Local energy assessment report

Summary of housing stock assessment modelling in Bedminster and Southville

Energy efficiency and the potential for low-carbon improvement

Prepared for **Southville Community Development Association** on behalf of **Bedminster Energy Group** by the Centre for Sustainable Energy, July 2012

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We are a national charity that helps people change the way they think and act on energy.

Introduction

In December 2011, the Government announced the launch of the Local Energy Assessment Fund (LEAF), a £10 million funding package to support communities seeking to investigate energy efficiency and renewable energy projects in their area.

LEAF funding was available to not-for-profit groups such as parish councils, co-operatives and community interest companies, and designed to help them benefit from low-carbon policies such as the Green Deal and Renewable Heat Incentive.

Bedminster Energy Group made a successful application to the Local Energy Assessment Fund and commissioned the Centre for Sustainable Energy (CSE) to carry out a Housing stock assessment designed to give a clearer picture of the options available for local renewable energy and/or energy efficiency projects at the community level in Bedminster and Southville.

These studies were undertaken early in 2012 and presented to Bedminster Energy Group in July 2012. This document is a summary of main findings of the studies.

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1 | A summary of **housing stock assessment modelling** in Bedminster and Southville

This is a summary of the housing stock assessment modelling carried out for **Bedminster Energy Group** in July 2012 by the Centre for Sustainable Energy.

This assessment of the local housing stock is based on a comprehensive computer modelling tool developed by CSE. This tool draws on a variety of reliable data sources to generate a full dataset for the area and produce a baseline assessment of household energy consumption, CO_2 emissions, fuel costs and SAP rating. Calculations are then made on the best combinations of energy efficiency and renewable energy measures that could be applied across the housing stock, including the potential for improving energy efficiency levels and reducing CO_2 emissions and household fuel costs.

CSE has extensive experience in housing stock modelling and analysis, and has developed a comprehensive housing stock assessment tool to analyse combinations of measures, scenarios and fuel poverty and carbon impact. Recent key projects include modelling Bristol's housing stock (across all tenures) and Somer Housing Group's stock for energy efficiency, and co-developing the scoping study for DECC's national household model.

Background

The UK has a target to reduce greenhouse gas emissions by at least 80% by 2050 and improving the energy efficiency of existing housing is one of the easiest and most cost-effective ways to achieve this. The UK also has very high household fuel bills compared with other countries, and has targets to address fuel poverty. Assessing potential for energy efficiency improvements in homes is key to addressing climate change and fuel poverty. The residential sector accounts for 30% of overall energy consumption in the UK. Improvements to the energy efficiency of our housing stock will result in reduced energy consumption, reduced carbon emissions, warmer homes and more affordable fuel bills.

This report summarises the findings of the assessment and compares it with houses in the wider region and in the UK as a whole. It details the best options calculated by the model for improvements to homes to achieve the best CO_2 reductions, bill savings and improvements to energy efficiency ratings, together with estimated costs and finance options.

Energy use for homes in Bedminster and Southville is estimated at 265,419,605 kWh per year in total, with Carbon emissions of 80,632 tCO_2.

The best packages of energy efficiency improvements across the whole housing stock has potential to cut modelled energy use by over a third, reduce carbon emissions to around 65,000 tCO_2 and bring energy bills down by an average of around £200 per household.

