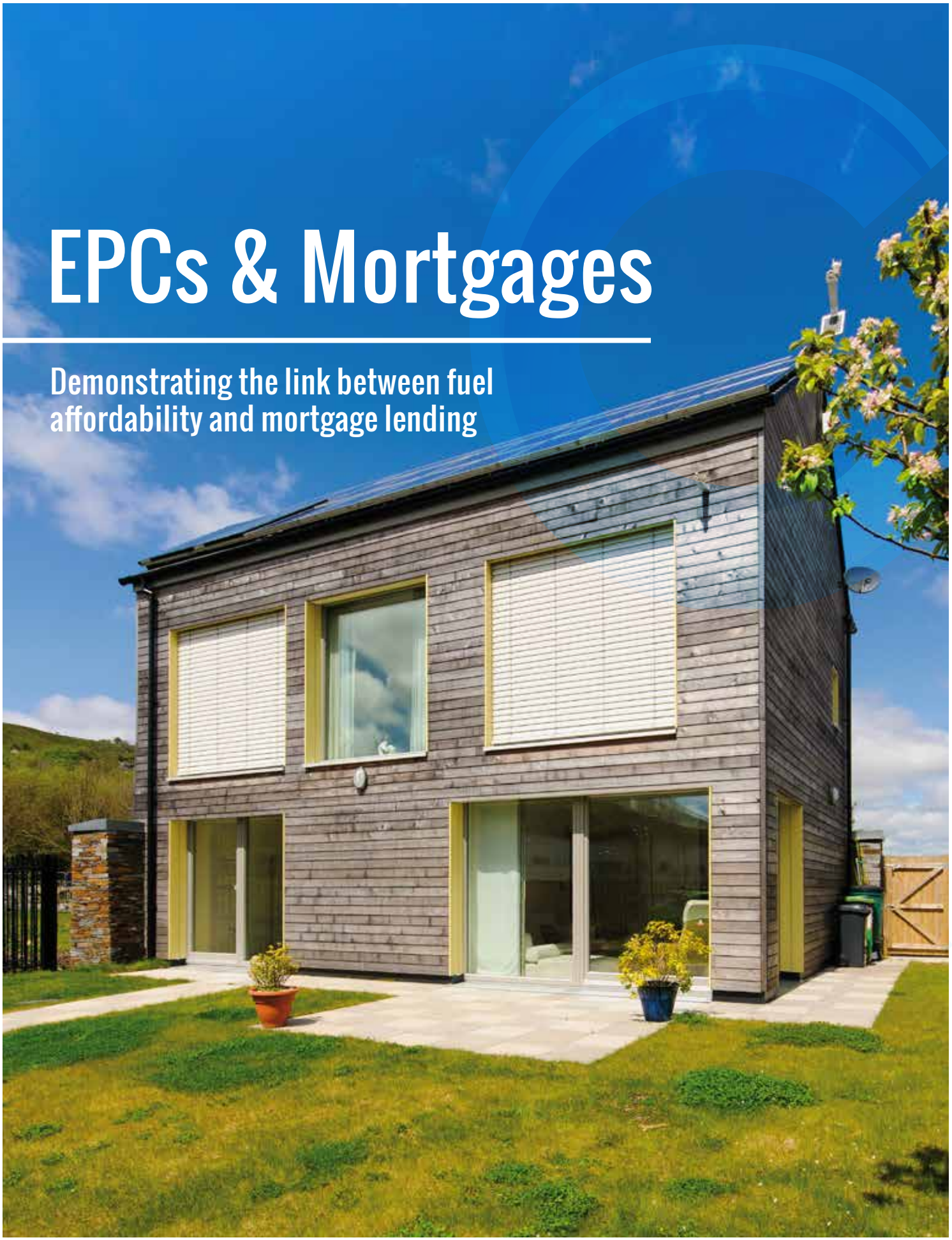
EPCs & Mortgages

Demonstrating the link between fuel affordability and mortgage lending



Grŵp Carbon Isel / Di-garbon Cymru
Wales Low / Zero Carbon Hub

ADEILADU ARBENIGRWYDD YNG NGHYMRU
CONSTRUCTING EXCELLENCE IN WALES

Ariennir gan Lywodraeth Cymru
Funded by Welsh Government

About Wales Low Zero Carbon Hub (WLZCH)

The hub's purpose is to work with Welsh Government to enable a zero carbon built environment in Wales.

The strategic aim of the hub is to:

'act as a dissemination mechanism to stakeholders and a source of advice to Welsh Ministers over activities and actions needed to achieve the aspiration of zero carbon new build and the contribution to be made by buildings that will help to deliver the 3% annual target to cut greenhouse gas emission'

This aim is delivered via the following actions:

- Advise Welsh Ministers on the most effective way to deliver relevant commitments of the Climate Change Strategy in respect of the built environment and contribute to a related policy review, development and implementation
- Raise awareness among stakeholders about solutions aimed at reducing emissions in new and existing buildings. To disseminate developing best practice and act as a focal point for obtaining the views of industry and wider stakeholders
- To work with existing knowledge networks and organisations working in the field
- Identify, propose and promote practical actions and policy options, including the uptake of research findings
- Identify any gaps in current policies (having regard for the limits of Welsh Government devolved responsibilities) which would usefully contribute to the achievement of policy objectives

The Hub has been established as a private/public/voluntary sector partnership. It has a Chairman, small core staff led by a funded Director and a number of key industry experts are procured on a project basis to deliver the Hub's work-streams. The work of the Hub is agreed and directed by the Steering Group that consists of representatives from key agencies and the private sector.

To ensure that the Climate Change Strategy is delivered across the devolved areas of competence, the Low/Zero Carbon Hub for Wales has been identified as a sub group to the Climate Change Commission in Wales. The Commissions current sub groups are: - Land use and Climate Change group, The Wales Low Zero Carbon Hub (built environment), The Adaptation task and finishing group and Business and Transport. The role of these Sub Group arrangements will be to provide real expertise and focus within their particular remit.

