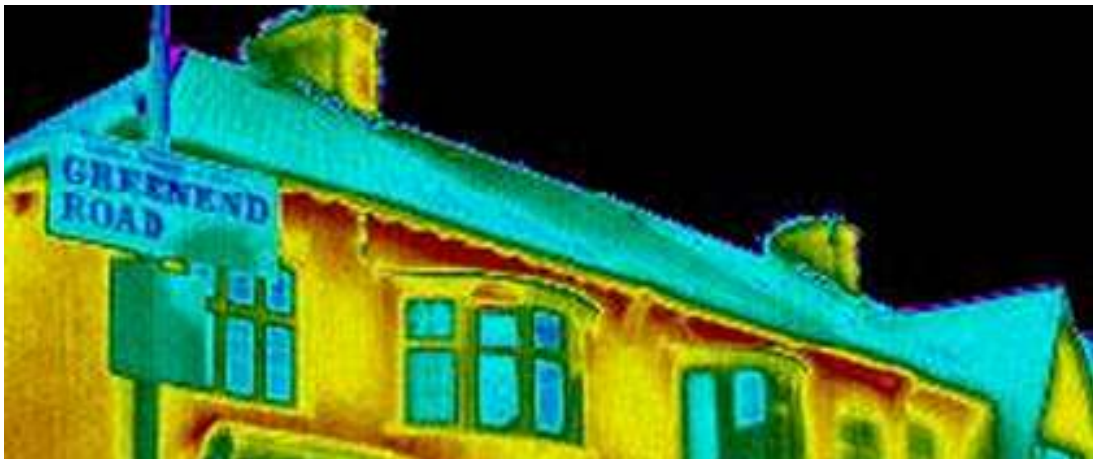




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# Green Streets



## Final Report to British Gas

March 2009

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## **Acronyms**

BREDEM	Building Research Establishment Domestic Energy Model
CERT	Carbon Emissions Reduction Target
CFL	compact fluorescent light-bulb
CO <sub>2</sub>	carbon dioxide
CWI	cavity wall insulation
EEC	Energy efficiency Commitment
kWh	kilo watt hour
LED	light-emitting diode
PV	photo-voltaic
RTD	real-time display
SO	Suppliers Obligation
TRV	thermostatic radiator valve

## **Executive summary**

### Key findings

- The average energy saving across all Green Streets households was just over 25%.
- All streets saw a significant reduction in their average energy use during the course of the project. The street average ranged from under 15% in London to almost 35% in Leeds, although most streets were in the range 22-27%.
- Average carbon emissions from domestic energy for Green Streets households in the base year (2007-08) were 6.14 tonnes of carbon dioxide, just above the national average for 2006 of 6 tonnes per household.
- The average reduction in carbon emissions over the course of the project was 23%, but again there was a considerable range between streets. In total, the reduction in emissions from energy use in Green Streets households was just under 89 tonnes.
- All streets maintained savings in gas use throughout the year (with the exception of the London households). Savings in electricity were also maintained in four streets (Birmingham, Cardiff, Leeds and Plymouth), but in the other streets changes in electricity use were more erratic.
- Analysis of actual vs. modelled energy savings implies that behaviour and lifestyle changes play a major role in determining outcomes.
- Interviews with participants suggest that the energy advisers, the hand-held electricity meters and the competition element were key drivers of behavioural change.
- An unanticipated effect of the Green Streets project was that it increased social interaction and community spirit, with many people meeting neighbours for the first time, and with some evidence of sustained and additional effects.

### Implications

- If the average energy savings from Green Streets were replicated across all UK households, the saving on fuel bills would be around £6 billion.
- If all UK households achieved similar carbon emissions reductions to the Green Streets households, emissions would be reduced by 35 million tonnes of carbon dioxide (MtCO<sub>2</sub>) a year at a national level. This is roughly equivalent to the annual carbon emissions of 3-4 modern coal-fired power stations. It is about a

third of what is needed for the UK to meet the 2020 emissions reduction target in the new Climate Change Act 2008.

- Gas demand across the Green Streets households fell on average by almost 26%. If all UK households were to see a similar fall, this would cut total demand for gas by over 8%, representing about a third of our current gas imports

### Policy recommendations

#### *Innovation in energy saving programmes*

- The roll-out of smart metering, including in-home displays, should proceed as rapidly as possible, as this is likely to have a significant impact on awareness of energy use, and stimulate energy saving
- The Government should encourage innovation in the development of different in-home displays, but ensure that minimum standards are in place to cover any display format.
- Scale up the provision of face-to-face energy saving advice in the home
- Government should explore several routes for advice, including commercially based energy services companies, the Suppliers Obligation, local authorities and possibly a dedicated agency, but then review and evaluate the experience to identify the most cost-effective method.

#### *Facilitate financing mechanisms*

- The Government should consider building on the existing Energy Performance Certificates system to require minimum standards, in order to drive a 'green mortgage' market
- To facilitate on-bill repayments the Government should work with the energy industry to examine ways in which the costs to suppliers of obtaining a Consumer Credit License and complying with the regulations in the Consumer Credit Act could be reasonably reduced without removing consumer protection
- Suppliers may be willing to take over consumer's loans if a consumer wants to switch their energy supply. But if this does not happen, Government should seek a solution to the switching problem that avoids excessive complexity, and is acceptable to both suppliers and consumers.

*Connect to communities*

- The Government should actively encourage and incentivise energy suppliers to work more closely with and through community groups (or organizations that work with community groups), for example to set up community energy clubs
- The Community Action for Energy programme, which provides groups with advice on funding, training, and technical support, should be expanded so that its services are widely accessed.
- Explore the use of smart metering to provide community comparisons and prizes to allow energy saving competitions

## **1. Introduction to Green Streets**

### Context

Domestic energy use in the UK is responsible for around one quarter of the UK's carbon emissions. It is responsible for 58% of carbon emissions from the average individual's energy use, including home energy, driving and flying (Retallack et al 2007; Defra 2008), and amounts to around 6 tonnes of carbon dioxide per home on average.

There is an urgent need to ensure that the homes we build from now on are sustainable, and the Government wants all new homes to be "Zero Carbon" by 2016. But around 90% of homes that will be standing in 2020 have already been built. It is existing homes that are the big problem. One in four homes were built before the Second World War, and one in five before the First World War, and many are still in a poor state, with a low level of energy performance and high costs. Poor insulation means around £1 in every £3 currently spent heating UK homes is wasted. Making the existing stock as energy efficient as possible therefore needs to be a priority

Since the 1990s an increasing effort has been put into this task, but there is still plenty to be done. The Committee on Climate Change recently estimated that, even with current policies, there will be scope to insulate another 4 million cavity walls and 13 million lofts, as well as to upgrade millions of boilers (Committee on Climate Change 2008: 222).

Energy efficiency policy has historically focused on individual low cost measures. However, in order to achieve the deeper savings in energy, money and carbon emissions that will become increasingly important, we are now moving towards a whole house and energy services approach, as outlined in the Government's recent heat and energy saving strategy proposals (DECC 2009). Given the significant barriers to the take up of energy saving measures (e.g. Stern 2007: Ch. 17, Committee on Climate Change 2008: Ch 6, NERA 2007, Sorrell et al 2004), this shift is particularly important.

### Green Streets

Green Streets was set up by British Gas as a unique social experiment in energy and carbon savings. 64 households - eight each from a "Green"-themed street in eight cities (Birmingham, Cardiff, Edinburgh, Leeds, London, Manchester, Southampton and Plymouth) were chosen to take part in a year-long challenge to reduce energy use and emissions by as much as possible. The participants were a mix of British Gas and non-British Gas customers, and there was no requirement to switch suppliers to take part. The prize for the winning street was £50,000 to spend on a community project of the participants' choice.

Their homes represented the full range of types found in the UK, including flats, terraced houses, bungalows, semi-detached and detached houses, reasonably close to the

proportions found in the national housing stock, as assessed by the English House Condition Survey 2006 (Table 1).

**Table 1**  
**Housing types**  
%

	<b>Green Streets households</b>	<b>EHCS 2006</b>
<b>Terraced house</b>	30.2	34.5
<b>Semi-detached house</b>	27.0	23.6
<b>Detached house</b>	19.0	16.4
<b>Bungalow</b>	11.1	10.9
<b>Flat</b>	12.7	14.5

In terms of household size, the Green Streets participating households were a little larger than the national picture at the time of the 2001 Census (Table 2), with one-person households a little under-represented and larger households over-represented.

**Table 2**  
**Household size**  
%

<b>Household size</b>	<b>Green Streets households</b>	<b>2001 Census</b>
1	13	29
2	33	35
3	18	16
4	18	14
5	13	5
6+	4	2

In interviews with a sample of participants (see section 2 below), we found that attitudes to energy use, costs and the environment were varied among the participants, and that this was reflected in the range of motivations for taking part (see Box 1).

Participants were brought together and introduced to the project in a series of meetings in late 2007, and energy assessments (including infra-red photographs) were made of each property. £30,000 worth of energy savings and renewable energy measures were offered to each street (Table 3), with the choice of measures influenced by the energy assessments, under the guidance of British Gas dedicated energy efficiency experts, one for each street. These experts were available to the participants throughout the project, and continued to give many households advice and information.



**Box 1 – Motivations for taking part in Green Streets**

*It's not just about the competition. It comes at a time when the debate about energy is front page news - London*

*“Both financially and environmentally and let's be honest if you're going to get people involved financial will come before the environmental, and if you can get both together you're onto a winner.” - Southampton*

*We wanted a free boiler, to be honest.... We thought it'd be good for the kids to get involved and you know appreciate the fact that what it costs and what can be saved” - Birmingham*

*The green agenda was interesting, I think that more than anything...we were really interested to see what things they would do to improve the energy performance of the house - London*

*I have certainly never been eco-friendly, energy conscious in any way at all ... But once we got involved with it, we realised how much it could save us, firstly. But the implications for, in a wider sense of having a two-year old daughter, possible effects to save CO2 emissions, you start being more conscious of it, reading the newspapers, on television and whatever - Edinburgh*

Decisions on how to divide the budget between houses was made in meetings at the end of 2007, and the insulation, lighting, appliances, heating system upgrades and other items were all installed at the end of January 2008.