Current energy demand (modelled): 265,419,605 kWh/year

Reduced energy demand: 165,182,626 kWh/year

Current carbon emissions (modelled): 80,632 tCO_2/year

Reduced carbon emissions: 65,001 tCO_2/year

Image: Clinton Johnston / istock.com

Assessment methodology and area

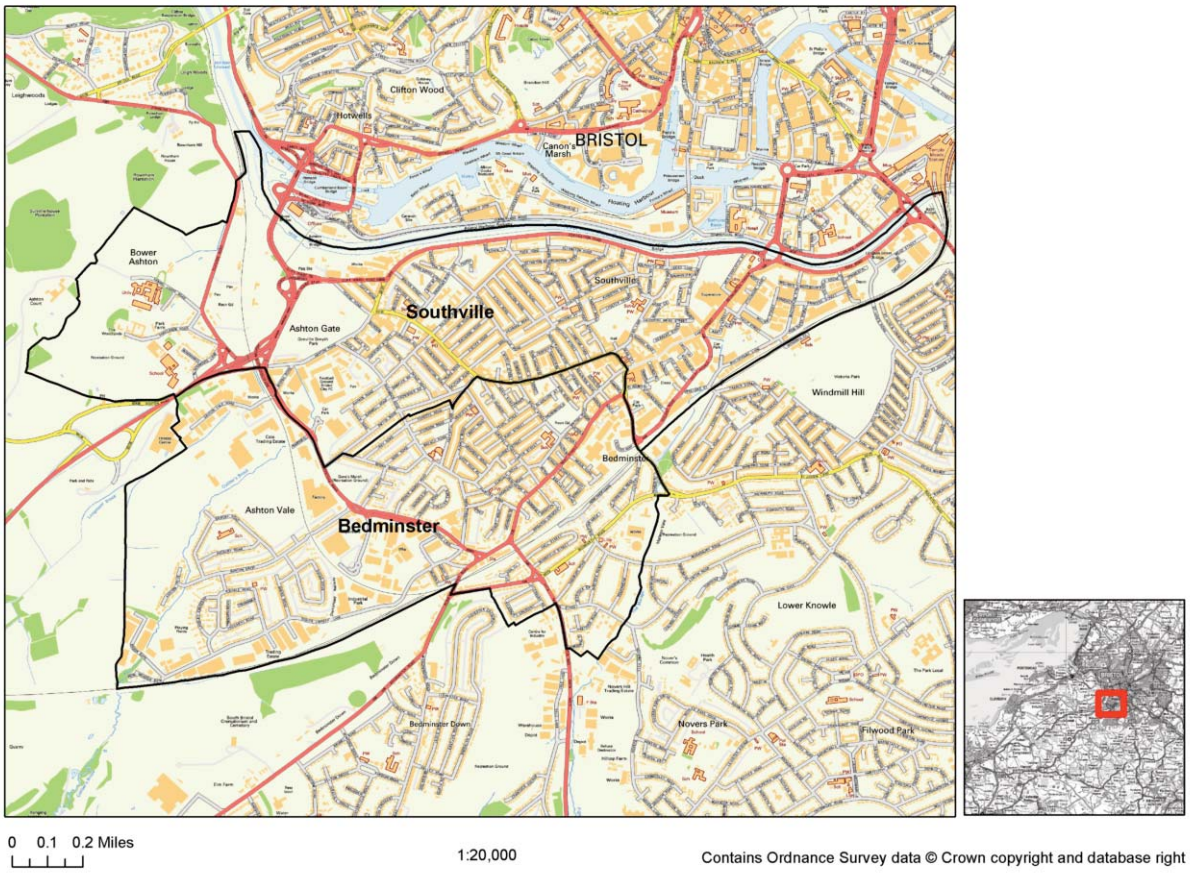
CSE used the Housing Assessment Model to analyse data about the housing stock in Bedminster and Southville.

Information on housing tenure; dwelling type; property age; number of bedrooms; gas connection; and socio-economic category was purchased and processed to establish a household level dataset. Data was then modelled to calculate household energy consumption levels, CO_2 emissions, fuel costs and SAP ratings, and the best packages of energy efficiency and renewable energy measures to make improvements.

Recommended improvements were calculated based on 3 scenarios: greatest improvement in SAP rating; greatest reduction in energy bills; and greatest reduction in CO_2 emissions. The approximate cost of carrying out these improvements is also given.

In addition to this modelling, 580 surveys were completed by local householders in order to gain more detailed information on individual houses. This was modelled as a sub-set of data for comparison but represents a small percentage (5%) of the total housing stock. Survey data was used to write up some local case studies.

Map of Bedminster and Southville

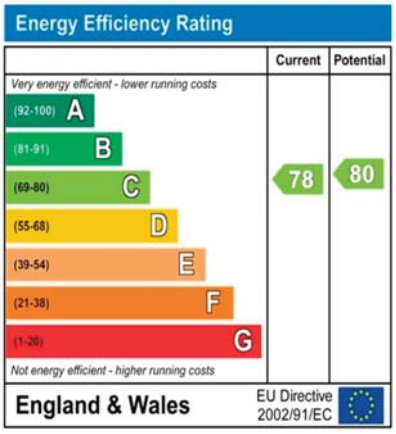


Explaining the terminology

Standard Assessment Procedure (SAP) Ratings

SAP ratings show the energy performance of a dwelling on a scale of 1 to 100, with A to G categories within this scale. The rating is a calculated based on energy cost per m^2 and is linked to the theoretical running costs of a house. A high number and letter means a good energy performance and low running costs.

Currently there are very few A-rated properties in England and Wales. Most properties have an average SAP rating of 53 and are either D or E banded properties. This highlights the pressing need to improve the national housing stock.



Estimating household energy demand using SAP

SAP calculations are made based on the size, shape and physical characteristics of a house, including insulation levels, to calculate the rate of heat loss through walls, roofs, windows, doors and floors. Information about a house's heating system is also used.

A calculation is made of the amount of fuel required to heat a house to 21°C in the living space and 18°C in the rest of the house for 9 hours during weekdays and for 16 hours at the weekend. Fuel consumption is measured in kilowatt hours (kWh) which is the amount of energy consumed by using 1 kW of energy for an hour. Other calculations are used to determine the hot water and lighting requirements of a dwelling. The cost of fuel and carbon emissions for the dwelling are then estimated and a SAP rating calculated.

As various assumptions are made (for example, the occupancy of the house), energy consumption will vary and, as a general rule, the majority of households tend to consume less energy than the SAP calculation. However this assessment procedure is used in the study as it is the one which the Government will use for Green Deal measures.

