Tackling fuel poverty, reducing carbon emissions and keeping household bills down: tensions and synergies

Report to the Committee on Fuel Poverty

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Acronyms

Acronym	Definition
BEIS	Department for Business Energy and Industrial Strategy
BHC	Before Housing Costs (when describing incomes)
BREDEM	BRE Domestic Energy Model
CERO	Carbon Emissions Reduction Obligation
CFP	Committee on Fuel Poverty
CSE	Centre for Sustainable Energy
ECO	Energy Company Obligation
EHS	English Housing Survey
FiT	Feed in Tariff
FPNES	Fuel Poverty Network Extension Scheme
HHCRO	Home Heating Cost Reduction Obligation
HHSRS	Housing Health and Safety Rating System
HNIP	Heat Network Investment Project
MEES in the PRS	Minimum Energy Efficiency Standard in the Private Rented Sector
NHM	National Household Model
PPM	Prepayment meter
RHI	Renewable Heat Incentive
WFP	Winter Fuel Payment
WHD	Warm Home Discount Scheme

1 Introduction

One of the key roles of the Committee on Fuel Poverty (CFP) is to advise the Government on the effectiveness of policies aimed at reducing fuel poverty in England. This includes a specific remit to support and challenge the Government on its delivery approach in order to underpin successful implementation of the 2015 fuel poverty strategy for England, 'Cutting the Cost of Keeping Warm',[1] including considering and reporting on:

- The effectiveness and efficiency of policies and schemes which contribute to meeting the 2030 target (i.e. as many fuel poor homes as is reasonably practicable achieve a minimum energy efficiency rating of Band C) and interim milestones (as many fuel poor homes as is reasonably practicable achieve a minimum of Band E by 2020 and Band D by 2025).
- The impact of other policies and schemes on fuel poverty.
- Modifications to existing policies and any additional policies and schemes needed to meet the milestones and 2030 target.

The Government has three overarching strategic objectives with respect to household energy policy:

- Meeting its statutory fuel poverty obligations (including the fuel poverty target set out above).
- Meeting its statutory climate change targets (i.e. reducing greenhouse gas emissions by at least 80% of 1990 levels by 2050 through a series of legally binding carbon budgets as set out in the 2008 Climate Change Act).
- Keeping household bills affordable across the wider population.

In this context, the Centre for Sustainable Energy (CSE) was commissioned to conduct a research study. The primary aim of this work was to develop a better understanding of:

a. The synergies, tensions and trade-offs which exist in how household energy policies and programmes in England contribute to (or, potentially undermine) each of these objectives.
b. Whether there are policy changes which can increase synergies and reduce tensions and thereby optimise the outcome across the three objectives.
c. High level principles which capture the nature of such 'optimisation' and which could be applied to future policy design.

Thus, the project had five key stages:

- **Stage 1:** Gather policy definitions, data and evidence (including interviews with all policy leads).

- **Stage 2:** Segmentation analysis of fuel poor households.

[1] Cutting the cost of keeping warm: a fuel poverty strategy for England, Department of Energy & Climate Change, March 2015 - www.gov.uk/government/publications/cutting-the-cost-of-keeping-warm

- **Stage 3:** Modelling of current policies (a business as usual approach).
- **Stage 4:** Develop and model policy change scenarios (policies adjusted to better align with government objectives).
- **Stage 5:** Develop high level principles.

The process and findings of these stages of the project are described and summarised in this report. Each different section in the remainder of this document broadly aligns with these separate project stages.

Section 3 discusses some of the tensions identified in the suite of policies, in terms of making progress on the three government objectives outlined above, and presents a series of policy adjustments that were modelled in the National Housing Model (NHM). An understanding of the tensions was developed by reviewing policy documents, policy data, and conducting interviews with leading civil servants responsible for or involved with these policies.

Section 4 provides a summary of the fuel poverty segmentation presenting a summary description of each of the twelve fuel poor archetypes derived from this analysis (further details on this element of the project can be found in an accompanying report[2]).

The results and analysis from the modelling work conducted using the NHM can be found in Section 5. This includes modelling results from both Stage 3 and Stage 4 of the project, i.e. representations of current policies and policies after having been subject to some adjustments (referred to throughout this report as 'policy change scenarios').

Section 6 then presents some of the high level principles that have been derived from the study. Finally, Section 7 presents some discussions, conclusions and recommendations that emerged from the work.

Appendix A contains a summary description of each policy modelled in the NHM and may be a useful source of reference.

[2] Segmentation of the EHS: Identifying fuel poor archetypes, Internal Paper for the Committee on Fuel Poverty, November 2017

2 Research and modelling approach

The following section outlines the approach used and methodology applied to each stage of the study, and the processes involved in making a series of proposed policy adjustments and deriving a set of high level principles.

2.1 Segmentation of the English Housing Survey: Fuel poverty archetypes

The English Housing Survey (EHS) 2014 has been used in conjunction with a Chi Squared Automatic Detection (CHAID) tree classification programme using SPSS statistical software to segment fuel poor households based on their fuel poverty gap. The objective of the segmentation of fuel poor households was to gain a better insight into:

- Why different households are in fuel poverty and what are the distinct drivers and characteristics of different fuel poor households, *and*
- How severely these distinct groups are in fuel poverty (fuel poverty gap).

An additional aim of this exercise was to categorise households using characteristics that can describe and identify them in the 'real world' (i.e. easily knowable based on a small number of household characteristics) potentially offering opportunities to target them accurately.

CHAID partitions a population into separate and distinct groups. The groups are defined by a set of independent (predictor) variables and the model seeks to fulfil the CHAID objective: the variance of the dependent (target) variable is minimized within the groups, and maximized between the groups. In this study the analysis was therefore aiming to find distinct groups with different severity of fuel poverty (as defined by the fuel poverty gap). The independent predictor variables fed to the model are listed in Table 2.1.

Table 2.1: Dependent variables from the EHS 2014 used in CHAID analysis to predict fuel poverty gap (from the Low Income High Costs definition of fuel poverty)

EHS variable	Variable description
hhltsick	Whether someone in the household has a long-term limiting health condition
WallType	Main wall type of dwelling
EPC	EPC band of dwelling
elecmop	Method of paying for electricity
fuelx	Main heating fuel
heat4x	Main heating system
dwage5x	Dwelling age (banded into five categories)
hhincx	Net household income of head of household and spouse
rumorph	Rural/urban morphology
tenure4x	Tenure
agehrpx	Age of head of household

In the second stage of the study, the segmentation results (i.e. distinct groups of households) were used to examine existing policy eligibility and impacts. In particular:

- The likely historical benefit of different groups (segments) from existing policies – including examination of targeting efficiency/leakage (where possible).
- Whether there are any identifiable instances where the benefits of policies have historically be concentrated (i.e. policy 'stacking').
- Considerations for future policy design (e.g. increase the efficiency of targeting certain fuel poor groups that have so far been disproportionately neglected).

2.2 Gathering policy definitions, data and evidence

The main policies reviewed in this work and which currently benefit or impact householders in England are:

- The Energy Company Obligation (ECO), with the current scheme including Affordable Warmth, Carbon Emissions Reduction Obligation (CERO) with a rural safeguard element and new flexible eligibility.
- The Warm Home Discount Scheme (WHD), including the core group, the broader group and wider Industry Initiatives.
- The Feed-in Tariff (FiT), which is available to households and landlords that install domestic renewable electricity generation systems - the costs of which are recovered by suppliers through customer bills.
- The Domestic Renewable Heat Incentive (RHI), similarly available to householders and landlords that install renewable heating systems but with funding provided by the Treasury.
- The Winter Fuel Payment (WFP), available to households in receipt of state pension.
- The PPM price cap and subsequent price caps focused on vulnerable households.
- The Minimum Energy Efficiency Standard (MEES) for the private rental sector.
- The Fuel Poverty Network Extension scheme (FPNES), which helps households connect to the gas network.
- The Housing Health and Safety Rating System (HHSRS).
- The Heat Network Investment Project (HNIP).