The focus was on gas and electricity use (no homes in Green Streets used heating oil or coal), and baseline data for 2007-08 was collected. Once the measures were in place, meter readings were taken monthly. Weather correction factors were applied to the data sets to control for differences in temperature between the two years. This is a standard procedure which should allow a fair comparison. However, it is worth noting that while the winter of 2007-08 was mild, the 2008-09 winter was very cold, and the difference may not be fully captured by weather correction. This would imply that, if the weather had been the same between the two years, energy use for heating in 2008-09 would have been lower than it actually was.

**Table 3**  
**Measures offered to households in Green Streets**

<b>Measure</b>	<b>Cost</b>	<b>Number installed</b>
<b><i>Lighting</i></b>		
CFLs / Energy Saving Lightbulbs	£30.00 for pack of 6	1,548
LEDs (Light Emitting Diodes)	£36.00 for pack of 3	331
<b><i>Appliances</i></b>		
Fridge-freezer	£350.00	20
Washing machine	£350.00	15
Kettle		25
Dishwasher	£350.00	5
Standby saver	£15.00	51
<b><i>Heating system</i></b>		
Heatkeeper radiator panels	£40.00 for pack of 4	100
Boiler	£2,500.00 - £4,500.00	41
Room thermostat	£59.00	24
TRV (Thermostatic Radiator Valves) set	£350.00	13
Hot water tank insulation	£30.00	7
Primary pipework insulation	£15.00	9
<b><i>Insulation</i></b>		
Cavity Wall Insulation	£250.00	39
Loft insulation	£250.00	7
Loft top-up insulation	£250.00	26
Draft proofing	£150.00	9
<b><i>Solar power</i></b>		
Solar PV (electricity)	£5,500	5
Solar thermal (water)	£4,300	3

## **2. Methodology**

British Gas asked ippr to make an independent assessment of the Green Streets experiment, validating and analysing the energy data, interviewing participants and drawing out policy lessons.

We conducted basic analysis on the energy data using an Excel spreadsheet, and then investigated outliers to check data quality. Of the 64 original households, one dropped out. Certain important life events also took place over the year, all of which had an impact on energy use, including one death, 2 births and some movement of people in and out of households.

Ideally, baseline data would have relied on a meter reading at the end of January 2007 and monthly readings after that. However, since this data had to be assembled

retrospectively, it was not possible to attain this ideal in every case. In about a quarter of cases, the initial meter figure is an estimate from the reading nearest to the end of January 2007. However, the margins of error are likely to be quite small (5-10%). The lack of accurate monthly readings throughout the baseline year also means that for many cases industry-standard modelling had to be used to produce monthly baseline data. This should be borne in mind when looking at the findings on savings over time below.

We also assessed the actual energy changes against the energy changes that would be expected from the installed measures, using spreadsheets developed for the Energy Efficiency Commitment, based on the Building Research Establishment's Domestic Energy Model (see section 4 below).

In addition to the quantitative data analysis, we conducted face-to-face interviews with 11 households in Southampton, London, Birmingham, Manchester and Edinburgh at the mid-point of the experiment in June and July 2008. These 11 households were selected as reflecting a range of energy savings, and the focus was on understanding behavioural change. The interview schedule we used is reproduced in Appendix 1 below.

### **3. Patterns of energy and carbon savings**

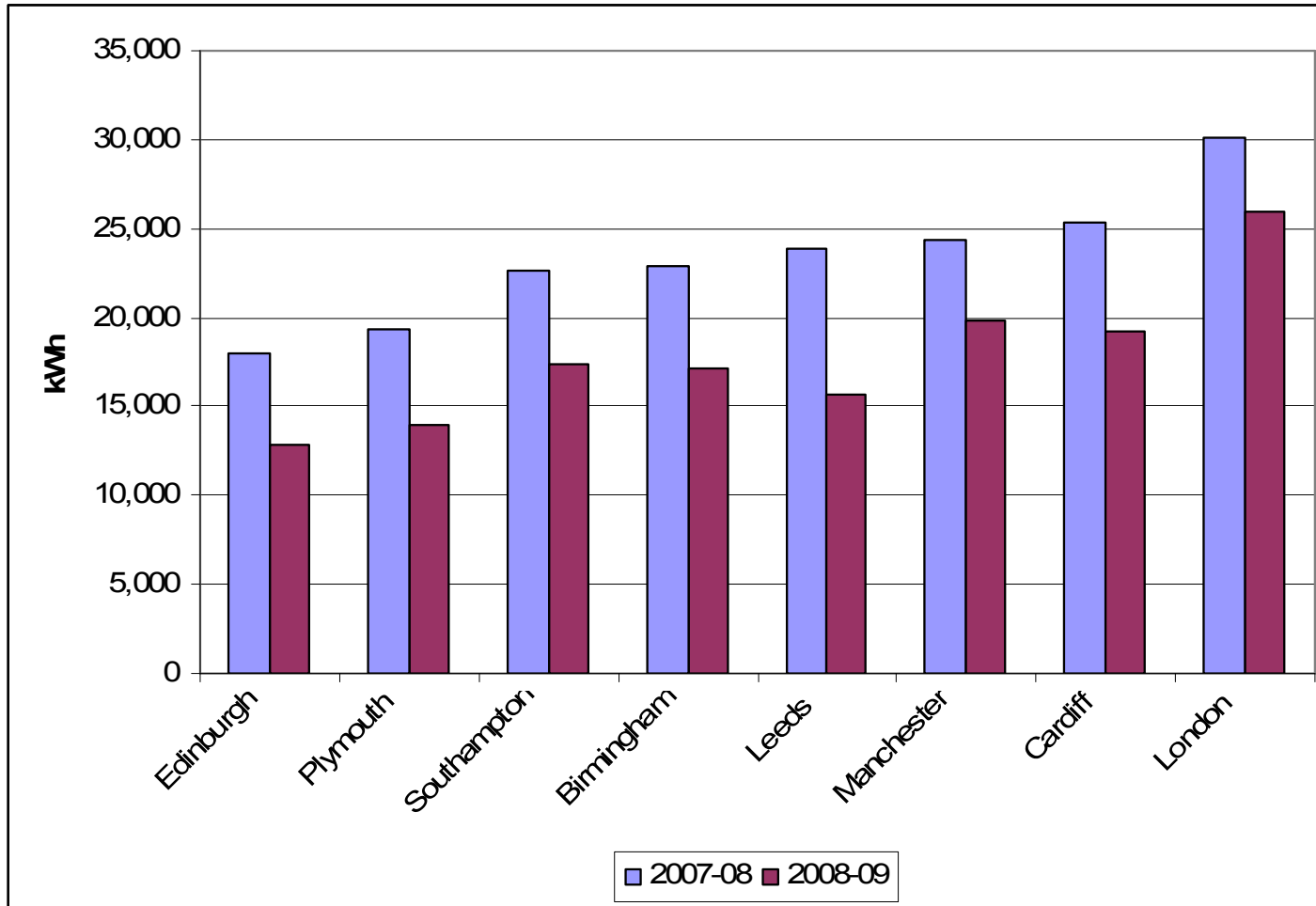
#### Energy savings

Patterns of energy use and savings by street are shown in Figures 1 and 2. The range of average household energy use (gas and electricity) in the baseline year (2007-08) was quite large, ranging from around 17,000 kWh in Edinburgh up to around 30,000 kWh in London (Figure 1). However, most streets clustered in the 22,000 – 25,000 kWh range. The low figure for Edinburgh reflects the fact that these are flats rather than houses.

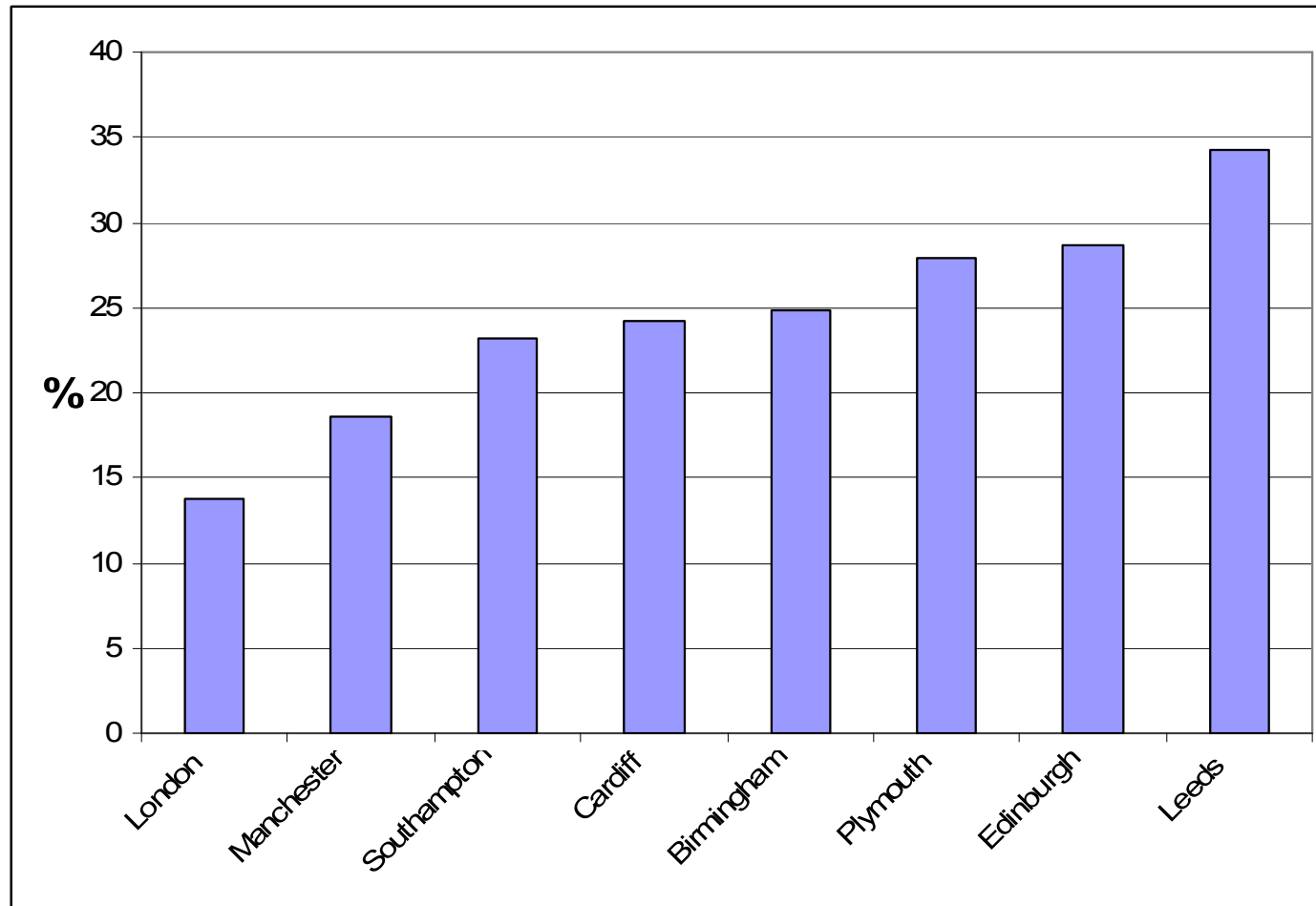
On average, all streets saw a significant reduction in their energy use during the course of the project. Average energy savings across all 63 households was 25.13%, but the street average ranged from under 15% in London to almost 35% in Leeds, which is the clear winner of the competition.

