



Conservation

Climate Change

Sustainability

# Cutting carbon emissions in Welsh homes

- a twin-track approach

**This report is based on analysis by the  
Energy Saving Trust for WWF-Cymru**

**Alun James, WWF-Cymru  
May 2012**

# Foreword

WWF is proud to be the world's leading conservation organisation. We believe in a world with a future in which people and nature thrive, but this vision is under serious threat from climate change. The greenhouse gases that we have emitted from our industries, cars and buildings since the start of the industrial revolution, and those that we carry on emitting, put at risk ecology, agriculture, forests, wildlife, water supplies and even social stability in a global context.

WWF therefore campaigns to remind governments around the world that climate change is a growing problem and that there needs to be international agreement as well as local action to limit the emission of greenhouse gases. We are pleased that all parties in the National Assembly for Wales have endorsed a commitment to reduce greenhouse gases from Wales by 40% by 2020 compared to emissions in 1990. In order to deliver on this commitment, all departments of the Welsh Government need to prioritise this objective and collaborate effectively with the UK Government and with Local Authorities.

WWF is encouraging the Welsh Government to adopt a parallel target of reducing the greenhouse gases from the housing sector by at least 40% by 2020. As well as contributing to the overall greenhouse gas reduction target, work on the housing sector has the huge benefit of reducing the high level of fuel poverty suffered in Wales – with over a third of households spending more than 10% of their income on home energy. Improving home insulation would also reduce respiratory illnesses, cold-related winter deaths in the elderly, and generate thousands of local jobs.

In order to quantify how much benefit there would be from a major house refurbishment programme, we commissioned EST to assess the implications of refurbishing the worst performing houses in Wales. The results are clear: **Bringing all the worst performing houses up to a SAP rating of D would reduce greenhouse gas emissions from housing by 40%, and also reduce the number of households in fuel poverty by 40%.**

Our suggestions for dealing with home energy efficiency and fuel poverty differentiates between those in the top income brackets and those in the bottom, and also calls for a targeted promotion of the Green Deal scheme whereby energy improvement work can be paid for from future energy savings. Our conclusion is that a combination of government-funded work integrated with the Green Deal would enable the poor energy efficiency of most of the homes in Wales to be tackled in a cost effective way.

Anne Meikle  
Head of WWF-Cymru

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# Executive summary

WWF-Cymru urges the Welsh Government to set a target for the reduction of carbon dioxide emissions from the housing sector in Wales by 40% by 2020 compared with emissions in 1990. This report is intended as a contribution to policies for achieving this reduction.

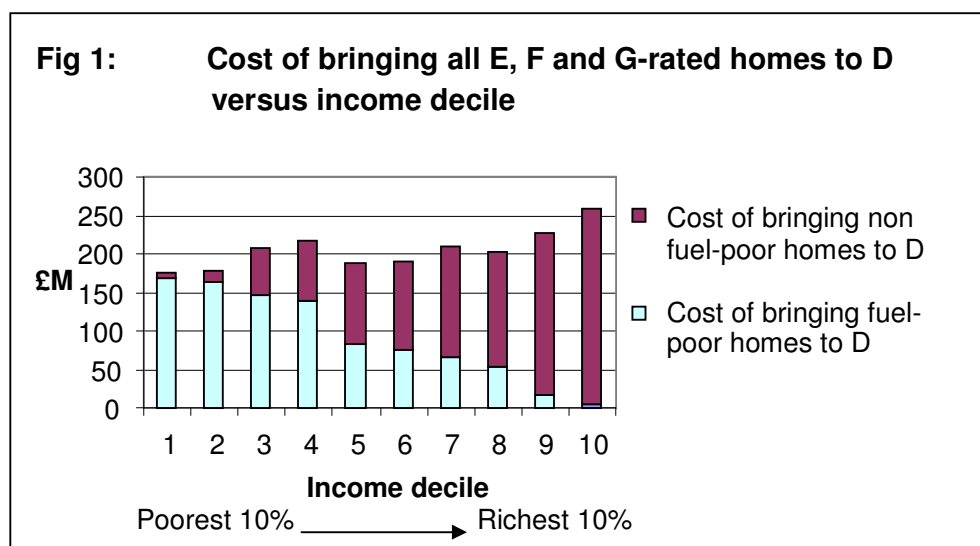
The report shows that bringing all the worst performing houses in Wales up to a SAP rating of D would reduce greenhouse gas emissions from the housing sector by 40% and reduce the number of households in fuel poverty by 40%.

The findings are based on analyses undertaken for WWF Cymru by the Energy Saving Trust<sup>1,2</sup>. The homes considered are those in the bottom three bands of energy efficiency as measured by the Standard Assessment Procedure; i.e. bands E, F and G of the seven band (A-G) SAP system.

The analyses showed that improving the 728,000 homes in Wales in these bands up to a D rating would reduce CO<sub>2</sub> emissions by 1.95 Mt/year, bringing the total emissions from the housing sector down to 5.45 MtCO<sub>2</sub>/yr **which is 40% less than emissions in 1990.**

The work would cost in the region of £2.1 billion and would reduce the total annual energy bills by £423 million. This would bring 132,000 households out of fuel poverty, which represents a 51% reduction on the current total within E, F and G properties, and a **40% reduction in fuel poverty across the whole housing sector** - as there is fuel poverty even in some D and C rated homes. In addition, the work would create 6,300 direct jobs (person-years of employment) and 14,600 gross jobs, when taking into account the multiplier effects of supply chain spending, spending of salaries and re-spending savings on fuel bills.

