



Energy Use in the Home

Measuring and Analysing Domestic Energy
Use and Energy Efficiency in Scotland

Energy Use in the Home

Measuring and Analysing Domestic Energy Use and Energy Efficiency in Scotland

The Scottish Government
August 2012

Scottish House Condition Survey and Research Team

Author: Susan Walker

Housing, Regeneration, Culture and the Commonwealth Games Directorate
Communities Analytical Services

Scottish Government

shcs@scotland.gsi.gov.uk

<http://www.shcs.gov.uk>

Tel: 0131 244 1685

Contents

Contents.....	1
List of Tables	2
List of Figures	5
Executive Summary	7
Chapter 1: Energy consumption and CO₂ emissions	11
Energy Consumption.....	12
Total Energy Consumption.....	12
Gas Consumption.....	17
Electricity Consumption.....	19
CO ₂ emissions.....	22
Chapter 2: The Housing Stock in Scotland	27
Type of dwellings	27
Age of dwellings.....	29
Size of dwellings.....	30
Construction of dwellings	31
Hard to treat dwellings	33
Hard to Treat Cavities	35
Location of dwellings	36
Chapter 3: Energy Efficiency Ratings	40
Standard Assessment Procedure (SAP)	40
National Home Energy Rating (NHER)	43
Energy Performance Certificates (EPC's)	48
Scottish Housing Quality Standard (SHQS)	51
Chapter 4: Energy Efficiency measures.....	55
Insulation	55
Loft insulation	55
Wall insulation	58
Hot Water Tank Insulation.....	62
Windows	64
Secondary glazing	66
Shutters.....	67
Installing and upgrading energy efficiency measures	67
Chapter 5: Space and water heating	71
Space heating.....	71
Primary heating fuel.....	71
Primary heating system	74
Boilers	76
Storage heating.....	77

Secondary heating	77
Heating Controls	79
Temperature Controls.....	79
Timing Controls	79
Water heating	80
Chapter 6: Changing Energy Use in the Home	81
Attitudes towards energy efficiency.....	82
Work done in home	83
Better energy management and usage	84
Monitoring Energy Use	85
Lighting/ Appliances.....	86
Installing domestic micro-generation through renewables	88
Solar panels (PV) and solar water heating.....	88
Biomass heating systems	89
Heat pumps.....	89
Influencing Public Attitudes and Behaviours.....	90
Chapter 7: Energy Efficiency Schemes	92
UK wide schemes	92
The Carbon Emissions Reduction Target (CERT).....	92
Community Energy Saving Programme (CESP).....	95
Renewable Heat Premium Payment Scheme	97
Feed-In Tariffs scheme (FITs)	98
Green Deal / ECO	98
Scotland wide schemes.....	99
Boiler Scrappage Scheme.....	99
Home Insulation Scheme (HIS) \ Universal Home Insulation Scheme (UHIS) ...	100
Home Renewables Loan and Home Loans Schemes	101
Energy Assistance Package (EAP).....	102
District Heating Loan Scheme	103

List of Tables

Table 1	Electricity consumption by domestic appliances in the UK : 1970 to 2010	21
Table 2	SAP fuel prices and emission factors	24
Table 3	Mean and Median CO₂ emissions (tonnes per year) by dwelling characteristics: 2010	25
Table 4	Mean CO₂ emissions by age and type of dwelling (tonnes per year): 2010.....	25
Table 5	Dwelling type (000s and percentage): 2010.....	28
Table 6	Age of dwellings (000s and percentage) : 2010.....	29
Table 7	Age of dwelling by type of dwelling (Row %): 2010	29
Table 8	Number of rooms by house or flat (000s and %): 2010.....	30
Table 9	Internal floor area by house or flat (000s and %): 2010	30
Table 10	Mean and median internal floor area by type of dwelling (m²): 2010..	31

Table 11	Internal floor area by age of dwelling (column %): 2010	31
Table 12	Principal external wall construction (count and percentage): 2010	32
Table 13	Principal external wall construction material by external wall construction (count and percentage): 2010	32
Table 14	Principal external wall material by age of dwelling (column %): 2010 .	33
Table 15	Hard to Treat dwellings (000s and %): 2010	34
Table 16	Dwellings with Hard to Treat cavities (000s and %): 2010	35
Table 17	Hard to Treat Dwellings by Hard to Treat Cavities (000s and %): 2010.	35
Table 18	Dwellings by urban/ rural classification (000s and %): 2010	36
Table 19	Age of dwelling by urban/ rural (000s and %): 2010	36
Table 20	Type of dwelling by urban/ rural (000s and %): 2010	36
Table 21	Floor area of dwelling by urban/ rural (000s and %): 2010	37
Table 22	Principal external wall construction by urban/ rural (000s and %): 2010	37
Table 23	Hard to treat dwellings by urban/ rural (000s and %): 2010	38
Table 24	Dwellings with Hard to Treat cavities by urban/ rural (000s and %): 2010	38
Table 25	Dwellings on/off gas grid by urban/ rural classification (000s and %): 2010.....	38
Table 26	Dwellings on/off gas grid by urban/ rural classification (000s and %): 2010.....	39
Table 27	Dwellings by SAP (2005) scores (000s and Column %): 2010.....	42
Table 28	Mean SAP score by dwelling age and type: 2010.....	43
Table 29	The modelled fuel used (Kwh), based on a standard heating regime, across Scotland to heat a semi-detached house with gas central heating and non-white meter electric heating and how this compares to Bristol.	44
Table 30	Dwellings by NHER scores (000s and Column %): 2010.....	45
Table 31	NHER bands (000s and %): 2010	46
Table 32	NHER band by dwelling characteristics (%): 2010	48
Table 33	Approximated EPC rating (000s and %): 2010.....	49
Table 34	SHQS Energy Efficiency criteria pass rate by tenure (%): 2003/04 – 2010	52
Table 35	Count of SHQS Energy Efficiency element failures (%): 2003/04 - 2010	52
Table 36	SHQS Energy Efficiency element failure rate by tenure (%): 2003/04 – 2010.....	52
Table 37	Depth of loft insulation (000s): 2003/04 to 2010.....	56
Table 38	Depth of loft insulation (000s and %) (2010)	57
Table 39	Depth of loft insulation by urban/ rural classification (000s and %) (2010)	58
Table 40	Depth of loft insulation (where applicable) by Hard to Treat and on/off gas grid (column %) (2010).....	58
Table 41	Potential to upgrade loft insulation (where applicable) by urban/ rural classification (000s and %) (2010).....	58
Table 42	External wall insulation by wall construction, 1996 to 2010	59
Table 43	Cavity wall insulation by tenure: 2010	60
Table 44	External wall insulation by hard to treat cavities (000s and %): 2010 .	60

Table 45	Insulation of external walls and wall construction by urban/ rural: 2010	61
Table 46	External wall insulation and wall construction by hard to treat and on/off gas grid (column %): 2010	62
Table 47	Thickness of insulation to hot water cylinder (mm): 2010	62
Table 48	Type of insulation on hot water cylinder: 2010	63
Table 49	Is insulation to hot water pipes in loft satisfactory: 2010	63
Table 50	Is insulation to cold water tanks and pipes in loft satisfactory: 2010...	63
Table 51	Is insulation to hot water tank, hot water pipes and cold water tanks and pipes in loft satisfactory? : 2010	64
Table 52	Type of glazing (%): 1991 – 2010	65
Table 53	Percentage of dwellings with double glazing by dwelling age: 2010....	65
Table 54	Typical window area by age of dwelling (m ²): 2010.....	65
Table 55	Type of glazing by urban/rural (000s and %): 2010	66
Table 56	Type of double glazing (000s and %): 2010	67
Table 57	Presence of internal window shutters (000s and %): 2010	67
Table 58	Potential for improving the energy efficiency (000s and %): 2010	68
Table 59	Number of potential improvement measures needed (000s and %): 2010.....	69
Table 60	Number of potential improvements by urban/ rural (000s and %): 2010	69
Table 61	Number of potential improvements by improvement needed (000s and %) : 2010	70
Table 62	Dwellings on/off the Gas Grid by urban/rural indicator (000s and %) .	72
Table 63	Primary Heating Fuel (000s and %): 2010	72
Table 64	Primary Heating Fuel by mains services (column %): 2010	72
Table 65	Primary heating fuel by NHER band (000s and %)	73
Table 66	Extent of central heating (000s and %): 2010	74
Table 67	Primary source of heating (000s and %): 2010.....	75
Table 68	Primary heating system age (000s and %): 2010.....	75
Table 69	Primary heating system boiler type (000s and %): 2010	76
Table 70	Type of storage heating (000s and %): 2010	77
Table 71	Secondary heating system (000s and %): 2010	78
Table 72	Do you have central heating which uses a time clock or thermostat? .	79
Table 73	Primary hot water heating source (000s and %)	80
Table 74	Energy efficiency measures which were a factor in your decision to move to this property (000s and %): 2008 - 2010	82
Table 75	Energy efficiency measures which were a factor in your decision to move to this property by time in property (%): 2010.....	82
Table 76	Energy efficiency improvements by tenure (column %): 2008/10.....	84
Table 77	Energy-use monitoring devices: 2008 to 2010 (000s and %)	85
Table 78	Extent to which energy use is monitored 2008 to 2010 (000s and %) ..	86
Table 79	Percentage of fixed light fittings with low energy lighting (000s and %): 2007 – 2010	88
Table 80	Suitability for solar water heating or photovoltaics (000s and %): 2010	89
Table 81	CERT installations by country (all years).....	93
Table 82	CERT installations in Scotland: 2008/09 – 2011/12 (to end Sep 11)	93

Table 83	Regional breakdown of CESP schemes, measures and CO ₂ savings.....	96
Table 84	Grants available through the Renewable Heat Premium Payment.....	97
Table 85	RHPP installs during phase 1 in Scotland	97
Table 86	HIS measures installed: 2009/10 – 2010/11	100
Table 87	UHS measures installed: 2010/11 – 2011/12	101
Table 88	EAP measures by stage : 2009/10 – 2011/12	102

List of Figures

Figure 1	UK domestic energy consumption by fuel: 1970 to 2010	12
Figure 2	Final domestic energy consumption in Scotland (GWh): 2005 - 2010 ..	15
Figure 3	UK domestic energy consumption by end use: 1970 to 2009.....	16
Figure 4	Modelled median energy consumption per household for space and water heating in Scotland (kWh): 1991 to 2010.....	16
Figure 5	Modelled median energy consumed for space and water heating in Scotland by NHER band (kWh) : 2010.....	17
Figure 6	Domestic gas sales per consumer (kWh) : 2005 – 2010.....	18
Figure 7	Average domestic gas consumption per consumer by region (kWh): 2010.....	19
Figure 8	Average domestic electricity consumption per household by region : 2010.....	20
Figure 9	Average domestic electricity sales per household (kWh) : 2005 – 2010	21
Figure 10	Electricity consumption by domestic appliances in the UK : 1970 to 2010	22
Figure 11	CO ₂ emissions from housing, comparison between NAEI and SHCS estimates: 1990 - 2010	23
Figure 12	Mean CO ₂ emissions by age and type of dwelling (tonnes per year): 2010.....	26
Figure 13	Age of dwelling by type of dwelling (Row %): 2010	30
Figure 14	Principal external wall construction (percentage): 2010.....	32
Figure 15	Principal external wall construction material by external wall construction : 2010	33
Figure 16	Type of dwelling by urban/ rural: 2010	37
Figure 17	Dwellings on/off gas grid by urban/ rural classification (000s and %): 2010.....	39
Figure 18	SAP(2005) score (000s of dwellings) : 2010	42
Figure 19	NHER score (000s of dwellings) : 2010.....	45
Figure 20	NHER bands: 1991 to 2010	46
Figure 21	SHQS Energy Efficiency element failure rate (%): 2003/04 – 2010	53
Figure 22	Depth of loft insulation (where applicable): 2003/04 – 2010.....	56
Figure 23	Depth of loft insulation (where applicable) by NHER band: 2010	57
Figure 24	External wall insulation and wall construction by NHER band: 2010 ...	61
Figure 25	Is insulation to hot water tank, hot water pipes and cold water tanks and pipes in loft satisfactory by hard to treat and on/off gas grid? : 2010	64
Figure 26	Type of glazing by age of dwelling: 2010	66
Figure 27	Number of potential improvements by age of dwelling : 2010.....	69

Figure 28	Number of potential improvements by hard to treat and on/off gas grid : 2010	70
Figure 29	Primary heating fuel by urban/rural indicator (%).....	73
Figure 30	Primary heating fuel by NHER band	74
Figure 31	Primary heating system age by NHER band: 2010	76
Figure 32	Secondary heating system by age of dwelling: 2010.....	78
Figure 33	Energy efficiency measures which were a factor in your decision to move to this property by tenure (%): 2010.....	83
Figure 34	Type of repair or work done to dwelling in the past year: 2008/10	84
Figure 35	Weekly household income band by extent to which households monitor energy use (%).....	86
Figure 36	Percentage of dwellings with no fixed low energy lighting: 2007 - 2010	87
Figure 37	Mix of CESP measures by region	96

Executive Summary

1. The Scottish Government has set targets to reduce final energy consumption by 12% by 2020¹, reduce CO₂ emissions by 80% by 2050² and eradicate fuel poverty where practicable by 2016, all of which can be positively influenced by improving the energy efficiency of Scotland's housing stock and enabling householders to use energy more efficiently. This report describes the current state of Scottish housing with regard to energy efficiency and its potential for future improvements. Information on the Scottish Government's proposals to improve the energy efficiency of Scotland's housing is set out in the consultation on its Sustainable Housing Strategy³.
2. This report draws on data from the Scottish House Condition Survey (SHCS), the Department for Energy and Climate Change (DECC), the National Atmospheric Emissions Inventory (NAEI) and the Energy Savings Trust (EST) to look at how households currently use energy within their homes and the energy efficiency of said homes.
3. This report is divided into 7 sections:
 - **Energy Consumption and CO₂ Emissions:** this section covers energy consumed by the domestic sector, how much is consumed and how this is used. It also looks at the resulting CO₂ emissions and how these vary across different types of housing.
 - **The Housing Stock in Scotland:** this covers key stock descriptors such as dwelling type and age, dwelling construction, hard to treat dwellings, whether a dwelling is on or off the gas grid and location of dwellings.
 - **Energy Efficiency Ratings:** this section looks at different ways of measuring energy efficiency; the National Home Energy Rating (NHER); the UK Government's Standard Assessment Procedure for the Energy Rating of Dwellings (SAP, 2005); approximated and real Energy Performance Certificates (EPC's) and the Scottish Housing Quality Standard (SHQS) energy efficiency criteria.
 - **Energy Efficiency Measures:** this covers the presence of and potential for loft insulation, wall insulation, hot water tank insulation and double glazing.
 - **Space and water Heating:** this covers the fuel used for heating homes, the type of heating system, the age of heating system and the presence and use of heating controls.
 - **Changing Energy Use in the Home:** this covers householders attitudes and behaviours towards energy efficiency in the home, including the extent to which householders monitor energy use

¹ <http://www.scotland.gov.uk/Publications/2010/10/07142301/0>

² <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact>

³ <http://www.scotland.gov.uk/Topics/Built-Environment/Housing/sustainable>

- **Energy Efficiency Schemes:** this covers schemes provided by the both the UK Government and the Scottish Government that could help Scottish households improve the energy efficiency of their home.

Each section includes detailed key findings. A broad summary of these findings is provided below.

4. **Energy Consumption** in the home rose from 1990 to 2005 then started to decline despite a continued rise in the number of dwellings. This is probably due to the installation of various energy efficiency measures and the reduced carbon emissions associated with new buildings built to higher energy standards. However, in 2010 energy consumption from the UK domestic sector had risen compared to 2009. It is not yet known whether Scotland's figures will show a similar rise.
 - *Domestic energy consumption at 47,600 GWh accounts for one third of all energy consumed in Scotland and 36% of all CO2 emissions (DECC/NAEI).*
 - *Energy consumption in the domestic sector has increased since 1990, but since 2005 there has been a decrease in domestic energy consumption each year overall and per household (DECC).*
 - *This reduction in consumption has been despite a 16% increase in the number of occupied dwellings in Scotland since 1991 (NRS).*
 - *Gas in 2009 accounted for around two thirds of energy used in the domestic sector in Scotland, with 77% of Scotland's households using mains gas as their primary heating fuel(DECC).*
 - *Since 1990 the way we produce our energy has improved significantly, meaning that there are less emissions associated with every unit of energy we use (DECC).*
 - *If Scotland follows the UK trend the statistics that are due to be published later this year may show that there has been an overall increase in domestic energy consumption in 2010 (DECC).*
5. Two thirds (66%) of the Scottish housing stock is relatively easy to treat for energy efficiency measures and on the gas grid to source lower cost fuels. However the remaining stock is more problematic: 4% are easy to treat but off the gas grid; 26% are on the gas grid but hard to treat, and 4% are hard to treat and off the gas grid. In addition to this 37% of all dwellings are flats.
 - *Scotland's housing stock is made up of 63% houses and 37% flats (SHCS).*
 - *Over one-fifth of Scotland's housing stock (22%) was built after 1982 (SHCS).*
 - *The majority (74%) of Scotland's housing stock is of cavity wall construction (SHCS).*
 - *However 30% of all dwellings are hard to treat in terms of wall or roof insulation (SHCS).*
 - *198,000 dwellings are off gas grid of which half are also defined as hard to treat (SHCS).*
 - *In rural areas 24% of the stock is both off the gas grid and hard to treat, this compares to less than 1% in urban areas(SHCS).*
6. Energy ratings are used to show the energy efficiency of a home. The National Home Energy Rating (NHER) includes all fuel use in the home and takes account of the

occupancy of the home and its location. It is often banded into Poor (0-2). Moderate (3-6) and Good (7-10). There has been a large rise in the number of homes with a 'good' NHER energy rating in the last 30 years from less than 1% in 1991 to 62% in 2010. Likewise the proportion of dwellings rated as 'poor' NHER has improved too with just 3% of dwellings rated poor in 2010, compared to almost 50% in 1991.

- *Since 2003/04 the number of dwellings with no loft insulation has more than halved and in 2010 represented just 3% of dwellings (SHCS).*
- *Since 1996 the proportion of insulated cavity walls has increased from 33% to 62% in 2010 (SHCS).*
- *In 2010, just under 1% of dwellings had a hot water tank with no insulation (SHCS).*
- *Since 1991 there has been a significant increase in the proportion of dwellings with double glazing from 46% to 92% (SHCS).*
- *95% of dwellings in Scotland have central heating. This compares to 61% in 1991 (SHCS).*
- *62% of dwellings have a primary heating system which is less than 12 years old (SHCS).*
- *Energy Performance Certificates provide homes with a cost based energy rating varying from 0 to 100 and independent of occupancy or location. The SHCS can approximate levels of EPC and this data shows that most homes in Scotland would have an approximate energy efficiency rating of D (44%) or C (32%).*

7. Energy efficiency measures can reduce energy consumption but to release their full potential energy behaviours within the home also need to change. The Scottish Environmental Attitudes and Behaviours Survey (2008) identified four recurring reasons as to why people do not always choose to adapt their behaviour. These were convenience, cost, a lack of alternative options and practical considerations.

- *Scots understand the importance of day-to-day behaviours but many of them do not follow this up with action to reduce emissions (SEABS'08).*
- *When asked which of a variety of energy efficiency measures were factors in moving to their current property 93% of householders said none (SHCS 2010).*
- *About 11% of all households undertook at least one energy efficiency improvement in the last year (SHCS 2008/2010).*
- *In 2010, about 33% of households said they monitored their energy use fairly closely and 12% said they monitored it very closely (SHCS 2010).*
- *In 2010, 24% of dwellings had no low energy lighting in fixed outlets, compared to 55% in 2007 (SHCS).*
- *65% of homes in Scotland are suitable for solar panels or photovoltaics. In 2010 less than 1% currently had them (SHCS).*

8. Scottish and UK Government programmes have had a substantial beneficial impact on domestic energy efficiency. The CERT scheme has professionally installed approximately 327,000 measures (mainly loft and cavity wall insulation) over the 3.5 year period 2008- September 2011 while the Scottish Government Home Insulation and Universal Home Insulation (HIS and uHIS) programmes have delivered an additional 62,000 loft insulation and 25,000 cavity insulation installations. In

addition, the Energy Assistance Package for fuel poor households referred over 54,000 households for stage 4 measures (central heating systems and/or insulation) in the financial years 2009/10 to 2011/12. Almost 20,000 households have received a subsidy from the Boiler Scrappage Scheme since its launch in May 2010.

Chapter 1: Energy consumption and CO₂ emissions

Key Findings

- Domestic energy consumption accounts for one third of all energy consumed in Scotland.
- In 2009, total energy consumption in the domestic sector in Scotland equalled 47,600 GWh, this equated to a 11% decrease since 2005 (DECC).
- Gas accounts for the largest proportion (66%) of energy used in the domestic sector in Scotland.
- Scotland has the highest domestic gas consumption per consumer of any GB region at 15,900 kWh, compared to a GB average of 15,200 kWh and the lowest consumption in the South West of 13,400 kWh per consumer.
- Residential combustion and electricity accounted for 36% of all CO₂ emissions in Scotland in 2009 (NAEI).
- Although energy consumption in the domestic sector has increased since 1990, the way we produce our energy has improved significantly, meaning that there are less emissions associated with every unit of energy we use.

9. Energy consumption and CO₂ emissions are closely related. Simply, for each unit of energy consumed a quantity of CO₂ will be produced. However if we look at the trends over time we will see that this relationship has not been constant. Improved technology both in the production of electricity and in the energy efficiency of household appliances mean that energy is now both produced and used more efficiently, so there are now less emissions associated with each unit of energy consumed.
10. In this chapter we will look at how domestic energy consumption has varied over time and how CO₂ emissions have varied also. The Department for Energy and Climate Change (DECC) are the official source of energy and CO₂ emission statistics, however data from the Scottish House Condition Survey (SHCS) is also used to model energy consumption and CO₂ emissions in Scotland.
11. The SHCS energy consumption and CO₂ data is modelled using the Building Research Establishment Domestic Energy Model (BREDEM). A number of different factors are taken into account, including dwelling age, building construction, depth of loft and wall insulation, heating systems and controls and location. The modelling uses dwelling details collected in the SHCS but does not account for occupant characteristics or behaviour, so uses a standard number of occupants⁴ and a standard heating regime⁵ for each dwelling.

⁴ Depending on total floor area (TFA), using formula $N = 0.0365 * TFA - 0.00004145$

⁵ Nine hours per 24 hour period during the week, with two hours being in the morning and seven hours in the evening and 16 hours per 24 at the weekend. The living-room heated to 21°C and rest of the house heated to 18°C.

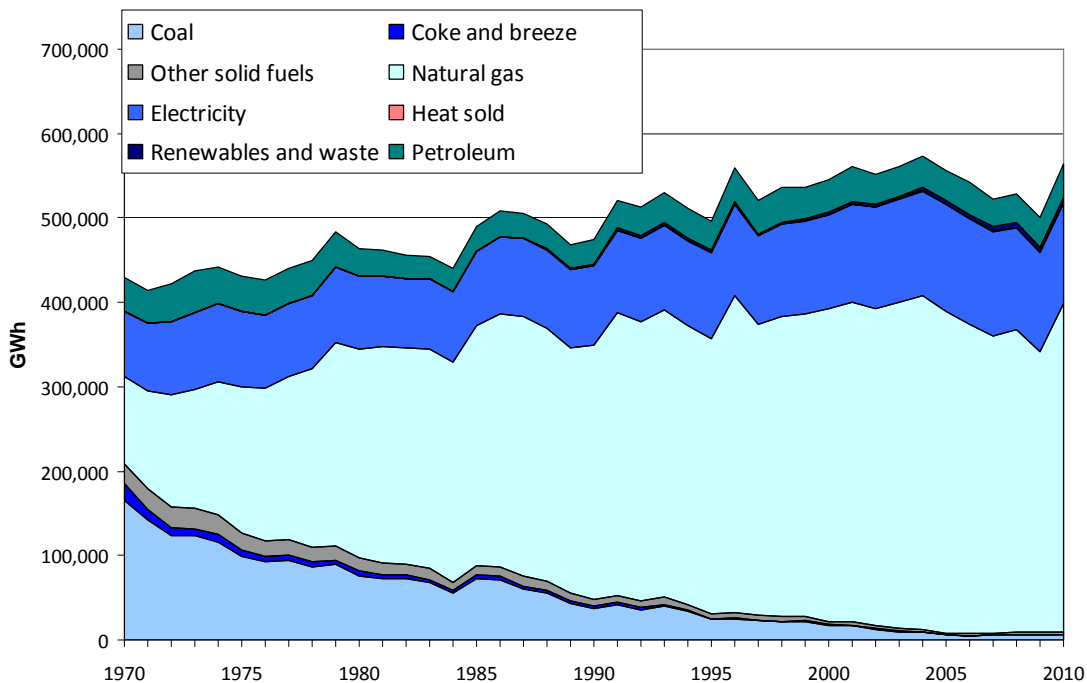
- 12. The DECC data is mainly consumption data collected from energy suppliers who collect this at customer meter level. However there are issues in separating domestic users from small non-domestic users.
- 13. DECC UK and Scotland final domestic consumption figures presented in this report are not directly comparable. The UK data uses real sales where as Scotland data uses real sales but the gas component is weather corrected. This is because gas consumption data at sub-national level is only available weather corrected, it accounts for approximately two thirds of total consumption in the domestic sector. This means that UK data will reflect an increase in domestic energy consumption when there is a colder than average winter (e.g 2010), where as Scotland figures will not (to the full extent).

Energy Consumption

Total Energy Consumption

- 14. Although DECC Scotland level data is only available from 2005, energy consumption data at UK level is available back to 1970. Figure 1 shows how the level and type of domestic energy consumption has changed over the past 40 years.

Figure 1 UK domestic energy consumption by fuel: 1970 to 2010



Source: DECC

- 15. In the 40 years since 1970 there has been a big shift in the fuel mix for domestic fuel consumption. In 1970 39% of consumption was coal, 24% natural gas and 18% electricity; this changed to 8% coal, 63% gas and 18% electricity in 1990; and to 1% coal, 69% natural gas and 21% electricity in 2010.

16. In 2010, energy consumption from the UK domestic sector was 564,000 GWh. This was 31 per cent higher than in 1970, 19 per cent higher than in 1990 and 13 per cent higher than in 2009. The increase in 2010 follows a general decline since 2004 and was largely driven by colder temperatures (DECC)⁶. Some of this overall increase has been driven by a 17% increase in the number of UK households and a 9 per cent increase in the UK population since 1990, with a 1% increase in both household and UK population since 2009. (Figure 1)
17. Scotland has a target to reduce final energy consumption by 12% by 2020 from a baseline of 2005-07. All sectors; industrial & commercial, domestic and transport, should contribute towards this target however in this chapter we will be looking at consumption in the domestic sector only.
18. The DECC and SHCS total energy consumption estimates vary quite significantly (between 21% and 31%). The reason for this is the differing methodologies and purposes of the data. The DECC data is mainly consumption data from energy suppliers and the SHCS data is modelled data, using standard heating regimes and standard occupancy. In essence DECC statistics demonstrate actual energy consumption⁷ and SHCS statistics estimate a theoretical energy consumption assuming every dwelling is heated in line with the standard heating regime and with households using an assumed amount of energy on lights, appliances, cooking and hot water.
19. DECC final consumption data⁸ is computed by summing consumption estimates for electricity, gas and other fuels. The datasets used for these estimates are based on the aggregation of data from different sources of information. The electricity and gas data is based on real consumption recorded from meters, this accounts for approximately 90% of total consumption. In contrast, modelled information, using CO₂ and other spatial data is used for the other fuels, this however accounts for only 10% of total consumption. It is also important to recognise that the gas consumption data is weather corrected, whereas all other fuel sources are unadjusted.
20. The methodology used to calculate energy consumption from SHCS data is not intended to provide figures for actual energy usage, instead it allows a comparison of energy consumption across different sectors of the Scottish housing stock, based on calculations of the level of energy use required to maintain a standard heating regime. It can therefore be used to compare the energy efficiency of the housing stock over time, based on a consistent heating regime.
21. Data from the SHCS suggests that modelled energy costs are approximately 10% higher than householders say they pay, at Scotland level (however this does vary significantly at household level). This difference in modelled and real energy costs can be used as a proxy for difference in modelled and real energy consumption, however it should be noted that these cost differences may also be due to tariff type

⁶ <http://www.decc.gov.uk/en/content/cms/statistics/publications/ecuk/ecuk.aspx>

⁷ Although gas consumption data is weather corrected so eradicates the annual variation due to external temperature.

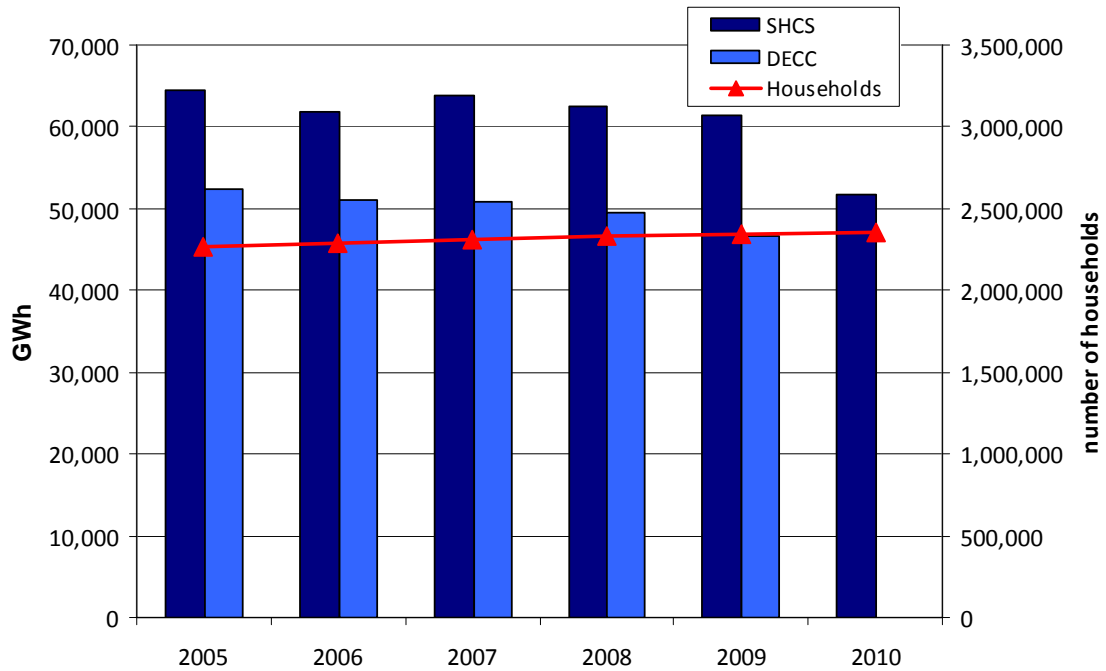
⁸ http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/regional.aspx

or multi-fuel reductions plus the 'real' energy costs are self reported, so may not be 100% accurate.