Executive Summary

The report provides a 'proof of concept' that illustrates that different home Energy Performance Certificates (EPCs) result in differing actual energy bills in the property.

The report demonstrates that the difference in the energy bills is sufficiently predictable that it could allow mortgage companies to factor different home energy costs, and an estimation of predicted fuel increases, into their lending affordability calculations to reflect different EPC bands, resulting in mortgage companies being able to lend larger capital sums for 'higher' rated EPC bands.

The report highlights that bills commonly range between £300 and £1,380 per annum for comparable properties with only differing EPC ratings. This means that 'higher' EPC rated property owners have potentially more than £1,000 per annum more 'disposable income' (c.£90/month) compared with those in less energy efficient properties, who are effectively committed to spending this income on energy. Based on a 5% interest rate, this difference in available income would equate to a maximum loan amount for a typical repayment mortgage could be approximately £15,600 higher for properties with a 'high' EPC (taken a "B") compared to those with a 'low' EPC, (taken as "E"), see Table 1 below.

EPC	Estimated Fuel Bills (£)	Money not spent compared to "low" EPC bills (£)	Amount of additional mortgage lending 'unspent' money could support (£)
40	1,380	0	0
50	1,107	273	3,892
60	833	547	7,797
70	559	821	11,703
80	285	1,095	15,609

Table 1 - Summary of Amount of Additional Mortgage Lending

This study has also confirmed that no mortgage product is currently offered that makes this link between home energy costs and lending amount.

Contents

Introduction & Scope

This report has been commissioned by the Wales Low/Zero Carbon Hub (WLZCH). The WLZCH is a government funded body with a remit to drive down carbon emissions across areas of the built environment devolved to the Welsh Government.

The WLZCH Steering Group conceived of a potential link between the affordability calculations undertaken by mortgage providers, and the Energy Performance Certificate (EPC) of the house being purchased. The proposal suggested that the EPC would be a reasonable indicator for the actual cost of fuel likely to be incurred by the owners, which in turn could then be used as one of the considerations included when undertaking affordability calculations to generate the maximum loan amount offered for a mortgage.

The WLZCH belief is that the inclusion of such an EPC-linked fuel cost estimation would create mortgage offers with the maximum loan amount dependent on the EPC of the property being lent upon; in essence the idea that a mortgage provider would offer "£200,000 for an EPC A property, £195,000 for an EPC C property, " and so forth.

It should be noted that the fuel estimation costs included in the Energy Performance Certificate are not a consideration of this potential link – these estimate only the 'regulated' energy costs, the WLZCH proposal is to estimate the actual fuel costs (comprising the 'regulated' and 'unregulated' energy costs incurred by the property owner).

Building from this principle, the WLZCH view is that such varied mortgage offers would stimulate interest in the energy performance of properties, and could consequentially contribute and generate an increased demand for higher EPC rated properties and/or reduced demand for the lower EPC rated homes. It is considered possible that such an alteration in the 'demand profile' of properties could, subsequently, begin to influence capital values of properties. If this were achieved, it is likely that both "EPC refurbishment" (retrofit works specifically to improve a property's energy performance certificate rating) and low energy new build home constructions, would increase.

This report's scope is one element of the WLZCH's overall agenda. The report has been commissioned to:

1. Research whether any readily available mortgage products in the marketplace already make the connection between EPC and capital loan amount offered by the lender

2. Establish the 'proof of concept' that a reliable prediction of fuel costs can be made from the EPC rating of a property.

It should be noted that the work to demonstrate the link between EPC and fuel costs is intended to be a sound scientifically robust study on a significant number of properties.It is not envisaged to be to the depth or include the total number of properties likely to be required before financial lending institutions can actively rely on the fuel cost predictions generated for 'live' lending purposes.

bre

Report Authors: Jelena Kiselova, Consultant and Andy Sutton, Associate Director, BRE

Online Review of Existing Mortgage Products

This chapter reviews the UK and international availability of products referring to themselves as "green mortgages" or in similar terms.

Hereafter all products are generally referred to as green mortgages. To assess what is currently in the marketplace for energy efficient homes in the UK and beyond online background market research was conducted.

The main strand of research was computer-based information gathering of currently available green mortgages, referencing both general sources of information and specific lender sites. The Google search engine was primarily used to research content, based on evidence that it has the best performance for relevant and thorough search results and the capacity to use enhanced search functions. Keywords such as "Green Mortgages", "Green Loans", "Loans for Energy Efficient Homes" were strategically extracted from project proposal as the words most likely to lead to a successful search (a list of keywords can be found in the appendix). Keywords were used to find relevant material this was screened for key triggers that signal a relevance to the project topic. Special search functions were used, such as quotation marks to narrow the search fields, and keywords were used in three different languages (English, German and French) to increase the extent of the search.

The research has found that currently the most common green mortgage offer is a financial incentive which encourages the home owner to buy or to work towards a "greener" home, although the exact mechanisms used by the lenders varies. A "greener" home is frequently measured in terms of energy efficiency, although in some instances other criteria (such as permitted materials) were included. The most prevalent version of the green mortgage provides discounts on loan charges or interest rates for homes that are certified as energy-efficient, or for work towards energy efficient measures. A significant number of the mortgages called "green mortgages" enable borrowers to roll in the costs of making specific energy saving improvements to the home they are building or purchasing.

Broadly, the research identified the following types of "green mortgage":

- Lower rate mortgage (than mortgage lender's 'standard' rate),
- Higher loan to value (than mortgage lender's 'standard' rate),
- Cash back or fees waived compared to normal charges.

It should be noted there are a number of special marketing features, such as the planting of trees, which have been ignored for the purposes of this research.

The most relevant search results are summarised in the table below.