Further analysis showed that if improvement measures were targeted at the E, F and G homes belonging to households with the lowest 4 income deciles (270,000 homes), the cost of bringing these to D would be about £780 million. Focusing on the lowest income households would ensure that almost all the refurbishment work would be directed at the fuel poor, as shown in figure 1.



The height of each histogram shows the total cost for bringing the homes of each income decile up to D, while the lighter portion of each histogram shows the cost of bringing fuel-poor homes to D.

<sup>1</sup> 'Analysing the fuel poverty impacts of bringing all properties in Wales up to a minimum EPC rating of D'; March 2012

<sup>2</sup> 'Analysis of costs and carbon savings from tackling the least energy efficient homes in Wales'; Energy Saving Trust for WWF-Cymru; December 2011

The figure shows that work focussed on improving energy efficiency for the bottom four income deciles is more effective in addressing fuel poverty than work on other income deciles. But it would be wrong to ignore the problems faced by higher income households whose homes have SAP ratings less than D. These homes are, typically, larger than those of lower income households hence the savings in fuel cost and carbon emissions are potentially greater

It is suggested that these higher income households should be encouraged to use the Green Deal financial mechanism, starting in autumn 2012, to get energy efficiency improvements in their homes with no up-front payment. The cost of the work will be paid back in instalments through their energy bills, and these will be lower than they were prior to the improvements.

Regarding the cost of the refurbishment measures, the EST's analysis found that 37% of homes could be improved to a D rating for less than £900 each, and a further 43% for between £2,500 and £3,500. However, it would cost considerably more to raise the standards of some types of homes; for example, there are 107,000 detached owner-occupied houses, heated by oil and LPG, with average annual fuel bills of £2,700, causing 44% of these households to be in fuel poverty. It would cost an average of £5,800 per property to bring these to a D rating but the estimated fuel savings would be significant, at £1,200 per year.

There will be benefits to integrating government-funded refurbishment initiatives with the Green Deal to enable an area-based approach to improving home energy efficiency. This could be 30 to 50% cheaper per house than tackling properties on an individual basis.

**Based on the findings summarised in this report, WWF-Cymru suggests that the Welsh Government, in collaboration with the Welsh Local Authorities, should:**

- **set a target to reduce greenhouse gas emissions from the housing sector by 40% by 2020 compared with 1990 emissions**
- **aim to bring all homes in Wales up to a SAP rating of at least D**
- **focus government-funded work on the lowest 4 income deciles**
- **actively promote the Green Deal initiative for upper income deciles**
- **seek ways of integrating government-funded home energy efficiency work with work funded via the Green Deal.**

# 1. Introduction

The Welsh Government has made a commitment to reduce annual greenhouse gas (ghg) emissions in Wales by 40% by 2020 against a 1990 baseline<sup>3</sup>. WWF-Cymru is urging Ministers to also set a target for reducing ghg emissions from the housing sector by at least 40% by 2020. This report considers ways of achieving this reduction.

WWF commissioned the Energy Saving Trust to assess the costs and benefits of improving the worst performing houses in Wales, as measured by the Standard Assessment Procedure (SAP)<sup>4</sup> which categorises buildings into 7 bands, from A-G. The cost of doing the improvements to bring E, F and G-rated homes to at least a D rating<sup>5</sup> was assessed against the original SAP rating and the benefits identified in terms of the reduction in CO<sub>2</sub><sup>6</sup> emissions and in the number of jobs created.

Band	SAP Rating
A	92-100 ( <i>Most efficient</i> )
B	81-91
C	69-80
D	55-68
E	39-54
F	21-38
G	1-20 ( <i>Least efficient</i> )

The households living in homes rated as E, F and G were divided into 10 groups according to their income, and the cost of bringing the homes of each income decile up to D was assessed. This cost was then apportioned according to whether or not the household was in fuel poverty (i.e. a household where more than 10% of the total income would have to be spent on fuel to maintain a satisfactory heating regime). This led us to propose an approach to tackling home energy efficiency that focuses government funds on the most needy households.

As it would not be feasible for the Welsh Government to fund all the work needed to improve the energy efficiency of homes even for the limited improvement to a D rating, other options for encouraging home refurbishment need to be considered. We suggest that, for households other than the most needy, the Welsh Government and Local Authorities undertake a targeted promotion of the Green Deal.<sup>7</sup>

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<sup>3</sup> *Climate Change Strategy for Wales, Welsh Assembly Government, October 2010*. This also contains a commitment to reduce ghg by 3% per year in areas of devolved competence from 2011 (measured against a baseline of average emissions between 2006 and 2010)

<sup>4</sup> For further details see: <http://wales.gov.uk/docs/desh/publications/101006ccstratfinalen.pdf> The Government has also made

<sup>5</sup> This is the minimum which the Welsh Housing Quality Standard requires for social housing. (SAP of 65)

<sup>6</sup> The analyses in this report were based on CO<sub>2</sub> emissions which, for the purpose of the proposals made, are assumed to be equivalent to the total greenhouse gas emissions.

