Association for the Conservation of Energy

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Burning Cash Day: 14th February

1 Summary

In the context of a growing political debate regarding the best way to cut energy bills, this briefing shows that a family could be wasting around £650 every year if they live in a typical fuel poor home, due to a low standard of energy efficiency. They could save 41% of their £1,590 gas costs each year by installing energy efficiency measures. There are over 6.7 million homes in England (one in three) which have very poor levels of energy efficiency, representing an E, F or G rating on an Energy Performance Certificate. In England, 1.41 million fuel poor homes (more than half) fall into this category.

If a family turn their heating on at the start of October, then that 41% saving is the equivalent of **all their gas costs** from the 14th of February until the next October. If they installed efficiency measures, it would be like having free heating and hot water from the 14th of February onwards. We could say that everything they spend on gas after that date is wasted money - so the 14th of February is 'Burning Cash Day'.

The savings from energy efficiency vary between different homes, so every home has its own Burning Cash Day. Even in a home which has an average level of energy efficiency (including at least some loft and cavity wall insulation) the family could still save £313, or 25% of their gas bill, through additional measures. This means that Burning Cash Day for this typical home is the 22nd of March.

The Energy Bill Revolution campaign is calling for major Government investment to provide energy efficiency measures for free for people in fuel poverty, and to provide subsidies for everyone else. It is proposed that this is paid for by recycling revenues from two carbon taxes that are paid by consumers – the European Emissions Trading Scheme and the Carbon Price Floor. Over the next 15 years the Government will raise an average of £4 billion every year in carbon taxes; this is enough revenue to insulate to a high degree an average of 600,000 fuel poor homes every year. In time, every household could benefit, and see major reductions in their energy bills.

2 Data and methods

2.1 Modelling a case study home

To calculate the gas savings that can be achieved through energy efficiency, we model the case of a 3-bedroom semi-detached home. We have chosen this as the typical type of housing, because: 1) The 2011 Census found that the most common number of bedrooms for all households in England and Wales was three, accounting for 42% of households; and 2) In 2010, the most common type of home was a semi-detached house; these houses made up 31% of all homes[1]. We have also chosen to model a building which has the same size, shape and structure, and the same gas and electricity prices, as that used by the Energy Saving Trust in their calculations of efficiency savings. This house has gas central heating (the most common form of heating).

To show the importance of efficiency measures, we assume this house starts with a poor level of energy efficiency. Energy efficiency of buildings is indicated by the Energy Performance Certificate (EPC) rating scale, ranging from A (most efficient) to G (least efficient). We assume this house initially falls into band E (with a SAP score of 39). This means the house is not 'average' in terms of the national average level of efficiency (the average is band D), but it has the average EPC rating for a fuel poor home and the type of home that most urgently needs energy efficiency improvements.

In England alone, there are 6.72 million homes, almost one in three, that fall into Band E, F or G, having the worst levels of energy efficiency. Of these, 2.36 million are semi-detached houses.