Type	Name	Provider	Country	Notes
Discounted APR	Generation Green	Bendigo Bank	Australia	0.50% concession on interest rate, no monthly service fee
	Green homes	State Bank of India	India	0.25% concession on interest rate, 5% discount on the margin money
	Environmental mortgage	Cantonal Bank of Berne	Switzerland	0.25% concession on interest rate
	Residential Mortgages	Ecology Building Society	UK	0.2% concession on interest rate
Lend more	The Energy Efficient Mortgage	Federal Housing Administration	USA	Maximum mortgage at 90% of home value
	Green Mortgage Programme	Federal Housing Administration	USA	Adding up to 5% of the property value up to $4,000 to the green mortgage. The limit may increase if the loan is used for weatherization improvements or to pay for PV and SHW
Cash back	Green Mortgage	Norwich and Peterborough Building Society	UK	£500 cash back (for a limited period), free energy rating surveys, plant 40 trees for each green mortgage
	Colorado Energy Saving Mortgage Programme	Local Government	Colorado, USA	$8,000 cash back
	New York Energy Saving Mortgage Programme	Local Government	New York, USA	$5,000 (50% energy reduction); $7,500 (75% energy reduction); $10,000 (zero net energy).
	Energy-Efficient Refund	Genworth	Canada	10% refund of the mortgage insurance, extended amortization period
Efficiency improvement	Green Additional Borrowing service	Nationwide Building Society	UK	Allow existing mortgage customers to take out loans of between £5,000 and £20,000 to undertake approved energy efficiency measures, It added that the loans would benefit from a 0.5% rate reduction on Nationwide's existing range of two-year fixed and tracker further advance rates, meaning the rates will be available from 2.29%
	VA's energy-efficient mortgage programme	U.S. Department of Veteran Affairs	USA	Through the VA's energy-efficient mortgage program, qualified military personnel, reservists and veterans are allowed to finance up to $3,000 in upgrades based solely on their documented costs and up to $6,000 if the improvements are projected to produce more savings than the cost of those upgrades.
	Sustainable Energy Loan	Kiwibank	New Zealand	Kiwibank will contribute up to $2,000 (over four years) towards the cost of the renewable energy system (solar, wind, small-scale hydro, geothermal). For existing Kiwibank Home Loan customer, Kiwibank also waive the fee to top-up your home loan. Any type of energy system that's professionally installed and creates energy from renewable resources could qualify.

Table 2 - Types of Mortgage Products currently available

As noted in the summary, this research has been undertaken to provide background to the assumptions made in the proposal - that there should be a lending consideration related to home energy costs which ties to the lending amount, effectively a larger capital loan amount for a lower energy home justified by the lower running costs of the fuel bills. Whilst no research can claim to be fully comprehensive in such a global marketplace that includes international lenders and niche regional operations, this study has investigated 50 mortgage products from the UK and beyond (including the USA, Australia, Canada and much of Europe). Based on this study, no mortgage product has been found that links home energy costs to the lending amount.

EPC Rating Against Energy Bills

Information on actual energy bills, Energy Performance Certificate ratings and related data has been collected from 125 properties previously studied by BRE.

The selected properties represent a broad range of house types, including differences of:

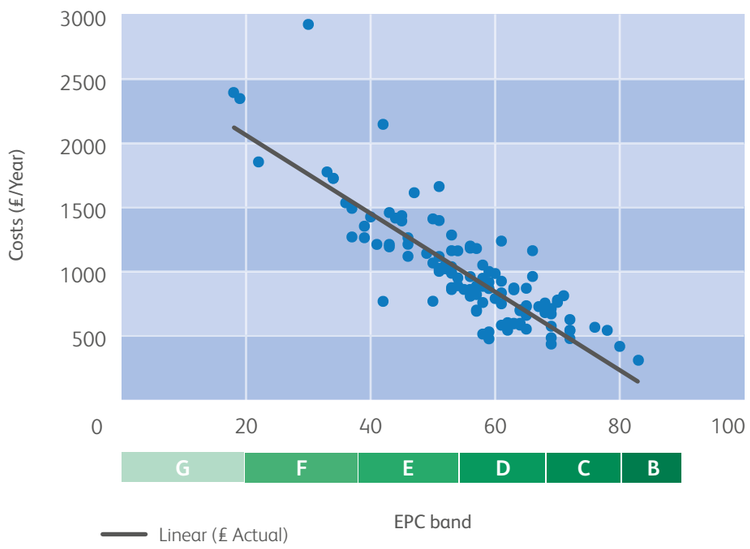
- house construction types (solid wall brick, solid wall stone, timber frame, cavity wall)
- house forms (terrace, end terrace/semi-detached and detached)
- bedroom numbers (ranging from 1 bed to 3 bedroom properties)
- geographical locations (Wales & England, and coastal & inland)
- occupant types (primarily 'out during the day' and 'in during the day' variations)
- primary heating fuel types (including mains gas, LPG, coal, oil and electricity)

The data was collated and formatted into uniform units of measurement to provide a single resource, primarily recording the Energy Performance Certificate rating and the recorded (or in some instances user estimated) actual fuel costs incurred by the property in question. The results of this are expressed in the graph Figure 1.

The graph shows a strong correlation between actual costs incurred by the property owners (£/year) and Energy Performance Certificate rating (and consequently EPC band). The graph has a derived 'trend line' (shown in black) that calculates the averaged correlation, 70% of the results are within ± 15% of this trend line.

Further interrogation of the data suggests that there does not seem to be a strong correlation between costs/EPC rate and house size, fuel type or house age. From an energy bills reduction viewpoint, it appears that all properties, irrespective of construction type, benefit from improved energy efficiency in a comparatively predictable fashion with regard to the impact on actual fuel costs.

Figure 1 - Correlation between Actual Costs (£/annum) and EPC band (based on respondents' replies)



Breakdown by Number of Bedrooms

As property purchases place a considerable emphasis on the number of bedrooms, the data has been further segmented by bedroom number.