22. Both estimates are useful in their own right. DECC data gives us an estimate of actual energy consumption and when looking at time series data we can see how both new technologies and consumer behaviour have effected energy consumption. The SHCS data gives us a theoretical energy consumption and when looking at time series data highlights the improvements in the energy efficiency of the housing stock. These latter statistics do not take into account consumer behaviour, so may over estimate the savings associated with energy efficiency improvements, due to not accounting for known behaviours such as the rebound effect⁹.
23. Since 2005, both DECC and SHCS data suggest that there has been a decrease in total domestic energy consumption in Scotland. In 2009, DECC statistics estimate that domestic energy consumption was 9.1% lower than the 2005/07 baseline and accounted for about one third of all energy consumed in Scotland. DECC sub national 2010 final consumption data will be available in December 2012, however from the published 2010 electricity and gas consumption figures (which account for 90% of total consumption) we can estimate that total energy consumption will stay roughly the same as 2009.
24. SHCS statistics suggested that in 2009 total energy consumption was already 3% lower than the baseline, it then suggests that in 2010 domestic energy consumption reduced significantly to 18% lower than the baseline. This coincides with an increase in energy efficiency.
25. The difference between the DECC and SHCS estimates was the largest over the period 2005 to 2009. One possible explanation for this is the recession. DECC data will have picked up if customers are using less fuel (possibly in order to save money), where as SHCS data will not as it assumes the same standard heating regime year on year. It should be noted that the reduction in energy consumption as shown by DECC figures may not hold when the economy becomes more buoyant.

⁹ The 'rebound' effect is the extent of the energy saving produced by an efficiency investment that is taken back by consumers in the form of higher consumption. E.g. A more efficient boiler decreases the cost of heating a house to a certain temperature. This cost saving may lead to an increased demand for that service (i.e. the house is heated for longer or to a higher temperature) so that the savings are partially offset by an increase in demand (i.e. a warmer house).

Figure 2 Final domestic energy consumption in Scotland (GWh): 2005 - 2010

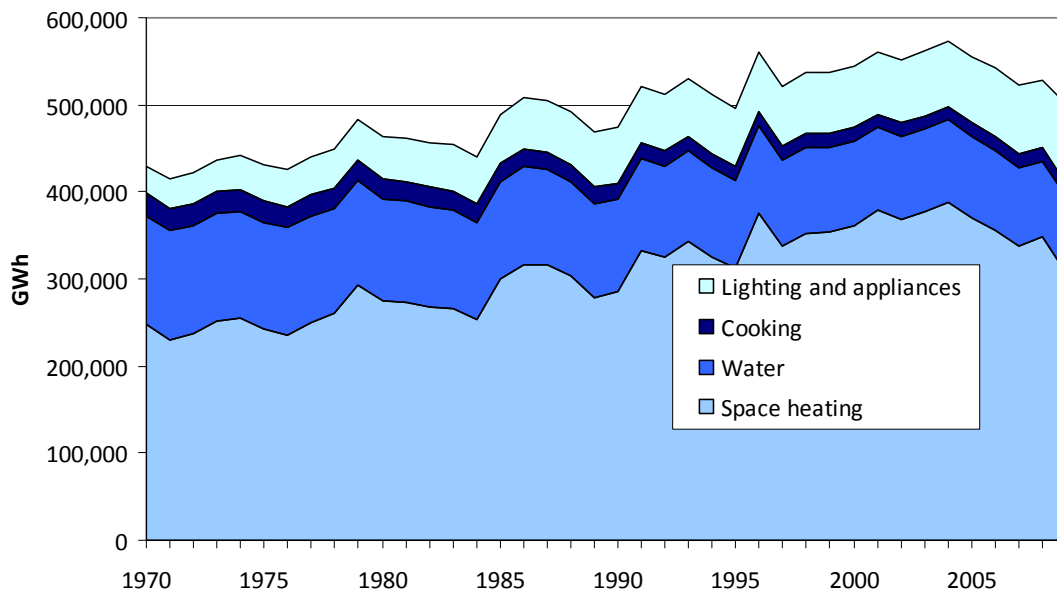


Source: DECC and SHCS

26. Calculating final domestic energy consumption per household highlights again that DECC statistics estimate domestic energy consumption to be less than the SHCS modelled statistics. In 2009, using DECC statistics we can estimate that the mean energy consumption per household¹⁰ is 19,900 kWh compared to a SHCS mean modelled energy consumption of 26,200 kWh. However if we look at the median SHCS modelled energy consumption for this period, this is much closer to the DECC estimate at 20,600 kWh. This suggests that the SHCS overestimates high energy users, possibly because the model assumes heating to a higher temperature than is used in reality.
27. The below Figure 3 illustrates domestic energy consumption by end use. As demonstrated in the previous graph, energy consumption since 1970 has increased. However, how households use energy has changed. The biggest change has been the increase in the proportion of energy used to power lighting and appliances. The proportion used for space heating has stayed roughly the same, presumably because energy savings from more efficient boilers and improved insulation have been counteracted by the increasing number of households and households heating their homes to a higher level.

¹⁰ Calculated by dividing total energy consumption in Scotland by the number of households in Scotland (<http://www.gro-scotland.gov.uk/statistics/theme/households/estimates/index.html>)

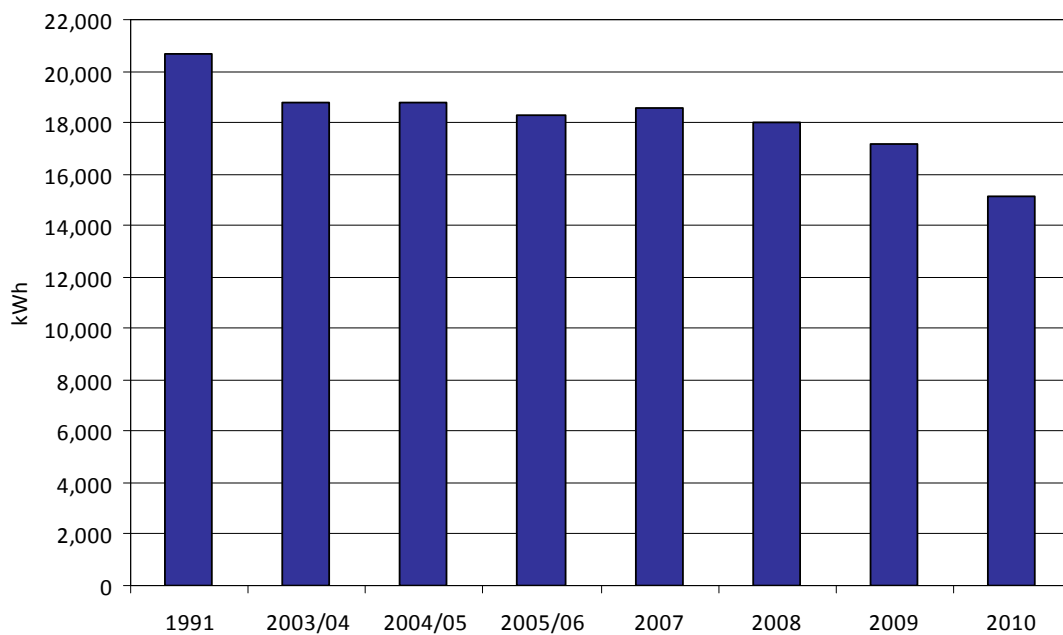
Figure 3 UK domestic energy consumption by end use: 1970 to 2009



Source: DECC -secondary analysis of data from the Building Research Establishment and modelling by Cambridge Architectural Research using the Cambridge Housing Model v2.5.

28. As can be seen from the above chart, space heating accounts for the largest proportion of domestic energy consumption. The SHCS also estimates that space heating accounted for 65% of domestic energy consumption in 2010, with water heating accounting for a further 17%.

Figure 4 Modelled median energy consumption per household for space and water heating in Scotland (kWh): 1991 to 2010



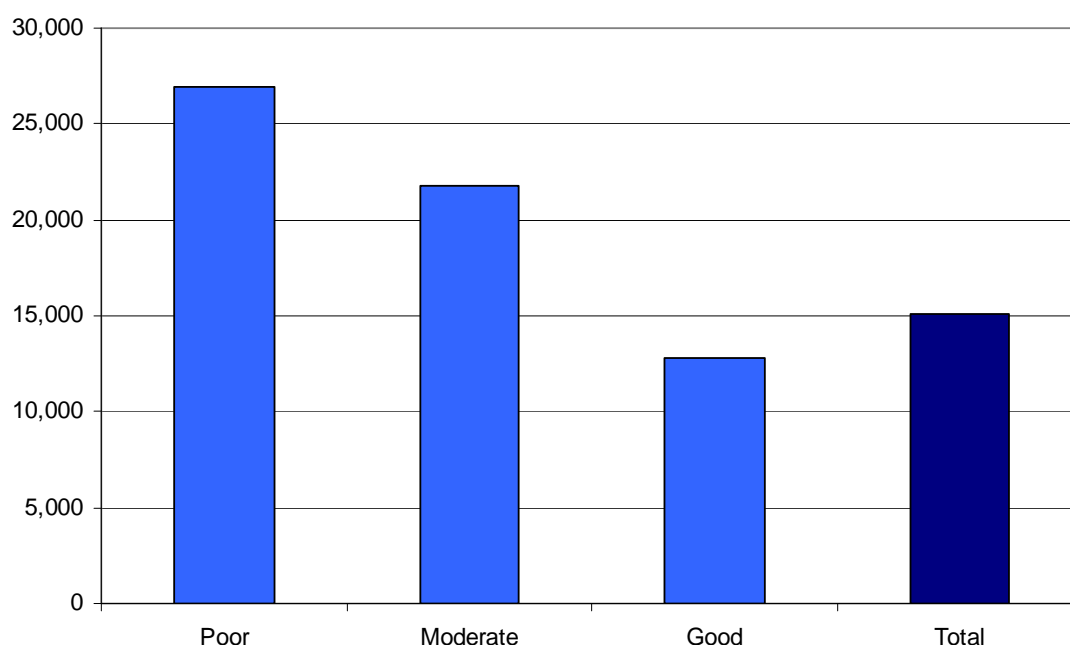
Source: SHCS

29. Figure 4 illustrates the decreasing amount of modelled energy consumption per household for space and water heating. In 1991 the modelled median amount of energy consumed for space and water heating was 20,700 kWh, in 2010 this had

decreased by 27% to 15,100 kWh. This decrease is most likely due to an increase in the presence of more energy efficient boilers and improved insulation.

30. The below chart (Figure 5) illustrates the difference in modelled energy consumption by NHER band. The average modelled median energy consumption for space and water heating is about 15,000 kWh. In dwellings rated with a 'good' NHER the median is about 13,000 kWh, but in 'poor' NHER dwellings the median is almost 27,000 kWh, double the consumption in a 'good' dwelling.

Figure 5 Modelled median energy consumed for space and water heating in Scotland by NHER band (kWh) : 2010



Source: SHCS

Gas Consumption

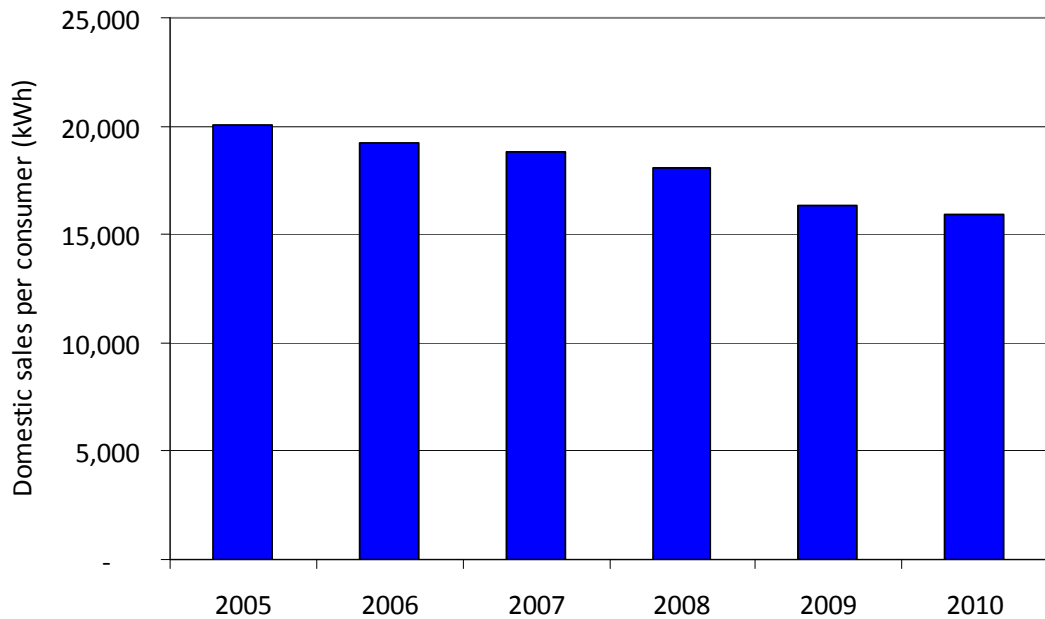
31. Gas accounts for the largest proportion of energy used in Scotland; in 2009 it accounted for 66% of all energy consumed in the domestic sector¹¹. The main use of gas is for space and water heating and a small proportion for cooking.
32. All DECC gas consumption data are weather corrected. This means that a particularly cold winter (as we had in 2010) does not cause fluctuations in the time series. This in turn helps identify changes in demand that are not due to year-to-year weather variation.
33. Since 2005 the gas consumption per consumer¹² has decreased by about 21%. One of the likely causes of this decrease is the improved energy efficiency of housing over

¹¹ <http://www.decc.gov.uk/assets/decc/11/stats/energy/sub-national-energy/3948-total-subnatl-final-energy-cons-2005-2008.xls>

¹² A major limitation of the gas consumption data is that it is not possible to accurately determine which consumers are domestic. All consumers using less than 73,200 kWh are assumed to be domestic. This method misallocates many small businesses to the domestic sector, and some households to the non-domestic sector.

this period, although the drop in 2009 may also be related to the recession and in 2010 could be effected by fuel price rises.

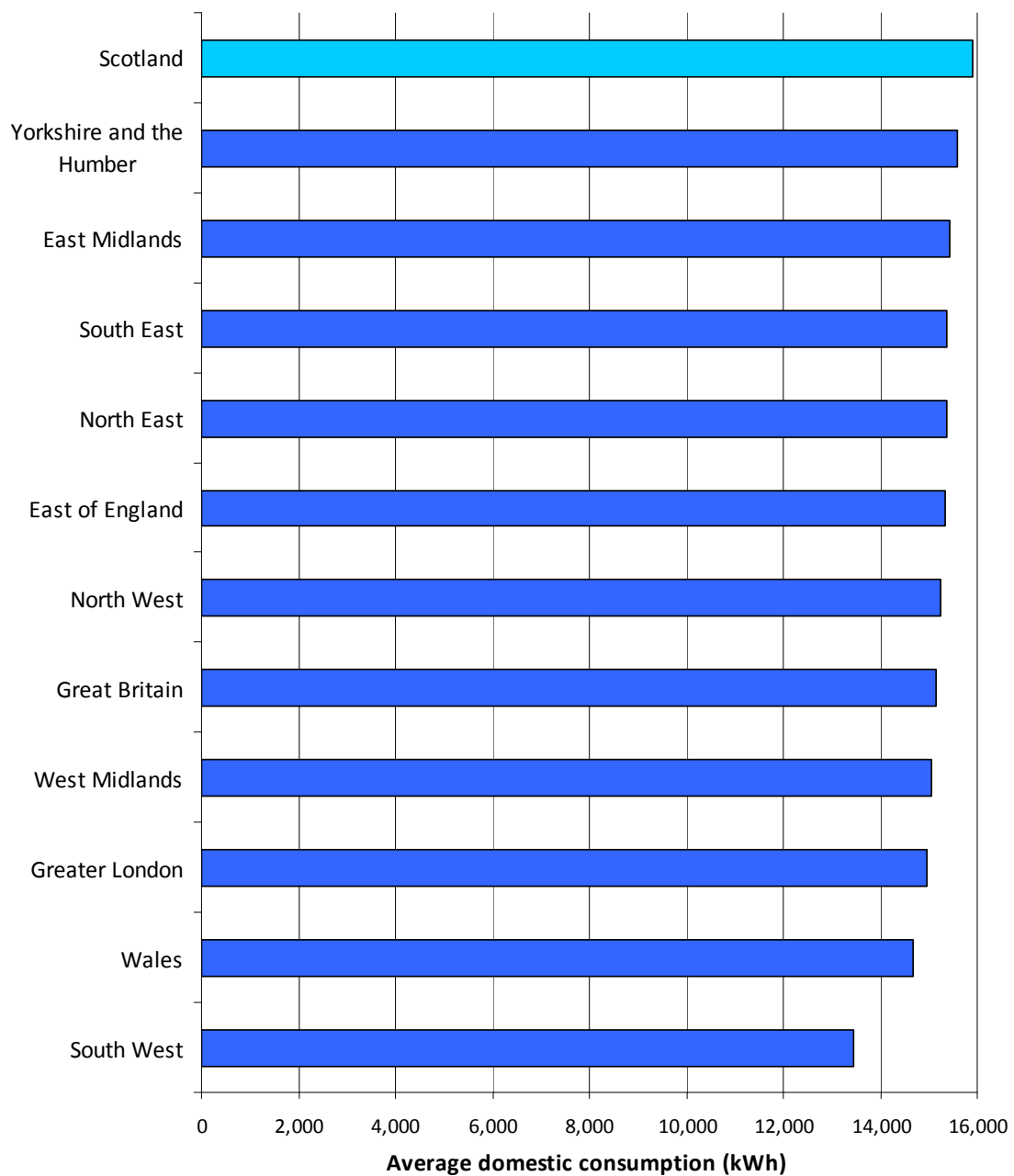
Figure 6 Domestic gas sales per consumer (kWh) : 2005 – 2010



Source: DECC

34. In 2010, domestic gas consumption per consumer in Scotland was about 15,900 kWh, a reduction from 16,300 kWh in 2009 and 20,000 kWh in 2005. Figure 7 shows the average gas consumption per consumer in Scotland, Wales and the English regions. As expected, the northern parts of the UK tend to have higher domestic consumption per customer, due to the impact of weather differences on demand for heating fuel.
35. Scotland has the highest domestic gas consumption per consumer of any GB region. The GB average in 2010 was 15,200 kWh, the Scotland average was 15,900 kWh and the South West average 13,400 kWh.

Figure 7 Average domestic gas consumption per consumer by region (kWh): 2010



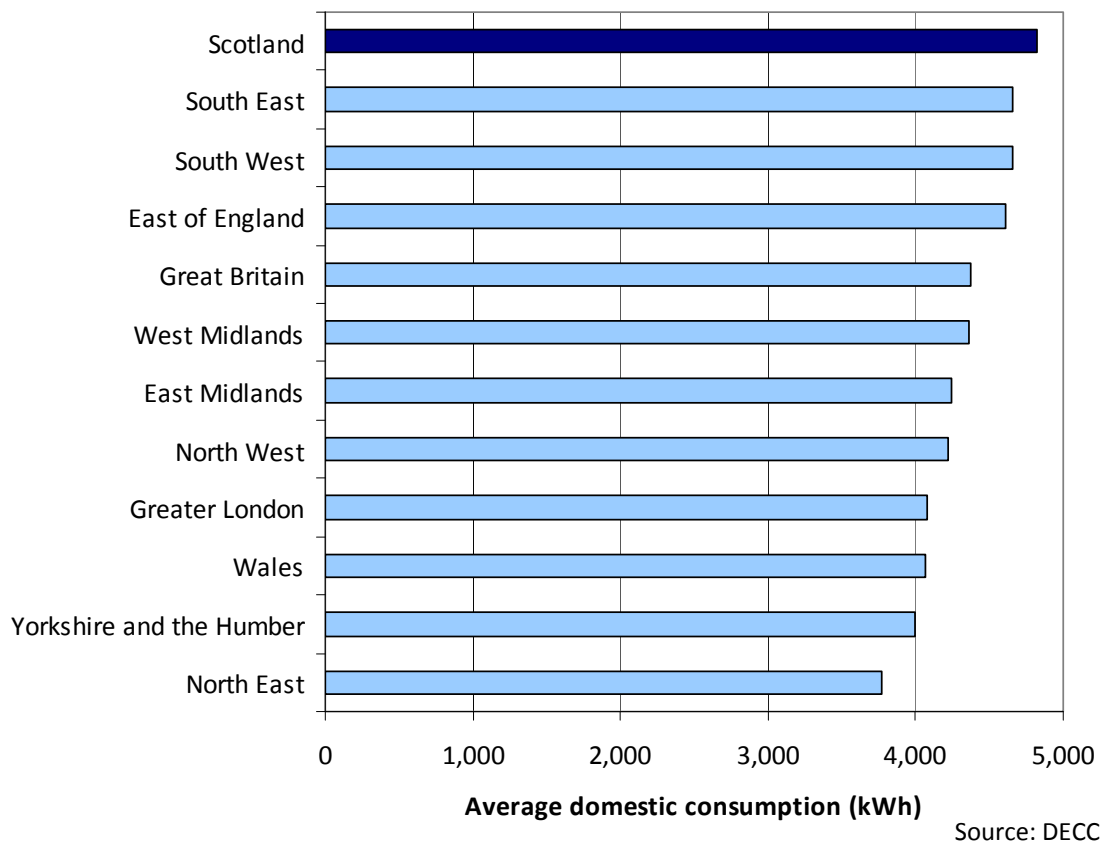
Source: DECC

Electricity Consumption

36. Domestic electricity consumption per household in Scotland in 2010 was estimated to be the highest in Great Britain, at 4,800 kWh, as shown in Figure 8. The GB average was 4,400 kWh. The higher electricity consumption in Scotland could be due to a higher proportion of households using electric heating systems and shorter days in the winter.
37. Note that the data presented here for electricity consumption are calculated by dividing total domestic consumption by number of households. The alternative of consumption per meter is not used because some dwellings, such as those on an

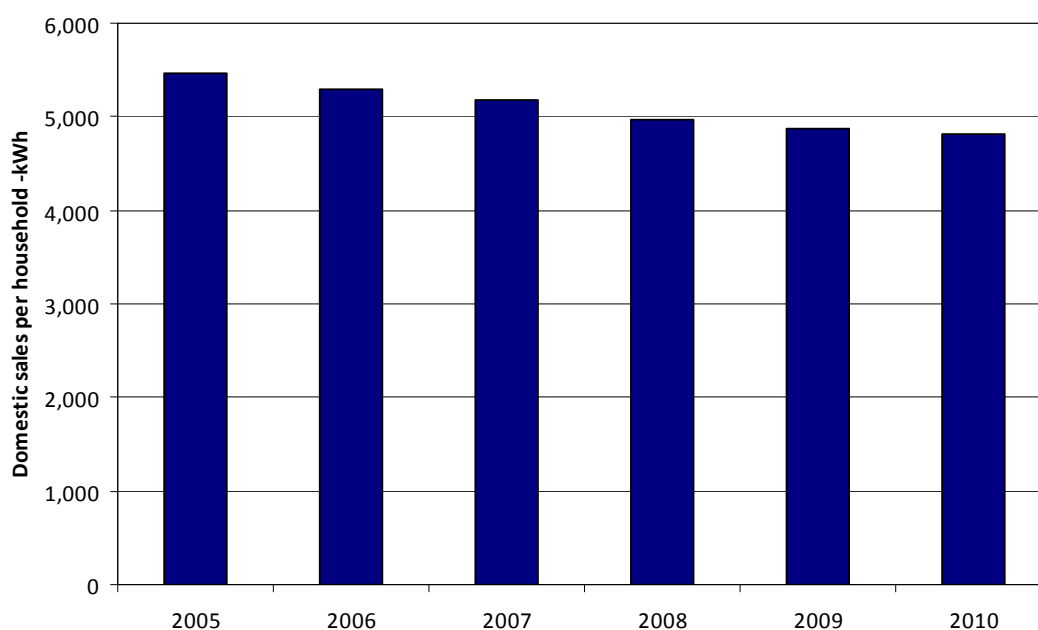
Economy 7 tariff (which provides cheaper off-peak electricity for seven hours each night), have more than one meter.

Figure 8 Average domestic electricity consumption per household by region : 2010



38. Figure 9 shows a 12% decrease in domestic electricity consumption per household from 2005 to 2010. Key drivers of this trend include increased prices and improved energy efficiency of appliances. The total domestic electricity consumption in Scotland has also decreased over this period from 12,400 GWh in 2005 to 11,400 GWh in 2010, a decrease of 8%.

Figure 9 Average domestic electricity sales per household (kWh) : 2005 – 2010



Source: DECC

39. DECC electricity consumption data is available at Scotland level since 2005, however at a UK level there is long term data back to 1970. Figure 10 and Table 1 below illustrate the electricity consumption by domestic appliances between 1970 and 2010 in the UK. In 1970 about 34,000 GWh of electricity were consumed by domestic appliances, by 2010 this had more than doubled with about 84,000 GWh being used.

Table 1 Electricity consumption by domestic appliances¹³ in the UK : 1970 to 2010

	Light	Cold	Wet	Consumer electronics	Home computing	Cooking	Total
1970	11,000	5,000	4,000	3,000	0	11,000	34,000
1980	14,000	12,000	6,000	6,000	0	11,000	51,000
1990	17,000	17,000	12,000	12,000	1,000	12,000	70,000
2000	18,000	17,000	13,000	16,000	3,000	12,000	80,000
2010	14,000	14,000	14,000	21,000	7,000	13,000	84,000

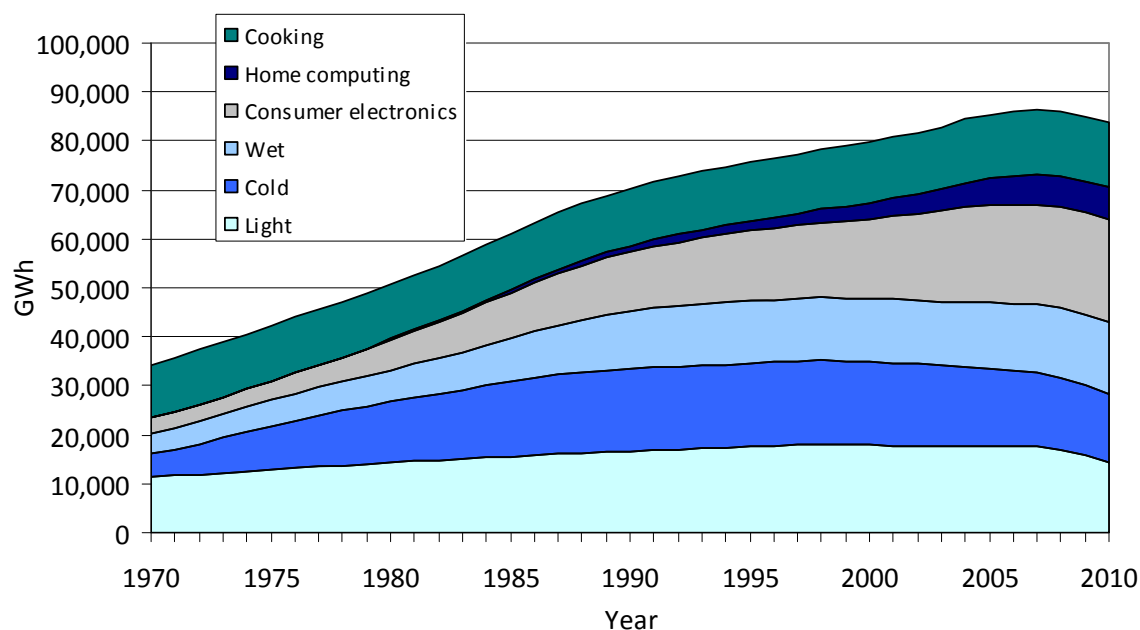
Source: Market Transformation Programme

40. Although lighting and household appliances are increasingly more energy efficient, this may have been offset by the growing number of energy-hungry gadgets in a typical home. For example, there are more laptops, large screen televisions and other electronic appliances.
41. The biggest increase has been in consumer electronics and home computing which have both seen a 7 fold increase since 1970. Home computing did not become popular until the 90's, so this is no surprise. The amount of electricity consumed by

¹³ The electricity consumption data for cooking was not included in the Market Transformation Programme for 2009 and 2010 as they considered that the data were insufficiently robust. Therefore, the data seen here are forecasts which were provided to the Department of Energy and Climate Change last in 2008.

lighting and cold appliances both decreased between 2000 and 2010. This is likely because of improved energy efficiency of such appliances and consumers becoming more aware of energy efficiency ratings.

Figure 10 Electricity consumption by domestic appliances in the UK : 1970 to 2010



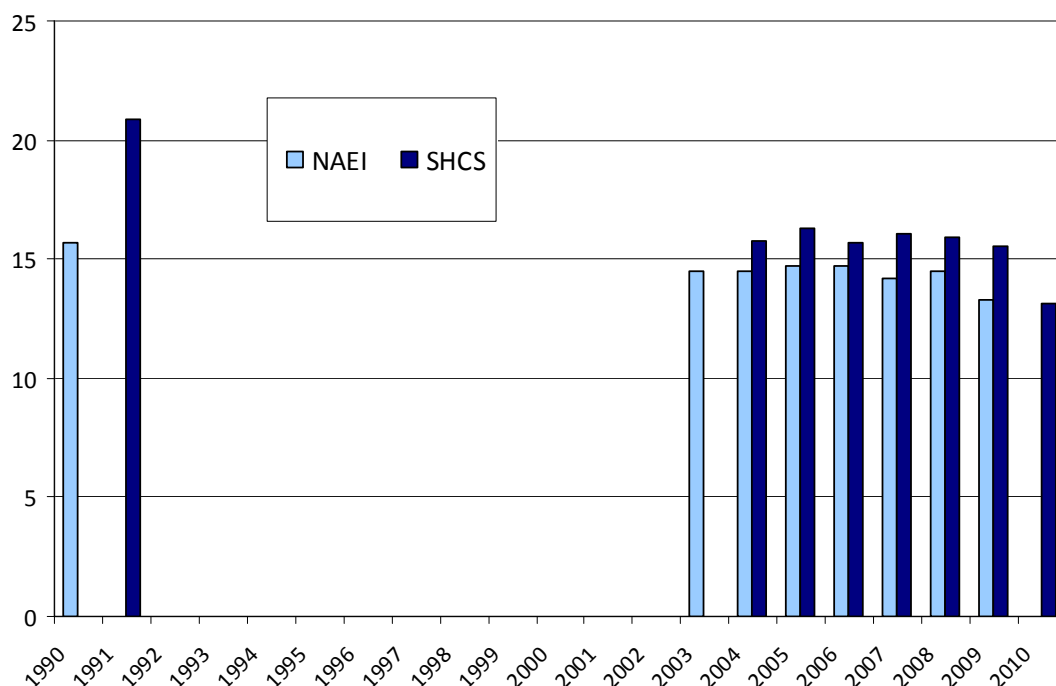
Source: Market Transformation Programme⁹

CO₂ emissions

42. The Kyoto Protocol (1997) set legally binding targets by which the UK must reduce emissions of a basket of six GHGs to 12.5% below baselines. The Scottish Government also have a set of targets set by The Climate Change (Scotland) Act 2009. It sets a statutory framework for GHG emissions reductions in Scotland with a reduction target of at least 80 per cent for 2050 and an interim 42 per cent reduction target by 2020. Both of these reductions are based upon the 1990 base year (1995 for the F-gases, i.e. hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride).
43. Residential combustion and electricity accounted for 36% of all CO₂ emissions in Scotland in 2009 and 28% of the basket of six GHGs¹⁴.

¹⁴ These estimates are from the end user inventory. All emissions associated with energy supply (e.g. power generation, coal mining, oil and gas extraction, refineries) are allocated to the final users of the energy rather than the producers. Without reallocating energy supply the residential sector accounts for 19% of CO₂ emissions and 15% of the basket of six GHGs.