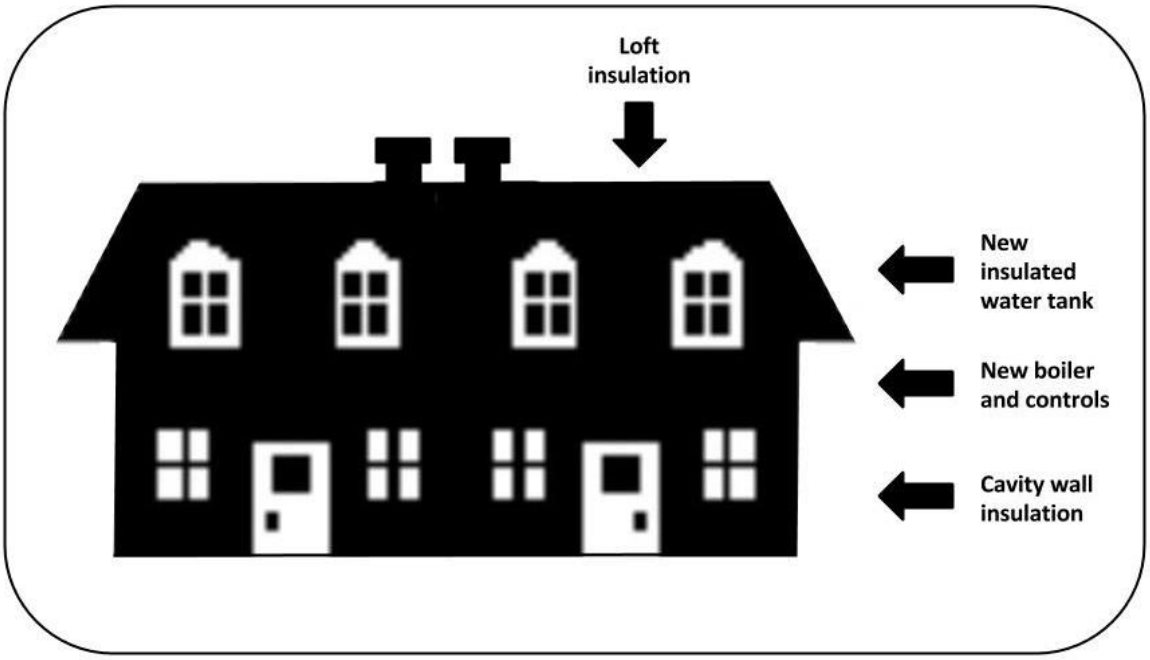
In addition, of the 6.72 million homes that are E, F or G-rated, 1.41 million are in fuel poverty under the Government's new definition[2]. This is more than half of all fuel poor households in England. This shows that inefficient homes are a major cause of fuel poverty and high energy bills, and that it is important to consider the financial savings that these fuel poor households can achieve through efficiency measures. This demonstrates why energy efficiency is the only permanent solution to fuel poverty.

The gas savings that can be achieved in our 3-bedroom semi-detached home, at different starting levels of efficiency, are shown in Appendix I.

2.2 Calculating savings from efficiency measures

We assume the case study house receives loft insulation, cavity wall insulation, a factory-insulated hot water tank, heating and hot water controls and a new boiler. This brings it up to an EPC band C (a SAP score of 71).

[1] (ONS 2012)
[2] See (ACE Research & Energy Bill Revolution 2014).



We use the Standard Assessment Procedure (SAP) 2009 (the same as is used by the Government and the Energy Saving Trust), to calculate the savings on gas consumption for heating and hot water that would be achieved by these efficiency measures. We assume a gas price of 4.21p per kWh and an annual standing charge of £96 to calculate the financial saving[3].

We take account of the fact that, in practice, measures may not achieve their full technical savings potential. Also, people may not see the full financial saving, because they may choose to keep their home warmer instead of paying a lower bill. We take these into account by applying an 'in-use' factor to every saving from an efficiency measure (following the Government's procedure as used in Green Deal calculations and by the Energy Saving Trust). This revises every saving downwards, meaning that our savings figures may, for some measures, be underestimates.

The annual financial savings from the measures, after in-use factors are applied, are presented in the list below. It is important to note that the savings are marginal savings; that is they are each based on the preceding measure already having been installed in the home[4]. On their own (apart from the first measure installed), measures would save more:

- Loft insulation: £192
- Cavity wall insulation: £148
- Factory-insulated hot water tank: £173[5]
- Cylinder thermostat: £4
- Heating controls: £18
- New condensing boiler: £118

[3] (DECC 2013); the same price is also used by the Energy Saving Trust in its latest savings calculations.
[4] The order in which the measures are installed follows the SAP 2009 recommendation.
[5] This saving high is because the boiler that heats up the tank is quite inefficient to begin with (it is non-condensing). The measure reduces the amount of gas needed to heat water by 60%, but conversely increases gas needed to heat the space by 17% (because the inefficient tank is no longer contributing nearly as much to heating the space). The net overall effect is a reduction in gas required of 21%.