A trend line has been established to indicate the correlation between EPC and actual energy costs for properties by bedroom number.This gives consideration for individual deviations to be averaged between the energy bills and EPCs. The trend line can be used to determine the strength of the relationship between the predicted energy costs from the known Energy Performance Certificate ratings and the number of bedrooms.

One bedroom properties

Data from thirty nine 1 bedroom properties was collected, these properties are a range of different house types, but are primarily bungalows. The properties have a range of different occupancy rates, the majority are single occupiers or couples. The fuel types vary from mains gas, LPG, coal and electricity.

Figure 2 supports the correlation shown in Figure 1: the higher EPC rate, the lower bills. The trend line has been calculated using the formula [y= -27.389x+2476.6 , where Y- is annual costs, and X- EPC rate (1)] which generates approximate costs for the each EPC rate. The trend line formula is shown on the graph in black. The results for the most common EPC rates (E40 – B80) are given in the table in the Appendix C.

As the table demonstrates, the annual costs for a one bedroom property may vary significantly depending on the EPC rating. The owner of a 40 (E) rated property spends approximately £1,400 per year, the owner of a 80 (B) rated property only spends about £300 per year for the same size property. This makes a B rated property more than 4 times less than an E rated property, and therefore creates a significant "affordability factor".

Two bedroom properties

Data from forty-four two bedrooms properties was analysed, these properties represent a range of different house types, in the main mid-terrace and end-terrace houses. The properties represent different occupancy rates, including: single occupiers, couples and families. The fuel types vary from mains gas, LPG, coal and electricity.

The trend line has been calculated and the formula indicated on the graph. The full table of results, and derived trend line results, can be found in the Appendix C.

As Figure 3 demonstrates, the annual costs for a 2-bedroom property vary considerably: from about £400 for an 80 (B) rated house to nearly £1,400 for a 40 (E) rated property.

Figure 2 - Correlation between Actual costs (£/year) and EPC band for 1 bedroom properties

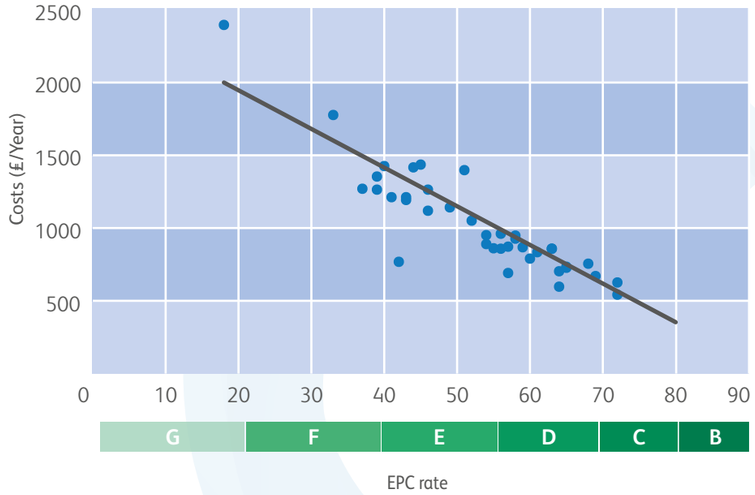
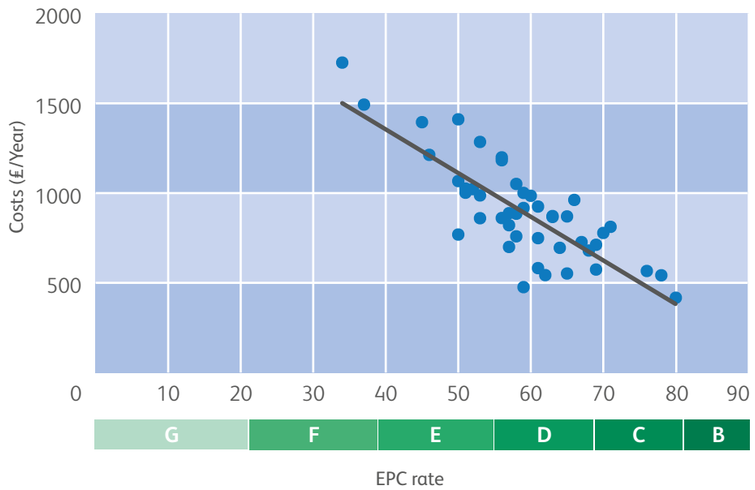


Figure 3 - Correlation between Actual costs (£/year) and EPC band for 2 bedroom properties



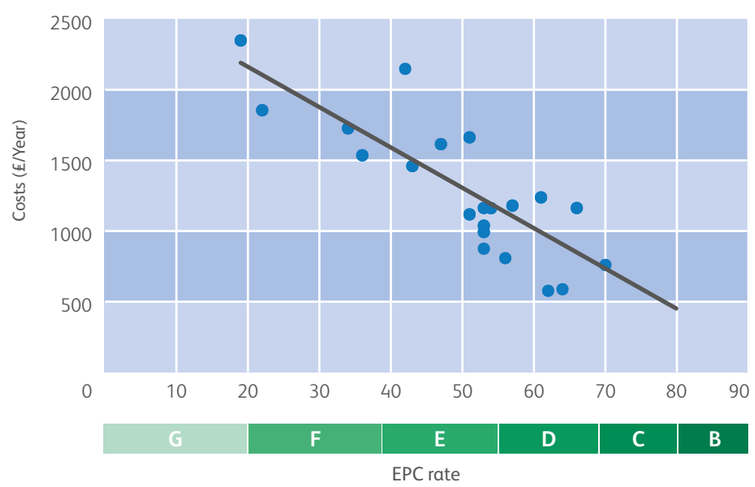
Three bedroom properties

Data from twenty-two three bedroom properties was collected, these properties represent different house types, including detached, mid-terrace and end-terrace houses. The houses have a range of different occupancy levels, but are predominantly occupied by families. The fuel type varies from mains gas, LPG, coal and electricity.