Figure 11 CO₂ emissions from housing, comparison between NAEI and SHCS estimates: 1990 - 2010¹⁵



44. The National Atmospheric Emissions Inventory¹⁶ (NAEI) is the official source of CO₂ emissions data. However, in using the SHCS estimates it is possible to compare levels of emissions by different dwelling characteristics. The methodology used to calculate CO₂ emissions is the same as that used to calculate the energy consumption: a dwelling is assumed to be heated using the standard heating regime and assumed occupied to a standard level depending on floor area.
45. The SHCS CO₂ emission estimates are calculated using SAP emissions factors (Table 2) in comparison to NAEI estimates which are end user estimates¹⁷. NAEI CO₂ emissions from domestic electricity use are output from an iterative model that re-distributes emissions from energy supply industries (power stations, refineries, collieries, upstream oil and gas, gas production etc.) and allocates the emissions on to the end users of electricity. The allocation of emissions to electricity users varies according to the fuel mix used in the energy supply industry that year, so annual changes in the mix of fuels used to generate the electricity will have an impact. An UK-wide grid allocation is used so it doesn't reflect Scotland-specific energy generation. Emissions from other fuels are available from the NAEI emissions factors database.¹⁸

¹⁵ 2010 NAEI estimates will be published on 17th July 2012, unfortunately too late to include in this publication.

¹⁶ <http://naei.defra.gov.uk/reports.php?list=DA>

¹⁷ <http://uk->

[air.defra.gov.uk/reports/cat07/1109061103_DA_GHGI_report_2009_Main_text_Issue_1.pdf](http://uk-air.defra.gov.uk/reports/cat07/1109061103_DA_GHGI_report_2009_Main_text_Issue_1.pdf) (Chapter 10)

¹⁸ <http://naei.defra.gov.uk/emissions/selection.php>

Table 2 SAP fuel prices and emission factors¹⁹

	Unit price (p/kWh)		Emissions (kg CO ₂ / kWh)	
	2005	2009	2005	2009
Gas (mains)	1.63	3.10	0.194	0.198
Electricity	7.12	11.46	0.422	0.517
Oil	2.17	4.06	0.265	0.274
LPG	3.71	5.73	0.234	0.245
House coal	1.91	2.97	0.291	0.301
Wood logs	2.20	3.42	0.025	0.008

46. Table 2 above illustrates the SAP unit price and emissions factors used to calculate SHCS CO₂ emission estimates. The current estimates are calculated using SAP (2005) emission factors, however the above table also shows the most recent emissions factors from SAP (2009). Electricity has seen the most significant increase in terms of emission factors with a 22% increase in kg of CO₂ emitted per kWh, whereas wood logs have seen a significant decrease of 68%. In terms of unit price, all fuels have seen at least a 50% increase in p per kWh. Mains gas has seen the largest increase of 90%, closely followed by oil which has had a 87% increase in price per unit.
47. Although energy consumption in the domestic sector has increased since 1990, the way we produce our energy has improved significantly, meaning that there are less emissions associated with every unit of energy we use. Both NAEI and SHCS data show a decrease in CO₂ emissions from housing since 1990 (1991 for SHCS), with NAEI data indicating a 15% decrease between 1990 and 2009 and the SHCS indicating a 26% decrease. The SHCS data also shows an improvement in 2010, with emissions dropping a further 15% between 2009 and 2010.
48. This large decrease in the modelled SHCS CO₂ emissions reflects the large decrease in SHCS modelled energy consumption between 2009 and 2010, linked to the improvement in energy efficiency of dwellings. However DECC electricity and gas consumption statistics do not show the same trend and indicate that in 2010 total consumption will be about the same as 2009.
49. The SHCS data estimates that around 13.1 million tonnes of carbon dioxide were released from domestic energy use in Scotland in 2010, an average of 5.6 tonnes per dwelling, and a reduction of 37% since the 1991 baseline figure of 20.1 million tonnes. These estimates assume that each household heats their dwelling to the standard heating regime, in reality households may choose differing patterns of energy use.
50. Table 3 shows the average CO₂ emissions by a selection of dwelling characteristics. Detached dwellings emit significantly more CO₂ emissions than any other type of dwelling, but the age of a dwelling is also an important factor - the older the dwelling the higher the CO₂ emissions. Use of gas for heating at least halves emissions compared to oil so naturally being off gas grid or in a rural location also increases CO₂ emissions.

¹⁹ http://www.bre.co.uk/filelibrary/SAP/2009/SAP-2009_9-90.pdf

Table 3 Mean and Median CO₂ emissions (tonnes per year) by dwelling characteristics: 2010

Dwelling Characteristics	Mean	95% Confidence Interval		Median	Unweighted sample size
		Lower bound	Upper bound		
Type of Dwelling					
Detached	8.5	8.2	8.9	7.2	779
Semi detached	5.8	5.6	6.0	5.2	716
Terraced	5.1	4.9	5.3	4.5	680
Tenement	4.0	3.8	4.1	3.5	531
Other flats	4.4	4.2	4.6	3.8	409
Age of Dwelling					
Pre-1919	7.8	7.3	8.3	6.0	553
1919-1944	5.8	5.4	6.2	4.7	398
1945-1964	5.1	4.9	5.3	4.7	758
1965-1982	5.2	5.0	5.2	4.6	744
Post-1982	4.6	4.4	4.8	4.2	662
Extent of Central Heating					
Full	5.6	5.5	5.7	4.7	2,945
Partial	6.8	5.7	6.8	5.5	116
No central heating	5.1	3.8	6.3	4.9	54
Primary Heating Fuel					
Gas	5.1	5.0	5.3	4.5	2,252
Oil	11.5	10.7	12.3	10.0	256
Electric	5.8	5.5	6.1	5.1	502
Other fuel type	6.5	5.4	7.7	3.9	102
Urban/Rural					
Urban	5.1	5.0	5.2	4.5	2,386
Rural	8.4	8.0	8.8	7.1	729
Gas Grid					
On Gas Grid	5.2	5.1	5.4	4.6	2,639
Off Gas Grid	9.9	9.4	10.4	8.5	475
All Scotland	5.6	5.5	5.8	4.7	3,115

Source: SHCS

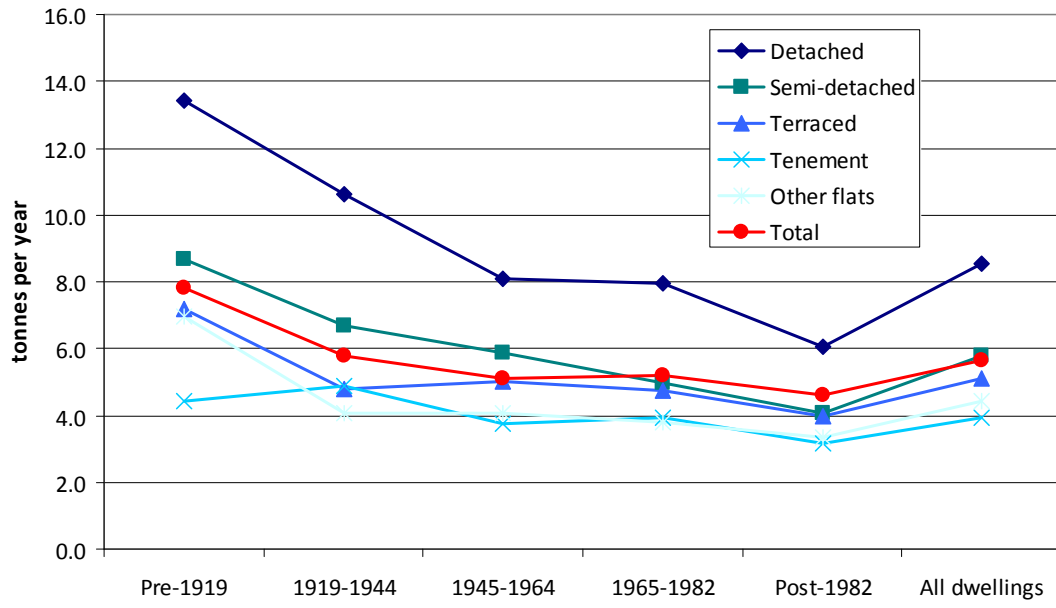
51. As illustrated in Table 3, older properties and detached properties emit the most CO₂. Table 4 and Figure 12 show that emissions from a detached, pre 1919 dwelling will emit on average over 4 times as much CO₂ as a modern (post 82) tenement flat. It also highlights that tenements on average emit the least CO₂ emissions. A traditional (pre 1919) tenement flat on average emits less CO₂ than a modern detached house.

Table 4 Mean CO₂ emissions by age and type of dwelling (tonnes per year): 2010

Age of dwelling	Type of dwelling					Total
	Detached	Semi-detached	Terraced	Tenement	Other flats	
Pre-1919	13.4	8.7	7.2	4.4	7.0	7.8
1919-1944	10.6	6.7	4.8	4.9	4.1	5.8
1945-1964	8.1	5.9	5.0	3.7	4.0	5.1
1965-1982	7.9	5.0	4.8	3.9	3.8	5.2
Post-1982	6.1	4.1	4.0	3.2	3.3	4.6
All dwellings	8.5	5.8	5.1	4.0	4.4	5.6

Source: SHCS

Figure 12 Mean CO₂ emissions by age and type of dwelling (tonnes per year): 2010



Chapter 2: The Housing Stock in Scotland

Key Findings

2010 Scottish House Condition Survey data shows...

- Since 1991 there has been a 16% increase in the number of occupied dwellings in Scotland.
- Scotland's housing stock is made up of 63% houses and 37% flats.
- Over one-fifth of Scotland's housing stock (22%) was built after 1982.
- About 60% of dwellings in Scotland have 4 or 5 rooms (excluding bathrooms).
- The majority (74%) of Scotland's housing stock is of cavity wall construction.
- 83% of Scottish dwellings are in urban areas and 17% are in rural areas.
- Approximately 704,000 (30 %) dwellings were defined as Hard to Treat (HtT), the majority of these dwellings were solid walled dwellings.
- Approximately 198,000 (8%) dwellings are off gas grid without access to the most energy efficient and cheapest fuels – just over half (101,000) of these dwellings are also defined as HtT.

52. This chapter gives an overview of the current housing stock in Scotland. The characteristics of the building stock is an important factor when looking at the energy efficiency of the stock and considering how it could be improved.
53. Although the majority of Scotland's housing stock can benefit from standard energy efficiency improvements, the wide variety of dwelling types, construction types and construction materials present in Scotland means that one solution does not fit all.
54. Since 1991 there has been a 16% increase in the number of occupied dwellings in Scotland. The proportion of detached dwellings within the housing stock has increased from 17% to 21%, since 1991. This is because the majority of modern houses being built are detached homes. This may be the most popular type of home, however it is also the type of dwelling which uses the most energy and therefore emits the most CO₂. (see Chapter 1)

Type of dwellings

55. In line with the rest of the UK, the majority of occupied dwellings in Scotland are houses (1,494,000) rather than flats (864,000). However, unlike the other nations, the proportion of flats in Scotland is very significant at 37%, compared to 19% in England²⁰.

²⁰ English Housing Survey <http://www.communities.gov.uk/documents/statistics/xls/1937429.xls>

Definition

Houses - are divided vertically from other dwellings, commercial premises etc, usually have their principal access from ground level and possess their own roof.

Detached - A house that is free standing with no party walls.

Semi-detached - A house sharing one party wall with another dwelling or commercial premises of a similar size.

Terrace – A house situated in a row of three or more dwellings, commercial premises etc.

Flats - are dwellings that are, either wholly or in part, divided horizontally from other dwellings, commercial premises etc;

Tenement - any dwelling within a common block of two or more floors (commonly up to five storeys but may be higher in certain circumstances) where some or all of the flats have a shared or common access.

4-in-a-block - each flat within the common block containing the selected dwelling has its own separate access.

Tower - ten or more storeys high; will usually contain at least one lift and usually have at least four dwellings per level.

Slab - generally over five storeys high, access predominantly horizontal and usually more than 6 dwellings per level.

Flat from converted house - where a house has been converted to provide more than one unit of accommodation/other premises.

56. There are equal proportions of detached, semi detached and terraced dwellings, each accounting for 21% of Scotland's housing stock. Tenement flats account for 23% of all dwellings (537,000) and 62% of all flats; the remainder are four-in-a-block 225,000 (10%), tower/slab blocks 56,000 (2%) and flats from converted houses 46,000 (2%). (Table 5)

Table 5 Dwelling type (000s and percentage): 2010

Type of dwelling	000s	%
Detached	503	21
Semi - detached	494	21
Terrace	497	21
All Houses	1,494	63
Tenement	537	23
4-in-a-block	225	10
Tower/slab	56	2
Flat from converted house	46	2
All Flats	864	37
All dwellings	2,357	100

Age of dwellings

57. Scottish housing tends to be of recent construction. Over one-fifth of dwellings (511,000) have been built since 1982 and, with a further 1,093,000 constructed between 1945 and 1982, post-war housing now constitutes 68% of Scottish housing. The 1919-1944 period accounts for 13% of dwellings with just under a fifth (19%) now dating from pre-1919 (Table 6).

Table 6 Age of dwellings (000s and percentage) : 2010

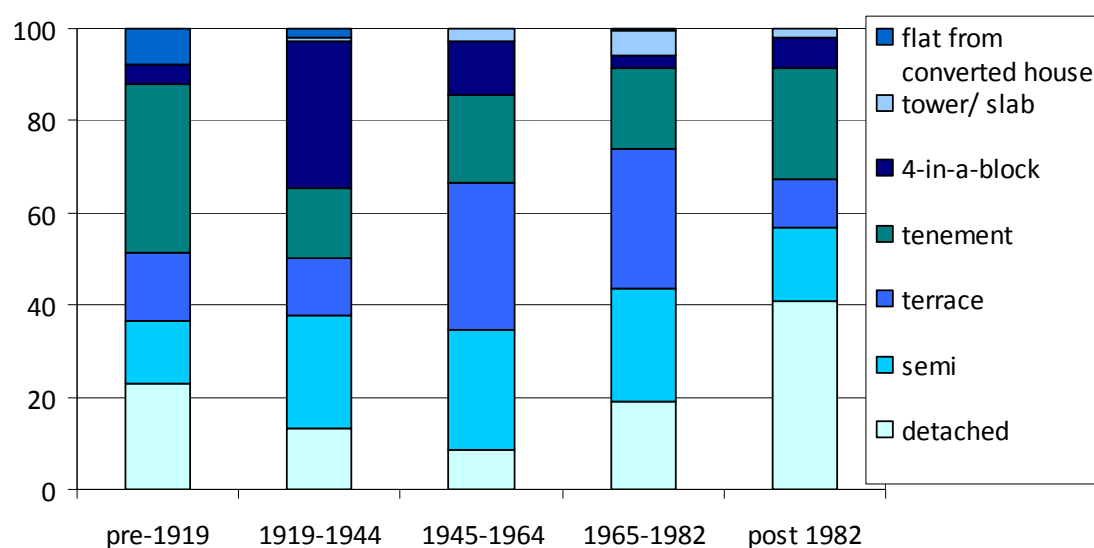
Age of dwelling	000s	%
pre-1919	455	19
1919-1944	298	13
1945-1964	554	24
1965-1982	539	23
post 1982	511	22
All dwellings	2,357	100

58. Most dwellings built prior to 1919 are either detached houses (23%) or tenement flats (37%). The interwar period, and the introduction of suburban housing estates, saw four-in-a-block type flats and semi-detached houses become the prevalent dwelling types. The post-war period saw a substantial increase in the proportion of terraced housing, a trend which continued into the 1960s and 1970s. (Table 7)
59. From 1982, construction moved to detached houses while the number of semi detached and terraced houses fell. Tower and slab construction fell while tenement construction increased slightly. (Table 7)

Table 7 Age of dwelling by type of dwelling (Row %): 2010

Age of dwelling	Type of dwelling							Table Total
	detached	semi	terrace	tenement	4-in-a-block	tower/ slab	flat from converted house	
pre-1919	23	14	15	37	4		8	100
1919-1944	13	25	12	15	32	1	2	100
1945-1964	9	26	32	19	12	3	0	100
1965-1982	19	24	30	18	2	6	0	100
post 1982	41	16	11	24	6	2	0	100
Table Total	21	21	21	23	10	2	2	100

Figure 13 Age of dwelling by type of dwelling (Row %): 2010



Size of dwellings

60. Two measures of dwelling size are available from the SHCS: the number of rooms designed to form part of the living space (i.e. including kitchen but excluding bathroom); and an estimate of the internal floor area.

Table 8 Number of rooms by house or flat (000s and %): 2010

No of rooms	House		Flat		All dwellings	
	000s	%	000s	%	000s	%
1-3	65	4	273	32	338	14
4	330	22	402	46	731	31
5	528	35	153	18	681	29
6	302	20	26	3	328	14
7 or more	269	18	11	1	279	12
All dwellings	1,494	100	864	100	2,357	100

Table 9 Internal floor area by house or flat (000s and %): 2010

Internal floor area - grouped	House		Flat		All dwellings	
	000s	%	000s	%	000s	%
< 50m ²	26	2	164	19	189	8
50 - 69m ²	117	8	288	33	405	17
70 - 89m ²	359	24	241	28	600	25
90 - 109m ²	372	25	91	11	463	20
110m ² +	620	41	80	9	699	30
All dwellings	1,494	100	864	100	2,357	100

61. About 60% of dwellings have 4 or 5 rooms (i.e. 2 or 3 bedrooms, kitchen and living room). Approximately 14% of dwellings are smaller than this and 26% are larger. Flats tend to be smaller than houses; almost 78% of flats have 4 rooms or less compared to only 26% of houses (Table 8).

62. The average flat has an internal floor area of 84 m², although flats created through some form of conversion are noticeably larger (averaging 147 m²). The average house has an internal floor area of 116 m² with detached houses being larger (152 m²) than semi-detached (101 m²) or terraced (93 m²).

Table 10 Mean and median internal floor area by type of dwelling (m²): 2010

Type of dwelling	Mean	Median
detached	152	135
semi	101	95
terrace	93	88
All houses	116	100
tenement	85	66
4-in-a-block	75	72
tower/slab	63	63
flat from converted house	147	99
All flats	84	68
All dwellings	104	88

63. Dwellings built prior to 1919 tend to be larger than those constructed later (Table 11). Pre-1919 dwellings have an average internal floor area of 135 m² and almost 60% of them are larger than 90 m². The average dwelling size fell in later years to below 90 m² in the 1945-1964 period, when only 15% of dwellings were larger than 110 m². From 1965 the size of dwellings began to increase slightly. Dwellings constructed after 1982 continued the increase in size, with the average internal floor area increasing to 112 m², and 40% of the post 82 stock have an internal floor area of more than 110m².

Table 11 Internal floor area by age of dwelling (column %): 2010

Internal floor area - grouped	Age of dwelling				
	pre-1919	1919-1944	1945-1964	1965-1982	post 1982
<50m ²	10	4	6	9	10
50 - 69 m ²	15	17	19	18	17
70 - 89 m ²	15	36	33	28	17
90 - 109 m ²	12	17	26	24	16
110 m ² +	47	25	15	22	40

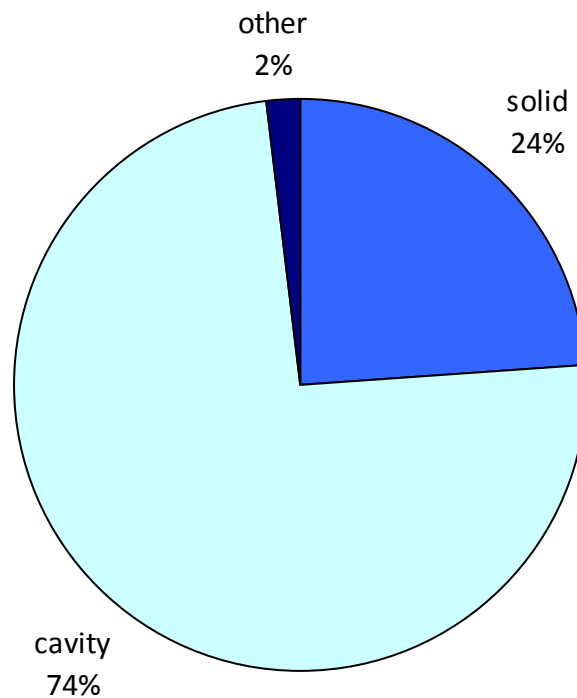
Construction of dwellings

64. The majority of Scotland's housing stock is of cavity wall construction. Almost three quarters are built using cavity wall construction, a further 24% are solid wall construction and the remaining 2% other construction. Other wall constructions are usually non-traditional and system builds, in general these are 'hard to treat'.

Table 12 Principal external wall construction (count and percentage): 2010

	000s	Percent
solid	564	24
cavity	1,747	74
other	47	2
Total	2,357	100

Figure 14 Principal external wall construction (percentage): 2010

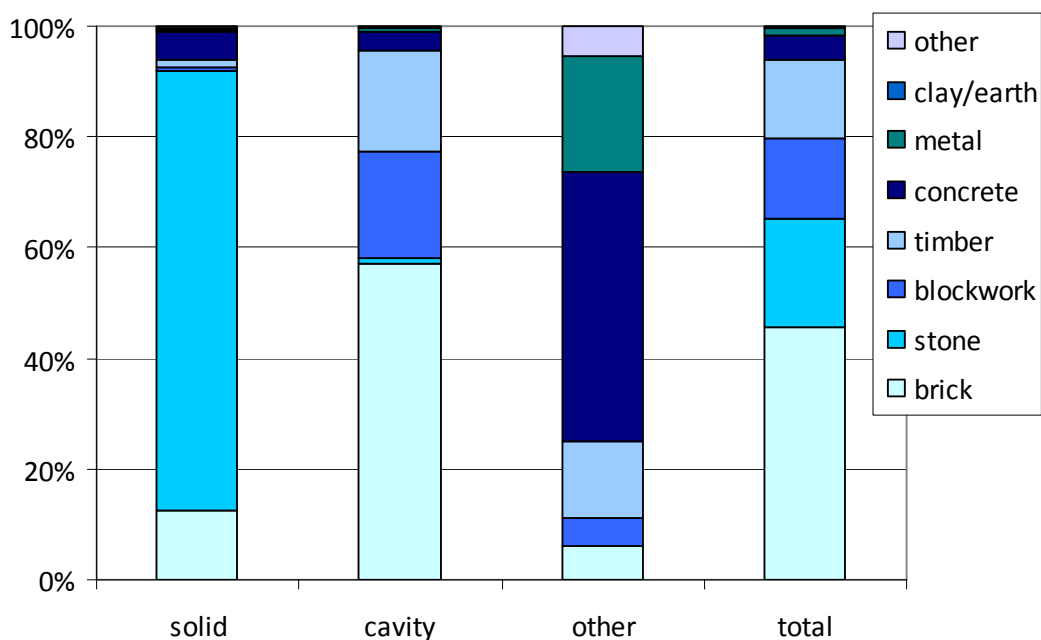


65. While the great majority (79%) of dwellings are of traditional masonry construction (built of load bearing brick, stone or block) around 20% are of timber frame construction or non-traditional construction such as concrete or metal. Almost 80% of solid walled dwellings are built using stone and the majority (57%) of cavity walled dwellings are built from brick. (Table 13)

Table 13 Principal external wall construction material by external wall construction (count and percentage): 2010

	solid		cavity		other		Total	
	000s	%	000s	%	000s	%	000s	%
brick	70	12	998	57	3	6	1,071	45
stone	448	79	18	1	-	-	467	20
blockwork	4	1	333	19	2	5	339	14
timber	6	1	323	18	7	15	336	14
concrete	30	5	54	3	23	51	107	5
metal	2	0	16	1	10	22	28	1
clay/earth	1	0	2	0	-	-	3	0
other	2	0	2	0	3	6	6	0
Total	564	100	1,747	100	44	100	2,357	100

Figure 15 Principal external wall construction material by external wall construction : 2010



66. Table 14 shows how construction methods and materials have changed over time. Nearly all dwellings built prior to 1919 were of solid wall construction, predominantly sandstone or granite, but by 1945 about 85% were of brick/block cavity construction. This has remained the predominant building type although different forms of non-traditional construction have become popular at various times. For example, concrete was a popular material during the late 1960s but was rarely used after 1982, whilst timber framed dwellings have become increasingly popular since 1965 and in the period since 1982 have accounted for over half of all dwellings.

Table 14 Principal external wall material by age of dwelling (column %): 2010

	Age of dwelling				
	pre-1919	1919-1944	1945-1964	1965-1982	post 1982
stone	92	12	2	0	0
brick	8	82	75	54	17
blockwork	-	3	8	28	27
timber	-	1	4	8	53
concrete	0	1	7	11	1
metal	-	0	3	-	2
clay/earth	0	-	0	0	0
other	-	0	1	-	0

Hard to treat dwellings

67. Some construction types are defined as Hard to Treat (HtT), this means that for whatever reason, the dwelling characteristics pose non-trivial problems for reducing energy consumption. These may be technical (e.g. difficulties with installing insulation) or economic (e.g. unfavourable cost / benefit results for improvement options).

68. There is no formal definition of HtT dwellings although most definitions are roughly similar. Some definitions state that a block which has 4 or more storeys is hard to treat and others define off-gas grid dwellings as HtT.
69. For the purposes of this report, Hard to Treat (HtT) properties are defined as having one or more of the following characteristics:
- Solid wall,
 - pre 1982 timber frame,
 - other wall support construction not cavity or solid e.g. metal frame with some form of cladding,
 - flat roofs,
 - mansard and half mansard roofs,
 - High rise (10 floors or above)

Table 15 Hard to Treat dwellings (000s and %): 2010

	000s	Percent
No, not hard to treat	1,653	70
Yes, hard to treat wall insulation	645	27
Yes, hard to treat roof insulation	24	1
Yes, wall and roof insulation both hard to treat	15	1
Yes, highrise, any insulation hard to treat	21	1
Total	2,357	100

70. In 2010, the SHCS estimated that approximately 704,000 (30 %) dwellings were HtT. The majority of these dwellings were solid walled dwellings. Of the whole housing stock, 24% have solid walls and a further 2% have pre 1982 timber frame and 2% other wall construction. All of these wall types require non cavity wall insulation.
71. Some 21,000 high rise dwellings with 10 or more floors exist in Scotland accounting for around 1% of the stock. Built largely in the 1960s and 1970s, high rise buildings pose a number of unique problems when improving their energy performance. Because of the form of high rise tower blocks, the technical potential for wall insulation is limited. They also tend to have flat roofs and the large number of households in the one block can also make improvements difficult to manage.
72. Properties where the principle roof is flat or mansard/half mansard are rare amongst the Scottish housing stock, accounting for just 2%. They are most commonly found on high-rise flats, where the benefits of improving insulation apply to the top floor only.
73. Pre 1982 timber frame homes are not very common and account for about 2% of Scotland's housing stock. They can cause a problem as it is unlikely they would have been built with sufficient insulation, however cavity wall insulation is not suitable. They can be treated in the same manner as solid wall properties, however have the added complication that the timber frame walls were designed to be 'breathable' and therefore still need some air to flow through and moisture to escape.

Hard to Treat Cavities

74. Although hard to treat cavities are not fully accounted for in the above definition of hard to treat dwellings, it is acknowledged that some cavity walls are not suitable for cavity wall insulation or will entail a higher than average cost to install cavity wall insulation.
75. The below types of cavity walls are said to be 'hard to treat cavities';
- a cavity wall in a building with 3 or more storeys where each storey has cavity walls;
 - a cavity within a cavity wall which is less than 50mm wide;
 - a cavity found in homes of prefabricated concrete construction or with metal frame cavity walls;
 - an uneven cavity formed in walls constructed of natural stone or from natural stone outer leaf and block or brick inner leaf;

Table 16 Dwellings with Hard to Treat cavities (000s and %): 2010

	000s	% of all stock
Cavity wall dwelling in block of 3 or more storeys	184	8
Cavity wall dwelling where construction material is concrete or metal frame	32	1
Cavity wall dwelling constructed of natural stone	16	1
Total Hard to Treat cavities	231	10

76. In 2010, the SHCS estimated that approximately 231,000 (10 %) dwellings had hard to treat cavities. The SHCS does not collect data on the width of cavities so is unable to estimate the number of dwellings with a cavity less than 50mm wide. The majority of the dwellings estimated to have hard to treat cavities were in a block 3 or more storeys high.

Table 17 Hard to Treat Dwellings by Hard to Treat Cavities (000s and %): 2010

	Hard to treat cavity				Total
	No		Yes		
	000s	col %	000s	col %	
No, not hard to treat	1,477	69	176	76	1,653
Yes, hard to treat wall insulation	621	29	23	10	645
Yes, hard to treat roof insulation	15	1	9	4	24
Yes, wall and roof insulation both hard to treat	11	1	4	2	15
Yes, highrise, any insulation hard to treat	3	0	18	8	21
Total	2,127	100	231	100	2,357

77. The majority (76%) of dwellings which have hard to treat cavities are not classified under the standard Hard to Treat definition.

Location of dwellings

78. Based on the Scottish Government definition of rural²¹, 83% of dwellings are in urban areas and 17% are in rural areas. The characteristics of dwellings in these two categories are very different.

Table 18 Dwellings by urban/ rural classification (000s and %): 2010

	000s	%
Urban	1,953	83
Rural	404	17
All dwellings	2,357	100

79. One-third (33%) of the dwellings in rural areas are old, dating from pre-1919, compared with 17% in urban areas (Table 19). Between 1919 and 1982 a disproportionately large number of houses were built in urban areas. However, since 1982 there has been an increase in housing in rural areas; in the post-1982 period 22% of dwellings were built in rural areas, an equal proportion to urban areas.

Table 19 Age of dwelling by urban/ rural (000s and %): 2010

	Urban-rural indicator			
	urban		rural	
	000s	%	000s	%
pre-1919	323	17	132	33
1919-1944	264	14	34	8
1945-1964	482	25	72	18
1965-1982	462	24	76	19
post 1982	421	22	90	22
All dwellings	1,953	100	404	100

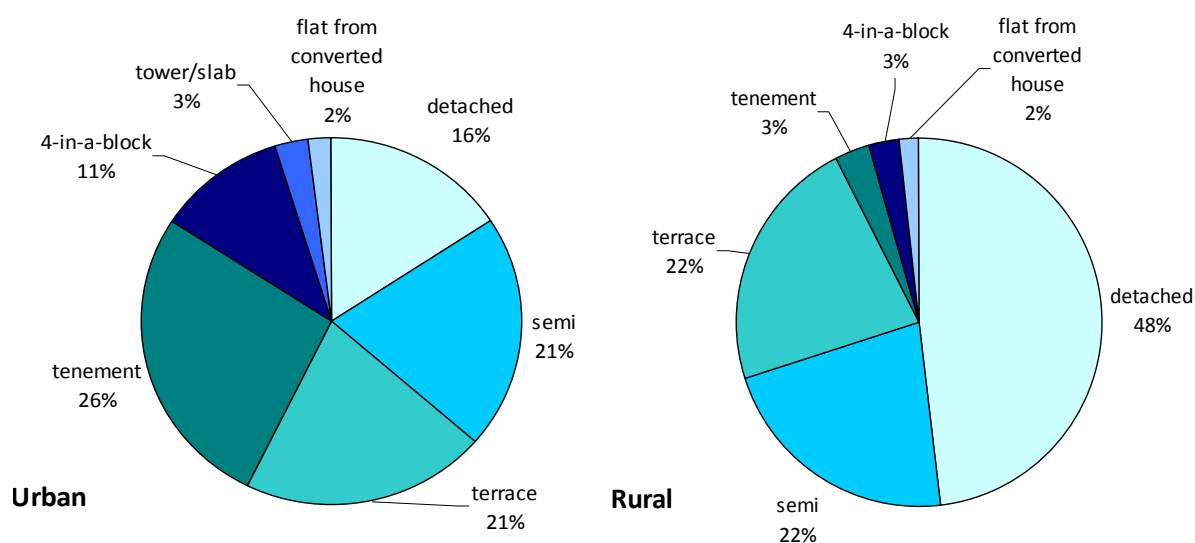
80. Dwelling type also differs by location (Table 20), with 92% of dwellings in rural areas being houses and 8% being flats, compared with 57% houses and 43% flats in urban areas. Moreover, in contrast to urban areas, a much high proportion of the houses in rural areas are detached rather than terraced or semi-detached.