We add up the savings from each measure to give a total financial saving of £653. Then, to identify a period of the year that has gas costs equivalent to this saving, we use data on the monthly distribution of heating and hot water costs from the official SAP methodology[6].

3 Results

3.1 How much cash is burned?

A family living in this home could cut their gas bill by £653 through energy efficiency measures. This assumes they heat their home to the same standard, both before and after improvements are carried out. They can choose either to save this £653, or to use part of these savings to help heat up their home, if they have been living in a cold home.

Having calculated the saving in financial terms, we can now express this as a particular section of the annual gas bill, which we call the 'savings equivalent period'. Gas costs in this time-period are equal to the savings from energy efficiency over the whole year.

We take the starting point as October, when the heating is typically switched on – this is called the start of the 'heating season'. We have chosen to show the savings equivalent period as the latter part of the bill. Figure 1 illustrates this, showing gas costs by month, with the savings equivalent period shown in yellow. The amount in yellow is equivalent to the amount of cash 'burnt' if energy efficiency measures are not installed.

Figure 1 shows that there is a point around halfway through February's bill where this savings equivalent period begins. We can identify the date to which this point corresponds, which we call 'Burning Cash Day'.

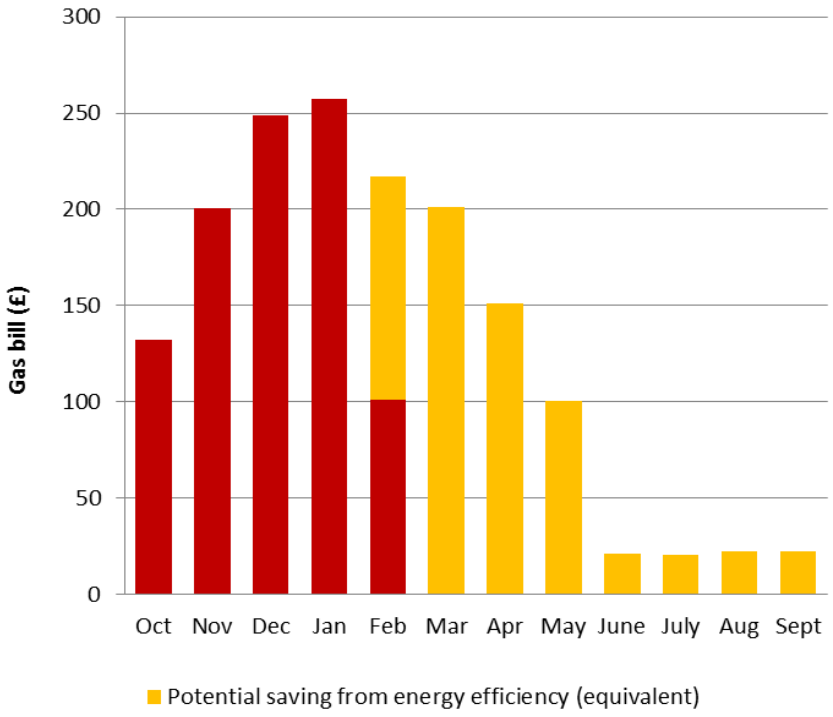


Figure 1: Savings from energy efficiency represented as a 'savings equivalent period' of heating costs for a typical household

[6] Available from (BRE 2014)

To identify Burning Cash Day, we first calculate the daily cost of gas in February: this is £7.72. Figure 1 shows that the February bill includes £101 that is spent before Burning Cash Day. If Burning Cash Day falls after £101 has been spent, and £7.72 is spent each day, this means that Burning Cash Day falls after 13 days, so it is the 14th of February.

This means that, if a typical home has poor levels of energy efficiency, the family will waste a sum of money that is equivalent to their entire gas bill from the 14th of February right through until the start of the next heating season in October.

In addition, we must take into account the fact that energy prices are likely to rise in future (DECC predicts residential gas prices will rise by 23% by 2022). This means that the energy efficiency savings could in fact be much higher.