The process of reviewing these policies and collecting information on them involved three main research avenues:

a) A systematic desk review of all recent literature, impact assessments, consultation documents and policy reports
b) Accessing all published data and statistics available for each policy (including any surveys conducted on recipients)
c) One-to-one interviews, held in person, with key policy leads for each of the policies.

The policy information gathering exercise had several aims. The primary aim was develop a clearer understanding of which of the three overarching objectives each policy was explicitly set up to achieve, and the extent to which the other objectives featured in policy design considerations.

Further sources of information, such as policy reports and published data, were reviewed to establish the different funding mechanisms and costs of each policy. The interviews were used to ensure that the baseline assumptions underpinning each policy were understood by the CSE project team so that a) they were appropriately characterised in the NHM and b) proposed policy adjustments were based on a good understanding of the existing policy designs.

Coincidentally, a number of the policies were in a state of flux while the research was being undertaken (Quarter 4 2017), including the preparation of several consultations and a series of internal discussions within policy teams about the future direction or design of certain policies. Some of this additional thinking on current changes was included when considering possible avenues of exploration for this study (or at least considered and used as context to the study).

As a result of the information gathering, a shortlist of policies to be modelled in the NHM was drawn up. After reviewing the information available on each policy (as well as the information available in the NHM housing stock representing all homes in England), we found it was not possible to model the HHSRS programme or the Heat Network Investment Project within the NHM. Furthermore, the lack of information collected about the characteristics of households benefiting from the FPNES (or the heating systems they were replacing) meant that it was very difficult to say with any certainty who has benefited from this project, and what their original and new circumstances were. Similarly, data relating to WHD recipients and the nature of benefit received from the Industry Initiatives aspect of the policy was not sufficiently detailed. Hence, only the core group and broader group were modelled in the NHM.

This information gathering stage allowed an initial reflection on the potential tensions and synergies that existed across the policies as well as other potential improvements that could be made. These initial findings helped feed into the development of high level principles (Section 6), as well as build on the body of evidence to propose policy adjustments for the second modelling stage (Section 5).

2.3 Modelling policies in the National Household Model

The National Household Model (NHM)

The NHM is an energy policy modelling tool, designed and built by CSE for DECC (now BEIS) to improve the quality of policy models in three key areas: consistency across different policies, visibility of assumptions and flexibility to vary input parameters. The NHM uses national housing surveys to represent the housing stock and its inhabitants and the BREDEM algorithm to calculate the energy performance of dwellings. The application includes a discrete-event modelling engine to simulate the passage of time and the exposure of households to changes during simulated time, with modelling scenarios specified using a scenario definition language developed specifically for the purpose. CSE holds the contract for supporting the development and maintenance of the model for BEIS, including training and assisting BEIS analysts in its use.

Summary of modelling approach

Scenarios were created in the NHM that represented and modelled the following policies:

- The Energy Company Obligation (ECO) - including both the Home Heating Cost Reduction Obligation (HHCRO) and the Carbon Emissions Reduction Obligation (CERO) with the latter also include the Solid Wall Insulation Minimum
- The Warm Homes Discount Scheme (WHD) - the core group and the broader group
- The Feed-in Tariff (FiT)
- The Domestic Renewable Heat Incentive (RHI)
- The Winter Fuel Payment (WFP)
- The PPM price cap (and possible extensions)
- The Minimum Energy Efficiency Standard (MEES) for the private rental sector (PRS)

The common aspects for each policy derived from the information gathering exercise (described in Section 2.2), were as follows:

Policy beneficiaries: the types of households eligible for a policy, or who have been shown to be the mostly likely to engage in a policy. The former applies to policies with specific eligibility criteria, such as the WHD or the WFP, whereas the latter applied to policies without specific eligibility criteria such as the FiT or the RHI.

Policy measures or other benefits: the actual benefit received by households, either one or more energy efficiency or low carbon measures, a payment, a discount on fuel bills, or a switch to a different tariff.

A policy envelope: the total available funding or other parameter that limits the size of the policy (e.g. an annual maximum spending allowance).

Cost recovery: This is how the policy is paid for, if applicable. This information falls into three categories depending on the funding mechanisms for each policy, which are either: through general taxation, through levies applied to fuel bills, or none/not applicable.

A summary of the beneficiaries, measures or benefits, envelopes and cost recover mechanism for each policy modelled in the NHM is provided in Table 2.2.

Table 2.2: Summary of policy modelling approach [B = billion, M = million]

Policy	Beneficiaries	Policy benefit	Approximate envelope (England)	Cost recovery
ECO	HHCRO: 85% of funding to households in receipt of specific benefits, 15% of funding awarded to local authorities, who are able to devise their own eligibility criteria. CERO: Any household.	HHCRO: One or more energy efficiency measures. CERO: Insulation measures only. Specific amount of carbon reduction must be achieved through installation of solid wall insulation.	£680M per annum	Fuel bill levy
WHD	Core group: in receipt of Guaranteed Element of Pension Credit. Broad group: a range of wider means tested benefits.	£140 discount on fuel bills	Core group: £1.2B Broad group: £800M	Fuel bill levy
WFP	Anyone on state pension	Between £150 - £400 per household depending on number and age of pensioners	£1.8B	Taxation
FiT	No eligibility criteria, but most likely are 'able-to-pay' and some social housing tenants. Dwellings rated EPC D or above receive a higher tariff and are more likely to install the technology.	Householder or landlord must pay upfront costs for the technology and then receive an annual payment for 20-25 years based on generation from technology.	Total spending approximates to around £210M per year	Fuel bill levy
RHI	No eligibility criteria, but most likely are 'able-to-pay' and some social housing tenants. Also, dwelling must have all suitable wall and loft insulation installed to qualify. For private households these are higher incomes than FiT as higher technology costs.	Householder or landlord must pay upfront costs for the technology and then receive an annual payment for seven years based on generation from technology.	Total spending on the domestic RHI approximates to around £110M per year	Taxation
MEES in the PRS	Any privately rented dwelling in EPC band F or G. However, this is currently subject to an opt-out clause whereby landlords are exempt if they need to fund the improvements themselves.	Any energy efficiency measures suitable for the home that improves the EPC rating.	n/a – all dwellings must meet this standard (with the exception of an exemption certificate). Funding may come from local grants or ECO.	None
PPM price cap	Anyone on PPM	Tariffs for these households capped – tariff calculation provided by Ofgem.	n/a	None

A set of scenarios were developed to represent all these policies in the NHM, using the above descriptions but supplemented with more detailed information obtained through discussions with key policy leads, modelling experts and analysts within government departments. In addition, some policies had detailed descriptions available in reports or impact assessments regarding how these have been modelled in-house at BEIS. These were followed as closely as possible, wherever feasible.

Heating behaviours and comfort-taking

In several policy documents there is recognition (and reported findings from studies showing) that some of the benefit received from certain policies will be used to increase the level of warmth and comfort in a home, rather than taking all the benefit as a purely financial gain. For example, a review of the WFP[3] estimated that households spend an average of 41% of the WFP on household fuel. This study was also used as basis for estimating the thermal comfort taken by recipients of the Warm Home Discount[4].