Energy use changes in individual households range even further, from an increase of almost 50% in one case, to a decrease of over 70% at the other extreme. The more extreme changes (and especially the increases in energy use) were often linked to major life events. For example, the largest increase in energy was in a household where a baby was born at the very end of the baseline year, so there was sharply increased energy use from an adult and a baby being at home during the day, keeping the house warmer, using the washing machine more etc. In some households there were changes in the numbers of people living in the house.

**Figure 1**  
**Average energy use, 2007-08 and 2008-09**



**Figure 2**  
**Average energy savings 2007-08 to 2008-09**



There is no clear relationship between energy savings and the size of the household (Table 4). One person households saved more energy on average than 3 person household, and 2 person households saved more than 6 person households. This is a little surprising, as one might expect larger households to have more flexibility in reducing energy use.

**Table 4**  
**Energy savings by household size**

Household size	Average energy saving (kWh)	Average energy savings (%)
1	3605.57	24.16
2	5659.17	25.23
3	3250.06	15.38
4	8007.30	32.71
5	6302.24	21.97
6	5433.14	28.67

### Carbon emissions

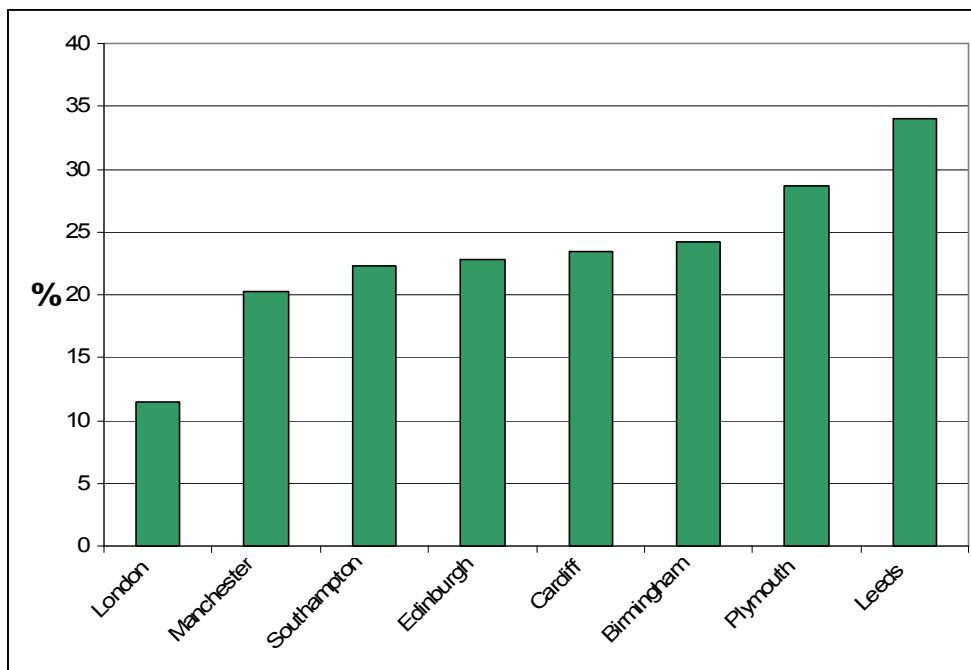
The resulting decrease in carbon emissions is also significant (Figure 3). Average carbon emissions from domestic energy for Green Streets households in the base year 2007-08 were 6.14 tonnes of carbon dioxide, just above the national average for 2006 of 6 tonnes per household.<sup>1</sup> The average reduction over the course of the project was 23%, but again with a considerable range.

The order and scores of cities are slightly different between Figure 2 (energy reduction) and Figure 3 (carbon emissions reduction). This is because of the different carbon factors for gas and electricity. Streets doing well on gas use reduction may not do so well on carbon cuts, as the factor for electricity is more than double that for gas.

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<sup>1</sup> Calculated from Committee on Climate Change (2008: 214)

**Figure 3**  
**Average reductions in carbon dioxide emissions,**  
**2007-08 to 2008-09**

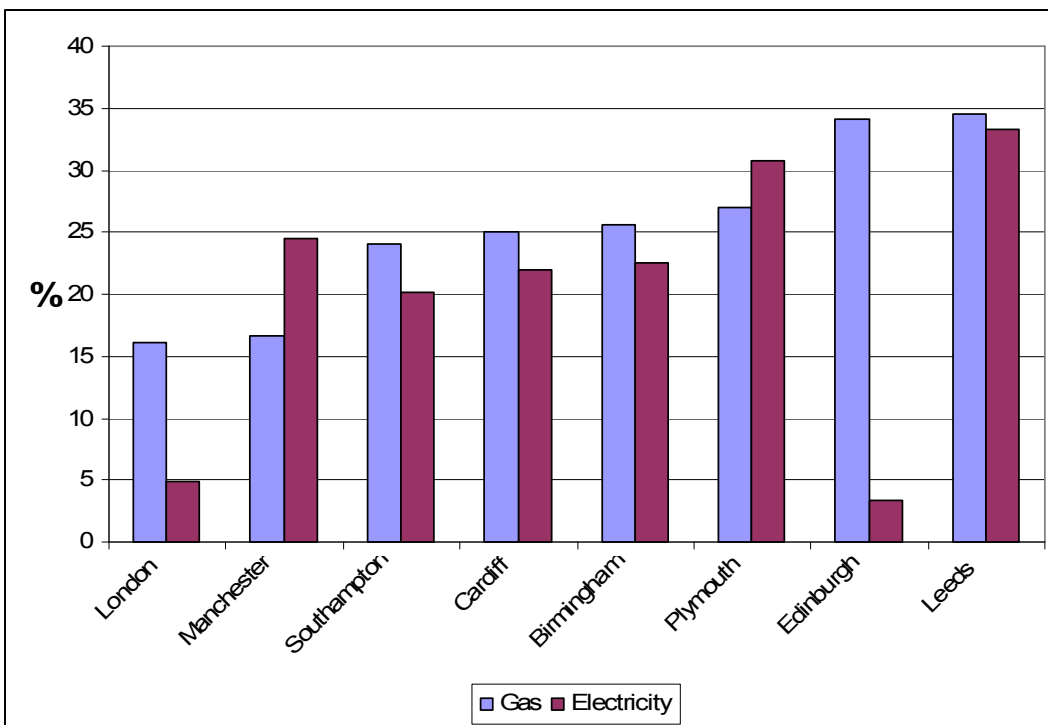
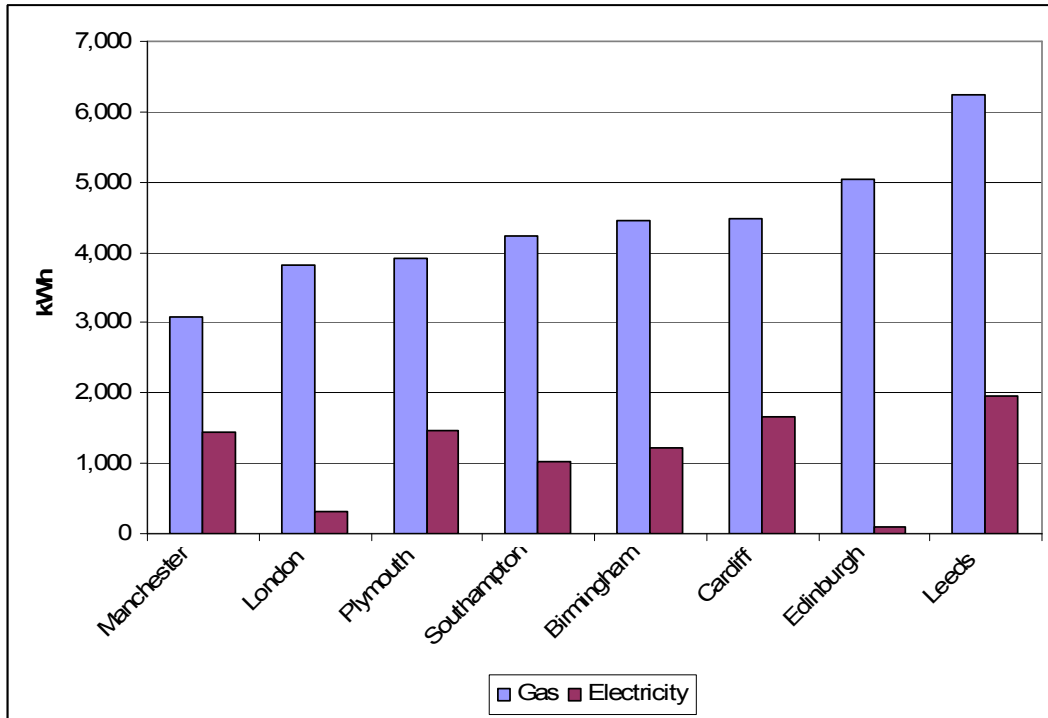


Note: Carbon factors of 0.19 kgCO<sub>2</sub>/kWh were used for gas, based on DEFRA (200??) and 0.501 kgCO<sub>2</sub>/kWh for electricity, based on the data of 2007 in BERR (2008 Table 5C, p 124)

### Gas and electricity

Street averages for reductions in gas and electricity use are shown in Figure 4 (in both absolute and percentage terms). Gas savings drive overall energy savings, whereas savings in electricity are smaller and more uneven. London and Edinburgh are clear outliers in having lower electricity savings than the other streets.

