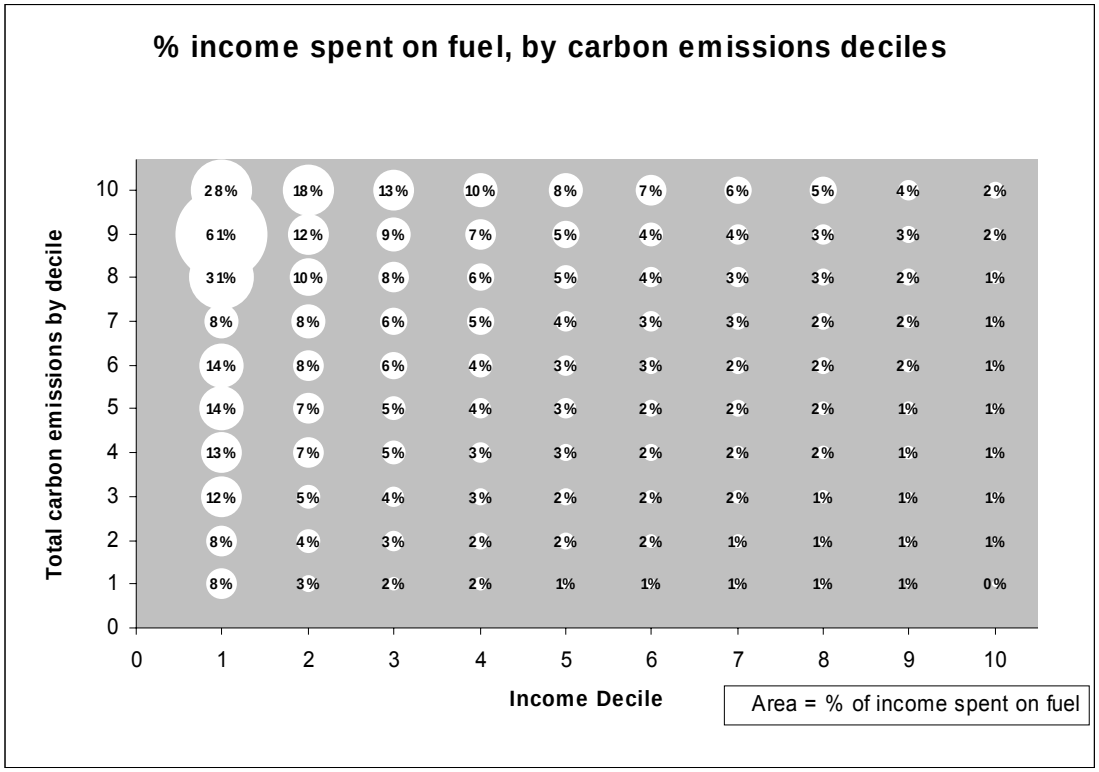
Using the same carbon emission deciles as used in Figure 4, the same representation can be made where the size of the bubble is the proportion of the household's income being spent on fuel. This is shown in Figure 5.

Figure 5



In Figure 6 the bubbles have been labelled with the value they represent to emphasise the sheer scale of difference between the low and high income households in terms of how much – or little – of their income they are spending on fuel.

Figure 6 (Figure 5 with data labels)



Clearly, there are some low income households (though, as Figure 4 demonstrates, not very many) spending very high proportions of their incomes on fuel.[15]

4.3. Affordable warmth

It should also be noted that even with this enhanced picture of the distribution of energy consumption and energy-related carbon emissions by household income, the data is unable to reveal whether households were warm and comfortable as a result of their expenditure. It cannot therefore comment on the implications for fuel poverty. A household may be spending only a small amount on energy but, as a result of high thermal performance of their home and the use of a low cost payment method, they would be warm and comfortable. Another household may be spending the same amount (or much more) and still be cold, due to inadequate insulation in their home and a poor quality and/or expensive heating source. The EFS does not capture sufficient data to assess this. [16]

15 The project team anticipates that the extreme figure of more than 60% of income shown in the ninth carbon emissions decile on the lowest income decile is an artefact of the relatively small number of households represented in the sample at this data point (and some of the others). These are weighted in the full EFS sample to reflect their 'representativeness' of all UK households. However, their true representativeness may be compromised by a few households with extremely high expenditure, potentially reflecting a debt or very high electricity demand (which would produce high carbon emissions). This problem, which requires further investigation, should not detract from the overall picture represented by Figure 6.

16 Having said this, Figure 6 and the background data reveals that all but the lowest energy users in the lower income decile are actually spending more than 10% of their income on fuel. Unless they are being unduly profligate and exceeding the required level of energy use to meet warmth standards, this almost certainly means that they are 'fuel poor'. As Figure 8 shows, it is very unlikely that they are exceeding their energy 'requirement' since most households in this income decile consume well below this.

The level of energy consumption required to maintain adequate warmth and other energy services can be derived from English House Condition Survey (EHCS) data (for homes in England). Like the EFS, the EHCS also collects household income data. This survey therefore can be (and is) used to calculate the number of households in England which are suffering fuel poverty (i.e. they need to spend more than 10% of their income on fuel to obtain adequate levels of warmth and other energy services).

However, as mentioned above, the EHCS no longer collects actual energy expenditure data – so it cannot report on the extent to which people actually spend to attain that required level of energy consumption. Indeed, a single dataset does not exist to enable this analysis.

