Association for the Conservation of Energy

Westgate House
2a Prebend Street
London N1 8PT

020 7359 8000
darryl@ukace.org

Centre for Sustainable Energy

Impact of energy policy on consumer bills

Darryl Croft, Ian Preston, Pedro Guertler, & Jack Carrington

Acknowledgements

In the preparation of this report a number of organisations and individuals provided helpful information, comments and advice. The team would particularly like to thank the following: David Green and Robert Buckley for giving their time and insight during discussions, and for providing feedback and suggestions on the report; DECC, the Committee on Climate Change, and Ofgem for engaging with us and providing information where possible; and finally Prashant Vaze from Consumer Focus for commissioning the project and offering invaluable support and considerable advice throughout its delivery.

Contacts for further information:

Darryl Croft
Senior Researcher
Association for the Conservation of Energy
Westgate House, 2a Prebend Street
London N1 8PT
www.ukace.org
darryl@ukace.org

Ian Preston
Senior Analyst
Centre for Sustainable Energy
3 St Peter's Court , Bedminster Parade
Bristol BS3 4AQ
www.cse.org.uk
ian.preston@cse.org.uk

Prashant Vaze
Chief Economist
Consumer Focus
Fleetbank House, Salisbury Square
London, EC4Y 8JX
www.consumerfocus.org.uk
Prashant.Vaze@consumerfocus.org.uk

Executive Summary

Introduction

With energy prices rising, fuel poverty becoming more widespread, and households struggling to afford their energy bills, some have sought to focus the blame on the impact of energy and climate change policies that often result in a direct or indirect levy upon energy bills. A lack of transparency over the magnitude and distributional impact of these costs has made it difficult for stakeholders to make considered judgements. Government[1] and the Committee on Climate Change (CCC)[2] have responded by publishing assessments of the impact policies currently have on energy bills, and the likely impacts by 2020.

Such assessments depend upon a range of assumptions covering a myriad of factors. The degree to which the impacts on bills will change if the assumptions made are incorrect is rarely explored beyond looking at fossil fuel price scenarios.

Similarly, the distributional impact of changes to energy bills is another area that is not well understood, as is the impact of policy costs being passed through as part of a standing charge or the unit rate. Using a combination of housing stock and household models, this report presents evidence as to the potential range of energy bills under different assumptions, the structure of the costs that are passed through to consumers, and explores the distributional impacts of bills in 2020.

Scenarios

Six scenarios are used to explore the changes to energy bills through to 2020, combining three 'fuel price' scenarios (made up of wholesale, network, metering and other non-policy costs met by suppliers) with two 'policy mix' scenarios.

Fuel price scenarios are based on DECC's low, central and high wholesale price projections[3], with costs assigned for transmission and distribution based on a variety of sources[4]. Transmission and distribution costs within our scenarios tend to be higher than those within the CCC and DECC studies. The existing price control framework is currently being changed in favour of a 'RIIO' model that it is hoped will reward companies for efficiently delivering the £32bn of required grid upgrades that Ofgem has identified through to 2020[5]. Where DECC and CCC project forward historic network costs, we have attempted to estimate the impact of RIIO on the price of energy.

The two policy mix scenarios are designed to reflect the full range of potential policy impacts on energy bills. Policy Mix 1 presents a combination of policies delivered at higher costs and/or which result in a lower/less cost-effective delivery of demand reduction measures. Policy Mix 2 presents the opposite situation, with policies delivered at lower costs and/or which result in a higher/more cost effective delivery of demand reduction measures. Both of our policy mix scenarios include the provision of boilers at a rate consistent with current boiler replacement rates.

[1] (DECC 2011a)
[2] (CCC 2011)
[3] (DECC 2011b) – Annex F
[4] Including (Redpoint Energy 2011)(Ofgem 2011a; Ofgem 2007) (Ofgem 2011b))
[5] (Ofgem 2010)

Sensitivity of Energy Bills

Total Energy Bills

Average fuel bills could be higher or lower than 2011 by 2020. Our scenarios indicate a range of £275 lower to £375 higher, though under a Central Fuel Price scenario bills are expected to increase by between £6 and £140 as illustrated in Figure E1. Most of this range is driven by uncertainties in fossil fuel prices rather than policy costs. Despite this variability, our scenarios indicate that for the average customer with gas central heating, Government's policies to promote renewables and improve energy efficiency will result in energy bills that in 2020 are less than if Government failed to implement a mix of climate and energy efficiency policies, and/or bills that are lower in absolute terms than they were in 2011.

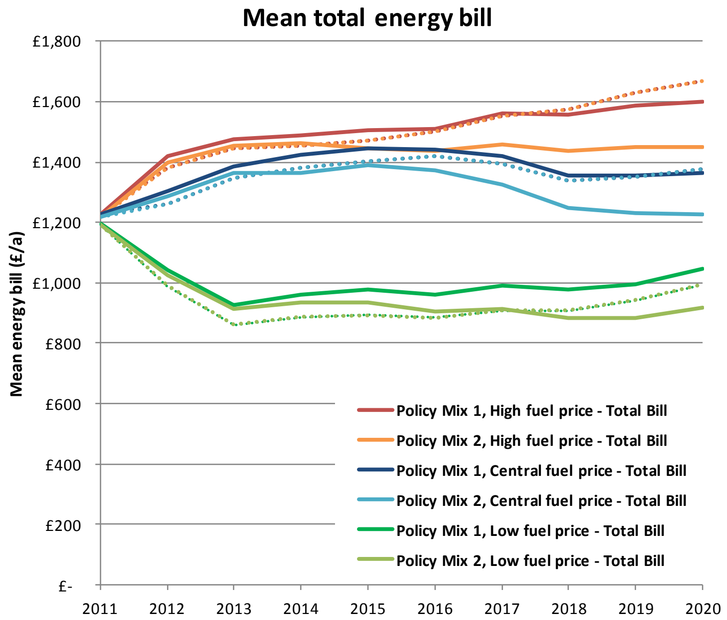


Figure E1– Mean total energy bill, 2011-2020. Counterfactual bills are shown in dotted lines for the high (orange), central (blue) and low (green) fuel price scenarios

Final bills in 2020 were lower than under counterfactual scenarios (where energy and climate change policies were ended in 2012) in five out of the six scenarios. Under Policy Mix 2 scenarios, 2020 bills were between 9% and 15% lower than the counterfactual bills. Policy Mix 1 bills were lower than the counterfactual under the high and Central Fuel Price scenarios by 4% and 1% respectively. Only under the Central Fuel Price scenario did the counterfactual perform better, with the Policy Mix 1 scenario giving a bill 5% higher. However, in absolute terms this bill was still £150 lower than in 2011. Across none of our scenarios were energy bills in 2020 both higher than in 2011 *and* higher than if the Government adopted a 'do-nothing' approach, abandoning all energy and climate policies from 2012.

Policy Mix 2 outperforms Policy Mix 1 and the counterfactuals across all fuel types and fuel price scenarios, resulting in average energy bills that are between £129 and £151 lower in 2020 than Policy Mix 1.

Gas Bills

There is a large range of potential gas bills in 2020, from a £256 reduction to a £246 increase for the average consumer from the average 2011 bill. Across all of our scenarios, the 2020 gas bills are lower than a counterfactual bill where all the energy and climate change policies (their costs and their impacts from 2012 onwards) are removed.

The gas bill in 2020 is almost entirely dictated by the changes in wholesale and network costs, which explain 99.8% of the variance in final bills. Policies are set to increase gas bills by £11-£12 but precipitate reductions to energy demand and fuel bills that save between £24 and £86 per year. This dynamic is illustrated for the Policy Mix 2, Central Fuel Price scenario in Figure E2.

The choice of Policy Mix scenario results in a difference for the average 2020 gas bill of £29 under the high fuel price scenarios, falling to £6 under the Central Fuel Price scenarios. At lower fuel prices, the increased provision of energy saving measures has less of an impact on bill saving.

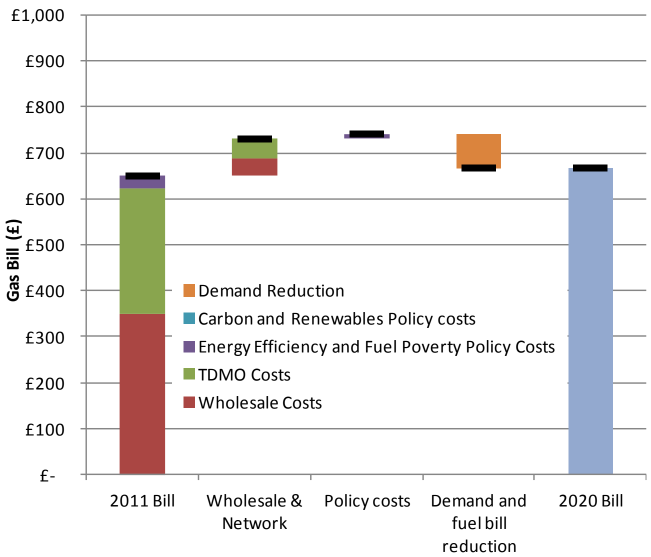
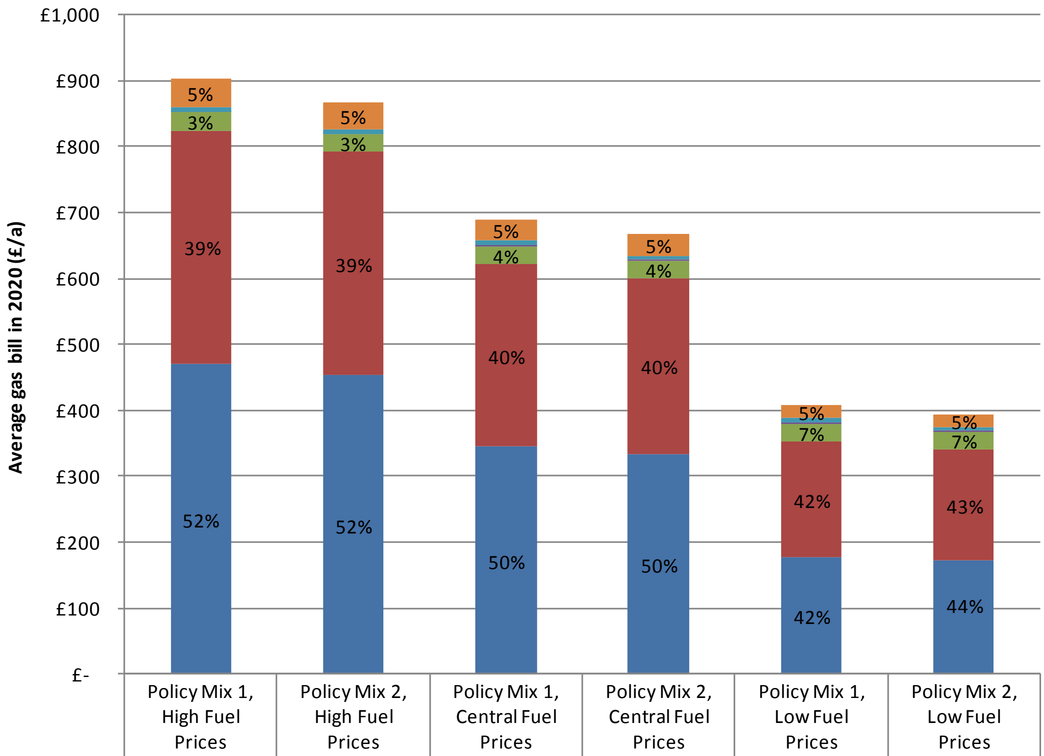


Figure E2 - Illustration breaking down the gas bill changes from 2011 to 2020 for the Policy Mix 2, Central Fuel Price scenario

In 2020, wholesale and network costs account for between 87%- 91% of the average gas bill, with a further 4%-9% due to policy costs, and 5% through VAT. Policy costs account for £34-£36 of the bill cost, but is more than compensated for by the fact that these policies have led to a net reduction in the gas bill across all scenarios. ECO represents the largest policy impact on the gas bill in 2020, making up 3% of the bill under the high fuel price scenarios, rising to 7% under the Low Fuel Price scenarios. The average 2020 gas bill is broken down for all six scenarios in Figure E3.



	Policy Mix 1, High Fuel Prices	Policy Mix 2, High Fuel Prices	Policy Mix 1, Central Fuel Prices	Policy Mix 2, Central Fuel Prices	Policy Mix 1, Low Fuel Prices	Policy Mix 2, Low Fuel Prices
VAT	£43	£41	£33	£32	£19	£19
WHD	£7	£7	£7	£7	£7	£7
Smart Metering & Billing	£1	£1	£1	£1	£1	£1
ECO	£28	£26	£28	£26	£28	£26
TDMO	£353	£340	£277	£268	£176	£170
Wholesale	£471	£453	£345	£334	£177	£171

Figure E3 - The average gas bill in 2020 across all six scenarios, broken down into constituent parts. The Warm Home Discount (WHD) and Smart Metering make up less than 1% of the 2020 bill.
TDMO = Transmission, Distribution, Metering and 'Other'.

Electricity Bills

Electricity bills in 2020 show a smaller range than gas bills in our scenarios, with the difference from the average 2011 bill spanning a £38 reduction to a £160 increase. If our Policy Mix 2 scenarios are followed, 2020 bills are £11 - £77 lower than in a counterfactual scenario (i.e. without the costs and benefits of energy and climate change policies). However, 2020 bills are £25-£86 higher than the counterfactual bills under the Policy Mix 1 scenarios.

The majority of the change to the electricity bill (61%) is due to changes to wholesale prices and network costs[6] – this proportion is lower than the equivalent proportion for gas bills. This is because a wider range of policies are applied exclusively to the cost of electricity, such as carbon pricing and renewable electricity levies. Though only responsible for the minority of the change, the cost of energy and climate change polices is higher and the impact of the policies in reducing energy demand and fuel bills is greater than is the case for gas. In the absence of demand reduction, policies would add between £102 and £169 to the average electricity bill by 2020. However, these policies lead to a reduction in fuel bills of between £129 and £191 per year. In all but two scenarios demand reduction exceeds the costs of the policies. This dynamic is illustrated for the Policy Mix 2, Central Fuel Price scenario in **Error! Reference source not found.**

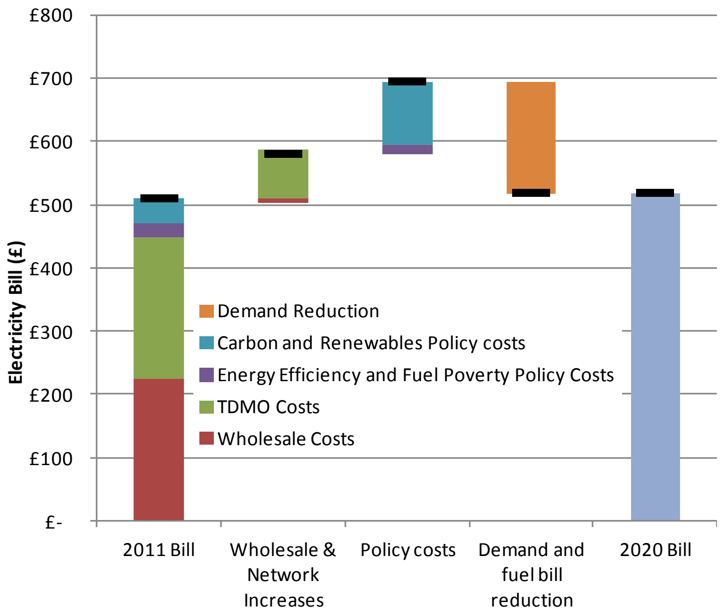


Figure E4 - - Illustration breaking down the electricity bill changes from 2011 to 2020 for the Policy Mix 2, Central Fuel Price scenario

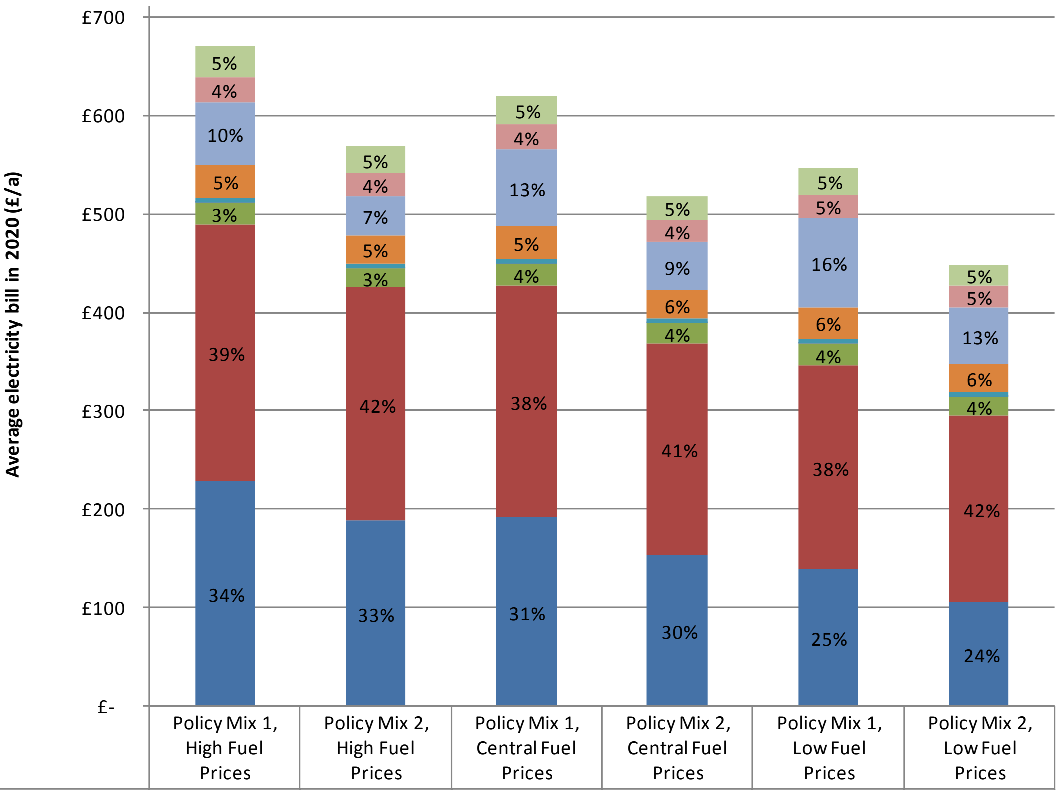
The choice of Policy Mix has a large impact on electricity bills in 2020, with a £98-£103 difference between bills under a given fuel price scenario. Around £30 of this difference is due to the Policy Mix 2 scenarios including an anticipated reduction in wholesale price in response to the EMR policy. The remainder is split between reduced policy costs (£33-£43) and greater reductions in demand and fuel expenditure (£27-£39) for Policy Mix 2.

In 2020, wholesale and network costs account for between 63%-75% of the average electricity bill, with a further 20%-32% due to policy costs, and 5% through VAT. Policy costs account for £116-£175 of the bill cost, though for all but two of the scenarios the reduction in energy demand and fuel bills that these policies generate exceeds this cost.

The costs of the Contract for Difference Feed-in-tariff (FiT CfD) and capacity mechanism under EMR, and the Renewables Obligation when combined represent the largest policy impact on bills of between 7% and 16%. The absolute cost of these policies increases from £40-£64 under the high fuel price scenarios to £57-£90 under the Central Fuel Price scenarios. This difference across fuel price scenarios reflects the fact that if fuel prices are low, the cost of the contract-for-

[6] The projected cost of investment in networks needed to integrate renewable electricity, identified by (Electricity Networks Strategy Group 2012), represent just 8%-10% of the total increase in network costs.

difference feed in tariff (FIT CfD) will be higher since consumers pay the difference between the wholesale price and the FIT CfD. The policy therefore acts to moderate price changes: under high fuel price scenarios the policy costs rather less. The EU Emissions Trading Scheme (EU ETS) and the Carbon Floor Price (CFP) together represent the second largest policy impact on bills by 2020, of 5% - 6%, with the FIT adding another 4%-5% to bills by 2020. The average 2020 electricity bill is broken down for all six scenarios in Figure E5.**Error! Reference source not found.**



	Policy Mix 1, High Fuel Prices	Policy Mix 2, High Fuel Prices	Policy Mix 1, Central Fuel Prices	Policy Mix 2, Central Fuel Prices	Policy Mix 1, Low Fuel Prices	Policy Mix 2, Low Fuel Prices
VAT	£32	£27	£30	£25	£26	£21
FIT	£25	£23	£25	£23	£25	£23
RO and EMR	£64	£40	£78	£49	£90	£57
EU ETS & CFP	£33	£29	£33	£29	£32	£29
WHD	£5	£4	£5	£4	£5	£4
Smart Metering & Billing	£1	£1	£1	£1	£1	£1
ECO	£22	£20	£22	£20	£22	£20
TDMO	£260	£237	£235	£215	£207	£188
Wholesale	£229	£188	£191	£154	£139	£106

Figure E5 - The average electricity bill in 2020 across all six scenarios, broken down into constituent parts. The Warm Home Discount (WHD) and Smart Metering make up less than 1% of the 2020 bill. TDMO = Transmission, Distribution, Metering and 'Other'.

Distributional Impacts

Expenditure and Fuel Poverty

Whereas average bills are lower than the counterfactual bills for most scenarios, the scenarios do not perform quite as well against the counterfactuals when looking at the impact on fuel poverty. As illustrated in Figure E6, High Fuel Price scenarios outperform the counterfactual, whilst Low Fuel Price scenarios perform less well. For the Central Fuel Price scenarios, Policy Mix 1 is outperformed by the counterfactual, whilst Policy Mix 2 performs better than it.

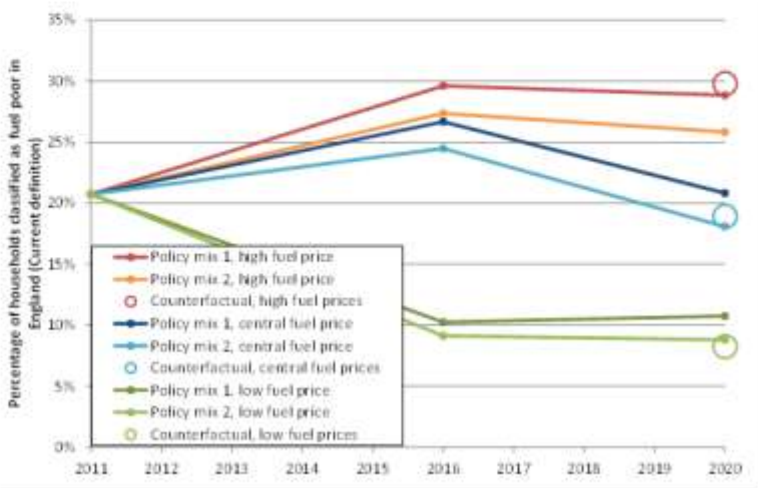


Figure E6 - Percentage of households classified as fuel poor – current definition

There are a couple of reasons as to why the scenarios tend to perform better against counterfactuals when comparing average bills than fuel poverty numbers. The first is that by definition[7] fuel poor households' homes are less efficient that the average household; importantly they have a much higher proportion of electric heating than average, and are more likely to live in difficult to treat solid wall homes. They are therefore more likely to be disadvantaged by the increases in (especially) electricity and (to a lesser degree) gas prices resulting from the energy and climate change policies, and less likely to benefit from the energy reduction measures that these policies bring than the average household.

Secondly, the nature of the current '10%' definition is that as energy prices rise and a greater proportion of households enter fuel poverty, a small increase in prices pushes an ever greater number of households in to fuel poverty – the 10% threshold is one over which households can be easily tipped. If fuel poor households need to pay slightly more for their energy need under the scenarios than they do under the counterfactual bills (owing to the greater proportion of electric heating) this can translate into a much larger number of additional fuel poor households.

The merits of the fuel poverty definition were recently studied by Professor Hills, who has issued his own recommendation for a new definition[8]. This would see a household being defined as fuel poor if both their relative income is low and their energy need is higher than the median household's need. Our assessment of how fuel poverty would change across our scenarios using the Hills definition is shown in Figure E7.

The Hills definition is successful in one of its objectives: it greatly reduces the sensitivity of fuel poverty numbers to fuel price variability which Hills sees as a weakness of the existing definition – fuel poor numbers vary by less than 300,000 households across fuel price scenarios despite a wide range in 2020 energy prices. However the Hills definition also reduces the sensitivity of fuel poverty numbers to the provision of energy efficiency improvements. Policy mix scenarios vary by 60,000 households or less across the scenarios.

Hills recommends an additional measure of fuel poverty: the 'fuel poverty gap', defined as the amounts by which the assessed energy needs of fuel poor households exceed the threshold for reasonable costs (i.e. more than the median household needs to pay). Across the three fuel price scenarios, the Policy Mix 2 variant reduces the fuel poverty gap consistently by approximately £200m compared to Policy Mix 1.

[7] Because fuel poverty is defined in terms of 'energy need'. This makes any household in an inefficient property more likely to be fuel poor.
[8] (Hills 2012)

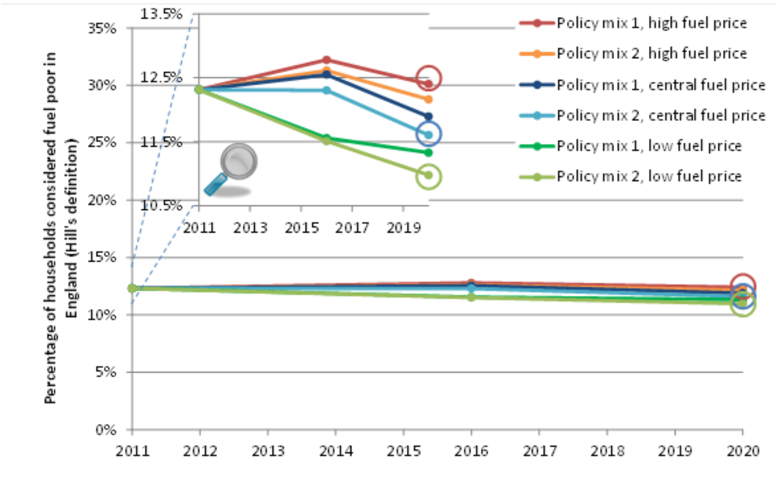


Figure E7 - Percentage of households in fuel poverty according to Hills definition

'Winners' and 'Losers'

Whilst households on average see a decrease in their bills relative to the counterfactual, there remains a significant difference between those that do and do not benefit from the receipt of energy saving measures or fuel price support through the various policies. Across all scenarios, the average difference between the total energy bill for those who receive (termed the 'winners') and those who don't receive measures (the 'losers') in 2020 is £279, based on an average bill of £1,155 for 'winners' and £1,434 for 'losers'. The difference across the scenarios is illustrated in Figure E8.

Figure E8 - Mean total energy bill in 2020 for the 'winners' and 'losers' by scenario

The key determinants for winners and losers are based on the technical opportunity for households to receive measures, the targeting of policy, and the heating fuels used. The prevalence of electricity for heating seems to be a key driver, partly explaining the difference in bills between 'losers' under different policy mix scenarios: the higher cost of electricity under Policy Mix 1 leaving those with electricity heating systems that don't receive measures with higher bills. This is of importance for low income households who are more likely to heat with electricity. 18.8% and 13.9% of households in income deciles 1 and 2 respectively heat with electricity compared to the UK average of 10.3%.

The targeting of policy measures at the priority group and the super priority group, coupled with the Warm Homes Discount for those on pensioners credit guarantee, helps drive a general trend of the greatest bill reduction for households that contain either a person over 60 or lone parents. The greatest 'losers' appear to be single adults under 60 who have a higher prevalence of electricity for heating: 17.8% compared to the UK average of 10.3%.

Both social landlords and the private-rented sector have a higher proportion of households that use electricity to heat their homes: 16.6% and 21.2% respectively. The private-rented sector and social housing also have a higher proportion of smaller properties and flats reducing the opportunity for energy efficiency and renewable technologies. Households within these tenures see bills that are higher than the counterfactuals under Policy Mix 1, and higher than owner-occupied tenures across all scenarios.

Standing Charges

The majority of energy tariffs available to consumers in the UK have an element of fixed costs either through a standing charge (a fixed charge every day) or through a higher unit rate on the first block of energy units ('tier 1') consumed. They are intended to reflect the fixed costs that suppliers face, though the level of supplier costs incurred and nature of the pass-through onto consumer bills is opaque.

Standing charges (which we use to describe tariffs with either a standing charge or a higher tier 1 unit rate) are to the relative detriment of those with below average energy consumption. They are costs that cannot be reduced by saving energy, meaning that for low consumers the standing charge will make up a greater proportion of the energy bill. They act against the 'polluter pays' principle by moderating the unit price, and making the marginal unit of energy consumed cheaper than both the first and the average unit price. Since the majority of low-income households are low users of energy, standing charges are commonly seen as regressive[9].

In 2020, standing charges range from £124 - £176 on the average total energy bill across our six scenarios, ranging from 35% higher to 4% lower by 2020, assuming the elements of the energy price contributing the standing charge continue to do so. For the highest expenditure decile households, standing charges constitute between 9% and 11% of these households' average bill, meaning that 89%-91% is based on their consumption, and could be reduced with reduced demand. For the lowest expenditure decile households, 15%-18% of the average bill is due to a standing charge. For these households, only 82%-85% is sensitive to the amount of energy consumed. The percentage of the bill that is made up of the standing charge across expenditure deciles in 2020 is illustrated in Figure E9.

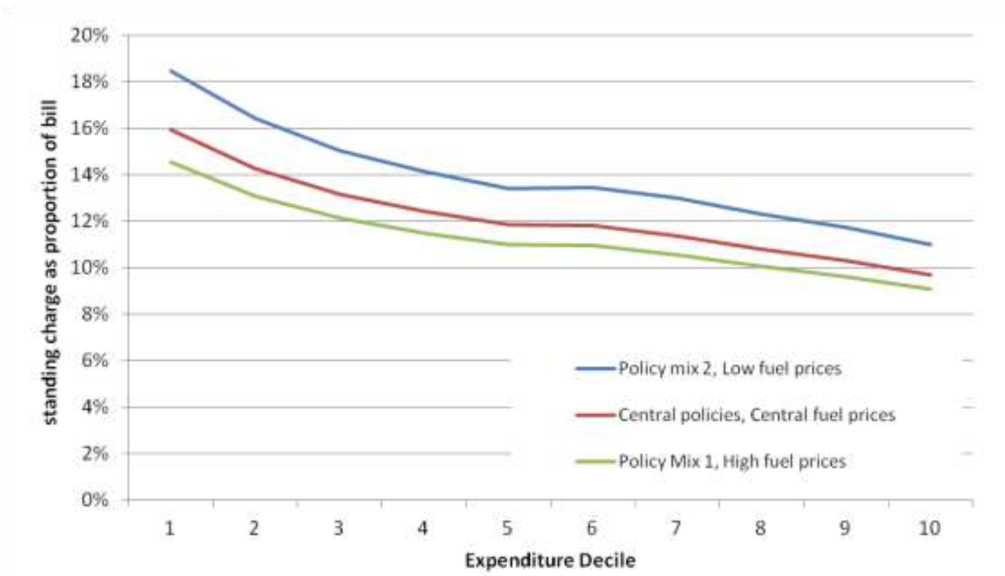


Figure E9 - Proportion of average bill due to standing charge in 2020 by expenditure decile

[9] (Preston, White, and Guertler 2010), (Croft and Carrington 2011)

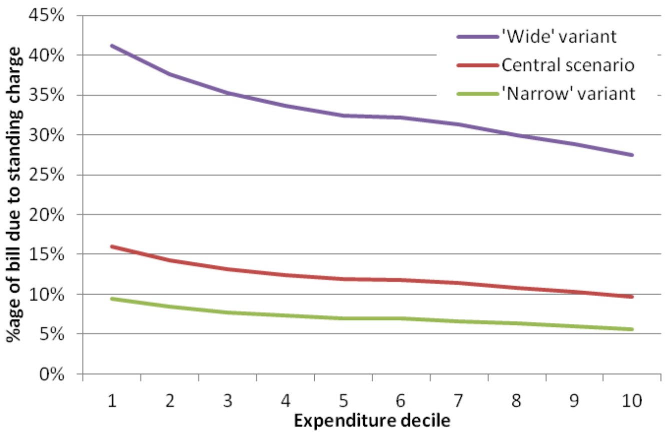
Ofgem are seeking to simplify tariffs by standardising the standing charge and eliminating unit charge 'tiers'[10]. Of interest to this project in particular is whether the standing charge should be 'wide' (higher), encompassing a large share of costs, or whether the charge should be 'narrow' (lower) with a higher per unit charge than at present.

To assess the distributional impact of the standing charges in different configurations, we model our central scenario with different variants, designed to reflect the full range of possible outcomes:

- **Standard** –Designed to reflect the current level of fixed costs covering an element of TDMO costs, as well as the ECO and the WHD.
- **'Narrow' standing charge** –As for standard, but the ECO and WHD costs are removed
- **'Wide' standing charge** –Expansion of the TDMO costs.

As would be expected, a wider standing charge would affect the lower expenditure decile households most drastically: the proportion of energy bills accounted for by the standing charge would reach 41%, with an absolute increase in fuel bills of £60 per year (7%). It would see the average bills of the highest expenditure decile fall by £53 on average (3%) and bills become less reflective of consumption.

Conversely, the narrow standing charge would result in average bills fall by £16 (2%) for the lowest expenditure households, as bills became more reflective of energy consumption. Those in the highest expenditure decile would spend £14 (1%) more each year. These are illustrated in Figure E10.



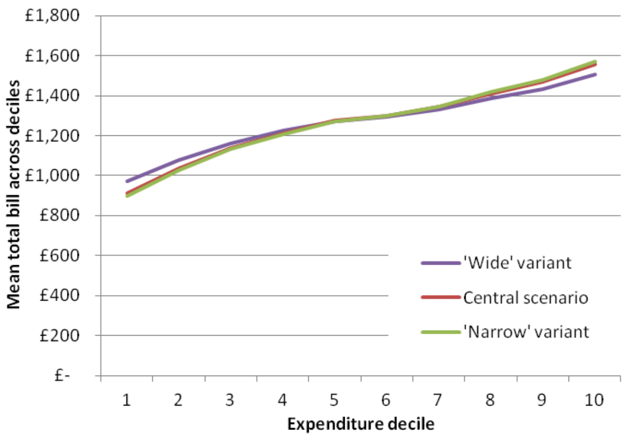


Figure E10– Left: Total policy costs as a proportion of final energy bill in 2020 for the standard and narrow standing charge approach. Right: Average energy bill in 2020 across expenditure deciles under different standing charge configurations.

Conclusions

Across all of our scenarios and across fuel types **the factor most likely to determine the average fuel bills in 2020 will be the costs of wholesale energy and the networks**. If wholesale prices follow a low fossil fuel price projection, then bills by 2020 are likely to be lower than today. If they follow a central or high price projection, bills will likely be higher. ***It is not true to say that policy costs are driving the cost of energy bills.***

In our scenarios, energy **bills in 2020 are <u>never</u> both higher than in 2011 *and* higher than if the Government adopted a 'do-nothing' approach**, abandoning all energy and climate

[10] (Ofgem 2011c)

policies this year. In other words customers are likely to face higher energy prices in 2020 in four out of our six scenarios due to higher fossil fuel costs. In all these scenarios the Government's future programme mitigates the rise in energy bills. There are two low fossil fuel price scenarios in which customer bills fall. In one the cost of policy is higher than the value of energy savings; while the overall bill is still lower than the average 2011 bill, it is higher than if policies had not been in place. In the last scenario the savings in energy are worth more than the cost of policy. Overall **the research finds the policy mix is an effective insurance against rising fossil fuel prices *for the average customer*.**

Policy Mix 2 consistently beats Policy Mix 1 and results in gas and electricity bills lower than a 'do nothing' counterfactual in all cases. The higher deployment of lower cost measures such as loft and cavity wall insulation alongside lower policy costs is the key driver for this trend. This underlies ***the importance of ensuring that low cost measures are fully adopted and bill-levied programmes designed and delivered as a cost-effectively as possible***.

Policy costs are levied far more greatly on to electricity bills than on to gas bills. This puts pressure on those heating with electricity, and requires an ambitious and successful products policy in order to help mitigate the impact of the higher prices.

The EU ETS and CFP are the only policies that do not directly fund or reimburse companies for the provision of lower carbon technologies. Instead they send an indirect investment signal through a carbon price. **Once Phase 3 of the EU ETS begins and the CFP comes into effect in 2013, these charges on bills will ultimately see a transfer of monies from the consumer meeting the cost of carbon, to the Government** who auction the permits and set the floor price. There is an argument that these monies should be recycled back to consumers in the form of energy efficiency investments to help protect the fuel poor from price rises and further reduce carbon emissions[11].

Additional assistance must be aimed at supporting those heating with electricity. Whilst the electrification of heat is a long term aim of Government, the increases in electricity costs and the inefficiency of most existing systems puts these households at real risk of energy affordability. Households heating with electricity are more likely to be low income and in fuel poverty. Prioritising energy efficiency improvements for these households and (potentially) more efficient electric heating systems would help address this inequity.

The proposed Hills fuel poverty definition is insensitive to stock-wide energy efficiency improvements. Under the existing definition, the different policy mixes result in a difference in fuel poverty numbers of up to 650,000. Under the Hills definition, this drops to 80,000. The problem presented by a definition which makes it impossible to reduce the number of households in fuel poverty by improving energy efficiency has been raised by others. ***DECC must seek to improve the Hills definition so that the reduced energy bills and improved comfort achieved by energy efficiency gains are reflected in the number of fuel poor households.***

Ofgem should move to deliver the narrowest possible standing charge as part of their Retail Market Review changes, in order to best protect the majority of low income low-consuming households. Standing charges and two-tier tariffs may be cost-reflective but are ultimately regressive. ***Ofgem might consider whether the benefits of tariffs featuring just a***

[11] (Camco 2012)

unit rate (less regressive, in line with 'polluter pays', more easily understood by consumers allowing greater tariff comparability) outweigh the drawbacks (not cost-reflective).