<sup>7</sup> The Green Deal is a UK Government financial mechanism whereby energy efficiency measures can be installed without the need for upfront payment, the intention being that the cost should be covered by the savings on the energy bills.

## 2. Benefits of refurbishment work

The benefits of improving the energy efficiency of all E, F and G-rated home in Wales to a D rating was assessed for 1,235 house types in the Welsh housing stock. The results are shown in table 1:

No. of homes	728,000
Total cost of improvements	£2.05 billion
Average cost per improved home	£2,964
Total annual CO2 saved	1.95 MtCO2
Average annual CO2 saving per improved home	2.74 tCO2
Total annual fuel bill reduction	£424 million
Average annual fuel bill reduction per improved home	£600

### Impacts on carbon emissions

In 1990, the emissions from the housing sector amounted to 9.08 MtCO<sub>2</sub>/yr. If there were to be a 40% reduction in these emissions by 2020 the emissions would need to reduce to 5.45 MtCO<sub>2</sub>/yr.

By 2009 the emissions had reduced to 7.60 MtCO<sub>2</sub>/yr<sup>8</sup> as a result of energy efficiency improvements and more efficient new homes, and by 2012 we assume that this will drop further, to less than 7.40 MtCO<sub>2</sub>/yr. If so, to achieve a 40% reduction by 2020, compared with 1990, emissions from the housing sector would need to reduce a further 1.95 MtCO<sub>2</sub>/yr.

This is the same saving as that assessed for bringing all E, F & G homes to D rating.

Further savings would be made if the centralised electricity generation was decarbonised. DECC assumes that by 2020 the CO<sub>2</sub> emissions from electricity use in the housing sector will have gone down from 2.92 Mt/yr in 2011 to 1.59 Mt/yr in 2020, saving 1.33 Mt per year. This would bring the savings in CO<sub>2</sub> emissions compared with 1990 up to 58%, but rebound and comfort taking would likely account for much more than this additional saving (see appendix). However, if by 2050 a third of homes are built to standards proposed for 2013, additional saving in CO<sub>2</sub> emissions would be realised.

### Impact on jobs and the economy

Large scale home energy improvement programmes can have a significant impact on the local economy by supporting local business and generating employment. In addition, there is the potential for a reduction in energy bills to change the way a householder behaves economically, which can have a consequential impact on greenhouse gas emissions across the economy.

<sup>8</sup> AEA, "Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2009". Sept 2011, P141;  
[http://uk-air.defra.gov.uk/reports/cato7/1109061103\\_DA\\_GHGI\\_report\\_2009\\_Main\\_text\\_Issue\\_1.pdf](http://uk-air.defra.gov.uk/reports/cato7/1109061103_DA_GHGI_report_2009_Main_text_Issue_1.pdf)



The Economic Impacts Model assesses the economic impacts associated with installing energy efficiency and microgeneration measures and has been peer reviewed by the UK Government's Interdepartmental Analysts Group. It calculates Gross Value Added (GVA), sales and jobs supported from installing different low carbon measures to homes.

The direct impacts presented in this analysis are:

- value of direct sales – the number of measures multiplied by the total cost of installation
- the levels of employment directly supported by installation demand (i.e. site preparation, architectural or design services, plumbing and installation), and
- the GVA directly created – the average GVA per person employed multiplied by the levels of employment supported.

The model also estimates the level of sales, employment and GVA that could be supported across the economy as a result of the multiplier effects of supply chain spending, spending of salaries and re-spending savings on fuel bills (gross impact).

Outputs of the Energy Saving Trust Economic Impacts Model

	<b>Total Direct</b>	<b>Total Gross</b>
Sales	£2.1b	£4.2bn
Jobs supported in one year (FTE)	6,300	14,600
GVA	£475m	£969m

Note: The Economic Impact Model used in the analysis assumes that all measures are installed in one year and that all sales, job supported and GVA are generated in that year. Improving all E, F and G-rated homes to a D rating would directly support the equivalent of 6,300 full time jobs for one year. However, if this were to happen over time, say between 2013 and 2019, then it would support the equivalent of 1,050 direct full time jobs for six years (6,300 divided by 6).

### 3. Fuel poverty considerations

According to the Welsh Government’s Fuel Poverty Strategy 2008<sup>9</sup>, “fuel poverty is defined as having to spend more than 10 per cent of income (including housing benefit) on all household heating needs.

The definition of a 'satisfactory heating regime' recommended by the World Health Organisation is 23°C in the living room and 18°C in other rooms, to be achieved for 16 hours in every 24 for households with older people or people with disabilities or chronic illness, and 21°C in the living room and 18°C in other rooms for a period of nine hours in every 24 (or 16 in 24 over the weekend) for other households.”