3.2 Savings from energy efficiency in different homes

The household used here could see its annual gas bill reduced by around £650 (41% of the bill). Of course, the savings that can be achieved through energy efficiency vary depending on the type and condition of the building, and can be higher than this. Equally, if the home already has some efficiency measures installed, then it will be burning less cash. The savings will vary between different homes, so every home has its own Burning Cash Day.

Details for some other homes are provided in Appendix I. For example:

- If the home already has loft and wall insulation and so has an average level of efficiency (falling into EPC band D) then the family could still save £313, or 25% of their gas bill, through a new factory-insulated hot water tank, a new boiler and new heating and hot water controls. This means that Burning Cash Day for this typical home is the 22nd of March.
- If the home has a good level of efficiency, falling into EPC band C or higher, then it might still benefit from some additional draught-proofing, or from renewable technologies. Because the home is already quite efficient, far less cash is being burned.

4 Conclusion

In the context of a growing political debate regarding rising energy bills, this briefing shows that a typical fuel poor household could be wasting around £650 every year due to poor levels of energy efficiency. They could save 41% of their gas costs of £1,590 by installing energy efficiency measures.

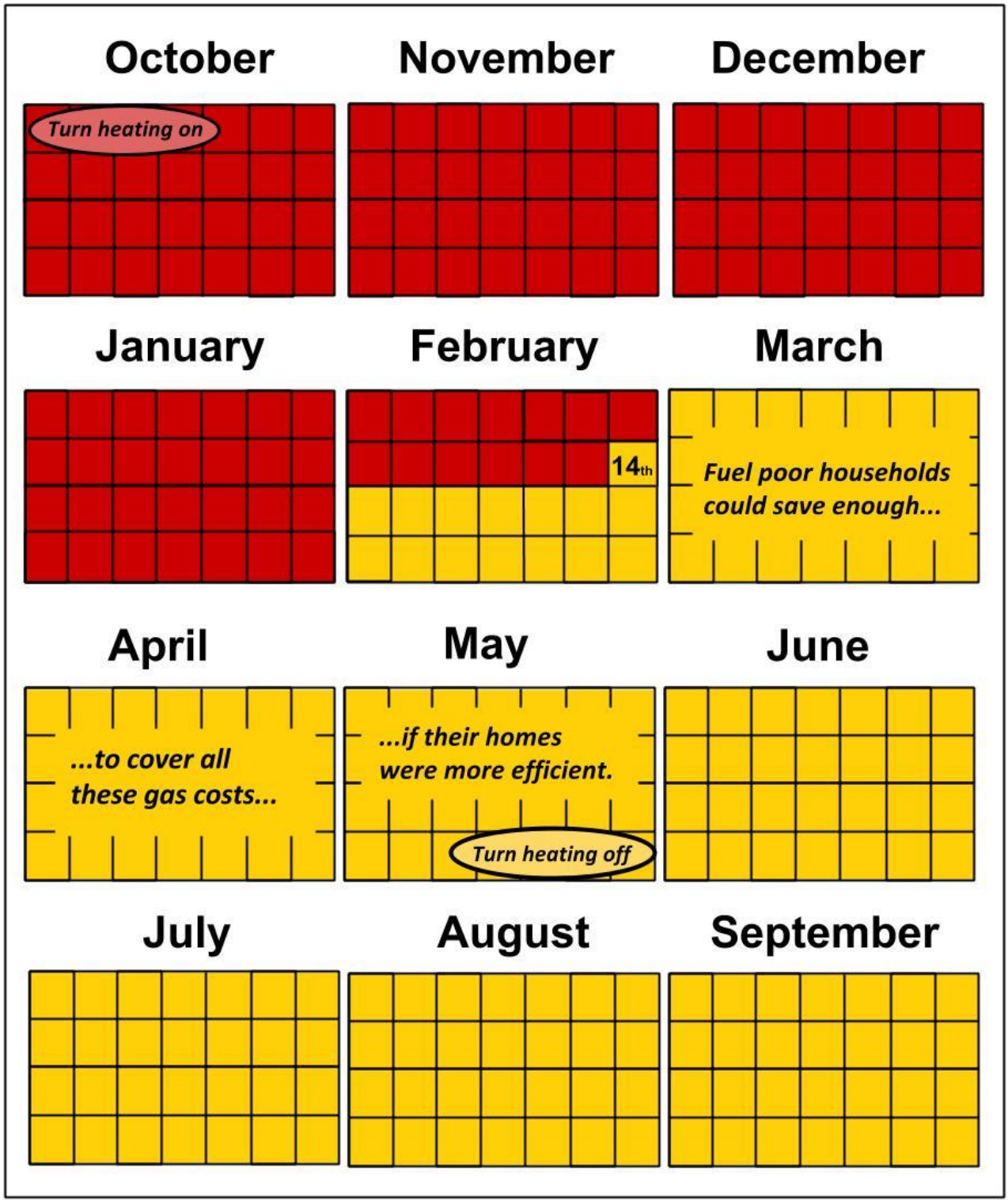
If they turn the heating on at the start of October, then that saving is the equivalent of **all their gas costs** from the 14th of February until 1st October. If they installed efficiency measures, it would be like having free heating and hot water from the 14th of February until 1st October. We could say that everything they spend on gas after that date is wasted money – so the 14th of February is 'Burning Cash Day'.