Contents

Glossary

ATP	Able-to-Pay households, generally used to refer to those who aren't low income, vulnerable, or in fuel poverty
BAU	Business as usual
CCC	The Committee on Climate Change
CCL	Climate Change Levy
CCS	Carbon Capture and Storage
CERT	Carbon Emissions Reduction Target, the programme that followed EEC 2.
CESP	Community Energy Savings Programme
CLG	Department for Communities and Local Government
CPF	Carbon Price Floor, to be implemented in the UK in 2013. The CPF will set a minimum price for carbon across some sectors. The CPF revenue represents the difference between the EU ETS carbon price and the floor price set.
CWI	Cavity Wall Insulation
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DIMPSA	Distributional Impacts Model for Policy and Strategic Analysis built by CSE to assess the impact of policies on household bills
ECO	Energy Company Obligation; the supplier obligation to replace CERT and CESP beyond 2012.
EEC	Energy Efficiency Commitment, the predecessor to the Carbon Emissions Reduction Target (CERT). EEC ran in two phases, with EEC 1 and EEC 2.
EHCS	English House Condition Survey, now replaced by the English Housing Survey (EHS)
EHS	English Housing Survey, which has replaced the English House Condition Survey (EHCS)
EMR	Electricity Market Reform
EPC	Energy Performance Certificate
EU ETS	The European Emissions Trading Scheme, which sets the price of carbon emissions across the EU.
FIT	Feed-in-Tariff
FIT CfD	Feed in Tariff with Contracts for a Difference (FiT CfD), a long term contract with the aim of providing certainty to investors. They work by providing for a long term strike price. If the market price is above the strike price, the generator returns money to the counterparty and, if it is below, the counterparty pays money to the generator. The level of the FiT CfD will vary depending between power generation types.
HSOT	Housing Stock Optimisation Tool built by ACE to assess the impact of policies on fuel poverty
IA	Impact Assessment
LCF	Living Costs and Food Survey
LI	Loft Insulation
OECD	Organisation for Economic Co-operation and Development
Ofgem	The Office of the Gas and Electricity Markets
OO	Owner-occupiers
PG	Priority Group. The group within CERT considered vulnerable, within which suppliers need to meet 40% of their obligation.
PRS	Private Rented Sector
PV	Photovoltaic panels
RHI	Renewable Heat Incentive
RHPP	Renewable Heat Premium Payment
RIIO	RIIO is the new performance based model introduced by Ofgem to set price controls. RIIO stands for Revenue=Incentives+Innovation+Outputs.
RMR	Ofgem's Retail Market Review
RO	Renewables Obligation
ROC	Renewables Obligation Certificate
ROI	Return on investment
SM	Smart Meters
Soc	Social housing (including housing association properties)
SPG	Super Priority Group. The group within CERT considered most vulnerable, within which suppliers need to meet 15% of their obligation.
SWI	Solid Wall Insulation (which can refer to both internal and external wall insulation)
TDMO	Transmission, distribution, metering and 'other' costs incurred by suppliers (excluding policy costs)
WHD	Warm Homes Discount

1 Introduction

1.1 Rationale

The context of this research is one of rising fuel prices, an increasing incidence of fuel poverty and more tangibly, the difficulty households are experiencing in affording their energy bills. Some parts of academia and the media have focussed the blame for this on the costs of energy and climate change policies that often result in a direct or indirect levy upon energy bills. A lack of transparency over the magnitude and distributional impact of these costs has made it difficult for stakeholders to make considered judgements.

Government has responded to the criticism by introducing a cap on the policy costs that DECC can see levied upon bills[12], and attempted to overcome the lack of transparency by publishing their own estimates of policy costs upon bills into the future[13]. Other organisations such as the Committee on Climate Change (CCC) have published alternative assessments[14].

By their very nature, such assessments depend upon a range of assumptions covering projections for wholesale energy prices and the costs of supplying energy, the costs of the policies themselves, the relative burden of these costs on the domestic and non-domestic markets, the efficacy of demand reduction polices, and any resulting behavioural response to rising prices. Sensitivities to these assumptions are usually presented only in relation to the impact of different fossil fuel price projections.

Similarly, there has been limited research into the distributional impact of price rises. A fuller understanding of the distributional impacts is needed to ensure our energy policy is delivered fairly.

This study aims to foster this better understanding by interrogating existing analyses, assessing the sensitivities of the assumptions, and illustrating distributional impacts beyond income deciles. To that end, the study has the following four objectives:

- To understand the assumptions behind existing studies – Chapter 2
- To determine the sensitivities of the assumptions – Chapters 3 and 4
- To assess the distributional impacts of the policies – Chapter 5
- To assess the sensitivity of different energy tariff structures – Chapter 6

1.2 Approach

The amount households pay for energy is based on three factors: the price of each unit that they purchase, and the amount of units that they consume, and the size of any charges on energy bills that are levied independently of the amount of energy consumed. We have modelled these separately:

- The likely cost of fuel, networks, and policies that make up the unit price of electricity and gas
- The impact of Government policies and underlying trends that will affect energy demand.

[12] (HM Treasury 2011)
[13] (DECC 2011a)
[14] (CCC 2011)

- The size of the standing charge and how this results in implied reductions to the unit price.

The project objectives have been met through addressing the following questions:

1) What are the assumptions behind existing studies?
2) How sensitive are the outputs of these studies to the assumptions used?
3) What are the distributional impacts of the policies across the scenarios?
4) How sensitive are the distributional impacts to the way in which policy costs are added onto the energy tariffs?

We addressed these questions through a combination of literature review and two models that assess the impact of polices upon household bills: DIMPSA, the model used by DECC within their distributional analysis, and HSOT, which can assess the impact of energy efficiency improvements and policy costs upon the magnitude and incidence of fuel poverty. The two approaches are entirely complimentary, DIMPSA being an energy consumption based model and HSOT based on energy need, thus offering results pertaining to actual bill changes and those households in fuel poverty.

Distributional Impacts Model for Policy and Strategic Analysis (DIMSPA)

CSE has worked with the DECC to develop DIMPSA. It is built upon a series of stored procedures and algorithms designed to model the costs and benefits of policy delivery, in terms of the energy bill. DIMPSA is based on the 2004 to 2009 Living Costs and Food Survey (LCF)[15] from which household energy consumption is derived. The LCF does not include detailed information on physical household characteristics, beyond built form, which are important in modelling the impact of energy policies. Data from the 2006-07 English House Condition Survey (EHCS) was therefore used to generate a predictive model to identify wall type, loft insulation levels and heating system age/communal heating in the LCF dataset[16].

Within this study, DIMPSA was used to model the impact of policies on bills across different scenarios (outlined below), determining the distributional impact, and the nature and number of 'winners' and 'losers' from the policy packages.

Housing Stock Optimisation Tool (HSOT)

ACE's 'Housing Stock Optimisation Tool' (HSOT) has been used to model the policy impacts upon the housing stock and on households for numerous projects(Croft et al. 2011; Croft and Carrington 2011; ACE 2011). It complements the use of DIMSPA, since the EHCS contains information on energy need (in order to determine fuel poverty) rather than the consumption-based survey data within the LCF Survey.

The model is highly flexible and can be used to assess a range of policy impacts across a range of variables. It updates the most recent English Housing Survey (EHS) with changes to energy efficiency, household income and fuel prices to the base year of analysis. Using a stock improvement module, technologies are applied to the stock according to measures-based, policy

[15] Previously known as the Expenditure and Food Survey or EFS dataset
[16] For a more detailed overview of the model's operation see Appendix 1.

or financial criteria. Changes to the housing stock (SAP score, technology distribution etc.), fuel bills and carbon emissions are all recorded.

For the purposes of this project, the tool was used to determine the potential impact of policies such as the Green Deal, Renewable Heat Incentive, Energy Company Obligation and Product Policy, and to determine the impact of the policy costs and improvement measures on those households that are fuel poor, as well as the extent of fuel poverty.

Synthesising the models

The models were used in combination as illustrated in Figure 1, and deployed efficiently to tackle the key issues: What are the typical impacts upon energy bills likely to be? How sensitive are these impacts to the various assumptions (and hence what are the full range of potential impacts for consumers)? And how are the impacts distributed across different household groups?

Using both models allowed us to account for actual household consumption using DIMPSA on the one hand, yet understand the interaction between energy efficiency improvements, household energy need, fuel poverty numbers and policy costs using HSOT on the other.

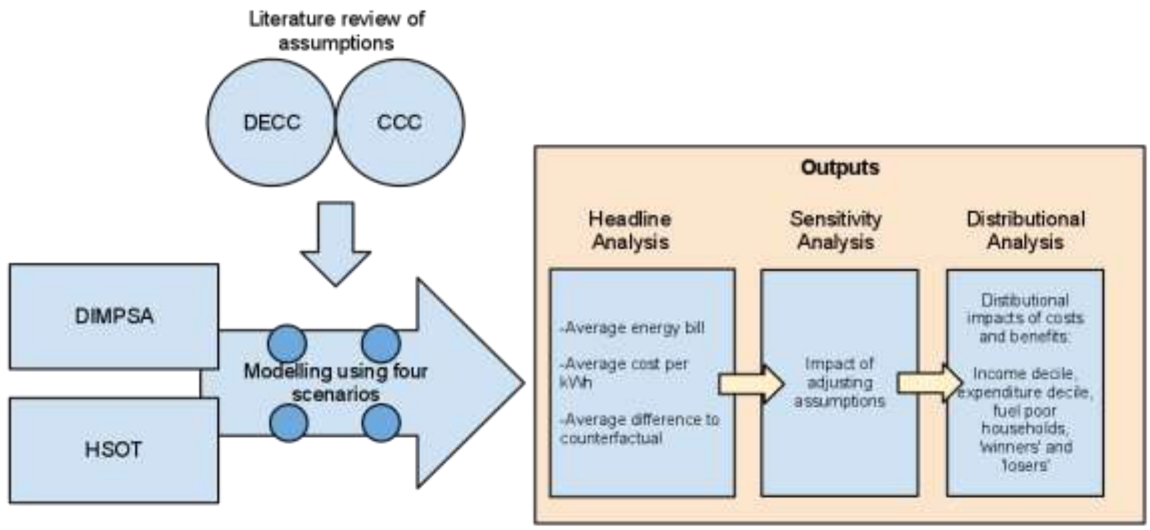


Figure 1 – Schematic illustrating the modelling approach taken

1.2.1 Understanding the assumptions behind existing studies

The first stage of the study involved the appraisal of the modelling assumptions used by DECC in their annual statement on distributional impacts[17] and the CCC's recent report on household energy bills[18]. The study also reviewed Ofgem's publications on future network investment, and numerous policy impact assessments to achieve a range of expected policy costs and impacts.

Assumptions fell across the following categories:

1) **Cost of each fuel**, as driven by wholesale prices and network investment
2) **Policy costs, and how these costs are recovered** from the price of different fuels.
3) **The performance of demand reduction measures**

[17] *Op. cit.*
[18] *Op. cit.*

4) **Changes in energy demand**, as driven by

    a. **Policy-induced behavioural change**

    b. **Natural demand-response to higher prices**

1.2.2 Determining the sensitivities of the assumptions used

Once the assumptions within the existing reports were ascertained, we compared them to each other and against a wider range of studies, then tested their sensitivity through the use of the DIMPSA and HSOT models. The sensitivity analysis involved the following steps:

1) A literature review for each assumption to determine a 'high' and 'low' value to model

2) The construction of six scenarios that represent the full range of potential impacts for consumers. They each represent a combination of policy costs/benefits and wholesale/supply prices as illustrated in Table 1.

Table 1 –The scenarios

		Policy Mix	
		Mix 1: High Cost, Low Impact	**Mix 2: Low Cost, High Impact**
Wholesale energy prices	**Low**	Scenario 1	Scenario 2
	Central	Scenario 3	Scenario 4
	High	Scenario 5	Scenario 6

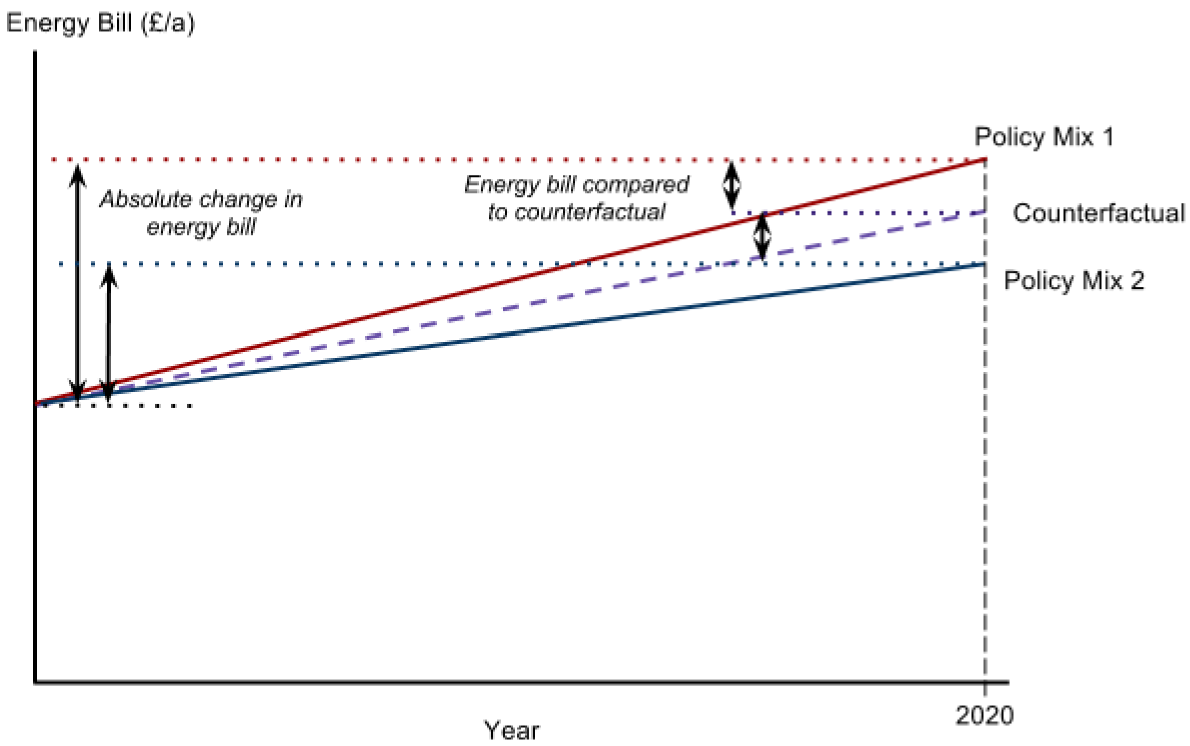


Figure 2 - Illustration for one fuel price scenario. For each, the energy bill impacts for two policy mix options are presented alongside the counterfactual.

The six scenarios reflect three variants in wholesale prices and network costs, each with two variants in the impact of policy costs and benefits. Figure 2 illustrates that for each wholesale price scenario, two policy cost and impact options are presented in Section 4, alongside a counterfactual bill based on wholesale fuel prices in the absence of policy costs and benefits. Both the scenarios and counterfactuals are explained in detail in Chapter 3.

3) We used DIMPSA and HSOT to assess the impact on consumers under the six scenarios.

- For each scenario, a likely gas and electricity price from each year between 2011 and 2020 was calculated, giving a unit price for energy.
- Using our assumptions for the number of measures delivered and costs of policies through each scenario, the models 'allocate' measures to households based on a number of technical and social eligibility criteria.
- DIMPSA, the consumption-based model, was the primary model to assess the overall impact upon bills and energy demand, with the energy need-based HSOT used to assess the impact on fuel poverty. The DIMPSA based fuel price assumptions were applied to energy need values in HSOT.

1.2.3 Assessing the distributional impacts of the policies

The scenarios modelled have been scrutinised for their distributional impacts upon households.

DIMPSA was used to determine the distributional impact in terms of expenditure decile, and an analysis of the costs for the 'losers' versus the savings for the 'winners'.

HSOT was used to determine the impact of the scenarios on the incidence of fuel poverty, and the impact on those fuel poor households.

1.2.4 Assessing the sensitivity of allocating policy costs to different parts of the energy tariff

Alongside the absolute costs and benefits of policies, the precise nature in the way the costs are passed on to households through the tariff structure affects the distributional impact. Using DIMPSA and HSOT, we assessed the difference in distributional impact of one scenario if the network and/or policy costs fall differently upon the tariff, either within a kWh component or the standing/tier 1 charge.

Ofgem are currently consulting on plans to simplify standard or 'evergreen' tariffs, creating a standardised element and allowing suppliers to compete on the unit price only. Whilst consumers would benefit from tariffs that are easier to understand and compare, there is a danger that tariffs with large standing charges or high first tier tariffs will be to the detriment of low consumers of energy. The majority of low income households are more likely to under-consume energy and are thus more likely to be disproportionately affected by fixed charges as they constitute a larger share of their bills.

We look at this issue in more detail, assessing what the distribution impact would be if network and/or policy costs were included or excluded from the fixed part of the energy bill.

2 Understanding energy bills and potential changes to 2020

The starting point for this analysis encompasses two reports released at the end of 2011 by DECC and the Committee on Climate Change:

- DECC, *Estimated impacts of energy and climate change policies on energy prices and bills*, November 2011 (referred to hence as DECC's Annual Energy Statement or AES)
- CCC, *Household energy bills, the impacts of meeting carbon budgets*, December 2011 (referred to hence as CCC's analysis of bills)

Both of these reports assess the degree to which energy policy is adding to the costs of energy prices and energy bills at present, and make assessments over the likely impacts in 2020. Whilst both studies consider how these impacts might change under different fossil fuel price scenarios, they do not consider alternative scenarios of policy costs, policy effectiveness, and wider costs of the upgrading of the electricity and gas networks.

This chapter reviews the headline analysis from the CCC, DECC and others, and the assumptions made in the studies, while presenting the parallel choices made through this study. We would like to acknowledge the support of both DECC and the CCC in developing these figures.

2.1 Headlines from the DECC AES and CCC analysis

Table 2 presents the headline results from the DECC and CCC studies. The results have several similarities:

- Relatively modest increases in total bills between 2011 and 2020
- Similar absolute costs on bills of energy and climate policies between the studies, almost doubling in both cases between 2011 and 2020
- Similar magnitude of increase in the unit price of energy

Table 2 – Headline findings from the recent DECC and CCC reports on energy policy and household bills

	DECC		CCC	
	2011	2020	2010	2020[19]
Gas price	4.1p	4.7p	3.7p	4.7p
Gas Demand [kWh][20]	*16,098*	*15,787*	17,241	12,665
Gas Bill	£660	£742	£630	£590
Electricity Price	14.9p	18.3p	12.6p	17.8p
Electricity Demand [kWh][20]	*3,946*	*2,967*	3,416	2,764
Electricity Bill	£588	£543	£430	£495
Total Bill	**£1,248**	**£1,285**	**£1,060**	**£1,085**
Policy cost[21]	£93	£161[22]	£87	£169
Total bill vs Counterfactual[23]	+£19	-£94	+£87	+£39

In addition, the results of the studies show several notable differences:

[19] The 2020 CCC scenario is based on further insulation measures and user driven efficiency improvements
[20] DECC energy demand figures are implied from the published figures on the total bill and unit prices
[21] Including the VAT resulting from these policy costs
[22] Derived from 2020 policy impacts on unit price and demand projections
[23] See the discussion on counterfactuals that follows

- The CCC study assumes a lower total bill throughout the period. This is because the CCC study is based on a dual-fuel customer, whose electricity consumption is only for power (not heat). The DECC figures are based on total electricity consumption, and include households that use electricity for heating. This also explains difference in electricity demand.
- Gas demand reduction is much greater within the CCC analysis than that implied by the DECC figures. This reflects three aspects of the CCC analysis: the inclusion of natural boiler replacement ('churn'), a hefty 'weather correction' from 2010, and a measures-based approach to demand reduction by 2020 in the CCC report. Boiler replacement reduces average demand by 915 kWh by 2020, 'weather correction' by a further 2,609 kWh, with further energy efficiency measures and behavioural change delivering more than 1,000 kWh of further savings.
- Boiler churn is excluded from the DECC analysis, and the average consumption is taken independently of that year's temperature. Further energy efficiency measures are expected to be dominated by the ECO and Green Deal, with more solid wall insulation and perhaps less by way of low cost loft and cavity wall insulation[24].
- The studies take a different approach to creating a 'counterfactual'. DECC compare the impact of the fuel bills each year to a counterfactual bill that represents the likely costs to households in the absence of policy, removing both the increased unit price and demand reduction measures supported. Interestingly, the counterfactual energy bill removes the savings that have been delivered to date through energy efficiency measures – when looking at the impact in 2020 we are looking at the impact of policies that have already been implemented in full (such as EEC 1 and 2) as well as those yet to come.
- By contrast, CCC doesn't explicitly create a counterfactual energy bill to compare against. Such a bill is possible to construct, using the energy demand reductions that CCC thinks will happen in the absence of policy, and applying the fuel prices with the policy costs removed.
- These counterfactuals are therefore very different: DECC's which includes savings already delivered but ignores BAU savings from boiler replacement, and CCC's which ignores already achieved savings and includes the impact of boiler churn. Whilst the DECC approach is suitable for their needs in illustrating the impacts of energy policy in 2011 as well as 2020, the CCC approach lends itself to the nature of the research within this report, and we will use this approach to construct the counterfactuals within our scenarios.
- It should be noted that the wider social, economic and environmental benefits of saving carbon and energy – such as reducing fuel poverty, CO_2 emissions, security of supply concerns – are not factored in to analysis such as this. Therefore a situation where energy and climate change policies cause an energy bill to be £39 per year higher than a case where those policies hadn't been implemented negates the benefits that those policies have delivered in reducing the carbon emissions from energy supply, reducing energy demand, lifting (some) households from fuel poverty, and helping the UK towards its emission targets.

Building on this headline analysis of methodologies and outputs, we now review specific assumptions and our approach to each.

[24] The Green Deal and ECO draft Impact Assessment projected a sharp reduction in the number of lofts and cavity walls insulated once CERT ends in January 2013 (DECC 2011c).

2.2 Wholesale/Network assumptions

2.2.1 Fossil fuel prices

Both the DECC and CCC studies use the same fossil fuel price scenario that sees the wholesale price of gas reaching 68p/therm in 2020. Our central fossil fuel price scenario uses updated projections that see gas reaching 70p/therm by 2020[25]. We also model a 'high' and 'low' fossil fuel price scenario, all based on DECC's energy and emissions projections[26].

The fuel price scenarios used are the principal determinants of energy bills in 2020. The wholesale cost of energy currently accounts for 43% of the unit price of electricity and 57% of gas unit prices. Under our central fuel price scenarios this will fall to around 34% for electricity and 55% for gas in 2020. The global trends for the wholesale costs of energy are therefore a key uncertainty in the estimation of future fuel prices. Whilst this study has presented the impacts of three different fuel price scenarios, the most likely outcome is unknown.

The future price of fossil fuels from international commodity markets is likely to be dependent on a number of factors, many of which are outside the control of UK energy policy. In 2008 prices rose beyond $140 a barrel with many expecting the upward trend to continue; instead the market collapsed with prices falling to $40 per barrel[27]. It is clear that a number of factors outside of the Government's control, including the global economy, foreign affairs, resource volume and exploitation (including shale gas), and climate affect demand for energy, and will all interact to affect the international wholesale price of energy.

2.2.2 Network costs

The cost of transmitting and distributing electricity and gas is subject to price control by Ofgem due to the monopolies managing the networks in each area. The existing price control framework, based on an 'RPI-X' calculation that rewards efficiency, is currently being changed in favour of a model that it is hoped will best reward companies for efficiently delivering the £32bn of required grid upgrades that Ofgem has identified through to 2020[28].

Price controls under the new model, known as RIIO (Revenue = Incentives + Innovation + Outputs), have yet to be set. A new price control model designed to stimulate network investment presents a highly uncertain outlook for impacts upon consumer bills.

The DECC and CCC studies have both used historic data on network costs provided by Ofgem and projected these forward to 2020. However, given the large investment costs needed and the new price control model, we believe a wide range of costs is possible. Our scenarios therefore reflect this uncertainty by including costs that exceed the historical projections within our 'higher bills' scenarios.

2.2.3 Other supplier costs and margin

In addition to the wholesale costs of fuel and costs associated with electricity and gas networks, there are other costs that fall upon energy bills. These include the costs of metering, the costs of balancing the grid, the costs of losses and constraints etc. In addition, suppliers can make a

[25] (DECC 2011b) – Annex F
[26] *Ibid.*
[27] (Trading Economics 2012)
[28] (Ofgem 2010)

margin on the price of energy – one of several ways in which they can make a return to their shareholders and investors.

Within the CCC analysis, these costs are incorporated into assumptions for the network and wholesale prices. DECC assume these costs represent a fixed percentage mark-up on wholesale costs

Our scenarios make three different assumptions on metering costs on the basis of the speed of the Smart Meter roll-out (the costs of which are presented separately). In addition we present three variants of 'other costs and margin' that reflect different possibilities: a low scenario where supplier margins narrow through enhanced competition and the costs to serve each customer fall, a central business as usual scenario where cost increases are in proportion to wholesale price rises, and a high scenario. The high scenario reflects a world in which the costs to supply each customer increase, balancing costs increase with a greater proportion met by consumers rather than generating plant, and/or supplier margins widen.

2.3 Policy assumptions

In addition to the costs associated with fuel and its transportation, assumptions need to be made about the costs and impact of energy and climate change policies.

2.3.1 EU ETS and the Carbon Price Floor

The price of carbon under the EU Emissions Trading Scheme (EU ETS) is inherently uncertain, subject to a myriad of factors that include the rate of economic growth; the success of complementary policies that reduce carbon emissions from entities subject to the EU ETS; changes to the number of allowances in circulation; and signals over future targets from policymakers. Households currently pay around £20 a year on average to cover the cost of the EU ETS. The above factors, twinned with the impact of Phase 3 of the EU ETS in 2013 where all emissions allowances to the electricity generators will be auctioned, make the impact on the 2020 energy bills highly uncertain.

In addition, the Government are introducing a Carbon Price Floor (CPF) that will guarantee a minimum price for carbon by amending the Climate Change Levy (CCL). The CCL will become an upstream charge for electricity generation, set at a level such that, when combined with the EU ETS carbon price, the total cost paid per unit of carbon emitted equals the CFP. The carbon price floor will begin at around £16/tCO2 in 2013 and follow a straight line trajectory to £30/tCO2 in 2020, increasing at around £2/tCO2 per year from 2013 to 2020 (all in 2009 prices).

To a degree, the combination of the EU ETS and CFP reduces the volatility and uncertainty over the impact upon bills: where the EU ETS carbon price is low, the CFP has a larger impact. There are however differences in the scope of the policies (with the EU ETS covering a wider range of entities). In addition, if the EU ETS price exceeds the CFP, the volatility would remain.

In their AES, DECC project a cost of the EU ETS in 2020 of 1.0p/kWh, with at CPF of 0.1p/kWh. The CCC have a similar total cost of carbon pricing in 2020 of 1.2p/kWh.

Our scenarios use two variants of policy costs: the DECC AES projection, and a recent projection from Camco for Transform UK[29] that assessed the potential revenues from the EU ETS and CPF in detail, suggesting a central cost in 2020 of 0.9p/kWh for the EU ETS and 0.2p/kWh for CPF.

2.3.2 Renewables Obligation (RO) and Electricity Market Reform (EMR)

A highly uncertain aspect of future energy bills is the potential impact of the proposed Electricity Market Reform (EMR). EMR will see support for plant offering generating capacity, create a Feed-in Tariff Contracts for Difference (FiT CfD) for low carbon generators, and put limits on the emissions from generators with an Emissions Performance Standard.

Generators will be able to choose between support from the Renewables Obligation (RO) or support from the FiT CfD mechanism under the EMR until April 2017.

DECC's assumptions are based on an RO and EMR combination in line with a trajectory to deliver an emission intensity of 100gCO_2/kWh for the power sector by 2030. Their costs for the EMR are based on the costs of a Strategic Reserve capacity mechanism and FiT CfD. They assume that RO supports new renewable generation until 2016 when support switches to the FiT CfD.

The CCC assumptions are based on the Renewable Energy Strategy set by the previous administration[30]. They assume a switch to the FiT CfD from 2017.

DECC project a cost in 2020 for renewables policies of 1.1p/kWh for the RO, 0.9p/kWh for the EMR policies and a saving of -0.5p/kWh due to the lower wholesale cost of the marginal electricity generator as a result of the polices. This gives a total impact of 1.5p/kWh.

By contrast, the CCC project higher costs for all renewables and CCS support (including the FIT) of 2.5p/kWh.

To assess the costs of renewable and low carbon generation added to bills, our scenarios are based on a switch from the RO to FiT CfD occurring in April 2016.

For the RO, we based our analysis on the Pöyry report to DECC on the proposed renewable obligation bandings to estimate the costs to consumers[31]. We used the obligation level in renewable obligation certificates (ROCs) shown in figures 8, 9 and 11 in Pöyry's report, historical data for the buyout price from Ofgem, and Figure 15 showing total policy costs to estimate the cost pass through. To provide a range of inputs for the study the low and high scenarios have allowed for a range of plus/minus 20% from the calculated value.

For the EMR, we use DECC's scenario with some adjustments. As with the RO, we assume plus/minus 20% variance in the policy costs. We also adjust the policy costs with the fuel price scenarios: low fuel prices give a high cost for the EMR (due to the higher cost of FiT CfDs) and vice-versa. In this way, the EMR policies act to moderate price volatility to an extent. Our higher cost scenarios do not include DECC's expected savings through the wholesale price generated through EMR. We include the 0.5p/kWh saving due to the lower wholesale cost of the marginal electricity generator within the wholesale price of the Policy Mix 2 scenarios.

[29] (Camco 2012)
[30] (HM Government 2009)
[31] (Pöyry 2011)

2.3.3 Energy Company Obligation (ECO) and the Green Deal

Domestic energy efficiency improvements are currently being delivered by two obligations on energy suppliers, CERT and CESP (the latter covers generators as well). Both of these policies run until the end of 2012, when they will be replaced by a new supplier obligation: the Energy Company Obligation (ECO). The ECO plans have yet to be finalised, but the position that Government consulted upon would see an obligation of around £1.3bn per year from 2013-2020 divided into two portions: 75% of the spend being used to support the delivery of solid wall insulation, and 25% for delivery of Affordable Warmth to low income households.

Alongside the ECO will be a new energy efficiency financing mechanism called the Green Deal. This will allow households to install packages of energy efficiency measures at no upfront cost, instead making repayments through their energy bills spread over 25 years. The repayments would need to be lower than the savings that the household makes (the 'Golden Rule'), meaning that the household bills would still be lower than before the installation. In addition, the repayments are tied to the home, not the household, meaning that the occupant is not liable for the outstanding balance were they to move before it was fully repaid.

Expected delivery under the ECO and particularly the Green Deal is highly uncertain. DECC's draft Impact Assessment for the ECO and Green Deal consultation gave an estimated cost (mentioned above) of £1.3bn a year for the ECO[32]. There was little further detail on expected delivery aside from a chart that illustrated an expectation for the two policies to insulate 1.52m solid walls, 1.35m cavities, and 220,000 lofts above business as usual between 2013 and 2022.

This is a very low number of lofts and cavities to be insulated through to 2022. It should be noted that these figures were released before an additional £205m was announced by HM Treasury to be used to incentivise Green Deal take-up. However, no updated figures have been released by DECC to date.

Both DECC and CCC give an expected cost for energy efficiency policies (ECO and Smart Meters) of 0.2p/kWh on the gas price. CCC's estimate for costs on the electricity bill is 1.0p/kWh, slightly higher than DECC's estimate of 0.8p/kWh.

Our scenarios use a bottom-up analysis of the ECO and Green Deal policies. We believe the DECC figures represent a lower boundary on the impact of the policies, since they negate a potential stimulus. They also would see the UK fall woefully short of the objectives in the Carbon Plan[33] and would likely precipitate further policy intervention were such a trajectory to be seen. Our lower bound scenario is therefore based on DECC's draft Impact Assessment giving a total cost of around £1.3bn/year that covers the costs of measure subsidy, scheme administration and economic rents (the latter at £0.5bn/year).

In addition, a second scenario has been built, based on the analysis within ACE's 'Dead CERT' report[34]. This scenario sees a continued focus on low-cost energy efficiency measures until such opportunities are exhausted. To minimise costs, measures delivered through the Green Deal at minimal subsidy levels are eligible to contribute to a higher overall ECO target. The lower cost carbon savings that accrue in this scenario allow for a greater proportion of expenditure on those considered most vulnerable. Whereas the DECC scenario sees most SWI going into the

[32] (DECC 2011c)
[33] (DECC 2011d)
[34] (Guertler, Croft, and Carrington 2012)

homes of those in a position to take up the Green Deal (generally assumed to be those of higher incomes who are less debt-adverse or able to contribute their own funds), the second scenario sees low income private-rented households and owner-occupied homes receiving the ECO-supported SWI measures. This means that a higher subsidy for SWI is provided, averaging 80% of the costs for SWI rather than 57% in the DECC scenario.

Boilers will also be delivered through the Green Deal and ECO. Both our scenarios assume almost 100,000 boilers are replaced through ECO's Affordable Warmth obligation. In addition, boilers are replaced via Green Deal financing. Our second scenario assumes that half of all boilers are replaced via Green Deal rather than bought outright. Only 20% are expected to be financed through Green Deal under the DECC scenario. In practice, as section 2.3.6 explains, the number delivered via the Green Deal does not affect the absolute number of boilers delivered.

2.3.4 Feed in tariffs

On 31 October 2011 the Government published a consultation on phase 1 of the Feed-in Tariffs Comprehensive Review. The take-up of domestic solar photovoltaic panels (PV) had significantly exceeded expectations due to significant cost reductions and innovative business models such as the rent-a-roof approach. The Government therefore announced a reduction in the level of solar subsidy through the feed-in tariff (FIT) from 43.3p to 21p/kWh. The addendum report '*Environmental levies, past, present and future'* provides more detail on the potential implications of the tariff reduction on energy bills.

We were therefore required to estimate the bill impacts and total installations associated with the revised rate. The following sources were used to help identify the possible take-up:

- Cumulative installations to date taken from DECC's website (see Table ET 5.6[35])
- DECC's response to Energy and Climate Change and Environmental Audit Committee's look at the impact of the feed-in tariff on consumers' bills. This provides an explanation of the methodology needed to calculate the assumed cost and per unit pass through to consumers from the figures presented in £/MWh for each year[36].
- DECC recently published an updated impact assessment[37] to accompany the *'Comprehensive Review Phase 1- Consultation on Feed in Tariffs for solar PV'*. We used the estimated cost to consumers, the revised tariff rates and the estimated total number of measures to 2020 to predict annual installation rates.

We opted to deploy 'Option A' under the Policy Mix 2 scenario which targets average rates of return of around 5 to 8%, with around 5% for domestic installations. This produces a tariff of 13.6p for 4kW solar PV installations, which gives a return on investment (ROI) ranging from 0.5% to 10%. Policy Mix 1 deployed 'Option C' which is based on a FIT cut of around 21% from April. This produces a tariff of 16.5p for 4kW installations, with a mid-range ROI of 6%. This option would be DECC's preference if deployment during March and April 2012 was less than 150 MW. However, it is important to note that the impact assessments do not provide data on the actual number of assumed PV installations per year, their size and typical profile of households taking up measures.

[35] (DECC 2012a)
[36] (DECC 2011e)
[37] (DECC 2012b)

2.3.5 Renewable Heat Incentive

The proposals for the Renewable Heat Incentive (RHI) were originally published alongside the February to April 2010 consultation. The historical analysis on the RHI can now be found on the National Archives website which features the *NERA/AEA study on the 'UK Supply Curve for Renewable Heat'*(Radov et al. 2009). However, the projections for installed capacity and the potential numbers of installations associated with the NERA analysis for the domestic RHI are dependent on different tariffs.

The current RHI impact assessment contains an outline of the proposed domestic tariff levels, but there is no detailed information on the possible installed capacity they might stimulate[38]. We therefore reviewed the current numbers of installations installed under the existing Renewable Heat Premium Payment (RHPP) on the Energy Saving Trust's website. The level of take-up has been relatively low, and for the purposes of this study we assumed an annual sector growth rate of 40%. In other words, we have assumed that the RHPP (subsidy-based) will continue to support domestic renewable heat with the deployment of tariff-based incentives focussing on the non-domestic sector.

2.3.6 Boiler churn

The CCC's analysis of energy bills allowed for the 'natural replacement' of boilers due to their age, inefficiency or failure – often referred to as 'churn'. However, DECC's AES excludes boiler replacement as the minimum boiler efficiency standards are covered by building regulations (CLG policy; outside of DECC's remit) rather than an exclusively energy or climate change-focussed policy.

We performed some initial sensitivity analysis which showed that the average total energy bill for our central scenario in 2020 was £30 lower with the inclusion of boiler churn. According to the CCC from 2013 there will be 6.5m old boilers to replace by 2020. Our analysis of the English Housing Survey suggests that 40% of these are in the priority group and 16% in the super priority group.