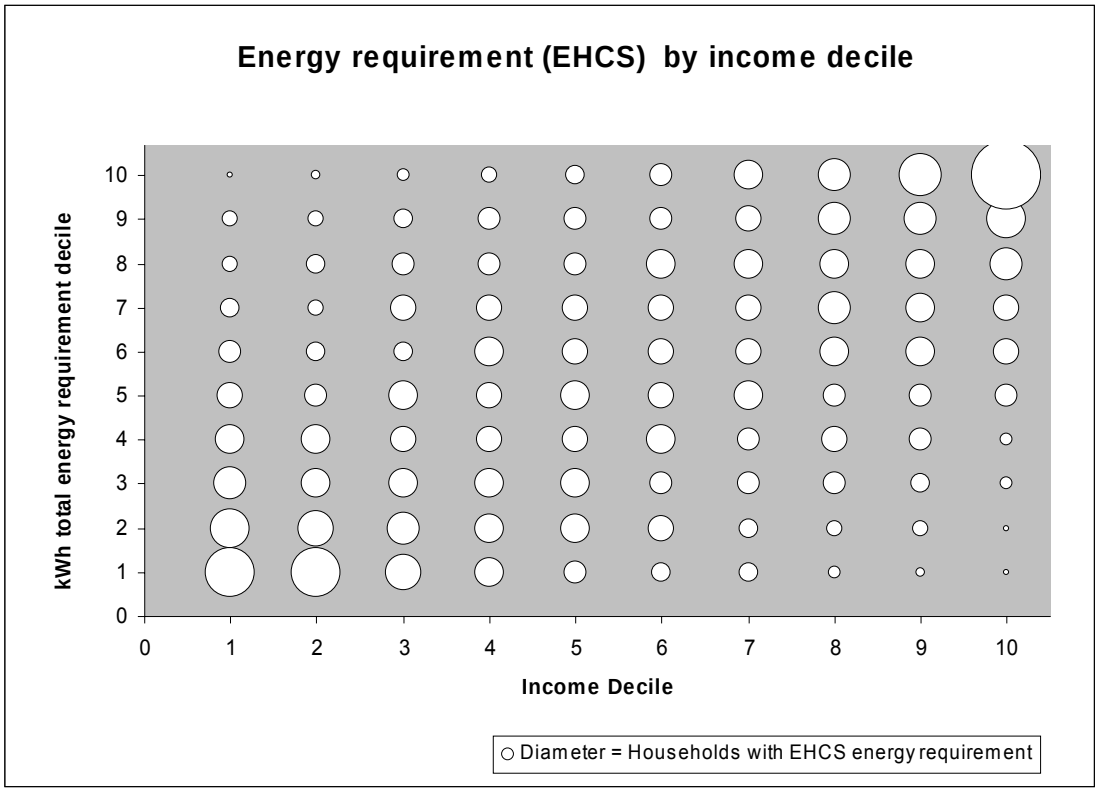
Yet, for an assessment of the full social impact of a supplier obligation (or any other energy market intervention), it is important to understand the level of energy service benefit like warmth actually being obtained by each household for what it spends. The distribution of such 'access to affordable warmth' is certainly not currently evenly spread across the population: the question is how a supplier obligation affects the distribution of access to 'affordable warmth' (or its inverse, fuel poverty) across households.

To examine the relationship in more depth, the study reviewed the EHCS data alongside the EFS energy consumption data. The EHCS data provides an energy requirement for each household in the sample to enable them to achieve adequate levels of energy services. As with the other data reported here, these energy requirements were allocated to energy deciles and assessed by income decile (as from EHCS). The result is shown in Figure 7 below, with the diameter of the bubbles representing the number of households in that combination of income and energy requirement. The modest correlation between income and energy requirement (R = 0.26) is similar as that between income and carbon emissions (R = 0.25). Note that the energy requirement deciles represent different (higher) levels of energy consumption that those in the consumption based analysis. The income deciles in ECHS are similar enough to EFS (as shown in Table 2) to render this a reasonable approach to take.

Table 2: Median values for income deciles for EFS and EHCS

	Annual Income (EFS)	Annual Income (EHCS)
Decile	Median (£)	Median (£)
1	5,649.38	6,306.95
2	8,614.42	9,147.04
3	11,621.17	11,727.08
4	15,219.57	14,405.46
5	18,941.52	17,517.81
6	22,756.76	20,914.15
7	27,272.96	25,260.72
8	32,908.20	30,674.86
9	41,013.44	39,475.40
10	60,268.16	54,571.11

Figure 7



To examine the extent to which different income groups actually use as much energy as this, the EFS consumption data can be 'binned' into the EHCS energy requirement deciles. By comparing the number of households actually consuming at each level of requirement, it is possible to expose the level of 'under-consumption' in each income decile.[17] This has been done in Figure 8 in which the household numbers actually consuming at the level of the each of the EHCS energy requirement decile (shown as purple bubbles) have been overlaid on the numbers which have that requirement (the white bubbles, as shown in Figure 7).

Clearly, because they are different data sets, this analysis cannot expose which households or types of households are 'under-consuming' within an income decile. In addition, as indicated in Footnote 17, there are limitations associated with combining electricity and gas use to establish an 'energy' requirement. However, even with these caveats, as Figure 8 shows, there is clearly 'under-consumption' in all income deciles, but it is particularly pronounced (in terms of the limited extent to which 'purple' covers 'white' in higher energy requirement deciles) in lower income deciles.

17 Note that there are significant imitations with combining all energy consumption data from the EFS to compare different households. An electrically heated home will have a lower energy consumption than a gas-fuelled centrally heated home (perhaps 8,000 kWh electricity for storage heating compared with 18,000 kWh for gas). This means that an apparent low user with electric storage heating may be meeting their energy requirement whereas a similar level of gas use would probably not. This does not alter the broad conclusion drawn here, but it does limit the potential use of this approach to study this issue in more detail without further analytical refinement.