Table 20 Type of dwelling by urban/ rural (000s and %): 2010

	Urban-rural indicator			
	urban		rural	
	000s	%	000s	%
detached	308	16	194	48
semi	405	21	89	22
terrace	407	21	90	22
All houses	1,120	57	374	92
tenement	523	27	13	3
4-in-a-block	215	11	11	3
tower/slab	56	3	-	-
flat from converted house	39	2	7	2
All flats	833	43	31	8
All dwellings	1,953	100	404	100

²¹ <http://www.scotland.gov.uk/Topics/Statistics/About/Methodology/UrbanRuralClassification>

Figure 16 Type of dwelling by urban/ rural: 2010



81. There is a corresponding tendency for dwellings in rural areas to be larger than their urban counterparts, both in terms of the number of rooms and internal floor area. 25% of dwellings in urban areas have an internal floor area of greater than 110 m² compared to 51% in rural areas (Table 21).

Table 21 Floor area of dwelling by urban/ rural (000s and %): 2010

	Urban-rural indicator			
	urban		rural	
	000s	%	000s	%
<50m2	176	9	13	3
50 - 69 m2	367	19	38	9
70 - 89 m2	534	27	66	16
90 - 109 m2	381	20	82	20
110 m2 +	495	25	205	51
All dwellings	1,953	100	404	100

82. Wall construction also varies between urban and rural areas, with a much higher proportion of rural dwellings having solid walls. This is because of the higher proportion of older dwellings in rural areas.

Table 22 Principal external wall construction by urban/ rural (000s and %): 2010

	Urban-rural indicator			
	urban		rural	
	000s	%	000s	%
Solid	417	21	147	36
Cavity	1,494	76	253	63
Other	42	2	5	1
All dwellings	1,953	100	404	100

83. Because of the greater proportion of solid walled dwellings and also a higher proportion of pre 82 timber frame dwellings (4% in rural areas, compared to 2% in urban) there is much higher proportion of dwellings that are considered Hard to Treat. In rural areas 42% of the stock is HtT compared to 27% in urban areas. (Table 23)

Table 23 Hard to treat dwellings by urban/ rural (000s and %): 2010

	Urban-rural indicator			
	urban		rural	
	000s	%	000s	%
No, not hard to treat	1,418	73	235	58
Yes, hard to treat wall insulation	477	24	168	41
Yes, hard to treat roof insulation	24	1	-	-
Yes, wall and roof insulation both hard to treat	13	1	2	1
Yes, highrise, any insulation hard to treat	21	1	-	-
All dwellings	1,953	100	404	100

Table 24 Dwellings with Hard to Treat cavities by urban/ rural (000s and %): 2010

	Urban		Rural	
	000s	col %	000s	col %
No, not hard to treat cavity	1,730	89	397	98
Hard to treat cavity	223	11	7	2
Total	1,953	100	404	100

84. Hard to treat cavities are a lot less common in rural areas compared to urban areas. The main reason for this is that cavity walls are less common in rural areas compared to urban (Table 22), plus the most common type of hard to treat cavity (a flat in a block of 3 or more storeys) is also a lot less common, 9% in urban areas compared to less than 1% in rural.
85. As well as a higher proportion of housing being HtT in rural areas there is also the added problem that 46% of rural dwellings are off gas grid, compared to 1% of urban dwellings. This means that one of the most energy efficient and cheapest fuels is not available to rural households for heating and cooking purposes. Not only does this mean that the energy efficiency of dwellings is lower in rural areas, it also effects the proportion of households that are fuel poor. See Table 2 for cost and CO₂ per kWh for different fuels.

Table 25 Dwellings on/off gas grid by urban/ rural classification (000s and %): 2010

	Urban			Rural		
	000s	Row %	Col %	000s	Row %	Col %
On gas grid	1,941	90	99	218	10	54
Off gas grid	12	8	1	185	92	46
All Dwellings	1,953	83	100	403	17	100

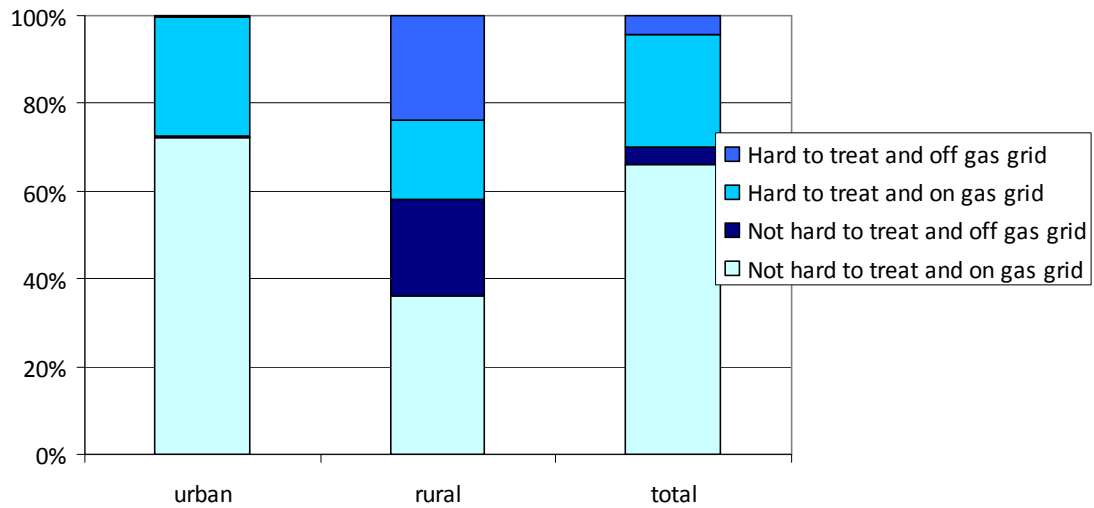
86. Below Table 26 highlights that in rural areas 24% of the stock is both off the gas grid and hard to treat, this compares to less than 1% in urban areas. On average the most simple and cost effective type of dwelling to improve the energy efficiency of will be

a non hard to treat, on gas grid dwelling. In urban areas 72% of the stock is this type of dwelling, however in rural areas it accounts for just 36% of the stock.

Table 26 Dwellings on/off gas grid by urban/ rural classification (000s and %): 2010

	urban		rural		Total	
	000s	Col %	000s	Col %	000s	Col %
Not hard to treat and on gas grid	1,411	72	145	36	1,556	66
Not hard to treat and off gas grid	8	0	89	22	97	4
Hard to treat and on gas grid	530	27	73	18	603	26
Hard to treat and off gas grid	4	0	97	24	101	4
All dwellings	1,953	100	404	100	2,357	100

Figure 17 Dwellings on/off gas grid by urban/ rural classification (000s and %): 2010



Chapter 3: Energy Efficiency Ratings

Key Findings – Scottish House Condition Survey 2010

- The majority of dwellings (40%) have a SAP (2005) rating between 61 and 70.
- 62% of dwellings are rated NHER 'good', compared to just 7% in 1991.
- The proportion of dwellings rated as 'poor' has improved too with just 3% of dwellings rated poor in 2010, compared to 17% in 1991.
- The SHCS can approximate levels of EPC and this data shows that most homes in Scotland would have an approximate energy efficiency rating of D (44%) or C (32%).
- 52% of all dwellings pass the energy efficiency criteria of the Scottish Housing Quality Standard, with 56% of social housing passing, compared to 51% of private housing.
- Since 2003/04 the percentage of dwellings passing the SHQS energy efficiency criteria has increased from 39% to 52% in 2010.
- Cavity wall insulation (CWI) is the element which the highest proportion of dwellings failed on. In 2010, 23% of dwellings failed this element.

87. The Scottish Government measures energy efficiency using two methodologies: the National Home Energy Rating (NHER) and the UK Government's Standard Assessment Procedure for the Energy Rating of Dwellings (SAP).
88. The SAP considers energy used by space heating (with auxiliary equipment), hot water and lighting (under SAP 2005), and uses a single UK climate source in East Yorkshire.
89. The NHER considers all energy use in the home including cooking and electrical appliances and allows for regional and geographic climate variations. Both measures are modelled using standard heating regimes²² and do not take into account the behaviours of individual households.

Standard Assessment Procedure (SAP)

90. The Standard Assessment Procedure (SAP) is the UK Government's recommended method for measuring the energy rating of residential dwellings. It calculates the typical annual energy costs for space and water heating and lighting.
91. The calculation is based on energy consumption taking into account a range of factors that contribute to energy efficiency:

²² Nine hours per 24 hour period during the week, with two hours being in the morning and seven hours in the evening and 16 hours per 24 at the weekend. The living-room heated to 21°C and rest of the house heated to 18°C.

- materials used for construction of the dwelling
- thermal insulation of the building fabric
- ventilation characteristics of the dwelling and ventilation equipment
- efficiency and control of the heating system(s) and hot water
- solar gains through openings of the dwelling
- the fuel used to provide space and water heating, ventilation and lighting
- renewable energy technologies.

92. The calculation is independent of factors related to the individual characteristics of the household occupying the dwelling when the rating is calculated, for example:

- household size and composition
- ownership and efficiency of particular domestic electrical appliances
- individual heating patterns and temperatures.

93. SAP ratings are not effected by regional or climatic conditions, so that a given dwelling would have the same rating in all parts of the UK.

94. SAP 2009 is the most up-to-date SAP system for rating the energy efficiency of existing dwellings, however throughout this report we will report on SAP (2005). It is scaled from 1 (poor) to 100 (excellent). A score of 100 would indicate that there are zero energy costs.

95. In 2010, the majority of dwellings (40%) had a SAP (2005) rating between 61 and 70. The mean SAP rating is 62 and the median 64, both of these show a statistically significant improvement on 2009 figures of 64 and 66 respectively (Table 27).

96. This improvement in SAP (2005) scores is likely due to the increase in the number of homes with wall insulation and the increase in dwellings with loft insulation as well as some homes benefiting from top up insulation (see Chapter 4).

Table 27 Dwellings by SAP (2005) scores (000s and Column %): 2010

Banded SAP 2005	000s	%	<i>Unweighted sample size</i>
1-10	3	0	8
11-20	14	1	24
21-30	31	1	45
31-40	85	4	120
41-50	231	10	345
51-60	495	21	739
61-70	939	40	1,182
71-80	512	22	588
81-90	21	1	22
91-100			
Sub-total	2,330	99	3,073
Unobtainable	27	1	42
Total	2,357	100	3,115
Median	64	+/- 95% Confidence	
Mean	61.9	61.5	62.3

97. As can be seen in Table 27 and Figure 18, most dwellings have a SAP rating between 41 and 80, only 1% of dwellings have a SAP greater than 80 and none have a SAP greater than 90. About 6% of dwellings have a SAP less than 40.

Figure 18 SAP(2005) score (000s of dwellings) : 2010

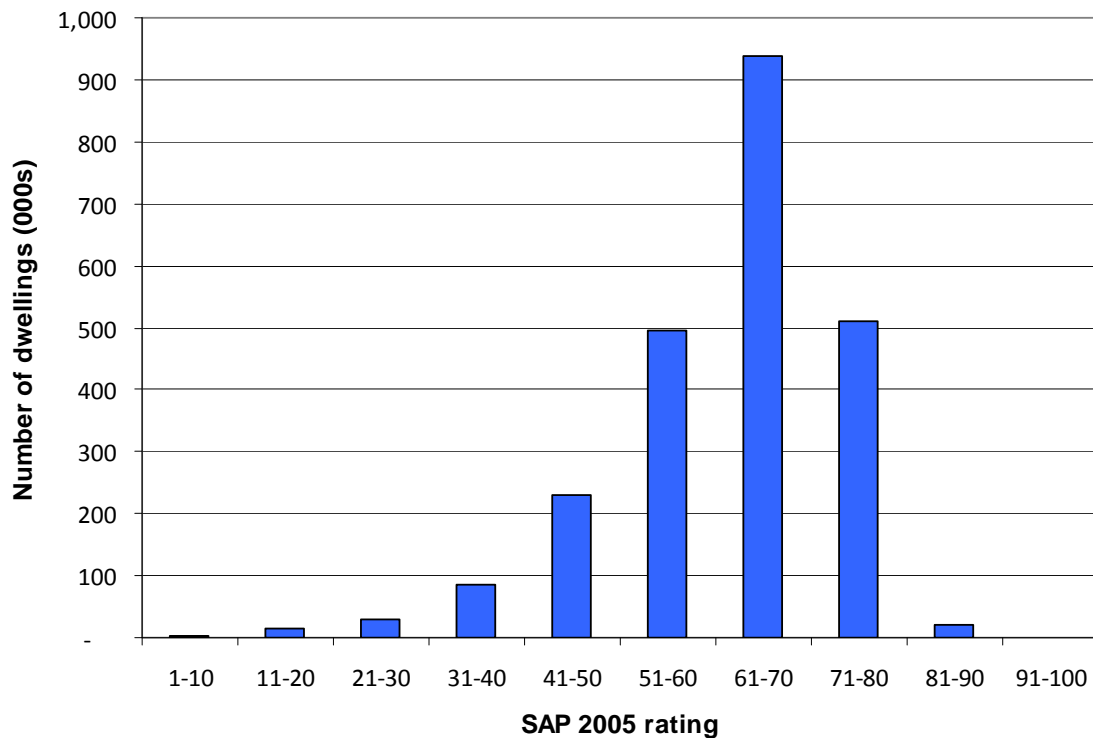


Table 28 Mean SAP score by dwelling age and type: 2010

Age of dwelling	Detached	Semi	Terrace	Tenement	Other flat	Total
pre-1919	41	51	57	62	56	54
1919-1944	49	58	65	63	67	61
1945-1964	53	59	64	67	66	62
1965-1982	55	62	65	64	65	62
post 1982	65	68	70	72	69	68
Total	55	60	64	66	65	62

98. Table 28 highlights the difference in energy efficiency by dwelling age and type. As expected, the older the property the lower the mean SAP score. Detached pre 1919 dwellings have the lowest mean SAP score at 41, compared to post 82 tenement flats which have a mean SAP score of 72.

National Home Energy Rating (NHER)

99. The National Home Energy Rating Scheme (NHER) is a rating scale for the energy efficiency of housing. The NHER calculation uses similar data to the SAP calculation but includes more detail on occupancy, location and appliance use to give a more accurate calculation of energy consumption, CO₂ emissions and running costs for a given dwelling.
100. NHER has been the preferred method of evaluating the energy efficiency of the housing stock in Scotland through the Scottish House Condition Survey. Using the SAP methodology energy efficiency is calculated using a constant climate variable. The outcome of this is that the same dwelling in South England and in the Highlands would receive the same SAP rating. This would imply that it takes the same amount of energy to heat both dwellings to the same temperature – it would not. The NHER methodology takes into account local temperature, wind speed and exposure values. As a result it would calculate that a dwelling in an exposed, northern area of Scotland would consume more energy than the same dwelling in a sheltered town in the Borders to heat to the same temperature.

Example

Table 29 The modelled fuel used (Kwh), based on a standard heating regime, across Scotland to heat a semi-detached house with gas central heating and non-white meter electric heating and how this compares to Bristol.

Location	Postcode	Gas Central Heating	Electric Room Heaters	Gas Central Heating	Electric Room Heaters
		Energy (Kwh)		% more than Bristol	
Braemar	AB35 5YL	19,300	12,300	55.6	57.5
Stornoway	HS1 2RN	18,700	11,800	50.8	51.1
Aberdeen	AB11 5QP	18,100	11,500	46.0	47.3
Edinburgh	EH15 1LF	14,800	9,300	19.4	19.1
Dundee	DD2 4PF	15,200	9,600	22.6	23.0
Glasgow	G3 6HB	14,400	9,100	16.1	16.5
Bristol	BS8 1HP	12,400	7,800	-	-

Source: Scottish House Condition Survey

From this data and using a standard price²³ to consumer of 3.62p per Kwh natural gas and 12.95p per Kwh electricity, the variable heating charges (excluding standing charges) can be calculated as follows:

Gas

Braemar £699
 Edinburgh £536
 Bristol £449

Electricity

Braemar £1,593
 Edinburgh £1,204
 Bristol £1,011

Fuel bills in practice will vary depending on utility provider, usage and standing charges. However the above shows that cost differences depending on location/heating season are significant.

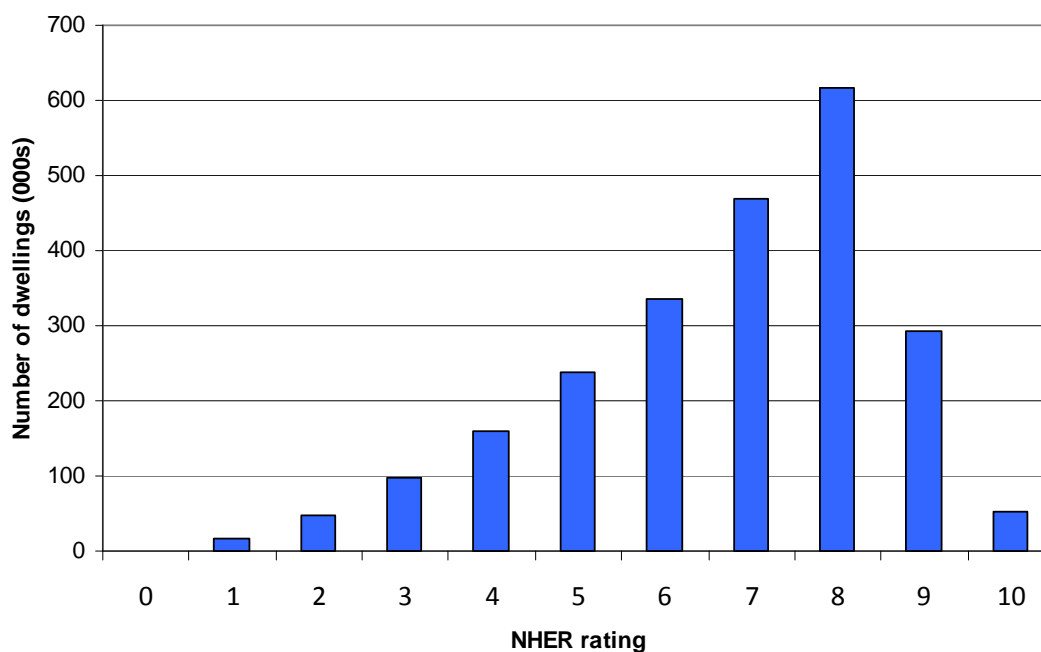
101. The SHCS uses an enhanced level 0 NHER which rates dwellings on a scale of 0 (poor) to 10+(excellent) based on the total energy costs per square metre of floor area.

²³ Prices as at October 2011

Table 30 Dwellings by NHER scores (000s and Column %): 2010

NHER band	NHER score	000s	Unweighted	
			%	sample size
Poor	0	1	0	5
	1	18	1	28
	2	48	2	78
Moderate	3	98	4	161
	4	159	7	251
	5	238	10	363
	6	336	14	450
Good	7	470	20	605
	8	617	26	745
	9	294	12	334
	10	53	2	53
Sub-total		2,330	99	3,073
Unobtainable		27	1	42
Total		2,357	100	3,115
Median		7.1		
		95% Confidence Interval		
		lower	upper	
Mean		6.7	6.6	6.8

Figure 19 NHER score (000s of dwellings) : 2010



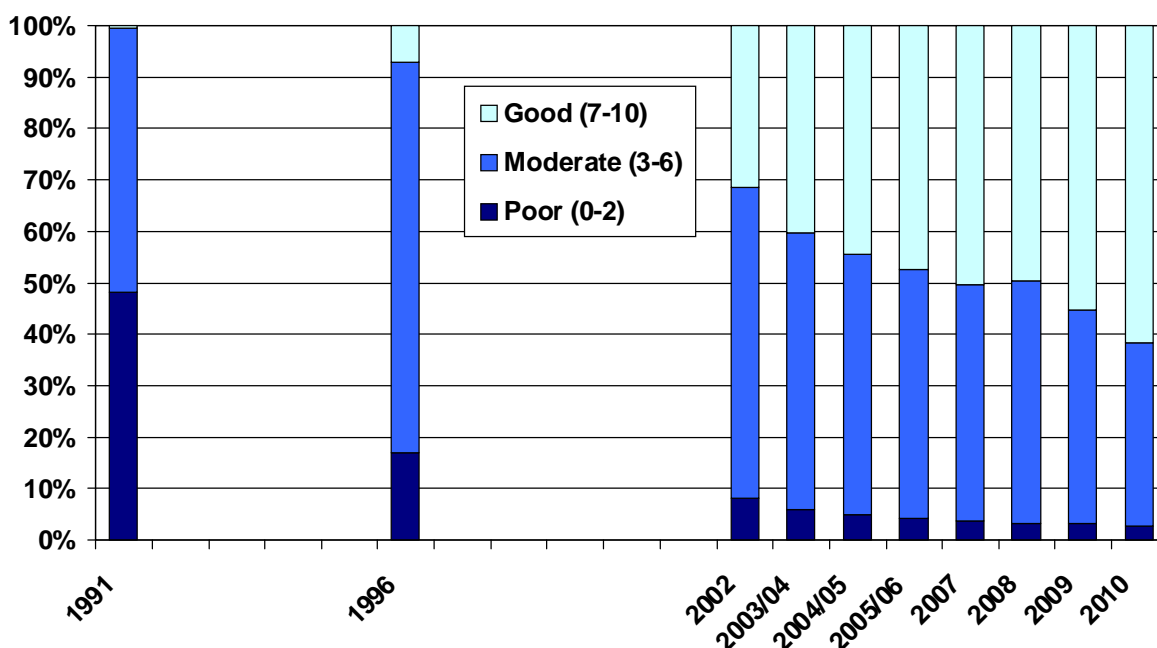
102. NHER ratings can be combined into grouped bands. Dwellings rated 7 or more are labelled as 'good' energy efficiency, those with a score between 3 and 6 are rated 'moderate' and those rated 2 or less are 'poor'. Table 31 shows that, in 2010, 62% of dwellings were rated 'good' and 3% 'poor'.

Table 31 NHER bands (000s and %): 2010

NHER band	000s	%	<i>Unweighted sample size</i>
Poor (0-2)	66	3	111
Moderate (3-6)	831	36	1,225
Good (7-10)	1,433	62	1,737
Unobtainable	27		42
Total	2,357	100	3,115

103. Since 1991 there has been a statistically significant improvement in the NHER rating of dwellings. In 1991 less than 1% of all dwellings were rated 'good', compared to 62% in 2010. The proportion of dwellings rated as 'poor' has improved too, with just 3% of dwellings rated poor in 2010, compared to almost 50% in 1991.
104. This vast improvement since 1991 is down to a number of factors which have led to the increased energy efficiency of the building stock. Stricter building regulations mean new homes are now a lot more energy efficient, the percentage of homes with double glazing has increased from 46% to 92% since 1991, any boilers replaced in this period will be a lot more efficient and increased proportions of homes now have effective loft and wall insulation (see Chapter 4 for more information).

Figure 20 NHER bands: 1991 to 2010



105. Table 32 shows NHER banding by dwelling characteristics. Houses have lower energy efficiency than other types of dwellings because more of their walls are exposed, resulting in increased heat loss. Hence, terraced houses generally have higher energy efficiency ratings than detached houses.
106. Flats tend to have higher energy efficiency ratings than houses. The majority of tenements and other flats have 'good' energy ratings, whereas under half of detached houses are rated 'good' (Table 32).

107. Newer dwellings are more likely to have a 'good' energy efficiency rating than older dwellings; 85% of dwellings built after 1982 have a 'good' energy efficiency rating compared to 40% of the pre-1919 occupied stock. Less than 1% of dwellings built after 1982 have 'poor' NHER ratings compared to 8% of those built before 1919 (Table 32).
108. Only about 2% of the housing stock has no central heating. A further 3% have only partial central heating. Of those without central heating, 39% have 'poor' NHER ratings, compared to just 2% of those with full central heating. Over 60% of those with full central heating have 'good' ratings, whereas no dwelling without central heating has a 'good' rating (Table 32).
109. Primary heating fuel has a significant effect on the NHER of a dwelling. In 2010, just 1% of households that used gas as their primary heating fuel had a 'poor' NHER, compared to 9% that used electricity, and around 12% of those who used oil or other fuels (Table 32).
110. 68% of dwellings in urban areas have a 'good' NHER rating compared with 29% of those in rural areas. Urban dwellings are also about eleven times less likely to be rated 'poor' than those in rural areas.

Table 32 NHER band by dwelling characteristics (%): 2010

	Poor	Moderate	Good	Total	<i>Unweighted sample size</i>
Type of Dwelling					
Detached	8	46	46	100	768
Semi detached	2	48	51	100	711
Terraced	1	31	68	100	669
Tenement	2	24	74	100	525
Other flats	1	26	73	100	400
Age of Dwelling					
Pre-1919	8	51	40	100	542
1919-1944	2	37	60	100	396
1945-1964	2	36	62	100	750
1965-1982	1	41	58	100	730
Post-1982	0	15	85	100	655
Extent of Central Heating					
Full	2	34	64	100	2,909
Partial	5	68	27	100	115
No central heating	39	61	-	100	49
Primary Heating Fuel					
Gas	1	28	72	100	2,244
Oil	13	78	9	100	250
Electric	9	61	30	100	478
Other fuel type	12	54	34	100	99
Urban/Rural					
Urban	1	31	68	100	2,366
Rural	11	60	29	100	707
Gas Grid					
On Gas Grid	1	32	66	100	2,616
Off Gas Grid	18	72	9	100	457
All Scotland	3	36	62	100	3,073

Energy Performance Certificates (EPC's)

111. Energy Performance Certificates (EPCs) were introduced to promote improvements to the energy efficiency of buildings. Under the Energy Performance of Buildings Directive (EPBD), all EU member states must promote improvement in the energy performance of new and existing buildings. An EPC must be provided to all prospective buyers or tenants. From 1 October 2012 the EPC rating will have to be provided within in any advertisement in the commercial media.
112. An EPC is a document which states the energy efficiency and environmental impact of a dwelling and also provides cost effective recommendations on improving energy efficiency, reducing carbon dioxide emissions and fuel bills.

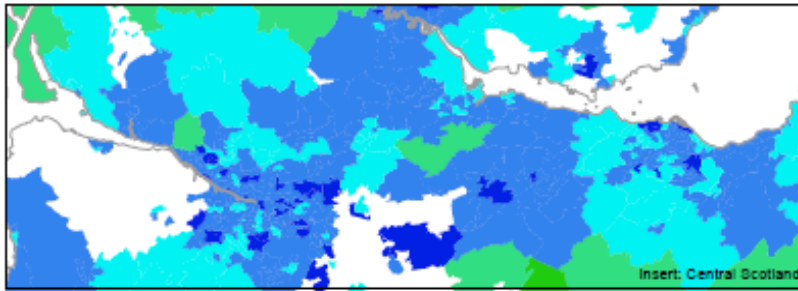
113. The calculation of the energy efficiency rating (EER) on an EPC for existing dwellings is based on the reduced data SAP (RdSAP) , which is a simplified version of the SAP methodology. Dwellings are given an EER on a scale of A and G, where A is the most energy efficient and G the least.
114. The Scottish House Condition Survey (SHCS) collects data that allows the EER element of domestic EPCs to be approximated based largely on the same dwelling data as the official EPC EERs but using SAP rather than RdSAP.

Table 33 Approximated EPC rating (000s and %): 2010

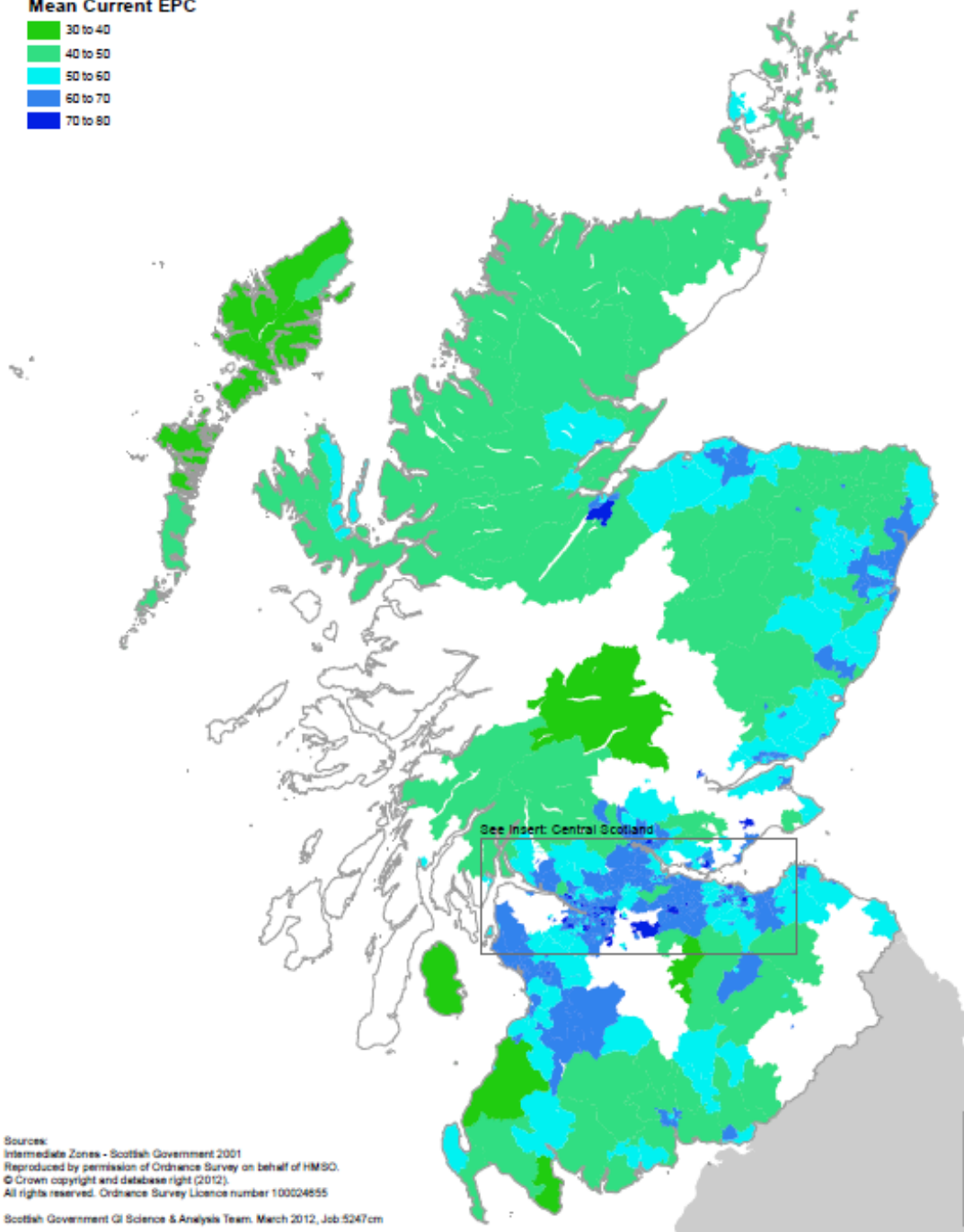
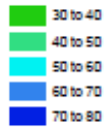
EPC rating	000's	%	<i>Unweighted sample size</i>
A			
B	21	1	22
C	744	32	875
D	1,031	44	1,363
E	435	18	665
F	82	3	116
G	17	1	32
Unobtainable	27	1	42
All Scotland	2,357	100	3,115

115. The SHCS estimates that the majority of dwellings in Scotland would be rated as band D or C. Only about 1% of dwellings would be rated B and none were found in the 2010 sample that would be rated an A.
116. All EPCs produced for existing buildings must be lodged on the EPC register, held by the Energy Saving Trust. All EPCs for new dwellings will also be registered from January 2013.
117. The below map uses data from the EPC register to map the mean current EPC rating by intermediate geography. The green areas represent areas where the mean EPC rating in that region is less than 50 (an E or less). As the map shows the majority of rural areas have a mean EPC of less than 50 and the more urban central belt and larger cities tend to have mean EPC ratings of greater than 50. The white areas represent areas where the number of EPC's registered is not large enough to provide a reliable estimate.