The extent to which gas and oil boiler replacement will become an integral part of the Green Deal is unclear; however, they represent a measure that is easy to install (where the boiler replaces an older model) and often purchased out of necessity. Boilers will in any case be delivered via the ECO's Affordable Warmth obligation.

Our boiler churn scenarios assume that all old boilers have been replaced by 2020. Where boilers are not delivered via Green Deal or the ECO, they are bought outright. This sees the same number of boilers delivered across our scenarios, but different means of paying for them.

2.3.7 Product Policy

The Product Policy assumptions are prepared by Defra as part of their analysis of the Market Transformation Programme (MTP). The Product Policy savings cover a variety of measures ranging from appliances to improvements in boiler efficiency. For the purposes of this study we extracted the savings associated with appliances only, since boiler churn has been modelled separately. Electricity demand is projected to fall by 18.47 TWh to 2020 with gas demand set to increase by 8.96 TWh. The increase in projected gas use is due to the heat replacement effect whereby more efficient appliances give off less heat. As discussed in section 2.3.6, the analysis

[38] (DECC 2011f)

of bill impacts performed for DECC's AES does not include the savings that result via boiler replacement as this is a CLG policy through building regulations.

Policy Mix 2 has used the same Product Policy parameters as DECC and the CCC. The Product Policy savings are large in size and as such have an important impact on the results. When examining trends for domestic electricity demand over the last ten years there has been a gradual decline in demand; however, the decline does not match that predicted by Defra. For the purposes of Policy Mix 1 we take the average between the projected ten year trend for per capita electricity demand and the Product Policy savings. The total reduction in electricity demand is thus 11.65 TWh, along with an increase in gas demand of 5.88 TWh.

2.4 Assumptions not covered

In this analysis we have attempted to address a wide range of assumptions. There are, however, several aspects that we have not reflected in our analysis. These include:

- Demand response to increased fuel prices across the scenarios. We might expect our high energy price scenarios to see a greater behavioural response.
- In addition to energy demand responding to price, price can respond to energy demand.

2.4.1 Elasticity of demand

The two models, DIMPSA and HSOT, do not allow for demand response as a result of increased fuel prices across the scenarios deployed. The extent to which the demand for a commodity changes as a result of changes in price is known as price elasticity.

The impact of price elasticity is difficult to quantify as trends in demand are driven by a multitude of factors: the consumer's own conceptions of energy costs; population growth; changes in the number and size of households, product efficiency, product ownership, energy efficiency, the climate, the economic outlook and fuel prices.

The long-term trend for energy use has been a continuing increase in demand for gas and electricity, whereas a ten-year weather-corrected trend would suggest a reduction in demand.

The modelling of long-term trends requires an approach that accounts for all of the factors listed above. Inherent underlying trends may be non-linear and reflect not only technical progress, which usually produces greater energy efficiency, but also other factors such as changes in consumer tastes and the economic structure – factors which may work in the opposite direction[39].

The two models do account for a number of the long-term factors that influence demand, namely household energy efficiency and product efficiency. The High Fuel Price scenario may lead to an additional behavioural response – however, quantifying this would require detailed time-series modelling to understand the relative importance of the identified factors and how these vary over time. These are therefore not covered by the models.

2.4.2 Demand reduction

Our renewable targets are based on the need for the UK to deliver a share of the EU target of sourcing 20% of energy (i.e. electricity, heat and transport fuels) from renewable sources by 2020. The EU's Renewables Directive proposes a UK target of 15% of energy consumption.

[39] (Hunt, Judge, and Ninomiya 2003)

However, if the UK reduces energy demand through energy efficiency deployment, then the absolute amount of energy required from renewables consequently falls.

Even beyond the Renewables Directive, aggressive energy efficiency deployment could negate the need for some marginal electricity generating capacity, reducing some of the wholesale, EMR and RO costs, as well as the EU ETS. These interactions have not been modelled, though it is important for policymakers to ensure demand and supply are linked so that we do not commit to more capacity than is needed under EMR.

3 Scenario modelling

In this chapter we present the six scenarios used for the central analysis within this report. The scenarios must be considered with caution: they are projections rather than forecasts, with results that are partially dependent on assumptions such as GDP and changes to population, household numbers and wholesale fuel prices. These are uncertain by nature, especially in today's difficult economic and budgetary circumstances. However, we think that the scenarios reflect a reasonable and/or plausible range of possible outcomes.

Our scenarios have been designed to illustrate two key points:

- The range of likely consumer fuel bills in 2020
- The impact of energy policies upon those bills

Each scenario is made up of the following constituent parts:

- One of three 'Wholesale and Network' scenarios, with low, central and high cost assumptions.
- One of two 'policy mix' scenarios, consisting of:
    - **Policy Mix 1**; combining high policy cost variants and/or reduced delivery of energy efficiency measures: i.e. a less cost-effective solution for consumers
    - **Policy Mix 2**; combining low policy cost variants and/or enhanced delivery of energy efficiency measures: i.e. a more cost-effective solution for consumers

For each fuel price scenario, this creates a range of final energy bills that vary according to the cost and impact of the energy policy mix.

3.1 Wholesale and network scenarios

Three scenarios that cover the costs of wholesale energy, and the costs met by suppliers in transmission, distribution, metering and supplying consumers, were created. The provenance of the scenarios is summarised in Table 3 and explained in Section 2.2.

Table 3 – Assumptions used in wholesale and network scenarios

	High Fuel Price	Central Fuel Price	Low Fuel Price
Fossil Fuel Prices	DECC high projection	DECC central projection	DECC low projection
Transmission	Electricity based on Redpoint Analysis, ICRP+ scenario[40] Gas based on historical trend	Electricity based on Redpoint Analysis, Status Quo scenario[41] Gas an average of high and low	Projected forward historical trend for electricity. Gas uses National Grid proposed business plan under RIIO-T1[42]

[40] (Redpoint Energy 2011)
[41] *Ibid.*
[42] (National Grid 2011)

Distribution	Electricity based on applying Redpoint projected increases proportionally from 2015 (end of DPCR5) Gas based on historic trend	Electricity average of high and low. Gas based on historic trend	Electricity based historic trend Gas based on historic trend
Metering	Assumes fast roll-out of SMs and reduced costs	Assumes central SM roll out, reducing metering costs	Assumes slow SM roll-out, increasing metering costs.
Other and Margin	Develops proportionally with fossil fuel price	Develops proportionally with fossil fuel price	Develops proportionally with fossil fuel price

3.1.1 Gas costs

Figure 3 illustrates the evolution and breakdown of the three wholesale and network scenarios from 2011 to 2020 for each kWh of gas purchased. The total price of these elements for each kWh of gas in 2020 ranges from 2.5p to 5.8p across the three scenarios.

Wholesale gas costs make up the majority of the unit price across all years and scenarios, representing 54% of the cost in 2020 under the High Fuel Price scenario, and 48% in the Central Fuel Price scenario. Between 2011 and 2020, transmission costs increased by between 36% and 84%, and distribution costs by 19% across all three scenarios. 'Other' costs follow the same trajectory as the wholesale prices.

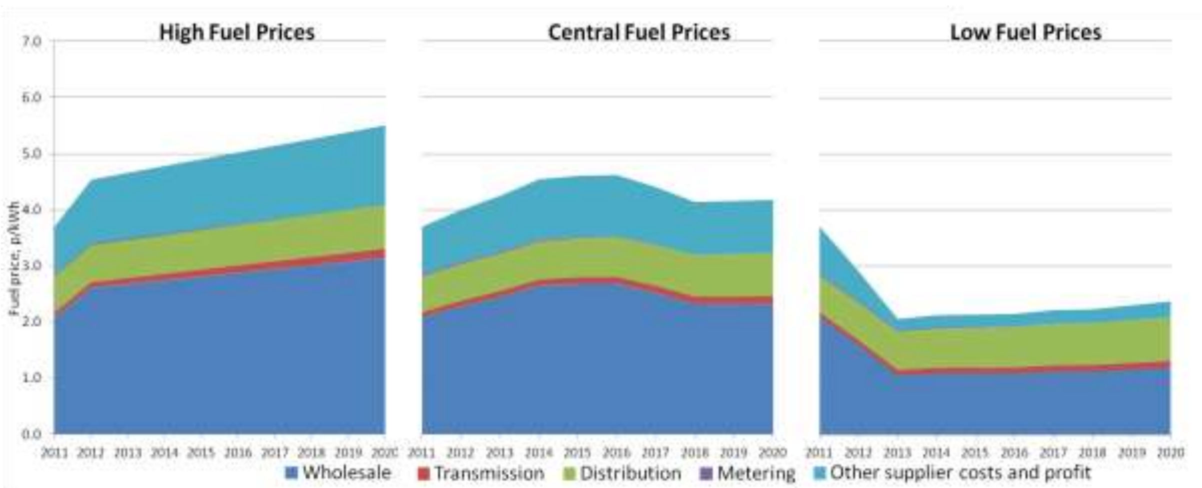


Figure 3 - Evolution of the wholesale and network costs on each kWh of gas supplied across all three scenarios, 2011-2020. Data in Table A40.

3.1.2 Electricity

Figure 4 **Error! Reference source not found.** illustrates the evolution and breakdown of the three wholesale and network scenarios from 2011 to 2020 for each kWh of electricity purchased. The total price of these elements for each kWh of electricity in 2020 ranges from 12.9p to 18.1p across the scenarios.

Wholesale electricity costs are the largest contributor to the costs across all years and scenarios, representing 45% of the cost in 2020 under the High Fuel Price scenario, and 38% in the Central Fuel Price scenario. Transmission costs show large increases of 92% to 138% between 2011 and 2020. Distribution costs increase by 53% to 62%. 'Other' costs follow the same trajectory as the wholesale prices.

We have not separated out the cost of general network upgrades from the specific cost required to integrate renewable technologies. The latest ENSG report(Electricity Networks Strategy Group 2012) puts the cost of the latter at £8.82bn. Adopting the same methodology as the CCC, annualising this cost over 40 years at 5% would give a cost increase of 0.16p/kWh. This represents just 8%-10% of the projected increase in the network cost across scenarios. The increase in network costs cannot therefore be attributed to the cost of integrating renewable energy.

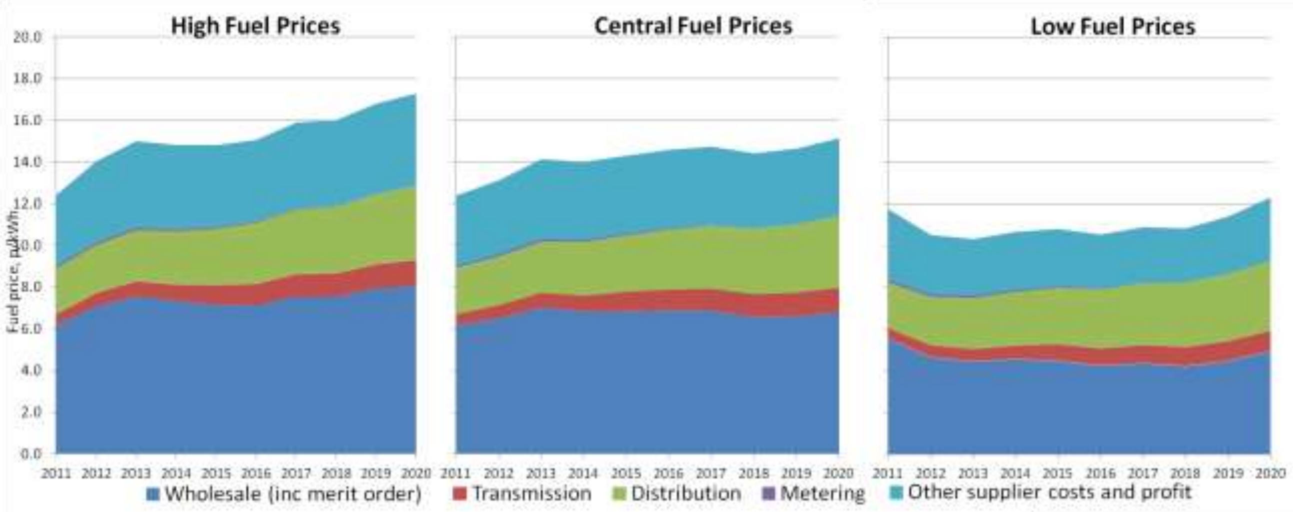


Figure 4 - Evolution of the wholesale and network costs on each kWh of electricity supplied across all three scenarios, 2011-2020. Data in Table A39.

3.2 Policy mix scenarios

Each of the wholesale and network scenarios is combined with one of the two policy scenarios[43]. The latter are designed to represent the full range of policy impacts on energy bills:

- **Policy Mix 1** presents a combination of higher policy costs and/or reduced delivery of demand reduction measures
- **Policy Mix 2** presents a combination of lower policy costs and/or high measure delivery

As such, they represent the range of likely outcomes when twinned with the wholesale and network scenarios. Table 4 illustrates how the assumptions combine to form the scenarios. Both scenarios assume a standard 35% in comfort taking from insulation measures within the DIMPSA model.

Table 4 – The make-up of the Policy Mix 1 and Policy Mix 2 scenarios

		Policy Mix 1	Policy Mix 2
Policy costs	**Billing**	Same assumptions	
Policy costs	**CERT**	Same assumptions	
Policy costs	**CESP**	Same assumptions	
Policy costs	**Carbon Price Floor**	DECC projections	Figures in recent analysis from Camco
Policy costs	**ECO/Green Deal**	Calculated bottom-up from DECC's draft Impact Assessment	Calculated bottom-up from an alternative scenario with more emphasis on low cost measures and low income support
Policy costs	**EMR**[44]	20% above DECC Impact Assessment	20% below DECC Impact Assessment
Policy costs	**EU ETS**	DECC projections	Figures in recent analysis from Camco
Policy costs	**FIT**	Option C from Impact Assessment	Option A from Impact Assessment
Policy costs	**Merit Order**	No impact	EMR Reduces wholesale price by 0.5p/kWh by 2020
Policy costs	**Renewables Obligation**	20% above Minimum Scope	20% below Minimum Scope
Policy costs	**Renewable Heat Incentive**[45]	Same assumptions / no cost on bills	
Policy costs	**Smart Meters**	Same assumptions	
Policy costs	**WHD**	Same assumptions	
Demand Reduction	**Measure performance**	Conventional assumptions	
Demand Reduction	**Product Policy**	The average of the 10yr historic per capita trend in electricity consumption, and the DECC assumptions.	DECC/CCC assumptions
Demand Reduction	**Measures**		
Demand Reduction	***FIT***	Option C from Impact Assessment	Option A from Impact Assessment
Demand Reduction	***ECO/Green Deal***	Based on Impact Assessment	Based on an alternative scenario with more emphasis on low-cost measures and low income support
Demand Reduction	***RHI***	One scenario	
Demand Reduction	***Boiler Churn***	Sufficient to see all non-condensing boilers replaced by 2020	
Tariff Structure		Assume a standing charge at a similar proportion to 2011.	

The energy efficiency measures delivered under each scenario are presented in Table 5. Policy Mix 1 is broadly in line with our interpretation of DECC's analysis for the ECO, together with a more ambitious (and costly) trajectory for the FIT. Policy Mix 2 gives an ECO scenario at a similar annual costs as Policy Mix 1, but with more of the remaining low-cost energy efficiency opportunities met (i.e. a greater volume of loft and cavity wall insulation) at the expensive of some SWI ambition. Policy Mix 2 also sees fewer photovoltaic panels delivered under the FIT.

[44] EMR also varies across the fuel price scenarios, as CfD FITs are closely tied to wholesale fuel prices.
[45] Costs met through public expenditure.

Table 5 - Measures delivered under each policy mix scenario between 2012 and 2020, including boiler churn (rounded to the nearest 1,000)

	Cumulative installations to 2012-2020	
Measure	Policy Mix 1	Policy Mix 2
SWI	1,175,000	930,000
CWI	1,950,000	4,725,000
Loft insulation, top-up	460,000	7,700,000
Loft insulation, full installation	600,000	1,400,000
Gas condensing boiler	6,660,000	6,760,000
Oil condensing boiler	670,000	5,70,000
Photovoltaics	3,090,000	2,750,000
Micro wind	2,500	2,500
Air source heat pump	62,000	62,000
Biomass boiler	29,500	29,500
Ground source heat pump	35,000	35,000
Solar hot water	35,000	35,000

3.3 Standing charge

3.3.1 Gas

For the six scenarios, we assume a **gas** standing charge in 2011 of £102, the average of that reported by DECC across UK cities in 2010[46] for typical consumption. Our analysis suggests that such a standing charge in 2011 could comprise the following elements:

- 25% of all transmission, distribution, metering and other (TDMO) supplier costs (excluding policies)
- All of the costs met by suppliers for the CERT, CESP and WHD policies

Based on this, each of our six scenarios sees the gas standing charge reflecting the same proportion of TDMO supplier costs, the policies listed above, and the costs of the Energy Company Obligation (ECO)[47] from 2013 onwards. The charge is determined by calculating the cost of these elements on the average bill in each year using a combination of DECC energy demand projections[48] and CLG household numbers[49] (and assuming half of new buildings will heat with gas).

3.3.2 Electricity

For the standing charge of the **electricity** bill, DECC figures suggest a lower charge of around £53 per account. Our analysis suggests that such a standing charge in 2011 could comprise the following elements:

- 10% of all transmission, distribution, metering and other (TDMO) supplier costs (excluding policies)

[46] (DECC 2012c)

[47] Though the decision on whether the ECO should be split between suppliers based on customer numbers or volume of sales has yet to be finalised, DECC's default position is to go with the former option. In theory, this would see the costs of the policy passed on in the standing charge/tier 1 unit price if tariffs are to cost-reflective. Alternatives modelled as part of this project are presented in Chapter 6.

[48] (DECC 2011b) – Annex C

[49] (CLG 2010), Table 401

- All of the costs met by suppliers for the CERT, CESP and WHD policies

In the same manner as for the gas standing charge, each of our six scenarios sees the electricity standing charge reflecting the same proportion of TDMO supplier costs, the policies listed above, and the costs of the Energy Company Obligation (ECO)[47] from 2013 onwards.

4 Headline Analysis

The amount that consumers pay for their energy is a function on the number of units they use and the price they pay for it, in both standing charges and unit prices. The scenarios outlined in Chapter 3 combine different assumptions about the cost component of each unit of energy, and the degree to which the number of units required will change from the present day.

This chapter sets out the results of our analysis in that order, firstly looking at the number of kWhs of gas and electricity consumers will use through to 2020, assessing the price of each unit of gas and electricity they use, and then presenting the final energy bill.

In addition to looking at the change between 2011 and 2020, we compare energy demand, unit prices and final bills in 2020 against counterfactuals. The counterfactuals represent the energy demand, unit price and fuel bills if energy and climate change policies were revoked in 2012. The cost of these policies would no longer be added to the unit price of energy, but nor would the policies deliver energy efficiency measures, reducing energy demand. Our counterfactuals exclude savings from boiler churn (since these saving derive from policy: the Building Regulations), but include the savings delivered by policy measures to date (unlike the approach taken by DECC). A different counterfactual is presented for each fuel price scenario.

4.1 Consumer energy demand

Average energy demand across consumers is a function of the energy saving policies within the Policy Mix scenarios. Figure 5 illustrates our expected mean household energy demand in kWhs for gas and electricity (power, i.e. for non-heating purposes) under our Policy Mix 1 and Policy Mix 2 variants for all fuel price scenarios.

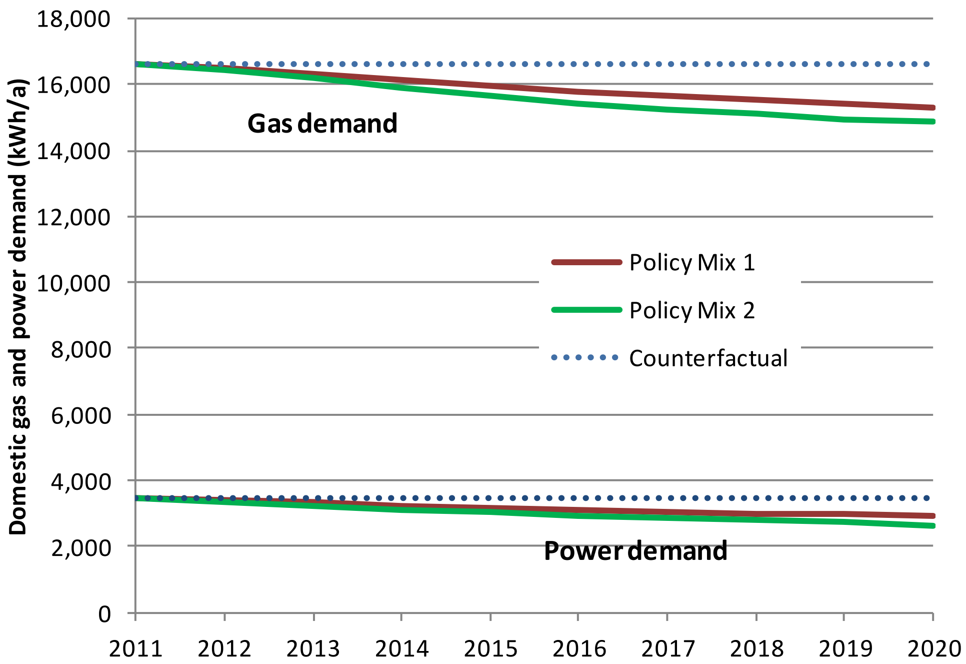


Figure 5 - Mean household demand for electricity and gas (kWh), 2011-2020. Data in Table A41.

The 2011 starting point is based on our expected delivery of energy efficiency measures to date, giving an average consumption of gas (for those heating with the fuel) of 16,650 kWh, and an average power consumption of 3,450 kWh. The average gas consumption is slightly greater than the 16,060 kWh calculated using Government projections on domestic gas demand[50] and an estimate of the number of homes on the gas network[51], though much lower than the (non-weather-corrected) 2010 figure used by the CCC of 17,240 kWh for dual fuel households. Power consumption is very close to the CCC figure (3,416 kWh) though lower than the 3,946 kWh used by DECC, since the latter includes all electricity consumption, not just that for power. In our counterfactuals, we assume gas and power demand stay constant through to 2020, reflecting the absence of policy drivers to reduce demand.

Our results suggest a 9% to 11% reduction in gas demand, and an 18% to 24% cut in power demand by 2020 relative to counterfactual 2020 demand (and by extension 2011 demand). This is entirely the result of energy efficiency policies, since our scenarios do not include the impact of rising prices on demand response.

4.2 Unit price of energy

The demand for energy presented in section 4.1 is combined with the unit prices presented in this section to give the final energy bills in section 4.3.

4.2.1 Gas

Figure 6 illustrates the evolution of the gas price between 2011 and 2020 across the six different scenarios. When combining the wholesale/network scenarios with the policy mix scenarios, gas prices in 2020 range from 2.7p/kWh to 6.0p/kWh. Price changes from 2011 therefore range from a drop of 33%, to a 48% increase.

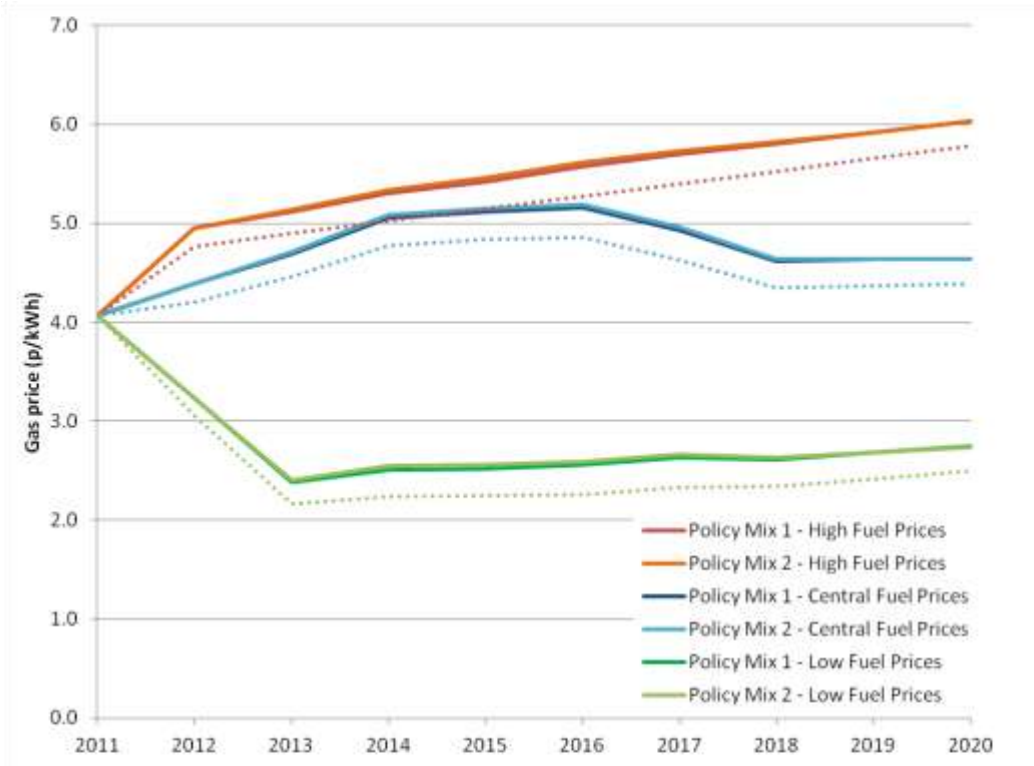


Figure 6 - - Price of each kWh of gas, 2011-2020. Breakdown of 2020 unit price in Table A42.

Policies add 0.25p/kWh in all scenarios in 2020, which represents between 4.1% (Policy Mix 2 – High Fuel Prices) and 9.1% (Policy Mix 1 – Low Fuel Prices) of the unit price in that year.

[50] 349 TWh in 2011 using figures from (DECC 2011b) – Annex C.
[51] 21.7m homes in the UK, based on (Palmer and Cooper 2011).
(DECC 2012d) and (CLG 2010), Table 401, assuming half of new homes constructed use gas for heating.

Seventy-seven to 78% of these policy costs are from the ECO, with a further 19% to 20% from the Warm Homes Discount. Overall, policy costs increase by between 38% and 41% from 2011.

The policy mixes make little difference to the gas price, largely because the cost of each ECO scenario is broadly the same. There are differences between the energy efficiency measures deployed however (as illustrated by the differences in demand in Figure 5), leading to a range of energy bills across the scenarios.

4.2.2 Electricity

Figure 7 illustrates the evolution in the price of electricity between 2011 and 2020. The combination of wholesale/network scenarios and policy mix scenarios gives electricity prices in 2020 that range from 17.5p/kWh to 23.7p/kWh. Prices range from being 21% to 61% higher in 2020 than in 2011.

Policies add between 4.7p/kWh and 6.5p/kWh to the cost of electricity in 2020, which represents between 21.5% (Policy Mix 2 – High Fuel Prices) and 33.6% (Policy Mix 1 – Low Fuel Prices) of the unit price in that year. RO support costs represent the biggest policy contributor to the unit price across all scenarios in 2020, representing 23%-33% of the policy costs. EMR (8%-23%), FIT (14%-20%), EU ETS plus CPF (17%-20%) and ECO (13%-17%) are all significant contributors. Overall, policy costs increase by 165% to 290%.

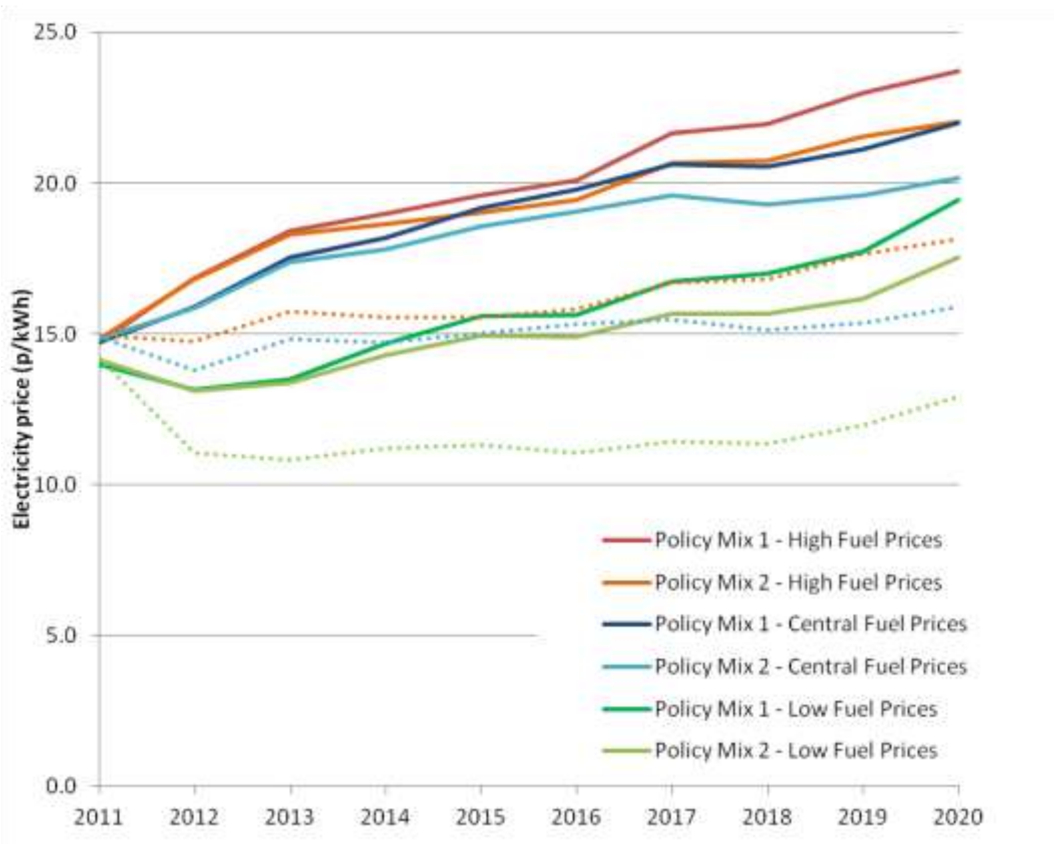


Figure 7 - Price of each kWh of electricity, 2011-2020. Breakdown of 2020 unit price in Table A43.

4.3 Mean energy bills

Sections 4.1 and 4.2 indicate that while average energy consumption is likely to fall under our scenarios, the amount that we pay for each unit of energy is likely to increase, particularly each unit of electricity. Here we present the net impact of the falling demand and rising unit costs on average energy bills.

4.3.1 Total bills

Figure 8 presents the mean total energy bills for households from 2011 to 2020. This is an average across all households, including those heating with fuels other than gas. The scenarios present bills in 2020 that range from £1,601 to £916; a 30% (£370) increase, to a 22% (£270) reduction. The chart also presents the counterfactual energy bill (dotted lines) were the costs of energy and climate change policies and the impact of these policies on energy demand removed.

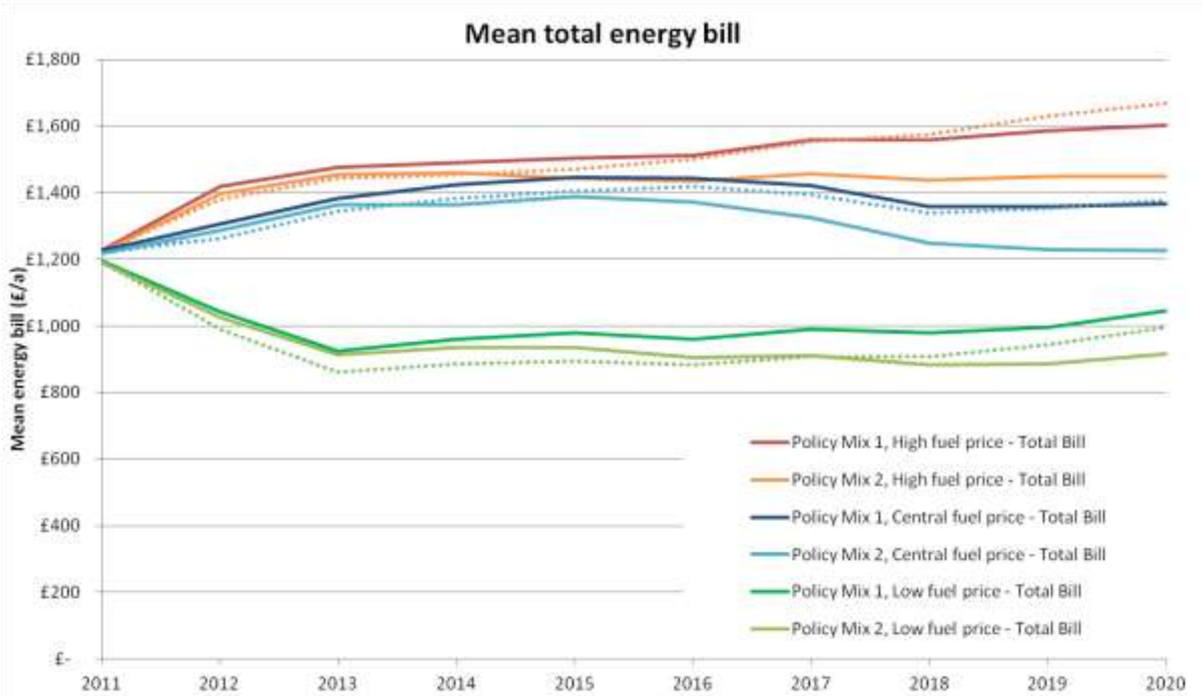


Figure 8 - Mean energy bills by scenario, 2011-2020. Dotted lines indicate counterfactual bills (excluding policy costs and impacts) for the high, central and low fuel price scenarios respectively (from top to bottom). Data in Table A44.

The chart illustrates the wide range of potential bills in 2020. Whilst predictions or estimates of energy bills into the future are useful, they are subject to a myriad of uncertainties, not least the underlying fossil fuel price. The price of fossil fuels accounts for 46%-55% of the gas price and 25%-36% of the electricity price in 2020. Fossil fuel prices are notoriously unpredictable.

Unsurprisingly Policy Mix 2 consistently outperforms Policy Mix 1, though the difference reduces with reducing fuel prices. More generally, energy demand policies within the Policy Mixes are more effective at reducing bills under higher fuel prices.

Table 6 - Absolute changes in total bills 2011-2020, and changes with respect to the counterfactual bills

Scenario	Change in total bill, 2011-2020	Change in bill against counterfactual in 2020
Policy Mix 1 - High Fuel Prices	£375	*-£67*
Policy Mix 2 - High Fuel Prices	£230	*-£218*
Policy Mix 1 - Central Fuel Prices	£140	*-£12*
Policy Mix 2 - Central Fuel Prices	£6	*-£153*
Policy Mix 1 - Low Fuel Prices	*-£151*	£50
Policy Mix 2 - Low Fuel Prices	*-£275*	*-£79*

As shown in Table 6, despite the increase in unit price of electricity and (in most cases) gas, by 2020 Policy Mix 2 energy bills are always lower than the counterfactual bills, with the impact of energy demand reduction and fuel bill support outweighing the costs of the policies.

The same is true even for Policy Mix 1 scenarios when combined with the Central or High wholesale energy prices. The benefits of reduced energy demand exceed the impacts of policy-induced higher unit prices by 2020 with the exception of where total bills are lower in 2020 than in 2011. In other words, bills are either lower than they would have been without the policies, or lower in absolute terms than in 2011. Only by removing all policies and hoping for the low fossil fuel price scenario to materialise could consumers be better off than through the application of policies, and even then they would have benefited to a greater degree had Policy Mix 2 been in place.

4.3.1 Gas bills

Figure 9 presents the same analysis based on the average gas bill in 2020. There is a large range in the 2020 gas bills from our scenarios, from a £256 reduction to a £246 increase for the average consumer from the average 2011 bill. Across all of our scenarios, the 2020 gas bills are lower than a counterfactual bill where all the energy and climate change policies (their costs and their impacts from 2012 onwards) are removed.

As shown in Table 7, the difference between Policy Mixes 1 and 2 for the average 2020 gas bill amounts to £29 under the High Fuel Price scenarios, and £6 under the Low Fuel Price scenarios. At lower fuel prices, the increased provision of energy saving measures has less of an impact on bill saving.

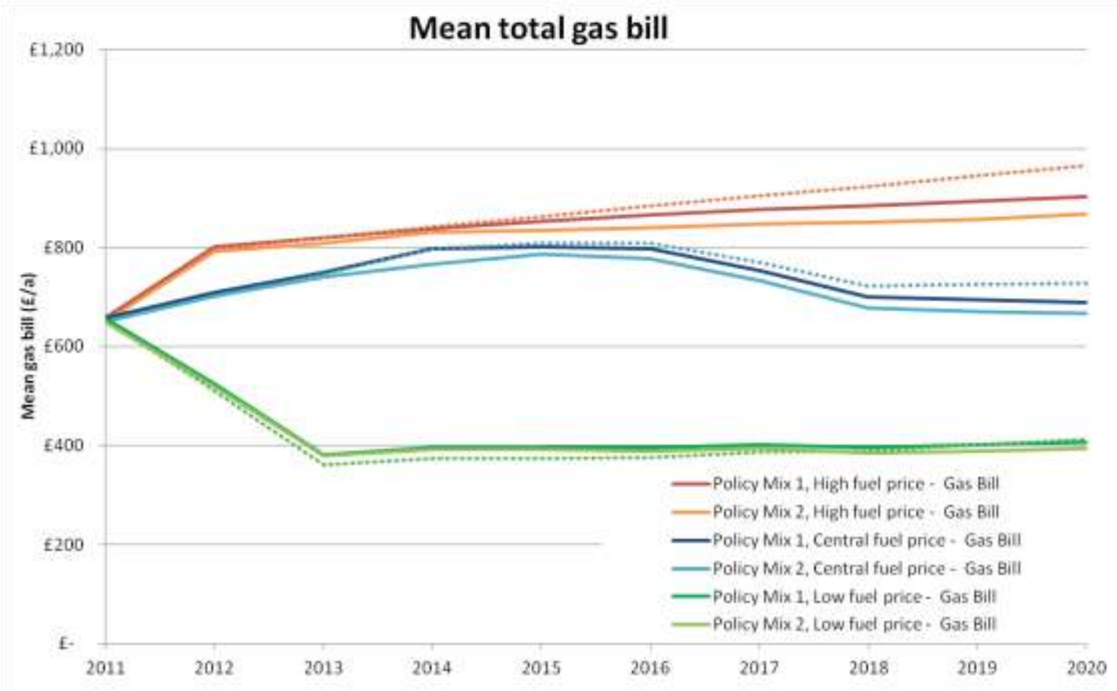


Figure 9 - Mean total gas bill, 2011-2020. Dotted lines indicate counterfactual bills (excluding policy costs and impacts) for the high, central and low fuel price scenarios respectively (from top to bottom).