**Figure 4**  
**Average reductions in gas and electricity use**  
**2007-08 to 2008-09**





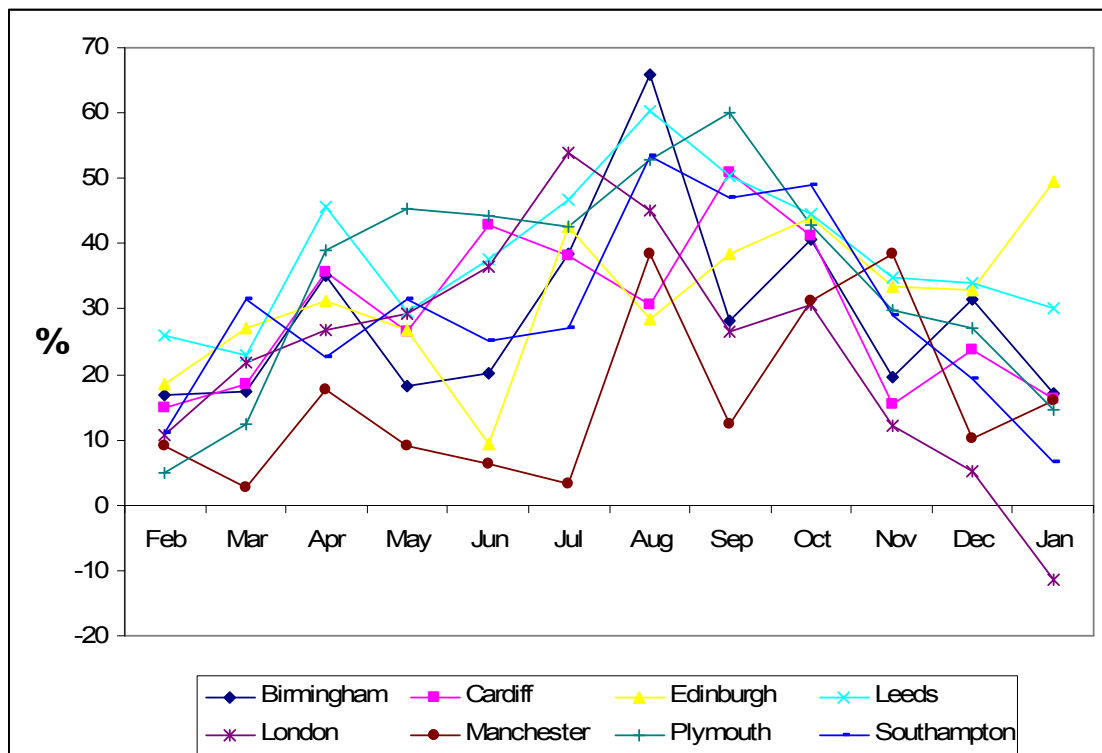
Changes over time

Patterns of average street savings over the course of the year are shown in Figures 5 and 6. There are limitations to this data, since for many households the monthly data for the baseline year are based on industry modelling rather than meter reads (see above section 2), and this should be borne in mind.

Gas use is generally quite low in the summer, often mostly for cooking, so the very high proportional savings at that time of year are less significant than reductions in the winter months when use is much higher, for heating.

What is important is that reductions at the end of the year are in most cases as high as at the beginning of the project. This is particularly the case in light of the fact that while 2007-08 was a mild winter, 2008-09 was an exceptionally cold winter, especially in January. Gas use data was adjusted to take account of this difference (this procedure is known as ‘weather correction’) but while such adjustments are useful for small differences between years, they probably do not fully take out the effects of the 2008/2009 contrast. Nevertheless, with the exception of London, gas savings held up.

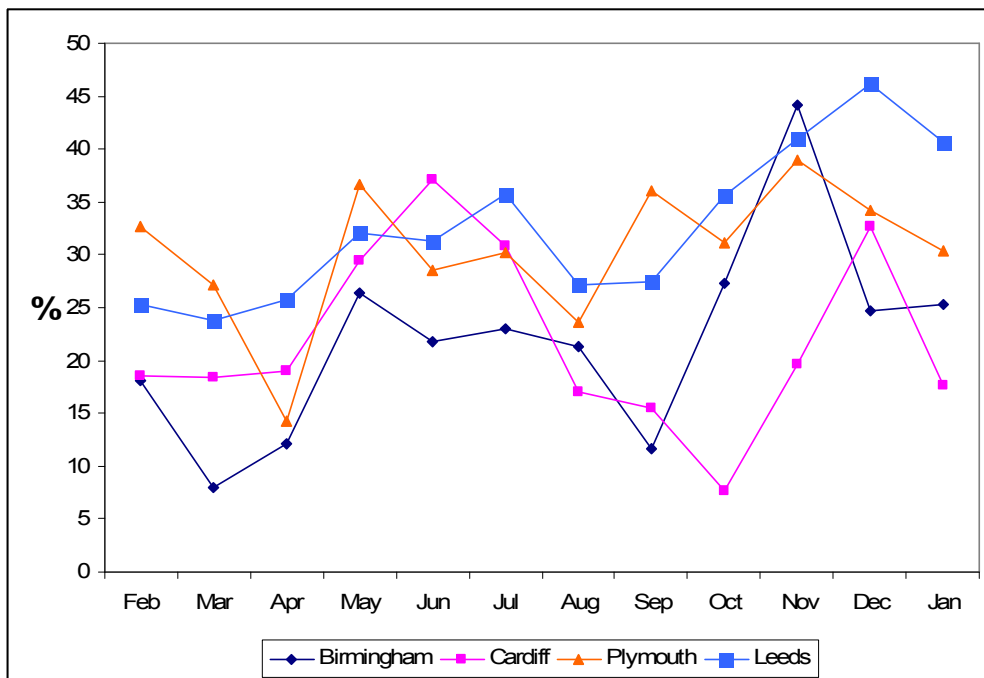
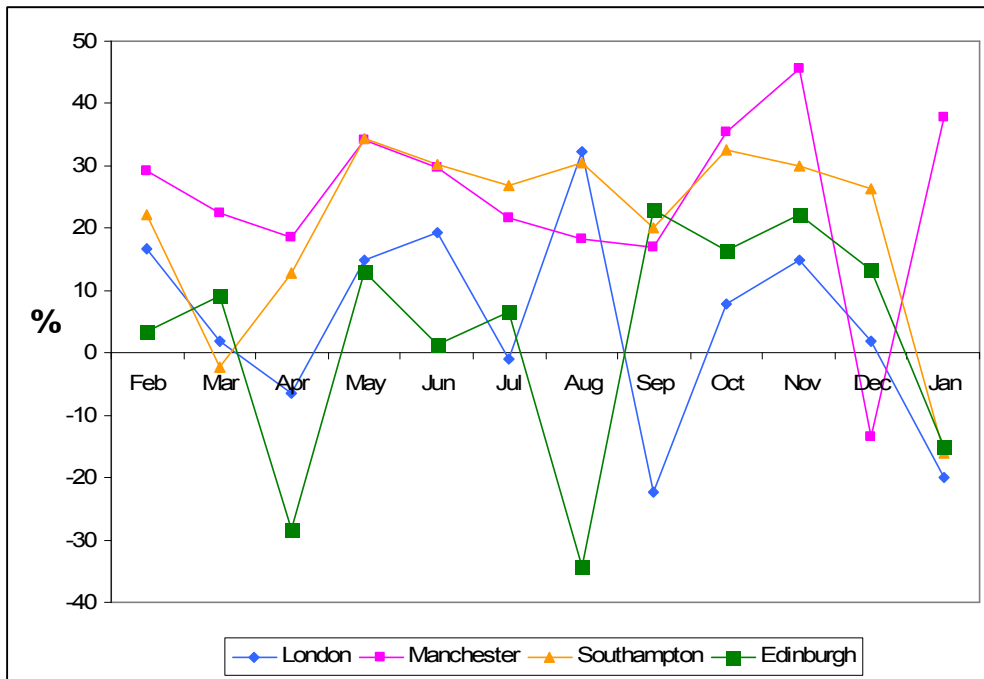
**Figure 5**  
**Average reductions in gas use,**  
**08-09 month against 07-08 month**



Savings in electricity use over time follow a somewhat different path (Figures 6a and 6b). While four of the streets saw consistent savings across the year, in the other four cities

changes were much more erratic and in some months there were increases in average electricity use.

**Figures 6a and b**  
**Average reductions in electricity use,**  
**08-09 month against 07-08 month**



#### 4. Role of installed measures

As noted above, the households taking part in Green Streets each received a number of measures to improve energy efficiency, and a few also received solar photovoltaic panels of solar water heating. For each street the total budget allocated between households was £30,000, or £3,750 per household.

The impact of the measures can be seen in Table 5 and Figure 7, which give information on the energy performance of the streets and individual homes before and after the measures were fitted. The A-G ratings are those used in the Energy Performance Certificate system, which are in turn based on a 0-100 scale used in the Standard Assessment Procedure, or SAP, with 0 being the poorest and 100 the best.

Table 5 shows that the initial average energy performance scores of the homes in each street varied considerably, with the poorest stock in Birmingham, and the best in Edinburgh. All streets saw a marked improvement in performance as a result of the measures, but while the average London score was boosted by 8, that in Edinburgh and Birmingham was increased by over 17.