In July 2010 the Welsh Government published a Fuel Poverty Strategy which aimed to reduce the number of households currently living in fuel poverty in Wales, and to take action that would help to achieve the target that, as far as is reasonably practicable, **no household in Wales will be living in fuel poverty by 2018**

The distribution of fuel poverty against EPC rating of homes is shown in table 2:

**Table 2: Levels of fuel poverty in Wales by EPC rating.**

EPC rating	Total no of homes X1000	No of fuel poor homes X1000	% fuel poor in each EPC band	Location of fuel poor as % of all homes	% of homes in each EPC band
B	2	0	0%	0%	0%
C	103	11	11%	3%	8%
D	435	62	14%	19%	34%
E	478	129	27%	39%	38%
F	181	81	45%	24%	14%
G	69	48	70%	15%	5%
Totals	1268	331	26%		100%

This shows that 78% of the fuel poor are located in EPC bands E, F and G. But it isn’t only the poorest in society that live in E, F and G properties, as shown in table 3:

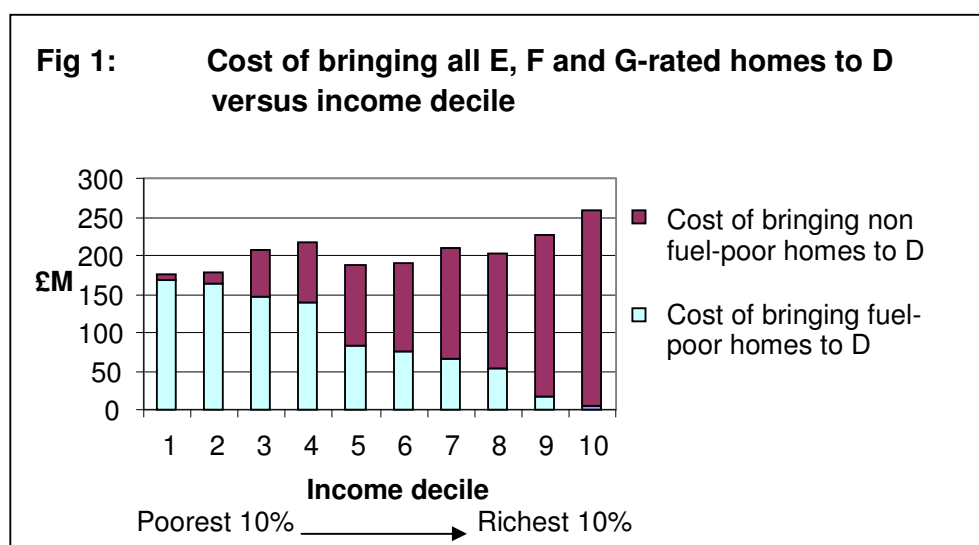
<sup>9</sup> <http://wales.gov.uk/docs/desh/publications/100723fuelpovertystrategyen.pdf>

**Table 3: Total number of E, F & G rated properties by income decile**

Full Income Decile	Number of E, F & G properties			Range of yearly full income	
	Fuel Poor	Non Fuel Poor	Total		
1 (Poorest 10%)	60,000	4,000	63,000	<£1,000	£8,830
2	55,000	10,000	65,000	£8,840	£11,390
3	48,000	22,000	71,000	£11,440	£13,690
4	34,000	37,000	71,000	£13,720	£16,260
5	21,000	57,000	78,000	£16,260	£19,430
6	18,000	49,000	67,000	£19,450	£23,410
7	11,000	59,000	70,000	£23,420	£27,220
8	10,000	75,000	85,000	£27,220	£33,130
9	2,000	72,000	75,000	£33,160	£43,320
10 (Richest 10%)	1,000	83,000	84,000	£43,320	£172,420
Total	259,000	469,000	728,000		

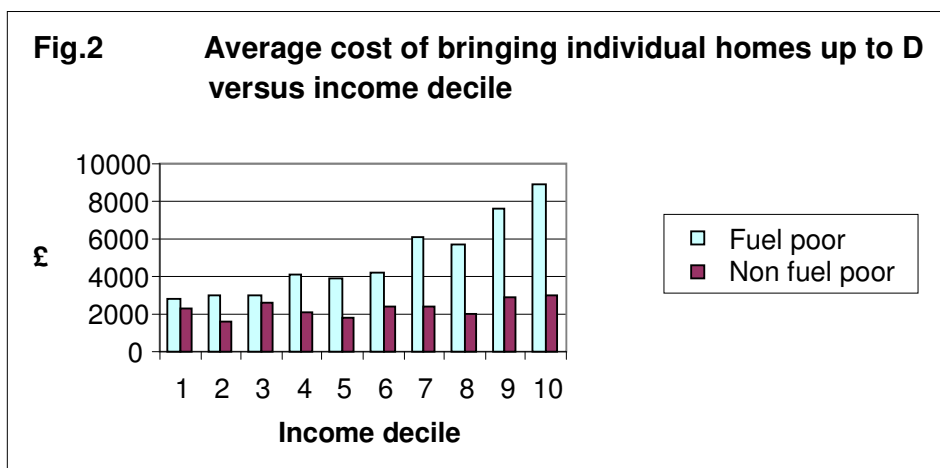
Hence, in order to get all E, F and G homes to D, work is needed across the whole spectrum of household incomes.

For the lowest income households almost all the refurbishment work to bring homes to a D rating would be directed at the fuel poor whereas most of the work would be on non-fuel poverty homes for those with highest income, as shown in fig. 1.



The height of each histogram shows the total cost for bringing the homes of each income decile up to D, while the lighter portion of each histogram shows the cost of bringing fuel-poor homes to D.

There are homes with low SAP ratings across all income bands and there are households meeting the definition of fuel poverty in all income bands. The EST assessed the cost of getting fuel-poor households up to a D rating and found that as we go up the scale of household income the refurbishment cost gets higher – typically as a result of the houses being larger. The results as shown in figure 2.