It is notoriously difficult to interpret and predict the response different households will have and to what extent they will 'comfort-take' when receiving a certain benefit. Thus we have made some general assumptions about the degree to which certain households are under-heating and the amount of comfort-taking likely to occur as a result of receiving a policy benefit. Wherever possible this has been underpinned by external research findings. The approach is summarised in Table 2.3. It should be stated that this is a simplistic representation and generalisation of the real world. Nevertheless, it is indisputable that some people heat their homes to lower temperatures than others and that for a significant proportion of these households this is due to being lower incomes. It is also reasonable to assume that the households heating their homes to lower than desired temperatures are likely to spend at least some of any additional income on increasing the warmth of their home. While some households on higher incomes may also be heating to lower temperatures these are less likely to spend additional income on higher temperatures (since income was unlikely to be the restraining factor on their choice of temperature).

This has important implications for the modelling and assessment of synergies and tensions within and across policies. For instance, the WHD will help reduce the fuel poverty gap of fuel poor households receiving the WHD, but it will also possibly increase carbon emissions through increased 'comfort-taking' for some of these households. (The official fuel poverty calculation does not take into account actual heating behaviour but uses a predefined required heating pattern to obtain an adequate level of warmth – see below.)

[3] Beatty, Blow, Crossley & O'Dea (2011). Cash by any other name? Evidence on Labelling from the UK Winter Fuel Payment, IFS Working Paper 11/10, available at: http://www.ifs.org.uk/wps/wp1110.pdf

[4] Warm Home Discount scheme 2016-18 Impact Assessment, Department of Energy & Climate Change, June 2016 - www.gov.uk/government/uploads/system/uploads/attachment_data/file/531163/Warm_Home_Discount_2016-18_extension_Final_IA_23_06_2016.pdf

Table 2.3: Assumptions on heating patterns and households comfort-taking

Annual net household income	Thermostat setting	Comfort-taking details
Less than £15,000: ***below the before housing costs (BHC) income poverty line***	18°C	Thermostat settings increased until either: a) the thermostat reaches 21°C or b) half of the financial gain from a policy is spent on additional heating costs (whichever occurs first)
Between £15,000 - £22,500: ***above poverty line but below 90% of median income***	19.5°C	
Over £22,500: ***on 90% of median income or higher***	21°C	No direct comfort-taking[5]

This comfort-taking has been included only for policies which result in a financial gain; the WHD and the WFP. It is less clear how tariff changes as a result of the PPM price cap will influence thermal behaviour. If this takes place as an automatic switch to a different tariff then there is likely to be less awareness of the event occurring so households won't adjust their spending in accordance. In addition, some households will probably be unsure exactly how much their bills will be reduced and thus reluctant to increase energy consumption for fear of increasing bills. Unlike the WHD or the WFP which specify a set amount of money or bill reduction (and have had research conducted on the impacts of these payments on energy behaviour), the impacts of tariff switching on energy behaviour are less clear. Therefore, we have assumed no comfort-taking for this policy.

Fuel poverty modelling

The NHM can be run in either a SAP mode or a BREDEM mode. Running it in BREDEM mode allows for a greater degree of flexibility in terms of modelling improvements, energy behaviour and heating patterns. Running it in SAP mode has fixed heating patterns and temperatures which align with fuel poverty methodology. Thus the NHM was run in two modes for each scenario, one mode to estimate the impacts on actual fuel bills and carbon emissions, and the other to investigate the likely impacts on headline fuel poverty statistics. The former approach was calculated assuming a degree of under-heating and comfort-taking (as specified above), whereas when calculating fuel poverty no under-heating or comfort-taking was assumed, in accordance with the fuel poverty calculation requirements.

However, the fuel poverty methodology was not fully implemented to exactly match that laid out in the official fuel poverty statistics methodology handbook[6] for several reasons, including: incomplete data in the housing stock to allow the full calculation, the use of a range of different fuel prices for 2017 from Ofgem for the PPM calculation, and the inability of the NHM to heat half of a dwelling which has been identified as being under-occupied. However, it was followed as closely as possible

[5] That said, giving any household more income is likely to result in higher carbon emissions, since the money will be spent on goods or services that themselves will have created carbon emissions. This has not been modelled here but should not be ignored when considering wider policy impacts.

[6] Fuel poverty methodology handbook 2017, Department of Energy & Climate Change, June 2016 - https://www.gov.uk/government/publications/fuel-poverty-statistics-methodology-handbook

wherever feasible and to the best extent that stock data and functionality in the NHM allowed. For instance, we added information to the NHM housing stock on occupancy patterns to determine whether a household requires a full heating regime (16 hours of heating a day) rather than a standard heating regime (nine hours of heating during weekdays and 16 hours of heating during the weekend), based on the household's characteristics.

2.4 Developing high level principles

One of the key outputs of the project was a set of 'high level principles' distilled and derived from significant findings and observations from other aspects of the project. A provisional set of high level principles emerged from the findings of the policy lead interviews, findings from modelling work for the study, and from internal discussions within CSE. These were presented at a stakeholder workshop attended by members of the CFP, the project steering group and other BEIS officials. The discussions emerging from this workshop were then used to refine and produce a revised set of high level principles which were presented to, and discussed with, the CFP. The final set of principles which has emerged from this process are presented in Section 6.

3 Review of tensions and synergies and proposed policy changes

3.1 Review of synergies and tensions

Across the set of policies that have been examined in this study there are a number of noteworthy areas where certain policies or combinations of different policies are pulling in different directions, in terms of the three objectives of meeting carbon abatement targets, fuel poverty reduction targets and keeping bills affordable. While there are also areas of synergy, this section aims to focus on examining existing tensions and proposing remedies that reduce these tensions where feasible.

The focus here is on tensions that prevent optimal progress towards the targets mentioned above. Other tensions may also exist, such as those between the objectives of different government departments. For example, there appear to be different opinions on whether the main purpose and objective of the WFP is fuel poverty reduction or pensioner poverty alleviation. However, these are beyond the remit of this study, although they are of interest given the scale of expenditure currently committed to the WFP.

It is also worth noting that some tensions may be acceptable or even desirable. For example, certain policies making financial contributions to households can result in people using these payments to increase the level of warmth in their homes by spending a proportion of this additional income or bill discount on increased energy consumption. This may increase carbon emissions when compared to a situation where they were not receiving a payment. However, the fact that these policies enable households to keep warmer at home means that this policy tension may be acceptable. That said, a better understanding of who is being given this option and whether they are the most in need might enable policy changes which reduce some of the tensions identified.

Carbon emissions reductions versus fuel poverty (and warmth)

Numerous studies have reported on the concept of comfort-taking when receiving a policy benefit and the fact that a potential financial benefit from an intervention, in this case a reduced bill or increased income, may instead be taken as improved comfort. Thermal improvements to a dwelling can allow inhabitants to both reduce their consumption (and thereby their bills) and increase the temperature in the home. Receiving additional income or receiving a bill discount can allow inhabitants to increase their consumption and still be financially better off, or just one or the other. While it is difficult to ascertain which households are mostly likely to exhibit this behaviour, it is highly probably that people on low incomes living in cold or expensive-to-heat homes are likely to be under-heating. It is therefore a reasonable assumption that these households in particular are more likely to improve their thermal comfort when receiving a financial benefit. There is, of course, an alternative scenario whereby low income households may keep themselves warm and go without other goods or services, such as spending less on food - often referred to as the ‘heat or eat’ dilemma.

The Warm Home Discount is an example of such a policy. By discounting fuel bills, this policy enables some households who would otherwise be under-heating their homes some financial flexibility to live in warmer circumstances, by enabling them to set their heating to come on for longer or set their thermostat to a higher temperature. The WHD payment is used in the fuel poverty calculation

and removed from bills when determining whether a household is in fuel poverty, this helps reduce the numbers and/or the depth of fuel poverty in certain instances. It can therefore been seen as a tension in the context of this study, in the sense that it is a policy that is helping to reduce fuel bills and fuel poverty but is in some instances likely to lead to increased energy consumption and thus carbon emissions. The WFP is another example of a policy exhibiting a similar tension.