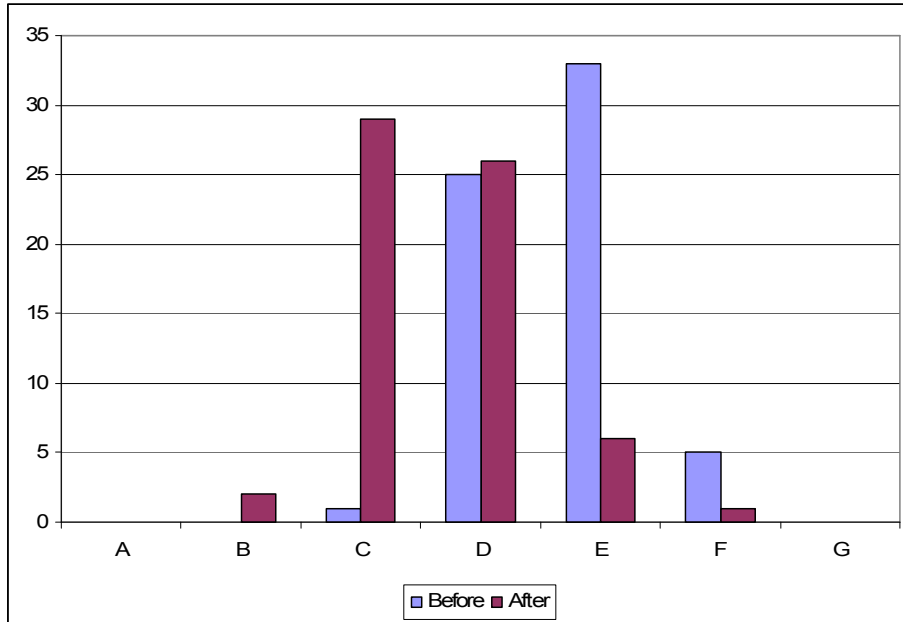
**Table 5**  
**Average SAP scores for streets before and after measures**

	<b>Before</b>	<b>After</b>	<b>Improvement</b>
Birmingham	44.75	61.75	17.00
Cardiff	45.25	59.13	13.88
Plymouth	48.13	63.63	15.50
London	49.13	57.13	8.00
Leeds	53.25	69.25	16.00
Manchester	54.38	68.00	13.63
Southampton	55.38	66.88	11.50
Edinburgh	60.13	77.25	17.13
<b>All</b>	<b>51.29</b>	<b>65.38</b>	<b>14.09</b>

The distribution of A-G ratings for individual households before and after is shown in Figure 7. Before the Green Streets measures were installed, the E category (with scores of 39-54) was the most common, comprising about half the homes. Almost all the other homes were in the D (55-68) category, with only one scoring C (69-80).

After the measures were installed the distribution of scores moves to the left, with most homes now in categories C or D, and with two in the B category.

**Figure 7**  
**Energy performance ratings before and after measures**



An interesting question is how much of the saving in energy seen in the Green Streets households is due to these measures, and by implication from the residual, how much is due to changes in lifestyle or in behaviour.

Clearly, the installed measures do have an impact, and there is a broad relationship between the average street SAP score improvements in Table 5 and the energy savings in Figure 2, so that, for example, London sees the smallest SAP score increase and the smallest energy savings. However, while Leeds saw significantly higher energy savings than other streets, its average SAP score improvement was not the highest. There is no simple mapping of one ranking onto the other.

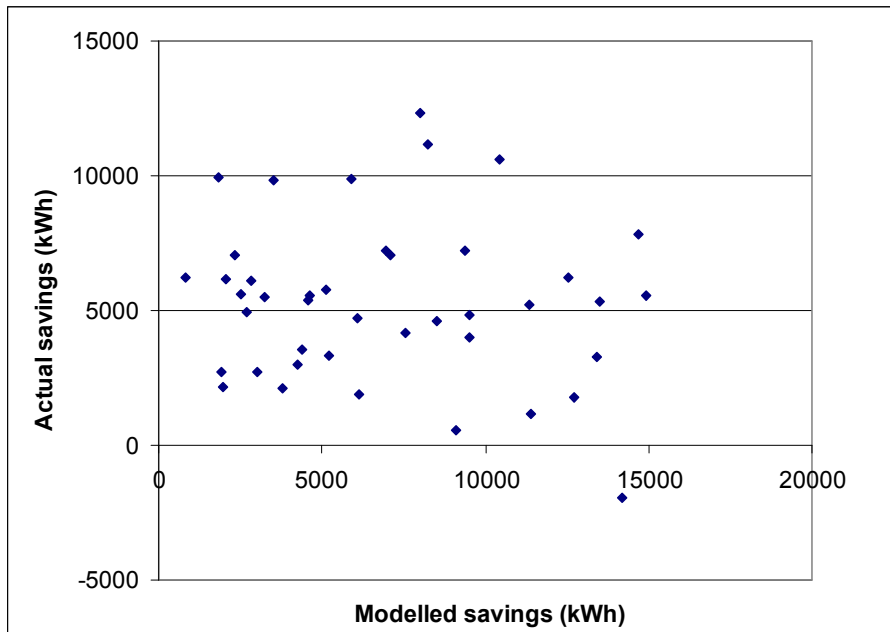
To make an assessment of the role of the installed measures, we drew on the estimates of their effects on energy use as applied in the Government’s main energy efficiency scheme.<sup>2</sup> These estimates are derived from a sophisticated model produced by the Building Research Establishment, which calibrates the effects of measures allowing for the size and age of the dwelling, and allows for interaction between measures (Ofgem 2005).

This analysis was conducted on a subset of 42 households for which full meter data was available. The relationship between the predicted energy savings and observed energy

<sup>2</sup> The Carbon Emissions Reduction target (CERT), previously known as the Energy Efficiency Commitment (EEC). Estimates were taken from the EEC spreadsheet on the Ofgem website.

savings is shown in Figure 8. If the modelled savings were a good prediction of actual savings, we would expect to see the points clustered along a 45° line from the origin.

**Figure 8**  
**Actual energy savings and modelled savings for selected Green Streets households**



As the graph shows quite clearly, the data points are in fact quite widely scattered. Regression analysis confirms that although there is a statistically significant relationship between them, the modelled estimates explain only around 50% of the variation in observed energy savings (see Appendix 2), which is consistent with other studies e.g. Martin and Watson (2006).

This does not mean that the installed measures make little difference. Careful studies have shown that measures such as cavity wall insulation and loft insulation will on average have a major impact on the energy performance of a building. However, what this finding does point to is the importance of changes in lifestyle and in behaviour for actual changes in energy use.

## **5. Behaviour Change**

The Green Streets participants we interviewed reported the full range of behavioural changes in energy use, including some quite innovative approaches (Box 2). However, there was also a range of responses – some individuals made major changes and sustained them, while others struggled to change at all.

**Box 2 – Reported changes in energy use behaviour use**

- Turning off lights
- Not leaving appliances on standby
- Not using a tumble drier
- Washing clothes at lower temperatures
- Using a dishwasher instead of washing up in the sink
- Fewer baths
- Not overfilling kettles
- Using and turning down thermostats
- Using thermostatic radiator valves to heat only rooms
- Turning down the hot water temperature boiler setting in summer
- Turning off the oven early and using the remaining heat to complete the cooking
- Washing hair early in the evening to allow it to dry naturally and not use a hair dryer
- Eating by candlelight

A few participants reported using more innovative approaches, including: turning off the oven early and using the remaining heat to complete the cooking, washing hair early in the evening to allow it to dry naturally and not use a hair dryer, and eating by candlelight.

Others in the competition reacted to the last of these – eating by candlelight - by saying that it went “too far”. This reaction indicated the need both to maintain ‘normality’ when making behavioural changes and to ensure that freedom of choice was not affected. This response is unsurprising and supported by much of the behaviour change literature most notably the theory of resistance to persuasion (e.g. Brehm 1966)

The majority of our respondents felt that a change of perspective was involved, as much as a huge change in their way of life:

*The whole thing has changed our, I won't say changed our way of life, because you don't do that. That's one of the things you mustn't do because it defeats the object. You've got to carry on as normal - Southampton*

Q. How much would you say you've had to change you way of life?

*A. Not that much really because you just get used to it. If you were looking at before and after to some people it might look a lot. And to some people it might look more than I've had to, because they didn't do things, some people might have had to change more...But things like that, that you didn't think of before, once you get used to knowing that you just don't leave it plugged in, once your phone's charged pull it out from the wall...But it just becomes habit quite easily, it isn't difficult to change things at all, you just get used to it. - Manchester*

There was clearly an initial conscious changing of habits, which some found relatively easy, but others much harder:

*Can't think of anything. If it had been hard, I might not have done it - Birmingham*

*The easiest thing to do is to turn bits off – Southampton*

*There's nothing onerous about anything. That's the fantastic message out of the whole thing – London*

*... the first couple of weeks were probably quite tough on us, because it's really annoying having to change your old habits - Southampton*

*It's difficult to make the kids change. And it's hard yourself a bit. Especially X (daughter), X is the hardest one because she uses more things. She's terrible with the computer – Birmingham*

Q. How have you two ( the parents) found giving up these habits?

A. Male: *Slow to change, I don't like giving up the tumble dryer, that's my bad habit.* Female: *We go through little spasms where I blame her and she blames me.* – Birmingham

*You can't alter your life too much, especially when you've got kids - Manchester*

Most respondents also felt that, having made the changes, they would sustain them:

*I think we will actually sustain the change in habits, I think they have become, over the last 4 or 5 months, it's become almost second nature to say, "right, we're not going to leave that on" and that has been our change in attitude, in terms that we are energy usage aware now - Southampton*

Q. Do you think the changes will continue after the competition is over?

A. *Oh yeah because you just get used to doing it, as I say, you get to where you're pointing it out to other people – Manchester*

*I think once you've trained yourself I don't think you can forget as much. It's everyday..... It just becomes second nature - Manchester*

Behaviour change is clearly a complex phenomenon (e.g. Jackson 2005). However, there is a relatively simple framework that can be used to understand how the Green Streets experiment might have been effective in changing participants' behaviour.

Defra has recently developed a framework for understanding pro-environmental behaviour (Defra 2008b), based on a considerable social research base. Their framework suggests four types of intervention to induce behavioural change (defined in a broad

sense to include purchasing decisions): *encourage* (through financial rewards and penalties), *enable* (through providing information and other means), *engage* (i.e. motivating people through a variety of communication channels) and *exemplify* (i.e. government at all level leading by example).

In the case of Green Streets, encouragement came from the expert advisers, who also enabled people to take action through providing information on what would be effective. Continuous information on electricity use also came from the hand-held real-time display units that were distributed to all participants. Control over use was further enabled by offering people stand-by busters. Finally, engagement came through the competition between streets and the mutual support (and peer pressure) between other participants in the same street. It is also clear from the interviews that saving money was a motivator for people early on in the project. As the year progressed and energy prices started to rise, this factor became more complex. On the one hand, the motivation to save money became even greater. On the other hand, the rise in prices threatened to remove some or all of the savings that participants were hoping to make.