*This shows that the cost of getting fuel-poor homes up to D rating ranges from less than £3000 to almost £9000 as one goes up the income scale.*

However, it should be noted that there are only 24,000 fuel poor houses in the top 4 income deciles compared to about 200,000 in the bottom four.

Regarding the cost of the refurbishment measures, the EST's analysis found that 37% of homes could be improved to a D rating for less than £900 each, and a further 43% for between £2,500 and £3,500. However, it would cost considerably more to raise the standards of some types of homes; for example, there are 107,000 detached owner-occupied houses, heated by oil and LPG, with average annual fuel bills of £2,700, causing 44% of these households to be in fuel poverty. It would cost an average of £5,800 per property to bring these to a D rating but the estimated fuel savings would be significant, at £1,200 per year.

**Improving all E, F and G rated homes in Wales** (728,000 homes) to at least a D rating would cost in the region of £2.1 billion. However, the cost of getting all the homes of the lowest 4 income deciles up to D (270,000 homes) would cost about £780 million. If the effort was limited to the fuel poor in the bottom four deciles, the cost would be £618 million.

It is recommended that government should support the refurbishment of all E, F and G-rated homes belonging to those in the lowest four deciles, regardless of whether they are currently in fuel poverty. Dealing with non fuel poor as well as fuel poor would increase total refurbishment costs by about 20% but it would help to prevent an increase in fuel poverty if energy costs rise, would provide more jobs, would facilitate an area-based approach to refurbishment, and would ensure that the desired reduction in carbon emissions was achieved.

Note: EST estimates that a 30 to 50% reduction in refurbishment costs would be possible if homes could be tackled on an area basis.

### **Application of Green Deal**

Poor households: As some poor households are not heating their homes to a level which is considered desirable (see page 22) they may not see their fuel bills fall enough to pay off the loan under the Green Deal – even though the measures undertaken would have been assessed as meeting the golden rule for a normally-heated home. This is why it is essential that the people in the lowest income ranges should receive priority treatment from government.

However, Green Deal could prove very beneficial to higher income households.

## 4. Suggestions for targeting home energy efficiency work in Wales

### Current and future initiatives

There are already some important initiatives in Wales to improve the energy efficiency of houses occupied by those with the lowest incomes:

**Nest** is the Welsh Government's scheme to combat fuel poverty in Wales. It offers a variety of services including energy efficiency improvements, guidance on benefit entitlement, energy tariffs and money management.

Nest is available to householders who are in receipt of means tested benefits and privately own or are privately renting a domestic property. In addition the property must have an energy efficiency rating of F or G.

The **Arbed** programme was established in 2009 to co-ordinate investment into Welsh homes. The first phase of the programme received £30m from the Welsh Government; £20m from local authorities, and at least £10m from energy companies. It engaged with social landlords to fit insulation and renewable technologies into homes in deprived areas of Wales.

The **Welsh Housing Quality Standard** aims to ensure that energy costs are kept down in social housing by requiring a minimum 'D' Energy Performance Certificate rating to achieve the standards;

The **Energy Act 2010**, which covers Great Britain, sets a mandatory requirement for energy suppliers to provide social price support (direct assistance with energy bills), which could be in the form of social tariffs, debt relief, installation of energy efficiency measures or trust funds.

An information note by DECC in November 2011 considered roles for Local Authorities in the Green Deal<sup>10</sup>. It stated:

"Local authorities have an important role to play in helping their residents and businesses to realise the benefits of the Green Deal. Every householder and business in the country has a local council they can refer to. Local authorities can also work with local community leaders to generate interest and take-up of the Green Deal, taking opportunities to engage local people and bring communities together to improve cost effectiveness. Local authorities are therefore well placed to champion the Green Deal locally, stimulating activity to meet specific local needs and supporting wider strategic priorities.

In particular local authorities:

- are able to link wider strategic priorities and funding streams e.g. through health, education and regeneration agendas;
- are able to draw on established local networks, partnerships, services and delivery partners;
- can draw on existing links with business and social enterprises and provide gateways through local advice agencies and services;
- are trusted to act in the best interests of their local residents.

To deliver the Green Deal locally there are broadly three approaches local authorities might choose to adopt:

- Provide – the Green Deal directly to their local residents and businesses, co-ordinating finance and delivery;

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<sup>10</sup> <http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/3499-local-authorities-green-deal-info.pdf>

- Partner - work in partnership with commercial Green Deal providers and community partners to deliver and facilitate delivery; or
- Promote – by acting as advocates for the Green Deal locally. “

### **WWF Proposals**

WWF is of the opinion that current initiatives to tackling fuel poverty and improving the housing stock are laudable but will not achieve a reduction in CO<sub>2</sub> emissions from the housing sector by 40% by 2020, compared with 1990 emissions. We propose a twin-tracked approach, based on the income of the householder, to enable all homes in Wales rated E, F and G to be improved to at least a D rating:

#### **For those in the lowest four income deciles:**

We urge that government support be provided to fund the improvements necessary, to bring these homes up to a D rating, whether the households fall within the definition of fuel poor or not. The aim should be to raise the standard above D where feasible.