A trend line has been calculated using the formula indicated on the graph. The full table of results, and derived trend line results, can be found in Appendix C.

As Figure 4 demonstrates annual costs for a three bedroom property vary considerably depending on the EPC rating. The owner of a 40 (E) rated property spends approximately £1,600 per year, the owner of an 80 (B) rated property pays about £500 per year for the same size property, approximately a third of the cost.

Figure 4 - Correlation between Actual costs (£/year) and EPC band for 3 bedroom properties



Variability of Prediction depending on Number of Bedrooms

Comparing Figures 2, 3 and 4 it can be established that the costs for a one bedroom B-rated property are on average 30% lower than energy bills for B-rated two bedrooms property and 85% lower than B-rated three bedroom house. The difference between E- rated houses is not significant: there is no difference between one bedroom and two bedroom E-rated properties, and only a 10% difference between one bedroom and threebedroom E-rated properties. This demonstrates that properties of all sizes can benefit from energy efficiency improvements, however smaller properties will benefit the most.

The Impact of Future Fuel Costs

The previous section of this report deals with the near-present day costs from actual fuel bills related to Energy Performance Certificate ratings, and demonstrates a strong correlation.

This section looks at the impact of predicted changes in future fuel costs, and reviews the likely impact that different fuel costs will have on the capacity to predict actual fuel bills from EPC ratings.

The UK Fuel price prediction models were used to develop a ten year forecast. The forecasts are based on the central parameters in the model, starting from a 2013 baseline.

Fuel	Predicted price increase in the next 10 years
Oil	13%
Gas	11%
Coal	26%
Electricity	16%

Table 3 - UK Fuel price predictions

The data in figure 5 presents DECC's long-term price projections for oil, gas and coal. These projections reflect long-term trends and do not capture short-term fluctuations in prices.

As the table and graph demonstrate, gas is predicted to have the lowest price increase in the next 10 years at 11%. In taking a conservative estimate, the calculations and forecast in the tables in Appendix C are based on these lowest price increases – this has been selected in preference to an average increase as this may over-estimate fuel bills in some instances.

Should it be deemed desirable, more accurate 'by fuel' cost increases can be used to generate future predicted actual fuel bills for properties using the data from Table 3 and the same methodology . This approach has not been considered in this report as it would require any mortgage offer to be based on both the EPC rating of the property and the primary heating fuel used. The view has been taken that this may introduce too much complexity to the marketplace at this time, but it remains a possibility for future research and mortgage products.

It is noted here that the most common mortgage period is understood to remain at 25 years. Based on the available DECC data we can project future costs towards the end of a mortgage period. With further data, it would be possible to extend this projection, although it is likely that the accuracy would decrease as this period extended.

Applying the 11% fuel cost increase based on the profile set out in the DECC graph to the overall results for the correlation between actual fuel costs and Energy Performance Certificate rating therefore allows a conservative estimation of actual fuel costs by EPC rating for the future.

Figure 5 - UK Fuel price in indices in the domestic sector in real terms

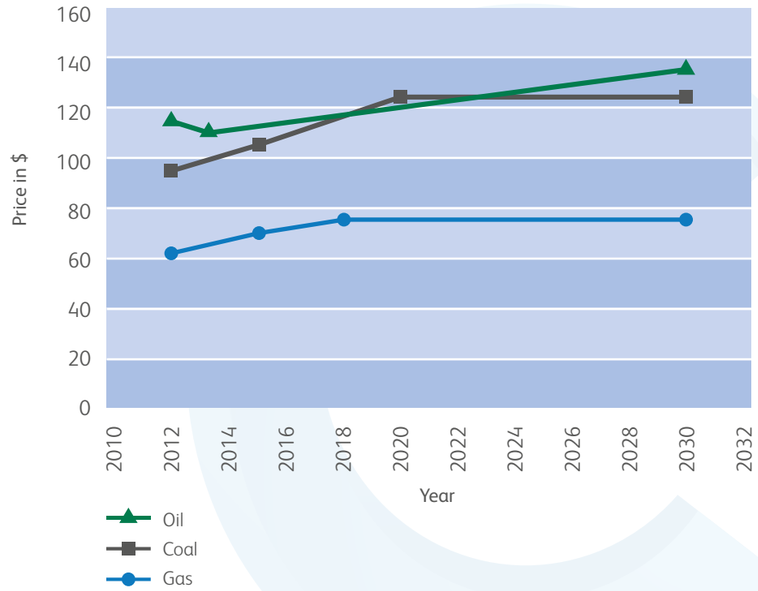
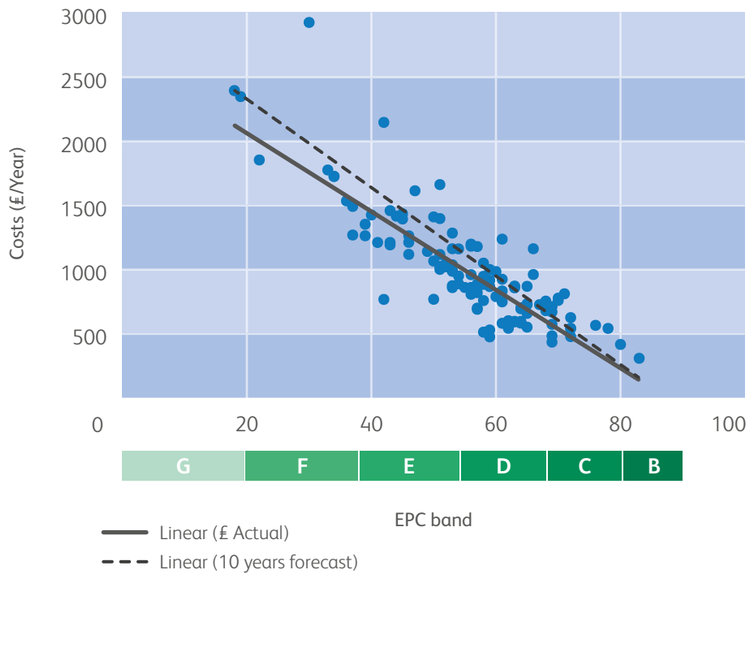


Figure 6 - Trend lines for present day and 10 years future



Taking this principle, we can project the trend line from the core graph of actual fuel costs against EPC rating to illustrate likely actual fuel costs at points in the future.