Mean Current EPC



Mean Current EPC



Sources:
Intermediate Zones - Scottish Government 2001
Reproduced by permission of Ordnance Survey on behalf of HMSO.
© Crown copyright and database right (2012).
All rights reserved. Ordnance Survey Licence number 100024655

Scottish Government GI Science & Analysis Team, March 2012, Job 5247cm



Scottish Housing Quality Standard (SHQS)

118. The Scottish Housing Quality Standard (SHQS) was announced by the (then) Minister for Communities in February 2004²⁴. A target was set that all social landlords must ensure that all their dwellings pass the SHQS by 2015. Private owners and private landlords are currently under no obligation to bring their properties up to a standard which meets the SHQS.
119. The SHQS is an aggregation of the results from about 60 different programme modules aggregated into 5 higher-level classifications which in turn provide a single pass/fail classification for all dwellings. The 5 higher-level criteria are that the dwelling must be:
- Above the statutory Tolerable Standard;
 - Free from serious disrepair;
 - Energy efficient;
 - With modern facilities and services;
 - Healthy, safe and secure.
120. The majority of dwellings that fail the SHQS fail on the energy efficiency criteria. In this report we will focus only on the Energy Efficiency criteria.
121. The SHQS Energy efficiency criteria consists of 5 elements, in order to pass the energy efficiency criteria a dwelling must have:
- Cavity wall insulation (where appropriate)
 - At least 100mm minimum of existing loft insulation e.g. glass wool or equivalent (or 270mm for first time insulation or first time additional insulation or as a further measure to reduce carbon)
 - Hot water tank and pipe insulation and cold water tank insulation as an ancillary measure
 - Full and efficient central heating
 - A minimum energy efficiency rating of either NHER 5 or SAP(2001) of 50 (gas systems) or 60 (electric systems).
122. Since 2003/4 there has been a steady improvement in the SHQS energy efficiency pass rate, in 2010 52% of all dwellings passed, compared to 38% in 2003/04. The social sector has consistently performed better than the private sector, although the difference between the two tenures is beginning to decrease and in 2010 the difference was not statistically significant.

²⁴ For more information see letter and notes at:

<http://www.scotland.gov.uk/Publications/2004/02/18860/32772>

Table 34 SHQS Energy Efficiency criteria pass rate by tenure (%): 2003/04 – 2010

	Private	Social	All
2003/04	35	43	38
2004/05	38	50	41
2005/06	41	52	44
2007	47	51	48
2008	45	60	49
2009	50	58	52
2010	51	56	52

Table 35 Count of SHQS Energy Efficiency element failures (%): 2003/04 - 2010

	2003/04	2004/05	2005/06	2007	2008	2009	2010
None	39	43	46	48	49	52	52
1 element failure	30	29	30	32	32	30	29
2 element failures	18	17	15	15	14	13	12
3 element failures	10	8	7	4	5	4	5
4 element failures	2.8	2.9	2.3	0.7	0.7	0.5	1.3
5 element failures	0.3	0.2	0.2				0.2
Total	100	100	100	100	100	100	100

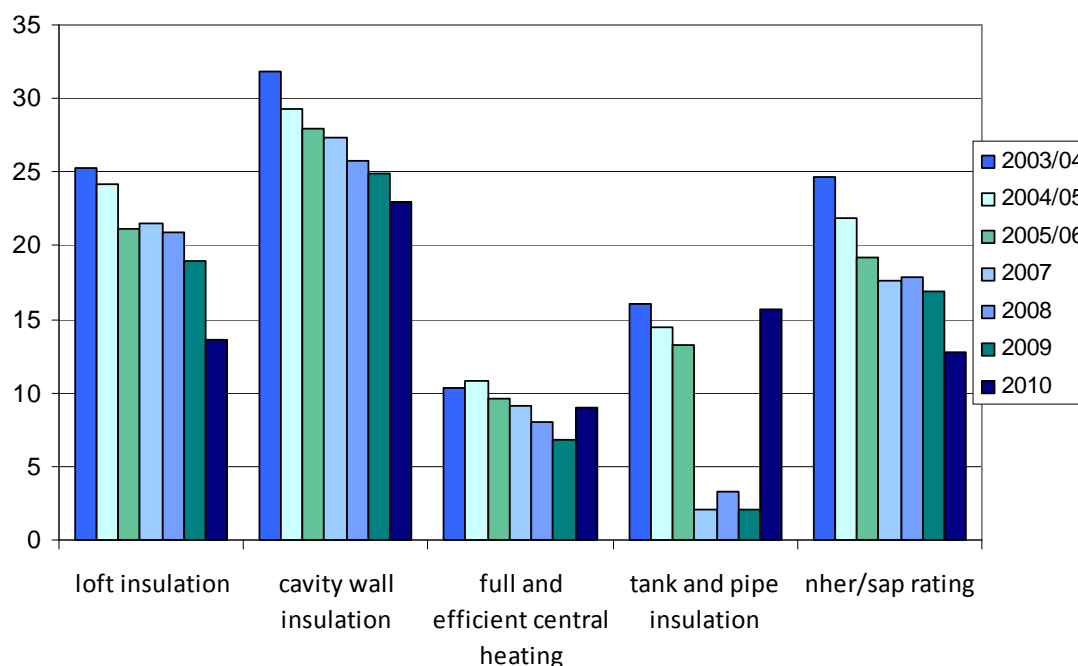
123. As well as a higher percentage of dwellings passing the SHQS energy efficiency criteria, the percentage of dwellings with 2 or more element failures has also decreased from 31% in 2003/4 to 19% in 2010. The total number of element failures within the Energy Efficiency criteria has decreased from 2.5 million in 2003/4 to 1.7 million in 2010. This indicates that even the dwellings which do not pass the energy efficiency criteria at present are improving their energy efficiency.

Table 36 SHQS Energy Efficiency element failure rate by tenure (%): 2003/04 – 2010

		2003/04	2004/05	2005/06	2007	2008	2009	2010
Loft insulation	Private	30	29	25	25	25	23	17
	Social	12	12	10	11	10	10	6
	All	25	24	21	21	21	19	14
Cavity wall insulation	Private	30	28	28	24	26	23	21
	Social	36	32	28	36	25	31	27
	All	32	29	28	27	26	25	23
Efficient Full Central Heating	Private	10	10	10	10	8	7	10
	Social	10	12	9	7	7	6	7
	All	10	11	10	9	8	7	9
Tank Insulation	Private	18	17	15	2	4	2	17
	Social	11	9	9	1	2	2	13
	All	16	14	13	2	3	2	16
SAP/ NHER rating	Private	29	25	23	21	22	21	15
	Social	14	13	8	10	8	7	7
	All	25	22	19	18	18	17	13

124. As can be seen in Table 36, social sector dwellings perform better in all SHQS energy efficiency elements apart from cavity wall insulation.

Figure 21 SHQS Energy Efficiency element failure rate (%): 2003/04 – 2010



125. Cavity wall insulation (CWI) is the element which the highest proportion of dwellings fail on. This has been the case since 2003/4, although there has been an improvement since then. In 2003/04 32% of dwellings failed this element, compared to 23% in 2010.
126. CWI is becoming increasingly difficult to identify over time as the injection holes age, fade or are covered up by later work. Contractors are also getting better at disguising their work. As expertise in this area increases more buildings in wetter areas are being deemed unsuitable for CWI. This type of information is not picked up by the survey. The SHCS survey team intend to carry out further work to investigate this problem.
127. Due to improved data collection in 2010, we now have more detailed data on insulation to hot and cold water tanks. The improvement in the data has caused an increase in the failure rate of the tank and pipe insulation element. 2010 failure rates have returned to a similar level as in 2003/04 (16%) compared to just 2% in 2009. In reality this does not mean that tank and pipe insulation has got any worse, just that we were not able to fully identify uninsulated tanks and pipes previously. In 2010, 17% of all households failing the SHQS Energy Efficiency criteria failed on tank and pipe insulation alone, compared to 2% in 2009.
128. The percentage of dwellings failing the loft insulation element has decreased significantly since 2003/04. In 2003/04, 25% of all dwellings failed compared to 14% in 2010. There was a larger than average drop between 2009 and 2010 especially in the private sector, possibly due to the introduction of Government schemes providing free or subsidised loft insulation.
129. The percentage of dwellings with full and efficient central heating has not improved significantly between 2003/04 and 2010. This may be because previous central

heating replacement programmes have run their course and updates are now due. Of those failing this element about 70% fail at least one other element too.

130. The element which has improved most over the period 2003/04 to 2010 is the SAP/NHER element. Between 2003/04 and 2010 the percentage of dwellings failing this element has halved. In 2010, 13% of all dwellings failed this element meaning they have a NHER rating of less than 5 or a SAP2001 rating of less than 50 (gas systems) or 60 (electric systems). This again shows that although every dwelling may not be passing every element quite yet, the energy efficiency of the whole housing stock is steadily improving.

Chapter 4: Energy Efficiency measures

Key Findings

- Since 2003/04 the number of dwellings with no loft insulation has more than halved and in 2010 represented just 3% of dwellings.
- In 2010, the SHCS approximated that there were 321,000 dwellings with less than 100mm loft insulation (virgin lofts) and a further 822,000 dwellings with between 100mm and 200mm loft insulation which would benefit from top up insulation.
- Since 1996 the proportion of insulated cavity walls has increased from 33% to 62% in 2010.
- In 2010, the SHCS estimated that there are approximately 1,213,000 dwellings without wall insulation. Of these 544,000 are suitable for cavity wall insulation and the rest could have internal or external insulation
- In 2010, just under 1% of dwellings had a hot water tank with no insulation, compared to about 2% in 1991.
- Since 1991 there has been a significant increase in the proportion of dwellings with double glazing, from 46% in 1991 to 92% in 2010.
- 25% of all dwellings did not need improvement in any loft, wall, tank and pipe insulation or glazing. A further 38% only needed one improvement and 27% two improvements.

Insulation

131. Installing or upgrading insulation is one of the easiest and most effective ways to improve the energy efficiency of a dwelling. It is estimated that in an average uninsulated house a third of all heat lost is through the walls and a quarter of heat is lost through the roof²⁵.
132. In an amendment to the Housing (Scotland) Act in 2006, the tolerable standard was redefined to include a clause that dwellings must have satisfactory thermal insulation. This means that any dwelling with no loft insulation is Below Tolerable Standard (BTS) and by definition it is not reasonable to expect people to continue to live in a house that falls below this standard. Local authorities have a statutory duty and specific powers to deal with houses that fall below the tolerable standard. This applies to all dwellings in Scotland.

Loft insulation

133. Table 37 and Figure 22 show the levels of loft insulation in all dwellings. A dwelling is classified as 'not applicable' for loft insulation if it has a flat roof or a non heat loss

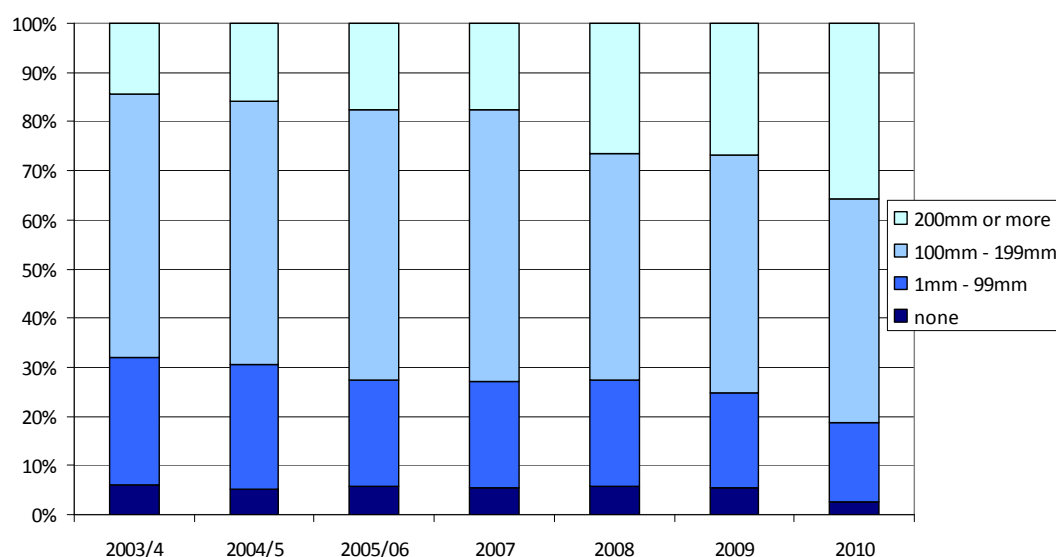
²⁵ <http://www.energysavingtrust.org.uk/scotland/In-your-home/Roofs-floors-walls-and-windows>

roof (has a floor above). Since 2003/04 the number of dwellings with no insulation has more than halved and in 2010 represented just 3% of dwellings which can have loft insulation. In 2010, 628,000 dwellings had 200mm or more loft insulation, a significant increase since 2003/4 when just 258,000 had this depth.

Table 37 Depth of loft insulation (000s): 2003/04 to 2010

Loft insulation	Survey Year						
	2003/4	2004/5	2005/06	2007	2008	2009	2010
none	110	96	104	99	101	96	46
1mm - 99mm	462	460	384	384	386	349	284
100mm - 199mm	953	982	987	987	818	872	806
200mm or more	258	289	315	315	471	485	628
Not applicable	486	472	524	524	555	542	593
All dwellings	2,269	2,301	2,315	2,309	2,331	2,344	2,357
<i>Unweighted total</i>	<i>3,090</i>	<i>3,103</i>	<i>3,147</i>	<i>3,032</i>	<i>3,015</i>	<i>3,346</i>	<i>3,115</i>

Figure 22 Depth of loft insulation (where applicable): 2003/04 – 2010



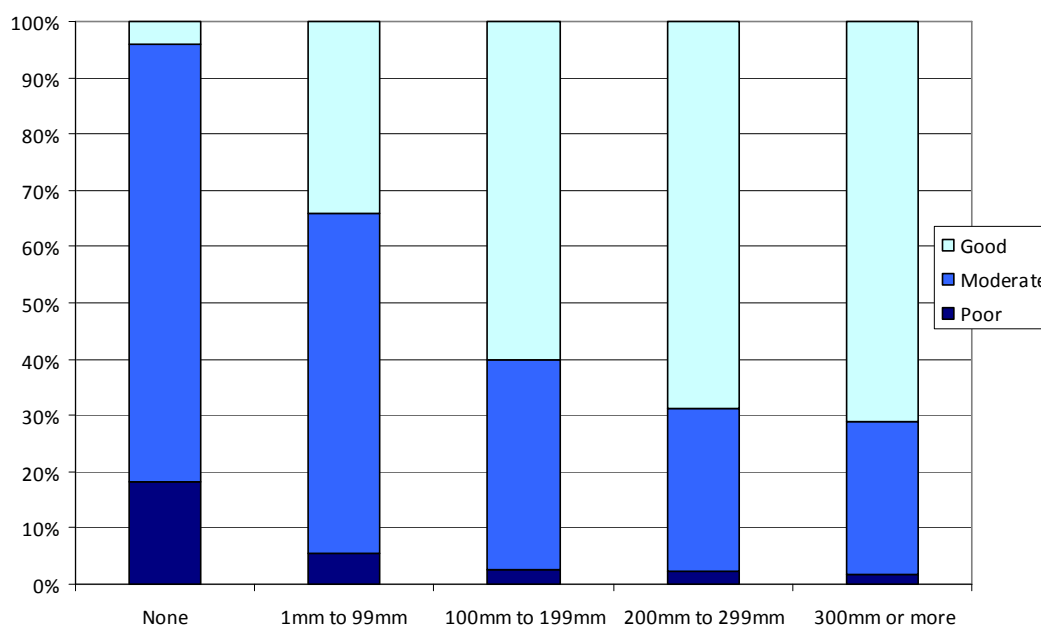
134. Table 38 shows in more detail the depth of loft insulation in 2010. The social sector have a higher proportion of better insulated lofts than the private sector. Less than 1% of social sector dwellings have no loft insulation, compared to 3% of private sector dwellings. One of the reasons behind this is that the Scottish Housing Quality Standard (SHQS) includes the criteria that dwellings must have at least 100mm of loft insulation. All social rented dwellings must meet the SHQS by 2015 (see Chapter 4 for more information).
135. In 2010 more detailed information on the depth of loft insulation was collected. From Table 38 we can see that 6% of dwellings (with a loft) in Scotland have 300mm or more of loft insulation and just 46,000 (3%) dwellings have no loft insulation at all.

Table 38 Depth of loft insulation (000s and %) (2010)

Roof/loft insulation	Private Sector		Social Sector		Total	
	000s	%	000s	%	000s	%
None	46	3	1	0	46	3
1mm - 99mm	243	18	41	10	284	16
100mm - 199mm	641	47	165	42	806	46
200mm - 299mm	379	28	151	38	530	30
300mm and more	64	5	34	9	98	6
Sub-total	1,373	100	392	100	1,764	100
Flat roof unmeasured	15		10		25	
Not Applicable	318		249		568	
Unobtainable	1				1	
All dwellings	1,707		650		2,357	
Unweighted total	2,292		823		3,115	

136. Below, Figure 23 illustrates the depth of loft insulation by NHER band. It shows that less than 5% of dwellings with no loft insulation are rated 'good' and almost 20% are rated 'poor'. More than 60% of dwellings with at least 100mm of loft insulation have a 'good' NHER rating.

Figure 23 Depth of loft insulation (where applicable) by NHER band: 2010



137. Table 39 below looks at the depth of loft insulation by urban rural classification. There is not much difference between urban and rural dwellings on average. 17% of urban dwellings have less than 100mm of loft insulation, compared to 20% of rural properties. However 38% of rural dwellings have 200mm or more compared to 34% of urban properties.

Table 39 Depth of loft insulation by urban/ rural classification (000s and %) (2010)

	urban		rural		Total	
	000s	%	000s	%	000s	%
None	29	2	13	3	42	2
1mm to 99mm	213	15	66	17	279	16
100mm to 199mm	658	48	164	42	822	47
200mm to 299mm	404	29	123	32	527	30
300mm or more	72	5	22	6	94	5
Sub total	1,377	100	387	100	1,764	100
Flat roof (unmeasured)	25		0		25	
Non heatloss roof	551		16		568	
Group Total	1,953		404		2,357	

Table 40 Depth of loft insulation (where applicable) by Hard to Treat and on/off gas grid (column %) (2010)

	Not hard to treat and on gas grid	Not hard to treat and off gas grid	Hard to treat and on gas grid	Hard to treat and off gas grid	Total
None	1	0	7	5	2
1mm to 99mm	14	14	20	23	16
100mm to 199mm	48	43	42	43	47
200mm to 299mm	31	37	26	27	30
300mm or more	6	6	4	2	5
Sub total	100	100	100	100	100

138. Hard to treat dwellings are more likely to have less loft insulation than non hard to treat dwellings. About 27% of hard to treat dwellings have less than 100mm of loft insulation, compared to 15% of not hard to treat dwellings.
139. When looking at improving loft insulation in dwellings, there are two categories: virgin lofts and top ups. A virgin loft is defined here as a loft which has less than 100mm of loft insulation and lofts which have between 100mm and 200mm of loft insulation are assumed appropriate for top up insulation.
140. In 2010, approximately 321,000 dwellings were suitable for virgin loft insulation and a further 822,000 were suitable for top up insulation.

Table 41 Potential to upgrade loft insulation (where applicable) by urban/ rural classification (000s and %) (2010)

	urban		rural		Total	
	000s	%	000s	%	000s	%
virgin loft	242	18	79	20	321	18
top up insulation possible	658	48	164	42	822	47
200mm or more already present	477	35	145	37	621	35
Group Total	1,377	100	387	100	1,764	100

Wall insulation

141. Most types of walls can be insulated in one way or another. In Scotland 74% of external walls are cavity walls and 24% are solid walls. Other types include steel

frame dwellings and dwellings made from pre-fabricated concrete, these types may be classified as 'hard to treat'.

142. Insulating cavity walls is relatively inexpensive and is one of the best ways to improve the energy efficiency of a dwelling. Cavity walls are most likely to be prevalent in homes built from 1920 onwards where the external walls are made of two layers with a small gap or 'cavity', at least 50mm wide, between them. Insulating cavity walls is filling this gap.
143. Cavity wall insulation (CWI) is becoming increasingly difficult for surveyors undertaking the SHCS to identify as over time the injection holes age, fade, are covered up by later work or better concealed by building contractors. This may mean that the SHCS under-estimates the number of homes with CWI.
144. CWI is not suitable for dwellings located in exposed wet areas²⁶. The survey is unable to collect this information, so could be overestimating the number of cavities which could be filled.
145. Table 42 shows the number and percentage of external walls which are insulated. Solid and other wall types are less likely to have insulation than cavity walls (see Chapter 2 for discussion of wall types). Since 1996 the proportion of insulated cavity walls has increased from 33% to 62% in 2010, this includes CWI and internal or external insulation. This compares to 6% of solid/other walled dwellings with insulation in 1996, rising to 11% in 2010.

Table 42 External wall insulation by wall construction, 1996 to 2010

		Solid/Other			Cavity			All dwellings
		Not insulated	Insulated	Sub total	Not insulated	Insulated	Sub total	
1996	000s	585	37	622	1,008	493	1,500	2,122
	%	94	6	100	67	33	100	
2002	000s	545	32	577	940	676	1,615	2,192
	%	94	6	100	58	42	100	
2003/04	000s	522	35	557	892	820	1,712	2,269
	%	94	6	100	52	48	100	
2004/05	000s	519	39	558	851	891	1,742	2,301
	%	93	7	100	49	51	100	
2005/06	000s	493	31	524	823	968	1,791	2,315
	%	94	6	100	46	54	100	
2007	000s	523	50	573	816	924	1,740	2,313
	%	91	9	100	47	53	100	
2008	000s	541	56	597	766	967	1,733	2,330
	%	91	9	100	44	56	100	
2009	000s	540	57	597	732	1,015	1,747	2,344
	%	90	10	100	42	58	100	
2010	000s	542	68	611	671	1,076	1,747	2,357
	%	89	11	100	38	62	100	

Note: All post 82 dwellings are assumed to have been insulated when built.

146. Table 43 looks in more detail at cavity wall insulation. In 2010, 46% of social dwellings had insulated cavity walls (34% CWI and 12% internal or external insulation), compared to 29% of private sector dwellings.

²⁶ These areas are likely to experience driving rain which could penetrate walls and cause damp.

147. Within the Energy Efficiency criteria of the SHQS there is an element which states cavity walls should be insulated where technically viable. Either cavity wall insulation or external or internal insulation is acceptable. There is a higher number and proportion of social sector cavity wall dwellings which have internal or external insulation compared to private sector dwellings. This is most likely due to the fact that dwellings in exposed sites cannot have cavity wall insulation but must be insulated to pass the SHQS.

Table 43 Cavity wall insulation by tenure: 2010

Cavity wall insulation	Private Sector		Social Sector		Total	
	000s	%	000s	%	000s	%
No - not technically viable*	484	40	122	22	605	35
No - but should be possible	368	31	176	32	544	31
Yes - CWI	312	26	184	34	496	28
Yes - internal or external insulatio	33	3	67	12	99	6
All cavity wall dwellings	1,197	100	548	100	1,745	100
Solid/Other - not applicable	509		102		611	
Unobtainable	1		0		1	
All dwellings	1,707		650		2,357	

*All timber frame dwellings are included in the not technically viable category, as are post 82 dwellings as they are assumed to already have insulation.

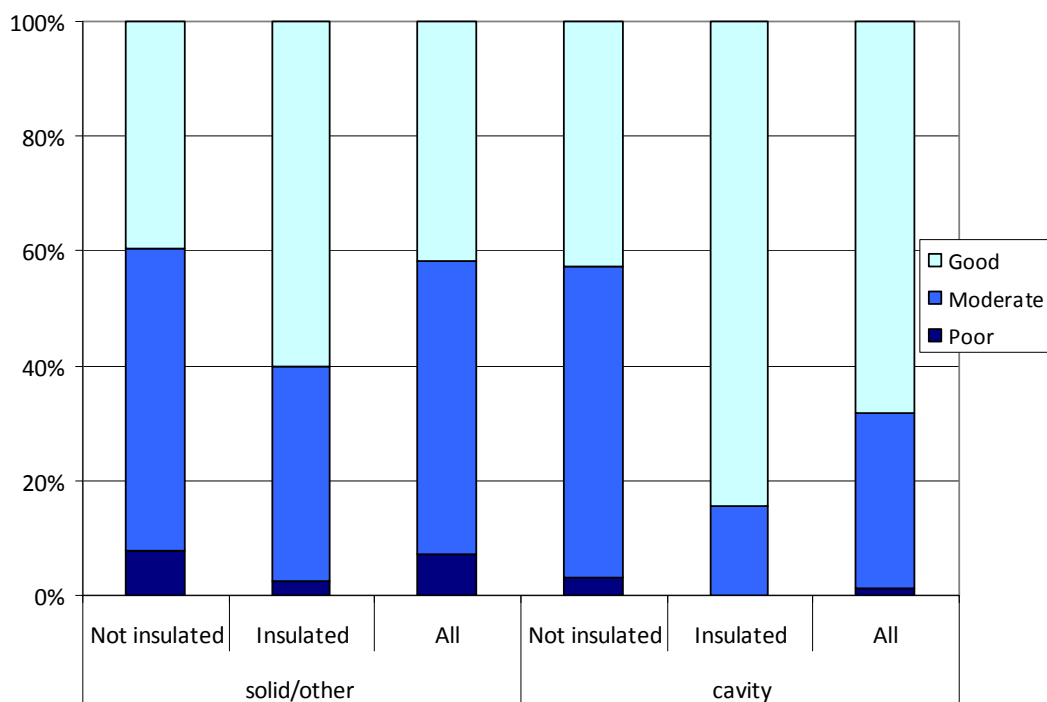
148. Table 44 looks at hard to treat cavities and the proportions of these insulated in comparison to other wall constructions. There are statistically significantly less insulated hard to treat cavities than standard cavities. Of those hard to treat cavities which were insulated about 90% were hard to treat because they were in a block of 3 or more storeys.

Table 44 External wall insulation by hard to treat cavities (000s and %): 2010

	solid/other		not hard to treat cavity		hard to treat cavity	
	000s	col %	000s	col %	000s	col %
Not insulated	520	90	561	36	132	57
Insulated	60	10	987	64	98	43
Total	579	100	1,547	100	231	100

149. Figure 24 below shows that 84% of all insulated cavity wall dwellings have a good NHER rating and none have a poor rating, compared to 43% of uninsulated cavity wall dwellings with a good rating and 3% with a poor rating. Solid/other walled dwellings do not achieve as high NHER ratings, with 60% of all insulated solid/other walled dwellings achieving a good NHER rating and 40% of uninsulated solid/other walled dwellings achieving a good NHER rating. 8% of uninsulated solid/other walled dwellings have a poor NHER rating.

Figure 24 External wall insulation and wall construction by NHER band: 2010



150. In 2010, 11% of all solid/ other construction external walls were insulated and 62% of all cavity walls were insulated²⁷. In rural areas a larger proportion (17%) of solid/ other walls were insulated compared to urban areas where 9% of solid/ other walls were insulated.

Table 45 Insulation of external walls and wall construction by urban/ rural: 2010

		urban		rural		Total	
		000s	%	000s	%	000s	%
solid/other	Not insulated	416	91	126	83	542	89
	Insulated	43	9	26	17	68	11
	All	459	100	152	100	611	100
cavity	Not insulated	565	38	106	42	671	38
	Insulated	929	62	147	58	1,076	62
	All	1,494	100	253	100	1,747	100

151. In 2010, 49% of all dwellings had insulated walls, whether they were of cavity, solid or other construction. As one might expect, a much lower proportion of hard to treat dwellings have wall insulation than non hard to treat dwellings. 64% of not hard to treat and on gas grid dwellings had insulated walls, compared to just 12% of hard to treat dwellings on the gas grid.

²⁷ It is assumed that dwellings built after 1982 would have been built with insulation.

Table 46 External wall insulation and wall construction by hard to treat and on/ off gas grid (column %): 2010

		Not hard to treat and on gas grid	Not hard to treat and off gas grid	Hard to treat and on gas grid	Hard to treat and off gas grid	Total
solid/other	Not insulated			90	82	89
	Insulated			10	18	11
	All			100	100	100
cavity	Not insulated	36	41	73	98	38
	Insulated	64	59	27	2	62
	All	100	100	100	100	100
Total	Not insulated	36	41	88	84	51
	Insulated	64	59	12	16	49
	All	100	100	100	100	100

Hot Water Tank Insulation

152. Given that 18% of all domestic energy is used to heat hot water it is important to ensure that any hot water tanks are insulated properly. Hot water will stay hot longer and less energy will be wasted heating it, if a hot water cylinder is insulated adequately. Fitting a jacket to your hot water cylinder can cut wastage by 75% compared to an uninsulated tank²⁸.
153. In 2010, just under 1% of dwellings had a hot water tank with no insulation, this compares to about 2% in 1991.

Table 47 Thickness of insulation to hot water cylinder (mm): 2010

	000s	Percent	<i>Unweighted count</i>
less than 10mm	14	1	20
10 - 29mm	406	36	559
30- 49mm	332	30	481
50mm or more	361	32	511
Sub-total	1,113	100	1,571
no hw stoarge	1,173		1,446
unobtainable	72		98
Total	2,357		3,115

²⁸ <http://www.energysavingtrust.org.uk/In-your-home/Heating-and-hot-water/Insulating-your-tank-and-pipes>

Table 48 Type of insulation on hot water cylinder: 2010

	000s	Percent	Unweighted count
sprayed	748	66	1,071
jacket	165	15	208
encapsulated	190	17	273
both	22	2	33
no Insulation	8	1	13
sub-total	1,132	100	1,598
no hw storage	1,173		1,446
unobtainable	52		71
Total	2,357		3,115

154. The SHQS also states that where pipe work or cold water tanks are located in the loft space and are part of the distribution of heat within a wet heating system or delivery of hot or cold water to kitchens or bathrooms, these must be suitably insulated to protect against potential freezing conditions.