#### **For middle and upper income households:**

It would not be feasible for government schemes to expand to all income bands, but it would be sensible to help these households improve the energy efficiency of their homes so as to reduce the amount of CO<sub>2</sub> emitted from the housing sector. This is the case even for those in the highest income decile as their homes tend to be larger and emit more CO<sub>2</sub> than smaller homes.

It is proposed that the WG and LAs become actively engaged with the Green Deal, particularly in regard middle and higher income households. It is likely that bringing their homes to a D rating would, in most cases, involve energy efficiency measures which would meet the Golden Rule, whereby the cost of paying for the work done, including interest charges, would be less than the savings in the energy bills.

It would also be desirable for the Welsh Government and LAs to integrate their own home-improvement work with the Green Deal to gain the benefits of economy of scale.

## 5. Conclusions

WWF-Cymru urges the Welsh Government, in collaboration with the Welsh Local Authorities, to:

- set a target to reduce greenhouse gas emissions from the housing sector by 40% by 2020 compared with 1990 emissions
- aim to bring all homes in Wales up to a SAP rating of at least D
- focus government-funded work on all E, F and G rated homes belong to households with the lowest 4 income deciles (income less than about £16,500 a year)
- actively promote the Green Deal initiative for middle and upper income deciles, and
- seek ways of integrating government-funded home energy efficiency work with work funded via the Green Deal.

# Disclaimer

This report is intended as a contribution to the development of policies on home energy refurbishment rather than a source of definitive statistics. The following caveats apply:

- The primary purpose of this report is to identify ways to reduce CO<sub>2</sub> emissions from the Welsh housing sector by 40% by 2020. The proposed approach is to improve the energy efficiency of homes with E, F and G SAP ratings to D. Other approaches, such as reducing the energy needs of a third of homes by 60% and encouraging improvements in the other two-thirds could also achieve the 40% reduction. (Previous assessment for Stop Climate Chaos Cymru<sup>11</sup> showed that the latter approach could create up to 20,000 person-years of employment – but at an estimated cost of £7Bn.)
- Due to the disruption caused by major energy efficiency work, it is desirable to improve the SAP rating beyond D where feasible.
- The twin track approach proposed, for improving houses to a D rating, involves:  
(i) Welsh Government support for the four lowest income deciles, and  
(ii) WG and LAs engagement with the Green Deal financial mechanism, in particular to encourage its use by those in higher income deciles.  
In practice, a sharp demarcation between the two targeted approaches might not be appropriate; for example, it might be more acceptable to vary the amount of government support for each income decile. Also, UK-government initiatives other than Green Deal, and other potential funding streams, have not been addressed but could be relevant.
- The analysis underpinning the report is based on data in the Living in Wales 2008 survey which was the latest available at the time of the EST contract; this refers to 26% of Welsh households being fuel poor. The EST analysis also uses 2008 fuel bill prices. There have been significant changes in some relevant parameters since then; for example the Centre for Sustainable Energy, working with Consumer Focus, estimated in January 2012 that, following energy price increases in the autumn of 2011, the total number of fuel poor households in Wales stood at 425,000, or 34%.
- The analyses in this report assess CO<sub>2</sub> emissions as opposed to all greenhouse gases. For the purpose of the proposals made, CO<sub>2</sub> emissions are assumed to be equivalent to the total ghg emissions.
- EST point out that all analysis outputs are based on modelled data, therefore all results should be interpreted with some degree of caution.

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<sup>11</sup> SCCC report “Cutting Carbon, Creating Jobs”, 2011; <http://stopclimatechaoscymru.org/wp-content/uploads/2011/03/SCCCreport.pdf>



# Appendix

## A1. Energy efficiency measures considered

The key energy efficiency and renewable energy measures available in EST's Refurbishment Calculator were:

- Low energy light bulb (CFL)
- Cavity wall insulation
- Loft insulation (full or top-up)
- Draught proofing
- Double glazing (16mm)
- Gas condensing boiler/gas combi condensing boiler
- Oil condensing boiler/oil combi condensing boiler
- Internal solid wall insulation
- External solid wall insulation
- Flexible insulated lining (insulated wall paper)
- Insulating render
- Biomass boiler
- Ground source heat pump
- Air source heat pump
- Solar water heating panel (solar thermal)
- Solar photovoltaic panel

For the analysis to bring E, F and G rated homes up to the D SAP band the measures considered can be grouped into five 'refurbishment cost ranges' (RCR)

### RCR 1 – Cheap measures

37% of homes could be improved for under £900. The required measures would be loft and cavity wall insulation, draught proofing and energy efficient lighting. The average fuel bill saving was assessed as £190, the average CO<sub>2</sub> saving as 1.0 tCO<sub>2</sub> and the average kWh saving as 4,300 (500 kWh traded sector and 3,800 non-traded sector)<sup>12</sup>.

### RCR 2 – Internal wall insulation

1% of homes could be improved for between £1,000 - £2,500. Average fuel bill saving was assessed as £710, CO<sub>2</sub> savings as 3.54 tCO<sub>2</sub> and average kWh saving as 16,300 (1700 kWh in the traded sector, 14,600 kWh in the non-traded sector).

### RCR 3 – Upgrading boilers

43% of homes could be improved for between £2,500 and £3,500 by replacing their gas or oil boiler with a more efficient unit. A small proportion of these homes would also require wall insulation (either internal solid wall insulation or cavity wall insulation). Average fuel bill savings were assessed as £690, CO<sub>2</sub> savings as 3.1 t CO<sub>2</sub> and average kWh saving as 12,000 (1,900 kWh in the traded sector 10,100 kWh in the non-traded sector).