Figure 8

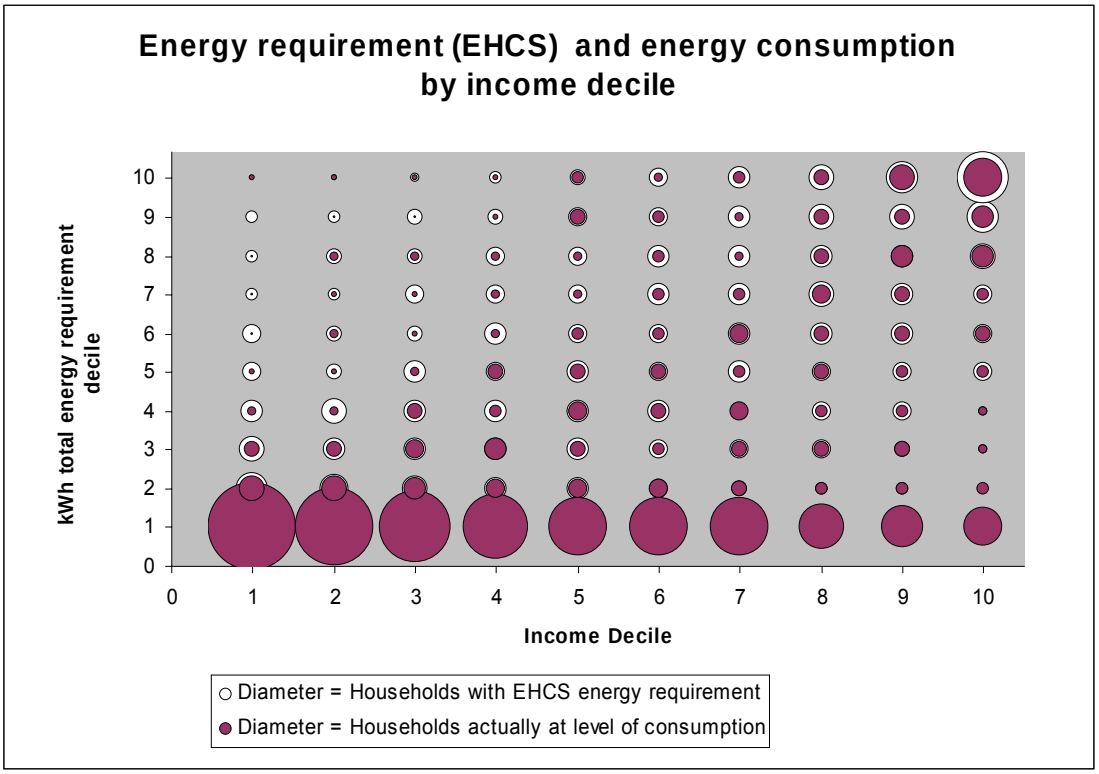


Figure 6 has already revealed the very high proportions of income which some lower income households are spending on energy. Figure 8 indicates that many of these households are probably spending this much in an attempt to keep warm in a high energy demand building – but are probably failing to do so. Many other low income households simply fail to consume enough to meet reasonable standards of warmth and other energy services.

5. The distribution of more and less 'desirable' customers under a cap-and-trade supplier obligation

With this improved picture of how energy consumption and carbon emissions distribute across income deciles, it is now possible to examine the characteristics of customers who become more or less desirable for energy suppliers faced with a 'cap-and-trade' style obligation to reduce customer carbon emissions.

5.1. Segmentation by 'desirabilty'

From Section 2 it is possible to characterise some types of customer as likely to become more or less desirable as a result of the supplier obligation:

MORE DESIRABLE CUSTOMERS

- Lower than average demand (to recruit and/or retain)
- 'Able to pay' high demand (with potential to reduce)
- Above average demand (with 'surplus' use to cut for reward)

LESS DESIRABLE CUSTOMERS

- Those unable or unwilling to pay for demand reduction
- Higher than average demand not responsive to encouragement to reduce
- Those living in 'hard to treat' properties unable or unwilling to contribute to costs of demand reduction

From the perspective of energy suppliers, they do not currently know much about the likely responsiveness of customers to demand reduction. If the 'responsiveness factor' is removed, this list can be simplified into three groups or 'segments' of customers likely to become more desirable customers with a supplier obligation and one group of customers likely to become less desirable (or perhaps better described as 'even less desirable').

MORE DESIRABLE SEGMENTS

- **High Emitters Able to Pay**
- **Low Emitters with Higher Incomes**
- **Low Emitters with Lower Incomes**[18]

LESS DESIRABLE SEGMENT

- **High Emitters Unable to Pay**

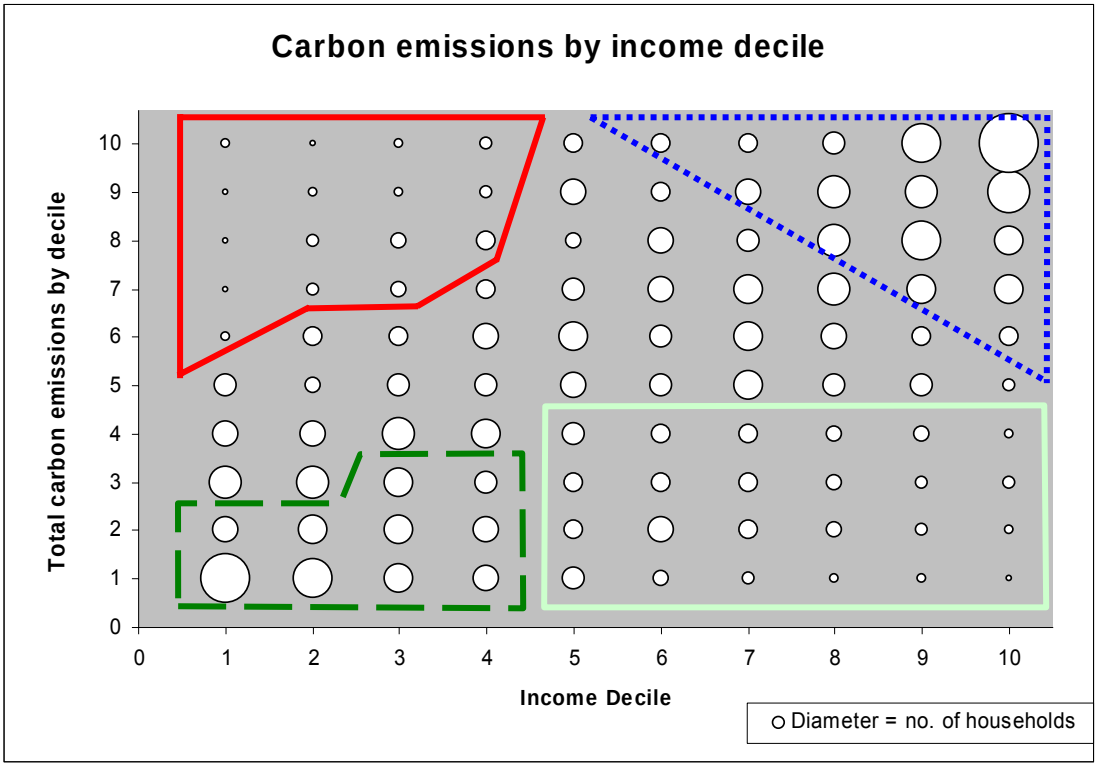
In practice energy suppliers are likely to develop far more sophisticated segmentation that this to target their marketing and demand reduction efforts. However, there is limited knowledge about their likely business strategies in the face of a supplier obligation. This rather simple segmentation is therefore likely to be sufficient to expose the most obvious potential social impacts of an obligation.