This graph demonstrates fuel costs increase during the likely period of mortgage lending, and therefore the likely impact on affordability for the owner. Note that no consideration of any energy saving refurbishment works have been taken into account , this is likely to reduce costs and may be the subject of a review of the lending amounts to increase borrowing.

From figure six it can be established that a property with an EPC rating of 80 (B) is currently likely to pay £250 per annum in fuel costs , rising to £300 in ten years' time. Conversely a property with an EPC rating of 40 (E) is likely to pay £1500 per annum in fuel costs today, rising to £1700 in the next ten years' time. This demonstrates that the EPC rating of the property, as an indicator of actual fuel costs, is both a relevant 'affordability indicator' in present day and an increasingly important factor in future years.

Conclusions

- This study has investigated fifty mortgage products from the UK and beyond (including the USA, Australia, Canada and much of Europe). Based on this study, no mortgage product has been found that delivers the link between home energy costs and lending amount.
- The research shows a strong correlation between actual bills and Energy Performance Certificate rating (and consequently EPC band). Furthermore, the report demonstrates that the difference in the energy bills is sufficiently predictable that it could allow mortgage companies to factor different home energy costs, and an estimation of predicted fuel increases into their lending affordability calculations to reflect different EPC bands.
- The research suggests that there does not seem to be any strong correlation between costs/EPC rate and house size, fuel type or house age. From a bill reduction point of view, it appears that all properties, irrespective of construction type, benefit from improved energy efficiency in a comparatively predictable fashion with regard to the impact on actual fuel costs.
- It is important to pay attention to the fact that UK energy prices are expected to keep rising, putting upward pressure on house owners' energy bills. Thus the difference between 'higher' EPC rated properties and 'lower' EPC rated properties will be increasing.
- The report highlights that 'higher' EPC rated property owners will have potentially more 'disposable income' compared with those in less energy efficient properties, who are effectively committed to spending this income on energy. This difference in available income could equate to a difference in the maximum loan amount for a typical repayment mortgage, that could be larger for properties with a 'high' EPC compared to those with a 'low' EPC. This could allow mortgage companies to factor different home energy costs into their lending affordability calculations to reflect different EPC bands, resulting in mortgage companies being able to lend larger capital sums for 'higher' rated EPC bands (See the table overleaf).

Table 4 - Amount of Additional Mortgage Lending

EPC	Estimated Fuel Bills	Money not spent compared to "low" EPC bills	Amount of additional mortgage lending 'unspent' money could support
40	1380	0	0
41	1353	27	385
42	1326	54	770
43	1298	82	1169
44	1271	109	1554
45	1243	137	1953
46	1216	164	2338
47	1189	191	2723
48	1161	219	3122
49	1134	246	3507
50	1107	273	3892
51	1079	301	4291
52	1052	328	4676
53	1024	356	5075
54	997	383	5460
55	970	410	5845
56	942	438	6244
57	915	465	6629
58	887	493	7028
59	860	520	7413
60	833	547	7797
61	805	575	8197
62	778	602	8582
63	750	630	8981
64	723	657	9366
65	696	684	9750
66	668	712	10150
67	641	739	10534
68	614	766	10919
69	586	794	11318
70	559	821	11703
71	531	849	12102
72	504	876	12487
73	477	903	12872
74	449	931	13271
75	422	958	13656
76	394	986	14055
77	367	1013	14440
78	340	1040	14825
79	312	1068	15224
80	285	1095	15609

Appendix A

Table of Keywords used in Research

Climate Change Mortgage	Environmental Lending	Green Loans
ECO Financing	EPC	Green Mortgage
Energy Efficiency	Green Borrowing	Home Energy Rating
Energy Efficient Buildings	Green Construction	Home Energy Costs
Energy Efficient Homes	Green Construction Financing	Mortgage Provider
Energy Savings	Green Construction Funding	Refurbishment
Energy-Efficient Refund	Green Construction Mortgage	Sustainability Lending
Environmental Financing	Green Construction Loan	Sustainability Loan
Environmental Funding	Green Finance Sector	Sustainability Mortgages
Environmental Loan	Green Lending	Sustainable Banking
Environmental Mortgage	Green Improvements	Sustainable Finance
Environmental Borrowing	Green Initiatives	

Appendix B

Table of Mortgage Products Researched

Generation Green	Bendigo Bank	Australia
Generation Green Plus	Bendigo Bank	Australia
Energy Matters	Local Government	Australia
Solar Finance	Local Government	Australia
Green Saver Loan	Hunter United Credit Union	Australia
Green Personal Loan	People's Choice Credit Union	Australia
First Green Loan	Community First Credit Union	Australia
Gogreen® Home Improvement Loan	MECU	Australia
Enviro Loans	Community Cps Australia	Australia
Energy-Efficient Refund	Genworth	Canada
Energy Saver Loan	Royal Bank Of Canada	Canada
Eco Action Community Funding Program	Local Government	Canada
Energy Innovators Initiative	Local Government	Canada
Energy -Efficient Home Loan	CMHC	Canada
Green Loans	TAF/Tridel	Canada
Green Home	Canada Mortgage and Housing Corporation	Canada
Grønne Boliglån	Svendborg sparekasse	Denmark
Go green mortgage	CFS	Europe