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<sup>12</sup> Traded emissions are those covered by the EU Emissions Trading System, and include electricity generation; non-traded are those not covered by the ETS and include gas, oil and coal fuel used for domestic heating.

#### RCR4 – Solid wall insulation & solar

4% of homes could be improved for £3,500 - £7, 250. Solar water heating was an option frequently chosen in combination with wall insulation for those homes on electric or oil heating as this would be cheaper than installing a new heating system. The average fuel bill saving were assessed as £660, average CO<sub>2</sub> savings as 2.8 tCO<sub>2</sub> and average kWh savings as 8,900 (3,600 kWh traded, 5,300 kWh non-traded).

#### RCR 5 – Fuel switching

15% of homes would cost over £7,250 to treat. The average fuel bill saving in this group was assessed as £1,290, average CO<sub>2</sub> savings as 6.1 tCO<sub>2</sub> and average kWh saving as 17,000 (10,200 kWh traded and 6,400 kWh non-traded).

## A2. Case studies of the impact of improving EPC ratings

The following three case studies demonstrate the potential impacts of improving EPC ratings.

<b>Scenario 1. Detached owner occupied oil &amp; LPG heated homes</b>	
Number of households	107,000
Proportion of Welsh housing stock	8%
Average annual fuel bills	£2,700
D rated	8%
E rated	33%
F rated	46%
G rated	12%
Rural / urban mix	95% in Hamlets and Villages
Location	Large numbers found in Powys (21%) Ceredigion (14%) and Carmarthenshire (13%)
Proportion of households that are fuel poor	44%

### Household characteristics

This home and household type makes up a significant proportion of the Welsh housing stock (8%) and is generally found in more isolated rural areas of Wales. An average number of these households are occupied by pensioners (26%) and fewer than average households are classified as workless (9%).

### Fuel poverty

Despite these households being owner occupiers, and as one might expect more affluent, a significantly higher proportion of these households are fuel poor (44%). This is in part due to the significantly higher fuel costs for many of these properties which have exceedingly poor energy performance. As shown above over 58% are rated below an F. On average a fuel poor household in this property would need to reduce their fuel bill by around £1,400 to reduce their fuel bill by enough so that it accounts for less than 10% of their full income.

### Measures applied

In the analysis to bring all E, F & G properties up to a minimum D rating, we found that that these properties could achieve a D rating at an average cost of £5,800 per property. To do this, nearly all of these properties required new condensing boilers (over 100,000). 52,000 of these properties required new or additional loft insulation and just under 46,000 required either solar PV or solar water heating. Just over 9,000 of these properties required internal wall insulation.

The measures applied for the analysis above would save on average £1,200 a year in fuel bills property and could potentially bring the majority of households out of fuel poverty.

<b>Scenario 2. Local Authority Semi Detached Homes</b>	
Number of households	49,800
Proportion of Welsh housing stock	4%
Average annual fuel bills	£1,210
C rated	3%
D rated	50%
E rated	37%
F rated	9%
G rated	<1%
Rural / urban mix	75% within 10km of town or city centre
Location	Large numbers in Neath & Port Talbot (14%), Cardiff (11%) and Swansea (11%)
Proportion of households that are fuel poor	32%

#### Household characteristics

Semi-detached homes are the most prevalent build form for homes in Wales owned by the local authority. This type of property makes up around 4% of all properties in Wales and is generally found in more urban areas of Wales. A larger than average proportion of these households has dependent children (40%), 23% of whom are single parents. A larger than average proportion of these households is workless (34%).

#### Fuel poverty

A larger than average proportion of these households is in fuel poverty (32%). With a lower than average share of worst performing homes (F& G rated) and lower than average fuel bills, the high level of fuel poverty is possibly due to households having lower incomes and also the high number of workless households. On average a fuel poor household in this property would need to reduce their annual fuel bill by around £310 to reduce their fuel bill by enough so that it accounts for less than 10% of their full income.

#### Measures applied

In the analysis to bring all E, F & G properties up to a minimum D rating, it was shown that these properties could achieve a D rating at an average cost of £2,000 per property. To do this, nearly half of these properties required new gas or oil condensing boilers (over 12,000). 6,900 of these properties required new or additional loft insulation. All that is needed to make the required energy performance improvements for some of these homes is draught proofing and additional energy efficient lighting.

The measures applied for the policy analysis above would save on average £420 a year in fuel bills property and could potentially bring the majority of households out of fuel poverty.

<b>Scenario 3. Private Rented Sector Terraces</b>	
Number of households	56,400
Proportion of Welsh housing stock	4%
Average annual fuel bills	£1,250
C rated	6%
D rated	37%
E rated	44%
F rated	7%
G rated	5%
Rural / urban mix	75% within 10km Of town or city centre
Location	Large numbers in Neath & Port Talbot (14%), Cardiff (11%) and Swansea (11%)
Proportion of households that are fuel poor	31%

#### Household characteristics:

Terraced homes are the most prevalent build form for homes in Wales in the private rented sector. Privately rented terraced homes make up around 4% of all properties in Wales and are generally found in more urban areas of Wales. A significantly high proportion of these of these homes are occupied by are single parent households (25%), and a very high proportion of these households are workless (40%). Whilst fewer than average households contain pensioners (15%), those that do are more likely to contain single pensioners.