The housing stock in Bedminster and Southville

CSE's model showed:

- There are approximately 12,000 households in the predominantly urban area.
- A significant majority of homes are terraced properties, which is a substantially higher proportion than both the regional and national averages. Flats also make up a considerable proportion of the housing stock.
- There are very few detached houses or bungalows and the proportion of semi detached dwellings is below regional and national averages.
- The majority of homes in the area were built between 1871 and 1945 which is older than the national average, with only 735 new dwellings built since 1980. The properties built before 1920 (46%) will mostly be low performing houses in terms of energy efficiency due to their solid wall construction.
- 57% of the homes are owner occupied and 27% are privately rented with the remaining 16% being social housing.

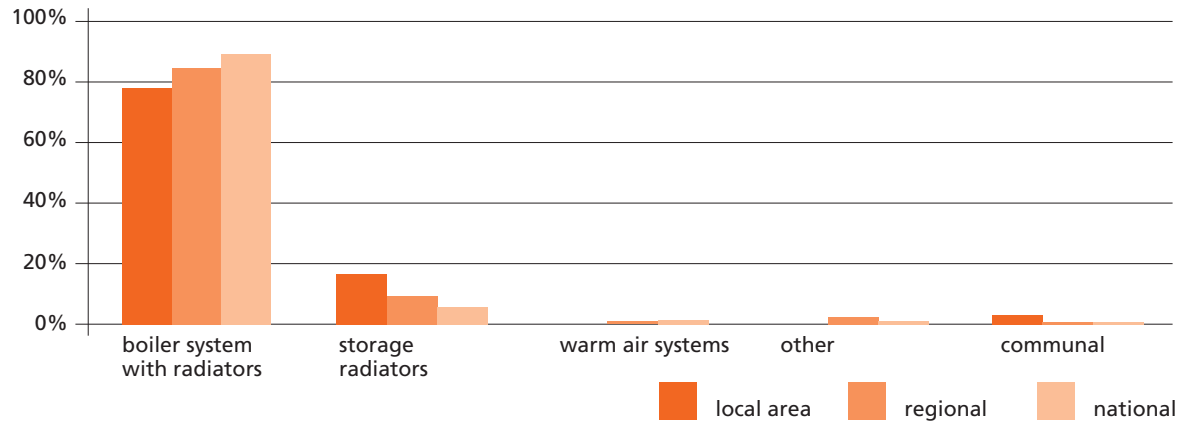
Housing stock in Bedminster and Southville by **dwelling type, age of property, tenure and mains gas connectivity**

	Households	Local area %	Regional %	National %
Dwelling type				
Detached	177	2%	20%	17%
Semi-detached	1,653	14%	24%	26%
Bungalow	105	1%	14%	9%
Terraced	7,004	61%	26%	29%
Flat	2,629	23%	16%	19%
Total	*11,568*	*100%*	*100%*	*100%*
Age of property				
pre-1870	715	6%	10%	5%
1871-1919	4,650	40%	13%	17%
1920-1945	3,823	33%	12%	17%
1946-1954	1,068	9%	5%	7%
1955-1979	577	5%	31%	30%
post-1980	735	6%	29%	23%
Total	*11,568*	*100%*	*100%*	*100%*
Tenure				
Owner occupied	6,578	57%	72%	68%
Privately rented	3,116	27%	16%	15%
LA/housing association	1,874	16%	12%	17%
Total	*11,568*	*100%*	*100%*	*100%*
Mains gas connectivity				
Connected to gas grid	9,172	79%	75%	87%
Not connected to gas grid	2,396	21%	25%	13%
Total	*11,568*	*100%*	*100%*	*100%*

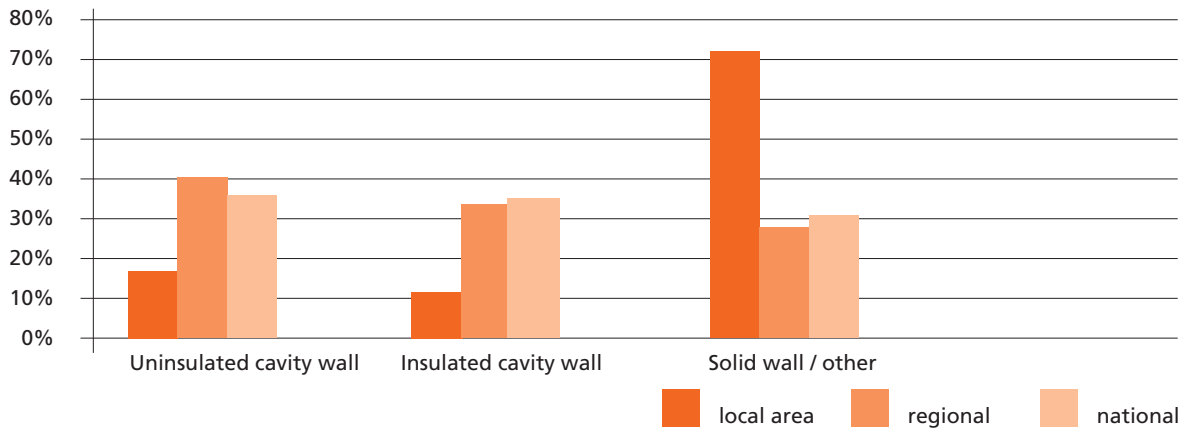
How Bedminster and Southville's homes are heated and insulated