Inappropriate targeting of measures

When considering the eligibility criteria or targeting of policies (or simply the types of households benefiting from policies) there are two apparent sources of tension. Firstly, inappropriate or inefficient targeting of schemes aiming to tackle fuel poverty result in policies failing to reach some of the most vulnerable households and thus insufficiently working towards alleviating fuel poverty. There are also examples where the majority of households benefiting from policies are on higher incomes than those who aren't benefiting from the policy yet all households are contributing to the costs of these policies. Essentially, these are 'regressive' policies whereby low income households pay for these policies without receiving any benefit. For example, policies such as the Feed-in Tariff or the Renewable Heat Incentive may be working towards reducing carbon emissions, but the former is funded through a levy on fuel bills and the latter, although paid for through taxation, still uses tax payer funding to finance the installation of measures into mostly wealthier homes. (It should be noted that some beneficiaries of these polices are households socially renting their homes from local authorities or housing associations, but the majority are households who own their own homes.)

Secondly, there are several groups of households who receive benefits from multiple policies while other types of households in similarly vulnerable situations receive much less support. The wider picture when considering the suite of policies in this study is that there is a 'stacking' of benefits on some types of household and a potential neglect of other types of households. Many of the latter are as likely to experience difficult circumstances and struggle to afford fuel bills.

An obvious example of policy stacking is for those households in receipt of the Guaranteed Element of Pension Credit. These households benefit from the following: automatic payment of the WFP, automatic bill discount through the core group of the WHD, inclusion in the safeguard tariff cap (effective from 2nd February 2018) and are eligible for the HHCRO element of ECO. Low income working age households with young children may qualify for ECO through their receipt of tax credits (and having an income below a certain threshold), and from being in the broader group of the WHD but they will not receive any automatic and regular benefit from any of the policies considered here (being in the broader group for the WHD does not guarantee receipt of the WHD as payments to this group are limited to approximately 800,000 households).

The receipt of means tested benefits has become a regularly used system for people to demonstrate their eligibility for policies. In the current financial climate of cuts to public services, including significant reductions in the welfare system, many households no longer qualify for these benefits. In addition, it is widely recognised that there exists a proportion of the population who qualify for benefits but, for many different reasons, fail to apply for these benefits. Thus, not only do they miss out directly on the benefits they are entitled to, they also miss out on any further entitlement to policies which rely on using these benefits as a proxy for low income status (or other vulnerable situations).

Thus the overall picture is one of over entitlement for some households and under entitlement for another group of households, in the context of a system which appears to ineffectively target fuel poor households.

Spending priorities: potential for better use of spending, particularly tax revenues

The majority of these policies are funded through either public funding from tax revenues (WFP, RHI) or through levies applied to fuel bills (WHD, ECO, FiT)[7]. They also work in two main ways: either applying a financial benefit to directly help reduce or pay for fuel bills (WFP, WHD, PPM cap) or assisting households or landlords to install energy efficiency or low carbon measures (ECO, RHI, FiT, MEES in the PRS). The WFP and the WHD make a one-off payment each year, and were these policies to end then those currently benefiting would be worse off the following year in the absence of any replacement policy. Installing energy efficiency measures will have a lasting impact on the energy requirement of a dwelling.

In essence, this then becomes a discussion of whether it is better to fund direct but short-term financial help each year, or to finance the improvement of dwellings and make more lasting change. In reality, a mixture of both is preferable. The costs of energy efficiency improvements for an individual home can be significantly greater than the value of the WHD or WFP payments to that household in any one year. Hence, fewer households could benefit from the same amount of annual funding being spent on energy efficiency improvements than direct financial benefits. Furthermore, a payment or bill discount in late autumn/early winter can make a considerable immediate difference to household finances and help manage energy bills and allow for a warmer home than would otherwise be possible. As officials from the Department for Work and Pensions (DWP) pointed out during their interview for this study, many people receiving these payments would not otherwise receive any help as things currently stand (in the year to September 2017, ECO installed a total of 215,000 measures[8] whereas the WFP reaches around six million households in England every year).

Having said that, approximately two thirds of the existing total expenditure on policies examined go toward fuel bill subsidies. Were these subsidies to end, they would have made no lasting difference to the condition of the housing stock or people's long-term ability to cope with cold winters (or hot summers).

Furthermore, these policies do nothing to reduce carbon emissions, either annually or in the long term, and may even increase them. Thus there appears to be a further tension between a) policies that provide immediate financial benefit to a large number of households but make no headway to

[7] It has been assumed in this modelling that the MEES in the PRS will be paid for either through grants from the ECO or privately financed by landlords. Similarly, the tariff price caps themselves do not need direct financing and it is assumed that these will be funded by energy companies through reducing their profit margin for these customers. A response to this may be that energy companies raise tariffs for other customers, but this is difficult to predict and this response has not been included in this analysis.

[8] Household Energy Efficiency National Statistics, headline release, Department for Business, Energy & Industrial Strategy, January 2018 - www.gov.uk/government/statistics/household-energy-efficiency-national-statistics-headline-release-january-2018

future proofing the housing stock and little or no reduction in carbon emissions, and b) policies that reach fewer households but make longer term improvements and work towards better housing for future generations. The funding balance currently appears to be weighted disproportionately towards the former. Shifting this balance a little towards the latter could help to make bigger inroads towards carbon emissions targets, have longer life time bill savings and could, if designed well and targeted effectively, assist with progress towards longer term fuel poverty targets. If we were to consider the lifetime bill savings of energy efficiency improvements with regard to their financing, rather than the immediate annual costs and bill savings, the latter option may also look more favourable.

As a result of the tensions discussed here, the rest of this section identifies a series of policy changes (or adjustments) that seek to address some of these tensions and adjust the balance of funding towards increasing the number of energy efficiency measures installed across the suite of policies under review.

3.2 Summary of proposed policy changes

The proposed policy changes outlined below arose from various aspects and outputs of this study, including modelling of current policies, the findings from the fuel poverty segmentation and meetings with both the project steering group and the members of the committee on fuel poverty. We also held discussions about individual schemes with key policy leads.

The proposed changes should not be regarded as a critique of individual policies or an attempt to wholly resign specific individual policies. The key objective here was to examine whether, when taken together as a suite of policies, a series of changes could be made that enable greater impact across the Government's collective goals: abating carbon emissions, reducing fuel poverty, and lowering energy bills.

This was not an exercise in proposing new policies or scrapping existing policies. The key word in this analysis is 'adjustment'. Naturally, the question then becomes: what constitutes an 'adjustment'. In this study, an adjustment to the policies was considered to be a change to the implementation, targeting or funding of the policy whilst simultaneously ensuring that each policy maintained its fundamental remit and purpose. The adjustments were considered within the existing policy or programme framework. For example, we did not change the mechanism for calculating ECO points or the types of measures available for ECO, or change the eligibility for the WFP to such an extent that it no longer focused on pensioners (the sole beneficiaries of this policy since its inception in 1998).

However, when considering future changes, some significant assumptions were made (as outlined below) for each policy change. Moreover, some potentially significant political barriers were not included as limitations to the proposed changes. More detailed discussion of these political barriers can be found in the conclusions at the end of the report.

An additional aim, when considering all policies in the round, was to ensure that there was no net spending change when considering total revenue and expenditure from both fuel consumers (through policy costs on their bills) and from general taxation. In other words, the total policy costs

of all policies combined was to remain constant between the two scenarios: current policy scenarios and policy change scenarios.