Table 7 – Absolute changes in gas bills 2011-2020, and changes with respect to the counterfactual bills

Scenario	Change in gas bill, 2011-2020	Change in gas bill against counterfactual in 2020
Policy Mix 1 - High Fuel Prices	£246	*-£63*
Policy Mix 2 - High Fuel Prices	£217	*-£99*
Policy Mix 1 - Central Fuel Prices	£33	*-£38*
Policy Mix 2 - Central Fuel Prices	£17	*-£61*
Policy Mix 1 - Low Fuel Prices	*-£250*	*-£6*
Policy Mix 2 - Low Fuel Prices	*-£256*	*-£19*

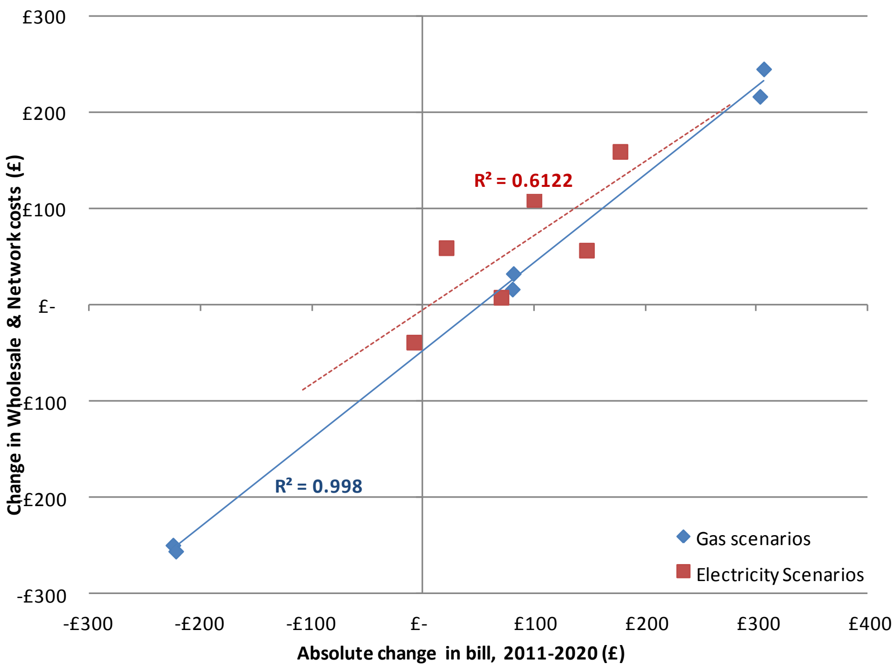


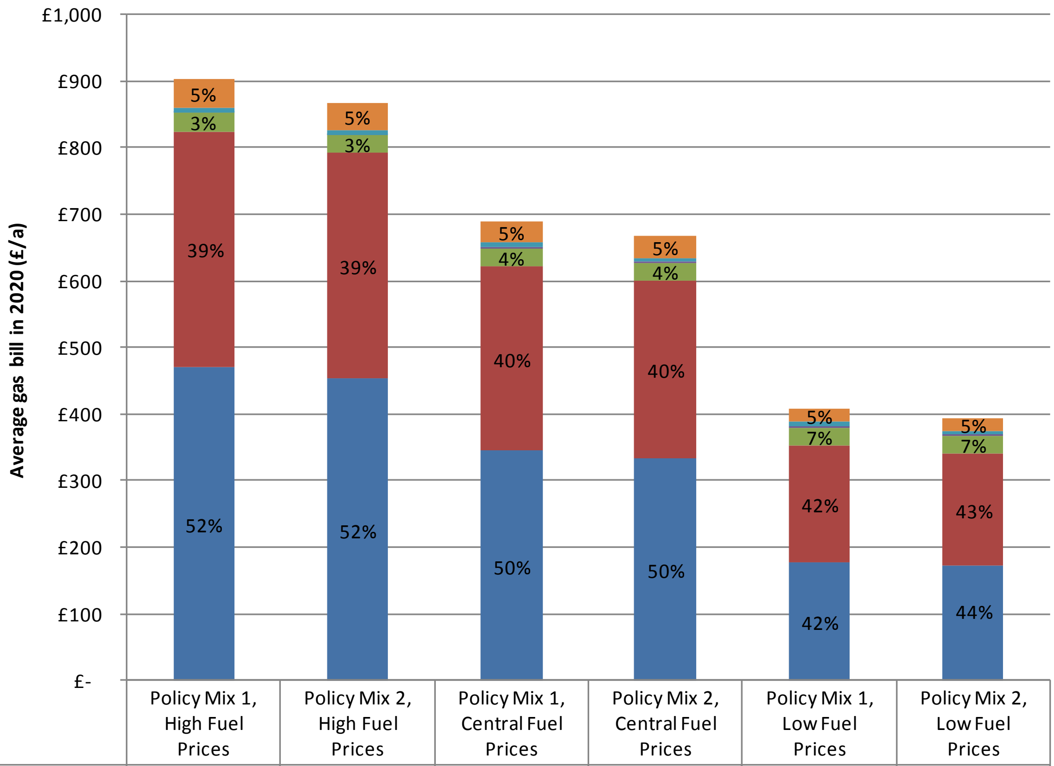
Figure 10 – The relationship between changes in wholesale and network costs and the change in the final gas and electricity bills across the six scenarios.

The gas bill in 2020 is almost entirely dictated by the changes in wholesale and network costs, which explain 99.8% of the variance in final bills as shown by the regression analysis in Figure 10. Policies are set to increase gas bills by £11 to £12 but precipitate reductions to energy demand and fuel bills that save between £44 and £96 per year as shown in Table 8. The dynamic between changes to wholesale and network costs, policy costs, and demand reduction is presented for all scenarios inFigure 12 Figure 12.

Table 8 – Changes in different aspects of the gas bill, 2011-2020.

Cost change	High FP, Policy Mix 1	High FP, Policy Mix 2	Central FP, Policy Mix 1	Central FP, Policy Mix 2	Low FP, Policy Mix 1	Low FP, Policy Mix 2
Wholesale & Network	+ £306	+ £303	+ £81	+ £80	*-£225*	*-£223*
Policies	+ £12	+ £11	+ £12	+ £11	+ £12	+ £11
Policy savings	*-£72*	*-£96*	*-£60*	*-£74*	*-£36*	*-£44*
Total Bill Change	+ £246	+ £217	+ £33	+ £17	*-£250*	*-£256*

In 2020, wholesale and network costs account for between 87% and 91% of the average gas bill, with a further 4% to 9% due to policy costs, and 5% through VAT. Policy costs account for £34 to £36 on the bill, but is more than compensated for by the fact that these policies have led to a net reduction in the gas bill across all scenarios. ECO represents the largest policy impact on the gas bill in 2020, making up 3% of the bill under the High Fuel Price scenarios, rising to 7% under the Low Fuel Price scenarios. The average 2020 gas bill is broken down for all six scenarios in Figure 11.



	Policy Mix 1, High Fuel Prices	Policy Mix 2, High Fuel Prices	Policy Mix 1, Central Fuel Prices	Policy Mix 2, Central Fuel Prices	Policy Mix 1, Low Fuel Prices	Policy Mix 2, Low Fuel Prices
VAT	£43	£41	£33	£32	£19	£19
WHD	£7	£7	£7	£7	£7	£7
Smart Metering & Billing	£1	£1	£1	£1	£1	£1
ECO	£28	£26	£28	£26	£28	£26
TDMO	£353	£340	£277	£268	£176	£170
Wholesale	£471	£453	£345	£334	£177	£171

Figure 11 - The average gas bill in 2020 across all six scenarios, broken down into constituent parts. The Warm Home Discount (WHD) and Smart Metering make up less than 1% of the 2020 bill. TDMO = Transmission, Distribution, Metering and 'Other'.

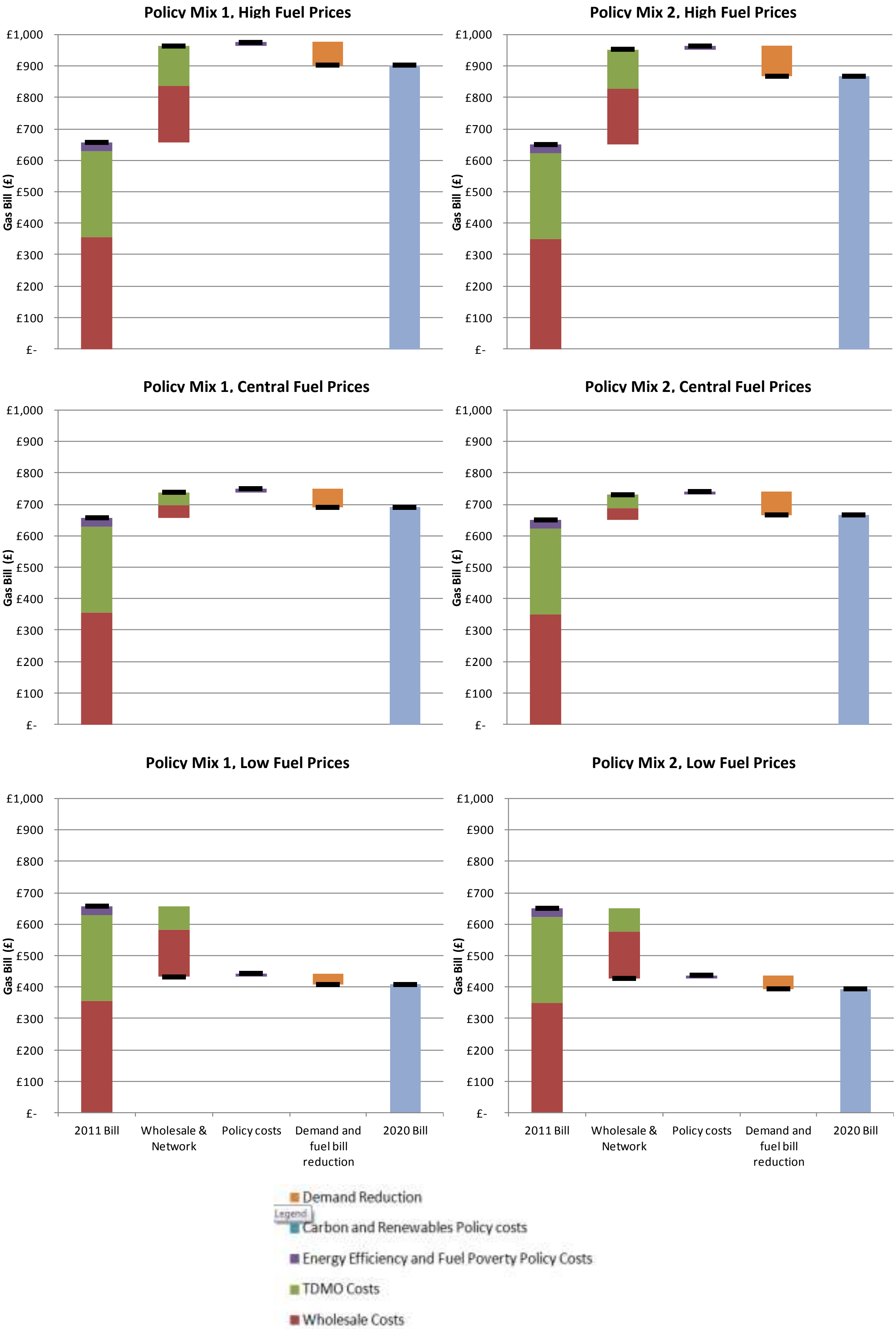


Figure 12 - Illustration breaking down the gas bill changes from 2011 to 2020 for the six scenarios. TDMO = Transmission, Distribution, Metering, and 'other' costs and margin faced by suppliers.

4.3.2 Electricity bills

Electricity bills for households (excluding electricity from heating) range from £448 to £671 in 2020, as illustrated in Figure 13. This represents a smaller range than for gas bills in our scenarios, with the difference from the average 2011 bill spanning a £38 reduction to a £160 increase.

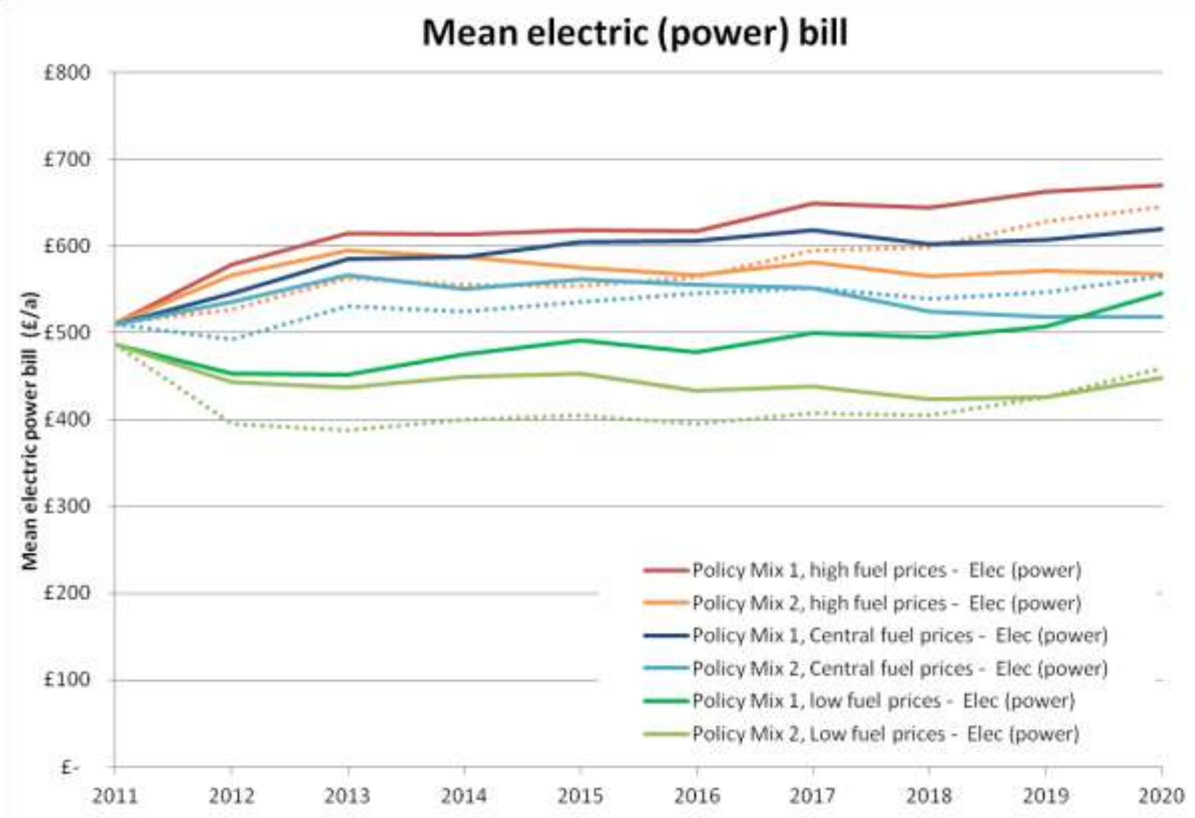


Figure 13 - Mean total electricity bills across all six scenarios, excluding electricity from heating, 2011-2020

Table 9 shows that if our Policy Mix 2 scenarios are followed, 2020 bills are £11 to £77 lower than in a counterfactual scenario (whereby energy and climate change policies are 'removed' from 2012). However, 2020 bills are £25 to £86 higher than the counterfactual bills under the Policy Mix 1 scenarios. This illustrates the importance of Product Policy and of DECC achieving their ambitious demand reduction projections if electricity bills are to be kept down.

Table 9 - Absolute changes to electricity bills 2011-2020, and changes with respect to the counterfactual bills

Scenario	Change in electricity bill, 2011-2020	Change in electricity bill against counterfactual in 2020
Policy Mix 1 - High Fuel Prices	£160	£25
Policy Mix 2 - High Fuel Prices	£57	*-£77*
Policy Mix 1 - Central Fuel Prices	£110	£55
Policy Mix 2 - Central Fuel Prices	£8	*-£47*
Policy Mix 1 - Low Fuel Prices	£60	£86
Policy Mix 2 - Low Fuel Prices	*-£38*	*-£11*

The majority of the change to the electricity bill (61%) is due to changes in the wholesale price and network costs[52] – this proportion is lower than the equivalent proportion for gas bills. This is because a wider range of policies are applied to the cost of electricity, such as carbon pricing and renewable electricity levies. Though only responsible for the minority of the change, the cost of energy and climate change polices is higher and the impact of the policies in reducing energy demand and fuel bills is greater than is the case for gas. In the absence of energy demand and fuel bill reduction measures, the cost of policies would add between £102 and £169 to the average electricity bill by 2020. However, these policies result in a reduction in fuel bills of between £129 and £191 per year. In all but two scenarios demand reduction exceeds the costs of the policies. This dynamic is illustrated for the all scenarios in Figure 15.

Table 10 - Changes in different aspects of the electricity bill, 2011-2020.

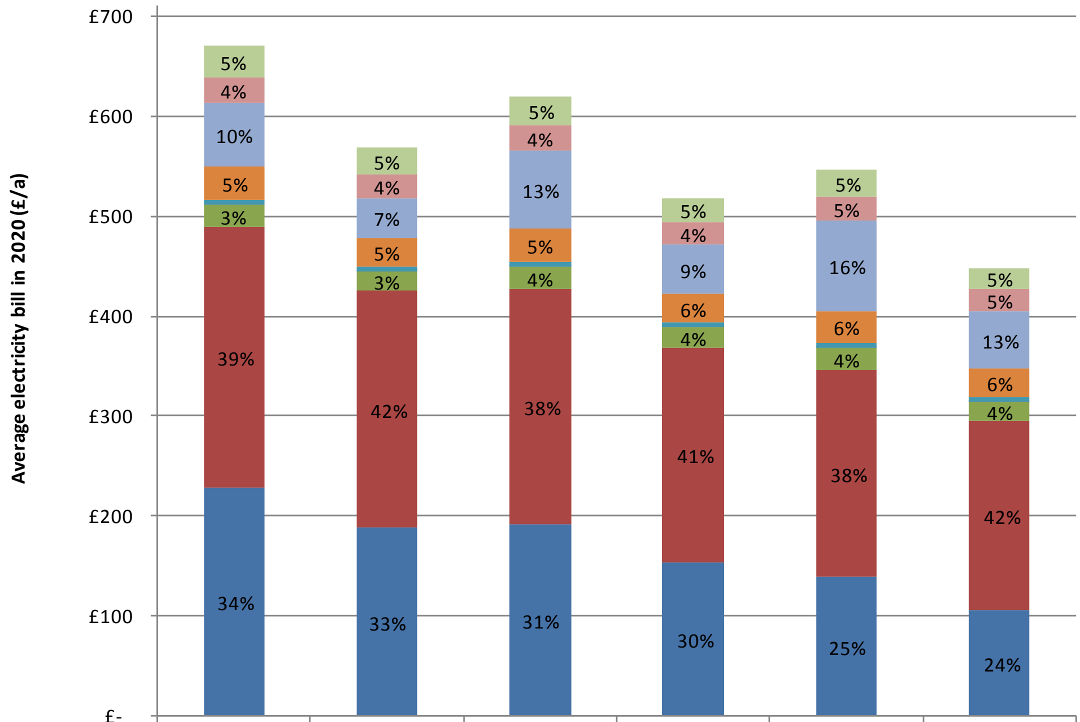
Cost change	High FP, Policy Mix 1	High FP, Policy Mix 2	Central FP, Policy Mix 1	Central FP, Policy Mix 2	Low FP, Policy Mix 1	Low FP, Policy Mix 2
Wholesale & Network	+ £177	+ £147	+ £100	+ £70	+ £21	*-£9*
Policies	+ £135	+ £102	+ £153	+ £115	+ £169	+ £126
Policy savings	*-£152*	*-£191*	*-£143*	*-£176*	*-£129*	*-£156*
Total Bill Change	+ £160	+ £57	+ £110	+ £8	+ £60	*-£38*

The choice of Policy Mix has a large impact on electricity bills in 2020, with a £98 to £103 difference between bills under a given fuel price scenario. Around £30 of this difference is due to the Policy Mix 2 scenarios including an anticipated reduction in wholesale price in response to the EMR policy. The remainder is split between reduced policy costs (£33-£43) and greater reductions in demand and fuel expenditure (£27-£39) for Policy Mix 2.

Figure 14 illustrates that in 2020, wholesale and network costs account for between 63% and 75% of the average electricity bill, with a further 20% to 32% due to policy costs, and 5% from VAT. Policy costs account for £116 to £175 of the bill cost, though for all but two of the scenarios the reductions in energy demand and fuel bills that these policies generate exceed these costs.

The costs of the Feed-in-Tariff Contracts for Difference (FiT CfD) and capacity mechanism under EMR, and the Renewables Obligation when combined represent the largest policy impact on bills of between 7% and 16%. The absolute cost of these policies increases from between £40 and £64 under the High Fuel Price scenarios to between £57 and £90 under the Low Fuel Price scenarios. This difference across fuel price scenarios reflects the fact that if fuel prices are low, the cost of the FiT CfD will be higher since consumers pay the difference between the wholesale price and the FiT CfD. The policy therefore acts to moderate price changes: under high fuel price scenarios the policy costs rather less. The EU ETS and the CFP together represent the second largest policy impact on bills by 2020 – 5% to 6% – with the domestic FIT adding another 4%-5% to bills by 2020. The average 2020 electricity bill is broken down for all six scenarios in Figure 14.

[52] We have not separated out the cost of general network upgrades from the specific cost required to integrate renewable technologies. The latest ENSG report**Error! Bookmark not defined.** puts the cost of the latter at £8.82bn. Adopting the same methodology as the CCC, annualising this cost over 40 years at 5% would give a cost increase of 0.16p/kWh. This represents just 8%-10% of the projected increase in the network cost across scenarios. The increase in network costs cannot therefore be attributed to the cost of integrating renewable energy.



	Policy Mix 1, High Fuel Prices	Policy Mix 2, High Fuel Prices	Policy Mix 1, Central Fuel Prices	Policy Mix 2, Central Fuel Prices	Policy Mix 1, Low Fuel Prices	Policy Mix 2, Low Fuel Prices
VAT	£32	£27	£30	£25	£26	£21
FIT	£25	£23	£25	£23	£25	£23
RO and EMR	£64	£40	£78	£49	£90	£57
EU ETS & CFP	£33	£29	£33	£29	£32	£29
WHD	£5	£4	£5	£4	£5	£4
Smart Metering & Billing	£1	£1	£1	£1	£1	£1
ECO	£22	£20	£22	£20	£22	£20
TDMO	£260	£237	£235	£215	£207	£188
Wholesale	£229	£188	£191	£154	£139	£106

Figure 14 - The average electricity bill in 2020 across all six scenarios, broken down into constituent parts. The Warm Home Discount (WHD) and Smart Metering make up less than 1% of the 2020 bill. TDMO = Transmission, Distribution, Metering and 'Other'.

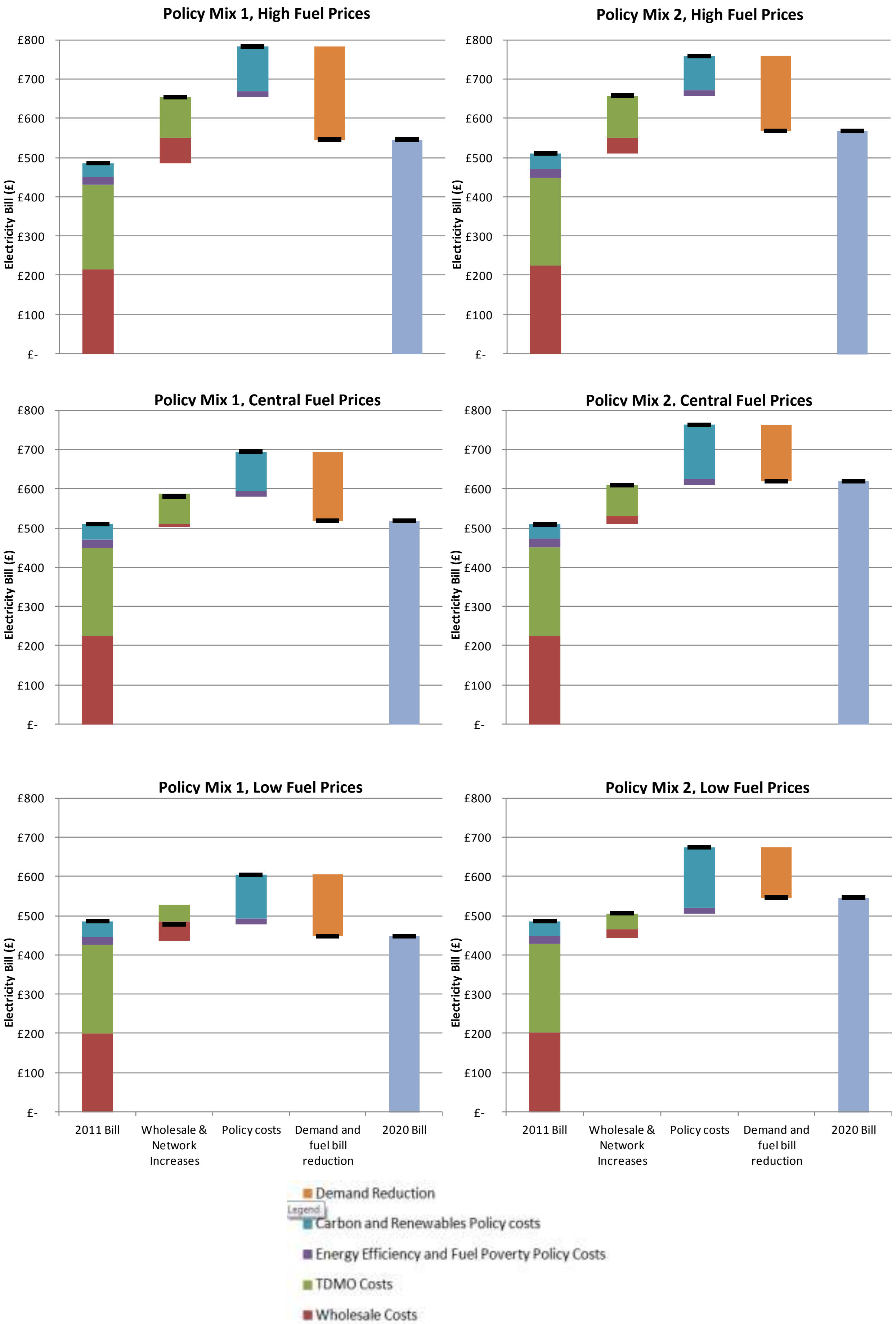


Figure 15 - Illustration breaking down the electricity bill changes from 2011 to 2020 for the six scenarios. TDMO = Transmission, Distribution, Metering, and 'other' costs and margin faced by suppliers.

5 Distributional Analysis

As well as evaluating the impact of changing energy prices on the average energy bills across all households, it is important to consider the distributional impact of rising energy bills. This chapter looks at the impact on households at different levels of expenditure, how the scenarios affect the number of fuel poor households, and looks at those households that 'win' and 'lose' as a result of changing energy prices and delivery of energy saving measures.

5.1 Expenditure decile

The Living Costs and Food Survey (LFS) provides a detailed record of household expenditure on goods, services and materials. Expenditure is itself a good indicator of financial wealth and income, as low income households typically spend less than higher income households. DECC and HM Treasury often use expenditure to analyse distributional impacts as a number of households in the lowest income deciles may not be experiencing poverty. For example, a student household may have a low income but may be supported by their family, or an elderly household may have a low income but significant savings upon which they can draw.

Equivalised expenditure is a measure of household expenditure that takes account of the differences in household size and composition. By using equivalised expenditure, we can account for the fact that a single person household will need to spend less to support their needs than a family with two children. For the purpose of this analysis the OECD equivalisation scale has been used[53].

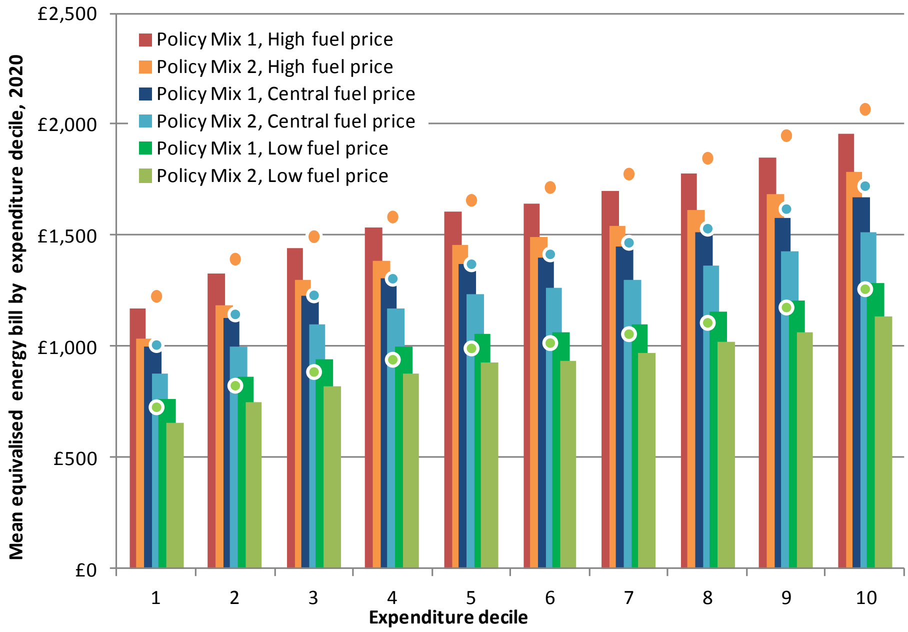


Figure 16 - Mean equivalised fuel bill in 2020 by expenditure decile. Counterfactual equivalised bills are shown as circular data-points for the High, Central and Low Fuel Price scenarios from top to bottom.

Figure 16 illustrates the mean equalivised fuel bills by expenditure decile in 2020 across all scenarios. Average bills for those in the highest expenditure decile are between 67% and 73% higher than those in the lowest expenditure decile, reflecting the fact that more affluent households spend more on energy. The scenarios show a similar relationship to the counterfactual bill across expenditure deciles as is exhibited for the average bill across all households.

[53] (OECD)

Policy Mix 2 variants deliver lower bills for households at all expenditure levels compared to Policy Mix 1, ranging from a £111 reduction for the lowest expenditure decile under the Low Fuel Price scenario, to £171 for the highest expenditure decile under the High Fuel Price scenario. Policy Mix 2 variants also see a greater proportional benefit to those in the lowest deciles: across each fuel price scenario, highest expenditure decile bills are five percentage points higher as a proportion of the lowest expenditure decile's bills. This is a function of more energy efficiency measures being targeted at low income households under this scenario.

The impact of bills on households is often expressed as the change in bill relative to the resources, through the equation in Box 1.

Box 1 - Change relative to resources

Change in bill relative to resources **= Total change in bill vs. the counterfactual / household expenditure**

The impact upon resources is presented in Figure 17.

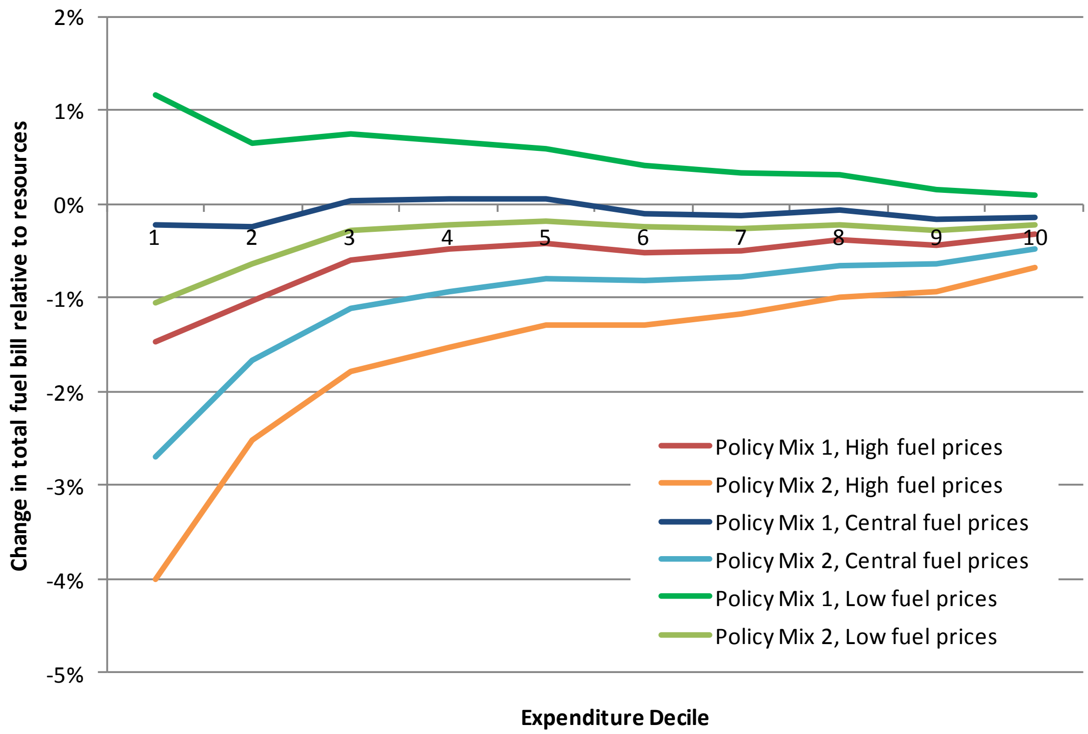


Figure 17 - Change in bill vs counterfactual in 2020 relative to resources across all scenarios and expenditure deciles

The figure illustrates the much larger impact that changes in energy bills have on those in lower expenditure deciles. Under five of the scenarios, the bills are lower than the counterfactuals, with only the Policy Mix 1, Low Fuel Price scenario showing an increase in bills across deciles.

Alongside the average impact on households at different expenditure deciles, it is of use to look at the impact upon those that receive measures in their homes and/or discounts through the Warm Homes Discount, and those that don't.

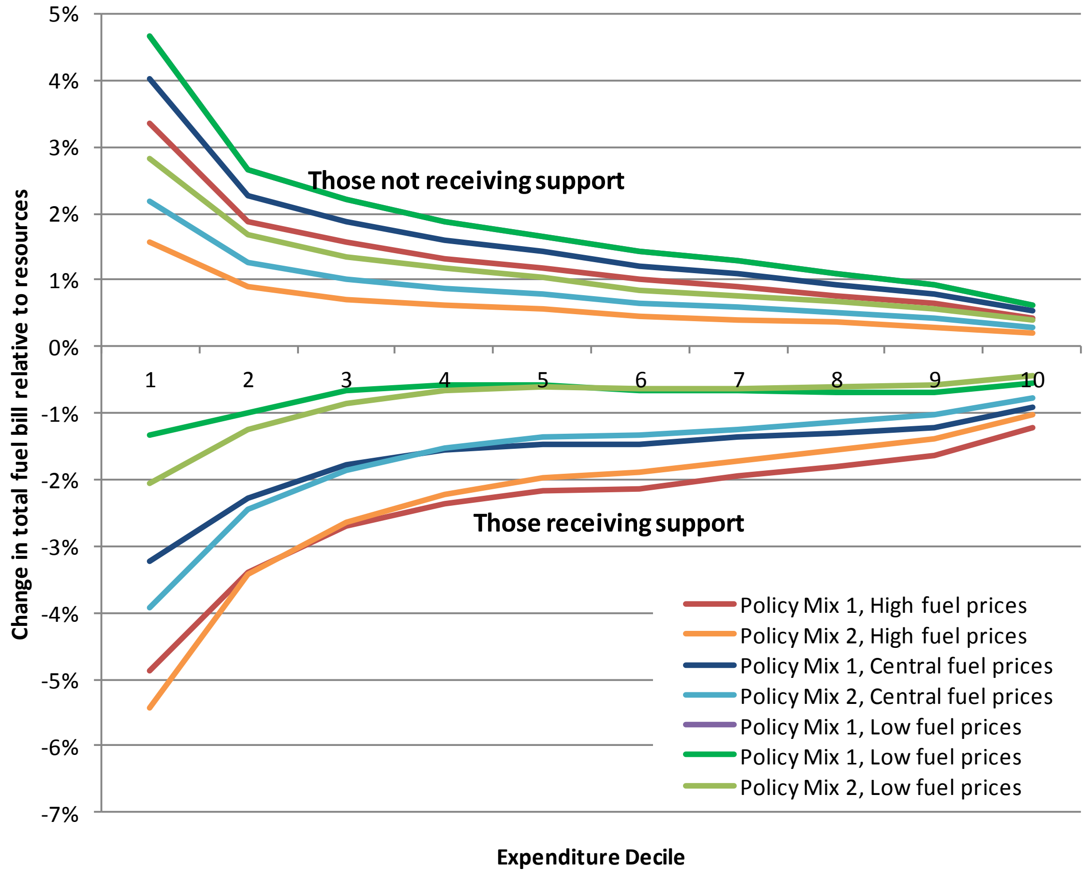


Figure 18 - Change in bill vs counterfactual in 2020 relative to resources across all scenarios and expenditure deciles, for those that do and those that do not receive support

Figure 18 illustrates this for all scenarios. Three things are clear from the chart: that on average, those receiving support from energy efficiency measures or fuel bill discounts are better off as a result, whilst those that don't receive support are worse off on average; that this difference is magnified at low expenditure deciles where bills make up a larger proportion of household budgets; and that the Policy Mix 2 scenarios perform better in this regard than the Policy Mix 1 scenarios.