- Being a predominantly urban community most homes are connected to the gas grid and thus have gas central heating systems (82%).
- There are also a significant number of flats in the area whose occupants use electricity to heat their homes (18%).
- Most of the houses in the area are older properties with solid walls (72%), so there is plenty of scope for solid wall insulation in the area to bring down energy use and bills.
- There may also be significant scope for top up loft insulation, with 69% of properties thought to have less than the recommended depth of 270mm.

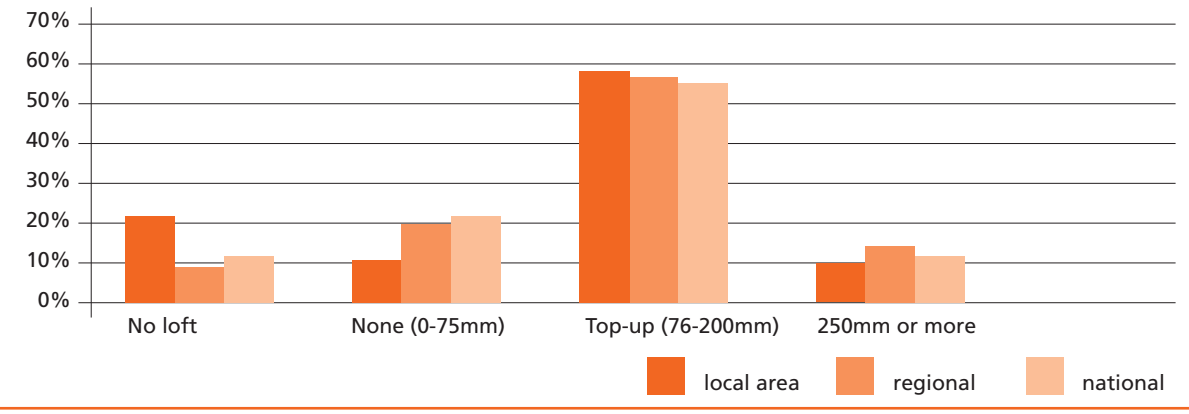
Heating system type



Wall type and insulation



Loft insulation levels

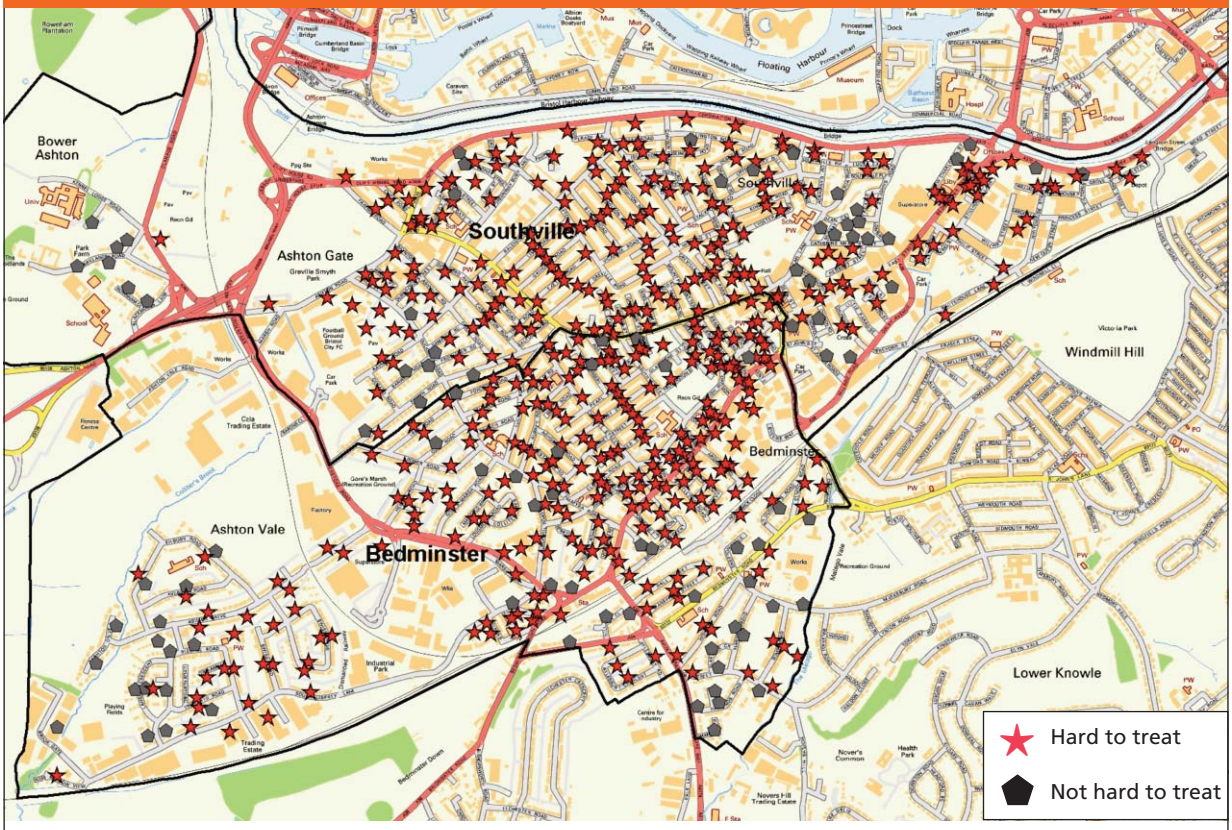


Hard-to-treat properties

'Hard-to-treat' properties are defined as those having no mains gas heating system and/or being a solid walled property. This means these properties have limited access to the most cost-effective energy efficiency measures and may be more expensive to heat.

- The high proportion of older solid wall properties in the area means that 83% of the housing stock is considered 'hard-to-treat'.
- 21% of homes are not fuelled by mains gas, and 72% of properties have solid walls. 10% of homes meet both of these criteria.