The éco-prêt à taux zéro	Ademe	France
Green Loan	KfW Bankengruppe's	Germany
Green Homes	State Bank Of India	India
Green Mortgage Initiative	De Nederlandsche Bank	Netherlands
Sustainable Energy Loan	Kiwibank	New Zealand
DNB Næringseiendom	DNB	Norway
Environmental Mortgage	Cantonal Bank Of Berne	Switzerland
Residential Mortgages	Ecology Building Society	UK
Green Mortgage	Co-operative Bank	UK
Green Additional Borrowing Service	Nationwide Building Society	UK
Green Mortgage	Co-Operative Bank	UK
Home Energy Efficiency Loan	Yorkshire Building Society	UK
Solar Panels Loan Scheme	British Gas	UK
Solar Panel Loan	EvoEnergy	UK
Renewable Energy Loan	Hitachi Personal Finance	UK
Green Loan	Green Investment Bank	UK
MyCommunityMortgage™	Citigroup	USA
Smart Commute Initiative Mortgage	Citigroup	USA
The Energy-Efficient Mortgage	Federal Housing Administration	USA
Green Mortgage Programm	The Federal Housing Administration	USA
VA's Energy-Efficient Mortgage Program	U.S. Department Of Veteran Affairs	USA
US Bank Green Home Mortgage	US Bank	USA
Energy Efficient Mortgage	Academy Mortgage Corp	USA
Energy Efficient Mortgage	Adirondack Trust Company	USA
Energy Efficient Mortgage	Advisors Mortgage Group Llc	USA
Energy Efficient Mortgage	1st Priority Mortgage Inc	USA
Loan for LEED certified buildings	Wells Fargo	USA
Green Loan for Multi-unit residential sectors	NRB	USA
Environmental Home Equity Program	Bank of America	USA
Green Mortgage	Sierra Pacific Mortgage Company	USA
Colorado Energy Saving Mortgage Program	Local Government	Colorado, USA
New York Energy Saving Mortgage Program	Local Government	New York, USA

Appendix C

Tables of EPCs by Number of Bedrooms

Costs for each EPC rate for 1 bedroom properties

EPC	Costs	+15%	-15%	10 years forecast	+15%	-15%
40	1380	1588	1173	1532	1762	1302
41	1353	1556	1150	1502	1727	1277
42	1326	1525	1127	1471	1692	1251
43	1298	1493	1104	1441	1657	1225
44	1271	1462	1080	1411	1622	1199
45	1243	1430	1057	1380	1587	1173
46	1216	1399	1034	1350	1552	1147
47	1189	1367	1010	1319	1517	1122
48	1161	1336	987	1289	1482	1096
49	1134	1304	964	1259	1447	1070
50	1107	1273	941	1228	1413	1044
51	1079	1241	917	1198	1378	1018
52	1052	1210	894	1167	1343	992
53	1024	1178	871	1137	1308	967
54	997	1147	847	1107	1273	941
55	970	1115	824	1076	1238	915
56	942	1084	801	1046	1203	889
57	915	1052	778	1015	1168	863
58	887	1021	754	985	1133	837
59	860	989	731	955	1098	811
60	833	958	708	924	1063	786
61	805	926	684	894	1028	760
62	778	895	661	863	993	734
63	750	863	638	833	958	708
64	723	832	615	803	923	682
65	696	800	591	772	888	656
66	668	769	568	742	853	631
67	641	737	545	711	818	605
68	614	706	522	681	783	579
69	586	674	498	651	748	553
70	559	643	475	620	713	527
71	531	611	452	590	678	501
72	504	580	428	559	643	476
73	477	548	405	529	608	450
74	449	517	382	499	573	424
75	422	485	359	468	538	398
76	394	454	335	438	503	372
77	367	422	312	407	469	346
78	340	391	289	377	434	320
79	312	359	265	347	399	295
80	285	328	242	316	364	269

Costs for each EPC rate for 2 bedrooms properties

EPC	Costs	+15%	-15%	10 years forecast	+15%	-15%
40	1352	1555	1149	1501	1726	1276
41	1328	1528	1129	1474	1696	1253
42	1304	1500	1109	1448	1665	1231
43	1280	1473	1088	1421	1635	1208
44	1257	1445	1068	1395	1604	1186
45	1233	1418	1048	1368	1573	1163
46	1209	1390	1027	1342	1543	1140
47	1185	1362	1007	1315	1512	1118
48	1161	1335	987	1288	1482	1095
49	1137	1307	966	1262	1451	1073
50	1113	1280	946	1235	1421	1050
51	1089	1252	926	1209	1390	1027
52	1065	1225	905	1182	1359	1005
53	1041	1197	885	1156	1329	982
54	1017	1170	865	1129	1298	960
55	993	1142	844	1102	1268	937
56	969	1115	824	1076	1237	914
57	945	1087	804	1049	1207	892
58	921	1060	783	1023	1176	869
59	897	1032	763	996	1146	847
60	873	1005	742	970	1115	824
61	850	977	722	943	1084	802
62	826	949	702	916	1054	779
63	802	922	681	890	1023	756
64	778	894	661	863	993	734
65	754	867	641a	837	962	711
66	730	839	620	810	932	689
67	706	812	600	784	901	666
68	682	784	580	757	871	643
69	658	757	559	730	840	621
70	634	729	539	704	809	598
71	610	702	519	677	779	576
72	586	674	498	651	748	553
73	562	647	478	624	718	530
74	538	619	458	598	687	508
75	514	592	437	571	657	485
76	490	564	417	544	626	463
77	466	536	396	518	595	440
78	443	509	376	491	565	418
79	419	481	356	465	534	395
80	395	454	335	438	504	372