#### Role of energy advisers

The energy advisors played two important roles in the project. One was in sorting out teething problems that arose with lighting, new appliances and boilers, and insulation installation (and in a few cases resolving issues with meter readings). The other was in providing information and advice on everything from how to read the energy performance reports, to using the hand-held meters to general energy saving tips.

*He's always thinking oh I might be able to get you a energy leaflet on that, or I've seen a little notebook with you know a hundred suggestions in, I'll see if I can get that for you. - Birmingham*

*[our adviser] was very effective when they were organising the changes they were going to make.... Making everyone feel comfortable about it - Southampton*

*we had our thermal imaging, before and after, and we looked at ours and its just like two different coloured photographs. But he actually came round to each house.... He went through that all explained what was what - Birmingham*

The fact that advice is seen not to be linked to any commercial advantage was important for some:

*That's a big part of this thing...because these people...you know that they're doing it as a demonstration project, so there's no sense of being conned...That's the thing that was the most bizarre and amazing thing about the project to start with, that someone was offering you good clear advice for nothing - London*



In terms of motivating participants, it was clear that people skills are as important as technical knowledge, and that some advisers were particularly engaging:

*X is brilliant... They're friends as well - Southampton*

*If there's any problem he will look into it and sort it out. He's very approachable.*  
- Birmingham

*He's very enthusiastic. A bit of a cheerleader. - Southampton*

*Well they keep us all interested in it, yeah, I can't imagine, if they hadn't been involved, if that hadn't been working, and I hadn't got the right light-bulbs, not give up, but you wouldn't be so involved with it. Yeah I don't think I could have done it without them being involved to the extent they have, I mean I could have done it, but do you know what I mean, I wouldn't have been so motivated to do it*  
– Manchester

### Role of handheld meters

Hand-held electricity meters were widely seen as a good motivator by making energy use visible, and evidence from elsewhere suggests they can have a significant impact on electricity use (Darby 2006). The Electri-save meters provided to Green Streets households clearly had a big impact in most cases:

*It's been brilliant for the children...I think it's been brilliant for us, too. We had great fun when it first arrived – you put the kettle on, you put the iron on, you put the micro-wave on, and [you see] that is big money” – London*

*Because we have this energy monitor thing which actually shows you how much electricity at any one time... how much it's costing you.. that was a revelation really. With that you can actually see how much something is costing you when you switch it on.... That's something I think every household should have, one of those. - Southampton*

Q. Have you been getting on with the handheld monitor?

*Female: I love it... It's always by the bed so we know sort of what we're using. We've got an alarm on it for when it hits 50p an hour*

*Male: which very rarely happens - Manchester*

*I have become absolutely obsessed with our meter readings. This has been the main thing that has made us change our behaviour... You become quite obsessed by it - Edinburgh*

There was also agreement that the novelty wore off, but this did not necessarily mean that behaviour change was reversed

*I think the best thing to do is to rent it to a household for a month... it doesn't take long to realise what uses most energy and what you can then save just by monitoring the use of things like the kettle, the iron, things like hair straighteners.*  
– Southampton

*The children...they don't notice it any more...like all these things, the interest passes... - London*

### Competition element

The competition element – especially between street or cities - has played an important motivational role for behaviour change for many participants. The idea of a community prize has been especially appealing for families with children.

*I like the challenge as well. I like the idea of pitting myself against the other seven and also that my team are pitting themselves against seven other teams up and down the country, and I get really upset when we start dropping.... - Birmingham*

*I don't want to be the one in our eight households that's not saving the most energy... that's seen not to be trying. – Southampton*

*I don't think that we're particularly competitive about it [within the street] ...I feel more competitive against Plymouth, Leeds, Edinburgh, than I do against my neighbours – London*

## **6. Street interaction**

A final, unexpected aspect of the Green Streets experiment that emerged from the interviews was the positive impact on social cohesion and community spirit. While some participants know each other beforehand, many didn't. While not every respondent felt the same way, for many participants Green Streets became the catalyst for greater contact with their neighbours, not simply about energy but a range of issues. Older people living alone seemed especially enthusiastic about this aspect of the project.

*We've not only gained from the green initiative and what we're doing and saving the energy but we've also met our neighbours and that's been a really good thing.*  
- Southampton

*The community coming together for the competition has been brilliant –*  
Southampton

*Because of this project I think personally for me it's made a big difference cause I know really well a lot more of my neighbours. It's made me feel much more part of the community. - Edinburgh*

*When you see people, the woman, at the end of the road and this sort of thing, and whereas I used to pass them before and didn't know them and stopping to say below and this sort of thing. Certainly with the people who are involved in it you get to know them more - Manchester*

*I've certainly met people that I didn't know existed...the last two meetings have been held in people's houses so we've got to know them, and see them, and know their names – London*

*we're like a little family, all of us, and it's its very nice. I wouldn't have had any means of introducing myself or the confidence had I not been involved in this. You don't go up to strangers in the street and introduce yourself do you? But no, it's been wonderful. If I've got nothing else out of it than the people I've met it's still been worthwhile. – Birmingham*

Q: Would you say that [the project] has changed the community feeling on the street?

A: *Yes, definitely, definitely, definitely - London*

Q. What's been the best thing about being involved in this so far?

Male: *I'd say saving the money. And yours is making the friends isn't it.*

Female: *Yeah, it is. It's great having... It was very quiet before and we didn't really go out much, we didn't do much, so this was sort of not only an opportunity to save money but we met new people. They're just our best friends now. I'm there everyday. Every single day. It's brilliant. They're great. - Manchester*

## 7. Policy implications

The Green Streets experiment has some important lessons for policies in a range of areas, including energy efficiency, carbon reduction and renewable energy. If the project could be replicated at a national level, the financial, carbon and energy security implications would be significant:

- The average domestic electricity bill in the UK in 2008 was £424, up almost 50% over the previous 10 years. The average gas bill has almost doubled, to £618 in 2008 (DECC 2008a: 12). Thus the average domestic energy bill was £1,042.<sup>3</sup> There are approximately 25 million households in the UK, meaning that in total households spent in the region of £26 billion on energy in 2008. If the average energy savings from Green Streets (19.42% electricity; 25.74% gas) are applied to these figures, the average energy bill falls to around £800, and the **saving across all UK households would be around £6 billion.**
- The 63 Green Streets households reduced their carbon dioxide emissions from domestic energy use by 88.66 tonnes, or 23%. If all UK households achieved

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<sup>3</sup> Excluding the small number of households using heating oil.

similar savings on average, emissions would be reduced by 35 million tonnes of carbon dioxide (MtCO<sub>2</sub>) a year at a national level. This is roughly equivalent to **the annual carbon emissions of 3-4 modern coal-fired power stations.**<sup>4</sup> It is about a **third of what is needed for the UK to meet the 2020 emissions reduction target in the new Climate Change Act 2008** (i.e. a reduction of at least 26% in carbon emissions from a 1990 baseline by 2020)

- Gas demand across the Green Streets households fell on average by almost 26%. Since one third of gas in the UK is used for residential heating and cooking, if all UK households were to see a similar fall, **this would cut total demand for gas in by over 8%. This represents about a third of our current gas imports** (DECC 2008b).

It would not be feasible to replicate Green Streets across the country in a literal manner. It would be too expensive, not least because of the cost of allocating one energy efficiency adviser to every eight homes.<sup>5</sup> However, it is possible to draw out some important lessons for policies to save energy and reduce emissions, especially in three areas:

### **1. Build on existing energy efficiency programmes, with a greater role for interventions that influence behaviour, especially direct feedback on energy use and face-to-face advice**

The Government's existing programme for domestic energy savings, now called the Carbon Emissions Reduction Target (previously the Energy Efficiency Commitment), is highly cost effective, and is reaching the stage where demand for natural gas in the residential sector is being reduced. The 2005-08 phase is estimated to be saving around 6 TWh of electricity a year and 7.4 TWh of gas, and reducing carbon emissions by over 2 million tonnes of CO<sub>2</sub> a year (Eoin Lees Energy 2008). The current phase (2008-2011) aims to double the impact of the previous phase, with additional resources added in September last year.

Under these programmes, the Government sets targets for energy saving and carbon emissions reductions, and rules for what types of measures (e.g. insulation, low-energy light-bulbs, etc) will count. Each major energy supply company has to meet its target in

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<sup>4</sup> A 1.6 GW modern (i.e. supercritical) coal plant with a carbon factor of 0.75 kgCO<sub>2</sub>/kWh and a capacity factor of 0.9 would produce 9.44 MtCO<sub>2</sub> a year.

<sup>5</sup> On the face of it, Green Streets appears to be an expensive project, with total capital costs of £240,000 (£30,000 per street) yielding around 90 tonnes of carbon dioxide abated, giving a cost per tonne abated of over £2,000. However, this headline figure is misleading. This is not only because of the requirement to have one high-cost renewable installation in each street, but more importantly because the project involved replacing boilers, fridges, washing machines and dishwashers. In a normal situation these will need to be replaced anyway, and the relevant cost is the additional cost of an A++ rated product relative to a B-rated one, or a condensing boiler over a non-condensing one. These are relatively marginal costs. In the headline figure the full cost of the new appliance or boiler is included. This matters because of the numbers involved. Green Streets saw the replacement of 20 fridges, 15 washing machines, 5 dishwashers and 41 boilers.

the way that it thinks is the most cost-effective, which has tended to be basic insulation and low energy lighting measures. For example, between 2005 and 2008, companies insulated almost 1.5 million cavity walls and lofts and gave away millions of low-energy CFLs. In the current phase, a million cavity walls and 750,000 lofts will be insulated every year (Eoin Lees Energy 2008). The programme is also designed to help meet fuel poverty policy objectives, as companies are required to prioritise households on benefits or pensioner households.

The Government wants to extend this approach into the future, under the generic heading of a Suppliers Obligation to deliver energy and carbon savings. The future shape of the programme after 2011 is currently being debated. It is clear that low-cost insulation measures will continue to play a central role. However, one of the main findings of Green Streets is that actual energy savings are also strongly affected by behaviour, and it would make sense for future policies to address this. Under the current rules, energy suppliers do not receive any credit for efforts to make consumers more aware of their energy use, or change their behaviour – just the area in which Green Streets was so successful. In the next phase of the Suppliers Obligation, the rules of the programme should be changed to allow more innovation, while also ensuring that basic insulation is delivered at an accelerating rate.