18 This segment is likely, particularly at lowest incomes, to be 'more desirable' only if they are very low emitters since other factors such as debt risk will start to impact on supplier assessment of desirability.

So where do these segments sit on the energy decile/income decile picture built up in Section 4?

This is shown in Figure 9. Each of the four segments is outlined roughly to show the income and carbon emission deciles considered to 'fit' with the descriptors.

Figure 9



KEY to Figure 9

- **= High Emitters Able to Pay**
- **= Low Emitters with Higher Incomes**
- **= Low Emitters with Lower Incomes**
- **= High Emitters Unable to Pay**

5.2. 'Winners' and 'Losers'?

The '**High Emitters Unable to Pay**' segment is likely to **lose** out with a supplier obligation. They are unappealing to energy suppliers and therefore unlikely to be targeted to secure any benefits of initiatives or interventions by their supplier. These customers – about **9% of all households** – have the highest emissions and lowest incomes and least ability to contribute to the cost of emission reduction measures. Their high consumption is probably driven by need (in turn driven by poor housing energy performance). Any reduced demand which is not achieved through improved energy efficiency is likely to reduce their standard of warmth, creating further deprivation.

Without any intervention to ensure that suppliers engage with these households (such as occurs with the Priority Group in the EEC/CERT), this segment will not receive any of the potential benefits of a supplier obligation.

The extent to which these 'losers' also end up paying for supplier obligation initiatives in other, more desirable households depends on how suppliers choose to recover the cost of meeting their obligation (as discussed above in Section 3). If they do seek to recover it evenly across all of their customers, it will have a disproportionately negative impact on this group. Such an approach to cost recovery is generally regressive so other lower income households would also lose out.

The likely 'Winners' from a supplier obligation fall into the three 'more desirable' segments outlined above. However, the amount by which they 'win' varies.

The **High Emitters Able to Pay** segment is likely to **'win'** most. Representing roughly **1 in 5 households**, they are likely to gain from a range of supplier offers to tempt them to invest in carbon emission reducing equipment and home improvements. Taking up the offers will reduce their energy consumption and carbon emissions, thereby potentially saving them money. The 'rewards' (eg 'nectar points') they are likely to receive from their supplier for cutting their carbon emissions will benefit them further.

These offers may be 'subsidised' by suppliers (and therefore paid for by all of the supplier's customer base), particularly if this significantly improves take-up and carbon reductions. If the subsidy is not direct and obvious, it is likely that suppliers will provide the tangible 'in kind' benefits of procuring and organising measures installation.

The **Low Emitters with Higher Incomes** – roughly **18% of all households** – will be attractive to an energy supplier with a supplier obligation (since recruiting them will reduce their average emissions per customer). Suppliers will therefore need to entice them and/or retain them with some benefits. Because of this group's higher than average incomes, they have significant future potential for increasing their energy-related carbon emissions through increased consumption. Therefore, suppliers may well reward them simply for not increasing consumption (rather than for reducing) and also offer them high efficiency products and services to curb demand growth.

The **Low Emitters with Lower Incomes** are likely to 'win' least of all the 'winners'. If this **14% of households** are desirable, then energy suppliers will need to offer them enough 'benefit' to be attracted as a new customer or to be rewarded for continuing to be a customer. However, they are unlikely to be offered initiatives which reward reductions in demand (because suppliers could be accused of rewarding increased deprivation). In addition, because they are unable to afford to increase their emissions, suppliers would have less need to reward them for curbing growth (than their higher income equivalents).

The 'winner' status of the Low Emitters with Lower Incomes segment almost certainly depends on how suppliers chose – or find themselves able – to recover the costs of meeting their supplier obligation across their customer base. If they spread the cost evenly through a small increment in all customers' unit prices, there is a possibility that this segment (along with other low income households) will find that their energy costs increase by more than the value derived from being in a 'more desirable' customer segment.

In other words, it is by no means obvious that this segment (and other lower income households) would gain in proportion to the costs they would bear. In such circumstances they would join the other lower income 'losers'.

5.3. More detail on the 'Winners' and 'Losers'

A more vivid picture of the 'winners' and 'losers' can be provided by using other data collected in the EFS for each household sampled. This includes social, demographic and economic characteristics. These are summarised below in Table 3.

Table 3: Demographic and other data on the segments

Characteristic	High Emitters Able to Pay	Low Emitters Higher Incomes	Low Emitters Lower Incomes	High Emitters Unable to Pay
% of households in segment (approx)	21%	18%	14%	9%
Mean income	£49,056	£32,012	£10,207	£10,353
Mean age of Household Ref Person	48	45	60	58
No. of OCCUPANTS	Average = 3.28 29%=2; 26%=3 28%=4	Average =2.45 18%=1; 45%=2 19%=3	Average = 1.45 67%=1; 25%=2	Average = 1.95 39%=1 42%=2
No. of adults	Average = 2.41 64%=2	Average = 1.98 65%=2	Average = 1.29 73%=1	Average = 1.57 49%=1; 48%=2
No. of Over 65s	Average = 0.15 90%=0	Average =0.21 85%=0	Average =0.65 47%=0; 42%= 1	Average =0.64 53%=0; 29%=1
No. of Children	Average = 0.86 53%=0	Average = 0.46 72%=0	Average = 0.15 90%=0	Average = 0.38 80%=0
Economic status	71% in Full-time work	68% in Full-time work	54%Retired 17% Full-time 15% Unoccupied[19]	47% Retired 24% Unoccupied
Average spend on fuel (% of income)	2.8%	1.5%	4.1%	12.8%
Proportion of total energy use as electricity	18%	45%	59%	17%
Dominant payment method	Direct Debit (60%)	Quarterly credit Direct Debit	Q'ly Credit (DD only c 30%)	Q'ly Credit & DD (Prepay 15-20%)
Dwelling type (main)	41% detached 35% semi-det	31% terraced 29% semi-det	34% purpose built flat 27% terraced 23% semi-det	32% semi-det; 29% terraced 24% detached
Tenure (main)	69% mortgage 23% owned	54% mortgage 22% owned 14% private rent	33% owned 22% LA tenant; 17% HA tenant 13% private rent	45%owned 20% mortgage 16% LA tenant 8% HA tenant

19 EFS defines 'unoccupied' as "persons under national insurance retirement age who are not working, nor actively seeking work. This category includes certain self-employed persons such as mail order agents and baby-sitters who are not classified as economically active."