Costs for each EPC rate for 3 bedrooms properties

EPC	Costs	+15%	-15%	10 years forecast	+15%	-15%
40	1560	1794	1326	1732	1992	1472
41	1535	1766	1305	1704	1960	1449
42	1510	1737	1284	1676	1928	1425
43	1485	1708	1263	1649	1896	1401
44	1460	1679	1241	1621	1864	1378
45	1435	1651	1220	1593	1832	1354
46	1411	1622	1199	1566	1801	1331
47	1386	1593	1178	1538	1769	1307
48	1361	1565	1156	1510	1737	1284
49	1336	1536	1135	1483	1705	1260
50	1311	1507	1114	1455	1673	1237
51	1286	1479	1093	1427	1641	1213
52	1261	1450	1072	1399	1609	1189
53	1236	1421	1050	1372	1577	1166
54	1211	1392	1029	1344	1546	1142
55	1186	1364	1008	1316	1514	1119
56	1161	1335	987	1289	1482	1095
57	1136	1306	966	1261	1450	1072
58	1111	1278	944	1233	1418	1048
59	1086	1249	923	1205	1386	1025
60	1061	1220	902	1178	1354	1001
61	1036	1191	881	1150	1323	978
62	1011	1163	859	1122	1291	954
63	986	1134	838	1095	1259	930
64	961	1105	817	1067	1227	907
65	936	1077	796	1039	1195	883
66	911	1048	775	1011	1163	860
67	886	1019	753	984	1131	836
68	861	991	732	956	1099	813
69	836	962	711	928	1068	789
70	811	933	690	901	1036	766
71	786	904	668	873	1004	742
72	761	876	647	845	972	718
73	737	847	626	818	940	695
74	712	818	605	790	908	671
75	687	790	584	762	876	648
76	662	761	562	734	845	624
77	637	732	541	707	813	601
78	612	703	520	679	781	577
79	587	675	499	651	749	554
80	562	646	477	624	717	530

Appendix D

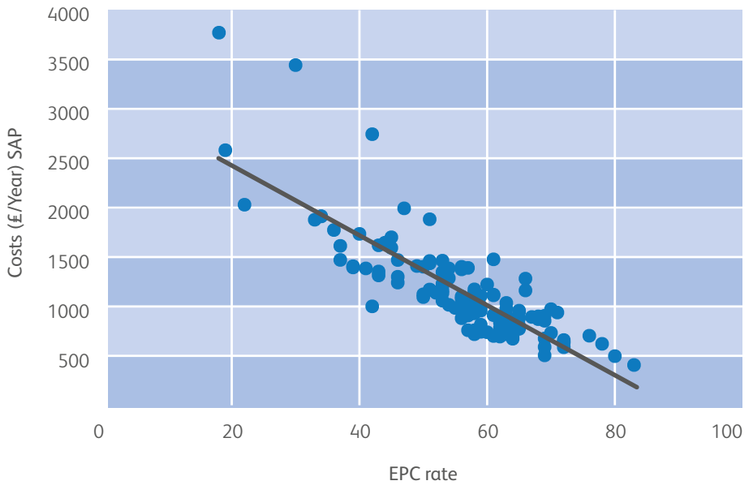
EPC Rating and SAP Predicted Energy Costs

This report is based upon a comparison between actual fuel costs (or in some instances user estimates) and the EPC rating of the property – the SAP estimation of fuel costs was not used in the main body of this report which establishes a link between EPC rating and actual fuel costs. Unlike the main report and for reference only, this appendix provides a graph illustrating the SAP estimation of fuel costs against the EPC rating.

As can be seen from the graph below, there is a general correlation between the SAP prediction of fuel costs (vertical axis) and the EPC rating generated by SAP (horizontal axis). Initially one might expect a perfect linear correlation since both outputs derive from the SAP tool, however the data for the graph includes a variety of fuel types and property sizes. This provides a 'hidden' variety in the SAP assessments, and results in the band of predicted costs ranging around a trend line (the trend line is shown in black).

The correlation of SAP costs to EPC rating looks similar to the one illustrated in Figure 1 (Actual Costs to EPC rating). However, the SAP predicted costs are an average +15 % above the actual regulated costs, and SAP predicted costs have a maximum +36 % difference and minimum -29 % (where "+" is costs overestimated by SAP and "-" is costs underestimated).

Figure 7 - Correlation between SAP predicted costs (£/year) and EPC band



Note from authors:

It is acknowledged that the core finding of this report – that EPC can be a reasonable predictor of actual fuel costs – runs contrary to some findings from other studies undertaken which have suggested either that EPC does not predict fuel costs, or that EPC over-estimates savings that are actually made from energy saving measures. This report has not investigated the reasons for this difference in outcome, but the authors provide the following observations:

- The data used for this report is drawn from actual EPCs and fuel costs for 125 properties, which represents a reasonable sample size but the authors acknowledge that larger samples would, inevitably, provide greater confidence.
- Almost all properties used in this report are privately owned, whereas in many other reports properties are primarily social housing. Whilst only speculation, it is noted that social housing properties have a higher instance of 'comfort gain' being taken from energy improvement measures than in privately owned properties.
- Reporting on its 1200 household energy efficiency retrofit programme in Sunderland, Housing Association Gentoo noted that "Predicted energy use generated using RdSAP is much higher than we have seen achieved. It's evident that social housing customers are generally under-heating their homes because they don't have the money to pay for their high and rising energy bills. Therefore pre-installation EPC results must be used carefully because the scope for savings is likely to be less." (The Energy Saving Bundle Report, 2013)
- Lastly, reports that suggest energy saving measures are achieving only small savings are frequently based on improvements such as loft insulation or boiler replacement. It is probable that such measures will only move a property by one or two EPC "bands", with a consequentially smaller energy saving than the potential savings from more extensive energy conservation measures.

ADEILADU ARBENIGRWYDD YNG NGHYMRU
CONSTRUCTING EXCELLENCE IN WALES

Grŵp Carbon Isel / Di-garbon Cymru
Wales Low / Zero Carbon Hub

2nd Floor East
Longcross Court
47 Newport Road
Cardiff, CF24 0AD

T: 029 2049 3322
F: 029 2049 3233
E: info@cewales.org.uk
www.cewales.org.uk

@CEWales
Constructing Excellence in Wales
CEinWales

Noddir gan
Lywodraeth Cymru
Sponsored by
Welsh Government