#### Fuel poverty:

Whilst on average fuel bills are lower in this type of property a higher than average proportion of households is in fuel poverty (31%). On average a fuel poor household in this property would need to reduce their annual fuel bill by around £400 to reduce their fuel bill so that it accounts for less than 10% of their full income.

#### Measures applied:

In the analysis to bring all private rented sector F&G rated properties up to a minimum E rating, it was shown that these properties could achieve a minimum E rating at an average cost of £1,700 per property. To do this, over one third of the properties improved (2,500) required new or additional loft insulation. 500 required replacement condensing boilers and 400 required internal wall insulation. The measures applied for the policy analysis above would save on average £150 a year in fuel bills property and would do little to bring many households out of fuel poverty.

In the analysis to bring all E, F & G properties up to a minimum D rating, it was shown that these properties could achieve a D rating at an average cost of £2,300 per property. To do this, nearly half of these properties improved required new gas or oil condensing boilers (over 23,000). 1,500 of these properties required new or additional loft insulation. 1,400 required cavity wall insulation, 1,100 required internal wall insulation and 800 required solar water heating. The measures applied for the policy analysis above would save on average £400 a year in fuel bills property and could potentially bring the majority of households out of fuel poverty.

## A3. Comfort-taking and Rebound

The temperature a home is heated to and the length of time for which a home is heated inevitably has a direct impact on the CO<sub>2</sub> emissions from the heating system. With any household energy modelling assumptions must be made about how householders heat their home. The EST analysis on which this report is based assumed that homes are heated to specific internal temperatures for the same period of time. For instance the housing stock refurbishment calculator uses the SAP 2005 assumption that homes are heated to 18 degrees Celsius except in the living areas where they are heated to 21 degrees<sup>2</sup>.

In reality, not all homes are heated to 18 degrees Celsius. Some households, perhaps particularly poorly insulated homes are likely to heat their homes to below this temperature. Therefore these models may overestimate the CO<sub>2</sub> emissions of a poorly insulated home, before improvements are made.

Furthermore, the model assumes that once insulation or heating improvement is installed in a home, the pattern of heating remains the same. However, empirical evidence suggests that this may not always be the case. Once insulation is installed in homes that are under-heated (below 18 degrees Celsius) householders may not continue to under-heat their home. Instead, the household is likely to increase the internal temperature of their home (for example to 18 degrees), therefore minimising carbon and fuel bill savings. This phenomenon is known as 'Comfort Taking'.

For groups thought to be fuel poor, DECC analysts allow for up to 40% of the estimated impact on energy savings to be taken in terms of increased comfort in the home. Also, some householders may choose to keep their home warmer after improvements are made, or do so unintentionally because, for example, heating settings are not altered after insulation is installed. DECC analysts assume a 15% reduction in predicted savings as a result of this type of rebound.

It is also important to consider that householders might spend their fuel savings on goods and services that have similar or greater carbon emissions. EST is continuing to explore, independently of WWF, how home refurbishment projects can impact greenhouse gas emissions across the economy.





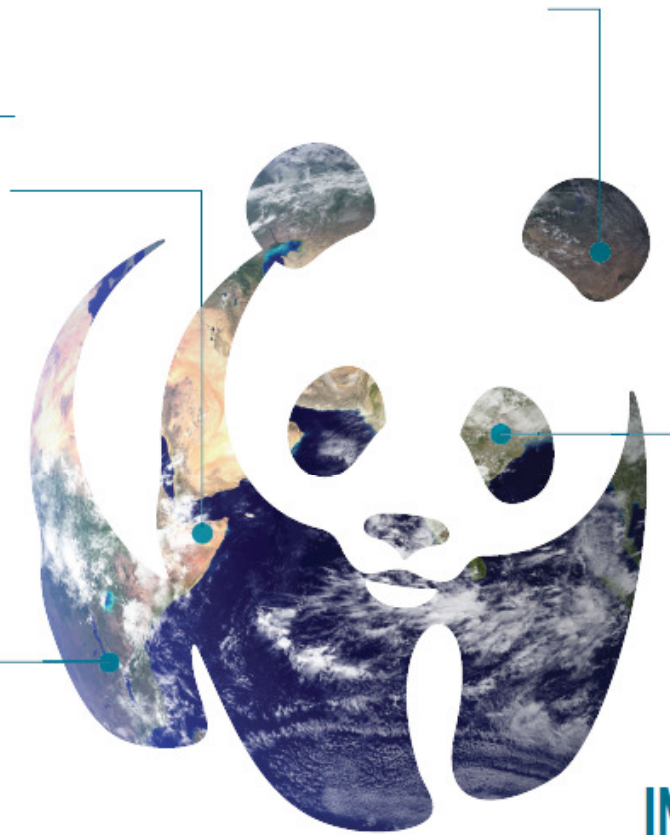
# WWF-UK in numbers

40%

cut in Welsh homes' emissions

14,600

new jobs



40%

fewer fuel poor

INTEGRATING

Welsh government plans with Green Deal

	<p><b>Why we are here</b>                  To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.</p> <p><a href="http://wwf.org.uk">wwf.org.uk</a></p>
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