The changes suggested here should not be considered a set of individual policy recommendations, and certainly a number of the changes, while making improvements in some areas, also create problems in other areas – most notably in removing some policies from certain households. However, these changes have been proposed as, overall, they have a net positive impact on achieving the triple aims of reducing fuel bills, reducing carbon emissions and tackling fuel poverty, without leaving households in vulnerable situations devoid of benefits they already receive.

Finally, the development of these set of proposals has focused on the potential adjustments that could be made to policy design and targeting. We have not fully reviewed or analysed the practicality of implementing some of the changes proposed; the focus of the work has been to highlight the theoretical gains that could be achieved in the change to policy design. In some instances, these may present significant hurdles, but all of the changes proposed here are implementable. There are no technically insurmountable changes proposed in these adjustments.

3.3 Details of policy changes

Changes were proposed for six of the policies, with just the Feed-in Tariff remaining the same in both modelling scenarios. The change in each policy is summarised below.

Winter Fuel Payment (WFP)

Various changes were considered when developing a policy change scenario for the WFP. The overarching aim of these options was to reduce the scale of the policy while ensuring it maintained support for some of the most vulnerable pensioners. This proved a difficult task, and no option resulted in an entirely satisfactory proposal.

The most favourable proposed change to the WFP was to introduce stricter eligibility criteria so that people only qualified for a payment each year if they are either on the Guaranteed Element of Pension Credit, or on a state pension ***and*** have a limiting long term health condition or disability. The payment structure remains the same as currently (e.g. a standard payment being £200 with those over 80 receiving £300).

The downside of this approach is that to a certain extent, it maintains one of the tensions identified - that of stacking benefits on certain group of the population, namely, those on Pension Credit. However, there is significant support for means testing the winter fuel payment at low income pensioners only. For instance, the Institute for Fiscal Studies (IFS) has previously recommended means testing the WFP to those on Pension Credit to generate additional funds to pay for social care[9]. Similar calls were made by the Social Market Foundation[10].

However, restricting the policy to only those on pension credit risks removing the policy from very low income pensioners who are eligible for Pension Credit but do not receive it. Thus, the intention

[9] Options for raising revenue to pay for long-term care, Institute for Fiscal Studies, November 2011 - https://www.ifs.org.uk/publications/5954

[10] Axing and taxing: How to cut the deficit, Social Market Foundation, June 2010 - http://www.smf.co.uk/publications/axing-and-taxing-how-to-cut-the-deficit/

of also including any pensioner with a long term health condition was to help target a wider group of vulnerable pensioners who are likely to have higher energy costs as a result of health conditions. For example, many health conditions are exacerbated by cold temperatures or result in people being less mobile and more sedentary thus requiring higher ambient temperatures to maintain an adequate level of warmth[11]. Therefore, the objective of this additional criterion is an attempt to include low income pensioners who are not in receipt of Pension Credit but have a long term limiting health condition or disability.

It is worth reiterating that this is not a perfect solution to readdressing the balance from bill support policies to energy efficiency programmes. It is likely to result in some fuel poor, low income and potentially vulnerable pensioners missing out on the WFP. Nevertheless, it is arguably a worthwhile option to consider and allows the reallocation of a significant amount of public funds towards better targeted policies that make lasting improvements in the energy efficiency of homes of vulnerable households, and to reducing carbon emissions.

Warm Home Discount Scheme (WHD)

The WHD is a good example of several aspects of interest to this study. Firstly, the positive impacts of the policy are that it has been a pioneering project to demonstrate the potential for data matching processes to successfully target and reach those intended by the policy. The WHD used primary legislation to enable an effective data matching process to be developed between government departments and energy suppliers. As both the volumes of data increase and the ability to accurately match large data sets improves, this is a potential future route for increasing targeting efficiency of polices, potentially reducing the administrative burdens and costs and improving the customer experience of interacting with this policy.

However, the WHD is also one of several policies examined in this study that 'stacks' benefits on to certain groups of the population. People on the Guaranteed Element of Pension Credit will be in receipt of WHD payment, the WFP, are eligible for ECO HHCRO and, as plans currently stand, will be included in the vulnerable group for Ofgem's safeguarding tariff which is expected to be rolled out in 2019. Other groups in the population, such as low income families, are entitled to less help as things currently stand, and certainly don't enjoy automatic enrolment.

The WHD is often heralded as a successful policy, and in many respects it has done what it set out to do and is popular with both fuel poverty practitioners and the general public. In addition, the policy is paid for by consumers' fuel bills and adds £13 to a household's annual electricity bill, yet there has been little pressure to scrap this levy (in contrast to other policies which are also paid for by fuel bill levies). Nevertheless, there are a significant number of low income households with large fuel bills who help pay for this policy yet experience no benefit from it. With the change of definition of fuel poverty in 2012, the proportion of people receiving the WHD payment in the core group who are fuel poor has also reduced.

[11] Marmot M, Geddes I, Bloomer E, Allen J, Goldblatt P. The health impacts of cold homes and fuel poverty. Friends of the Earth/Marmot Review Team, 2011

All policies need to reflect both the changing circumstances of the wider world as well as the areas where they can be changed to better achieve their aims and objectives. For this project, we have suggested the following changes be implemented to the WHD:

- Remove the broader group and the variable eligibility criteria set at the discretion of different energy suppliers.
- Adjust the core group eligibility criteria to include all those eligible for the Cold Weather Payment[12] and assume that the majority qualify through an automated data matching process and payment.

These changes are not without disadvantages. They would remove the payment from a number of households that currently benefit from the policy through being in the broader group (all current core group households will still qualify). However, it would ensure that a broader set of vulnerable households automatically receive a discount on their energy bill. For instance, this policy is likely to reach more households currently living in the private rented sector.

These changes would also have several additional benefits. For example, currently some households in the broader group are reluctant to switch energy supplier for fear that they will no longer meet the broader group criteria of a different supplier. These changes eliminate that problem.

It should be noted that this study has not modelled the Industry Initiatives aspect of the WHD in the NHM, due to a lack of data as to its target beneficiaries or the precise nature and volume of benefits they actually receive.

Energy Company Obligation

The changes to ECO probably represent the biggest single change in terms of individual policy adjustments. As has been discussed previously, the most effective way of tackling all three objectives of lower bills, lower carbon emissions and fewer households living in fuel poverty (or in less severe fuel poverty) is to significantly increase the energy efficiency of as many homes as possible, particularly for the lowest income households and the most inefficient dwellings.

Tackling the inefficiency of the worst homes has the potential to make the most significant gains in carbon abatement and fuel bill savings. We have therefore proposed channelling the spending savings gained from reductions to the WFP into partially subsidising ECO from general taxation, to increase the impacts of ECO. This approximately doubles the ECO budget. With increased budget, there is also scope to adjust the eligibility criteria, and we have looked at two options for this (see

[12] Qualification criteria for Cold Weather Payment include: Pension Credit; Income Support and income-based Jobseeker's Allowance and have any of the following: a disability or pensioner premium, a child who is disabled, Child Tax Credit that includes a disability or severe disability element, a child under 5; Income-related Employment and Support Allowance (ESA) and have any of the following: a severe or enhanced disability premium, a pensioner premium, a child who is disabled, Child Tax Credit that includes a disability or severe disability element, a child under 5; Universal Credit, and not employed or self-employed and one of the following apply: limited capability for work amount (with or without a work-related activity amount), the disabled child amount in the UC claim, a child under 5.

below). The annual installation cap for boilers was also increased in line with the funding increases, from approximately 24,000 per year to 50,000 per year.

For the CERO element of the policy, the proposed changes to eligibility are to include all homes rated in EPC bands E, F or G, in order to focus on the most inefficient dwellings in the stock. (This also aligns with and would help work towards the long term ambitions set out in the Clean Growth Strategy[13] of improving all homes to a C rating by 2035.) The Solid Wall Minimum element was maintained, but the target was doubled, again in line with increased funding levels (as with the boiler maximum installation cap).