The savings will vary between different homes, so every home has its own Burning Cash Day. Even if the home already has an average level of energy efficiency (for example, it already has loft and wall insulation), then the family could still save £313, or 25% of their gas bill, through additional measures. This means that Burning Cash Day for this typical home is the 22nd of March.

The Energy Bill Revolution is calling for major Government investment to provide measures for free for people in fuel poverty, and to provide subsidies for everyone else. It is proposed that this is paid for by recycling revenues from two carbon taxes that are paid by consumers – the European Emissions

Trading Scheme and the Carbon Price Floor. Over the next 15 years the Government will raise an average of £4 billion every year in carbon taxes; this is enough revenue to insulate to a high degree an average of 600,000 homes every year. In time, every household could benefit from recycling carbon tax into energy efficiency measures. The Energy Bill Revolution proposes that fuel poor households are prioritised for assistance. Research by Cambridge Econometrics and Verco[7] shows that, compared to other potential stimulus packages, this is the most effective way to promote economic growth and create employment. This is also the only permanent solution to end fuel poverty and bring down energy bills.

[7] (Cambridge Econometrics and Verco 2012)


October
Turn heating on
November
December
January
February
14th
March
Fuel poor households could save enough...
April
...to cover all these gas costs...
May
...if their homes were more efficient.
Turn heating off
June
July
August
September

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Appendix I: Savings achieved by measures for a typical home with different starting levels of efficiency

This Appendix contains four tables showing savings achieved by energy efficiency measures, based on different starting points in terms of the measures already installed in the home. All data in this Appendix relates to the same 3-bedroom semi-detached house. The main parameters of the house are matched as closely as possible to the Energy Saving Trust's standard 3-bedroom semi, modelled in SAP 2009 and used to provide estimates of what different measures will save. The house matches the Energy Saving Trust's insofar as it: is of cavity wall construction with a loft and pitched roof; has 89m^2 of floor area spread over a ground and first floor; has 17m^2 of windows, 80% of which have been replaced with double-glazed windows pre-2002, with the single-glazed windows draught-proofed; and faces a gas price of 4.21 p/kWh and an electricity price of 13.52 p/kWh.

Its starting heating system is a pre-1998 non-condensing gas boiler which heats water via an uninsulated hot water tank. The only control is a room thermostat, and its loft and cavity are uninsulated. The savings estimates used in this briefing have had 'in-use factors' applied to them. These take account of the fact that, in practice, compared to the modelling, measures may not achieve their full technical savings potential. In-use factors are applied to the savings from most efficiency measures (following the Government's procedure as used in Green Deal calculations and by the Energy Saving Trust). This revises measures' individual savings downwards (meaning that our savings figures may, for some measures, be underestimates). The following in-use factors have been applied to the measures modelled here:

Table 1: In-use factors used in this briefing[8]

Measure	Savings reduced by…
Loft insulation	35%
Cavity wall insulation	35%
Factory-insulated hot water tank	15%
Cylinder thermostat	50%
Programmer and thermostatic radiator valves	50%
New condensing boiler	25%
Door insulation	15%

[8] (DECC 2012)

The other measures modelled here do not have in-use factors applicable to their savings.