The importance of targeting energy efficiency measures effectively, and prioritising support for the lowest expenditure decile households is paramount. The lowest expenditure decile households can see a 5% reduction in their resources on average if they do not receive support.

5.2 Fuel Poverty

This section considers the impact of policy and fuel costs upon the number of people classified as fuel poor. First we consider fuel poverty under the current definition, those with a deemed energy need that costs more than 10% of their household disposable income[54]. We then use the definition proposed in the recently published Hills Fuel Poverty Review (Hills 2012).

'10%' Definition

Table 11 presents the number of households in fuel poverty (as currently defined in England) across the six scenarios in the key years of 2011, 2016 and 2020. Across the three fuel price scenarios, the Policy Mix 2 scenario's higher level of energy efficiency deployment, deployed more cost effectively, result in an incidence of fuel poverty two to three percentage points lower than under the Policy Mix 1 scenario. In addition to the Low Fuel Price scenarios, only the Central Fuel Price / Policy Mix 2 scenario sees the number of households in fuel poverty in 2020 fall compared to 2011 (by close to 600,000 households).

The difference in performance compared to the counterfactual between Policy Mix scenarios 1 and 2 underscores the importance of deploying energy efficiency improvements cost-effectively and in a well-targeted manner, especially when their costs are met by energy consumers.

Table 11: Number of households classified as fuel poor (millions)

	High fuel price		Central fuel price		Low fuel price	
	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2
2011	4.46m	4.46m	4.46m	4.46m	4.46m	4.46m
2016	6.38m	5.89m	5.74m	5.27m	2.20m	1.97m
2020	6.21m	5.56m	4.48m	3.89m	2.31m	1.89m
2020 (counterfactual)	*6.42m*		*4.08m*		*1.78m*	

Figure 19 presents the same data as a percentage of households in England. It is clear that fuel price has a significantly greater impact on fuel poverty than policy scenario. The range of fuel poverty outcomes from the three fuel price scenarios is an order of magnitude greater than the difference between the Policy Mixes under each fuel price scenario.

[54] Assumptions used to estimate changes in household income to 2020 are given in Appendix 1: Appendix 2 - Income progression.

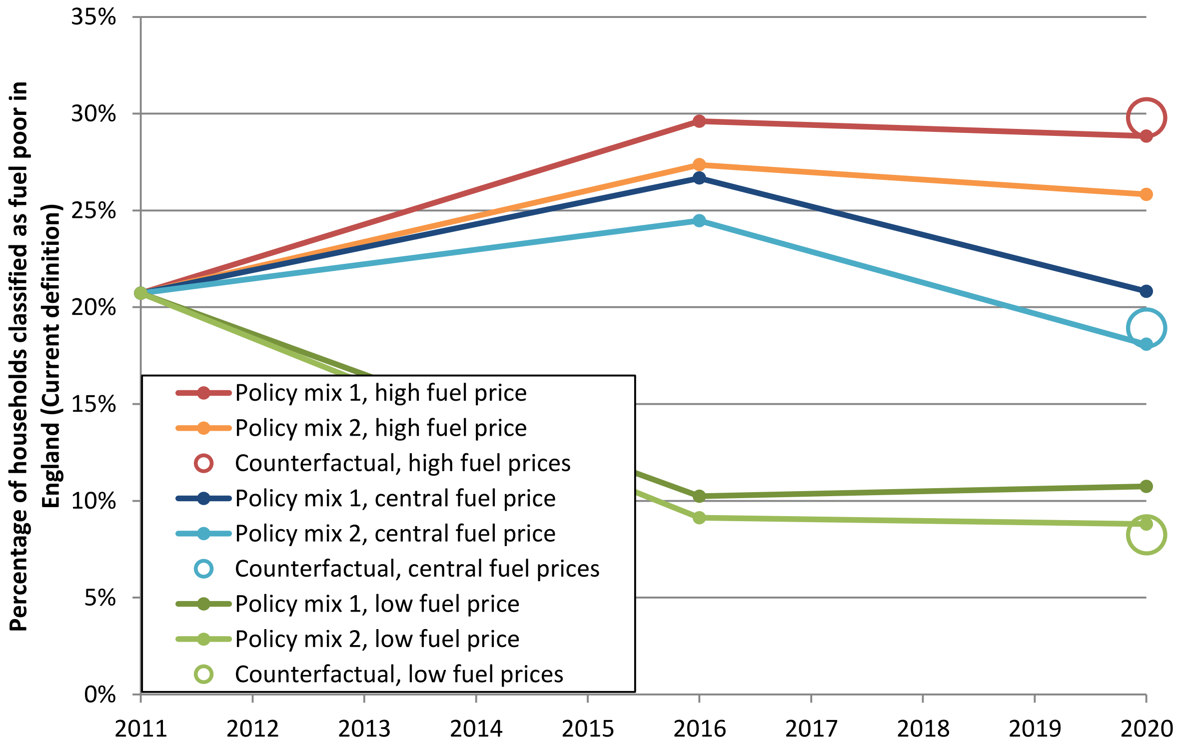


Figure 19 - Percentage of households classified as fuel poor – current definition. The circles indicate the percentage of fuel poor households under the counterfactual scenarios for the high (red), central (blue) and low (green) fuel price scenarios.

Whereas section 4.3 has illustrated that average bills are lower than the counterfactual bills for most scenarios, the scenarios do not perform quite as well against the counterfactuals when looking at the impact on fuel poverty. Figure 8 showed that for mean energy bills, the counterfactual bill only outperforms the Low Fuel Price, Policy Mix 1 scenario. In terms of impact on fuel poverty however, counterfactuals outperform both Low Fuel Price scenarios as well as the Central Fuel Price, Policy Mix 1 scenario. The latter would see an extra 400,000 fuel poor households in 2020 compared to the counterfactual.

There are a couple of reasons as to why the scenarios tend to perform better against counterfactuals when comparing average bills than fuel poverty numbers. The first is that by definition[55] fuel poor households' homes are more likely to be less efficient that the average household; importantly they have a much higher proportion of electric heating than average, and are more likely to live in difficult to treat solid wall homes. They are therefore more likely to be disadvantaged by the increases in (especially) electricity and (to a lesser degree) gas prices resulting from the energy and climate change policies. Crucially they are less likely to benefit from the energy reduction measures that these policies bring than the average household: they will be less suited to benefits through the FIT or RHI, and unlikely to be targeted for support under the Carbon Obligation part of the ECO. In other words, this group contains a larger proportion of 'losers' who do not receive energy reduction measures whilst feeling the worst effects of policy price rises due to a greater reliance on electricity.

[55] Because fuel poverty is defined in terms of 'energy need'. This makes any household in an inefficient property more likely to be fuel poor.

Secondly the nature of the current '10%' definition is that as energy prices rise and a greater proportion of households enter fuel poverty, a small increase in prices pushes an ever greater number of households in to fuel poverty. If fuel poor households need to pay slightly more for their energy need under the scenarios than they do under the counterfactual bills (owing to the greater proportion of electric heating and 'losers') this can translate into a much larger number of additional fuel poor households.

Further to the overall incidence of fuel poverty it is important to consider its depth. Figure 20 - shows the percentage of households in increasing depth of fuel poverty - those spending more than 10%, 15% and 20% of their income on fuel.

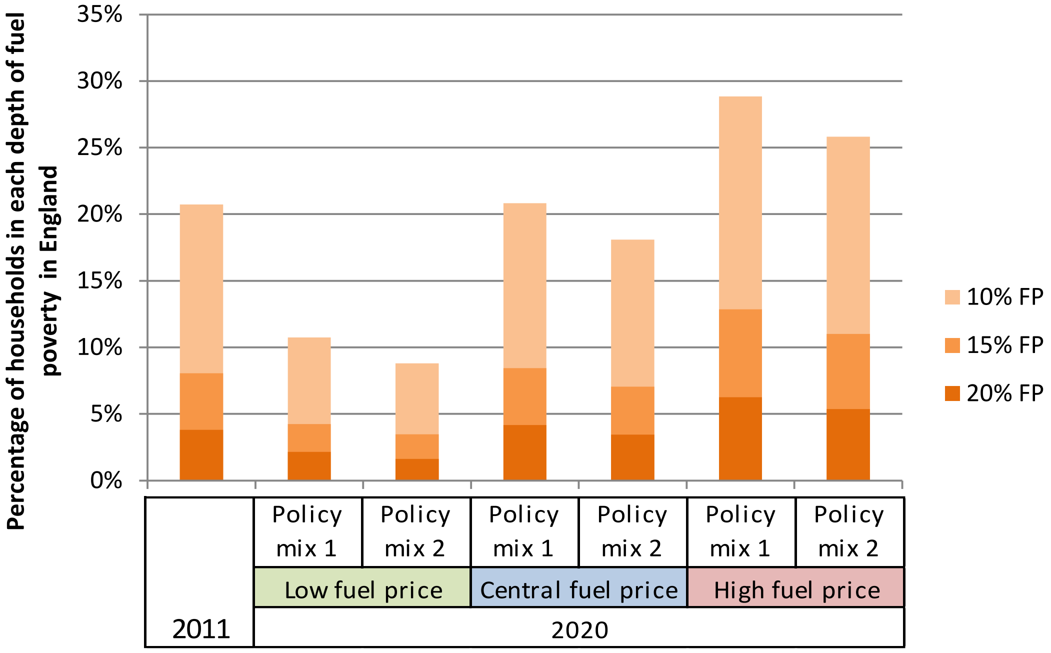


Figure 20 - Depth of fuel poverty (current definition) in 2020

The Policy Mix 2 scenarios not only result in a lower incidence of fuel poverty as discussed above, but also have the added advantage of a more favourable profile of fuel poverty depth within the fuel poor population – they help reduce the incidence of those needing to spend more than 20% of their income of energy. This is owing to a higher level of energy efficiency improvement, deployed in a more targeted manner.

Hills Definition

The Hills Fuel Poverty Review has proposed a new fuel poverty definition based on equivalised median income and required fuel costs. Table 12 and Figure 21 -below respectively show the number and percentage of English households classified as fuel poor based on the new Hills definition. It is clear that the changing median incomes and required fuel costs under the Hills definition mean that there is little movement in the incidence of fuel poverty across the scenarios (ranging from 2.36 to 2.67 million households).

Table 12: Number of households considered fuel poor under the Hills definition[56]

	High fuel price		Central fuel price		Low fuel price	
	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2
2011	2.65m	2.65m	2.65m	2.65m	2.65m	2.65m
2016	2.75m	2.72m	2.70m	2.65m	2.49m	2.48m
2020	2.67m	2.62m	2.56m	2.50m	2.44m	2.36m
Median Energy Bill (eq.)	*£1,943*	*£1,830*	*£1,621*	*£1,515*	*£1,171*	*£1,081*

The Hills definition is successful in one of its objectives: it greatly reduces the sensitivity of fuel poverty numbers to fuel price variability which Hills sees as a weakness of the existing definition – the number of households deemed to be fuel poor ranges by fewer than 270,000 across fuel price scenarios despite a wide range in 2020 energy prices.

However comparing the Policy Mix variants under the Hills definition highlights the remarkably small effect higher energy efficiency deployment has on this metric, despite Policy Mix 2 reducing the equivalised median energy bill by £90 to £113 in comparison to Policy Mix 1: fuel poverty numbers vary by between 50,000 and 80,000 between the policy mix scenarios. The insensitivity of the number of fuel poor households to the energy efficiency improvements raises important questions about the methods Government would use to tackle fuel poverty if such a definition were adopted.

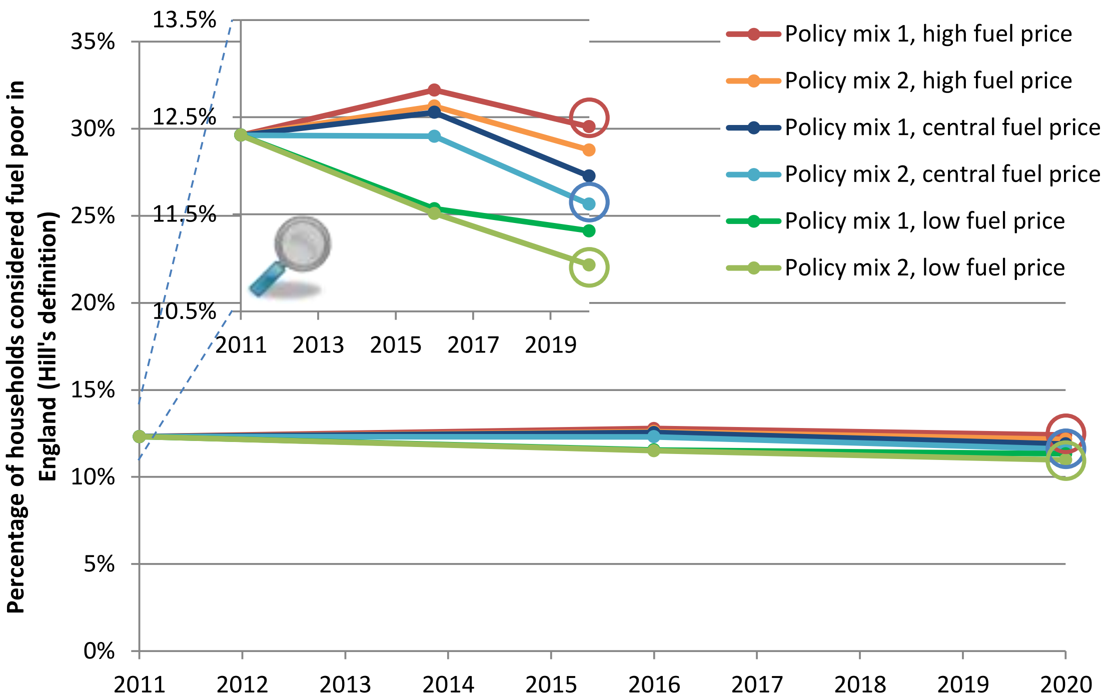


Figure 21 - Percentage of households in fuel poverty according to Hills definition. The circles indicate the percentage of fuel poor households under the counterfactual scenarios for the High (red), Central (blue) and Low (green) Fuel Price scenarios.

[56] The median income in 2020 is £13,809 in 2011 prices, based on a return to income growth in early 2013 and an average growth rate of 2% above inflation from 2015. The growth rates are applied differently to those in different income deciles. A full explanation is given in Appendix 1 Section 0.

The Hill's definition uses an additional metric to measure the depth of fuel poverty: the 'fuel poverty gap'. It is calculated by assessing the amount by which a household's theoretical energy bills would need to reduce for the household to no longer be fuel poor, and adds up the totals across the housing stock.

Figure 22 -presents the fuel poverty gap in our scenarios through to 2020. This metric shows considerably more variation across the six scenarios than the number of households in fuel poverty does – both across the fuel price scenarios and between the policy variants. Under High Fuel Prices, and despite the fact that the incidence of fuel poverty falls under both policy variants, the fuel poverty gap actually widens between 2016 and 2020. This indicates the considerably worsening depth of fuel poverty for this (slightly) smaller number of households than in 2016. Under Central Fuel Price assumptions, the slightly larger reduction in the number of households in fuel poverty between 2016 and 2020 is matched by smaller fuel poverty gap.

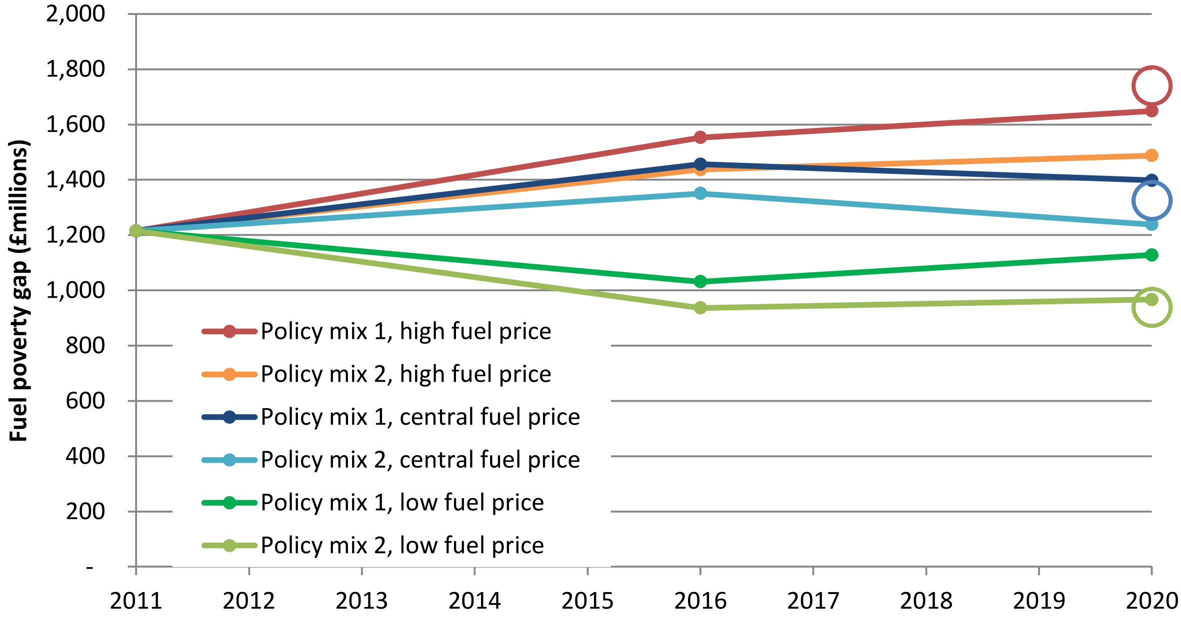


Figure 22 - Size of fuel poverty gap, Hills definition. The circles indicate the percentage of fuel poor households under the counterfactual scenarios for the High (red), Central (blue) and Low (green) Fuel Price scenarios.

Across the three fuel price scenarios in 2020, Policy Mix 1 widens the fuel poverty gap consistently by approximately £180m compared to Policy Mix 2. The fact that this difference is consistent compared to the wide variation in the fuel poverty gap under different fuel prices indicates the clear beneficial effect a higher level of energy efficiency deployment has on households defined by Hills as being in fuel poverty.

The performance of the scenarios against the counterfactual bills in 2020 is nearly identical to that seen with the number of households under the current definition. The performance varies across the scenarios, but in general the scenarios perform worse against the counterfactuals when looking at the fuel poverty gap than they do when looking at average bills. As discussed earlier, this is a function of the fuel poor households being more likely to heat with electricity and less likely to receive support through the policies: they have a greater proportion of 'losers' than the housing stock as a whole.

5.3 'Winners' and 'Losers'

DIMPSA is designed to simulate energy policy by distributing measures to households based on physical property characteristics and demographics. For example, for the household to receive a free cavity wall installation under CERT in 2012 the property must have an unfilled cavity and the householder must qualify for the Super Priority Group. The simulation of policy in 2012 will first filter the cases by these criteria and then use a seeded randomisation function to select winners from within this group.

The 'winners' and 'losers' can be broadly separated into those households that receive energy efficiency measures or renewable energy technologies (for both heat and power). DIMPSA also deploys smart meters to the majority of households by 2020. However, as the energy savings associated with smart meters are relatively small (2% to 3% demand reduction) the measure is excluded from the winners category. Similarly all households benefit[57] from Product Policy and as such are not included in the winners category, as the purpose of this division is to identify the impacts of major interventions.

Table 13 - Cumulative winners and losers by policy scenario to 2020

Beneficiary	Policy mix 1	Policy mix 2
Loser	12,323,862	6,226,89
Winner	12,092,466	18,189,434

Table 13 above shows the cumulative total of 'winners' and 'losers' under each scenario. Under the Policy Mix 2 scenario, 75% of households benefit from measures. This is considerably higher than under Policy Mix 1. The main driver for the additional number of beneficiaries under Policy Mix 1 is the focus on more cost effective energy efficiency measures as a result of the analysis performed in ACE's *'Dead CERT'* report[58]: particularly cavity wall insulation and loft top-ups (see section 2.3.3). In addition to the higher number of measures Policy Mix 2 retains a larger share of measures targeting the Priority Group compared to Policy Mix 1, such as a higher proportion of solid wall installations targeting low income households under the ECO.

It is important to note that both scenarios include boiler churn and as such are not directly comparable with the analysis performed for DECC's AES. Under the two Policy Mix scenarios between 6.5 and 6.6 million gas condensing boilers are replaced which has a significant impact on the total number of winners. The replacement of boilers is split between householder and Green Deal-funded replacements. Policy Mix 1 sees 11% of boilers installed under the Green Deal with a higher proportion of 30% under Policy Mix 2. Under both of these funding scenarios the costs are not borne by all households via their energy bills and as such this will improve the overall performance of energy policy.

Figure 23 shows the mean total energy bill in 2020 for each of the scenarios deployed. Across the scenarios the mean total bill for a household receiving a measure in 2020 is £189-£381 lower than the average bill for those not receiving a measure. The average difference between

[57] Householders' share of Product Policy is based on the number of rooms in the property and LCF reported ownership of white and brown goods.
[58] (Guertler, Croft, and Carrington 2012)

the total energy bills for winners and losers in 2020 across all scenarios is £279 based on a bill of £1,434 for winners and £1,155 for losers.

The chart shows the expected trend of higher energy bills for the 'losers' under the Policy Mix 1 scenario as these households are exposed to higher policy costs. The receipt of measures results in a lower average bill for the winners with the mean bill under Policy Mix 2 being marginally lower than that for Policy Mix 1. The receipt of measures can therefore provide householders with some protection from higher policy costs.

The figure also shows the average bill for winners and losers in 2011. The average bill for a household that has gained a measure by 2020 is in 2011 already £141-£177 lower than the average household that doesn't receive a measure by 2020. This illustrates that 'losers' are more likely to live in homes that both heat with electricity and are more difficult or expensive to insulate.

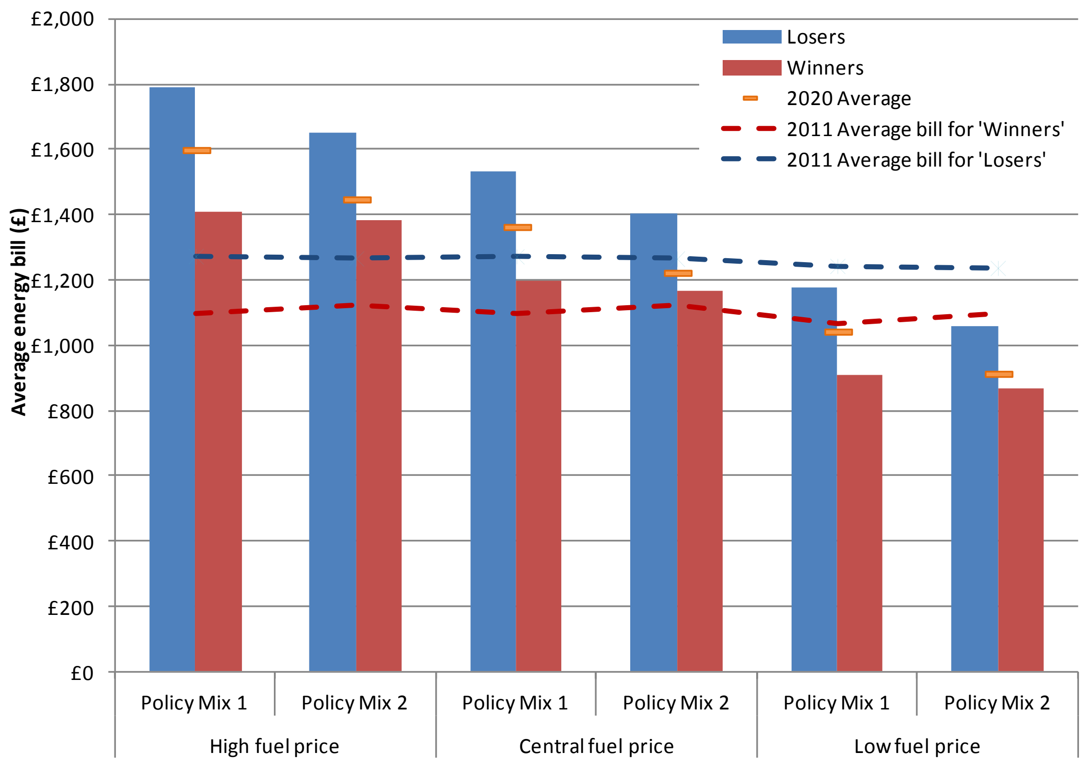


Figure 23 - Mean total energy bill in 2020 for the 'winners' and 'losers' by scenario

5.3.1 Results by Heating Fuels

Figure 24 below shows percentage change in the total energy bill when compared to the counterfactual energy bill in 2020 – by heating fuel for all households – for the Central Fuel Price scenarios. The results show an overall reduction in energy bills for Policy Mix 2 scenarios across all fuel types against the counterfactual bill.

The reduction in the average bill is lower for Policy Mix 1 scenarios, with an overall increase in bills for those heating with electricity. The difference is driven by two key factors, the higher numbers of measures under Policy Mix 2 and the higher policy costs under Policy Mix 1.

For properties that heat with electricity, Policy Mix 1 has a 3% higher demand for heat in 2020 on average than Policy Mix 2. This is a similar difference in demand between the scenarios to the remaining fuels, but overall the policy scenarios only reduce electric heating demand by 4%-7%, compared to average heat demand reduction of 9%-11% between 2011 and 2020.

As discussed, the level of environmental and social levies are higher on electricity than other fuels. Policy Mix 1 features an additional cost of 0.8-1.1 p/kWh across the scenarios compared to Policy Mix 2.

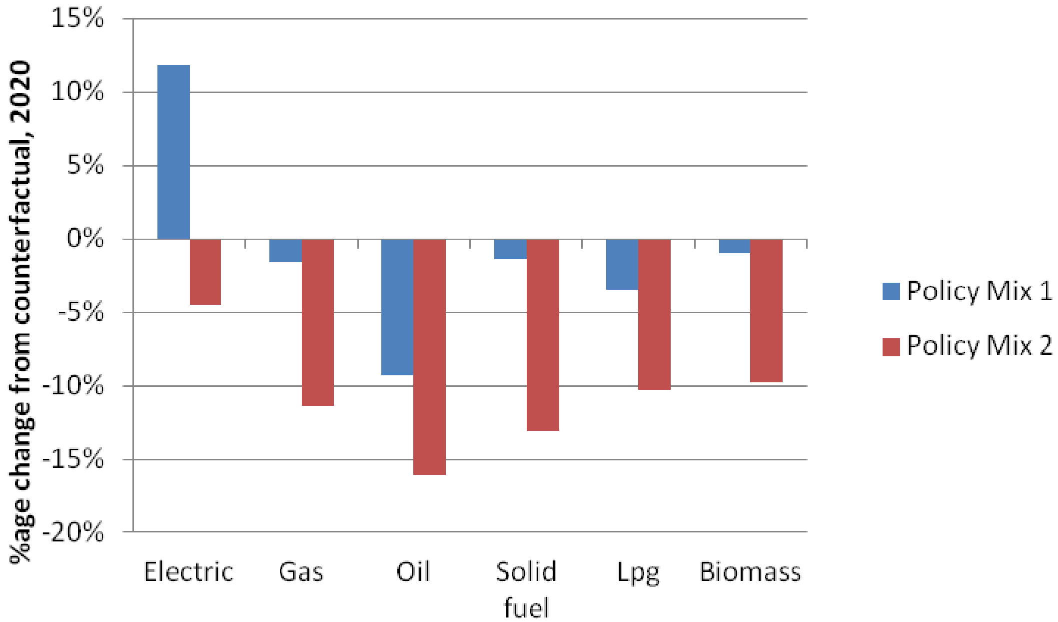


Figure 24 - Percentage change in energy bill compared to the counterfactual in 2020 for Policy Mix 1 and 2 by heating fuel

5.3.2 Results by household composition

Figure 25 shows the overall impact of the two policy scenarios by household composition. Policy Mix 2 again shows an overall positive impact on the energy bills of all household types with the reduction being greatest for households that contain a person over 60, households with children and lone parents. The overall trend is partly driven by the volume of measures being deployed and the higher eligibility for the Priority Group and Super Priority Group – that is for couples that are over 60 with no children, lone parent and people living on their own that are over 60. Couples with children and multi-person households tend to live in larger properties and as such have a greater opportunity for taking up renewable technologies in addition to the large volumes of insulation. Single adults under 60 have a higher prevalence of electricity for heating: 17.8% compared to the UK average of 10.3% which contributes to their lower saving under Policy Mix 2 and the increase in bills on average under Policy Mix 1.

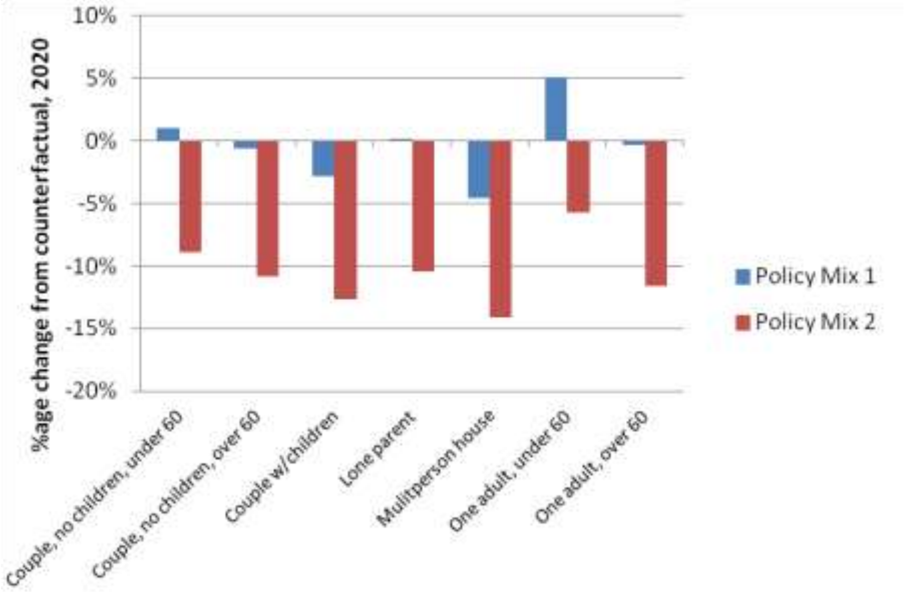


Figure 25 - Percentage change in energy bill compared to the counterfactual in 2020 for Policy Mix 1 and 2 by household composition

5.3.3 Results by Region

Figure 26 shows the results by English Government Office Region and devolved nations. The main result of interest is the significant saving for Northern Ireland under both policy mix scenarios and the slight increase for Scotland under Policy Mix 1. Northern Ireland has a high prevalence of oil heating and as such the main heating fuel is not subject to additional policy costs but eligible for the benefits in terms of energy saving.

Alongside this, the model does not contain a regional or national bias for take up, and as such this region has a relatively high take-up of energy efficiency measures, higher than might be expected based on historic evidence. Scotland has a higher than average proportion of households using electricity for heating (15.6% compared to 10.3%) and relative to the rest of the UK there are fewer opportunities for standard insulation measures.

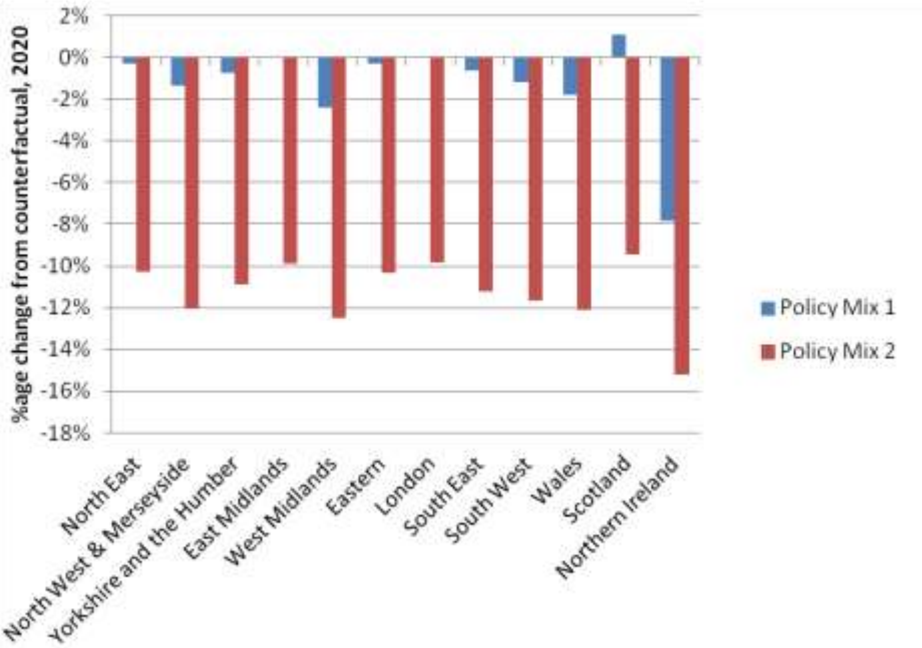


Figure 26 - Percentage change in energy bill compared to the counterfactual in 2020 for Policy Mix 1 and 2 by Government Office Region

5.3.4 Results by Tenure

Figure 27 shows the mean change in energy bill relative to the counterfactual by tenure. The main results of interest are the increase in bill for both social landlords and the private-rented sector for Policy Mix 1. Both social housing and the private-rented sector have a higher proportion of households that use electricity to heat their homes: 16.6% and 21.2% respectively. The exposure to the higher policy costs associated with electricity will be the key driver for this trend.

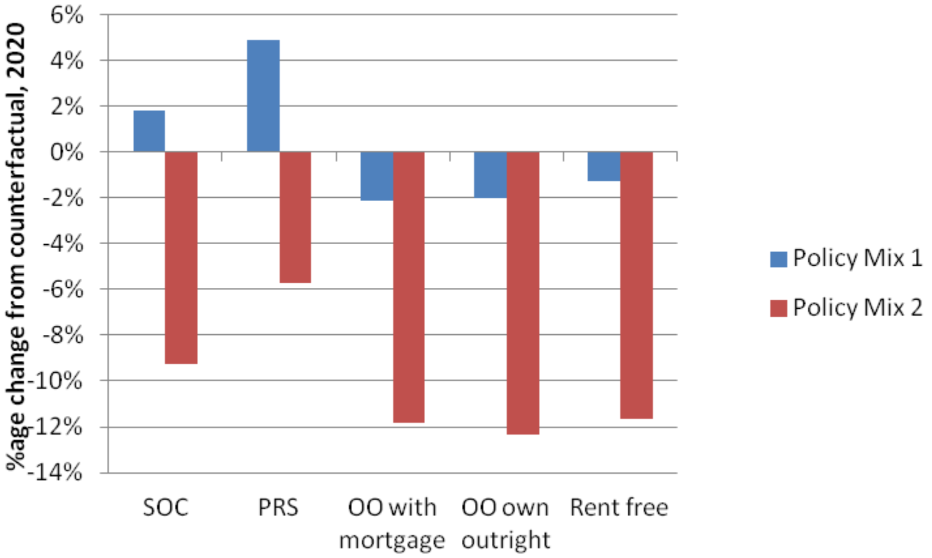


Figure 27 - Percentage change in energy bill compared to the counterfactual in 2020 for Policy Mix 1 and 2 by tenure

In addition, the social housing sector has lower mean consumption per household for both heat and power and as such will generate reduced absolute energy savings. Alongside this the properties tend to be smaller and as a result there is less opportunity for renewable technology adoption. The social housing sector also contains a higher proportion of flats. Unfortunately the information about flats in the Living Costs and Food survey (LCF) is limited and it is not therefore possible to determine the opportunity for community-scale opportunities such as PV or community heating[59].

The private-rented sector typically receives fewer measures due to the relatively high proportion of flats within this tenure. In turn this means that there are fewer opportunities for insulation and a number of renewable heat technologies are excluded.

Government plans to regulate this sector in England, requiring all rented properties to have a minimum EPC rating of E by 2018. Our two policy mix scenarios for the ECO and Green Deal distribute measures to this sector such that the take-up of solid wall insulation is comparable to that expected as a result of the regulations in 2018 – approximately 200,000 improved PRS dwellings.

5.3.1 Results by Built Form

Figure 28 shows the change relative to the counterfactual by built form. The highest savings are those associated with detached properties followed by semi-detached and then terraced homes.

[59] DIMPSA can identify properties that are already communally heated but is unable to identify new opportunities.

The main driver for this pattern is the size of the property with mean consumption falling in the same order, giving higher savings for larger properties. Alongside this the overall opportunity for renewables is greater in larger properties – for example, the required roof space for PV.