Map showing hard-to-treat properties in Bedminster and Southville



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Carbon Footprint and energy efficiency of Bedminster and Southville's housing stock

Total annual energy demand	265,419,605 kWh
Total annual CO_2 emissions	80,632 tCO_2

In general, the modelled energy demand, CO_2 emissions and energy bills of the housing stock in Bedminster and Southville are slightly lower than the regional and national averages.

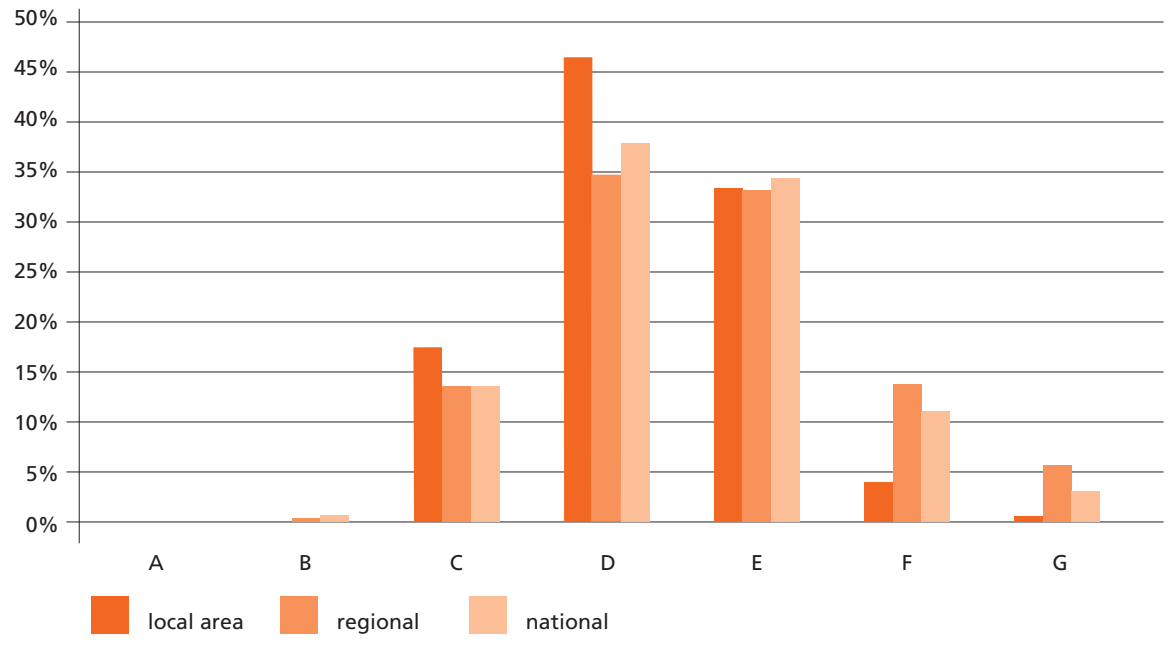
The values shown here are based on modelled energy demand (using energy demand assumptions set by government), rather than actual consumption. In reality consumption will usually be lower and therefore potential savings will also be less.

How do Bedminster and Southville compare?

	Local area	Regional	National
Average annual household energy demand (kWh)	22,944	29,756	29,019
Average annual household CO_2 emissions (tCO_2)	7.0	9.1	8.5
Average annual household energy bill (£)	1,314	1,682	1,585

The average SAP rating of a dwelling in the local area is estimated to be 58, or SAP band D. The majority of properties in Bedminster and Southville fall into band D or E as shown below:

SAP band (baseline)



What improvements can be made?