Table 2 and Table 3 show savings with in-use factors applied. Table 2 shows savings in cash terms, while Table 3 expresses them in percentage (of the gas bill) terms. These are the sorts of savings households would see on a Green Deal assessment report. The application of in-use factors, by reducing the savings estimates, is in large part designed to ensure that if the household does decide to take out Green Deal finance to undertake improvement works, it is very unlikely that their Green Deal finance repayments will exceed the actual savings made[9].

Table 4 and Table 5 show the same data, but without in-use factors applied. These are the sorts of savings households would see on an Energy Performance Certificate report.

Each table uses the same format. Shown in green are the measures already installed in the home. These measures are cumulative, so for each column, the measures already installed are those shown in the column heading, plus all those in the headings to the left. The measures are shown in the order used in the official Green Deal and SAP methodologies. This means it is possible to compare the savings that are achieved across homes that are more or less efficient to begin with.

Shown in pink are the new measures to be installed. Again, these are cumulative, so for each row, the new measures added are those shown in the row heading, plus all those in the headings above. Again, these are applied in the Green Deal and SAP order. By choosing an initial starting point (a column) and then choosing a set of new measures (a row) it is possible to see the total savings that are achieved by adding those new measures to that home.

Shown in blue are the outcomes of the installations, in terms of the home's SAP score, EPC band and gas bill. These are cumulative, so each figure represents the outcome of the efficiency measure in that row, plus all the measures in the rows above.

In Table 2 and Table 3 the cells highlighted in orange represent the case used in the briefing to show savings for a typical home that initially has a poor level of efficiency. The cells highlighted in purple represent the case used in the briefing to represent a typical home with an average initial level of efficiency.

*[*Photovoltaics give no saving on the gas bill, but do give a saving of £139 on the annual electricity bill. (This assumes a 2.5kW array.) Feed in tariff income (which can be significant) is not included here.]*

[9] This has been the trigger for introducing official 'in-use' factors alongside the Green Deal: to ensure "that savings estimates are not overly optimistic, resulting in inappropriate [Green Deal finance] charges being applied to fuel bills" (DECC 2011); a fuller rationale can be found on pp. 4-5 of (DECC 2012)

Table 2: Cumulative savings achieved by measures [£], with in-use factors applied

New measures to be installed	Measures already installed										Outcomes (cumulative)		
	None	Some loft insulation	…and top-up loft insulation	…and cavity wall insulation	…and a factory-insulated hot water tank	…and a cylinder thermo-stat	…and new heating controls	…and a new boiler	…and solar water heating	…and door insulation and draught-proofing	SAP score	EPC band	Gas bill
None											39	E	£1,591
Some loft insulation	£176										48	E	£1,414
…and top-up loft insulation	£192	£16									49	E	£1,399
…and cavity wall insulation	£340	£164	£149								57	D	£1,250
… and a factory-insulated hot water tank	£513	£337	£322	£173							64	D	£1,077
…and a cylinder thermostat	£517	£340	£325	£176	£3						64	D	£1,074
…and new heating controls	£535	£358	£343	£194	£21	£18					66	D	£1,056
… and a new condensing boiler	£653	£477	£461	£313	£140	£136	£118				71	C	£938
…and solar water heating	£715	£538	£523	£374	£201	£198	£180	£62			73	C	£876
…and door insulation and draught-proofing	£722	£546	£530	£382	£209	£206	£188	£69	£7		73	C	£868
…and photovoltaics	£722	£546	£530	£382	£209	£206	£188	£69	£7	£0*	85	B	£868