The first option for ECO HHCRO eligibility was to align this with the above proposal for the CERO element of ECO. Essentially, both ECO elements had the same eligibility criteria (any home in an EPC band E, F or G), but the mechanisms of funding of each element remained as they are currently (i.e. CERO installations were installed based on their lifetime carbon savings and HHCRO installations were installed based on lifetime bill savings of measures).

The second option modelled in the NHM was a more targeted eligibility design, which introduced a means tested benefit requirement; households had to be on one of the following benefits to qualify for the scheme[14]:

- Guaranteed Element of Pension Credit
- Income-based Jobseekers Allowance
- Income-based Employment and Support Allowance
- Income Support
- Child Tax Credits and/or Working Tax Credits or Universal Credit, with incomes below an equivalised threshold, dependent on household composition.

This reduced the total pool size of eligible households so the energy efficiency criteria for this second option was expanded to include dwellings rated D (any dwelling with an EPC rating of 68 or below).

All housing tenures were eligible for either element of ECO. (No Local Authority Flex criteria or spending has been included in this analysis – it has been assumed that measures will only be installed under this ECO to the households that qualify through the eligibility criteria as outlined above.)

Minimum Energy Efficiency Standards in the PRS

We believe that the Minimum Energy Efficiency Standards regulation for the Private Rented Sector heralds a great opportunity to improve the energy efficiency of some of the worst housing inhabited by some of the lowest income households. Approximately 46% of private rented households living in

[13] Clean Growth Strategy, Department for Business, Energy & Industrial Strategy, October 2017 - www.gov.uk/government/publications/clean-growth-strategy

[14] Note: The housing stock data did not include information on whether households were in receipt of Universal Credit. If it did, this would also have been added to the list of benefits here.

homes rated in EPC bands F or G rated are estimated to be in fuel poverty[15]. However, the existing regulations are not robust enough to capitalise on this opportunity to alleviate these household's fuel poverty. We therefore modelled a scenario in which landlords are required to spend a maximum of £5,000 per dwelling to bring a dwelling that is below the minimum standards up to or as close as possible to the minimum standard. Certain private rented tenants will also theoretically be eligible for ECO, if they are on certain means tested benefits. The modelling has therefore proceeded by first assuming a proportion of these households will access some ECO funding in order to improve the energy efficiency of their dwellings. For the PRS dwellings that remain in EPC bands F or G, the model then sought to improve these dwellings, applying this spending cap. Thus, in the modelling, the spending cap itself is independent of any ECO funding accessed.

PPM price cap and additional safeguard tariff

The proposed changes for the price cap very much follow Ofgem's lead and their recently published recommendations to extend a safeguard tariff to a further set of vulnerable households on standard variable tariffs[16]. However, this proposal stacks an additional benefit on those currently in receipt of the WHD, and to counter this we have attempted to target the safeguard tariff at a wider group of vulnerable households.

Data on the EHS (and thus by association the NHM stock) does not include information on which energy tariffs households are on, just the method of payment used to pay for fuel bills. Therefore, when modelling this extension, we have selected anyone using standard credit to pay for electricity or gas as being on a standard variable tariff. Eligibility for a tariff switch is then dependent on a household having someone who is on one of the following benefits[17]:

- Guaranteed Element of Pension Credit
- Income-based Jobseekers Allowance
- Income-based Employment and Support Allowance
- Income Support
- Child Tax Credits and/or Working Tax Credits with incomes below an equivalised threshold, dependent on household composition.

And also having someone in the household who:

- Has a long term illness or disability
- Is in receipt of a state pension
- Is a child under the age of 5 years

[15] Fuel Poverty Trends 2017, National Statistics, June 2017 - https://www.gov.uk/government/statistics/fuel-poverty-trends-2017

[16] Vulnerable customer safeguard tariff, Ofgem website - https://www.ofgem.gov.uk/about-us/how-we-work/working-consumers/protecting-and-empowering-consumers-vulnerable-situations/consumer-vulnerability-strategy/vulnerable-customer-safeguard-tariff

[17] Note: The housing stock data did not include information on whether households were in receipt of Universal Credit. If it did, this would also have been added to the list of benefits here.

Thus these criteria aim to include people who are both low income but with an additional vulnerability (having a long term health condition, being an older adult, or with a young child).

The tariff cap applied is the same currently applied to those using prepayment meters. We have assumed that data matching will enable an automatic switch to occur under this policy.

Renewable Heat Incentive

The Renewable Heat Incentive (RHI) is currently a policy that on the whole enables households who are able to afford the upfront costs of technologies to install low carbon heating technologies. The nature of the technologies included in the policy mean that beneficiaries of this policy live in mostly rural locations as the systems are replacing off gas heating systems. It should also be noted that social landlords have also used the RHI to help fund the installation of heating systems in social housing.

As the RHI is paid for through general taxation, this is a relatively more progressive policy than the Feed-in Tariff, which is funded from fuel bills. During the research, current policy thinking was being developed in an attempt to allow lower income households to engage in the policy through an 'assignment of rights' amendment. This would allow a third party to pay the upfront costs of installing the technology in a home, and then receive the seven year payments to recuperate this cost. The household would not pay for the technology or receive the RHI payments, but they would own the technology - a new system that would likely reduce fuel bills and almost certainly produce less carbon emissions.

The details were yet to be finalised during the modelling stage of the work, and it is uncertain as to how successful this will be in practice. However, adjusting the policy like this does potentially allow for lower income households to benefit from these technologies, particularly low income households living off the gas grid. Therefore, in terms of modelling these potential changes, we have assumed that in the future some lower income households in the private sector will benefit from the installation of low carbon heating systems through the RHI. It has also been assumed that some RHI installations will continue to be installed in social housing.

Since concluding this research, the Government has confirmed that the RHI will be modified to include an 'assignment of rights' aspect in the policy. This will come into effect in June 2018.

3.4 Summary of financial changes

The following two tables (Table 3.1 and Table 3.2) show the approximate funding amounts and sources for ECO, WFP, WHD, RHI and FiT policies. The PPM price cap and the MEES in the PRS are assumed to be regulatory instruments and not included here.

The funding shown in the data is for England only. It is estimated that the current annual cost of providing WFP to pensioners in England is £1.8B. This is paid for through general taxation, as is the annual £156M required for the domestic element of the RHI. Currently ECO, the WHD and the FiT are payed for through fuel bill levies, with £670M collected for ECO, £315M for the WHD and approximately £210m for the FiT annually.

The proposed financial changes are summarised in Table 3.2. The changes to the WHD require an additional £109M per year. In order to ensure there was no increase in overall fuel levies after the policy adjustments, the additional requirement resulting from the WHD adjustments was taken from the ECO budget. This was then increased by £892M of public funding made available by reducing the scale of the WFP. Overall the total funding for ECO increased from £670M to £1,473M, and the cost of WFP policy reduces to £892M from £1.8B. However, as shown in the total row in each table, the total public funding and the total funding from fuel bill levies remained constant between both scenarios, ensuring that no additional levies were placed on fuel bills and no additional public money was required.

Table 3.1: Summary of sources and annual funding requirements for current policies

Policy	Funding from tax (£M)	Funding from fuel bill levies (£M)	Total funding (£M)
ECO (HHCRO and CERO)	-	£670	£670
WFP	£1,802	-	£1,802
WHD	-	£315	£315
RHI (Domestic only)	£156	-	£156
FiT	-	£211	£211
All five policies	**£1,958**	**£1,196**	**£3,154**

Table 3.2: Summary of sources and annual funding requirements for policies after proposed changes

Policy	Funding from tax	Funding from fuel bill levies	Total funding
ECO (HHCRO and CERO)	£910	£563	£1,473
WFP	£892	-	£892
WHD	-	£424	£424
RHI	£156	-	£156
FiT	-	£209	£209
All five policies	**£1,958**	**£1,196**	**£3,154**

4 Fuel Poverty Segmentation

4.1 Headline results

A full report[18] which includes a detailed methodology and describes each fuel poor archetype in detail was prepared for the Committee on Fuel Poverty and accompanies this report separately. The following section provides a summary of the segmentation findings and a summary of the characteristic of each archetype. (For further assessment of each archetype, please refer to the separate report.)