The savings are reduced in flats under Policy Mix 2, with an increase in bills within these properties compared to the counterfactual under Policy Mix 1. The key drivers for this are the lower mean values for energy consumption in flats and the reduced opportunity for energy efficiency measures to be installed. As mentioned the LCF has limited information on flats and as such the community-scale technological opportunities cannot be modelled. In addition flats have a far lower prevalence of gas heating and consequently cannot often benefit from the deployment of boilers, as well as being exposed to the higher policy costs associated with electric heating.

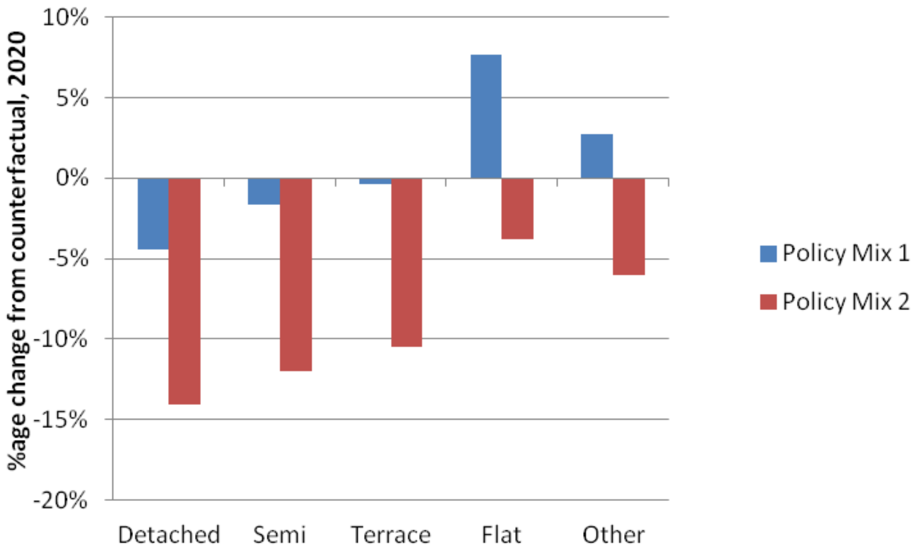


Figure 28 - Percentage change in energy bill compared to the counterfactual in 2020 for Policy Mix 1 and 2 by built-form[60]

[60] The 'other' category is a relatively small proportion of the LCF dataset and corresponds to 'unclassifiable' properties such as park homes and caravans.

6 Impact of the 'standing charge'

The majority of energy tariffs available to consumers in the UK have an element of fixed costs that are reflected in a standing charge (a fixed charge every day), or through a higher unit rate on the first block of energy units consumed[61] (the higher rate spreading those fixed costs across a block of kWhs, referred to as 'tier 1', which virtually all households are likely to consume). They reflect the fixed costs that suppliers face, though the level of supplier costs incurred and nature of the pass-through onto consumer bills is opaque.

Standing charges (which herein we use to describe tariffs with either a standing charge or a higher tier 1 unit rate) are to the relative detriment of those with below average energy consumption. They are costs that cannot be reduced by saving energy, meaning that for low consumers, the standing charge will make up a greater proportion of the energy bill. They act against the 'polluter-pays' principle by moderating the unit price, and making the marginal unit of energy consumed cheaper than both the first and the average unit.

Since the majority of low-income households are low users of energy, standing charges are commonly seen as regressive[62]. However, Ofgem supports the notion that tariffs should be cost-reflective – that is for costs to be levied upon consumers in the same way as costs are levied upon suppliers, with the fixed charge representing the fixed costs of supplying energy and the costs of meeting some of the suppliers' policy obligations.

Aware that the plethora of tariffs with different standing charges, tier 1 rates, and thresholds before tier two begins, are confusing consumers, Ofgem is seeking to simplify tariffs by standardising the standing charge[63]. To this end, they are currently consulting on how they should go about setting this. Of interest to this project in particular is whether the standing charge should be 'wide' (higher), encompassing a large share of transmission and distribution costs as well as energy and climate change policies, or whether the charge should be 'narrow' (lower) with a higher per unit charge than at present.

Below we present our analysis of the impact of standing charges at present, and the difference if Ofgem were to move to a 'wide' or 'narrow' standing charge.

6.1 Current standing charge

As set out in Section 0, we modelled the standing charges between 2011 and 2020 on the assumption that for the average consumer they were made up from the CERT, CESP, WHD and ECO policy costs, as well as a portion of the TDMO costs (10% for electricity, 25% for gas).

Figure 29 presents the average standing charge faced by consumers through to 2020. It shows two scenarios presented previously as the extreme cases, and a central scenario based on Central Fuel Prices and a Policy Mix 1.5 scenario[64] that will be used for the purpose of the standing charge analysis. In 2020, standing charges range from £124 to £176.

[61] Ebico doesn't – no fixed charges.
[62] (Preston, White, and Guertler 2010), (Croft and Carrington 2011)
[63] (Ofgem 2011c)
[64] This is a scenario half-way between Policy Mix 1 and Policy Mix 2, used only for the purpose of the standing charge analysis.

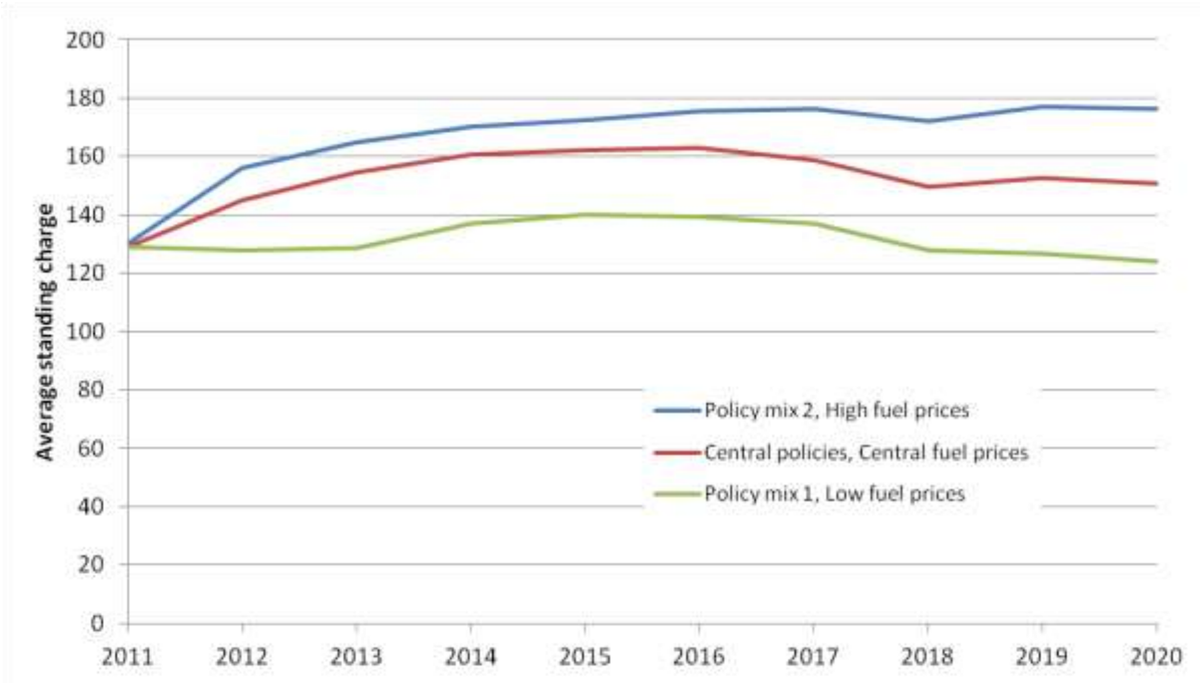


Figure 29 - Average standing charge that consumers face under three scenarios, 2011-2020.

Standing charges range from being 35% (£46) higher to 4% (£-5) lower by 2020. As illustrated in Figure 30 the charges are fairly consistent across expenditure deciles – the slight reduction across the lowest deciles is due to the higher proportion of these households using non-metered fuels, for which standing charges are less common.

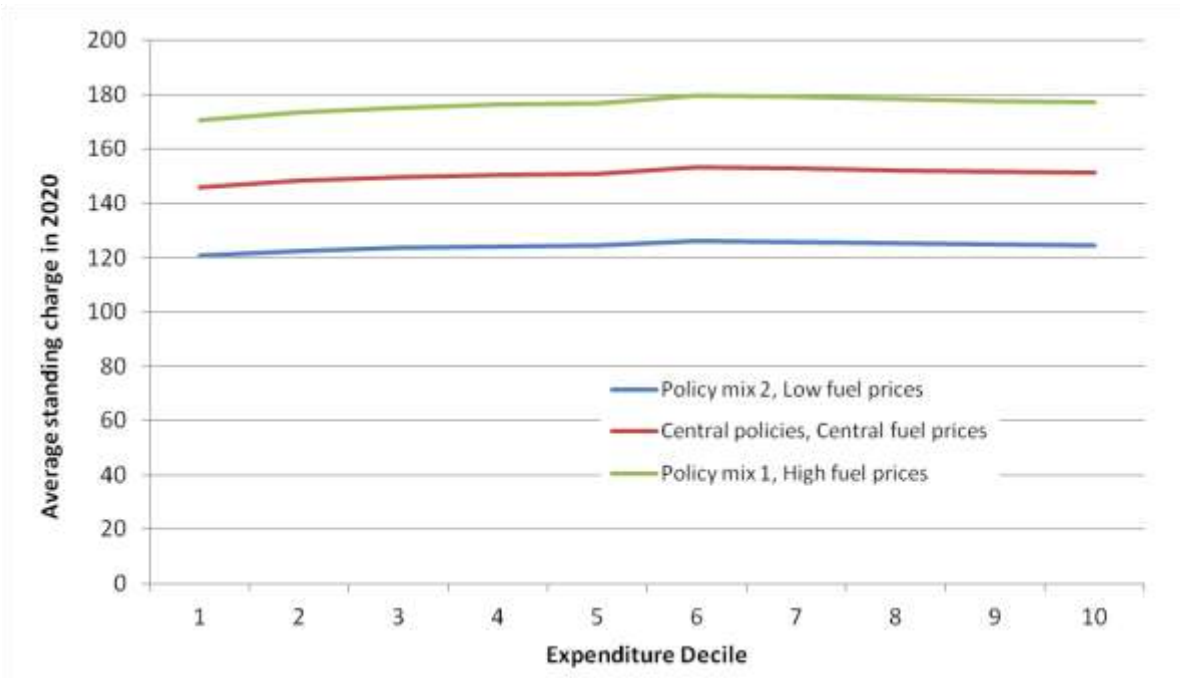


Figure 30 - Average standing charge by expenditure decile in 2020.

Though the absolute amount paid in standing charges is fairly consistent across expenditure deciles, this hides the greater proportion of the energy bill constituting the standing charge for low expenditure households on average. Figure 31 illustrates the proportion of the average bill constituted by the standing charge in 2020.

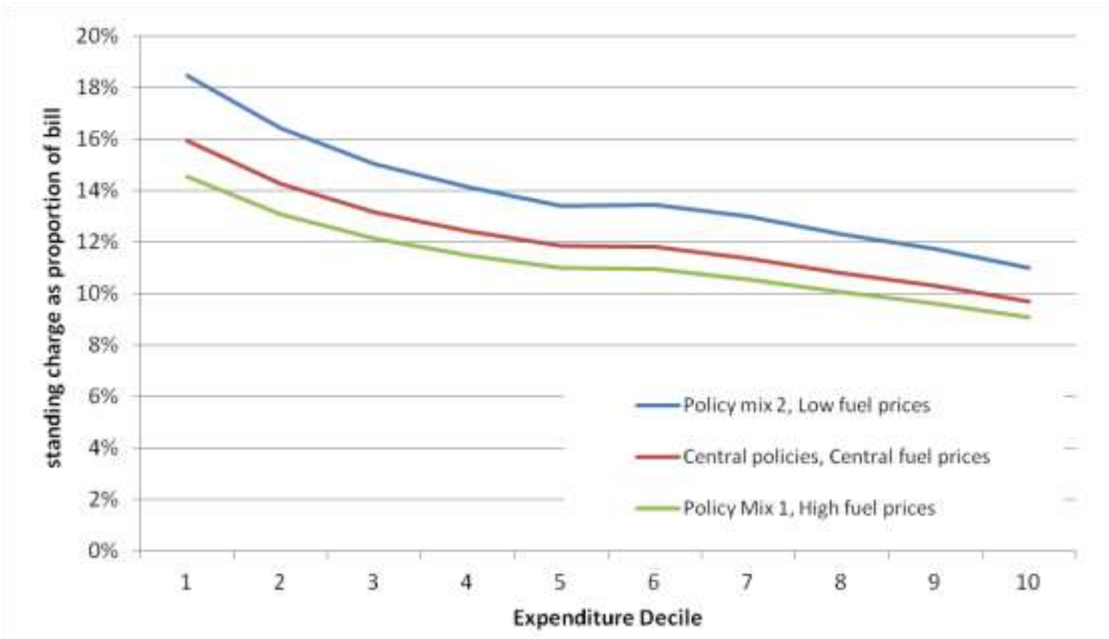


Figure 31 - Proportion of average bill due to standing charge in 2020 by expenditure decile

For the highest expenditure decile households, standing charges constitute between 9% and 11%, meaning that 89% to 91% of the bill is based on their consumption, and could be reduced by lowering demand. For the lowest expenditure decile households, between 15% and 18% of the average bill is due to a standing charge. For these households, only 82% to 85% is sensitive to the amount of energy consumed.

6.2 Impact of a wide or narrow standing charge

To assess the importance of standing charges on distributional impacts, and inform Ofgem's plans to standardise the standing charges, we have taken our Central Polices, Central Fuel Prices scenario[65] and modelled it with different approaches to the standing charge, designed to reflect the full range of possible outcomes:

- **Central Scenario, standard** – The standing charge is designed to reflect the current level of fixed costs experienced by consumers: covering an element of wholesale cost, transmission and distribution costs, and metering costs (TDMO). The costs of the ECO and the Warm Homes discount have then been added to this cost as a fixed per household element. This matches one of Ofgem's Retail Market Review proposals to add an element of policy costs to the fixed standing charges.
- **Central Scenario, narrow standing charge** – Under the narrow standing charge scenario the fixed costs for wholesale cost, network costs, transmission costs and distribution costs are the same. The ECO and WHD policy costs are then passed on to consumers on a per unit basis.
- **Central Scenario, wide standing charge** – The wide standing charge scenario features an expansion of the fixed costs experienced by consumers: 66% of the TDMO costs are applied as a fixed fee with the inclusion of the ECO and WHD on a per household basis.

Figure 32 illustrates the proportion of the bill across expenditure deciles under the different standing charge assumptions. A 'wide' variant would see 41% of a typical bill for the lowest

[65] Referred to simply as 'Central Scenario'.

expenditure decile households being due to the standing charge. At the other extreme, the narrow variant would reduce the standing charge to just 6% of the typical energy bill for those in the highest expenditure decile.

Total policy costs as a proportion of final energy bill in 2020 for the standard and narrow standing charge approach

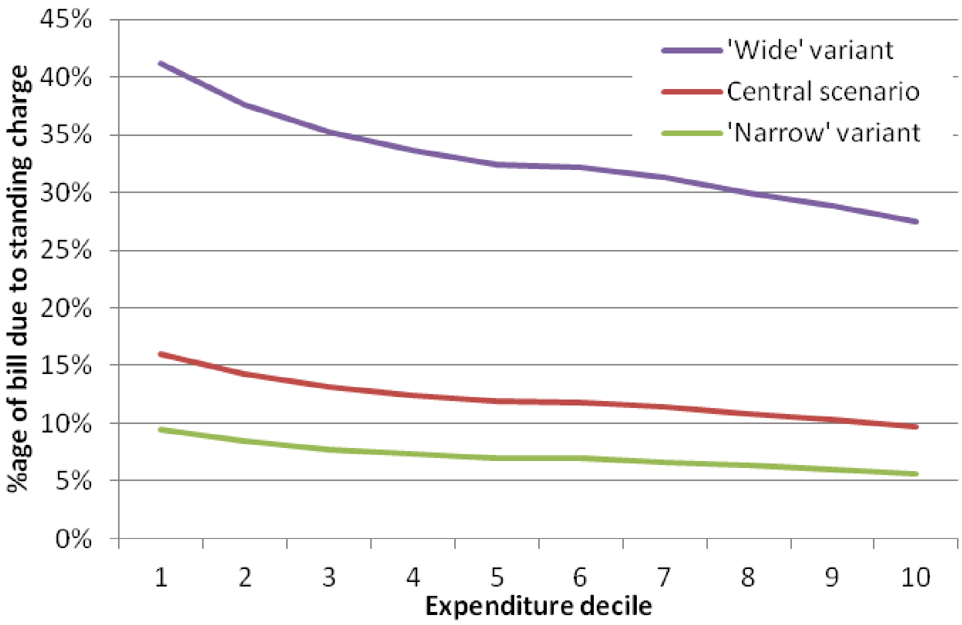


Figure 32 – Percentage of bill due to standing charge in 2020 by expenditure decile

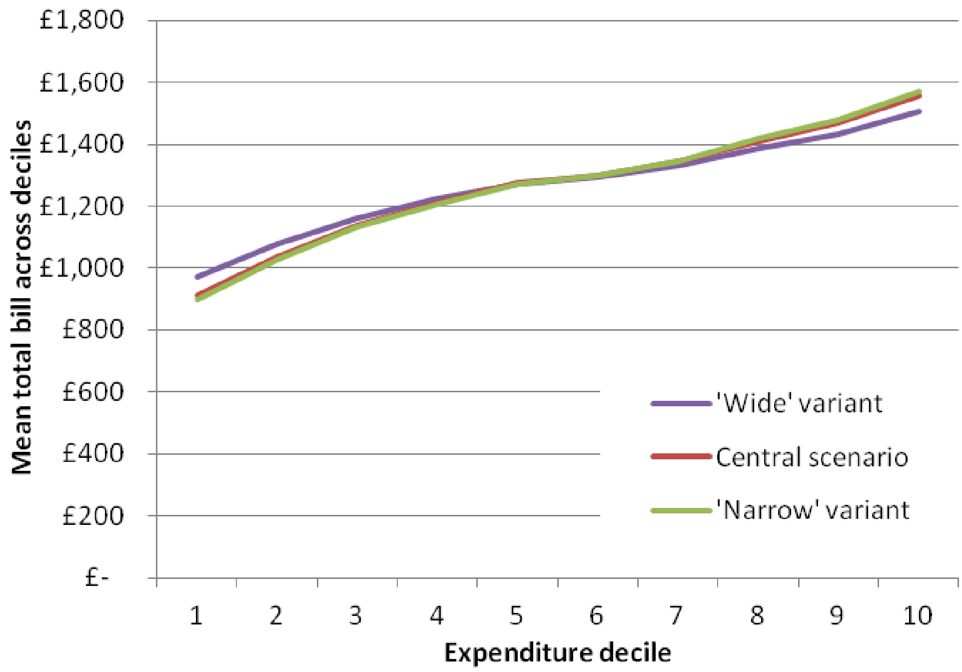


Figure 33 - Average energy bill in 2020 across expenditure deciles under different standing charge configurations.

Figure 33 illustrates the impact of those standing charges on the average energy bills across expenditure deciles. The wide variant would see the proportion of energy bills accounted for by the standing charge reach 41% for the lowest expenditure decile, with an absolute increase in fuel bills of £60 per year (7%). It would see the average bills of the highest expenditure decile reduce by £53 on average (3%) and bills become less reflective of consumption. As a result, such a move would see an increase share of total energy costs borne by the lowest expenditure households.

Conversely, the narrow standing charge would result in average bills reducing by £16 (2%) for the lowest expenditure households, as bills became more reflective of energy consumption. Those in the highest expenditure decile would spend £14 (1%) more each year.

These findings have implications for both the way Ofgem decides to implement their RMR reforms, and DECC choose to split the ECO obligation between energy suppliers. If DECC decide that the obligation will be split on the basis of the number of customers each supplier has, it is more likely that suppliers will pass these costs on as 'fixed' costs within a standing charge or the first tier of a two-tier tariff. However, if the ECO obligation is divided on the basis of units supplied by each supplier, this will make it more likely that the ECO will be passed on in the unit price.

The decision on the ECO will essentially lead to a narrow or wide standing charge. Our results suggest that DECC should divide the ECO between suppliers based on the amount of energy the supply rather than customer numbers, and that Ofgem should look to implement the narrowest standing charge possible. Removing standing charges altogether would only benefit the majority of low income households.

7 Conclusions

7.1 Energy Bills

Average fuel bills could be higher or lower by 2020. At the extremes, our scenarios indicate a potential range of £275 lower to £375 higher, though under a Central Fuel Price scenario bills are expected to increase by between £6 and £140. Despite this variability, **our scenarios indicate that, for average customers that heat their homes with gas, energy bills by 2020 will be less than if Government failed to implement a mix of climate and energy efficiency policies, and/or lower in absolute terms than in 2011.**

Final bills in 2020 were lower than under counterfactual scenarios (where energy and climate change policies were ended in 2012) in five out of the six scenarios. Under Policy Mix 2 scenarios, 2020 bills were between 9% and 15% lower than the counterfactual bills. Policy Mix 1 bills were lower than the counterfactual under the High and Central Fuel Price scenarios, at 4% and 1% respectively. Only under the Low Fuel Price scenario did the counterfactual perform better, with the Policy 1 scenario giving a 5% higher bill. However, in absolute terms this bill was still £150 lower than in 2011. **Across none of our scenarios were energy bills in 2020 both higher than in 2011 *and* higher than if the Government were to adopt a 'do-nothing' approach, abandoning all energy and climate policies this year.**

Policy Mix 2 performs better than Policy Mix 1 and the counterfactual bills across all fuel types and fuel price scenarios. For total fuel bills, Policy Mix 2 saves between £129 and £151 each year compared to Policy Mix 1. The higher deployment of lower cost measures such as loft and cavity wall insulation alongside lower policy costs is the key driver for this trend. **This underscores the importance of ensuring that low cost measures are fully adopted and programmes designed and delivered as a cost-effectively as possible.**

7.1.1 Gas bills

There is a wide range of potential gas bills in 2020, from a £256 reduction to a £246 increase for the average customer from the average 2011 bill. **Across all of our scenarios, the 2020 gas bills are lower than a counterfactual bill where all the energy and climate change policies** (their costs and their impacts from 2012 onwards) **were removed.**

Across the scenarios, the **gas bill in 2020 is almost entirely dictated by the changes in wholesale and network costs**, with 99.8% of the variance in final bills being explainable by these changes. Policies are set to increase gas bills by £11 to £12 but precipitate reductions to energy demand and fuel bills that save between £24 and £86 per year.

In 2020, wholesale and network costs account for between 87% and 91% of the average gas bill, with a further 4% to 9% due to policy costs, and 5% owing to VAT. Policy costs account for £34 to £36 of the bill cost, though this negates the fact that these policies have led to a net reduction in the gas bill across all scenarios. ECO represents the largest policy impact on the gas bill in 2020, making up 3% of the bill under the High Fuel Price scenarios, rising to 7% under the Low Fuel Price scenarios.

7.1.2 Electricity bills

Electricity bills in 2020 show a smaller range of changes than gas bills in our scenarios, and range from a £38 reduction to a £160 increase. If our Policy Mix 2 scenarios are followed, 2020 bills are £11 to £77 lower than in a counterfactual scenario that sees energy and climate change policies removed from 2012. However, 2020 bills are £25 to £86 higher than the counterfactual bills under the Policy Mix 1 scenarios.

A smaller proportion of the changes to the electricity bill (61%) can be explained by changes to the wholesale price than is seen with gas bills. Though still responsible for the majority of the change, the cost of energy and climate change polices is higher and the impact of the policies in reducing energy demand and fuel bills is greater than is the case for gas. In the absence of demand reduction, policies would add between £102 and £169 to the average electricity bill by 2020. **Policies lead to a reduction in fuel bills of between £129 and £191 per year, in all but two scenarios exceeding the costs of the policies themselves.**

The choice of Policy Mix results in a difference for the average 2020 gas bill of £29 under the High Fuel Price scenarios, falling to £6 under the Low Fuel Price scenarios. At lower fuel prices, the increased provision of energy saving measures has less of an impact on bill saving. **The Policy Mix scenarios have a much larger impact on electricity bills in 2020**, with a £98 to £103 difference between bills at a given fuel price. Around £30 of this difference is due to the Policy Mix 2 scenarios including an anticipated reduction in wholesale price in response to the EMR policy. The remainder is split between reduced policy costs (£33-£43) and greater reductions in demand and fuel expenditure (£27-£39) for Policy Mix 2.

In 2020, wholesale and network costs account for between 63% and 75% of the average electricity bill, with a further 20% to 32% due to policy costs, and 5% owing to VAT. Policy costs account for £116 to £175 of the bill cost, though for all but two of the scenarios the reduction in energy demand and fuel bills that these policies generate exceeds this cost. **The EMR and RO when combined represent the largest policy impact on bills of between 7% and 16%**. The absolute cost of these policies increases from between £40 and £64 under the High Fuel Price scenarios, and from between £57 and £90 under the Central Fuel Price scenarios. This difference across fuel price scenarios reflects the fact that if fuel prices are low, the cost of the Feed-in Tariff Contracts-for-Difference (FIT CfD) will be higher, since consumers will pay the difference between the wholesale price and the FiT CfD. The policy therefore acts to moderate price changes: under high price scenarios the policy costs rather less.

The EU ETS and the CFP together represent the second largest policy impact on bills by 2020, of 5% to 6%. Unlike other policies paid for by the consumer which ultimately directly fund or reimburse for the provision of lower carbon technologies, the EU ETS and CFP only impact on technological investment indirectly, through creating a carbon price. Whilst it may result in some switching of generation from coal to gas at the margin, the current and likely levels of the carbon price are unlikely to see low carbon technologies come online in the absence of other policy mechanisms. Once Phase 3 of the EU ETS begins and the CFP comes into effect in 2013, these charges on bills will ultimately see a transfer of monies from the consumer meeting the cost of carbon, to the Government who auctions the permits and sets the floor price. **There is an argument that these monies should be recycled back to consumers in the form of energy efficiency investments to help protect the fuel poor from price rises and further reduce carbon emissions**[66].

[66] Camco paper

7.2 Distributional Impact

Expenditure and Fuel Poverty

Whereas average bills are lower than the counterfactual bills for most scenarios, **the scenarios do not perform as well as the counterfactuals when looking at the impact on fuel poverty.** High Fuel Price scenarios outperform the counterfactual, whilst Low Fuel Price scenarios perform less well. For the Central Fuel Price scenarios, Policy Mix 1 is outperformed by the counterfactual, whilst Policy Mix 2 performs better than it.

There are a couple of reasons as to why the scenarios tend to perform better against counterfactuals when comparing average bills than fuel poverty numbers. The first is that by definition[67] fuel poor households' homes are less efficient that the average household; they have a much higher proportion of electric heating than average, and are more likely to live in difficult to treat solid wall homes. They are therefore **more likely to be disadvantaged by the increases in (especially) electricity and (to a lesser degree) gas prices resulting from the energy and climate change policies, and less likely to benefit from the energy reduction measures that these policies bring than the average household**.

Secondly, the nature of the current '10%' definition is that as energy prices rise and a greater proportion of households enter fuel poverty, **a small increase in prices pushes an ever greater number of households in to fuel poverty** – the 10% threshold is one over which households can be easily tipped. If fuel poor households need to pay slightly more for their energy need under the scenarios than they do under the counterfactual bills (owing to the greater proportion of electric heating) this can translate into a much larger number of additional fuel poor households.

The merits of the fuel poverty definition were recently studied by Professor Hills, who has issued his own recommendation for a new definition (Hills 2012). This would see a household being defined as fuel poor if both their relative income is low and their energy need is higher than the median household's need.

The Hills definition is successful in one of its objectives: it greatly reduces the sensitivity of fuel poverty numbers to fuel price variability which Hills sees as a weakness of the existing definition – fuel poor numbers vary by fewer than 270,000 households across fuel price scenarios despite a wide range in 2020 energy prices. However **the Hills definition also reduces the sensitivity of fuel poverty numbers to the provision of energy efficiency improvements.** The policy mix scenarios result in a variation of 80,000 fuel poor households or fewer across the scenarios.

Hills recommends an additional measure of fuel poverty: the 'fuel poverty gap', defined as the amounts by which the assessed energy needs of fuel poor households exceed the threshold for reasonable costs (i.e. more than the median household needs to pay). **Across the three fuel price scenarios, the Policy Mix 2 variant reduces the fuel poverty gap consistently by approximately £180m compared to Policy Mix 1.**

[67] Because fuel poverty is defined in terms of 'energy need'. This makes any household in an inefficient property more likely to be fuel poor.

'Winners' and 'Losers'

Whilst households on average see a decrease in their bills relative to the counterfactual, there remains a significant difference between those that do and do not benefit from the receipt of energy saving measures or fuel price support through the various policies. **Across all scenarios, the average difference between the total energy bill for those who receive (termed the 'winners') and those who don't receive measures (the 'losers') in 2020 is £279, based on an average bill of £1,155 for 'winners' and £1,434 for 'losers'.**

The key determinants for winners and losers are based on the technical opportunity for households to receive measures, the targeting of policy, and the heating fuels used. **The prevalence of electricity for heating seems to be a key driver, partly explaining the difference in bills between 'losers' under different policy mix scenarios: the higher cost of electricity under Policy Mix 1 leaving those with electricity heating systems that don't receive measures with higher bills.** This is of importance for low income households who are more likely to heat with electricity. 18.8% and 13.9% of households in income deciles 1 and 2 respectively heat with electricity compared to the UK average of 10.3%.

The targeting of policy measures at the priority group and the super priority group, coupled with the Warm Homes Discount for those on pensioners credit guarantee, helps drive a general trend of the greatest bill reduction for households that contain either a person over 60 or lone parents. **The greatest 'losers' appear to be single adults under 60 who have a higher prevalence of electricity for heating: 17.8% compared to the UK average of 10.3%.**

Both social landlords and the private rented sector have a higher proportion of households that use electricity to heat their homes: 16.6% and 21.2% respectively. The private rented sector and social housing also have a higher proportion of smaller properties and flats reducing the opportunity for energy efficiency and renewable technologies. **Households within these tenures see bills that are higher than the counterfactuals under Policy Mix 1, and higher than owner-occupied tenures across all scenarios.**

7.3 Standing Charges

Standing charges (which we use to describe tariffs with either a standing charge or a higher tier 1 unit rate) are to the relative detriment of those with below average energy consumption. They are costs that cannot be reduced by saving energy, meaning that for low consumers the standing charge will make up a greater proportion of the energy bill. They act against the 'polluter pays' principle by moderating the unit price, and making the marginal unit of energy consumed cheaper than both the first and the average unit price. **Since the majority of low-income households are low users of energy, standing charges are commonly seen as regressive[68].**

In 2020, standing charges range from £124 - £176 on the average total energy bill across our six scenarios, ranging from 35% higher to 4% lower by 2020, assuming the elements of the energy price contributing the standing charge continue to do so. For the highest expenditure decile households, standing charges constitute between 9% and 11% of these households' average bill, meaning that 89%-91% is based on their consumption, and could be reduced with reduced demand. **For the lowest expenditure decile households, 15%-18% of the average bill is**

[68] (Preston, White, and Guertler 2010), (Croft and Carrington 2011)

due to a standing charge. For these households, only 82%-85% is sensitive to the amount of energy consumed.

Ofgem are seeking to simplify tariffs by standardising the standing charge and eliminating unit charge 'tiers'(Ofgem 2011c). Our analysis suggests that **a 'wide' standing charge would affect the lower expenditure decile households most drastically: the proportion of energy bills accounted for by the standing charge under our scenario would reach 41%,** with an absolute increase in fuel bills of £60 per year (7%), whilst the average bills of the highest expenditure decile would fall by £53 on average (3%) and bills become less reflective of consumption. Conversely, the narrow standing charge would result in average bills falling by £16 (2%) for the lowest expenditure households, as bills became more reflective of energy consumption.

7.4 Lessons

Across all of our scenarios and across fuel types **the factor most likely to determine the average fuel bills in 2020 will be the costs of wholesale energy and the networks**. If wholesale prices follow a low fossil fuel price projection, then bills by 2020 are likely to be lower than today. If they follow a central or high price projection, bills will likely be higher. ***It is not true to say that policy costs are driving the cost of energy bills.***

In our scenarios, energy **bills in 2020 are <u>never</u> both higher than in 2011 *and* higher than if the Government adopted a 'do-nothing' approach**, abandoning all energy and climate policies this year. In other words customers are likely to face higher energy prices in 2020 in four out of our six scenarios due to higher fossil fuel costs. In all these scenarios the Government's future programme mitigates the rise in energy bills. There are two low fossil fuel price scenarios in which customer bills fall. In one the cost of policy is higher than the value of energy savings; while the overall bill is still lower than the average 2011 bill, it is higher than if policies had not been in place. In the last scenario the savings in energy are worth more than the cost of policy. Overall **the research finds the policy mix is an effective insurance against rising fossil fuel prices *<u>for the average customer</u>*.**

Policy Mix 2 consistently beats Policy Mix 1 and results in gas and electricity bills lower than a 'do nothing' counterfactual in all cases. The higher deployment of lower cost measures such as loft and cavity wall insulation alongside lower policy costs is the key driver for this trend. This underlies ***the importance of ensuring that low cost measures are fully adopted and bill-levied programmes designed and delivered as a cost-effectively as possible***.

Policy costs are levied far more greatly on to electricity bills than on to gas bills. This puts pressure on those heating with electricity, and requires an ambitious and successful products policy in order to help mitigate the impact of the higher prices.

The EU ETS and CFP are the only policies that do not directly fund or reimburse companies for the provision of lower carbon technologies. Instead they send an indirect investment signal through a carbon price. **Once Phase 3 of the EU ETS begins and the CFP comes into effect in 2013, these charges on bills will ultimately see a transfer of monies from the consumer meeting the cost of carbon, to the Government** who auction the permits and set the floor price. There is an argument that these monies should be recycled back to consumers in the form of energy efficiency investments to help protect the fuel poor from price rises and further reduce carbon emissions(Camco 2012).

Additional assistance must be aimed at supporting those heating with electricity. Whilst the electrification of heat is a long term aim of Government, the increases in electricity costs and the inefficiency of most existing systems puts these households at real risk of energy affordability. Households heating with electricity are more likely to be low income and in fuel poverty. Prioritising energy efficiency improvements for these households and (potentially) more efficient electric heating systems would help address this inequity.

The proposed Hills fuel poverty definition is insensitive to stock-wide energy efficiency improvements. Under the existing definition, the different policy mixes result in a difference in fuel poverty numbers of up to 650,000. Under the Hills definition, this drops to 80,000. The problem presented by a definition which makes it impossible to reduce the number of households in fuel poverty by improving energy efficiency has been raised by others. ***DECC must seek to improve the Hills definition so that the reduced energy bills and improved comfort achieved by energy efficiency gains are reflected in the number of fuel poor households.***

Ofgem should move to deliver the narrowest possible standing charge as part of their Retail Market Review changes, in order to best protect the majority of low income low-consuming households. Standing charges and two-tier tariffs may be cost-reflective but are ultimately regressive. ***Ofgem might consider whether the benefits of tariffs featuring just a unit rate (less regressive, in line with 'polluter pays', more easily understood by consumers allowing greater tariff comparability) outweigh the drawbacks (not cost-reflective).***

Appendix 1 - Assumptions

Current energy prices

Based on analysis from DECC[69] and Ofgem[70], Table A1 sets out the breakdown of a typical unit of electricity in 2011.

Table A1 - Electricity unit breakdown 2011

Bill component	p/kWh	% Unit cost
Wholesale energy cost	6.50	43.5%
Transmission, distribution and metering	2.82	18.9%
Transmission	*0.51*	*3%*
Distribution	*2.18*	*15%*
Metering	*0.13*	*1%*
Other supplier costs and margin	3.38	22.6%
Energy and climate change policies	1.53	10.2%
CERT Extension	*0.43*	*2.9%*
EU ETS	*0.49*	*3.3%*
RO	*0.43*	*2.9%*
Warm Home Discount	*0.12*	*0.8%*
CESP	*0.03*	*0.2%*
FITs	*0.03*	*0.2%*
Better billing	*0.00*	*0.0%*
VAT (5%)	0.71	4.8%[71]
Total	**14.95**	**100%**

[69] (DECC 2011a)
[70] (Ofgem 2011d)
[71] VAT is levied at 5% of the unit price. It then represents 4.8% of the new total unit price.

The same analysis forms the breakdown of the gas unit costs in Table A2.

Table A2 - Gas unit breakdown 2011

Bill component	p/kWh	% Unit cost
Wholesale energy cost	2.09	51%
Transmission, distribution and metering	0.77	19%
Transmission	*0.09*	*2%*
Distribution	*0.65*	*16%*
Metering	*0.03*	*1%*
Other supplier costs and margin	0.85	21%
Energy and climate change policies	0.17	4%
CERT Extension	*0.13*	*3%*
Warm Home Discount	*0.03*	*1%*
CESP	*0.01*	*0%*
Better billing	*0.00*	*0%*
VAT (5%)	0.19	5%
Total	**4.07**	**100%**

Wholesale prices and networks

Wholesale prices

Three scenarios for the wholesale prices have been developed, based on DECC assumptions for the wholesale price in 2020[72] and their projections for the wholesale price of gas to 2020[73].