Table 49 Is insulation to hot water pipes in loft satisfactory²⁹: 2010

	000s	Percent	Unweighted count
yes	580	76	848
no	184	24	266
no insulation	0	0	1
sub-total	765	100	1,115
no hw pipes in loft	917		1,251
n/a no loft	618		661
unobtainable	58		88
Total	2,357		3,115

Table 50 Is insulation to cold water tanks and pipes in loft satisfactory: 2010

	000s	Percent	Unweighted count
yes	717	73	1,057
no	256	26	362
no insulation	11	1	14
sub-total	984	100	1,433
no cw pipes/tank in loft	691		924
n/a no loft	616		660
unobtainable	67		98
Total	2,357		3,115

155. Table 51 looks at all elements to do with water tank insulation. Insulation to water tanks is deemed satisfactory if hot water tanks (wherever located) have either spray-on insulation to a minimum thickness of 10mm or have an added tank jacket to a minimum thickness of 50mm, there must also be satisfactory¹⁶ insulation to any hot

²⁹ Insulation is not satisfactory if some of the exposed hot water pipes in roof/loft space have no insulation

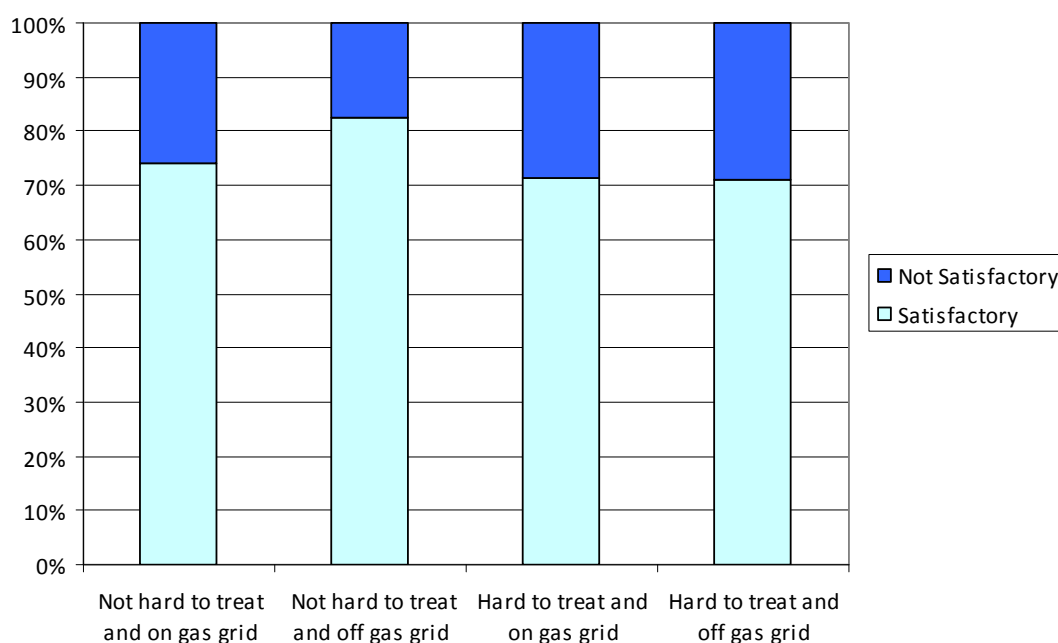
water or cold water pipes if they are situated in the loft and satisfactory insulation to the cold water tank if situated in the loft.

156. In 2010, 26% of dwellings with a hot water tank do not have satisfactory insulation on at least one of the hot water tank, hot water pipes and the cold water tank and pipes.

Table 51 Is insulation to hot water tank, hot water pipes and cold water tanks and pipes in loft satisfactory? : 2010

	urban		rural		Total	
	000s	%	000s	%	000s	%
Satisfactory	814	74	235	73	1,049	74
Not Satisfactory	284	26	86	27	370	26
Not Applicable	856	-	83	-	939	-
Total	1,953		404		2,357	

Figure 25 Is insulation to hot water tank, hot water pipes and cold water tanks and pipes in loft satisfactory by hard to treat and on/off gas grid? : 2010



Windows

157. All properties lose heat through their windows, it is estimated that around 20% of the heat in a house will be lost through single glazed windows. But energy efficient glazing will keep a dwelling warmer, quieter and reduce energy bills. Installing double glazing, triple glazing, using shutters or even heavy curtains will all help reduce energy loss through windows.
158. Since 1991 there has been a significant increase in the proportion of dwellings with double glazing. In 2010, approximately 92% of all dwellings in Scotland had double glazing, compared to 46% in 1991.

Table 52 Type of glazing (%): 1991 – 2010

Year	Type of glazing		
	Single	Double	Triple
1991	54	46	-
1996	37	62	0
2002	19	81	0
2003/04	14	86	0
2004/05	14	86	0
2005/06	12	88	0
2007	11	89	0
2008	10	90	0
2009	9	91	0
2010	8	92	0

159. In the early 1990's double glazing became standard in new build dwellings, however it was not until 2003 that double glazing became compulsory for new builds and any replacement windows³⁰.
160. Table 53 below shows how the percentage of double glazing varies with the age of dwelling. 99% of all dwellings built post 82 have double glazing, compared to 71% of dwellings built pre 1919.

Table 53 Percentage of dwellings with double glazing by dwelling age: 2010

Age of dwelling	% of dwellings with double glazing
pre-1919	71%
1919-1944	95%
1945-1964	95%
1965-1982	97%
post 1982	99%

Table 54 Typical window area³¹ by age of dwelling (m²): 2010

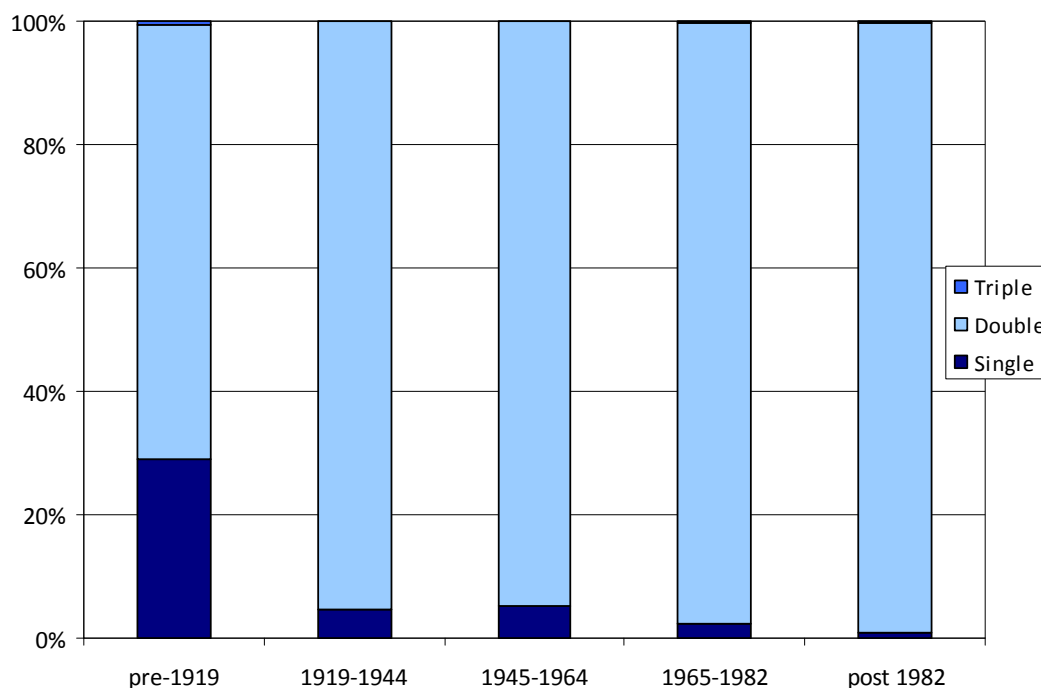
	pre-1919	1919-1944	1945-1964	1965-1982	post 1982
2 bedroom tenement flat	12	11	11	11	8
3 bedroom semi-detached house	23	19	18	17	13

161. Table 54 illustrates the typical window area by age of dwelling for a 2 bedroom tenement flat and a 3 bedroom semi-detached house. It can be seen from this table that pre 1919 dwellings tend to have larger windows, this relates to the fact that they also have a larger floor area.
162. Figure 26 illustrates the type of glazing by the age of dwelling. It can be seen that a much larger proportion of pre 1919 dwellings have single glazing. In 2010, almost 30% of all pre 1919 dwellings had single glazing, compared to 5% or less in all other age bands.

³⁰ Double glazing is not compulsory if a dwelling has a specific status that does not allow the appearance of the building to be changed. E.g Listed buildings.

³¹ Typical window areas are calculated using formulae set out in Table S4 of SAP 2005 Appendix S page 94, BRE (2009)

Figure 26 Type of glazing by age of dwelling: 2010



163. Table 55 below shows that there is a slightly higher proportion of dwellings with single glazing in rural areas.

Table 55 Type of glazing by urban/rural (000s and %): 2010

	urban		rural		Total	
	000s	%	000s	%	000s	%
Single	149	8	43	11	193	8
Double	1,801	92	360	89	2,161	92
Triple	3	0	1	0	4	0
Total	1,953	100	404	100	2,357	100

Secondary glazing

164. Secondary glazing is a type of double glazing, most commonly found in older properties. A secondary pane of glass and frame is fitted inside the existing window reveal. Secondary glazing can often be cheaper than installing new double glazed windows, it is also a valid option in conservation areas, period properties or listed buildings where there may be restrictions on the changes that can be made and where suitable double glazing is often a lot more expensive than standard double glazing.

165. Secondary glazing is not very common in Scotland, with just 1% of all double glazed windows being secondary glazing (Table 56).

Table 56 Type of double glazing (000s and %): 2010

Type of double glazing	000s	Percent	Unweighted count
double pre 2003	1,453	67	1957
double post 2003	652	30	829
double unknown	41	2	82
double secondary	14	1	17
any double glazing	2,161	100	2885
no double glazing	197		230
Total	2,357		3115

Shutters

166. Shutters are an efficient way of reducing heat loss from windows. Research shows that closed shutters can reduce heat loss from a single glazed window by approximately 51%³².
167. In 2010, just over 2% of all dwellings in Scotland had at least some working shutters, although less than 1% had working shutters on all windows. As would be expected shutters are more common in older dwellings, with 11% of all pre 1919 dwellings having at least some working shutters.

Table 57 Presence of internal window shutters (000s and %): 2010

Internal window shutters	000s	Percent	Unweighted count
none	2,307	98	3,053
less than 50%	25	1	34
more than 50%	17	1	21
all windows	8	0	7
Total	2,357	100	3,115

Installing and upgrading energy efficiency measures

168. Having identified the energy efficiency measures currently present in Scotland's housing stock, this section will now look at the potential for upgrading the stock.

³² <http://www.historic-scotland.gov.uk/thermal-windows.pdf>

Table 58 Potential for improving the energy efficiency (000s and %): 2010

		000s	% of all stock
	virgin lofts	321	14
loft insulation	top up insulation	822	35
	cavity wall insulation	544	23
wall insulation	internal/ external insulation	669	28
	hot water tank insulation	97	4
tank insulation	hot water pipes insulation	185	8
	cold water tank/ pipes insulation	267	11
glazing	double/ secondary glazing	193	8

169. In 2010, the SHCS approximated that there were 321,000 dwellings with less than 100mm loft insulation (virgin lofts) and a further 822,000 dwellings with between 100mm and 200mm loft insulation which would benefit from top up insulation.
170. Overall the SHCS estimated that there are approximately 1,213,000 dwellings without wall insulation. Of these 544,000 are suitable for cavity wall insulation and the rest could have internal or external insulation³³.
171. In 2010, about 370,000 dwellings had unsatisfactory insulation to at least one of the hot water tank, hot water pipes (if in loft) and cold water tank and pipes (if in loft).
172. About 193,000 dwellings had single glazing which could be upgraded with either secondary glazing or double glazing.
173. The only measures considered in this section are loft insulation, wall insulation, hot/cold water tank and pipe insulation and windows. This is not intended to be an exhaustive list of measures. Another key measure of energy efficiency is the efficiency of a dwellings heating system, this is discussed further in Chapter 5. The potential for solar panels and photovoltaics is also discussed in Chapter 6.
174. Table 59 shows the number of measures which could be improved per dwelling. A quarter of all dwellings already have satisfactory, loft, wall and tank and/or pipe insulation and glazing. 38% of dwellings have one measure which could be improved, 27% have two measures which could be improved, 9% have three measures which could be improved and 1% of dwellings need all 4 measures improved.

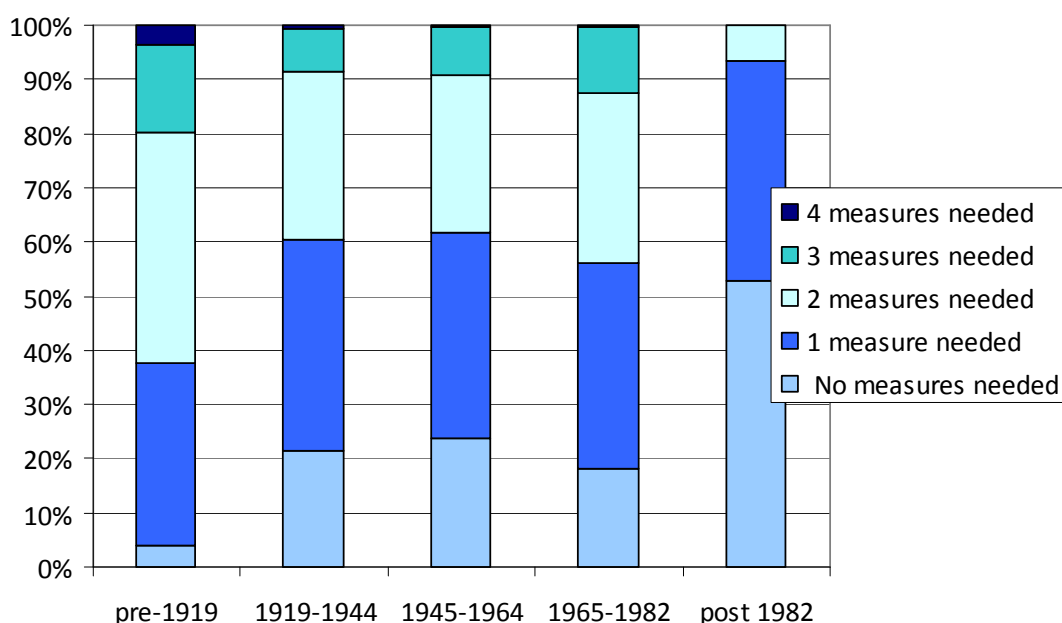
³³ Hard to treat cavity walls are deemed unsuitable for cavity wall insulation so are assumed to have potential for internal or external insulation.

Table 59 Number of potential improvement measures needed (000s and %): 2010

	000s	%
No measures needed	581	25
1 measure needed	893	38
2 measures needed	648	27
3 measures needed	213	9
4 measures needed	23	1
Total	2,357	100

175. As might be expected a larger proportion of older dwellings need improvements. Over half of all post 82 dwellings need no improvements, compared to just 4% of pre 1919 dwellings. Just under 20% of pre 1919 dwellings need 3 or more.

Figure 27 Number of potential improvements by age of dwelling : 2010



176. Rural properties tend to have a greater number of potential improvements that could be made. 48% of rural dwellings have 2 or more measures which could be improved, compared to 36% of urban dwellings.

Table 60 Number of potential improvements by urban/ rural (000s and %): 2010

	urban		rural		Total	
	000s	%	000s	%	000s	%
No measures needed	503	26	78	19	581	25
1 measure needed	761	39	132	33	893	38
2 measures needed	526	27	122	30	648	27
3 measures needed	149	8	65	16	213	9
4 measures needed	14	1	8	2	23	1
Total	1,953	100	404	100	2,357	100

Figure 28 Number of potential improvements by hard to treat and on/off gas grid : 2010

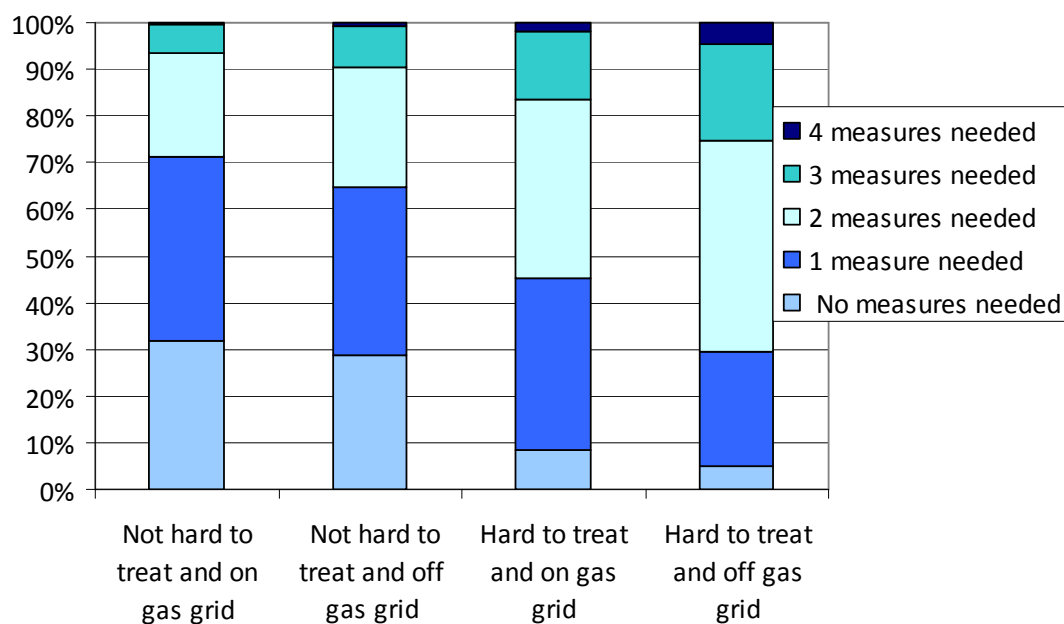


Table 61 Number of potential improvements by improvement needed (000s and %) : 2010

	000s	%
No measures needed	581	25
1 measure - wall insulation	431	18
1 measure - loft insulation	399	17
1 measure - double/secondary glazing	17	1
1 measure - tank or pipe insulation	46	2
2 measures - loft and wall insulation	413	18
2 measures - wall insulation and double/secondary glazing	93	4
2 measures - wall insulation and tank or pipe insulation	42	2
2 measures - loft insulation and double/secondary glazing	9	0
2 measures - loft insulation and tank or pipe insulation	91	4
3 measures - loft and wall insulation and double/secondary glazing	45	2
3 measures - loft, wall and tank or pipe insulation	162	7
3 measures - wall and tank or pipe insulation and double/secondary glazing	5	0
3 measures - loft and tank or pipe insulation and double/secondary glazing	2	0
4 measures - loft, wall and tank or pipe insulation and double/secondary glazing	23	1
All households	2,357	100

177. Chapter 7 describes the Government schemes which are currently available to help householders identify and/ or fund suitable energy efficiency improvements for their home.

Chapter 5: Space and water heating

Key Findings – Scottish House Condition Survey 2010

- 77% of Scotland's dwellings used mains gas as their primary heating fuel. In rural areas 38% of dwellings use mains gas as their primary heating fuel, compared to 84% in urban areas.
- 95% of dwellings in Scotland have central heating, this compares to 61% in 1991.
- 62% of dwellings have a primary heating system which is less than 12 years old.
- 84% of dwellings use a boiler as their primary source of heating, 12% used storage heating, 2% room heaters and 1% community heating.
- 69% of householders said that their central heating system had both time and temperature controls, compared to 50% in 2007.

178. In 2009, just over 60% of all energy consumed in the UK domestic sector was used for space heating and a further 18% used for water heating³⁴. Since 1970 the amount of energy used for space heating has increased by 24%, despite increased levels of insulation and much improved efficiency of new boilers. The increase is mainly due to an increase in the number of households, a likely increase in the temperature occupants heat their homes to and an increase in the number of dwellings with central heating.

Space heating

179. The efficiency and cost of a household's heating system depends on many factors: the type of fuel used, the type of heating system, the age of the heating system, maintenance regime and how efficiently and effectively a heating system is used by the occupants.

Primary heating fuel

180. In Scotland the majority of households use mains gas as their primary heating fuel. Mains gas is usually the cheapest fuel and it also has the lowest carbon dioxide emissions (apart from wood). However, in Scotland 9% of households are off the gas grid and so not able to access mains gas. Rural areas are worst affected by this, with 92% of all off gas grid dwellings in Scotland located in rural areas, where 46% of dwellings are off-gas.

³⁴ <http://www.decc.gov.uk/en/content/cms/statistics/publications/ecuk/ecuk.aspx>

Table 62 Dwellings on/off the Gas Grid by urban/rural indicator (000s and %)

On mains gas grid	Urban		Rural		Total	Un-weighted
	000s	row %	000s	row %	000s	sample size
On Gas Grid	1,941	90	218	10	2,159	2,639
Not On Gas Grid	12	8	185	92	197	473
All Dwellings	1,953	83	403	17	2,356	3,112

181. In 2010, 77% of Scotland's dwellings used mains gas as their primary heating fuel, 14% used electricity and 6% used oil. The remaining 3% use a mixture of LPG/ bottled gas, solid fuel, community heating and dual fuel (Table 63).

Table 63 Primary Heating Fuel (000s and %): 2010

Primary Heating Fuel	000s	Percent	Unweighted count
Gas (mains)	1,816	77	2,225
Electricity	327	14	502
Oil	133	6	256
Solid Fuel	35	1	60
Community Heating	29	1	42
LPG/bottled gas	17	1	27
Dual Fuel	1	0	3
Total	2,357	100	3,115

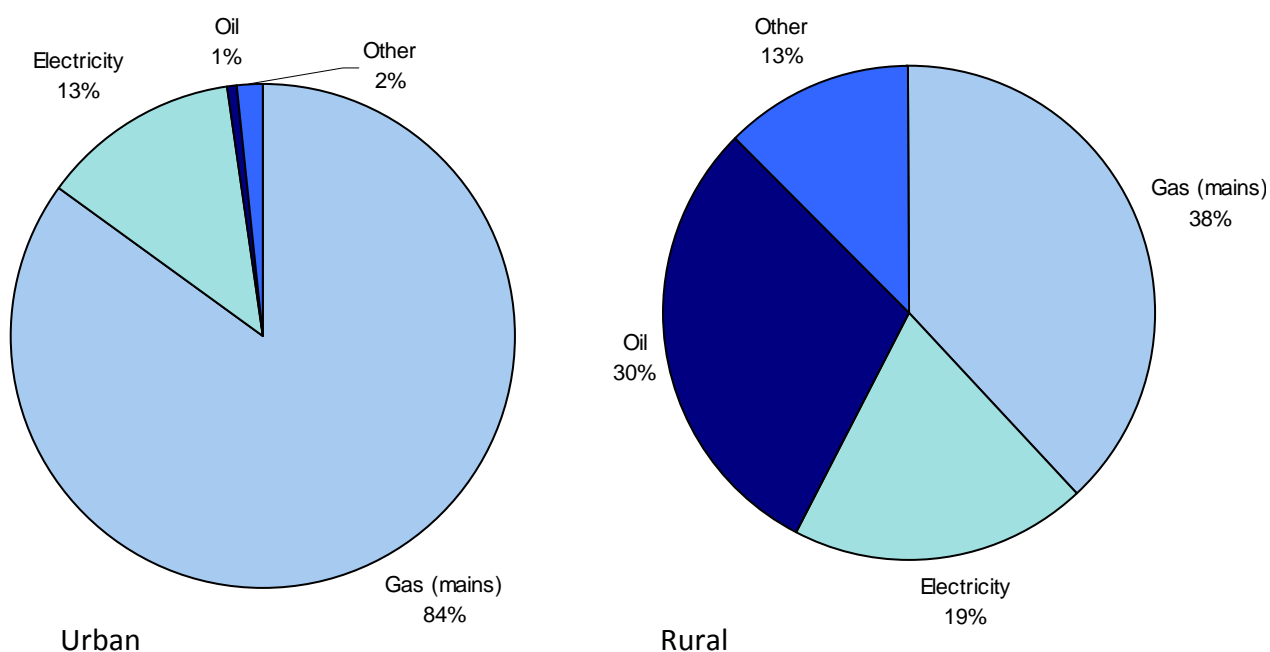
182. Table 64 highlights the primary heating fuel by the type of mains services they have available. Of those who have electricity only, the most common primary heating fuel used is electricity (61%), with a further 27% of households using oil. Of the dwellings with both electricity and gas mains services, 96% of households use gas as their primary heating fuel, with the remaining households using either electricity or oil.

Table 64 Primary Heating Fuel by mains services (column %): 2010

	electricity only	electricity and gas
Gas (mains)	-	96%
Electricity	61%	2%
Oil	27%	2%
Solid Fuel	7%	0%
Community Heating	3%	0%
LPG/bottled gas	2%	0%
Dual Fuel	1%	-

183. Figure 29 highlights the difference in fuel mix between urban and rural areas. Mains gas is more commonly used in urban areas compared to rural areas and oil makes up a much larger proportion (30%) of the fuel mix in rural areas. 'Other' fuels are also a lot more commonly used in rural areas.

Figure 29 Primary heating fuel by urban/rural indicator (%)



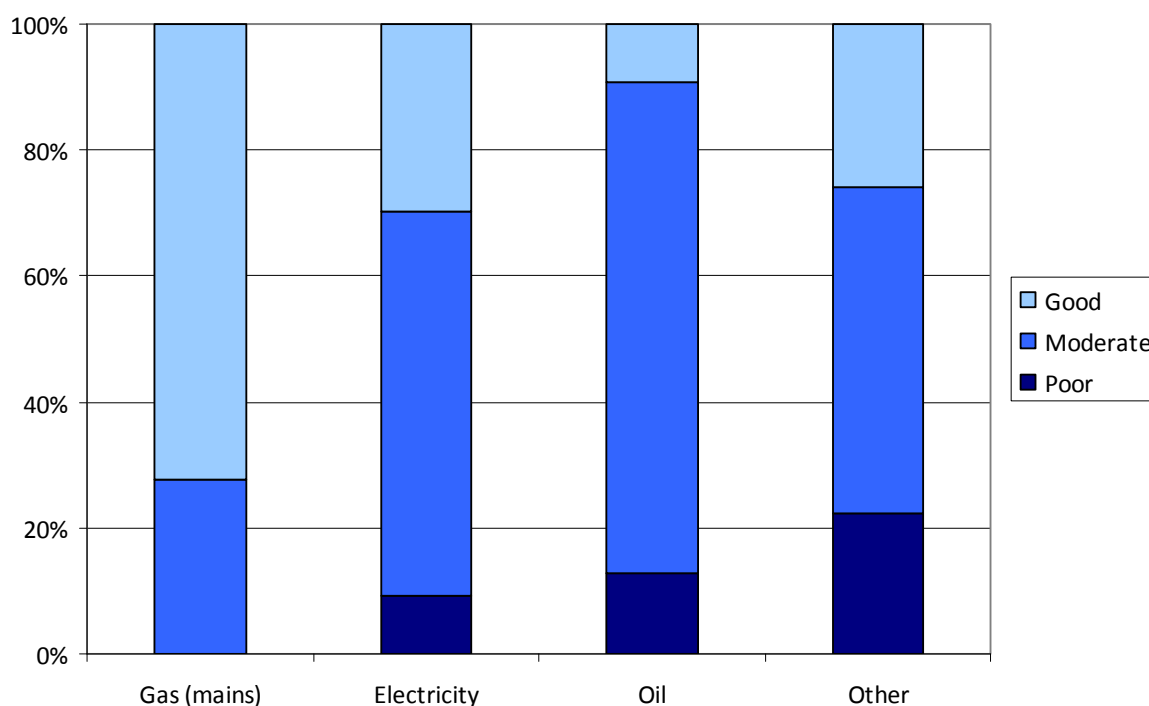
Other includes LPG/bottled gas, solid fuels, community heating and dual fuel

184. Table 65 and Figure 30 show the proportion of homes in each NHER band by their primary heating fuel. This shows that the majority of dwellings (72%) which use mains gas have a good NHER rating, compared to 30% of those who use electricity and 9% of those that use oil.

Table 65 Primary heating fuel by NHER band (000s and %)

	Poor		Moderate		Good		Total	Unweighted count
	000s	Row %	000s	Row %	000s	Row %		
Gas (mains)	2	0	498	28	1,308	72	1,808	2,225
Electricity	29	9	190	61	92	30	312	502
Oil	17	13	102	78	12	9	131	256
Other	18	22	41	52	21	26	79	132
All	66	3	831	36	1,433	62	2,330	3,115

Figure 30 Primary heating fuel by NHER band



Primary heating system

185. In 2010, 95% of dwellings in Scotland had central heating. This compares to 61% in 1991, an increase of 34 percentage points. A further 3% have partial central heating and just 2% have no central heating. This compares to 22% having no central heating in 1991.

Table 66 Extent of central heating (000s and %): 2010

Extent of central heating?	Count	Percent	<i>Unweighted Count</i>
full	2,236,000	95	2,945
partial	75,000	3	116
no central heating	46,000	2	54
Total	2,357,000	100	3,115

186. The majority of dwellings in Scotland have a boiler as their primary source of heating. Of those with a boiler 99% have full central heating. Storage heating is used by 12% of households: 84% of these households have full central heating and 16% partial. Those with no central heating use room heaters as their primary source of heating. The majority (60%) of these are electrical although around a quarter are gas fuelled.

Table 67 Primary source of heating (000s and %): 2010

Primary source of heating	000s	Percent	Unweighted count
Boiler	1,991	84	2,561
Community heating	29	1	42
Storage heating	279	12	439
Room heater	41	2	47
Warm air system	10	0	13
Heat pump	2	0	7
Room heater (bb no rads)	5	0	6
Total	2,357	100	3,115

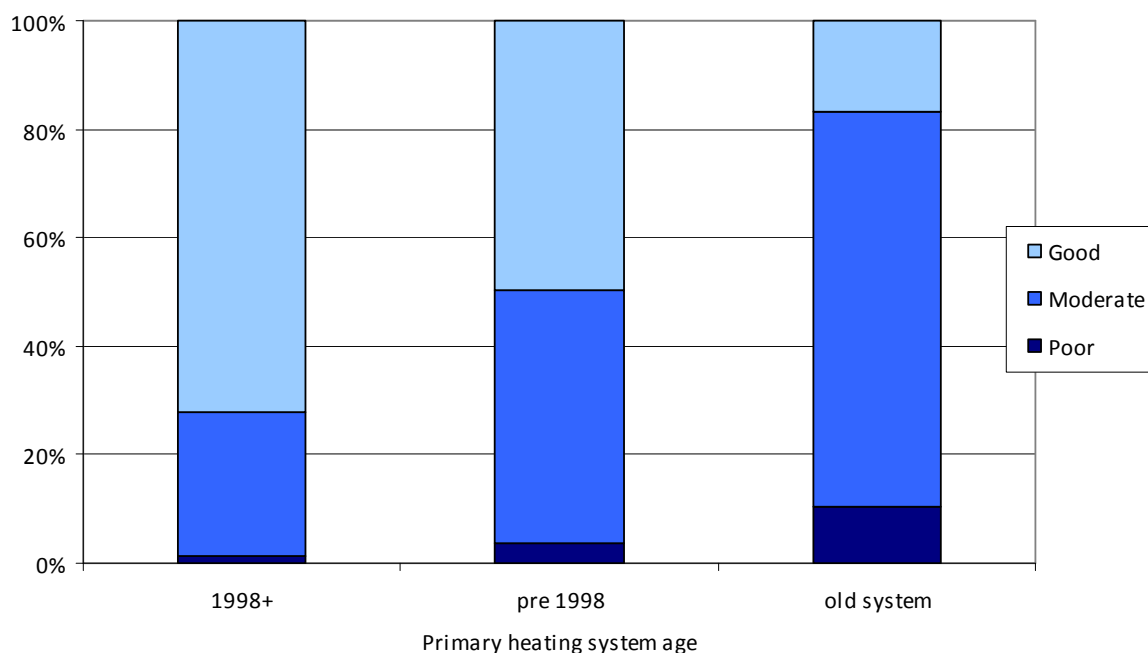
187. As a result of the EU Boiler Efficiency Directive that came into effect in 1998, the efficiency of all gas, LPG and oil boilers were improved significantly. Meeting this requirement resulted in many changes to boiler design (more responsive heat exchangers, less water contained within the boiler, the use of fan flues, getting rid of permanent pilot lights) with the effect of raising the overall efficiency of boilers.
188. Although the SHCS does not currently collect data on the efficiency of boilers, it can be seen from Figure 31 that the age of heating system correlates to the overall energy efficiency of the dwelling. In 2010, over 72% of all dwellings with a heating system installed from 1998 onwards had a good NHER rating, compared to 17% of those with an old system.