The complete segmentation of households in the EHS is shown in Table 4.1 below. These are distinct and separate sets of households and each case in the EHS was allocated to one of these groups. The 'fuel poor' archetypes were categorised as those groups where the proportion of fuel poor households was greater than the national average (11%). Thus, the top 12 groups in Table 4.1 are the fuel poor archetypes identified in this analysis. Together they accounted for 1.8 million of the 2.4 million fuel poor households, or 76% of all fuel poor homes in England in 2014.

Further analysis demonstrated that 91% of fuel poor households living in F or G rated dwellings and 95% living in E rated dwellings were captured by these archetypes. The majority of the fuel poor households not included in the fuel poor archetypes were living in EPC D rated homes and half of these could be found in two large D archetypes. Fuel poor households in these 'non-fuel poor' archetypes shared similar household and housing characteristics as the rest of the group but typically were at the lowest end of the income spectrum and the highest end of the fuel cost spectrum in these groups.

Energy efficiency ratings of homes proved to be one of the most significant drivers of the fuel poverty gap and the 12 fuel poverty archetypes were further sub-divided into three sets of four archetypes with energy efficiency ratings of 'D', 'E', and 'F/G', respectively. The archetype group names have been allocated according to the energy efficiency bands of their homes, thus the four fuel poor archetypes with energy efficiency ratings of F or G are referred to from here on as F&G1, F&G2, F&G3 and F&G4, respectively, with the same naming system used for each of the four 'E' and 'D' archetypes. (They are also given more lengthy names in the more detailed descriptions below, which summarise their distinct household and housing characteristics.) These three sets of fuel poor archetypes, split by energy efficiency rating are summarised in the diagrams provided below in section 4.2. Further individual descriptions and summaries of each group are available in a separate report (see above).

[18] Segmentation of the EHS: Identifying fuel poor archetypes, Internal Paper for the Committee on Fuel Poverty, November 2017

Table 4.1: Summary of groups identified through CHAID analysis of fuel poverty gap (EHS 2014)

Archetype	Proportion in fuel poverty	Total number of households	Number of fuel poor households	Average FP gap of FP households only	Aggregate fuel poverty gap (total)	Average energy efficiency rating (SAP)	Average modelled fuel costs (£)	Average household income (£)
Group F&G1	84%	133,141	112,274	£998	£112m	27	£2,092	£14,919
Group F&G2	24%	193,163	47,288	£1,397	£66m	29	£3,013	£41,346
Group F&G3	39%	145,601	56,550	£767	£43m	27	£2,382	£18,778
Group F&G4	31%	148,421	46,092	£943	£43m	26	£1,908	£11,005
Group E1	56%	275,901	154,313	£485	£75m	48	£1,545	£14,844
Group E2	37%	719,393	268,148	£407	£109m	49	£1,676	£24,524
Group E3	46%	504,502	232,985	£260	£60m	49	£1,390	£13,597
Group E4	16%	414,213	66,104	£503	£33m	49	£1,726	£25,758
Group D1	44%	357,296	155,877	£218	£34m	62	£1,290	£14,789
Group D2	17%	501,935	84,332	£259	£22m	62	£1,418	£28,762
Group D3	23%	2,396,036	550,405	£163	£90m	63	£1,268	£18,865
Group D4	12%	279,173	33,111	£284	£9m	61	£1,487	£30,617
Non-fuel poor archetypes	*4%*	*457,121*	*18,121*	*£807*	*£15m*	*30*	*£2,267*	*£42,927*
	10%	*136,989*	*13,128*	*£304*	*£4m*	*62*	*£1,039*	*£12,604*
	6%	*104,944*	*6,491*	*£241*	*£2m*	*28*	*£1,908*	*£18,841*
	3%	*734,664*	*19,325*	*£438*	*£8m*	*48*	*£1,633*	*£23,546*
	1%	*1,187,757*	*17,443*	*£768*	*£13m*	*48*	*£1,938*	*£54,769*
	8%	*2,459,695*	*208,211*	*£131*	*£27m*	*63*	*£1,133*	*£16,928*
	6%	*1,970,837*	*108,860*	*£199*	*£22m*	*63*	*£1,454*	*£44,908*
	4%	*1,717,931*	*69,791*	*£213*	*£15m*	*73*	*£1,023*	*£22,044*
	5%	*1,086,302*	*52,602*	*£169*	*£9m*	*62*	*£1,401*	*£41,448*
	2%	*1,501,553*	*25,883*	*£94*	*£2m*	*74*	*£1,031*	*£30,324*
	1%	*2,644,122*	*22,430*	*£152*	*£3m*	*63*	*£1,430*	*£43,443*
	1%	*1,303,109*	*9,593*	*£40*	*£0*	*74*	*£862*	*£14,771*
	0%	*1,168,471*	*0*	*£0*	*£0*	*73*	*£1,261*	*£53,495*

4.2 Summary of fuel poor archetypes by energy efficiency rating (D, E, F and G)

Overall, the nature of fuel poverty and its definition means that there are some common characteristics associated with fuel poor households and the homes in which they live. For example, the majority of fuel poor households (approximately 2 million of the total 2.4 million fuel poor households) live in urban areas in homes connected to the mains gas grid. In addition, almost 60% of fuel poor households live in dwellings with energy efficiency ratings of D or above.

However, households are likely to be in more severe fuel poverty (i.e. have a larger fuel poverty gap) if they live in older dwellings, with solid walls and don't use mains gas to heat their homes – typically homes with energy efficiency ratings of E or below, and many of which are in more rural locations. In addition, a similar energy efficiency rating (e.g. EPC band D) does not necessarily infer similar dwelling characteristics – the EPC rating of buildings can be influenced by a variety of factors including the wall type, the levels of insulation, the heating system and the heating fuel.

In addition, household characteristics of the fuel poor can vary significantly too. On average, fuel poor households are on low incomes and households which are disproportionally affected by fuel poverty (i.e. have high proportions of their 'type' in fuel poverty) are those living in private rented accommodation, unemployed and younger. However, the majority of fuel poor households are working or retired, and owner occupied households account for over 40% of fuel poor households.

Therefore, the segmentation presented here aims to serve several purposes. Firstly, to reveal those households who suffer more extreme levels of fuel poverty and typically have different characteristics to the majority of fuel poor households. These households are often referred to as '*hard-to-treat*', primarily because they inhabit homes which are off the gas grid and use more expensive heating fuels, but also have solid walls which are expensive to retrofit and insulate. The four archetypes identify by CHAID that have energy efficiency ratings of F or G represent the majority of these '*hard-to-treat*' fuel poor households.

Secondly, the analysis sought to reveal the differences that exist within a wider and seemingly more homogenous set of fuel poor households. For example, looking at the archetypes living in homes with energy efficiency ratings of D, archetype D3 represents a set of middle aged households renting newer but poorly insulated homes (built since 1945) that are in low income employment, whereas archetype D4 is comprised of older households which include someone with a long-term limiting illness or disability. These households own their own homes and are on significantly higher incomes than D3 but live in very old (pre-1919) solid wall constructed homes.