Such a change will be a major shift of direction for energy efficiency programmes, as in the past little or no effort has been put into engaging householders, beyond getting permission to install free or subsidised measures. But in addition to our findings, there is supporting evidence from elsewhere that measures aimed at changing behaviour (more broadly defined to include purchasing or investment decisions) can have a significant impact on energy savings and emissions (Enviros 2008, Darby 2006).

#### Direct feedback on energy use

As noted above, the Green Streets experiment involved several key elements that encouraged, enabled and engaged householders. One of these were the hand-held electricity use meters (sometimes called real-time displays or RTDs) that were given to all participants, which take information from the conventional electricity meter and display it on a small screen. The advantage of these RTDs is that they give continuous direct feedback on use that is readily available anywhere in the house.

However, the current potential of RTDs is limited by the nature of the conventional meters they take information from. Existing metering technology is a century old, and a whole new generation of ‘smart’ meters is now available, not only for electricity but also gas. We therefore strongly support the rapid roll-out of smart metering, which the Government has committed to begin by 2010, which will be one of the biggest changes in domestic energy supply in recent times.

Smart meters will be able to send and receive information about usage over time, payment and tariffs, demand on the electricity system etc. Smart metering systems will also be able to incorporate micro-generation generation and exports. Subject to measures

to protect personal data, smart metering may also facilitate consumers comparing their energy use over time with average use in all sorts of local and national reference groups.

It is also likely that consumers will be able to access information from their smart meter not simply through a dedicated RTD, but also through other in-home or even remote platforms, including mobile phones and personal computers, and it is possible that a market will develop in creative graphical user interfaces that will enhance the visibility and impact of the information. The Government should encourage such activity, but ensure that minimum standards are in place to cover any display format.

### Information and advice

Another aspect of Green Streets was the information, advice and back-up given by the British Gas energy advisers, who in many cases also motivated participants to seek ways of saving energy. Locally available, house-specific, face-to-face advice is particularly important for people taking information and advice on board. We therefore welcome the Government's recently stated intention to make such advice much more widely available. In addition to the energy savings, the scaling up of energy advice would provide additional skilled employment.

Clearly, it is impossible to provide one advisor to every eight households in the UK, but in the Interim Report we calculated that one adviser per local authority ward would mean a ratio of about 1 adviser per 2,500 households, or 1 per 20 streets or so. This would require approximately 10,000 advisers across the UK. For comparison, there are already some 8,000 people who have been trained as Domestic Energy Advisors (DEAs) who are qualified to carry out the assessments for Energy Performance Certificates required when a property is sold or let.

Expanding face-to-face information and advice services on this scale would also create skilled jobs, particularly valuable during the current recession. Some of these posts could potentially be filled by trained DEAs, but Government support for further training may also be needed.

Energy saving information and advice tailored to the needs of individual households could be delivered through a number of routes.

There may be a niche market for energy and other environmental services on a commercial basis, and this market is currently being tested both by energy suppliers, other companies and local authorities. However, these pilots are in most cases still being subsidized and this market is likely to be quite small.

A second approach would be appropriate incentives for energy suppliers to provide more face-to-face information and advice to customers within the Suppliers Obligation. This route makes sense in that some suppliers already have considerable capacity, and already give information and advice to customers in various forms. The Government is already taking steps to put such incentives in place.

However, some people may treat information and advice provided by suppliers as commercially motivated, and be less willing to accept and act on it. There are various ways in which suppliers can tackle this barrier (and already do within the context of customer suspicion regarding offerings under CERT), especially working in clear partnership with more trusted bodies such as local authorities and voluntary organizations.

A further possibility would be to deliver expanded information and advice through an independent directly-funded agency, possibly through building on the Energy Saving Trust network of Sustainable Advice Centres. Such an approach would not face the same trust barriers, but would not be able to build on the resources and experience of the energy suppliers.

Initially it may be best to try a number of such approaches, and then rigorously evaluate which delivers the most effective service at the lowest cost.

It will also be essential to develop appropriate accreditation for advisors and a code of conduct, regardless of the delivery route.

#### **Summary:**

- **In the next phase of the Suppliers Obligation, the rules of the programme should be changed to allow more innovation in developing ways of changing behaviour, while also ensuring that basic insulation is delivered at an accelerating rate.**
- **The roll-out of smart metering, including in-home displays, should proceed as rapidly as possible**
- **The Government should encourage innovation in the development of different in-home displays, but ensure that minimum standards are in place to cover any display format.**
- **Scale up the provision of face-to-face energy saving advice in the home**
- **Government should explore several routes for advice, including commercially based energy services companies, the Suppliers Obligation, local authorities and possibly a dedicated agency, but then review and evaluate the experience to identify the most cost-effective method.**

## **2. Facilitate innovative financing mechanisms**

Green Streets participants benefited from an average of £3,750 of free insulation, energy efficient appliances, upgraded heating systems and renewable energy. If we are to see

similar levels of energy saving and carbon reduction across the country, householders will inevitably need to make investments themselves.

The sums involved could be considerable if one includes measures that offer deeper savings but cost more, such as solid wall insulation. For example the Conservative Party has recently argued that up to £6,500 per household may be needed to deliver a package that includes such measures (Conservative Party 2009).

But it is well-known that capital costs are a barrier to investing in energy saving, even if measures pay for themselves eventually. This is especially the case for the more expensive items. Renewable and low carbon micro-generation is also currently expensive, although the introduction of assured rewards for small-scale renewable electricity in the form of feed-in tariffs, as included in the 2008 Energy Act, should help stimulate a finance packages, if the level of tariff is right (although in the current climate of constrained credit the Government should monitor the situation and provide backing if necessary).

For other measures, innovative approaches to financing will be required to make it easier for householders to take the big energy saving measures, particularly in harder to treat properties. There are a range of possibilities. For example, if energy saving measures are installed at the point that a home is sold, a ‘green mortgage’ approach could be taken, as the costs will be marginal to the total value of the property. However, the experience in the USA is that the green mortgage market has only become significant where it is driven by regulations requiring energy efficiency upgrades at the point of sale (e.g. the Berkeley Residential Conservation Ordinance in California). This would imply building on the existing Energy Performance Certificates system to require minimum standards.

A particularly attractive approach for energy saving finance packages is to have ‘on-bill’ repayment, where payments appear on the gas or electricity bill and made to the appropriate energy supply company. The customer can directly compare repayments with savings, and no separate direct debit is required.

However, there are certain barriers to on-bill repayment. One is that energy suppliers would have to become providers of finance. Currently, although some suppliers offer loans (for example for new boilers or insulation), the finance is offered by a third party, and repayment is organised separately. To have true on-bill repayment, loans would have to be made by energy suppliers to their customers. However, this would require suppliers to obtain a Consumer Credit License and to comply with the regulations in the Consumer Credit Act, which involves additional costs. The Government should work with the energy industry to examine ways in which these costs could be reasonably reduced without removing consumer protection.

A further problem with on-bill repayment is switching between suppliers. If a consumer was originally buying energy from company A, then took out an energy saving loan with that company, but subsequently switched their energy supply to company B, the advantages of on-bill repayment is lost and the arrangements become more complex and



costly. The same applies when people move house, since the measures stay with the property, not move with the consumer.<sup>6</sup>

It may be that a market may arise in which companies took over loans as consumers switched their energy supply, much as credit card providers or re-mortgage companies do currently. However, if this were not the case, the problem would have to be addressed in a way that works for both suppliers and consumers.

**Summary:**

- **Innovative financing mechanisms to overcome the capital cost barrier to energy saving measures should be facilitated**
- **The Government should consider building on the existing Energy Performance Certificates system to require minimum standards, in order to drive a ‘green mortgage’ market**
- **To facilitate on-bill repayments the Government should work with the energy industry to examine ways in which the costs to suppliers of obtaining a Consumer Credit License and complying with the regulations in the Consumer Credit Act could be reasonably reduced without removing consumer protection**
- **Suppliers may be willing to take over consumer’s loans if a consumer wants to switch their energy supply. But if this does not happen, Government should seek a solution to the switching problem that avoids excessive complexity, and is acceptable to both suppliers and consumers.**

### **3. Connecting to communities**

One of the unexpected but important findings of the assessment was that the Green Streets project has increased the interaction between people in the streets involved and had a positive impact on community spirit and neighbourliness.

The street approach and competition element was intended to create both peer pressure and mutual support to maintain energy efficient behaviour, but it also brought neighbours together who hadn’t met before. Other people living in the streets involved have become interested and in some cases have been motivated to take measures to save energy as well. At least one of the street groups has independently held community meetings to share their experience and advice. There is clearly some potential here for a virtuous

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<sup>6</sup> Proposals have been made for a greater role for the companies that run the electricity and gas distribution networks, the logic being that measures are permanently installed in the property, and the connection with the network is also permanent. However, in practice, this route would be complex, and risks locking consumers into a situation where there is a monopoly supply of finance for micro-generation and other costly energy measures.

circle between households acting together to reduce energy demand and the strengthening of social cohesion.

There are a number of ways in which public policy could help unleash this potential. One is to encourage and incentivise energy suppliers to work more closely with and through community groups (or organizations that work with community groups), for example to set up community energy clubs. Note that communities do not have to be purely geographically defined here; rather, they are best thought of as networks of households connected by common interests.

The Government should also think about resources and materials for community groups. The recently developed Community Action for Energy programme, which provides groups with advice on funding, training, and technical support, should be expanded so that its services are widely accessed.

A community approach could also allow the wider use of competitions. The competition element in Green Streets was fun, motivating and helped sustain interest. The competition involved two parts - comparison and an incentive (prize). Community prizes (for example funding for local projects or institutions such as swimming pools, football club, church or pub) are likely to be particularly motivating and reinforce the idea of acting together with others. Such competitions could be run and funded either within the Suppliers Obligation or directly by Government, possibly via the Energy Saving Trust.

Community energy saving competitions could also be greatly enabled by smart metering (subject to credible assurances on personal data protection). Rather than a crude and simple comparison of energy use with a national average, smart metering could allow the averaging and comparison of data across streets, neighbourhoods, non-geographically defined communities, cities etc., with prizes at different levels.