There are fairly stark differences between these groups (which between them constitute 60% of UK households). They are 'characterised' overall in Table 4 below. Energy suppliers would be able to target many of these characteristics with easy-to-acquire data (MOSAIC, energy consumption record etc).

Table 4 also details the project team's assessment of: (a) the most likely strategies for energy suppliers for these segments under a supplier obligation, and; (b) the likely balance of costs and benefits for each segment as a result of the supplier obligation.

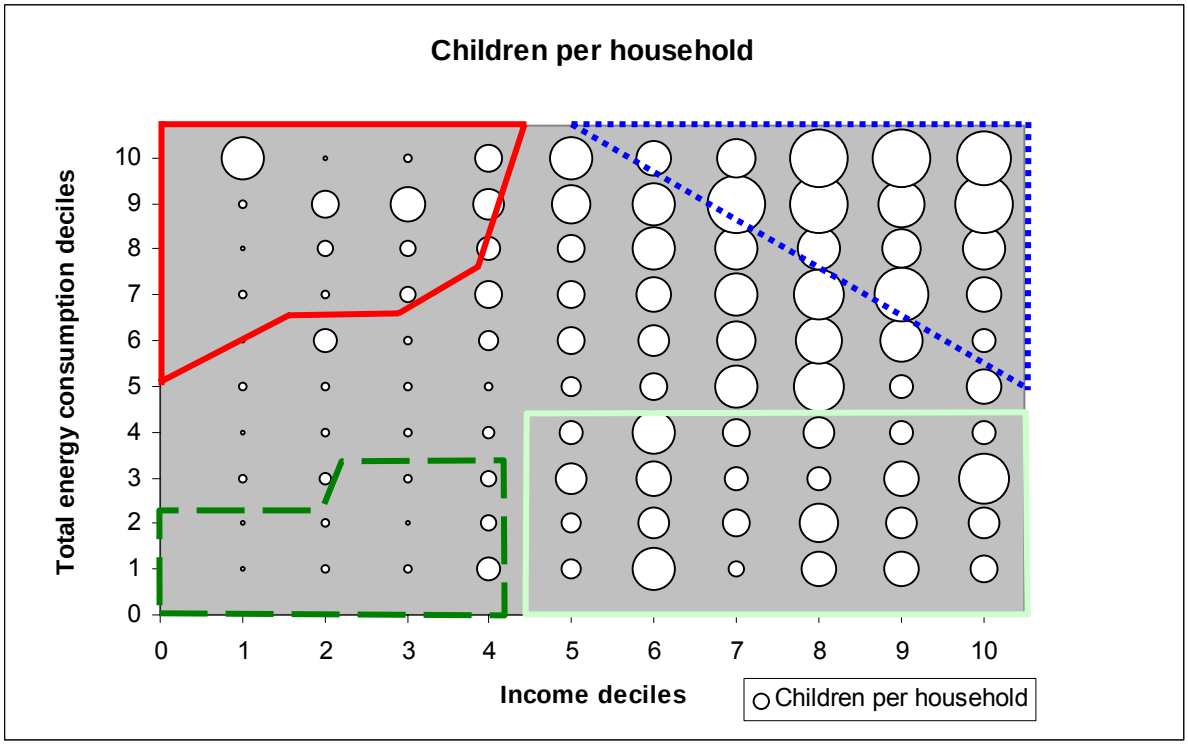
Table 4: Characterisation of Segments and possible energy supplier 'approaches'

	High Emitters Able to Pay	Low Emitters Higher Incomes	Low Emitters Lower Incomes	High Emitters Unable to Pay
OVERALL CHARACTERISATION	Well off families with older children, large houses and energy consumption to match	Reasonably well off young couples with smaller homes, either starting a family. Or 'empty nesters' older couples	Mainly retired or 'unoccupied' single people in small, often sheltered homes with limited income	Low income retired or near retirement unoccupied couples with larger than average homes (possible debt history (PPM)
POSSIBLE ENERGY SUPPLIER APPROACHES	Energy services and performance contracts; improved feedback/meters; rewards for demand reduction; subsidised energy saving measures (as in EEC/CERT)	New home deals; tariffs and rewards to stimulate demand reduction (and maybe simply to avoid increase); improved feedback/meters; subsidised energy saving measures (as in EEC/CERT)	Recruitment via affiliation schemes with local authorities, housing associations and sheltered housing providers; loyalty reward schemes; social/charitable agency referral initiatives	No offers of measures; possible attempt to recover through higher tariffs the costs of supplier obligation disproportionately from this 'undesirable' segment
LIKELY BALANCE OF COSTS & BENEFITS from Supplier Obligation	Significant benefits mainly at own cost	Significant benefits mainly at cost to others	Limited benefits potentially carrying cost of subsidised benefits for others	No benefits and carrying significant cost of subsidised benefits for others

In terms of targeting of marketing activity, the presence of children is a stark differentiator between the groups. This may mean that energy suppliers target recruitment and demand reduction initiatives through children or to appeal to children through brand awareness.

The bubble chart in Figure 10 overlays the segmentation of Figure 9 with information about the average number of children in households. In this case, the diameter of the bubbles represents the average number of children in the households in that income/energy decile. A larger circle means more children. In this case it is 'binned' by total energy consumption deciles rather than carbon emissions deciles. Figure 10 shows clearly how well a strategy of targeting children would enable a supplier to reach both the High Emitters Able to Pay segment and the Low Emitters with Higher Incomes groups with reasonable accuracy.

Figure 10



As identified in Table 4, the prevalence of local authority and housing association 'retired' people in 'old people's homes' amongst the Low Emitters with Lower Incomes could result in energy suppliers targeting such landlords with attractive affiliation deal to recruit their tenants as customers.

6. Comparison with EEC/CERT and measures-based approaches

It is instructive to consider briefly how this social impact of a cap-and-trade approach compares with that arising from EEC/CERT or any future development of a measures-based approach as an alternative to a cap-and-trade supplier obligation.