The Housing Assessment Model calculates the best packages of improvements based on three scenarios:

1) Measures which would result in the greatest improvement in SAP rating at the lowest cost

2) Measures resulting in the greatest reduction in energy bills

3) Measures resulting in the greatest reduction in CO_2 emissions

A number of energy efficiency measures were considered for improving the housing stock. These included loft and wall insulation, heating upgrades and controls, and a number of renewable energy technologies.

The costs of some measures, particularly wall insulation and heating systems, will vary depending on the type and size of dwelling. For example, the cost of insulating the four external walls of a large detached house is considerably higher than the cost of insulating a small terraced house. Typical costs are shown here. These represent the highest cost that each measure might be, taking into account that many householders will require a professional installer, even though in reality some measures can be installed DIY for a lower cost.

Energy efficiency options and sample costs

Measure	Cost (£)	Measure	Cost (£)
Cavity wall insulation	429	Gas condensing boiler (15 kW)	2,571
Internal solid wall insulation	7,404	Ground source heat pump (5 kW)	9,061
Loft insulation (full)	286	Log stove (5 kW)	1,683
Loft insulation (top-up)	240	Oil condensing boiler (15 kW)	7,649
External solid wall insulation	13,099	Solar water heating (2 kW)	4,636
Hot water cylinder insulation (80mm jacket)	70	Micro wind turbine (1.5 kW)	2,463
Time and temperature zone controls	675	1kW solar PV system	4,506
Air source heat pump (9.5 kW)	7,462	2kW solar PV system	8,822
Biomass boiler (15 kW)	7,579		

It was found that:

- Two thirds of the properties could benefit from solid wall insulation. A further 15% would benefit from cavity wall insulation. These are identified as key measures to improve the local housing stock under all modelling scenarios.
- There is considerable scope for loft insulation with the potential for around half of the properties to benefit from installing loft insulation to 270mm.
- Heating controls are identified as a key measure to reduce fuel bills and can be installed at low cost to the householder.
- Around 15% of households could benefit from upgrading their heating systems to new efficient condensing gas boilers.
- Solar water heating appears to be a favourable option under the 'lowest bills' scenario (as these should further reduce household expenditure on fuel), and air source heat pumps could be suitable for around 16% of the housing stock, mainly in flats and off-gas properties.

The number of households suitable for each measure is shown in the table overleaf:

Number of households suitable for each measure and scenario			
	Scenario 1: Best SAP	Scenario 2: Lowest bills	Scenario 3: Lowest CO_2
Insulation			
Cavity wall insulation	1,628	1,876	1,876
Solid wall insulation	8,096	8,116	8,116
Loft insulation top-up	3,937	6,727	6,727
Loft insulation full	1,287	1,287	1,287
Hot water tank insulation	1,646	1,920	1,923
Heating & controls			
Gas condensing boiler	1,655	1,682	1,682
Oil condensing boiler	13	58	26
Heating controls (full zone)	4,576	9,102	9,099
Renewables			
Air source heat pump	1,991	2,064	2,096
Solar water heating	327	1,186	1,165
Photovoltaics (1kW)	447	447	447
Photovoltaics (2kW)	874	897	897

If all of the measures identified were to be installed:

- The total cost would range from £81.3 million to £89.2 million.
- The average cost per dwelling would be between around £7,000 and £7,700 (less when financial incentives are factored in).
- The average SAP rating of Taunton's housing stock could rise from 58 (band D) to 74 (band C).
- The average household annual energy demand could drop from 22,944kWh to 14,276kWh.
- The average household annual fuel bill could drop to £1,086 (a reduction of £228).
- Scenario 3 (below) would achieve the greatest reduction in carbon emissions and fuel bills.
- Scenario 1 is the most cost effective option as it offers the best value in terms of £ spent per tonne of carbon saved, despite fewer measures being installed.

Totals for each scenario			
	Scenario 1: Best SAP	Scenario 2: Lowest bills	Scenario 3: Lowest CO_2
Totals			
Total measures	26,477	35,362	35,341
Total cost of measures (£m)	£81.3	£89.2	£89.2
Average cost per dwelling	£7,032	£7,711	£7,706
£ per tCO_2 saved	£5,534	£5,720	£5,705

Average change on baseline after energy efficiency improvements				
	Current average	Scenario 1: Best SAP for lowest cost	Scenario 2: Lowest bills	Scenario 3: Lowest CO_2
Household energy demand (kWh)	22,944	-8,031	-8,647	-8,669
Household energy bill (£)	£1,314	-£214	-£228	-£227
Household CO2 emissions (tCO2)	7.0	-1.3	-1.3	-1.4
SAP Rating	58	+15	+16	+16

Financing improvements

Green Deal, ECO and Customer Contributions

From late 2012, the Green Deal and the Energy Company Obligation (ECO) will be the main Government policies used to drive and fund domestic energy efficiency improvements. Although the final details of these policies are yet to be published, the Department of Energy and Climate Change have produced guidance which has been used in this report to calculate how the local residents may be able to benefit.