## Summary

- **Use public policy to tap into the potential virtuous cycle between joint action to save energy and community spirit**
- **The Government should actively encourage and incentivise energy suppliers to work more closely with and through community groups (or organizations that work with community groups), for example to set up community energy clubs**
- **The recently developed Community Action for Energy programme, which provides groups with advice on funding, training, and technical support, should be expanded so that its services are widely accessed.**
- **Explore the use of smart metering to provide community comparisons and prizes to allow energy saving competitions**

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**Appendix 1**  
**Interview schedule**

**GREEN STREETS INTERVIEW DISCUSSION GUIDE**

<b>Times</b>	<b>Discussion guide</b>
<b>0.00</b>	<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• My name is xxxx. I am from an independent research organisation. British Gas has asked us to undertake some independent research into the 'Green Streets' competition.</li> <li>• Just to emphasise we are not from British Gas we are acting as independent researchers and I am here to find out about your experiences of taking part in the competition.</li> <li>• So firstly, thank you for very much for agreeing to meet with me and take part in this aspect of the competition.</li> <li>• The interview should take about an hour and certainly no more than an hour and a half.</li> </ul>
<b>0.01</b>	<p><b>Before we start</b></p> <ul style="list-style-type: none"> <li>• Firstly, as I said I'm from an independent research company, I'm not an energy expert. I'm interested in your experiences and what you think so please feel free to say anything that comes to mind.</li> <li>• There are no right or wrong answers.</li> <li>• I'd like your permission to record the interview. This is so that everything you say is captured correctly and kept safe, and will really help with writing up an accurate report. The recordings will only be accessible to the researchers working on the project and we won't use anybody's names when we write the report.</li> <li>• Do you have any questions before we start?</li> </ul>
<b>0.03</b>	<p><b>Warm up</b></p> <p>It would be good to find out a bit about you.</p> <ul style="list-style-type: none"> <li>• Can you each introduce yourselves to me - tell me your name, your age and what you are up to at the moment?</li> </ul>
<b>0.05</b>	<p><b>Background:</b></p> <ul style="list-style-type: none"> <li>• How did you get involved in the competition? <i>Did you respond to a communication from B Gas?</i> <i>Did another household on your street encourage you?</i></li> <li>• Why did you want to take part? <i>What were your reasons – financial/environmental?</i></li> <li>• What was your approach to using energy before you got involved with the competition? <i>For electricity and for gas:</i> <i>How far were you aware of it?</i> <i>What were your reasons – financial/environmental?</i></li> </ul>

	<p style="text-align: right;"><i>Was it something you discussed as a household or just one person's responsibility?</i></p> <p><b>The competition:</b></p> <ul style="list-style-type: none"> <li>• How have you found the competition so far?</li> <li>• What do you think of the prize?</li> </ul> <p style="text-align: right;"><i>Prize is a £50,000 green makeover for a community organization of the streets' choosing</i></p> <p><b>Energy Efficiency Expert</b></p> <p>X from British Gas has been guiding you through the competition.</p> <ul style="list-style-type: none"> <li>• How often have you had contact with X?</li> <li>• In addition to the group meetings with other householders on the street have you met with them individually as a household?</li> <li>• Who gets in touch with who?</li> <li>• Have they helped you with any problems?</li> <li>• Have they helped you in any other way?</li> <li>• What are the good and bad things about having them involved?</li> <li>• How important has their involvement been?</li> </ul> <p><b>Energy Efficiency Measures</b></p> <p>As part of the competition you've had an energy audit done on your home?</p> <ul style="list-style-type: none"> <li>• What was your reaction to it?</li> </ul> <p style="text-align: right;"><i>The process</i> <i>The results: a surprise?; or as expected?</i></p> <p>Now I'd like to talk to you in some detail about the energy efficiency measures you have had installed by British Gas as part of the competition.</p> <ul style="list-style-type: none"> <li>• What measures have you had installed?</li> </ul> <p style="text-align: right;"><i>For each one:</i> <i>Was it easy to install</i> <i>How do you feel about having had these changes made to your home?</i> <i>Has it changed the way you that you live?</i> <i>Has it changed the way that you use energy?</i> <i>Do you notice it?</i></p> <p>Perhaps I can now just bring out this sheet to make sure we've covered everything? You can see it has a list of all the possible measures available as part of the competition and shows the ones that you have had installed. So if we can take each section in turn (being aware that some have hopefully been discussed already).</p> <p style="text-align: right;"><i>For each section use the same prompts as above</i> <i>Using sheet</i></p>
0.10	
0.15	

<p><b>0.30</b></p>	<ul style="list-style-type: none"> <li>• So lets look at lighting equipment ...</li> <li>• ... and now the appliances ...</li> <li>• ... the heating system ...</li> <li>• ... insulation ...</li> <li>• ... and finally solar equipment.</li> </ul> <ul style="list-style-type: none"> <li>• If you were able to choose again, would you choose anything different, and if so, why?</li> </ul> <p>The sheet also has a list of all the prices of the measures.</p> <ul style="list-style-type: none"> <li>• Having had the measures installed, which would you be willing to pay for yourself?</li> </ul> <p style="text-align: right;"><i>Use sheet</i></p> <ul style="list-style-type: none"> <li>• Aside from the competition, have you made any other new purchases that use energy since the competition began?</li> </ul> <p style="text-align: right;"><i>e.g. TV, computer, kitchen appliances etc</i></p> <ul style="list-style-type: none"> <li>• Did you think about energy use when you bought it?</li> </ul> <p>Every house has been given a hand-held energy use monitor.</p> <ul style="list-style-type: none"> <li>• What have your experiences of using this been?</li> </ul> <p style="text-align: right;"><i>Has it helped? Were you surprised by what it showed? Who has used it the most? Interest in it changed over time?</i></p> <ul style="list-style-type: none"> <li>• Have you had a smart meter installed? If so what have your experiences of using this been?</li> </ul> <p style="text-align: right;"><i>As above</i></p> <p><b>Behaviour change</b></p> <ul style="list-style-type: none"> <li>• What else have you been doing to try and reduce your energy consumption?</li> </ul> <p style="text-align: right;"><i>switching off lights switching off appliances from standby filling kettle less washing clothes at lower temperatures not using tumble drier unplugging your mobile phone</i></p> <ul style="list-style-type: none"> <li>• How much have you had to change your day to day life?</li> <li>• What have been the easiest things to change?</li> <li>• What has been harder to change?</li> <li>• As a household, how have you gone about making these changes?</li> </ul> <p style="text-align: right;"><i>Devise a system? Have different family members' been given specific responsibilities?</i></p>
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<p><b>0.40</b></p> <p><b>(If time)</b></p>	<ul style="list-style-type: none"> <li>• Do you think the changes that you have made will continue after the competition is over?</li> </ul> <p>Thinking now away from the home:</p> <ul style="list-style-type: none"> <li>• Have you made any changes at work or school?</li> <li>• ... to the way that you travel?</li> <li>• ... to the way that you shop?</li> </ul> <p><b>Community</b></p> <ul style="list-style-type: none"> <li>• How do you feel that the competition has worked in your street?</li> <li>• How strongly do you feel you are in competition with the streets in other cities?</li> <li>• Has having contact with other families in the street changed your energy use? In what ways?</li> <li>• Has this been helpful?</li> <li>• Have you spoken about the project with other people in the street who are not taking part? If yes, what has their reaction been?</li> <li>• Do you think the Green Streets competition has had any other impact on the street or community?</li> </ul> <p style="text-align: right;"><i>to your relations with your neighbours to the community feeling</i></p> <ul style="list-style-type: none"> <li>• How have your friends and wider family responded to your involvement in the competition?</li> </ul> <p style="text-align: right;"><i>What do they think? Changed their behaviours?</i></p>
<p><b>0.50</b></p>	<p><b>Publicity</b></p> <p>The competition has been very widely publicised in the media.</p> <ul style="list-style-type: none"> <li>• Have you been involved in this? If so how did you find it?</li> <li>• Has it affected how you've engaged with the competition?</li> </ul> <p><b>Overall</b></p> <ul style="list-style-type: none"> <li>• Overall what are the best aspects of the competition?</li> <li>• And what are the worst?</li> </ul> <ul style="list-style-type: none"> <li>• Who in the family has enjoyed the competition the most?</li> <li>• Which parts?</li> <li>• And who has enjoyed it the least?</li> <li>• Why?</li> </ul> <ul style="list-style-type: none"> <li>• Has being involved in the competition changed your views on the contribution that individuals and families can make to reducing energy consumption? If so, how?</li> <li>• What, in your view, is the purpose of families such as yourselves</li> </ul>



<p><b>0.55</b></p>	<p>reducing their energy consumption?</p> <ul style="list-style-type: none"> <li>• Have your views on this changed as a result of being involved in the competition?</li> <li>• Do you have any views on how can a family like yourself can best be helped to reduce their energy consumption?</li> <li>• Do you have any view on what the Government could do?</li> </ul>
<p><b>1.00</b></p>	<p><b>Fact check</b> Just before we finish, I just to check a few things which might be significant to you energy use that we haven't covered.</p> <ul style="list-style-type: none"> <li>• Have any of you had any significant changes to your lifestyles during the course of the competition which might have affected the amount of time you've spent in the home? <i>Become employed/unemployed/retired</i> <i>Had a baby/come off maternity leave</i> <i>Become ill/well</i></li> <li>• Have you have had any household members arrive or leave during the course of the competition?</li> </ul> <p><b>Closing</b></p> <ul style="list-style-type: none"> <li>• Thank you very much for taking part.</li> <li>• Do you have any more questions?</li> <li>• Here are my contact details if you want to get in touch.</li> <li>• Would you like to see a copy of the report when it is complete?</li> </ul>

## Appendix 2

### Analysis of the role of installed measures

To assess the relationship between the predicted energy savings from the BREDEM-based EEC estimates and actual energy savings, we regressed actual on modelled savings using ordinary least squares. The results are shown below. There is a strongly positive and highly significant relationship between modelled and actual savings, but the  $R^2$  shows that a considerable amount of variance remains unexplained, as is indicated by the shape of the plots in Figure 8.

<i>Regression Statistics</i>	
Multiple R	0.724516
R Square	0.524923
Adjusted R Square	0.500533
Standard Error	4232.102
Observations	42

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	8.11E+08	8.11E+08	45.30187	4.46E-08
Residual	41	7.34E+08	17910686		
Total	42	1.55E+09			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.544754	0.080936	6.730666	3.96E-08	0.3813	0.708208