Table 68 Primary heating system age³⁵ (000s and %): 2010

Primary Heating System age	000s	Percent	Unweighted Count
1998+	1,452	62	1,852
pre 1998	687	29	938
old system	59	2	83
other	5	0	6
not applicable	156	7	236
Total	2,357	100	3,115

³⁵ For mains gas and LPG boilers, 'Old' refers to boilers installed up to 1979. For oil boilers, 'Old' refers to those installed up to 1985.

Figure 31 Primary heating system age by NHER band: 2010



Boilers

189. The boiler is the most common type of primary heating system, with 84% of all dwellings in Scotland using one. In the majority of cases the boiler will provide both space and water heating.
190. In 2010, the most common type of boiler was a combi boiler. A combi (combination) boiler provides both space heating and instantaneous hot water within the same unit and therefore no hot water storage is needed.

Table 69 Primary heating system boiler type (000s and %): 2010

PHS boiler type	000s	Percent	<i>Unweighted Count</i>
standard	591	29	793
combi	792	40	942
condensing	79	4	103
condensing combi	355	18	463
back boiler	180	9	254
cPSU	2	0	6
range cooker	6	0	20
Total dwellings with boiler	2,005	100	2,581
not applicable	351	-	533
unobtainable	1	-	1
Total	2,357	-	3,115

191. Since May 2007, condensing boilers are required (where practicable) by the Building Regulations to be installed in new dwellings, and where boiler replacements are undertaken in existing homes. In 2010, 4% of dwellings had condensing boilers and a further 18% had condensing combi boilers.

192. A back boiler is usually built into the chimney breast and is located behind a gas or solid fuel fire or heater. It is designed to provide both room heat and domestic hot water or central heating. In 2010, 9% of dwellings used a back boiler as their primary source of heating.
193. A standard boiler (also referred to as a conventional boiler, a regular boiler, or system boiler) has an indirect hot water cylinder attached to the system. 29% of dwellings with a boiler have a standard boiler.
194. A Combined Primary Storage Unit (CPSU) is a single appliance designed to provide both space heating and the production of domestic hot water, in which there is a burner that heats an integral thermal store (that is, within the boiler casing, as opposed to standing separately outside the boiler casing) which contains mainly primary water which is in common with the space heating circuit. The thermal store must have a capacity of at least 70 litres in size and the feed to the space heating must be taken directly from the thermal store.

Storage heating

195. The original concept of storage heaters emerged in the late 1960's and was designed to utilise spare generating electricity capacity at night that would be stored up as heat overnight, and then released into the house throughout the next day. Storage heating is not central heating in a 'traditional' sense, that is, distributing heat through the house from a central heat source, but is considered to be a 'whole house' heating system. All dwellings with storage heating will also have some form of secondary heating.
196. In 2010, 12% of dwellings in Scotland used storage heating as their primary form of heating. Of these dwellings 84% had new style storage heaters (also known as slimline), 8% had old style (usually pre 1978) and 5% had fan assisted.

Table 70 Type of storage heating (000s and %): 2010

Type of storage heating	000s	Percent	<i>Unweighted count</i>
new style	236	84	378
fan assisted	13	5	23
old style	23	8	28
integrated storage/direct	3	1	3
underfloor	4	2	7
All dwellings with storage heating	279	100	439
not applicable	2,078	-	2,676
Total	2,357	-	3,115

Secondary heating

197. The majority of dwellings in Scotland will have some sort of secondary heating system, whether it is used on a daily basis or purely as a decorative feature. Secondary heating is becoming less common in new builds, most likely because it is not necessary - central heating is now standard and energy efficiency of buildings is a

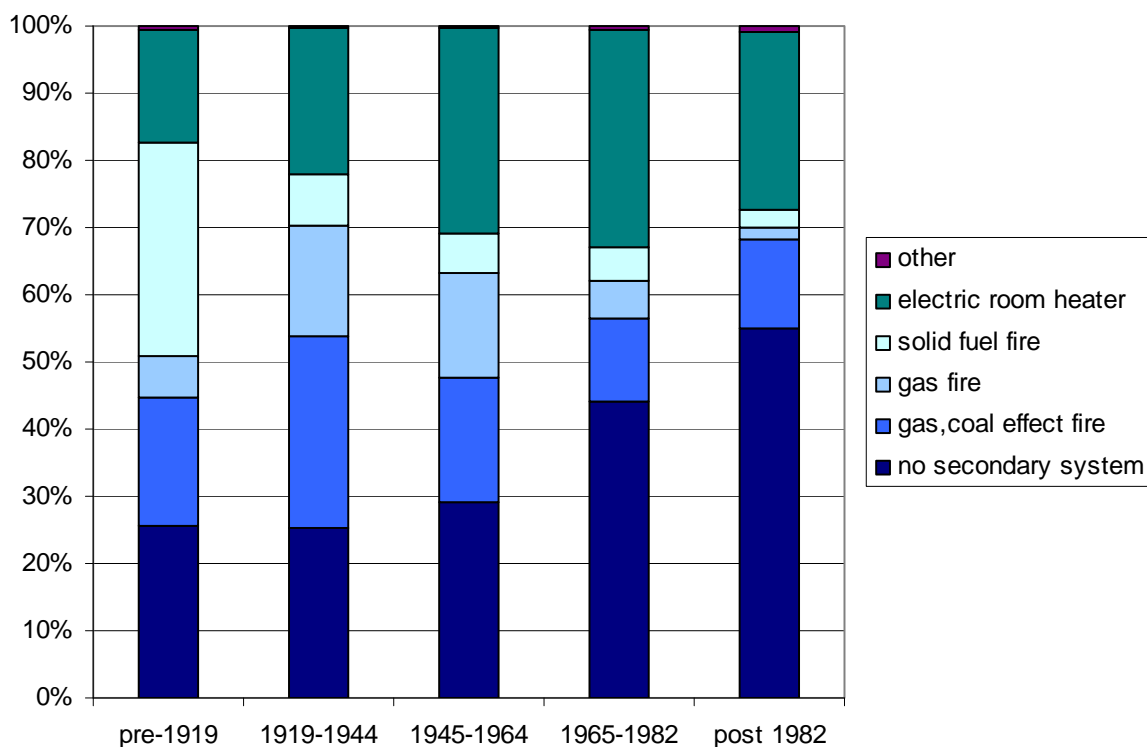
lot higher. Over half of all post 82 dwellings have no secondary heating, compared to a quarter of pre 1919 and 1919 – 1944 builds.

198. Electric room heaters are the most common type of secondary heating, with 26% of all dwellings using these. A further 17% of dwellings have coal effect gas fires. These are commonly used to replace the original solid fuel fire in older dwellings.
199. Solid fuel fires are the most common type of secondary heating in pre 1919 dwellings but become decreasingly common as the age of dwelling increases.

Table 71 Secondary heating system (000s and %): 2010

Secondary heating system	000s	Percent	Unweighted count
no secondary system	872	37	1,071
gas,coal effect fire	408	17	539
post 1980 gas fire	169	7	219
pre 1980 gas fire	35	1	41
open solid fuel fire	167	7	260
closed solid fuel fire	72	3	126
electric room heater	620	26	841
other	14	1	18
Total	2,357	100	3,115

Figure 32 Secondary heating system by age of dwelling: 2010



Heating Controls

200. Using heating controls enables households to keep their home at a comfortable temperature without wasting fuel or heat. This in turn will reduce heating bills and CO₂ emissions.
201. The SHCS asks householders if they had a central heating system which uses a time clock or thermostat, if they use these controls and if they find them easy to use. Table 72 show the responses to the first question. Of those who answered the question in 2007, 50% said they had both time and temperature controls. This increased to 69% in 2010.

Table 72 Do you have central heating which uses a time clock or thermostat?

	2007		2008		2009		2010	
	000s	%	000s	%	000s	%	000s	%
Yes, time clock	644	30	520	23	474	21	346	15
Yes, thermostat	236	11	225	10	221	10	185	8
Yes, both	1,090	50	1,289	58	1,375	61	1,559	69
No, neither	139	6	157	7	131	6	126	6
Don't know	57	3	45	2	49	2	36	2
Total	2,166	100	2,237	100	2,249	100	2,253	100
Missing	147		94		95		105	
Total	2,314		2,331		2,344		2,357	

Temperature Controls

202. Temperature controls allow householders to set their heating so that it keeps their home at a specific temperature. This means that the heating will automatically switch off when the home reaches this temperature and come back on when it drops below it.
203. Of those who reported having some sort of temperature control linked to their central heating, about 90% said that they used it to adjust how they heated their home and of those that used it 98% said that they found it easy to control and use.

Timing Controls

204. Timing controls allow you to set your heating so that it will automatically switch off at times when you're not at home, or when you don't need it, such as when you're in bed.
205. Programmers allow you to set 'on' and 'off' time periods. Most models will let you set the central heating and domestic hot water to go on and off at different times and there are also usually manual overrides which will allow you to turn on the heating out-with the preset times.

206. Of those who reported having some sort of time control linked to their central heating, about 85% said that they used it to adjust how long they heated their home for and of those that used it 96% said that they found it easy to control and use.

Water heating

207. In most cases, water will be heated by either the primary heating boiler or by an electric immersion heater (single or dual immersion).

Table 73 Primary hot water heating source (000s and %)

Primary hot water heating source	000s	Percent	<i>Unweighted count</i>
primary heating	2,017	86	2,598
electric immersion	319	14	476
electric instant	9	0	13
gas instant (multi point)	2	0	3
kitchen range	8	0	20
secondary heating	2	0	5
Total	2,357	100	3,115

Chapter 6: Changing Energy Use in the Home

Key Findings

- Scots understand the importance of day-to-day behaviours, but that many of them do not follow this up with action to reduce emissions (SEABS'08).
- When asked which of a variety of energy efficiency measures were factors in moving to their current property 93% of householders said none (SHCS 2010).
- About 11% of all households undertook at least one energy efficiency improvement in the last year (SHCS 2008/2010).
- In 2010, about 33% of households say they monitor their energy use fairly closely and 12% say they monitor it very closely (SHCS 2010).
- In 2010, 24% of dwellings had no low energy lighting in fixed outlets, compared to 55% in 2007 (SHCS).
- SEAB'08 suggests that awareness of the energy efficiency ratings of domestic appliances could be improved.
- In 2010 less than 1% of dwellings had PV or solar panels. However 50% of all dwellings are suitable for solar panels (and PV) and a further 15% are suitable for PV only.
- SEABS'08 identified four recurring reasons as to why people do not always choose to adapt their behaviour. These were: convenience; cost; a lack of alternative options; and practical considerations.

208. Improving the energy efficiency of Scotland's housing stock is just one step towards reducing energy consumption and CO₂ emissions. Householders must also change and adapt their behaviour and attitudes towards domestic energy use. This is one of the major challenges in converting the technical or theoretical potential of Scotland's housing stock into realised savings.
209. The Scottish Environmental Attitudes and Behaviours Survey 2008 (SEABS'08) provides data on energy-efficiency attitudes and behaviours. It suggests that a large majority of Scots understand the importance of day-to-day behaviours, but that many of them do not follow this up with action to reduce emissions or, if they do, they are unaware of the relative impact of different actions.
210. The Scottish Government 'Climate Change Behaviours Research Programme' (CCBRP)³⁶ features a range of research projects, both in-house and commissioned work, to better understand: the behaviour areas that are central to addressing climate change and the most effective mechanisms for stimulating, facilitating and supporting new and more sustainable ways of living.

³⁶ <http://www.scotland.gov.uk/Topics/Research/by-topic/environment/social-research/Behaviour-Change-Research>

Attitudes towards energy efficiency

211. Data from the SHCS indicates that the energy efficiency measures currently installed in a dwelling are not a major factor in householders decision to move to that dwelling.

Table 74 Energy efficiency measures which were a factor in your decision to move to this property (000s and %): 2008 - 2010

	2008		2009		2010	
	000s	%	000s	%	000s	%
Double Glazing	80	4	88	4	119	5
Efficient central heating	78	3	74	3	110	5
Loft insulation	24	1	29	1	41	2
Cavity wall insulation	22	1	20	1	31	1
Renewable energy source	6	0	4	0	4	0
Good Energy Performance Certificate	8	0	4	0	11	1
The overall energy efficiency of your home	35	2	38	2	49	2
None of these	2,118	95	2,113	94	2,078	93

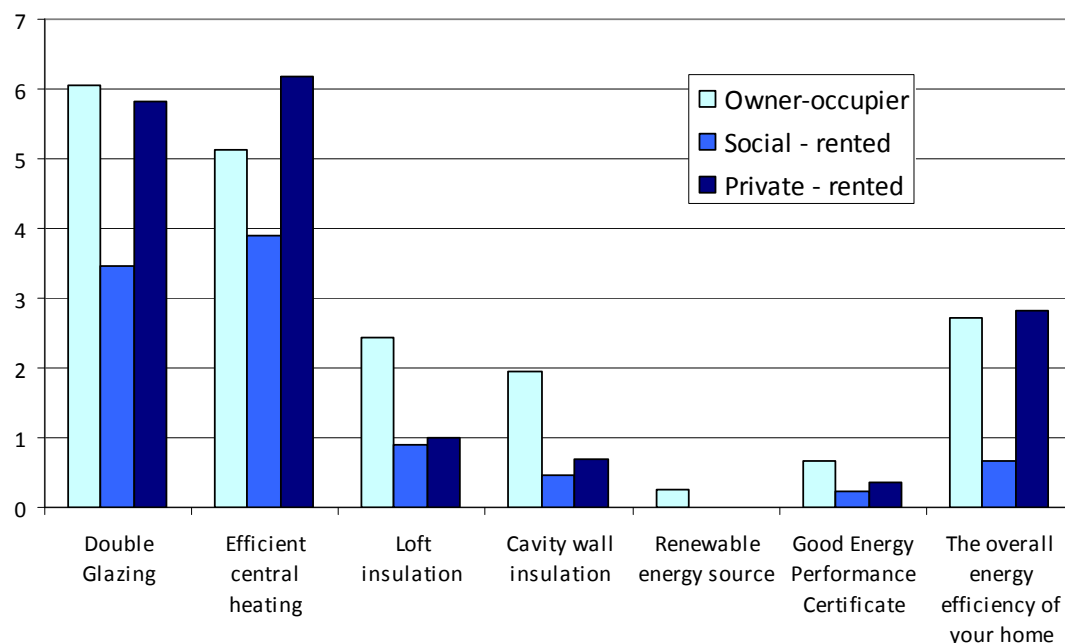
212. When asked which of the listed energy efficiency measures were factors in moving to their current property 93% of householders said none, in 2010. This was a slight decrease from 2008 and 2009 but not significantly so. In 2010, the energy efficiency measures which were considered the most valuable were the presence of double glazing and an efficient heating system.
213. Table 75 looks at whether certain energy efficiency measures were a factor in the decision to move to the property by the length of time the householders have lived in that dwelling. It shows that households that have lived in the dwelling 10 years or less took more account of energy efficiency measures in their decision to move to the property.

Table 75 Energy efficiency measures which were a factor in your decision to move to this property by time in property (%): 2010

	10 years or less	More than 10 years	Total
Double Glazing	7	4	5
Efficient central heating	6	3	5
Loft insulation	2	1	2
Cavity wall insulation	2	1	1
Renewable energy source	0	0	0
Good Energy Performance Certificate	1	0	1
The overall energy efficiency of your home	3	1	2
None of these	91	95	93

214. SHCS data also suggests that householders living in social rented housing are less likely to take energy efficiency measures into account in their decision to move to a property. 95% of social renters did not take any of the listed energy efficiency measures into account when moving, compared to 92% of owner occupiers and 91% of private renters. This may be due to limited ability to choose in the social rented sector or other factors being more important.

Figure 33 Energy efficiency measures which were a factor in your decision to move to this property by tenure (%): 2010

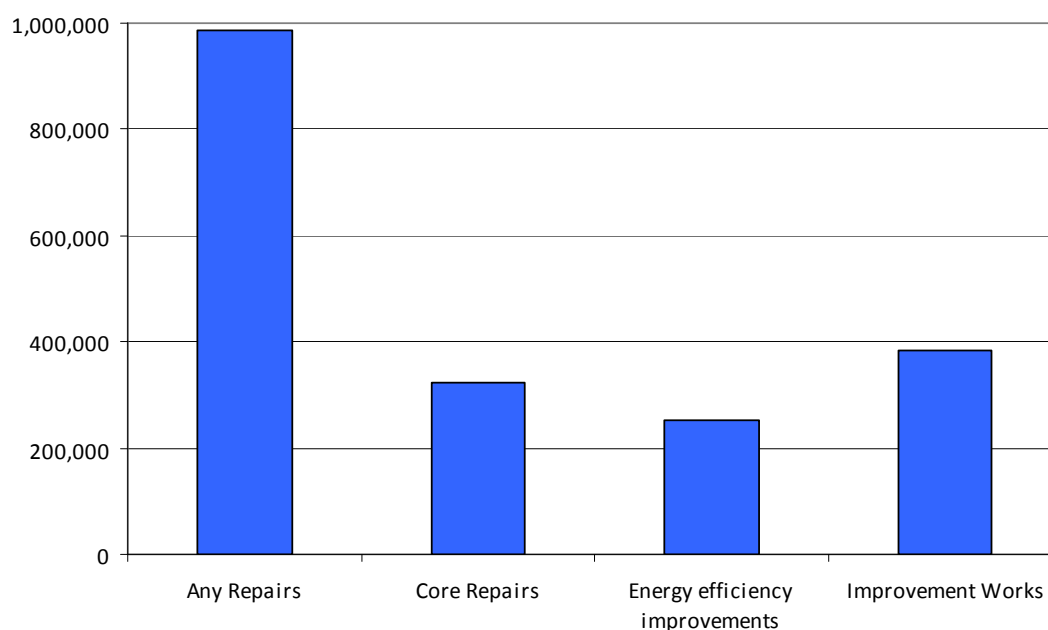


215. This evidence suggests that householders do not take into account whether a dwelling they move to currently has energy efficiency measures installed. This may be because they are not aware or fully informed of the benefits or because they intend to remedy any energy issues when they move home. The next section considers whether households prioritise installing energy measures over other improvement works.

Work done in home

216. Installing insulation and upgrading a dwelling's heating system are some of the most effective ways to improve energy efficiency and reduce domestic energy use.
217. The SHCS records data about repairs and work done to dwellings in the past year as reported by the respondent.

Figure 34 Type of repair or work done to dwelling in the past year: 2008/10



218. Compared to other work and repairs to the home, energy efficiency improvements³⁷ did not account for a large proportion of work done. About 11% of all households undertook at least one energy efficiency improvement in the last year. Of the households undertaking at least one type of work or repairs to their home, energy efficiency improvements accounted for about 26%.

Table 76 Energy efficiency improvements by tenure (column %): 2008/10

	Owner- occupier	Social - rented	Private - rented	Total
Yes	12	11	5	11
No	88	89	95	89

219. As can be seen in Table 76, the private rented sector are least likely to have had energy efficiency improvements made to their home in the past year.
220. Contradictory to this evidence there have been significant increases in the number of dwellings with double glazing, central heating and insulation (see Chapter 4). Some of these improvements will have been carried out under Government schemes or with the help of an incentive, however a lot of these improvements are through householders taking action themselves.

Better energy management and usage

221. As stated in Chapter 1, energy use from the domestic sector accounts for about one third of all energy used in Scotland. By better managing energy use and opting for more energy efficient appliances within the household the amount of energy used and therefore emissions from dwellings could be reduced.

³⁷ Installing complete central heating system, replacing central heating system, installing or improving loft insulation and installing wall insulation.

222. Voluntary changes to a householders lifestyle such as turning the thermostat down by 1°C or turning off appliances rather than leaving them on standby are important steps to reducing energy consumption. Other choices such as buying more energy efficient appliances can also contribute towards using less energy.

Monitoring Energy Use

223. One way to enable better energy management is to provide households with the means to monitor their energy usage.
224. The UK Government have pledged that 'smart' meters are to be installed in every home by 2020 to encourage better household energy management. Smart meters keep track of the energy used and will probably be accompanied by an in-home display, which enables the household to see how much energy is being used in real time.
225. Since 2008 the SHCS has asked respondents to what extent they monitor the energy use in their property. Table 78 shows the results of this question. Since 2008 there has been very little variation in the responses.
226. In 2010, about 33% of households say they monitor their energy use fairly closely and 12% say they monitor it very closely. Figure 35 shows the extent of energy monitoring by net weekly household income band. It shows that there is little difference between income bands - with just under 50% of each income band monitoring their energy use either very or fairly closely.

Table 77 Energy-use monitoring devices: 2008 to 2010 (000s and %)

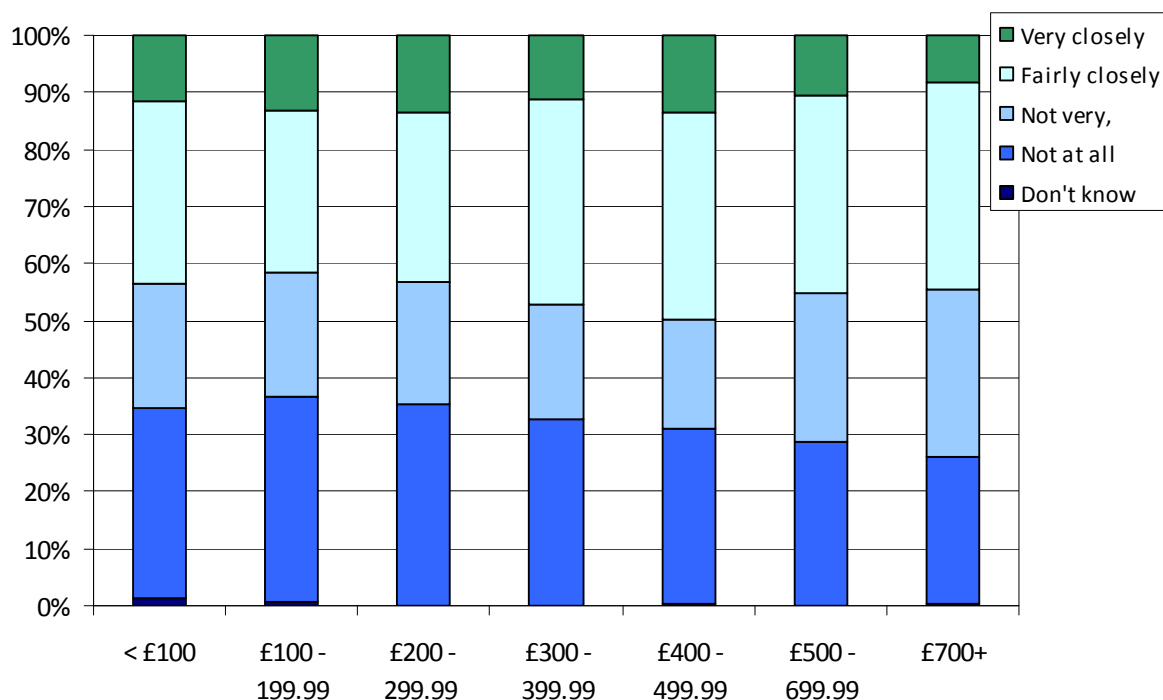
	2008		2009		2010	
	000s	%	000s	%	000s	%
Yes	37	2	54	2	101	4
No	2,286	98	2,285	97	2,254	96
Don't know	8	0	6	0	3	0
Total	2,331	100	2,344	100	2,357	100
Unweighted Total	3,762		4,153		3,853	

227. Although the extent to which householders monitor their energy use has not changed over the period 2008 to 2010, the number and proportion of people who have an energy-use monitoring device in their home has. Table 77 shows that the number of households with an energy-use monitoring device in their home has more than doubled over this period, although this still represents a very small proportion (4% in 2010) of all households in Scotland.

Table 78 Extent to which energy use is monitored 2008 to 2010 (000s and %)

	2008		2009		2010	
	000s	%	000s	%	000s	%
Very closely	265	11	294	13	275	12
Fairly closely	775	33	794	34	783	33
Not very closely	551	24	588	25	543	23
Not at all	727	31	660	28	750	32
Don't know	13	1	9	0	7	0
Total	2,330	100	2,344	100	2,357	100
Unweighted total	3,762		4,153		3,853	

Figure 35 Weekly household income band by extent to which households monitor energy use (%)



Lighting/ Appliances

228. Buying energy efficient lighting and appliances will also help reduce the amount of energy used in a home. However as shown in Chapter 1 the rise in the number of light points means that these efficiencies are not realised in reduced energy for lighting.

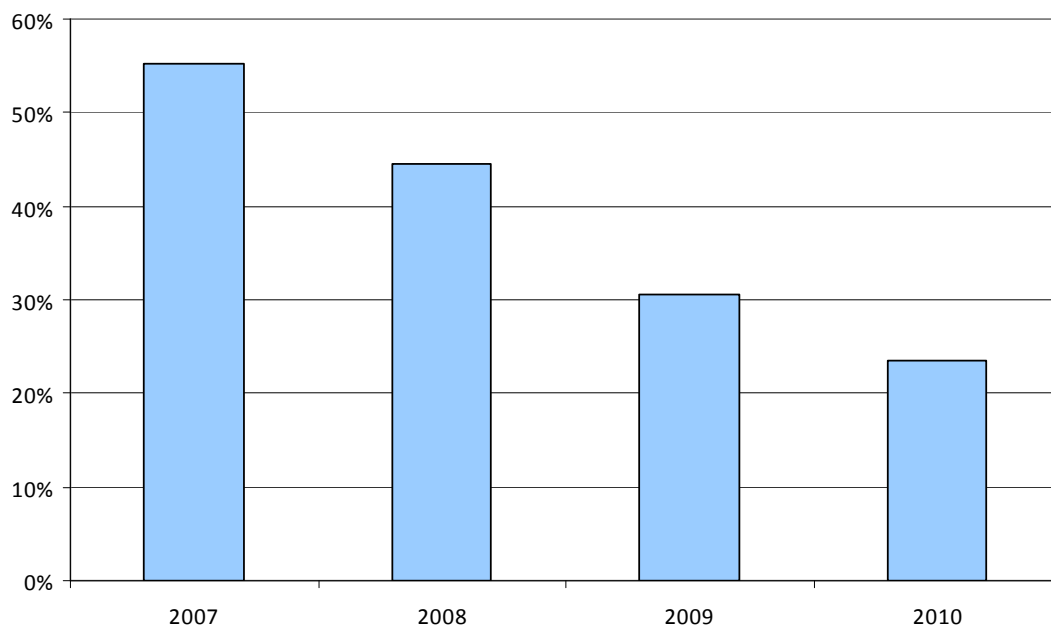
Lighting

229. Lighting accounts for 8% of a typical household's energy bills and cutting lighting bills is one of the easiest ways to save energy and money in the home.
230. If a traditional light bulb is replaced with a compact fluorescent bulb of the same brightness it will typically save around £3 per year, or £55 over the life of the bulb. If

a 50W halogen downlighter is replaced with a 6W LED it will typically save around £4 per year, or £70 by the time you have to replace the bulb³⁸.

231. Low-energy lighting is fast becoming the norm as old, inefficient bulbs are phased out. The new technology is developing quickly and there are now a wide range of products to choose from. The European Commission has been working to phase out inefficient light bulbs, standard filament bulbs from 60W upwards have now been phased out, and lower output bulbs are due to go in September 2012. Halogen spotlights will have to meet new minimum efficiency standards from 2016.
232. Since 2007 the SHCS has collected data on low energy lighting (LEL). Since 2007 the number of households with no LEL has more than halved. In 2010, 24% of dwellings had no LEL in fixed outlets, compared to 55% in 2007.

Figure 36 Percentage of dwellings with no fixed low energy lighting: 2007 - 2010



³⁸ <http://www.energysavingtrust.org.uk/In-your-home/Lighting/Saving-energy-from-lighting>

Table 79 Percentage of fixed light fittings with low energy lighting (000s and %):
2007 – 2010

	2007		2008		2009		2010	
	000s	%	000s	%	000s	%	000s	%
0%	1,279	55	1,039	45	717	31	556	24
10%	134	6	223	10	269	11	201	9
20%	204	9	211	9	250	11	248	11
30%	104	4	113	5	168	7	185	8
40%	67	3	72	3	105	4	135	6
50%	131	6	173	7	220	9	236	10
60%	48	2	64	3	85	4	124	5
70%	33	1	49	2	86	4	109	5
80%	62	3	113	5	145	6	166	7
90%	61	3	98	4	130	6	145	6
100%	190	8	169	7	170	7	251	11
Not applicable	1	0	7	0	1	0	-	-
Total	2,313	100	2,331	100	2,344	100	2,357	100

Appliances

233. Appliances account for around one third of the average electricity bill. Steps to enable householders to identify more energy efficient products, such as white goods A- G ratings encourage them to buy products which are more energy efficient.
234. SEAB'08 suggests that awareness of the energy efficiency ratings of domestic appliances could be improved. People surveyed who had bought electrical appliances in the last two years were asked whether they knew the energy efficiency rating of their appliance. Most said they did not or that they could not remember the rating, although the figure varied depending on the specific type of appliance bought. Of those who had bought a television, just over four in five did not know its energy-efficiency rating, compared with around half of those who had bought a fridge, freezer, washing machine or dish washer.

Installing domestic micro-generation through renewables

235. Generating your own energy not only reduces CO₂ emissions but can also save money. Micro- generation systems make use of renewable energy - energy from a source that is naturally replenished when used. The most common types of renewables used are energy from sunlight (solar) , heat from the earth, the air or water sources, plants grown for fuel (biomass or biofuels), the movement of water (known as hydro) and wind.

Solar panels (PV) and solar water heating

236. Solar panel electricity systems, also known as solar photovoltaics (PV), transform solar energy into electricity using photovoltaic cells. These cells don't need direct sunlight to work - they can still generate some electricity on a cloudy day. The electricity generated can be used to run household appliances and lighting and if excess is generated it can be exported to the national grid.

237. Solar water heating systems also use solar energy, but they use the heat from the sun to directly heat domestic hot water. A conventional boiler or immersion heater can be used to make the water hotter, or to provide hot water when solar energy is unavailable.
238. The SHCS collects data on whether dwellings have PV or solar water heating and also data on whether the dwelling is suitable for either. To benefit from the installation of PV and/or solar water heating, a dwelling must have a roof of sufficient size and appropriate orientation that is not over-shaded by objects that will block out the sun in winter. A dwelling that is suitable for solar water heating will also be suitable for PV as PV benefit from a wider angle of incidence in their orientation.

Table 80 Suitability for solar water heating or photovoltaics (000s and %): 2010

	000s	Percent	<i>Unweighted count</i>
no	828,000	35	1,062
yes, photovoltaics	342,000	15	497
yes, solar water heating	1,179,000	50	1,543
solar water heating already installed	7,000	0	11
photovoltaics already installed	0	0	1
unobtainable	1,000	0	1
Total	2,357,000	100	3,115

239. Table 80 shows that in 2010 less than 1% of dwellings had PV or solar panels. However 50% of all dwellings are suitable for solar panels (and PV) and a further 15% are suitable for PV only.

Biomass heating systems

240. Biomass is a collective term for all plant and animal material. A biomass heating system uses such material as its fuel. Wood-fuelled heating systems are the most common in domestic use, they burn wood pellets, chips or logs to provide warmth in a single room or to power central heating and hot water boilers.
241. EST estimate that a typical three-bedroom semi-detached house with basic insulation could save almost £600 a year if switching from electricity or about £100 if switching from gas to a biomass heating system. There would also be significant CO₂ savings; 7.5 tonnes a year if switching from electricity and 3 tonnes a year if gas³⁹.