Through the Green Deal, a household energy assessment is carried out to assess the potential improvements to a property and the savings which could be made on the energy bill. Finance is then made available to cover the cost of the measures, which is paid back monthly via the customers energy bill over a set period of time. The monthly repayments should be lower than the monthly saving made as a result of the measures installed, so that the household is financially better off, as well as more comfortable in their home.

Some costly measures, such as solid wall insulation, will not result in large enough savings to cover the cost through energy bills alone, in which case the customer may need to contribute. The ECO will provide help to pay for these higher cost measures for the most vulnerable households.

For renewable energy installations, the Feed-in-Tariff (FIT) and Renewable Heat Incentive (RHI) will provide financial incentives. These are government payments designed to encourage generation of renewable energy. For more information see the information sheets on FIT and RHI available online here: www.cse.org.uk/energy-advice-leaflets.

- On average, around a third of the cost of improvement measures identified in the modelling could be funded under the ECO, with a further third being mostly covered by Green Deal finance. The final third would be expected to come from customer contributions and would range from around £2,500 to £2,900 per household, depending on the scenario (and therefore measures) modelled.
- There will however be significant variation on these figures on a house-by-house basis, as not all homes will be able to access the same level of finance or require the same number or type of measures.

Financing measures - average across the three scenarios

	Scenario 1: Best SAP	Scenario 2: Lowest bills	Scenario 3: Lowest CO_2
Green Deal finance received	£2,095	£2,247	£2,245
ECO finance available	£2,426	£2,587	£2,592
Customer contribution required	£2,510	£2,877	£2,869
Total Cost of Measures	£7,032	£7,711	£7,706

Survey data

Householders in Bedminster and Southville have completed 580 household surveys which were input into the computer model. While this number isn't a large enough proportion of the housing stock to make a significant difference to the results, it is useful to compare some of the answers given by householders with the modelled data. The results given by some of the households have been used as case studies.

- The 580 houses surveyed represent 5% of the total 11,637 houses in the area.
- 75% of the properties surveyed were terraced houses, while a further 15% were semi-detached houses.
- The majority of properties surveyed were built before 1919. Only 10% of the survey covered houses built after 1946.
- The majority of those surveyed owned their own homes, 25% rent their home.
- Of those properties surveyed, 43 had log stoves while 10 had solar PV systems and 9 had solar thermal systems.
- The main measures recommended for the surveyed properties include wall insulation, loft insulation and gas boiler upgrades. This is similar to the measures recommended from the modelled data.
- A significant number of properties would benefit from advanced heating controls to improve the efficiency of their heating systems.
- In terms of renewable energy technology, several houses could benefit from solar PV systems and a handful which could be suitable for air source heat pumps.
- By installing recommended packages of measures across the surveyed houses, annual energy bill savings in the region of £460 to £490 per house could be made, and CO2 emission reductions of up to 40%.

Case studies

Some case studies are shown here which are taken from surveyed homes representing some of the typical house types in the community, and the improvements which householders may be able to make. Note there will be significant variation between individual homes but the case studies give examples of the possible improvements that could be made in a dwelling and the expected changes in the SAP rating, energy bills and carbon emissions that will occur as a result.

Case study 1

Terraced, solid walls, gas heating

5,569 houses (48% of community)

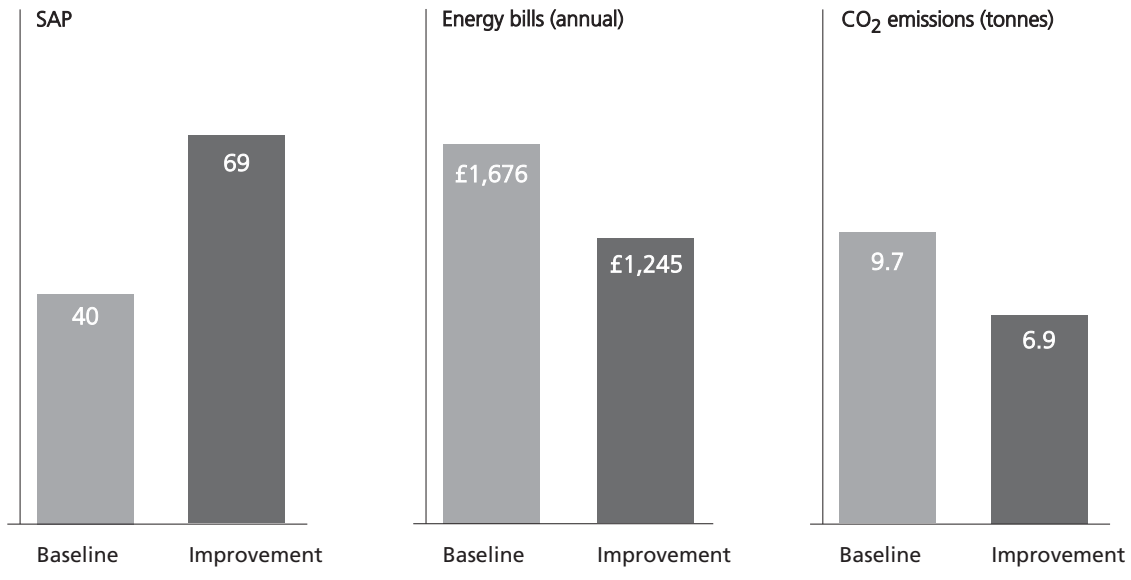
Recommended improvements for this type of property:

- Internal solid wall insulation
- Top up loft insulation
- Upgrade to gas condensing boiler
- Hot water cylinder insulation
- Install TRVs to radiators

Estimated cost	
Total package costs	£9,172
Green Deal finance available	£7,335
ECO finance available	£1,837
Customer contribution required	£0

Expected impact of recommended improvements	Current energy use	Reduced energy use
Household energy demand (kWh)	36,884	17,716
Household energy bill (£)	£1,676	£1,245
Household CO_2 emissions (tCO_2)	9,661	6,872
SAP Rating	40	69

Comparison of before and after figures for SAP, energy bills and CO_2 emissions



Case study 2

Semi-detached, cavity walls, gas heating

900 houses (8% of community)

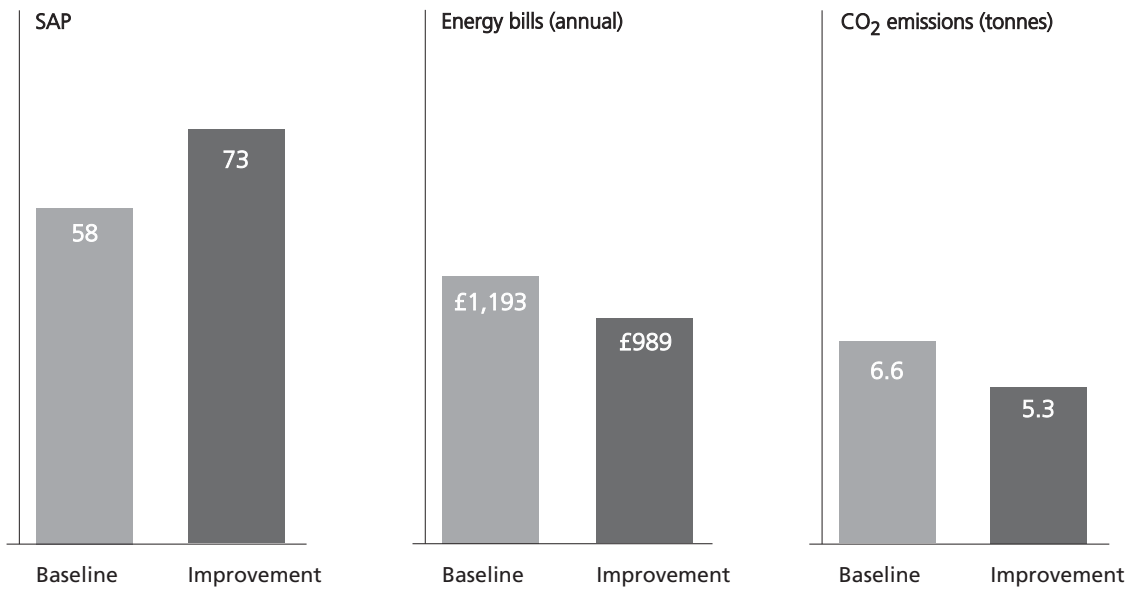
Recommended improvements for this type of property:

- Cavity wall insulation
- Top up loft insulation
- Upgrade to gas condensing boiler

Estimated cost	
Total package	£3,040
Green Deal finance available	£3,040
ECO finance available	£0
Customer contribution required	£0

Expected impact of recommended improvements		
	Current energy use	Reduced energy use
Household energy demand (kWh)	23,489	14,417
Household energy bill (£)	£1,193	£989
Household CO_2 emissions (tCO_2)	6,593	5,273
SAP Rating	58	73

Comparison of before and after figures for SAP, energy bills and CO_2 emissions



Case study 3

Terraced, cavity walls, gas heating

809 houses (7% of community)

Recommended improvements for this type of property:

- Cavity wall insulation
- Top up loft insulation
- Upgrade to gas condensing boiler
- Upgrade of heating controls

Estimated cost	
Total package	£3,915
Green Deal finance available	£3,915
ECO finance available	£0
Customer contribution required	£0

Expected impact of recommended improvements	Current energy use	Reduced energy use
Household energy demand (kWh)	37,521	19,145
Household energy bill (£)	£1,696	£1,283
Household CO_2 emissions (tCO_2)	9,796	7,124
SAP Rating	39	67

Comparison of before and after figures for SAP, energy bills and CO_2 emissions