Although both approaches would encourage suppliers to deliver energy saving measures, a cap-and-trade approach introduces two new features to the existing framework. Firstly, it focuses suppliers' efforts on their own customer base. By contrast, EEC/CERT currently allows measures to be delivered to any household. Secondly, a cap-and-trade approach focuses suppliers on achieving real demand or emissions reduction from their customers, which can be achieved not only by installing measures but also initiatives to change behaviour.[20] The cap-and-trade approach therefore opens up a wider range of interventions and approaches to energy suppliers to meet their obligations, some of which may have lower costs than a measures-based programme.

At present, the social impacts described in this report do not obviously result from the EEC/CERT approach.[21] However, this is principally because of the current insistence in EEC/CERT that a fair proportion of the total measures (currently 50%) are installed in the homes of low income people (the Priority Group).

As a result of this requirement, Priority Group households very rarely pay anything towards the cost of installing measures in their own homes, with suppliers seeking to secure cost contributions from social landlords and/or local authorities. While all Priority Group customers contribute towards the cost of their suppliers' EEC/CERT programmes through their tariffs, the energy saving benefits of the 'free' measures ensure that, as a group, they are net beneficiaries.[22]

The analysis thus far in this study has not assumed any 'social correction' to address the adverse social impact for the cap-and-trade approach (though this is discussed in Section 7.1). To make a fair comparison between approaches, the assessment therefore needs to consider the social impact of EEC/CERT (or any future development of a measures based approach as an alternative to a cap-and-trade supplier obligation) without its 'social correction' of the Priority Group

There are two major factors which determine this: (a) which households would be targeted by suppliers to install measures in the absence of the Priority Group requirement, and; (b) how suppliers seek to recover the costs of installation both from the benefiting households paying towards the cost of measures and from their entire customer base through tariffs.

Without the Priority Group, suppliers faced with a measures-based instrument would be principally interested in a household's willingness to pay for energy saving measures. Such households are likely to be more persuadable than low income households to pay towards the

20 Proposals for CERT provide for suppliers to 'count' towards their targets some behaviour changing interventions which have been proven to reduce demand. However, these will be regulated and are likely to include only a relatively narrow range of approaches, such as improved metering feedback.

21 That said, in undertaking this study it has become clear that there has not to date been detailed study of the actual social impact of EEC to enable accurate comparisons.

22 However, as mentioned at the end of this section, the distribution of benefits and costs within the Priority Group has not been studied. Judging by the strategies typically adopted by energy suppliers to meet their Priority Group obligations, it is likely that Priority Group households in the social rented sector have benefited disproportionately from the installation of measures when compared with Priority Group owner occupied and private rented households.

cost of measures. Targeting these households therefore potentially reduces the proportion of the costs of installing measures which suppliers would have to meet and which they would therefore need to recover through tariffs.

|n terms of the segmentation in this study, suppliers would therefore target both the 'Able to Pay' segments: **High Emitters Able to Pay** and **Low Emitters with Higher Incomes**. Suppliers would not be particularly interested in the level of energy saving actually achieved by the installed measure and therefore would draw little distinction between these higher income segments beyond their ability and willingness to pay.

Furthermore, because suppliers can meet a measures-based target in any household, their interest in delivering it through an energy services approach (to maximise the contribution of the benefiting household) is likely to be constrained. This is because; (a) the energy services approaches can only work alongside the provision of energy supply and therefore only with their own customers, and; (b) unless all suppliers are doing only the energy services approach, there will certainly be more heavily subsidised measures on the market from other suppliers which undercut any energy services offers.

Suppliers would therefore be likely to sustain the 'subsidised measures' approach they currently use to meet their 'non-Priority Group' EEC targets, recovering the cost of these subsidies across their own customer base through their tariffs.

This is in contrast to the possibility of energy suppliers using an energy services approach with the High Emitters Able to Pay segment under a cap-and-trade obligation, as identified in Section 5.2. Without this impetus for energy services, the contribution from benefiting households towards the costs of measures is likely to be lower. This implies that suppliers will have to recover through their tariffs a higher proportion of the costs of meeting a measures-based obligation than a customer-focused cap-and-trade obligation.

In other words, under a measures-based approach without social correction, the main households benefiting from measures are not only better off than average – the **High Emitters Able to Pay** and **Low Emitters with Higher Incomes.** They are also likely to receive greater cross-subsidies from the rest of the customer base than under a cap-and-trade obligation.

There are two other key differences between measures-based and a cap-and-trade approaches.

With a measures-based approach with no Priority Group, suppliers would have little or no interest in both the **High Emitters Unable to Pay** and the **Low Emitters Lower Incomes** segments since both are 'unable to pay' towards the cost of measures. These segments are therefore very unlikely to benefit from the installation of measures. Instead, these groups would be helping to pay – through their tariffs – for subsidies on measures in the homes of higher income households. Both segments would therefore certainly be 'losers' under a measures-based approach without any social correction.

Yet this study indicates that the **Low Emitters Lower Incomes** segment (1 in 7 of households) could be 'winners' under a cap-and-trade supplier obligation.

Households in the **High Emitters Unable to Pay** segment are 'losers' under both approaches, though this segment would probably not be seen as quite as 'undesirable' as this report suggests they would be under a cap-and-trade supplier obligation. It is therefore

unlikely that suppliers would seek to recover programme costs disproportionately from this segment as they might under a cap-and-trade approach.

That said, it is possible that, even with the Priority Group, the High Emitters Unable to Pay segment is currently 'missing out but paying anyway' with EEC/CERT. More analysis of households which are benefiting now from EEC Priority Group initiatives would be helpful to see if households in this segment are receiving their 'fair share' of Priority Group benefits (see also Footnote 22).

Table 5 compares the conclusions of the analysis of a cap-and-trade supplier obligation (detailed in Table 4) with the conclusions from this section with respect to a measures-based obligation without any social correction.