Table A3 - Wholesale electricity price scenarios

Wholesale electricity price (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
High	6.2	7.1	7.6	7.4	7.2	7.1	7.6	7.6	8.0	8.1
Central	6.2	6.5	7.0	6.8	6.8	6.9	6.9	6.6	6.6	6.8
Low	5.5	4.7	4.4	4.6	4.5	4.2	4.4	4.2	4.5	4.9

Table A4 - Wholesale electricity price scenarios

Wholesale gas price (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
High	2.1	2.6	2.7	2.7	2.8	2.9	2.9	3.0	3.1	3.1
Central	2.1	2.3	2.5	2.7	2.7	2.7	2.5	2.3	2.3	2.3
Low	2.1	1.6	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2

[72] (DECC 2011a)
[73] (DECC 2011g)

Transmission

The costs of upgrading the electricity transmission network, incorporating offshore connections and HVDC (high voltage direct current) 'bootstraps' has been projected using analysis from Redpoint Energy[74] and National Grid[75]. Figure A1 illustrates two scenarios from the Redpoint analysis illustrating the projected change in transmission revenues under different charge arrangements.

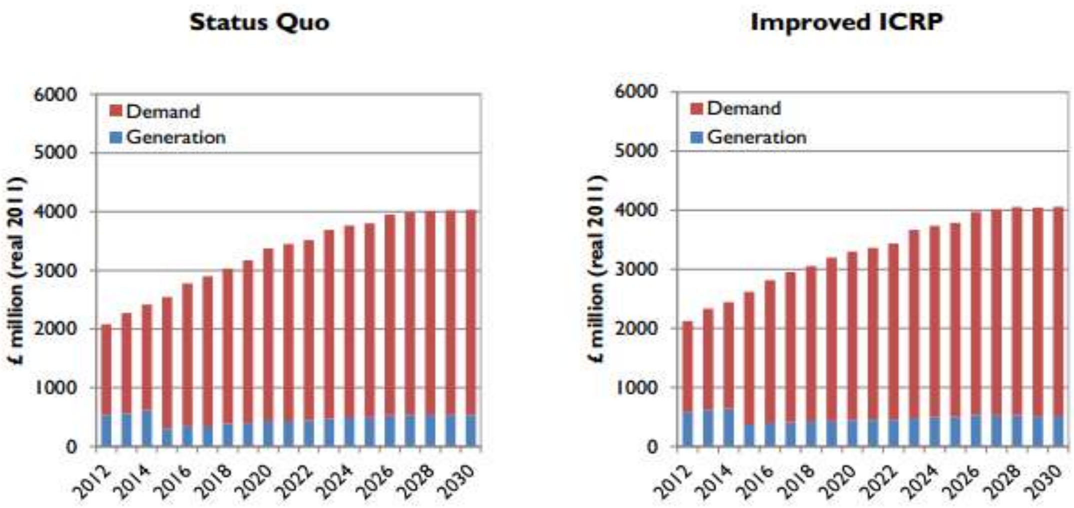


Figure A1 – Maximum Allowed Revenue (MAR) under different transmission charging arrangements. Redpoint Energy, 2011.

Table A5 –Transmission cost assumptions, electricity

Electricity transmission costs[76] (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Status Quo (Redpoint)	0.51	0.65	0.72	0.77	0.95	1.02	1.08	1.11	1.16	1.22
ICRP+ (Redpoint)	0.51	0.65	0.72	0.77	0.95	1.02	1.07	1.11	1.15	1.19
National Grid	0.51	0.56	0.60	0.64	0.79	0.83	0.87	0.91	0.95	0.99

[74] (Redpoint Energy 2011)
[75] (National Grid 2011)
[76] These costs are calculated in the same way as Ofgem calculate the impact of distribution costs on consumer bills: applying the proportional increase in allowed revenue to the typical costs met by consumers in the first year.

Table A5 gives the electricity transmission costs for all three scenarios between 2011 and 2020. All are calculated in the same way:

- Establish the revenue share met by energy consumers; assumed to be 73% until 2015 when it changes to 85%[77]. The balance is borne by generators
- Establish the cost per kWh in each year, accounting for demand reduction by using DECC demand projections[78] through to 2020. Household and non-household customers are assumed to spend the same on a per kWh basis
- Apply the proportional increase to the 2011 transmission costs – 0.51p/kWh.

The cost of upgrading the gas transmission network is uncertain as RIIO-T1 is still being finalised. These assumptions have been constructed by projecting forward the increases under TPCR4 into future years, and in using the proposed business plan from National Grid[79]. In the case of the latter, the assumed increase in revenue was applied to the 2011 transmission cost – 0.09p/kWh.

Table A6 - Transmission cost assumptions, gas

Gas transmission costs (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
BAU	0.09	0.10	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17
National Grid	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.13

[77] Currently 27% of revenue is recovered through charges on generators and 73% from charges on demand. The changes to a 15:85 split in 2015 reflect the EU Tariffication Guidelines which reduces generation tariffs and increases demand charges.
[78] (DECC 2011b) – Annex C
[79] (National Grid 2011)

Distribution

The cost of upgrading the electricity distribution network is uncertain beyond the end of the DPCR5 in 2015, when RIIO-ED1 will begin. These projected costs have been calculated by projecting the annual increase through DPCR5 through to the end of 2020, or, beyond 2015, applying an increase in costs in line with the projected transmission costs as modelled by Redpoint[80].

Table A7 - Electricity distribution cost scenarios

Electricity distribution costs (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
BAU	2.18	2.31	2.44	2.57	2.70	2.83	2.96	3.09	3.22	3.35
Following T1 through RIIO	2.18	2.31	2.44	2.57	2.70	2.91	3.07	3.16	3.30	3.48

The costs of upgrading the gas distribution network is uncertain once the 2007-2012 price controls end, with RIIO-GD1 still being finalised. These assumptions are constructed by projecting forward the annual increases under the current price controls. We also looked at the submissions from the gas distribution companies. Averaging their expected increases gave us the same resulting impact on unit price output. As such, only one scenario was used.

Table A8 – Gas distribution cost assumption

Gas distribution costs (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Central	0.65	0.66	0.68	0.69	0.70	0.72	0.73	0.74	0.76	0.77

[80] (Redpoint Energy 2011)

Metering

These metering costs are based on DECC's Smart Metering impact assessment, which project the annual reduction in metering charges. They exclude the costs of the smart meter roll-out (accounted for separately).

Table A9 - Metering cost scenarios, electricity

Electricity metering costs (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
High	0.13	0.12	0.11	0.09	0.07	0.04	0.02	0.01	0.01	0.01
Central	0.13	0.12	0.12	0.10	0.08	0.06	0.04	0.02	0.01	0.01
Low	0.13	0.13	0.12	0.11	0.09	0.07	0.05	0.03	0.02	0.01

Table A10 - Metering cost scenarios, gas

Gas metering costs (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
High	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.00	0.00	0.00
Central	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.00	0.00	0.00
Low	0.03	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.00	0.00

Other supplier costs and profit

We use three variants of 'other costs and margin' that reflect different possibilities:

- a low scenario where supplier margins narrow through enhanced competition and the costs to serve each customer fall,
- a central business as usual scenario where cost increases are in proportion to wholesale price rises,
- a high scenario that reflects a world in which the costs to supply each customer increase, balancing costs increase with a greater proportion met by consumers rather than generating plant, and/or supplier margins widen.

The three scenarios show the same proportional change as the wholesale price scenarios.

Table A11 – Other supplier cost and profit scenarios, electricity

'other' electricity costs p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Low	3.38	2.85	2.71	2.79	2.74	2.59	2.67	2.58	2.74	3.02
Central	3.38	3.55	3.83	3.73	3.73	3.75	3.75	3.59	3.60	3.70
High	3.38	3.86	4.13	4.01	3.90	3.89	4.12	4.12	4.33	4.40

Table A12 - Other supplier cost and profit scenarios, gas

Other gas costs (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Low	0.85	0.53	0.20	0.22	0.22	0.22	0.24	0.24	0.26	0.28
Central	0.85	0.93	0.99	1.07	1.09	1.09	1.02	0.94	0.94	0.94
High	0.85	1.13	1.17	1.20	1.24	1.27	1.31	1.34	1.38	1.42

Policies that don't deliver energy efficiency measures

Smart Meters

The impact on bills of the smart meter roll-out is projected using DECC's 2011 Impact Assessment[81]. We use only one scenario for Smart Meters.

Table A13 - Smart meter roll-out cost assumption, electricity

Smart metering costs, electric (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Central	0.0	0.014	0.026	0.110	0.182	0.197	0.198	0.143	0.060	0.028

Table A14 - Smart meter roll-out cost assumption, gas

Smart metering costs, gas (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Central	0.0	0.004	0.008	0.030	0.049	0.050	0.050	0.035	0.014	0.007

[81] (DECC 2011h)

EU ETS and Carbon Floor Price

The EU ETS and CFP scenarios have been taken from work by DECC(DECC 2011a) and Camco(Camco 2012) which is summarised in the tables below.

Table A15 - EU ETS cost assumptions

EU ETS cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Camco	0.60	0.61	0.62	0.67	0.73	0.74	0.78	0.83	0.86	0.88
DECC	0.51	0.53	0.55	0.66	0.78	0.80	0.88	0.98	1.05	1.09

Table A16 - Carbon Floor Price cost assumptions

Carbon Price Floor cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Camco			0.12	0.16	0.19	0.21	0.21	0.22	0.24	0.24
DECC			0.06	0.08	0.10	0.11	0.11	0.11	0.12	0.12

Table A17 – Combined EU ETS and CPF cost assumptions

EU ETS & CPF (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Camco	0.60	0.61	0.74	0.83	0.92	0.95	0.99	1.05	1.10	1.12
DECC	0.49	0.51	0.59	0.70	0.84	0.87	0.94	1.05	1.11	1.15

Renewables Obligation

The RO costs are based on our analysis of the Pöyry report to DECC on the proposed renewable obligation bandings to estimate the costs to consumers[82]. We used the obligation level in renewable obligation certificates (ROCs) shown in figures 8, 9 and 11 in Pöyry's report, historical data for the buyout price from Ofgem, and Figure 15 showing total policy costs to estimate the cost pass through. To provide a range of inputs for the study the low and high scenarios have allowed for a range of plus/minus 20% from the calculated value.

Table A18 - Renewables obligation cost scenarios

RO electricity cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Minimal scope –20%	0.485	0.643	0.779	0.871	0.978	0.908	1.087	1.105	1.118	1.180
Minimal scope +20%	0.485	0.778	1.029	1.198	1.397	1.267	1.598	1.631	1.655	1.770

Electricity Market Reform (Capacity mechanism, Cfd FITs, EPS)

The EMR costs are based around DECC's central assumption in the Impact Assessment. Given the uncertainty over the policy, variants have been created 20% above and below these costs. In addition, the cost of EMR is closely related to the fossil fuel price, due to CfD FITs – at higher fossil fuel prices, the cost of CfD FITs will fall. As such, we present the impact on unit price by fuel price scenario as well as policy scenario.

Table A19 - Electricity Market Review cost scenarios

EMR electricity cost (p/kWh real 2010 prices)		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EMR (low FF prices)	**EMR + 20%**				0.212	0.439	0.563	0.719	0.871	0.849	1.425
	EMR - 20%				0.154	0.319	0.410	0.523	0.633	0.618	1.036
EMR (central FF prices)	**EMR + 20%**				0.212	0.351	0.482	0.586	0.679	0.849	1.008
	EMR - 20%				0.154	0.256	0.351	0.426	0.494	0.618	0.733
EMR (high FF prices)	**EMR + 20%**				0.159	0.246	0.317	0.386	0.418	0.468	0.504
	EMR - 20%				0.116	0.179	0.230	0.281	0.304	0.340	0.366

In addition, DECC assume that EMR reduces the wholesale price of electricity by 0.5p/kWh by 2020 due to the lower wholesale cost of the marginal electricity generator as a result of the polices. We add this saving to the wholesale price within the Policy Mix 2 scenarios.

[82] (Pöyry 2011)

Warm Homes Discount

We assume that the Warm Home Discount (WHD) continues at the same level of spend between 2013 and 2020. The figures given below give an effective unit cost of the policy based on the average fuel bill. In reality the costs of the WHD are likely to be passed on through the standing charge or the tier one tariff, and so the effective unit price will change with consumption. Only one WHD scenario has been modelled.

Table A20 – Warm Homes Discount assumption, electricity

WHD electricity cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Central scenario	0.12	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14

Table A21 - Warm Homes Discount cost assumption, gas

WHD gas cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Central scenario	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

Policies with measures

Carbon Emission Reduction Target (CERT)

CERT is the primary policy that delivers energy efficiency measures and will run until the end of 2012. As with the WHD, the figures given below give an effective unit cost of the policy based on the average fuel bill. In reality the costs of CERT are likely to be passed on to consumers through the standing charge or the tier one tariff, and so the effective unit price will change with consumption. Only one CERT scenario has been modelled, based on the DECC AES(DECC 2011a).

Table A22 - CERT cost assumptions, electricity

CERT electricity cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DECC AES	0.43	0.43								

Table A23 - CERT cost assumptions, gas

CERT gas cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DECC AES	0.13	0.13								

Table A24 – Measures installed annually under CERT

CERT Measures	2012	2013	2014	2015	2016	2017	2018	2019	2020
Cavity Wall Insulation	922,980								
Loft Insulation - top up	260,000								
Loft Insulation - full	920,000								
Solid Wall Insulation	12,000								

These are based on ACE's analysis in Dead CERT(Guertler, Croft, and Carrington 2012) based on suppliers meeting their target in 2012, through a higher proportion of loft and cavity wall insulation and less solid wall insulation than anticipated in the IA illustrative mix.

Community Energy Saving Programme

CESP operates alongside CERT and will also finish at the end of 2012. It focussed on the area-based delivery of whole-house approaches, with more emphasis on more expensive insulation measures. As with CERT, the figures given below give an effective unit cost of the policy based on the average fuel bill. In reality the costs of CESP are likely to be passed on to consumers through the standing charge or the tier one tariff, and so the effective unit price will change with consumption. Only one CESP scenario has been modelled, based on the DECC AES(DECC 2011a).

Table A25 - CESP cost assumption, electricity

CESP electricity cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DECC AES	0.032	0.032								

Table A26 - CESP cost assumption, gas

CESP gas cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DECC AES	0.009	0.009								

Table A27 - Measures installed annually under CESP

CESP Measures	2012	2013	2014	2015	2016	2017	2018	2019	2020
Solid Wall Insulation	28,491								
Cavity Wall Insulation	8,620								
Loft Insulation	35,623								

Green Deal / ECO

CERT and CESP will be replaced by two policies: Green Deal allowing households to finance energy efficiency improvements, and the ECO which will provide subsidy for specific measures and specific households. The cost of ECO will be borne by all consumers; the cost of Green Deal finance will be met by the occupant of the improved property only.

Two Green Deal/ECO scenarios have been developed, both with broadly similar total costs. The first is based on DECC's draft Impact Assessment(DECC 2011c) giving a total cost of around £1.3bn/year that covers the costs of measure subsidy, scheme administration and economic rents (the latter at £0.5bn/year).

The second scenario has been built, based on the analysis within ACE's 'Dead CERT' report[83]. This scenario sees a continued focus on low-cost energy efficiency measures until such opportunities are exhausted. To minimise costs, measures delivered through the Green Deal at minimal subsidy levels are eligible to contribute to a higher overall ECO target. The lower cost carbon savings that accrue in this scenario allow for a greater proportion of expenditure on those considered most vulnerable. Whereas the DECC scenario sees most SWI going into the homes of those in a position to take up the Green Deal (generally assumed to be those of higher incomes who are less debt-adverse or able to contribute their own funds), the second scenario sees low income private-rented households and owner-occupied homes receiving the ECO-supported SWI measures. This means that a higher subsidy for SWI is provided, averaging 80% of the costs for SWI rather than 57% in the DECC scenario.

Boilers will also be delivered through the Green Deal and ECO. Both our scenarios assume almost 100,000 boilers are replaced through ECO's Affordable Warmth obligation. In addition, boilers are replaced via Green Deal financing. Our second scenario assumes that half of all boilers are replaced via Green Deal rather than bought outright. Only 20% are expected to be financed through Green Deal under the DECC scenario. In practice, the number delivered via the Green Deal does not affect the absolute number of boilers delivered.

Table A28 - Green Deal / ECO overall cost

Overall Cost (£bn real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DECC			£1.30	£1.42	£1.45	£1.49	£1.44	£1.30	£1,37	£1.30
ACE – Dead CERT			£1.47	£1.67	£1.75	£1.76	£1.68	£1.45	£1.37	£1.26

DECC currently propose that the ECO is split between suppliers based on their share of customer accounts, and we have modelled the policy on this basis. The unit costs below therefore reflect an effective unit cost of the policy based on the average fuel bill. In reality the costs are likely to be passed on to consumers through the standing charge or the tier one tariff, and so the effective unit price will change with consumption.

[83] (Guertler, Croft, and Carrington 2012)

Table A29 - ECO cost assumptions, electricity

ECO electricity cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DECC			0.60	0.69	0.70	0.80	0.81	0.75	0.82	0.79
ACE			0.68	0.81	0.84	0.94	0.94	0.84	0.82	0.77

Table A30 - ECO cost assumptions, gas

ECO gas cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DECC			0.17	0.20	0.17	0.19	0.19	0.18	0.19	0.19
ACE			0.19	0.23	0.21	0.23	0.22	0.20	0.19	0.18

Table A31 - Measures installed annually under *ECO Scenario 1*: based on draft Green Deal/ECO impact assessment

DECC ECO/GD Measures		2013	2014	2015	2016	2017	2018	2019	2020
Solid Wall Insulation	**Total**	**136,214**	**162,651**	**165,659**	**169,848**	**156,504**	**122,120**	**135,932**	**120,161**
Of which	*Super Priority Group*	*44,359*	*58,047*	*58,023*	*60,457*	*55,489*	*41,639*	*42,203*	*35,516*
	Able to Pay	*91,854*	*104,604*	*107,636*	*109,390*	*101,014*	*80,481*	*93,729*	*84,645*
Cavity Wall Insulation	**Total**	**201,539**	**196,956**	**188,622**	**182,789**	**171,956**	**161,747**	**151,539**	**141,331**
Of which	*Super Priority Group*	*75,000*	*71,667*	*68,333*	*65,000*	*61,667*	*58,333*	*55,000*	*51,667*
	Able to Pay	*126,539*	*125,289*	*120,289*	*117,789*	*110,289*	*103,414*	*96,539*	*89,664*
Loft top up	**Total**	**38,500**	**38,500**	**38,500**	**38,500**	**38,500**	**38,500**	**38,500**	**38,500**
Of which	*Super Priority Group*	-	-	-	-	-	-	-	-
	Able to Pay	*38,500*	*38,500*	*38,500*	*38,500*	*38,500*	*38,500*	*38,500*	*38,500*
Gas Condensing Boiler	**Total**	**218,394**	**185,394**	**179,394**	**170,394**	**152,394**	**158,394**	**167,394**	**155,394**
Of which	*Super Priority Group*	*98,394*	*98,394*	*98,394*	*98,394*	*98,394*	*98,394*	*98,394*	*98,394*
	Able to Pay	*120,000*	*87,000*	*81,000*	*72,000*	*54,000*	*60,000*	*69,000*	*57,000*
Oil Condensing Boiler	**Super Priority Group**	**10,933**	**10,933**	**10,933**	**10,933**	**10,933**	**10,933**	**10,933**	**10,933**

Table A31 shows the delivery of measures under ECO based on the draft Green Deal/ECO impact assessment. The split between delivery in the Super Priority Group (as defined under CERT) and the remaining 'Able to Pay' group is estimated within Dead CERT(Guertler, Croft, and Carrington 2012) and presented in the table above. The scenario assumes £500m in economics 'Rents' and £1.91m in administration costs (apart from in 2013, where the admin costs are £385,000 higher).

Table A32 - Measures installed annually under *ECO Scenario 2*: based on ACE's Dead CERT scenario

ACE ECO/GD Measures		2013	2014	2015	2016	2017	2018	2019	2020
Solid Wall Insulation	**Total**	**85,024**	**122,990**	**138,938**	**148,510**	**141,769**	**105,714**	**100,678**	**81,990**
Of which	*SPG - social housing*	*41,518*	*49,942*	*45,128*	*45,730*	*40,314*	*30,687*	*33,696*	*29,484*
	SPG - OO/PRS	*28,974*	*56,500*	*76,782*	*85,475*	*85,475*	*62,295*	*52,154*	*39,115*
	ATP	*14,531*	*16,548*	*17,028*	*17,306*	*15,980*	*12,732*	*14,828*	*13,391*
Cavity Wall Insulation	**Total**	**764,126**	**759,747**	**742,380**	**733,793**	**450,574**	**340,700**	**300,858**	**277,373**
Of which	*SPG - Hard-to-treat*	*72,539*	*73,263*	*76,308*	*77,927*	*83,227*	*88,760*	*95,081*	*102,371*
	SPG – Conventional	*175,002*	*175,002*	*175,002*	*175,002*	*175,002*	*175,002*	*175,002*	*175,002*
	ATP	*516,585*	*511,482*	*491,070*	*480,864*	*192,345*	*76,938*	*30,775*	-
Loft top up	**Total**	**105,803**	**100,429**	**82,956**	**59,630**	**37,299**	**20,303**	**9,617**	**3,964**
Of which	*SPG*	*49,123*	*46,628*	*38,515*	*27,685*	*17,318*	*9,426*	*4,465*	*1,840*
	ATP	*56,680*	*53,801*	*44,441*	*31,944*	*19,982*	*10,877*	*5,152*	*2,123*
Loft full	**Total**	**1,879,262**	**1,783,808**	**1,473,455**	**1,059,137**	**662,507**	**360,617**	**170,811**	**70,403**
Of which	*SPG*	*874,134*	*829,734*	*685,374*	*492,655*	*308,163*	*167,740*	*79,452*	*32,748*
	ATP	*1,005,128*	*954,074*	*788,081*	*566,482*	*354,343*	*192,877*	*91,359*	*37,655*
Gas Condensing Boiler	**Total**	**398,394**	**332,394**	**314,394**	**296,394**	**242,394**	**254,394**	**284,394**	**254,394**
Of which	*SPG*	*98,394*	*98,394*	*98,394*	*98,394*	*98,394*	*98,394*	*98,394*	*98,394*
	ATP	*300,000*	*234,000*	*216,000*	*198,000*	*144,000*	*156,000*	*186,000*	*156,000*
Oil Condensing Boiler	**SPG**	**10,933**	**10,933**	**10,933**	**10,933**	**10,933**	**10,933**	**10,933**	**10,933**

Table A32 shows the delivery of measures under ECO based on the Dead CERT scenario(Guertler, Croft, and Carrington 2012). The scenario assumes £500m in economics 'Rents' and £1.91m in administration costs (apart from in 2013, where the admin costs are £385,000 higher). Despite higher differentials between the costs of supported measures than in the DECC scenario, the nature of the measure delivery as described in Dead CERT should ensure that economic rents are no higher.

Feed-in-Tariff

DECC recently consulted on three policy options for the future of the FIT(DECC 2012b). We model the two outer options (A and C) for our scenarios. 'Option A' under the Policy Mix 2 scenario targets average rates of return of around 5 to 8%, with around 5% for domestic installations. This produces a tariff of 13.6p for 4kW solar PV installations, which gives a return on investment (ROI) ranging from 0.5% to 10%.

Policy Mix 1 deploys 'Option C' which is based on a FIT cut of around 21% from April. This produces a tariff of 16.5p for 4kW installations, with a mid-range ROI of 6%. We assume no change across scenarios for microwind installations. DECC's choice to employ either scenario is based on the take up of PV in early 2012, with the options designed to cost households the same amount overall.

Table A33 - Feed in Tariff cost assumptions

FIT electricity cost (p/kWh real 2010 prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Option A	0.04	0.11	0.18	0.26	0.36	0.50	0.64	0.76	0.83	0.88
Option C	0.04	0.11	0.18	0.26	0.36	0.50	0.64	0.76	0.83	0.88

On the basis that consumers are paid 6months in arrears, and costs passed on similarly.

Table A34 - PV systems installed annually under the Feed-in-Tariff

PV installations	2012	2013	2014	2015	2016	2017	2018	2019	2020
Option A	117,172	193,334	302,567	151,284	113,463	226,926	317,696	444,774	889,548
Option C	99,600	152,388	251,440	251,440	188,580	207,438	290,413	522,744	1,123,900

Table A35 - Micro wind systems installed annually under the Feed-in-Tariff

Micro-wind installations	2012	2013	2014	2015	2016	2017	2018	2019	2020
Option A	423	294	286	289	275	281	283	205	203
Option C	423	294	286	289	275	281	283	205	203

Renewable Heat Incentive

We use just one scenario for the RHI, based on a continuation of the RHPP, based on a 40% annual increase in rates of installation from the 2011 provisional RHPP figures from the EST[84]. The assumptions are highly uncertain. However, since costs are met through taxation and only one scenario is in use, they are unlikely to impact upon the trends within the scenarios.

Table A36 - Measures installed annually under the Renewable Heat Incentive

RHI Measures (40% growth rate)	2012	2013	2014	2015	2016	2017	2018	2019	2020
Air Source Heat Pump	1,263	1,768	2,475	3,466	4,852	6,793	9,510	13,314	18,639
Biomass boiler	601	841	1,178	1,649	2,309	3,232	4,525	6,335	8,869
Ground Source Heat Pump	716	1,002	1,403	1,965	2,751	3,851	5,391	7,548	10,567
Solar Water Heater	724	1,013	1,418	1,985	2,780	3,892	5,448	7,627	10,678

Non-policy delivery

Boiler replacement

Both scenarios assume 1.5m boilers are replaced each year through to 2020. Of these 1m are old boilers being replaced by condensing boilers in 2013, but the proportion of non-condensing boilers being replaced reduces to 700,000 by 2020. This sees 6.5m old boilers replaced by condensing boilers between 2013 and 2020, consistent with the CCC targets for 2022.

60% of old boilers that get replaced are within the ATP households, with 40% within the PG, of which 16% within the SPG.

Under Policy Mix 1:

- 15% of the naturally replaced boilers in ATP households are installed through the Green Deal.
- In addition, the Green Deal brings forward the replacement of 5% of boilers from the following year.
- Affordable Warmth sees just under 100,000 gas boilers and 10,000 oil boilers installed each year[85].

[84] (Energy Saving Trust 2012)

[85] We assume a similar delivery to Warm Front, but more focussed on cost-effectiveness. This concentrates delivery on heating and cavity wall insulation. CWI delivered through Affordable Warmth was derived from the GD and ECO IA. The remaining spend is modelled to deliver gas and oil boilers in a 9:1 ratio. Through supplier-led delivery, the margin between cost of the Programme and total costs of the measures has been reduced by 40% from that calculated for Warm Front.

- The remaining boilers are assumed to be delivered outside of policy.

Under Policy Mix 2:

- 40% of the naturally replaced boilers in ATP households are installed through the Green Deal.
- In addition, the Green Deal brings forward the replacement of 10% of boilers from the following year.
- Affordable Warmth sees just under 100,000 gas boilers and 10,000 oil boilers installed each year.
- The remaining boilers are assumed to be delivered outside of policy.

Table A37 - Gas boilers installed annually under the normal replacement 'churn'

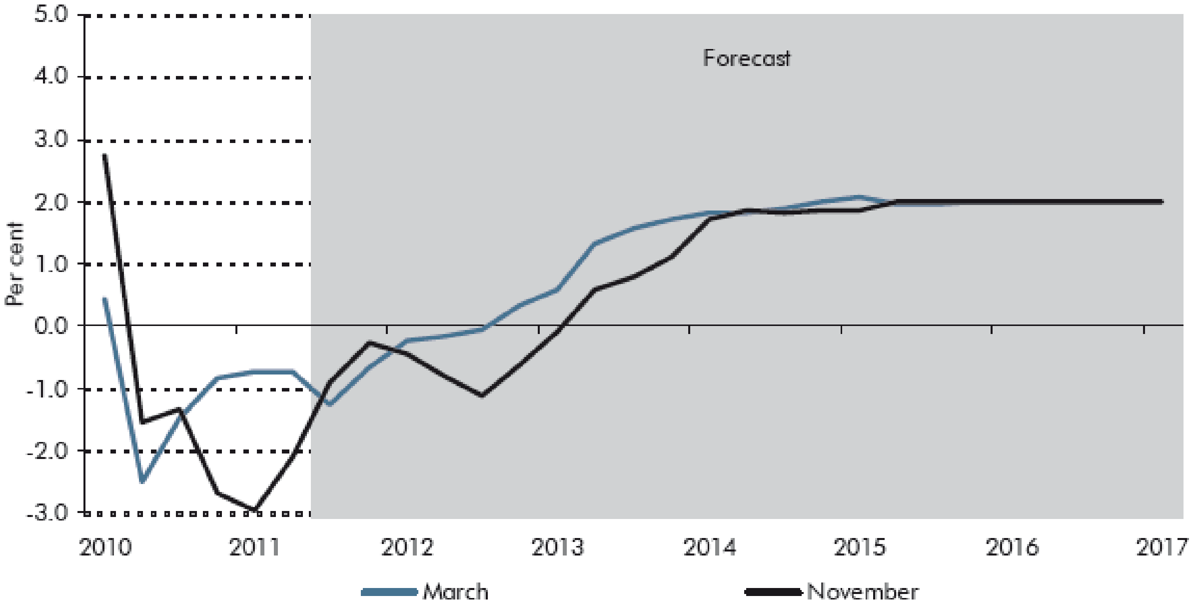
Gas boilers improved through churn	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Policy Mix 2		900,000	531,606	591,006	517,206	533,406	312,006	301,206	454,206	391,206
Policy Mix 1		900,000	693,606	723,306	638,706	646,806	393,006	387,606	559,506	480,306

Table A38 - Oil boilers installed annually under the normal replacement 'churn'

Oil boilers improved through churr	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Policy Mix 2		100,000	59,067	65,667	57,467	59,267	34,667	33,467	50,467	43,467
Policy Mix 1		100,000	77,067	80,367	70,967	71,867	43,667	43,067	62,167	53,367

Appendix 2 - Income progression

In order to estimate future fuel poverty levels we need to project household income as well as fuel expenditure. In November 2011 the OBR produced an earnings growth forecast to 2017[86]. We have assumed an overall income growth at the same rate as their November 2011 figures and have extrapolated the 2% growth assumption which they use from 2015 onwards on to 2020.



Source: ONS, OBR. Annual growth of wages and salaries per employee, deflated by the GDP deflator. Estimates for March forecast adjusted for changes to the ONS' methodology for the process of deflation.

Figure A2 - OBR Income forecast

However, incomes do not increase equally across the board and the past fifteen years has shown a trend of low incomes growing more slowly than high incomes. The Department of Work and Pensions published an analysis of the income distribution 1994/95 – 2009/10 in May 2011[87]. Figure A3 - shows the historical growth trends of weekly income in each income decile.

[86] (OBR 2011), data underlying chart 3.31
[87] (DWP 2011)

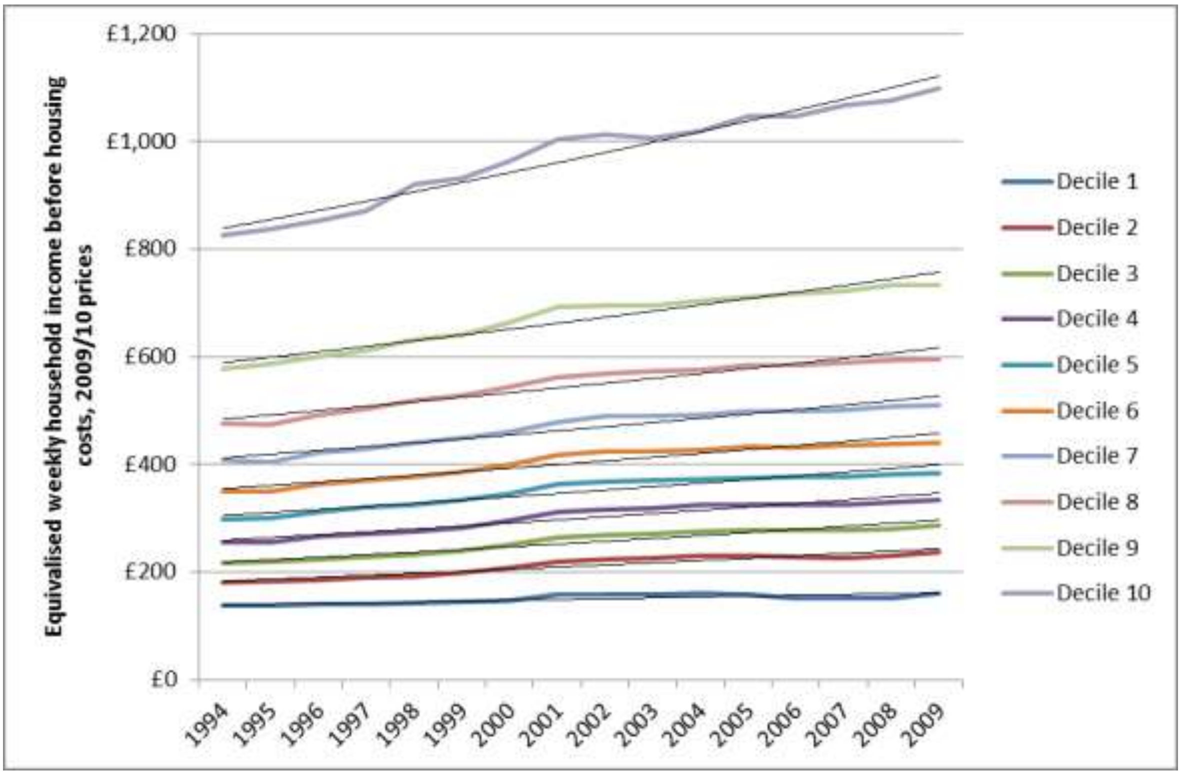


Figure A3 - Historical income trends by income decile

By projecting each decile's income forward according to its historical growth rate we are able to calculate an adjustment factor for each decile that can be applied to the forecast overall income growth. This allows us to retain the overall growth predicted by OBR but share that growth between the deciles according to historical trends of income growth in each decile.

Appendix 3 – Headline energy demand, price and bill data

Table A39 - Make-up of the electricity wholesale and network scenarios in 2020 [p/kWh of electricity]

	2011	2020 Fuel Price Scenarios		
		Low	Central	High
Wholesale	6.21	4.95	6.79	8.09
Transmission	0.51	0.99	1.19	1.22
Distribution	2.18	3.35	3.45	3.55
Metering[88]	0.13	0.01	0.01	0.01
Other supplier costs and profit	3.38	3.02	3.70	4.40
VAT	*0.62*	*0.62*	*0.76*	*0.86*
Total	**13.04**	**12.92**	**15.89**	**18.15**

Table A40 - Make-up of the gas wholesale and network scenarios in 2020 [p/kWh of gas]

	2011	2020 Fuel Price scenarios		
		Low	Central	High
Wholesale	2.09	1.19	2.32	3.15
Transmission	0.09	0.13	0.15	0.17
Distribution	0.65	0.77	0.77	0.77
Metering[88]	0.03	0.00	0.00	0.00
Other supplier costs and profit	0.85	0.28	0.94	1.42
VAT	*0.19*	*0.12*	*0.21*	*0.28*
Total	**3.89**	**2.49**	**4.39**	**5.78**

Table A41 - Average household gas and electricity (for power) demand in kWh, 2011-2020.

	Gas kWh		Electric (power) kWh	
	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2
2011	16,629	16,450	3,484	3,457
2012	16,436	16,277	3,406	3,353
2013	16,273	16,023	3,321	3,241
2014	16,092	15,746	3,231	3,124
2015	15,913	15,478	3,157	3,025
2016	15,726	15,217	3,102	2,943
2017	15,583	15,042	3,050	2,865
2018	15,463	14,913	3,004	2,792
2019	15,307	14,777	2,962	2,723
2020	15,167	14,681	2,910	2,644

[88] Metering excludes the costs of smart metering, but accounts for the reduction in metering costs that accrue. The costs of this policy are accounted for within the policy scenarios.

Table A42 - Price of gas (p/kWh) in 2020 for each of the six scenarios, broken down by components

	2011 (p/kWh)	2020 (p/kWh)					
		High		Central		Low	
		Policy mix 1	Policy mix 2	Policy mix 1	Policy mix 2	Policy mix 1	Policy mix 2
Wholesale	2.09	3.15	3.15	2.32	2.32	1.19	1.19
Transmission	0.09	0.17	0.17	0.15	0.15	0.13	0.13
Distribution	0.65	0.77	0.77	0.77	0.77	0.77	0.77
Metering	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Other supplier costs and profit	0.85	1.42	1.42	0.94	0.94	0.28	0.28
ECO support cost		0.19	0.18	0.19	0.18	0.19	0.18
Smart Meters		0.01	0.01	0.01	0.01	0.01	0.01
CERT Extension	0.19						
CESP	0.01						
Better Billing	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WHD support cost	0.03	0.05	0.05	0.05	0.05	0.05	0.05
VAT	0.20	0.29	0.29	0.22	0.22	0.13	0.13
Domestic retail price	4.13	6.03	6.03	4.64	4.63	2.74	2.74

Table A43 - Price of electricity (p/kWh) in 2020 for each of the six scenarios, broken down by components

	2011 (p/kWh)	2020 (p/kWh)					
		High		Central		Low	
		Policy mix 1	Policy mix 2	Policy mix 1	Policy mix 2	Policy mix 1	Policy mix 2
Wholesale[89]	6.21	8.09	7.29	6.79	5.99	4.95	4.15
Transmission	0.51	1.22	1.22	1.19	1.19	0.99	0.99
Distribution	2.18	3.55	3.55	3.45	3.45	3.35	3.35
Metering	0.13	0.01	0.01	0.01	0.01	0.01	0.01
Other supplier costs and profit	3.38	4.40	4.40	3.70	3.70	3.02	3.02
ECO support cost		0.79	0.77	0.79	0.77	0.79	0.77
Smart Meters		0.03	0.03	0.03	0.03	0.03	0.03
CERT Extension	0.64						
CESP	0.03						
Better Billing	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WHD support cost	0.12	0.16	0.16	0.16	0.16	0.16	0.16
EU ETS	0.49	1.03	0.88	1.03	0.88	1.03	0.88
CPF		0.12	0.24	0.12	0.24	0.12	0.24
RO support cost	0.49	1.77	1.18	1.77	1.18	1.77	1.18
EMR support cost		0.50	0.37	1.01	0.73	1.42	1.04
FIT support cost	0.04	0.88	0.88	0.88	0.88	0.88	0.88
VAT	0.71	1.13	1.05	1.05	0.96	0.93	0.83
Domestic retail price	14.94	23.71	22.04	21.98	20.18	19.45	17.53

[89] In the 'low bills' scenarios the wholesale costs are reduced due to EMR impacting upon the merit order. We assume EMR makes no difference to the wholesale costs in the 'high bills' scenario.