Table 3: Cumulative savings achieved by measures [%], with in-use factors applied

New measures to be installed	Measures already installed										Outcomes (cumulative)		
	None	Some loft insulation	…and top-up loft insulation	…and cavity wall insulation	…and a factory-insulated hot water tank	…and a cylinder thermo-stat	…and new heating controls	…and a new boiler	…and solar water heating	…and door insulation and draught-proofing	SAP score	EPC band	Gas bill
None											39	E	£1,591
Some loft insulation	11%										48	E	£1,414
…and top-up loft insulation	12%	1%									49	E	£1,399
…and cavity wall insulation	21%	12%	11%								57	D	£1,250
… and a factory-insulated hot water tank	32%	24%	23%	14%							64	D	£1,077
…and a cylinder thermostat	32%	24%	23%	14%	0%						64	D	£1,074
…and new heating controls	34%	25%	25%	16%	2%	2%					66	D	£1,056
… and a new condensing boiler	41%	34%	33%	25%	13%	13%	11%				71	C	£938
…and solar water heating	45%	38%	37%	30%	19%	18%	17%	7%			73	C	£876
…and door insulation and draught-proofing	45%	39%	38%	31%	19%	19%	18%	7%	1%		73	C	£868
…and photovoltaics	45%	39%	38%	31%	19%	19%	18%	7%	1%	0%*	85	B	£868

Table 4: Cumulative savings achieved by measures [£], without in-use factors applied

New measures to be installed	Measures already installed										Outcomes (cumulative)		
	None	Some loft insulation	…and top-up loft insulation	…and cavity wall insulation	…and a factory-insulated hot water tank	…and a cylinder thermo-stat	…and new heating controls	…and a new boiler	…and solar water heating	…and door insulation and draught-proofing	SAP score	EPC band	Gas bill
None											39	E	£1,591
Some loft insulation	£271										48	E	£1,319
…and top-up loft insulation	£295	£24									49	E	£1,295
…and cavity wall insulation	£524	£253	£229								57	D	£1,067
… and a factory-insulated hot water tank	£727	£456	£432	£203							64	D	£863
…and a cylinder thermostat	£734	£462	£438	£210	£6						64	D	£857
…and new heating controls	£770	£499	£475	£246	£43	£36					66	D	£821
… and a new condensing boiler	£928	£656	£632	£404	£200	£194	£158				71	C	£663
…and solar water heating	£989	£718	£694	£465	£262	£256	£219	£62			73	C	£601
…and door insulation and draught-proofing	£998	£727	£703	£474	£271	£264	£228	£70	£9		73	C	£593
…and photovoltaics	£998	£727	£703	£474	£271	£264	£228	£70	£9	£0*	85	B	£593

Table 5: Cumulative savings achieved by measures [%], without in-use factors applied

New measures to be installed	Measures already installed										Outcomes (cumulative)		
	None	Some loft insulation	…and top-up loft insulation	…and cavity wall insulation	…and a factory-insulated hot water tank	…and a cylinder thermo-stat	…and new heating controls	…and a new boiler	…and solar water heating	…and door insulation and draught-proofing	SAP score	EPC band	Gas bill
None											39	E	£1,591
Some loft insulation	17%										48	E	£1,319
…and top-up loft insulation	19%	2%									49	E	£1,295
…and cavity wall insulation	33%	19%	18%								57	D	£1,067
… and a factory-insulated hot water tank	46%	35%	33%	19%							64	D	£863
…and a cylinder thermostat	46%	35%	34%	20%	1%						64	D	£857
…and new heating controls	48%	38%	37%	23%	5%	4%					66	D	£821
… and a new condensing boiler	58%	50%	49%	38%	23%	23%	19%				71	C	£663
…and solar water heating	62%	54%	54%	44%	30%	30%	27%	9%			73	C	£601
…and door insulation and draught-proofing	63%	55%	54%	44%	31%	31%	28%	11%	1%		73	C	£593
…and photovoltaics	63%	55%	54%	44%	31%	31%	28%	11%	1%	0%*	85	B	£593