Table 5: Comparison of measures-based and cap-and-trade obligations

	High Emitters Able to Pay	**Low Emitters Higher Incomes**	**Low Emitters Lower Incomes**	**High Emitters Unable to Pay**
OVERALL CHARACTERISATION	Well off families with older children, large houses and energy consumption to match	Reasonably well off young couples with smaller homes, either starting a family. Or 'empty nesters' older couples	Mainly retired or 'unoccupied' single people in small, often sheltered homes with limited income	Low income retired or near retirement unoccupied couples with larger than average homes (possible debt history (PPM)
POSSIBLE ENERGY SUPPLIER APPROACHES **CAP-AND-TRADE**	Energy services and performance contracts; improved feedback/meters; rewards for demand reduction; subsidised energy saving measures (as in EEC/CERT)	New home deals; tariffs and rewards to stimulate demand reduction (and maybe simply to avoid increase); improved feedback/meters; subsidised energy saving measures (as in EEC/CERT)	Recruitment via affiliation schemes with local authorities, housing associations and sheltered housing providers; loyalty reward schemes; social/charitable agency referral initiatives	No offers of measures; possible attempt to recover through higher tariffs the costs of supplier obligation disproportionately from this 'undesirable' segment
LIKELY BALANCE OF COSTS & BENEFITS **CAP-AND-TRADE**	Significant benefits mainly at own cost	Significant benefits mainly at cost to others	Limited benefits potentially carrying cost of subsidised benefits for others	No benefits and carrying significant cost of subsidised benefits for others
POSSIBLE ENERGY SUPPLIER APPROACHES **MEASURES-BASED (No Priority Group)**	Subsidised energy saving measures (as in EEC/CERT)	Subsidised energy saving measures (as in EEC/CERT)	No interest in targeting this group (unless someone else pays for subsidy)	No interest in targeting this group (unless someone else pays for subsidy)
LIKELY BALANCE OF COSTS & BENEFITS **MEASURES-BASED (No Priority Group)**	Significant benefits mainly at cost to others	Significant benefits mainly at cost to others	No benefits and carrying significant cost of subsidised benefits for others	No benefits and carrying significant cost of subsidised benefits for others
GAIN/LOSS from MEASURES-BASED vs CAP-AND_TRADE	Greater proportion of benefits with less share of total costs **(GAIN)**	Greater proportion of benefits at similar share of total costs **(GAIN)**	Lower proportion of benefit and higher share of total costs **(LOSS)**	Possible slight reduction in share of costs **(SIMILAR)**

This brief analysis indicates that both the benefits and the costs of a measures-based approach are likely to be more unfairly distributed across households than with a cap-and-

trade approach. Higher income households are likely to receive a greater proportion of the benefits and contribute a lower proportion of the costs than under a cap-and-trade obligation. This is principally because: (a) the measures-based approach does less to enable and encourage suppliers to maximise contributions to measures from higher income households through energy services approaches, and; (b) it lacks the focus on 'own customers' which ensures that lower emission lower income customers have some attraction for suppliers faced with a cap-and-trade approach.

7. Conclusions and potential policy implications

The analysis for this study provides no indication that low income or fuel poor households will benefit from a cap-and-trade supplier obligation. They may instead pay for others to gain benefits which will not be made available to them.

There is a significant segment of low income households with low carbon emissions – mainly single retired people – which will potentially prove attractive for suppliers to recruit and/or retain. However, suppliers are unlikely to find them sufficiently desirable to provide significant benefits to entice them as customers, particularly with many other commercial factors (such as payment reliability, loyalty, cost-to-serve, cash-flow impacts) continuing to have a strong influence on the desirability of customers.

In addition, these households are unlikely to be able to reduce demand without risking an increase in deprivation unless the demand reduction is achieved through improved energy efficiency or fuel switching (for which these households are unable to pay).

Depending on the strategies which suppliers adopt to recover the costs of meeting their obligation across their customer bases, such households may even end up losing more (in higher costs) than they gain (in rewards).

On the basis that other households are likely to gain benefits from a supplier obligation – through encouragement/reward to reduce demand and subsidised offers of products and services to assist in doing so – the supplier obligation will not distribute its benefits evenly across the population. Again, if suppliers choose to recover the costs of the obligation across their customer base, this would be regressive.

A segment of low income households who have largely need-driven high carbon emissions stand to miss out on any benefits of a supplier obligation. They may end up carrying the cost of benefits delivered to others. Yet these are possibly the most needy segment of households, demonstrating very high expenditure on fuel which it must be presumed results from inefficient, hard-to-heat housing.

Comparisons with the potential social impacts of an EEC/CERT-type measures-based obligation (without any Priority Group or other 'social correction') indicate that they may be greater than under a cap-and-trade approach. The brief analysis here suggests that both the benefits and the costs of a measures-based approach are likely to be more unfairly distributed across households. This is particularly because the measures-based approach does not make lower emission, lower income households more 'desirable' in the way that a cap-and-trade supplier obligation would.

7.1. Addressing the negative social impacts

Is it possible to address these negative social impacts of a cap-and-trade supplier obligation? Four approaches are outlined below, divided into one which 'fiddles' with the supplier obligation (approach 1 below) and those which ensure energy suppliers equitably address the needs of their low income customers through another regulatory mechanism (approaches 2 to 4).

1. The supplier obligation could be divided into two or three customer segments with a requirement to reduce average carbon emissions for each customer segment (potentially by different amounts).

'Vulnerable' customers could be one of these segments. Suppliers should probably be required to demonstrate and monitor a range of approaches they were using with this segment to ensure that demand reduction was not being achieved through increased deprivation. This would have the advantage of maintaining a clear overall environmental objective whilst ensuring costs and benefits are more fairly distributed.

2. An 'all customers' supplier obligation could be introduced alongside a continuation of EEC/CERT focused only on Priority Group households (and potentially only on the suppliers own Priority Group customers).

This would ensure that Priority Group households received benefits through interventions which are suitable for them (i.e. not demand reduction through deprivation) whilst also leaving suppliers 'free' to deliver the supplier obligation across its entire customer base in the most cost-effective manner.

3. A separate 'social obligation' could be placed on suppliers to provide a range of services and benefits – such as insulation measures, social tariffs, benefit checks etc – to a defined group of customers (such as those currently in the Priority Group or a better focused measure or proxy for households in or at risk of fuel poverty).

A design principle for such a social obligation could be that, as a starting point, it had to more than correct for any inequities arising from the delivery of the supplier obligation.

4. Another mechanism could be used alongside the supplier obligation which did not involve energy suppliers centrally (such as an expanded Warm Front). This would target assistance at those households unlikely to benefit from a supplier obligation, potentially ensuring the target to eliminate fuel poverty in vulnerable households by 2011 is achieved (i.e. as a supplier obligation comes into effect).