Table A44 - Mean total energy bills, 2011-2020 (£/a)

	High fuel price			Central fuel price			Low fuel price		
	PM 1	PM 2	*Counterfactual*	PM 1	PM 2	*Counterfactual*	PM 1	PM 2	*Counterfactual*
2011	£1,226	£1,220	*£1,226*	£1,225	£1,219	*£1,225*	£1,196	£1,191	*£1,196*
2012	£1,418	£1,397	*£1,381*	£1,305	£1,286	*£1,263*	£1,042	£1,026	*£989*
2013	£1,477	£1,455	*£1,444*	£1,384	£1,364	*£1,345*	£924	£914	*£860*
2014	£1,490	£1,461	*£1,454*	£1,425	£1,363	*£1,382*	£961	£936	*£886*
2015	£1,504	£1,444	*£1,471*	£1,446	£1,389	*£1,404*	£979	£935	*£893*
2016	£1,511	£1,435	*£1,500*	£1,443	£1,371	*£1,418*	£959	£905	*£884*
2017	£1,559	£1,457	*£1,554*	£1,422	£1,326	*£1,393*	£990	£911	*£908*
2018	£1,558	£1,438	*£1,576*	£1,357	£1,247	*£1,340*	£978	£883	*£907*
2019	£1,587	£1,448	*£1,629*	£1,357	£1,230	*£1,353*	£995	£885	*£943*
2020	£1,601	£1,450	*£1,668*	£1,365	£1,225	*£1,378*	£1,045	£916	*£995*

Table A45 - Mean equivalised fuel bill in 2020 by expenditure decile

	High fuel price			Central fuel price			Low fuel price		
	PM 1	PM 2	*Counterfactual*	PM 1	PM 2	*Counterfactual*	PM 1	PM 2	*Counterfactual*
1	£1,172	£1,035	*£1,222*	£996	£874	*£1,003*	£765	£654	*£723*
2	£1,326	£1,187	*£1,390*	£1,126	£1,001	*£1,141*	£860	£746	*£820*
3	£1,444	£1,301	*£1,491*	£1,230	£1,099	*£1,227*	£942	£822	*£882*
4	£1,533	£1,385	*£1,580*	£1,307	£1,171	*£1,302*	£1,003	£878	*£937*
5	£1,606	£1,458	*£1,655*	£1,373	£1,235	*£1,367*	£1,056	£928	*£988*
6	£1,643	£1,495	*£1,712*	£1,400	£1,261	*£1,411*	£1,067	£938	*£1,012*
7	£1,697	£1,543	*£1,773*	£1,446	£1,302	*£1,463*	£1,103	£969	*£1,052*
8	£1,776	£1,616	*£1,844*	£1,516	£1,364	*£1,527*	£1,159	£1,020	*£1,103*
9	£1,850	£1,688	*£1,946*	£1,580	£1,426	*£1,615*	£1,208	£1,066	*£1,172*
10	£1,956	£1,784	*£2,064*	£1,674	£1,511	*£1,718*	£1,285	£1,134	*£1,255*

Appendix 4 –Counterfactual and total bill in 2011 and 2020 by socio-demographics

'Winners' and 'Losers'

Table A46 - Mean total energy bills, 2011-2020 (£/a) for the households that receive a measure, 'winners'

	High Fuel Price		Central Fuel Price		Low Fuel Price	
	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2
2011	£1,097	£1,125	£1,096	£1,124	£1,068	£1,096
2012	£1,255	£1,273	£1,151	£1,169	£911	£927
2013	£1,302	£1,364	£1,217	£1,279	£805	£857
2014	£1,294	£1,376	£1,235	£1,283	£826	£881
2015	£1,295	£1,366	£1,243	£1,314	£834	£884
2016	£1,298	£1,365	£1,238	£1,304	£815	£859
2017	£1,344	£1,387	£1,223	£1,262	£845	£866
2018	£1,345	£1,369	£1,169	£1,186	£836	£838
2019	£1,380	£1,379	£1,177	£1,170	£856	£839
2020	£1,409	£1,381	£1,198	£1,165	£911	£868

Table A47 - Mean total energy bills, 2011-2020 (£/a) for the households that don't receive a measure, 'losers'

	High Fuel Price		Central Fuel Price		Low Fuel Price	
	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2	Policy Mix 1	Policy Mix 2
2011	£1,273	£1,267	£1,273	£1,266	£1,243	£1,237
2012	£1,488	£1,467	£1,370	£1,351	£1,098	£1,082
2013	£1,559	£1,525	£1,462	£1,430	£980	£957
2014	£1,593	£1,552	£1,524	£1,449	£1,032	£993
2015	£1,626	£1,553	£1,564	£1,494	£1,062	£1,006
2016	£1,649	£1,563	£1,575	£1,493	£1,052	£987
2017	£1,711	£1,607	£1,562	£1,464	£1,092	£1,010
2018	£1,721	£1,604	£1,501	£1,393	£1,087	£994
2019	£1,765	£1,637	£1,512	£1,394	£1,114	£1,011
2020	£1,790	£1,652	£1,530	£1,401	£1,177	£1,056

Results by Heating Fuel

Table A48 - Mean total energy bills in 2011 and 2020 (£/a) for the households by heating fuel

Total Bill		High fuel price			Central fuel price			Low fuel price		
		Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*
2011	Electric	£1,224	£1,226	*£1,161*	£1,222	£1,224	*£1,160*	£1,161	£1,163	*£1,096*
	Gas	£1,175	£1,168	*£1,134*	£1,174	£1,167	*£1,135*	£1,149	£1,143	*£1,109*
	Oil	£1,859	£1,847	*£1,853*	£1,858	£1,846	*£1,853*	£1,828	£1,817	*£1,822*
	Solid fuel	£1,038	£1,034	*£1,038*	£1,038	£1,033	*£1,037*	£1,014	£1,009	*£1,013*
	Lpg	£1,585	£1,579	*£1,573*	£1,584	£1,579	*£1,573*	£1,559	£1,554	*£1,547*
	Biomass	£1,587	£1,585	*£1,565*	£1,586	£1,585	*£1,564*	£1,557	£1,556	*£1,534*
2020	Electric	£1,730	£1,499	*£1,548*	£1,588	£1,356	*£1,420*	£1,380	£1,150	*£1,146*
	Gas	£1,563	£1,421	*£1,593*	£1,296	£1,168	*£1,318*	£937	£821	*£893*
	Oil	£1,933	£1,793	*£2,123*	£1,872	£1,733	*£2,064*	£1,781	£1,647	*£1,934*
	Solid fuel	£1,140	£1,009	*£1,151*	£1,088	£958	*£1,103*	£1,012	£886	*£997*
	Lpg	£1,766	£1,646	*£1,824*	£1,712	£1,592	*£1,774*	£1,632	£1,517	*£1,662*
	Biomass	£1,735	£1,583	*£1,748*	£1,673	£1,523	*£1,689*	£1,582	£1,437	*£1,559*

Results by Household Composition

Table A49 - Mean total energy bills in 2011 and 2020 (£/a) for the households by household composition

Total Bill		High fuel price			Central fuel price			Low fuel price		
		Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*
2011	Couple, no children, under 60	£1,239	£1,230	*£1,185*	£1,238	£1,229	£1,184	£1,209	£1,201	*£1,155*
	Couple, no children, over 60	£1,293	£1,289	*£1,259*	£1,292	£1,288	£1,259	£1,263	£1,259	*£1,228*
	Couple with children	£1,414	£1,405	*£1,366*	£1,413	£1,404	£1,365	£1,381	£1,372	*£1,332*
	Lone parent	£1,026	£1,021	*£994*	£1,025	£1,020	£993	£1,001	£757	*£969*
	Mulitperson house	£1,507	£1,500	*£1,467*	£1,506	£1,499	£1,466	£1,470	£1,463	*£1,429*
	One adult, under 60	£936	£930	*£890*	£935	£929	£889	£912	£906	*£866*
	One adult, over 60	£957	£956	*£945*	£957	£956	£944	£932	£932	*£919*
2020	Couple, no children, under 60	£1,630	£1,483	*£1,666*	£1,390	£1,254	£1,376	£1,064	£938	*£991*
	Couple, no children, over 60	£1,693	£1,534	*£1,755*	£1,449	£1,300	£1,458	£1,115	£978	*£1,062*
	Couple with children	£1,811	£1,643	*£1,922*	£1,540	£1,385	£1,585	£1,173	£1,031	*£1,140*
	Lone parent	£1,365	£1,222	*£1,419*	£1,154	£1,031	£1,151	£880	£768	*£814*
	Mulitperson house	£1,914	£1,739	*£2,061*	£1,625	£1,462	£1,702	£1,232	£1,082	*£1,228*
	One adult, under 60	£1,268	£1,148	*£1,256*	£1,088	£976	£1,035	£843	£739	*£745*
	One adult, over 60	£1,279	£1,147	*£1,325*	£1,095	£971	£1,099	£843	£728	*£798*

Results by Dwelling Type

Table A50 - Mean total energy bills in 2011 and 2020 (£/a) for the households by dwelling type

Total Bill		High fuel price			Central fuel price			Low fuel price		
		Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*
2011	Detached	£1,568	£1,560	*£1,531*	£1,567	£1,559	£1,530	£1,533	£1,525	*£1,495*
	Semi	£1,249	£1,242	*£1,212*	£1,249	£1,241	£1,211	£1,220	£1,213	*£1,181*
	Terrace	£1,130	£1,125	*£1,091*	£1,130	£1,124	£1,090	£1,103	£1,098	*£1,062*
	Flat	£871	£869	*£832*	£870	£868	£832	£845	£843	*£806*
	Other	£1,424	£1,422	*£1,372*	£1,423	£1,421	£1,371	£1,388	£1,386	*£1,335*
2020	Detached	£1,961	£1,782	*£2,101*	£1,689	£1,519	£1,767	£1,313	£1,157	*£1,320*
	Semi	£1,637	£1,478	*£1,718*	£1,383	£1,238	£1,407	£1,038	£906	*£995*
	Terrace	£1,493	£1,352	*£1,553*	£1,262	£1,134	£1,267	£953	£834	*£894*
	Flat	£1,216	£1,096	*£1,181*	£1,050	£938	£975	£825	£719	*£707*
	Other	£1,833	£1,691	*£1,844*	£1,626	£1,487	£1,583	£1,340	£1,205	*£1,236*

Results by Tenure

Table A51 - Mean total energy bills in 2011 and 2020 (£/a) for the households by tenure

Total Bill		High fuel price			Central fuel price			Low fuel price		
		Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*
2011	Social	£906	£904	*£882*	£905	£904	£882	£882	£880	*£858*
	PRS	£1,051	£1,045	*£1,009*	£1,050	£1,045	£1,008	£1,022	£1,017	*£979*
	OO with mortgage	£1,371	£1,361	*£1,319*	£1,370	£1,361	£1,318	£1,339	£1,330	*£1,286*
	OO own outright	£1,290	£1,285	*£1,260*	£1,290	£1,285	£1,260	£1,260	£1,255	*£1,229*
	Rent free	£1,188	£1,183	*£1,161*	£1,187	£1,182	£1,161	£1,158	£1,153	*£1,130*
2020	Social	£1,234	£1,101	*£1,260*	£1,043	£930	£1,025	£799	£694	*£731*
	PRS	£1,423	£1,290	*£1,414*	£1,230	£1,106	£1,173	£970	£852	*£859*
	OO with mortgage	£1,765	£1,607	*£1,858*	£1,499	£1,351	£1,532	£1,135	£999	*£1,096*
	OO own outright	£1,671	£1,512	*£1,755*	£1,431	£1,280	£1,460	£1,099	£961	*£1,065*
	Rent free	£1,521	£1,373	*£1,589*	£1,326	£1,186	£1,343	£1,056	£927	*£1,016*

Results by Government Office Region

Table A52 - Mean total energy bills in 2011 and 2020 (£/a) for the households by dwelling type

Total Bill		High fuel price			Central fuel price			Low fuel price		
		Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*	Policy mix 1	Policy mix 2	*Counterfactual*
2011	North East	£1,133	£1,127	£1,096	£1,132	£1,126	£1,095	£1,106	£1,100	£1,068
	North West & Merseyside	£1,189	£1,181	£1,154	£1,188	£1,180	£1,153	£1,160	£1,152	£1,125
	Yorkshire and the Humber	£1,196	£1,190	£1,160	£1,195	£1,190	£1,159	£1,168	£1,162	£1,131
	East Midlands	£1,232	£1,227	£1,188	£1,232	£1,227	£1,187	£1,203	£1,198	£1,157
	West Midlands	£1,213	£1,206	£1,179	£1,212	£1,206	£1,178	£1,184	£1,178	£1,149
	Eastern	£1,277	£1,271	£1,233	£1,276	£1,270	£1,232	£1,245	£1,240	£1,200
	London	£1,145	£1,140	£1,102	£1,144	£1,139	£1,102	£1,117	£1,113	£1,074
	South East	£1,213	£1,207	£1,172	£1,212	£1,206	£1,171	£1,183	£1,177	£1,141
	South West	£1,281	£1,274	£1,242	£1,280	£1,273	£1,241	£1,248	£1,242	£1,208
	Wales	£1,256	£1,248	£1,222	£1,255	£1,247	£1,221	£1,227	£1,219	£1,192
	Scotland	£1,238	£1,233	£1,197	£1,237	£1,232	£1,197	£1,206	£1,202	£1,165
	Northern Ireland	£1,630	£1,624	£1,617	£1,630	£1,623	£1,616	£1,601	£1,594	£1,586
2020	North East	£1,511	£1,371	£1,567	£1,271	£1,143	£1,274	£949	£831	£892
	North West & Merseyside	£1,574	£1,415	£1,649	£1,324	£1,180	£1,342	£987	£857	£939
	Yorkshire and the Humber	£1,585	£1,435	£1,649	£1,338	£1,201	£1,347	£1,004	£878	£949
	East Midlands	£1,620	£1,474	£1,672	£1,379	£1,242	£1,378	£1,050	£923	£990
	West Midlands	£1,579	£1,430	£1,669	£1,336	£1,198	£1,369	£1,006	£879	£972
	Eastern	£1,663	£1,510	£1,720	£1,427	£1,283	£1,431	£1,104	£970	£1,048
	London	£1,527	£1,391	£1,581	£1,282	£1,156	£1,282	£951	£834	£887
	South East	£1,598	£1,444	£1,662	£1,355	£1,211	£1,364	£1,023	£891	£968
	South West	£1,643	£1,483	£1,716	£1,424	£1,273	£1,441	£1,124	£984	£1,076
	Wales	£1,615	£1,456	£1,695	£1,387	£1,241	£1,412	£1,077	£945	£1,040
	Scotland	£1,643	£1,485	£1,682	£1,408	£1,261	£1,392	£1,088	£952	£1,010
	Northern Ireland	£1,756	£1,619	£1,936	£1,670	£1,537	£1,812	£1,550	£1,422	£1,653

Appendix 5 – Total bill in 2011 and 2020 by 'winners' and 'losers' and socio-demographic breakdown

Results by Heating Fuel

Table A53 - Mean total energy bills in 2011 and 2020 (£/a) for the households by heating fuel, split between 'winners' and 'losers'

Total Bill		High fuel price				Central fuel price				Low fuel price			
		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2	
		Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners
2011	Electric	£1,271	£1,100	£1,272	£1,128	£1,269	£1,099	£1,270	£1,126	£1,206	£1,041	£1,208	£1,068
	Gas	£1,220	£1,050	£1,213	£1,077	£1,219	£1,049	£1,212	£1,076	£1,194	£1,025	£1,187	£1,052
	Oil	£1,912	£1,716	£1,912	£1,716	£1,922	£1,680	£1,911	£1,715	£1,892	£1,651	£1,882	£1,686
	Solid fuel	£1,079	£966	£1,079	£966	£1,088	£942	£1,079	£966	£1,064	£919	£1,055	£942
	Lpg	£1,639	£1,456	£1,639	£1,456	£1,646	£1,418	£1,638	£1,455	£1,620	£1,394	£1,612	£1,431
	Biomass	£1,661	£1,325	£1,661	£1,325	£1,679	£1,161	£1,660	£1,325	£1,649	£1,139	£1,630	£1,300
2020	Electric	£1,872	£1,528	£1,643	£1,430	£1,726	£1,392	£1,494	£1,290	£1,512	£1,194	£1,281	£1,088
	Gas	£1,627	£1,353	£1,627	£1,353	£1,456	£1,138	£1,340	£1,111	£1,056	£818	£946	£779
	Oil	£2,106	£1,704	£2,106	£1,704	£2,198	£1,630	£2,041	£1,645	£2,100	£1,545	£1,949	£1,561
	Solid fuel	£1,130	£966	£1,130	£966	£1,184	£970	£1,076	£916	£1,105	£897	£1,001	£845
	Lpg	£1,812	£1,566	£1,812	£1,566	£1,834	£1,544	£1,756	£1,514	£1,751	£1,469	£1,676	£1,440
	Biomass	£1,768	£1,501	£1,768	£1,501	£1,826	£1,292	£1,700	£1,444	£1,727	£1,221	£1,605	£1,362

Results by Household Composition

Table A54 - Mean total energy bills in 2011 and 2020 (£/a) for the households by household composition, split between 'winners' and 'losers'

Total Bill		High fuel price				Central fuel price				Low fuel price			
		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2	
		Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners
2011	Couple, no children, under 60	£1,270	£1,120	£1,267	£1,144	£1,269	£1,119	£1,266	£1,144	£1,239	£1,092	£1,237	£1,116
	Couple, no children, over 60	£1,340	£1,179	£1,333	£1,199	£1,340	£1,178	£1,332	£1,198	£1,310	£1,150	£1,303	£1,170
	Couple with children	£1,452	£1,298	£1,449	£1,315	£1,451	£1,297	£1,448	£1,315	£1,418	£1,266	£1,415	£1,283
	Lone parent	£1,452	£916	£1,449	£941	£1,451	£916	£1,448	£941	£1,418	£893	£1,415	£917
	Mulitperson house	£1,076	£1,354	£1,064	£1,376	£1,075	£1,353	£1,063	£1,375	£1,051	£1,318	£1,040	£1,340
	One adult, under 60	£1,565	£843	£1,565	£862	£1,564	£842	£1,564	£861	£1,527	£821	£1,528	£839
	One adult, over 60	£964	£837	£960	£845	£963	£836	£959	£844	£940	£813	£936	£821
2020	Couple, no children, under 60	£1,785	£1,415	£1,651	£1,407	£1,527	£1,201	£1,400	£1,188	£1,174	£910	£1,054	£885
	Couple, no children, over 60	£1,880	£1,493	£1,743	£1,470	£1,611	£1,277	£1,482	£1,245	£1,242	£979	£1,122	£934
	Couple with children	£2,056	£1,583	£1,927	£1,551	£1,750	£1,345	£1,629	£1,306	£1,335	£1,022	£1,219	£969
	Lone parent	£1,538	£1,240	£1,420	£1,171	£1,295	£1,052	£1,191	£990	£981	£808	£877	£740
	Mulitperson house	£2,230	£1,665	£2,098	£1,636	£1,904	£1,406	£1,777	£1,372	£1,461	£1,053	£1,334	£1,009
	One adult, under 60	£1,376	£1,114	£1,261	£1,096	£1,182	£954	£1,077	£929	£918	£737	£823	£700
	One adult, over 60	£1,463	£1,119	£1,301	£1,101	£1,259	£953	£1,109	£929	£979	£725	£844	£693

Results by Dwelling Type

Table A55 - Mean total energy bills in 2011 and 2020 (£/a) for the households by dwelling type, split between 'winners' and 'losers'

Total Bill		High fuel price				Central fuel price				Low fuel price			
		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2	
		Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners
2011	Detached	£1,618	£1,422	£1,613	£1,447	£1,617	£1,421	£1,612	£1,446	£1,583	£1,388	£1,578	£1,413
	Semi	£1,866	£1,118	£1,845	£1,142	£1,729	£1,118	£1,709	£1,141	£1,411	£1,090	£1,395	£1,114
	Terrace	£1,951	£1,019	£1,917	£1,039	£1,838	£1,018	£1,805	£1,039	£1,274	£992	£1,249	£1,013
	Flat	£1,990	£741	£1,956	£763	£1,913	£741	£1,835	£762	£1,335	£717	£1,294	£739
	Other	£2,028	£1,296	£1,966	£1,347	£1,958	£1,295	£1,896	£1,346	£1,369	£1,258	£1,314	£1,309
2020	Detached	£2,215	£1,705	£2,103	£1,678	£1,914	£1,463	£1,799	£1,428	£1,498	£1,128	£1,382	£1,085
	Semi	£1,882	£1,444	£1,848	£1,408	£1,882	£1,216	£1,848	£1,177	£1,882	£908	£1,848	£859
	Terrace	£1,919	£1,315	£1,885	£1,289	£1,919	£1,112	£1,885	£1,081	£1,919	£838	£1,885	£795
	Flat	£1,301	£1,057	£1,296	£1,016	£1,301	£909	£1,295	£867	£1,272	£709	£1,267	£662
	Other	£1,528	£1,552	£1,510	£1,584	£1,402	£1,379	£1,386	£1,394	£1,113	£1,139	£1,100	£1,132

Results by Tenure

Table A56 - Mean total energy bills in 2011 and 2020 (£/a) for the households by tenure, split between 'winners' and 'losers'

Total Bill		High fuel price				Central fuel price				Low fuel price			
		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2	
		Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners
2011	Social	£960	£787	£956	£801	£959	£786	£955	£800	£935	£764	£932	£778
	PRS	£1,078	£975	£1,075	£988	£1,078	£974	£1,074	£987	£1,050	£948	£1,047	£961
	OO with mortgage	£1,400	£1,268	£1,402	£1,274	£1,400	£1,267	£1,401	£1,273	£1,368	£1,237	£1,370	£1,243
	OO own outright	£1,345	£1,162	£1,338	£1,185	£1,344	£1,161	£1,337	£1,184	£1,314	£1,132	£1,308	£1,155
	Rent free	£1,253	£1,030	£1,250	£1,057	£1,252	£1,029	£1,249	£1,056	£1,223	£1,001	£1,219	£1,028
2020	Social	£1,380	£1,103	£1,266	£1,040	£1,171	£930	£1,075	£876	£903	£706	£812	£651
	PRS	£1,092	£1,308	£1,055	£1,249	£1,092	£1,133	£1,055	£1,072	£1,092	£897	£1,055	£828
	OO with mortgage	£1,110	£1,539	£1,072	£1,521	£1,110	£1,303	£1,072	£1,276	£1,110	£978	£1,072	£940
	OO own outright	£1,078	£1,472	£1,075	£1,443	£1,078	£1,256	£1,074	£1,219	£1,050	£957	£1,047	£912
	Rent free	£1,261	£1,363	£1,241	£1,308	£1,164	£1,189	£1,147	£1,124	£938	£949	£923	£869

Results by Government Office Region

Table A57 - Mean total energy bills in 2011 and 2020 (£/a) for the households by government office region, split between 'winners' and 'losers'

Total Bill		High fuel price				Central fuel price				Low fuel price			
		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2		Policy mix 1		Policy mix 2	
		Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners	Losers	Winners
2011	North East	£1,183	£991	£1,175	£1,026	£1,182	£990	£1,174	£1,026	£1,155	£965	£1,147	£1,000
	North West & Merseyside	£1,231	£1,092	£1,220	£1,113	£1,230	£1,091	£1,219	£1,112	£1,202	£1,064	£1,192	£1,085
	Yorkshire and the Humber	£1,250	£1,064	£1,244	£1,088	£1,249	£1,063	£1,243	£1,087	£1,221	£1,037	£1,215	£1,061
	East Midlands	£1,277	£1,092	£1,268	£1,132	£1,276	£1,091	£1,267	£1,131	£1,247	£1,064	£1,238	£1,103
	West Midlands	£1,262	£1,090	£1,255	£1,117	£1,262	£1,090	£1,254	£1,116	£1,233	£1,062	£1,226	£1,088
	Eastern	£1,315	£1,161	£1,316	£1,174	£1,314	£1,160	£1,315	£1,173	£1,283	£1,131	£1,284	£1,143
	London	£1,186	£1,019	£1,180	£1,049	£1,185	£1,018	£1,179	£1,048	£1,158	£992	£1,152	£1,022
	South East	£1,264	£1,063	£1,261	£1,090	£1,263	£1,062	£1,261	£1,089	£1,233	£1,035	£1,231	£1,061
	South West	£1,321	£1,173	£1,309	£1,207	£1,320	£1,172	£1,308	£1,206	£1,288	£1,141	£1,277	£1,175
	Wales	£1,312	£1,120	£1,297	£1,158	£1,311	£1,119	£1,296	£1,157	£1,282	£1,092	£1,268	£1,130
	Scotland	£1,293	£1,086	£1,288	£1,114	£1,292	£1,085	£1,288	£1,113	£1,260	£1,057	£1,256	£1,085
	Northern Ireland	£1,696	£1,443	£1,688	£1,482	£1,695	£1,442	£1,687	£1,481	£1,665	£1,415	£1,658	£1,454
2020	North East	£1,694	£1,324	£1,533	£1,301	£1,433	£1,105	£1,288	£1,081	£1,083	£812	£950	£780
	North West & Merseyside	£1,755	£1,409	£1,612	£1,359	£1,479	£1,183	£1,350	£1,131	£1,107	£878	£991	£819
	Yorkshire and the Humber	£1,778	£1,400	£1,646	£1,363	£1,503	£1,180	£1,387	£1,137	£1,131	£882	£1,029	£826
	East Midlands	£1,810	£1,398	£1,692	£1,383	£1,544	£1,186	£1,430	£1,164	£1,181	£898	£1,070	£862
	West Midlands	£1,787	£1,390	£1,664	£1,359	£1,518	£1,169	£1,397	£1,138	£1,153	£871	£1,029	£834
	Eastern	£1,838	£1,478	£1,685	£1,450	£1,582	£1,263	£1,434	£1,231	£1,231	£970	£1,088	£929
	London	£1,692	£1,339	£1,566	£1,317	£1,425	£1,120	£1,307	£1,093	£1,063	£824	£952	£785
	South East	£1,793	£1,389	£1,670	£1,370	£1,526	£1,172	£1,407	£1,147	£1,161	£874	£1,046	£840
	South West	£1,822	£1,469	£1,652	£1,430	£1,580	£1,273	£1,421	£1,226	£1,247	£1,004	£1,103	£947
	Wales	£1,803	£1,419	£1,660	£1,398	£1,551	£1,215	£1,424	£1,188	£1,210	£938	£1,098	£900
	Scotland	£1,843	£1,428	£1,710	£1,407	£1,585	£1,218	£1,463	£1,191	£1,233	£933	£1,121	£893
	Northern Ireland	£2,043	£1,517	£1,913	£1,519	£1,944	£1,442	£1,817	£1,441	£1,806	£1,337	£1,683	£1,333

Bibliography

ACE. 2011. *A Future Obligation on Energy Companies*. London: Association for the Conservation of Energy funded by Carillion Energy Services. http://www.ukace.org/publications/ACE%20Research%20(2011-06)%20-%20A%20Future%20Obligation%20on%20Energy%20Companies%20revisions%20following%20consultation.

Camco. 2012. *Energy Bill Revolution Campaign Report*. London: Transform UK, The co-operative and Consumer Focus. http://www.energybillrevolution.org/wp-content/uploads/2012/02/Energy-Bill-Revolution_full-report.pdf.

CCC. 2011. *Household Energy Bills - Impacts of Meeting Carbon Budgets*. London: Committee on Climate Change. http://downloads.theccc.org.uk.s3.amazonaws.com/Household%20Energy%20Bills/CCC_Energy%20Note%20Bill_bookmarked_1.pdf.

CLG. 2010. *Household Projections, 2008 to 2033, England*. London: Communities and Local Government. http://www.communities.gov.uk/documents/statistics/pdf/1780763.pdf.

Croft, Darryl, and Jack Carrington. 2011. *Costs of the ECO: The Impact on Low Income Households*. London: Association for the Conservation of Energy for Eaga Charitable Trust. http://www.eagacharitabletrust.org/index.php/projects/item/costs-of-the-eco-the-impact-on-fuel-poverty.

Croft, Darryl, Ian Preston, David Weatherall, Frances Downy, and Jack Carrington. 2011. *Access for All: Making the Green Deal a Fair Deal*. London: Association for the Conservation of Energy, Centre for Sustainable Energy and Energy Saving Trust for Consumer Focus. http://www.consumerfocus.org.uk/files/2011/11/Access-for-all.pdf.

DECC. 2011a. *Estimated Impacts of Energy and Climate Change Policies on Energy Prices and Bills*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/assets/decc/11/about-us/economics-social-research/3593-estimated-impacts-of-our-policies-on-energy-prices.pdf.

———. 2011b. *Updated Energy and Emissions Projections 2011*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx.

———. 2011c. “Green Deal and the Energy Company Obligation - Draft Impact Assessment”. Department of Energy and Climate Change. http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/3603-green-deal-eco-ia.pdf.

———. 2011d. *The Carbon Plan: Delivering Our Low Carbon Future*. London: Department of Energy and Climate Change. http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/carbon-plan/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf.

———. 2011e. “HC 1605 Energy and Climate Change and Environmental Audit Committees: Supplementary Written Evidence Submitted by the Department of Energy and Climate Change.” *Parliament*. http://www.publications.parliament.uk/pa/cm201012/cmselect/cmenvaud/1605/1605we13.htm.

———. 2011f. *Renewable Heat Incentive; IA No: DECC 0057*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/renewable%20energy/policy/renewableheat/1381-renewable-heat-incentive-ia.pdf.

———. 2011g. *DECC Fossil Fuel Price Projections: Summary*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/assets/decc/11/about-us/economics-social-research/2933-fossil-fuel-price-projections-summary.pdf.

———. 2011h. *Smart Meter Rollout for the Domestic Sector (GB); IA No: DECC0009*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/assets/decc/11/consultation/smart-metering-imp-prog/2549-smart-meter-rollout-domestic-ia-180811.pdf.

———. 2012a. "Feed-in Tariff Statistics." *Department of Energy & Climate Change*. http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/fits/fits.aspx.

———. 2012b. *Feed-in Tariffs Scheme - Consultation on Comprehensive Review Phase 2A: Solar PV Cost Control; IA No: DECC0081*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/assets/decc/Consultations/fits-review/4320-feedin-tariffs-review-phase-2a-draft-impact-asses.pdf.

———. 2012c. *Quarterly Energy Prices March 2012*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/assets/decc/11/stats/publications/qep/4777-qep-mar12.pdf.

———. 2012d. "GB Home Insulation Levels." http://www.decc.gov.uk/assets/decc/11/stats/energy/energy-efficiency/4536-statistical-table-estimates-of-home-insulation-le.xls.

DWP. 2011. *Households Below Average Income: An Analysis of the Income Distribution 1994/95 - 2009/10*. London: Department for Work and Pensions. http://research.dwp.gov.uk/asd/hbai/hbai2010/pdf_files/full_hbai11.pdf.

Electricity Networks Strategy Group. 2012. *Our Electricity Transmission Network: A Vision For 2020*. http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/future-elec-network/4263-ensgFull.pdf.

Energy Saving Trust. 2012. *Renewable Heat Premium Payment Scheme Weekly Statistics*. http://www.energysavingtrust.org.uk/Publications2/Generate-your-own-energy/Renewable-Heat-Premium-Payment-Scheme-weekly-statistics.

Guertler, Pedro, Darryl Croft, and Jack Carrington. 2012. *Dead CERT - Framing a Sustainable Transition to the Green Deal and the Energy Company Obligation*. London: Association for the Conservation of Energy. http://www.ukace.org/publications/ACE%20Research%20(2012-01)%20-%20Dead%20CERT%20-%20full%20report.pdf.

Hills, John. 2012. *Getting the Measure of Fuel Poverty - Final Report of the Fuel Poverty Review*. London: Centre for Analysis of Social Exclusion at the LSE. http://www.decc.gov.uk/assets/decc/11/funding-support/fuel-poverty/4662-getting-measure-fuel-pov-final-hills-rpt.pdf.

HM Government. 2009. "The UK Renewable Energy Strategy". HMSO. http://www.decc.gov.uk/assets/decc/What%20we%20do/UK%20energy%20supply/Energy%20mix/Renewable%20energy/Renewable%20Energy%20Strategy/1_20090717120647_e_@@_TheUKRenewableEnergyStrategy2009.pdf.

HM Treasury. 2011. *Control Framework for DECC Levy-funded Spending*. London: HM Treasury. http://hm-treasury.gov.uk/d/control_framework_decc250311.pdf.

Hunt, Lester C, Guy Judge, and Yasushi Ninomiya. 2003. "Underlying Trends and Seasonality in UK Energy Demand: a Sectoral Analysis." *Energy Economics* 25 (1): 93–118.

National Grid. 2011. "RIIO T1 Business Plans". National Grid. http://www.nationalgrid.com/NR/rdonlyres/3D1A5494-4871-4F42-AF2A-9877AE812CA8/48957/RIIO_A4110804a.pdf.

OBR. 2011. *Economic and Fiscal Outlook November 2011*. London: Office for Budget Responsibility. http://cdn.budgetresponsibility.independent.gov.uk/Autumn2011EFO_web_version138469072346.pdf.

OECD. *What Are Equivalence Scales?* http://www.oecd.org/dataoecd/61/52/35411111.pdf.

Ofgem. 2007. *Gas Distribution Price Control Review Final Proposals Document*. http://www.ofgem.gov.uk/Networks/GasDistr/GDPCR7-13/Documents1/GDPCR%20final%20proposals%20appendix%20rev.pdf.

———. 2010. "RIIO - a New Way to Regulate Energy Networks". Office of Gas & Electricity Markets. http://www.ofgem.gov.uk/Media/FactSheets/Documents1/re-wiringbritainfs.pdf.

———. 2011a. *TPCR4 Rollover: Final Proposals*. http://www.ofgem.gov.uk/Networks/Trans/PriceControls/TPCR4Roll-over/Documents1/TPCR4_Rollover_Final_Proposals.pdf.

———. 2011b. *Electricity Distribution Annual Report for 2008-09 and 2009-10*. http://www.ofgem.gov.uk/Networks/ElecDist/PriceCntrls/DPCR5/Documents1/Electricity_Distribution_Annual_Report_for_2008-09_and_2009-10v2%5B1%5D.pdf.

———. 2011c. *The Retail Market Review: Domestic Proposals*. London: Office of Gas & Electricity Markets. http://www.ofgem.gov.uk/Markets/RetMkts/rmr/Documents1/RMR%20Domestic%20Consultation%20December%202011.pdf.

———. 2011d. *Updated: Household Energy Bills Explained*. London: Office of Gas & Electricity Markets. http://www.ofgem.gov.uk/Media/FactSheets/Documents1/updatedhouseholdbillsjan11.pdf.

Palmer, Jason, and Ian Cooper. 2011. *Great Britain's Housing Energy Fact File*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/assets/decc/11/stats/climate-change/3224-great-britains-housing-energy-fact-file-2011.pdf.

Pöyry. 2011. *Potential Impact of Revised Renewables Obligation Technology Bands*. London: Department of Energy & Climate Change. http://www.decc.gov.uk/assets/decc/11/consultation/ro-banding/4081-poyry-revised-ro-bands-review.pdf.

Preston, Ian, Vicki White, and Pedro Guertler. 2010. *Distributional Impacts of UK Climate Change Policies*. Newcastle: Association for the Conservation of Energy and Centre for Sustainable Energy for Eaga Charitable Trust. http://www.ukace.org/publications/ACE%20Research%20(2010-09)%20with%20CSE%20-%20Distributional%20Impacts%20of%20Climate%20Change%20Policies.pdf.

Radov, Daniel, Per Klevnäs, Adil Hanif, Mahmoud Abu-Ebid, Nick Barker, and Jeremy Stambaugh. 2009. *The UK Supply Curve for Renewable Heat*. http://www.rhincentive.co.uk/library/regulation/0907Heat_Supply_Curve.pdf.

Redpoint Energy. 2011. *Modelling the Impact of Transmission Charging Options*. London: Office of Gas & Electricity Markets. http://www.ofgem.gov.uk/Networks/Trans/PT/Documents1/Modelling%20the%20impact%20of%20transmission%20charging%20options.pdf.

Trading Economics. 2012. "Brent Crude Oil." *Trading Economics*. http://www.tradingeconomics.com/commodity/brent-crude-oil.