Heat pumps

242. A heat pump is a device that absorbs heat energy from a low temperature source and upgrades it to a higher temperature so that the heat can be usefully used for space or water heating. Heat pumps have some impact on the environment as they need electricity to run, but the heat they extract from the ground, air, or water is constantly being renewed naturally.

³⁹ <http://www.energysavingtrust.org.uk/Generate-your-own-energy/Wood-fuelled-heating>

Ground Source Heat Pumps (GSHP)

- 243. Ground source heat pumps use pipes which are buried in the garden to extract heat from the ground. This heat can then be used to heat radiators, underfloor or warm air heating systems and hot water.
- 244. A GSHP circulates a mixture of water and antifreeze around a loop of pipe which is buried either vertically or horizontally in the garden. Heat from the ground is absorbed into the fluid and then passes through a heat exchanger into the heat pump. The ground stays at a fairly constant temperature under the surface, so the heat pump can be used throughout the year - even in the middle of winter.

Air Source Heat Pumps (ASHP)

- 245. Air source heat pumps absorb heat from the outside air. This heat can then be used to heat radiators, underfloor heating systems, or warm air convectors and hot water. It can get heat from the air even when the temperature is as low as -15° C, though the efficiency of the system may be affected at very low temperatures.
- 246. The SHCS started collecting data on heat pumps in 2010. In 2010, less than 1% of all dwellings had any type of heat pump. Unfortunately as the sample size is so small it is not possible to do any further analysis. We hope that in future as more dwellings begin to install renewable sources of energy we will be able to look at these households in more detail.
- 247. Information on the uptake of Government schemes which subsidise the installation of renewable technologies are available in Chapter 7.
- 248. SEABS'08 suggests that understanding of microgeneration is low. Usage is very low, with only around 1% of people in the survey using energy from microgeneration. People were generally very unsure as to whether their homes were suitable for photovoltaics, solar panels, air and ground source heat pumps or micro wind turbines.

Influencing Public Attitudes and Behaviours

- 249. SEABS'08 suggests that public awareness of environmental and energy consumption issues, while undoubtedly important, is less of an issue than translating awareness into action.
- 250. There are many barriers to action, and the choices available to consumers can appear limited, not always enabling them to take the positive action they would wish. SEABS'08 identified four recurring reasons as to why people do not always choose to adapt their behaviour. These were: convenience; cost; a lack of alternative options; and practical considerations.
- 251. A paper published in 2010 summarised an evidence review to examine the effectiveness of different policy approaches to reducing domestic energy

consumption through changing people's behaviours⁴⁰. Overall, the evidence suggests that the challenges were in line with those found through SEABS. However, the review found that savings of 5 to 15 percent may be possible in some households with considerable variation both between and within interventions. This evidence review found that:

- Although information awareness campaigns have been the policy tool of choice the evidence consistently reports that on its own general information is not a very effective strategy and tends to generate limited and short-lived effects.
- Research consistently reports that tailored information and feedback interventions (e.g. where information about an individual's energy consumption (and production) levels is provided) are considerably more effective than general information campaigns.
- To maximise impact, research suggests that information needs to be personalised, continuous and visually appealing
- The evidence suggests that community projects tend to be relatively effective showing the powerful influence of an individual's social circle in promoting cooperative behaviour and improved performance. However, community-led interventions tend to be resource intensive for participants and are highly dependent on the determination of individual enthusiasts and highly motivated participants, and so may not be achievable on a national scale.
- The effectiveness of an intervention may also depend on the behaviours that it targets. The 'whole house' approach appears to be more effective than those targeted at a small number of behaviours.

252. There is a huge challenge involved in enabling and encouraging people in Scotland to make voluntary changes to their lifestyles which will significantly reduce emissions. Chapter 7 describes some programmes that both the UK and Scottish Government have initiated to help people improve domestic energy efficiency of their home, these range from providing energy saving advice to providing free or subsidised wall and loft insulation.

⁴⁰ [Changing Household Energy Behaviours: Key Findings from a Review of Applied Research](#)

Chapter 7: Energy Efficiency Schemes

Key Findings

- Between April 2008 and September 2011 there have been approximately 327,000 measures installed in Scotland through Carbon Emissions Reduction Target.
- In Scotland, there were 52 schemes with 233 measures submitted to the Community Energy Saving Programme as at 31st December 2011.
- From April 2009 to February 2012 the Energy Assistance Programme has provided energy advice on just over 230,000 occasions to households in Scotland and referred over 54,000 households for central heating systems.
- Between 1 April 2010 and 31 December 2011 just under 10,000 renewable installations have been registered under the Feed in Tariff scheme in Scotland (not all domestic).
- Since its launch in May 2010, just under 20,000 households have received a subsidy under the Boiler Scrappage Scheme.
- During phase 1 of the Renewable Heat Premium Payment Scheme there were a total of 673 installations in Scotland.

253. Both the UK and Scottish Governments see improving the energy efficiency of their housing stock as a vital step to meeting climate change targets, as well as eliminating fuel poverty. Improving energy efficiency is one of the most cost effective ways of achieving desired reductions in carbon emissions by reducing energy consumption.
254. The UK and Scottish Government both run a variety of programmes that Scottish households are able to apply for if eligible. The benefits of these schemes can range from advice on how to cut down energy bills to free loft and cavity wall insulation.
255. This chapter takes a brief look at some of the main schemes and where possible tries to quantify the benefits of each. A full list of all schemes available to householders in Scotland will be available on the Scottish Government website in due course⁴¹.

UK wide schemes

The Carbon Emissions Reduction Target (CERT)

256. The Carbon Emissions Reduction Target (CERT) requires all domestic energy suppliers with a customer base in excess of 250,000 GB customers to make savings in the amount of CO₂ emitted by householders. Suppliers meet this target by promoting the uptake of low carbon energy solutions to household energy consumers, thereby assisting them to reduce the carbon footprint of their homes.

⁴¹ <http://www.scotland.gov.uk/Topics/Built-Environment/Housing/sustainable>

257. Energy suppliers provide grants and offers to help customers pay for energy efficiency measures and renewable energy technologies for their home. These measures will in turn reduce the energy consumption in these households, thereby reducing the CO₂ emitted.
258. CERT years run from the 1st April to 31st March, with Year 1 starting on 1st April 2008. From April 2008 until September 2011 there have been approximately 327,000 professionally installed loft and cavity insulation measures installed in Scotland, accounting for about 11.5% of homes. This compares to almost 12% of homes in England and 15% of home in Wales. (Table 81)
259. There is a known difference in the data reported in the below tables (from HEED, EST) and the number of records reported to Ofgem (who operate the scheme). This is referred to as the “Data Gap”. A significant cause of the data gap is a lag in the submission of data to HEED. The lag in data submission is sometimes longer for social housing installations. There are approximately 50,000 CWI and 100,000 LI installations across Great Britain relating to the Q12 and Q14 submissions which are expected in Q16. The cumulative Data Gap for quarters 1-14 of CERT is currently estimated to be 12%.

Table 81 CERT installations by country (all years)

Country	Cavity Wall Insulation 000s	Loft Insulation 000s	Total 000s	% of homes treated
England	1,371	1,742	3,112	11.7%
Scotland	143	185	327	11.5%
Wales	94	150	244	15.3%
Great Britain	1,608	2,076	3,684	11.8%

Source: Energy Savings Trust

260. Of the installations made in Scotland over the 3 year period April 2008 to September 2011, 44% were cavity wall insulation and 56% were loft insulation. The split was the same in England, however in Wales there was a higher proportion of loft insulation (61%) and lower proportion of cavity wall insulation (39%).

Table 82 CERT installations in Scotland: 2008/09 – 2011/12 (to end Sep 11)

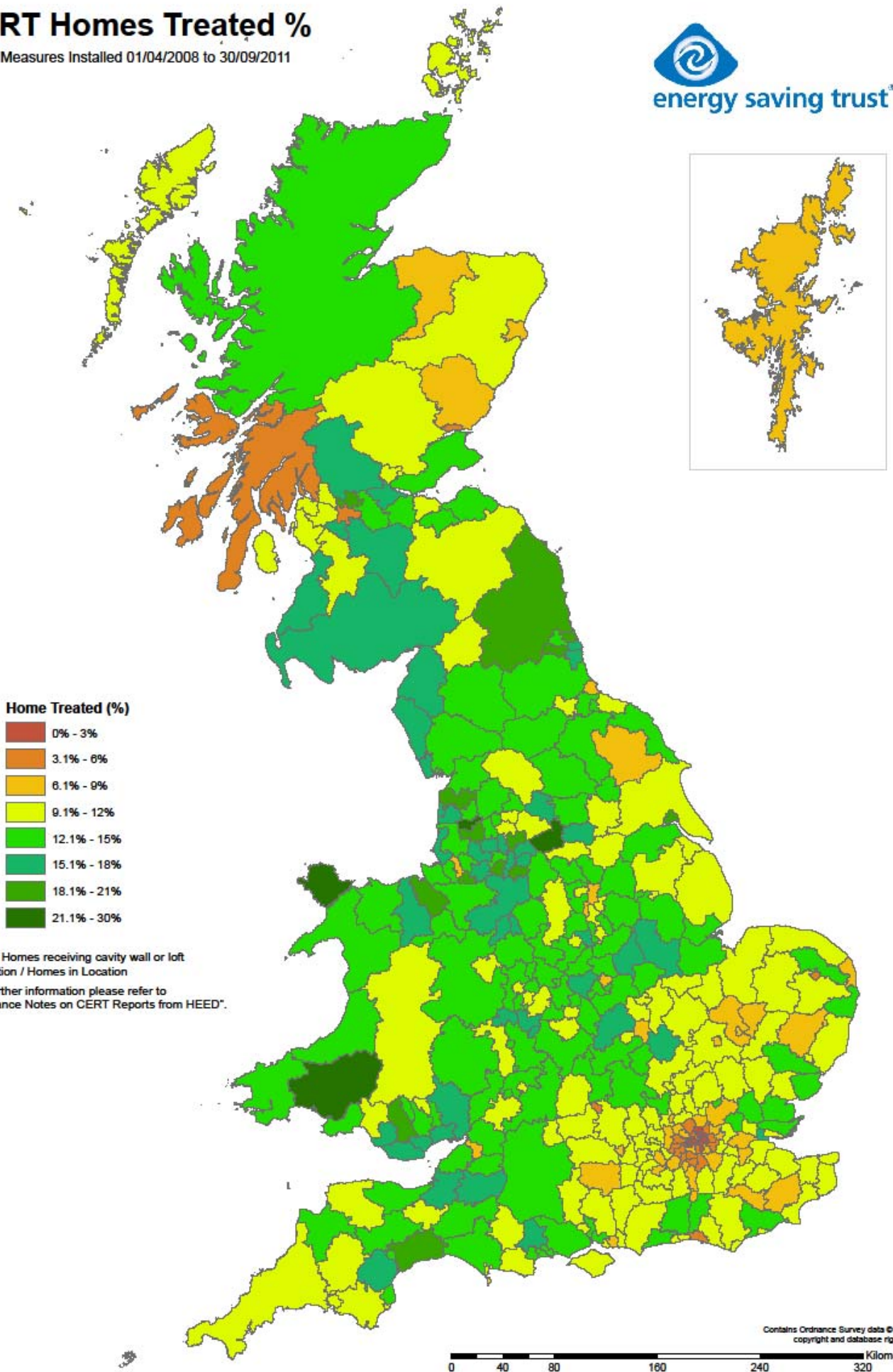
	Cavity Wall Insulation 000s	Loft Insulation 000s	Total 000s
CERT Year 1	40	39	79
CERT Year 2	46	52	99
CERT Year 3	40	60	100
CERT Year 4 (to end Sep 2011)	17	32	49
Total	143	185	327

Source: Energy Savings Trust

261. The below map illustrates the extent of CERT installations across Great Britain between 1st April 2008 and 30th September 2011. In general the more rural areas have a lower installation rate.

CERT Homes Treated %

CERT Measures Installed 01/04/2008 to 30/09/2011



Community Energy Saving Programme (CESP)

262. The Community Energy Saving Programme (CESP) was created as part of the UK Government's Home Energy Saving Programme. It requires gas and electricity suppliers and electricity generators to deliver energy saving measures to domestic consumers in specific low income areas of Great Britain.
263. The CESP obligation period runs from 1 October 2009 to 31 December 2012. It requires gas and electricity suppliers and electricity generators to meet a carbon emissions reduction target. These suppliers/generators must comply with an overall carbon emissions reduction target of 19.25 million tonnes of carbon dioxide (MtCO₂) by 31st December 2012.
264. CESP will also help reduce fuel poverty by requiring actions to be delivered in geographical areas selected using the Income Domain of the Indices of Multiple Deprivation (IMD) in England, Scotland and Wales. In England, the lowest 10 per cent of areas ranked in IMD qualify and in Scotland and Wales the lowest 15 per cent of areas qualify. There are currently 4,500 areas UK wide that are eligible for CESP.
265. CESP promotes a “whole house” approach i.e. a package of energy efficiency measures best suited to the individual property. The programme is delivered through the development of community-based partnerships between Local Authorities (LAs), community groups and energy companies, via a house-by-house, street-by-street approach.
266. At 31 December 2011 a total of 304 schemes had been submitted to Ofgem, 65 had received formal approval with a total estimated savings of 13.12 million (lifetime) tonnes CO₂. If all 304 schemes were completed this would represent 68% of the overall CESP target.⁴²
267. Of the 304 submitted schemes, all but 31 offer more than one measure. The average number of measures per scheme is 4.6 with a maximum of 12. The sum of all measures offered across the 304 schemes is 1,400.
268. Of the 1,400 offered measures, 49% are insulation measures featuring in 78% of schemes. Heating measures (39% of offered measures) are included in 77% of schemes.

⁴² Ofgem's Report on the Community Energy Saving Programme (CESP) 2009 – 2012, to 31 December 2011

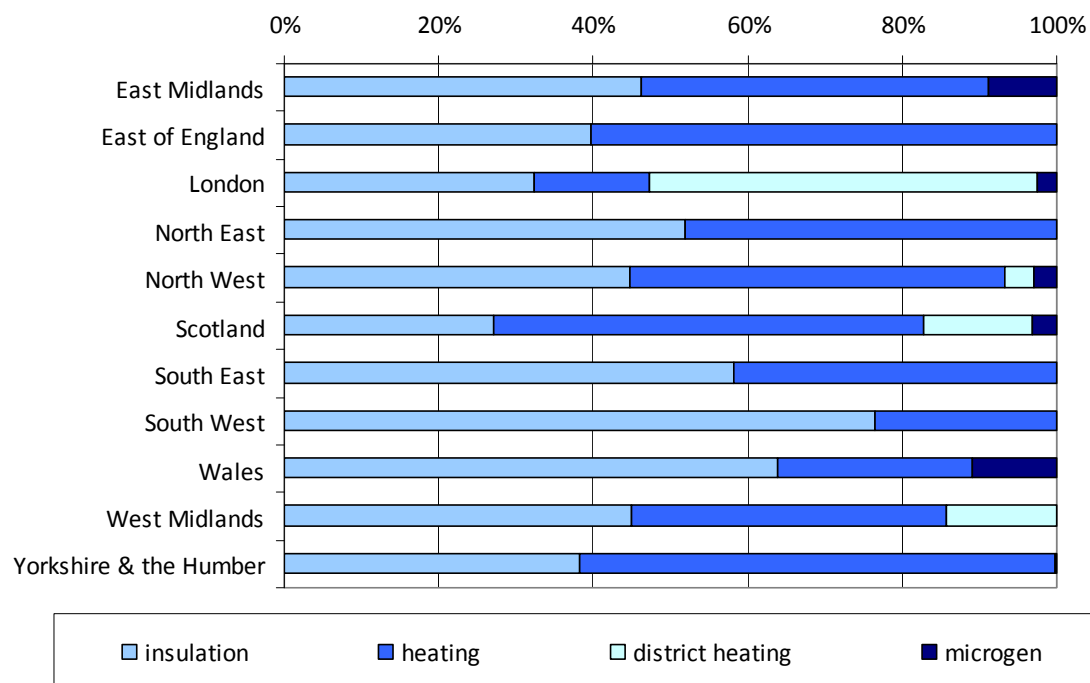
Table 83 Regional breakdown of CESP schemes, measures and CO₂ savings

Region	No. of CESP eligible LSOAs	Percentage of eligible LSOAs	No. of Schemes	Estimated CO ₂ Savings (Mt)	No. of Measures
	East Midlands	187	4%	17	1.33
East of England	114	3%	11	0.26	47
London	795	18%	23	0.86	105
North East	265	6%	28	1.02	124
North West	768	17%	64	2.91	278
Scotland	976	22%	52	2.13	233
South East	104	2%	6	0.16	25
South West	93	2%	11	0.34	36
Wales	284	6%	36	1.33	189
West Midlands	491	11%	26	1.58	119
Yorkshire & the Humber	431	10%	29	1.4	168
Great Britain	4508	100%	303	13.32	1399

Source: Ofgem²⁸

269. Of the schemes submitted up to December 2011 17% of schemes were situated in Scotland. The high scheme counts in the North West and Scotland mirror the proportion of LSOAs in those regions. Conversely, the reverse is the case in London where there is a significant mismatch between the number of eligible areas and both the scheme count and estimated CO₂ savings.

Figure 37 Mix of CESP measures by region



Source: Ofgem²⁸

270. Insulation and heating account for the majority of measures in all regions apart from London. In Scotland, 27% of measures are insulation, 56% heating, a further 14% district heating and the remaining 3% microgen.

Renewable Heat Premium Payment Scheme

271. The Renewable Heat Premium Payment (RHPP) voucher scheme is a UK Government scheme that gives money to householders to help them buy renewable heating technologies – solar thermal panels, heat pumps and biomass boilers. This scheme aims not only to cut carbon emissions but also to gather information on what people think of these technologies and how they perform in a variety of conditions.
272. Any householder in England, Wales or Scotland can apply for RHPP for solar thermal products, however, only householders with no access to mains gas can apply for funding for ground source and air source heat pumps and for biomass boilers.

Table 84 Grants available through the Renewable Heat Premium Payment

All houses	Houses off the gas grid
£300 – solar thermal – voucher valid for 3 months	£950 – biomass boiler – voucher valid for 6 months
	£850 – air source heat pump – voucher valid for 5 months
	£1250 – ground source or water source heat pump – voucher valid for 6 months

273. Successful applicants have to meet certain simple conditions; the dwelling must be the main home and it must have basic energy efficiency measures in place. This means the dwelling must already have at least 250mm loft insulation and cavity wall insulation, where these measures are practical.
274. The applicant must also agree to having an extra meter attached to the installation as one of the objectives of the scheme is to monitor and learn about how heating systems are used in practice in various different circumstances and types of home. Applicants will also be asked to fill in two customer questionnaires, one immediately after installation and one after a follow-up period.
275. Phase 1 of the RHPP scheme came to an end on the 31st March 2011. During phase 1 of the scheme there were a total of 673 installations in Scotland. Table 85 shows which technologies these installs were of.

Table 85 RHPP installs during phase 1 in Scotland

Technology	Count
Air Source Heat Pump	153
Biomass Boiler	225
Ground or Water Source Heat Pump	119
Solar Thermal	176
Total	673

Source: EST

276. Phase 2 of the RHPP scheme runs from 1st May 2012 to 31st March 2013⁴³.

Feed-In Tariffs scheme (FITs)

277. The Feed-in Tariffs (FITs) scheme was introduced on 1 April 2010, under powers in the Energy Act 2008. FITs will allow many people to invest in small-scale low-carbon electricity, in return for a guaranteed payment from an electricity supplier of their choice.

278. There are three financial benefits from FITs:

- Generation tariff – the electricity supplier of your choice will pay you for each unit (kilowatt) of electricity you generate
- Export tariff – if you generate electricity that you don't use yourself, you can export it back to the grid. You will be paid for exporting electricity as an additional payment (on top of the generation tariff)
- Energy bill savings – you will not have to import as much electricity from your supplier because a proportion of what you use you will have generated yourself, you will see this impact on your electricity bill.

279. Most domestic technologies (and larger systems up to 5 megawatts) qualify for the scheme, including:

- solar electricity (PV) (roof mounted or stand alone)
- wind turbines (building mounted or free standing)
- hydroelectricity
- anaerobic digesters
- micro combined heat and power (CHP).

280. It is estimated that a typical domestic solar electricity system with an installation size of 3kWp could earn £670 per year⁴⁴.

281. Tariffs under the scheme are currently under review and updates can be found on DECC and EST's websites.

282. A total of 147,112 renewable installations have been registered under the scheme between 1 April 2010 and 31 December 2011 across the UK, just under 10,000 of these are in Scotland. Of the UK installs 67% are domestic schemes and 1% community schemes.

Green Deal / ECO

283. The Energy Act 2011⁴⁵ enables the UK Government to create a new market driven initiative - the Green Deal. There is also a new Energy Company Obligation (ECO) which will replace existing energy company obligations. Both domestic Green Deal

⁴³ <http://www.energysavingtrust.org.uk/Generate-your-own-energy/Financial-incentives/Renewable-Heat-Premium-Payment>

⁴⁴ <http://www.energysavingtrust.org.uk/Generate-your-own-energy/Financial-incentives/Feed-In-Tariffs-scheme-FITs>

⁴⁵ http://www.decc.gov.uk/en/content/cms/legislation/energy_act2011/energy_act2011.aspx

and ECO are due to start in October 2012, with the non domestic Green Deal following thereafter. The Act creates a new financing framework which will enable the provision of energy efficiency improvements to domestic and non-domestic properties, funded by a charge on energy bills.

284. Under the Green Deal, individuals and businesses will be able to implement energy efficiency improvements to their properties at no upfront capital cost. The capital costs will be recouped over time through regular instalments on electricity bills.
285. The Green Deal 'Golden Rule' specifies that repayment charges must be less than the expected savings from the energy efficiency measure, so that customers total bills should not increase (unless they make other lifestyle changes which affect their energy consumption).
286. Energy companies will also be required to achieve carbon saving, carbon saving community and affordable warmth targets, it is estimated they will invest £1.3bn per year GB wide in promoting and subsidizing energy efficiency measures. The key focus of ECO will be on those households who cannot achieve significant energy savings without an additional or different measure of support. For example, this includes vulnerable and low-income households and those living in harder to treat properties, such as solid walled properties. There is also a Carbon Saving Communities element which is designed to target insulation measures in low-income communities.
287. As it is for energy companies to determine where their investment takes place in order to meet their targets, there is no guarantee of a specific level of investment in Scotland. However, the Scottish Government is working with energy companies, local councils and other partners to develop a national retrofit programme to tackle fuel poverty and maximise energy company investment in Scotland.

Scotland wide schemes

Boiler Scrappage Scheme

288. The Boiler Scrappage Scheme was launched in May 2010 and is managed by the Energy Saving Trust (EST). It offers owner occupiers a £400 subsidy to help meet the cost of replacing inefficient boilers with new more efficient alternatives. The boiler being replaced must be in working order and have a SAP(2009) efficiency rating of less than 70% in order to qualify for the scheme.
289. In the first year of the scheme (FY 2010/11) just over 7,000 households received a subsidy and in FY 2011/12 it is estimated that just over 12,000 have.⁴⁶ For each new boiler installed it is estimated that about 1 tonne of CO₂ is saved annually and that householders will make a saving of about £300 each year on their energy bills.⁴⁷

⁴⁶ <http://www.energysavingtrust.org.uk/scotland/Publications2/Take-Action/Detailed-report-2009-2012-EAP-stages-1-3-to-end-Feb-2012-Excel-439KB>

⁴⁷ <http://www.energysavingtrust.org.uk/scotland/In-your-home/Heating-and-hot-water/Replacing-your-boiler>

290. Following the success of the Boiler Scrappage Scheme the Private Sector Landlord Boiler Scrappage Scheme was launched in November 2010.

Home Insulation Scheme (HIS) \Universal Home Insulation Scheme (UHS)

291. The Home Insulation Scheme (HIS) was an area based scheme designed to improve the energy efficiency of houses by promoting and installing free or discounted loft and cavity wall insulation and other energy saving measures. It was managed by the Energy Saving Trust (EST) and backed by the Scottish Government, with additional funding from local authorities, housing associations and energy companies.
292. HIS was an area-based scheme, available to around 380,000 properties in 29 local authority areas. The scheme began in November 2009 when it was available to around 100,000 properties in 10 local authority areas.
293. Areas covered by the scheme were chosen according to criteria including levels of fuel poverty and emissions, the potential number of treatable houses and the potential for complementary funding.
294. In 2010/11, EST advisors visited over 290,000 homes across 28 local authorities within the year to give energy advice and to make installation referrals on the doorstep. More than 29,000 insulation measures have been installed under HIS between 2009/10 and 2010/11, with 27,521 households benefiting from these (each household can receive more than one measure).

Table 86 HIS measures installed⁴⁸: 2009/10 – 2010/11

Insulation measure	2009/10	2010/11	Total
Loft – virgin	1,679	1,134	2,813
Loft – top-up	12,240	9,336	21,576
Cavity wall	3,227	1,404	4,631
Total measures	17,146	11,874	29,020
No. of households that got measures	16,348	11,173	27,521

295. The Universal Home Insulation Scheme (UHS) was introduced in 2010-11 replacing the Home Insulation Scheme (HIS). UHS is a free-to-all scheme which provides free energy efficiency measures, such as loft and cavity wall insulation in selected areas. UHS has proved to lead to more insulations than HIS. The Scottish Government has committed to investing over £16 million to fund UHS throughout 2012-13.
296. UHS is available in areas selected and put forward by local authorities, who are also responsible for the administration of the scheme. In 2012–13 every local authority in Scotland will be participating in the scheme..

⁴⁸ <http://www.energysavingtrust.org.uk/scotland/Publications2/Take-Action/Detailed-report-2009-2012-EAP-stages-1-3-to-end-Feb-2012-Excel-439KB>

Table 87 UHIS measures installed⁴⁹: 2010/11 – 2011/12

	2010/11	2011/12
Loft – virgin	5,601	5,975
Loft – top-up	13,451	11,974
Internal wall	42	27
Cavity wall	10,682	9,764
Other	4,121	1,898
Total	33,897	29,638

297. In the first year of UHIS just under 34,000 insulation measures were installed in households in Scotland and in the second year (2011/12) just under 30,000 insulation measures were installed⁵⁰.
298. It is estimated that the measures installed through UHIS in 2010/11 will save approximately 11 ktonnes of CO₂ per year and 459 ktonnes through the lifetime of the measures and measures installed should save a further 11 ktonnes of CO₂ per year and 442 ktonnes through out their lifetime.⁵¹

Home Renewables Loan and Home Loans Schemes

299. Since 2007, the Scottish Government has provided nearly £13 million in grants and loans direct to householders to help install microgeneration and continues to fund interest free loans for householders through the Home Renewables Loan and Home Loans schemes to help them benefit from the Feed in Tariff (FIT) and Renewable Heat Premium Payments (RHPP).
300. Until 2010, grants were available for renewable energy equipment, with over 80% paid for renewable heating systems. Support has now switched to loans as grants would have made householders ineligible to receive FIT and RHI payments.
301. The Homes Renewables Loans scheme is administered by Energy Saving Trust and, until recently, provided interest-free loans of up to £2,000 to householders for renewable energy installations. A new £5 million boost in the budget has allowed an increase in these loans to up to £10,000 to target renewable heat. This increase better reflects the cost of renewable heating systems and gives householders the capital to install the equipment.
302. The Home Loans scheme is a separate scheme in Universal Home Insulation Scheme (UHIS) areas, aimed primarily at improving energy efficiency. This scheme can provide loans of up to £10,000 for renewable heating systems in UHIS areas,

⁴⁹ A household can have more than one measure installed.

⁵⁰ These are not final figures for 2011/12. Local Authorities are still completing work from the 2011/12 budget on an on going basis. Final figures for loft and cavity insulation should be confirmed by the end on September 2012 and final figures for any hard to treat measures will be confirmed by the end March 2013.

⁵¹ <http://www.energysavingtrust.org.uk/scotland/Publications2/Take-Action/Detailed-report-2009-2012-EAP-stages-1-3-to-end-Feb-2012-Excel-439KB>

although it is not promoted as such, and there has been some limited uptake for heating in these areas.

Energy Assistance Package (EAP)

303. The Energy Assistance Package provides a range of measures to support those likely to have difficulty paying their fuel bills or keeping their home sufficiently warm.
304. EAP is designed so that almost everyone can get some form of help. The package has four stages:
- Stage one offers free expert energy advice to anyone who phones the Energy Savings Scotland advice centre (ESSAC).
 - Stage two provides benefits and tax credit checks and information on low cost energy tariffs to those at risk of fuel poverty.
 - Stage three provides a package of standard insulation measures (cavity wall and loft insulation) to older households and those on one of a range of benefits.
 - Stage four offers a package of enhanced energy efficiency measures to those who are most vulnerable to fuel poverty.
305. The Energy Saving Trust (EST) manages delivery of Stages 1-3 of the package on behalf of the Scottish Government and Scottish Gas manage the delivery of Stage 4. From April 2009 to February 2012 EST estimate that EAP has provided energy advice on just over 230,000 occasions to households in Scotland.

Table 88 EAP measures by stage⁵² : 2009/10 – 2011/12⁵³

	2009-10	2010-11	2011-12
Stage 1 Energy saving advice (households)	66,024	126,855	37,478
Stage 2 Income maximisation referral (people)	11,095	19,856	7,012
Stage 2 Energy cost reduction referral	20,055	30,939	7,182
Stage 3 Insulation referral (households)	9,263	9,440	4,799
Stage 4 referral (households)	15,061	24,406	14,177

Source: EST⁵²

306. Under Stage 2 of EAP approximately 38,000 people were given an income maximisation referral and 58,000 an energy cost reduction referral between April 2009 and February 2012. EST estimate that on average the reduction in annual energy costs from switching to social tariffs⁵⁴/rebates/discounts was about £130 for those that were helped and if switching payment type the average saving for those helped was about £79.

⁵² <http://www.energysavingtrust.org.uk/scotland/Publications2/Take-Action/Detailed-report-2009-2012-EAP-stages-1-3-to-end-Feb-2012-Excel-439KB>

⁵³ EAP 2011/12 stages 1 to 3 data is to end February 2012.

⁵⁴ These estimated benefits are savings predicted by the fuel supplier, based on actual customers helped (Source: Energy Retailers Association). Each company sets its own conditions for social tariffs.

- 307. Stage 3 measures are estimated to have reduced annual fuel bills for those assisted by an average of £136 to September 2011 and saved households about 0.6 tonnes CO₂ per year.
- 308. Approximately 54,000 households received referrals to Stage 4 of EAP. Through Stage 4 households can receive a package of energy efficiency measures, most of which will include a new heating system.

District Heating Loan Scheme

- 309. The Scottish Government's district heating loan fund has been operating since 2011 and is administered by Energy Saving Trust. The scheme provides loans for both low carbon and renewable technologies to help organisations implement district heating projects to benefit local communities.
- 310. Low interest loans of up to £400,000 per project will be made available to be repaid over a period of up to 10 years. The scheme is open to local authorities, registered social landlords, small and medium sized enterprises and energy services companies (ESCOs).
- 311. In 2011 around £1.9 million was allocated to district heating schemes across Scotland. At least a further £5 million has been allocated to the loan scheme to continue and we expect it to be self financing in the medium term, providing some confidence of finance opportunities for developers of these schemes. In order to achieve the scale of ambition we have for district heating, we have also made provision for funding district heating within the recently announced £103 million Renewable Energy Investment Fund and the £50 million Warm Homes Fund.