Such assistance would focus on improving the thermal performance of the homes and increasing incomes, thereby potentially 'future-proofing' the households for the cost implications of a supplier obligation.

Without one of these approaches, or something similar, a cap-and-trade supplier obligation is likely to have social impacts which are generally regressive and potentially quite severe for a proportion of the most vulnerable and needy households.

Appendix: Data analysis methodology

The methodology used for this study starts with the preparation of the dataset of energy consumption and carbon emissions linked to income. This was undertaken principally by the RESOLVE team at the University of Surrey with input from the CSE project team.[23] It involved three steps:

1. Household expenditure on each type of fuel was taken from the Expenditure and Food Survey (EFS) data for 2004-05;
2. Household expenditure was converted to quantity of energy used, using price information for each type of fuel at the time of the survey;
3. Carbon dioxide emissions were estimated by using carbon emissions factors for each type of fuel.

The raw data from the 2004-05 Expenditure and Food Survey (EFS) is used as a basis for this study. This dataset gives information concerning each of the approximately 7,000 sampled households (or 'case households'). It gives details of the expenditure of each case household on fuel by the various payment methods shown in Table 6. It also gives information on the socio-economic and demographic characteristics of each household and the month when the sample was taken.

Table 6: Fuel payment categories and price 'matches'

EFS fuel payment categories	Fuel price categories
Electricity:	**Electricity:**
Slot meter	Pre-payment
Account	Credit
Board budget scheme	Direct debit
Gas	**Gas**
Slot meter	Pre-payment
Account	Credit
Board budget scheme	Direct debit
Other fuels	**Other fuels**
Bottled gas for central heating	Bottle Gas Propane
Bottled gas - other	Bulk LPG
Coal & coke	Coal
Oil for central heating	Heating oil
Paraffin	Assume similar cost to heating oil
Wood & peat	Wood

Estimation of energy use

Fuel prices vary regionally and there were also significant price rises during the year of study (2004-05). Furthermore, prices also vary depending on the type of payment method used Table 6. In order to reflect these variations, a matrix of energy prices was developed by the

23 More detail on this methodology (and further detail on its application to local area resource analysis (LARA) can be found in Druckman A and T Jackson (2007) *Towards a low carbon society: a highly disaggregated model of household energy consumption*, Paper to 11th European Roundtable on Sustainable Consumption and Production, RESOLVE, University of Surrey, June 2007 (Contact a.druckman@surrey.ac.uk)

project team. This detailed the price paid for each type of fuel for each Government Office Region, for each payment method, and for different time bands (April- July 04; August-December 04; January-March 05). The prices were based on data from DTI,[24] Sutherland (SALKENT) Tables,[25] energywatch[26] and BRE[27]. Further details concerning the methodology used in compiling this price matrix is available from CSE.[28] Energy consumption for each EFS case household was then calculated by dividing recorded expenditure by the appropriate price (by payment method, region and time of EFS survey). From this the mean UK energy consumption was estimated.

A validation check and adjustment process was carried out to ensure that the figures used in this study (which are generated from household expenditures) concur with published delivered energy totals from other sources. The estimated total UK consumption from this study for each type of fuel was found by scaling up to the number of households in the UK. These totals were compared to the UK delivered fuel totals published in Energy Trends (DTI various years) and in the Digest of United Kingdom Energy Statistics (DUKES) (DTI various years). The ratio of the results expected from DUKES and the results estimated in this study was found and the estimations were adjusted accordingly to ensure agreement with published UK totals.

This adjustment was required as, in essence, this study uses a sample of approximately 7,000 households to estimate total fuel demand in the UK. These households used in the EFS will not necessarily have been chosen to be representative of UK households in terms of energy use; hence an adjustment is expected. Additionally, various inaccuracies in the price matrices and combining them with energy consumption may also contribute to the potential discrepancies.

These discrepancies result principally from the assumptions required to match EFS payment categories with more standard categories used in energy price datasets. In a few cases in the EFS it is evident that electricity and gas payments were combined or mixed, and this may be a cause of errors. In addition, some household cases in the sample recorded zero electricity payments, which is surprising. Exploration of this with the EFS team at ONS revealed that this is due to the method used to collect expenditure data in the EFS.[29] For the purposes of analysis undertaken here, these 'zero electricity' households have been excluded. This undoubtedly distorts slightly the results (in that they will be slightly less representative of the household population as a whole) but potentially by less than the distortion that would be caused by including them. In addition, the small sample size of the EFS limits the accuracy of analysis of Other Fuels that are purchased less frequently by households.

Estimation of carbon emissions

The carbon emissions factors for each type of fuel were obtained from Defra sources.[30] The carbon emissions estimated for electricity and gas are assumed to be correct, but inaccuracies arise in the emissions estimated due to Other Fuel use. This is mainly due to the

24 See http://www.dti.gov.uk/energy/statistics/publications/prices/index.html
25 See http://www.sutherlandtables.co.uk
26 See http://www.energywatch.org.uk/
27 See http://www.bre.co.uk
28 Preston I (2007), *Methodological Note on Fuel Prices Look-up Table*, Centre for Sustainable Energy, Bristol. Unpublished.
29 The majority of households with zero electricity expenditure use the 'card, disc, token or electronic key' method for electricity payment. Expenditure using these methods is collected via the two-week diary and not the questionnaire, which covers three months (S Dunstan, ONS, email communication 2007).
30 See http://www.defra.gov.uk/environment/business/envrp/pdf/envrpgas-annexes.pdf

small number of household cases in the EFS that purchased Other Fuels. The adjustment procedure was carried out on the lines described above, but applied to Other Fuels only.

Demographic and other data analysis

As mentioned above, each EFS case household has considerable detail not only on other expenditure by the household (not analysed for this study) but also on a range of demographic and socio-economic characteristics. The relevant fields for each case household from the EFS dataset (weighted in accordance with the validation exercise on energy demand detailed above to ensure the sample represented UK households) were combined with the energy consumption and carbon emissions data to expose more detail about population 'segments' identified as relevant to this study. These were analysed using standard statistical techniques within SPSS to provide the detail in Table 3 and the sample counts within the various Figures presented here.