Thirdly, by segmenting households in this way, the analysis reveals the different drivers of fuel poverty that exist for different types of households. In some cases, the three-way clash of having very low incomes, inefficient homes and paying high fuel costs all combine to result in the most extreme experiences of fuel poverty, such as the case for archetypes F&G1 and F&G4. In other groups of households, one of these drivers of fuel poverty tends to dominate more than others, such as the case of the more wealthy F&G2 households where the large fuel poverty gaps of these households is primarily the result of large inefficient homes that are expensive to heat. For E3 households, their low incomes appear to be the most influential factor in driving this group into fuel poverty.

Furthermore, the segmentation of these households can assist with the identification of different solutions to reduce fuel poverty within each group and thus across the country as a whole. This is explored in the following section (section 5), which presents the findings of the modelling results. However, this should not distract from a previously made point – that there is an undoubtable correlation between high fuel poverty gaps and the inefficiency of homes. For the majority of households across all archetypes, the experience of fuel poverty could be significantly lessened over the long term through energy efficiency improvements, particularly the insulation of solid walls and remaining empty cavities, to a lesser extent any lofts yet to receive full loft insulation, and also heating system upgrades.

Finally, it should be stated that none of the 'fuel poor' archetypes are comprised of 100% fuel poor households – the proportion of households in fuel poverty ranges from 84% in group F&G1 to 12% of group D4. However, all the households in each of the groups will share common characteristics, and many of those who are not currently specified as being fuel poor are close to the fuel poverty thresholds. Small changes to their circumstances or, for example, to the national median fuel cost threshold could result in a number of these households being 'pulled' into fuel poverty.

A diagrammatic summary of each set of fuel poor archetypes is shown below in Figure 4.2 (F&G archetypes), Figure 4.3 (E archetypes) and Figure 4.4 (D archetypes). These more detailed descriptions include a comparison between the fuel poor and the non-fuel poor households, highlighting any key differences in the dwelling and households characteristics between those living in fuel poverty and those not.

The colour scheme applied to the archetype tables mimic the energy efficiency rating colour scheme shown below in Figure 4.1. F or G archetypes have been associated with red, E with orange and D with yellow.

Figure 4.1: Energy efficiency rating scale for EPCs in England and Wales

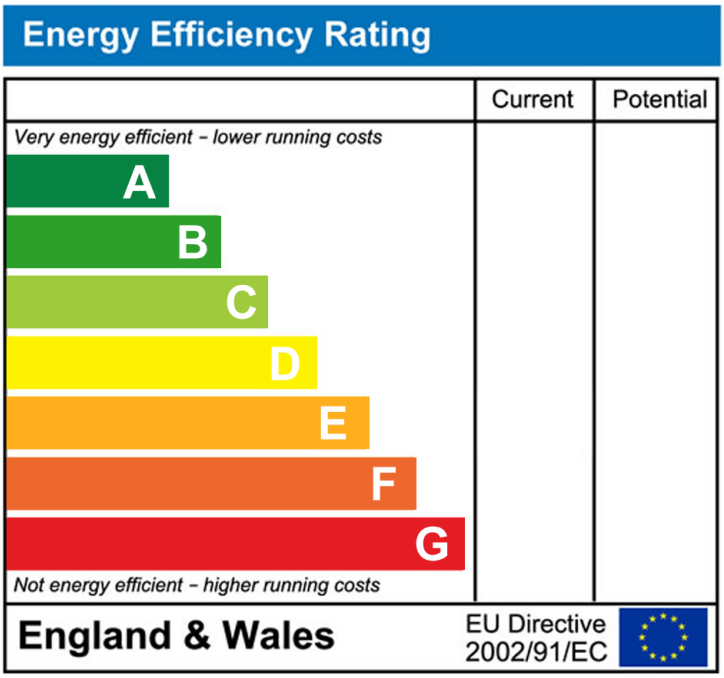


Figure 4.2: Summary of fuel poor archetypes living in dwellings rated in EPC bands F or G

	F&G1 Private rented low income tenants living in the least efficient solid wall electrically heated converted flats	F&G2 Wealthier middle age or retired household living in villages/hamlets in solid walled, oil heated detached houses with very high fuel costs	F&G3 Off-gas empty nesters in low paid employment living in old solid wall dwellings	F&G4 Very low income retired households living in off-gas dwellings that they own outright	All F and G archetypes
Size of group	133,100	193,200	145,600	148,400	620,300
Proportion in Fuel Poverty	84%	24%	39%	31%	42%
Numbers in Fuel Poverty	112,300	47,300	56,600	46,100	262,300
Total fuel poverty gap	£112,068,291	£66,068,424	£43,392,741	£43,465,716	
Average Fuel Poverty gap (FP households)	£998	£1,397	£767	£943	
Tenure	Private renters (80%)	Owner occupiers (88%)	Owner occupiers (54%) and private renters (37%)	Owner occupiers (100%)	
Rurality	60% urban, 40% rural locations	Villages and hamlets	Two-thirds urban, 25% villages and hamlets	65% urban, 20% town and fringe 15% villages	
Age	Mixed: 30% under 35, 25% 65 years or older	Most working age above 45 years, 33% pensioners	Older households (most over 45 years old, 33% over 65 years old)	80% over 65	
Household type	Single adult households (67%) HMOs (22%)	Couples or families with children	Single adults (50%), couples (30%), families (20%)	60% lone pensioners 17% pensioner couples	
Income	Low (average = £14,900) 57% on means tested benefits	High (average = £41,000), no household on means tested benefits	Below average (£18,800)	Very low (average = £11,000) 57% on means tested benefits	
Employment status	30% in employment, 29% retired, 29% unemployed, 10% eductation	Either in full employment (66%) or retired (34%)	In employment (70%) or retired (14%) or other inactive (13%)	Retired (80%)	
Ethnic origin of households	10% from BAME backgrounds	No BAME households	11% from BAME backgrounds	6% from BAME households	
Long term illness or disability	51%	19%	22%	48%	
Method of paying for electricity	33% Direct Debit, 36% PPM	78% Direct Debit	61% Direct Debit, 20% PPM	61% Direct Debit, 20% PPM	
Dwelling type	54% flats (36% converted, 18% purpose built)	Detached (70%) or semi-detached (22%)	Terraced or semi-detached	Bungalows, semi-detached or terraces	
Dwelling age	Old: 71% built before 1919	Old: 76% pre-1919	63% pre-1919, 30% 1919-1965	Old and newer: 42% pre-1919, 40% post 1945	
Wall type	Solid walls (78%)	Solid walls (78%)	Mostly solid walls (67%), but also uninsulated cavities (25%)	Mostly solid walls (64%), but also uninsulated cavities (23%)	
Heating fuel	59% Electricity	100% Oil central heating (All off gas)	51% electricity, 15% solid fuel	48% electricity, 11% oil	
Loft insulation	Poor: 22% with none and 47% with less than 100	OK: 67% with more than 100mm, 25% with full loft insulation	OK: 50% with 100mm or more, but 20% with none	OK: 63% with 100mm or more, but 20% with none	

Figure 4.3: Summary of fuel poor archetypes living in dwellings rated in EPC band E

	E1 Low income non-working or retired adult only households living in old solid wall gas heated urban terraces	E2 Average earning families with high housing costs privately renting or owning terraces or semi-detached houses	E3 Older very low income households living in post war bungalows and semi-detached houses	E4 Middle-aged working adults on reasonable incomes living in larger solid wall or uninsulated cavity wall houses	All E archetypes
Size of group	275,900	719,400	504,500	414,200	1,914,000
Proportion in Fuel Poverty	56%	37%	46%	16%	38%
Numbers in Fuel Poverty	154,300	268,100	233,000	66,100	721,500
Total fuel poverty gap	£74,788,569	£109,033,298	£60,496,840	£33,270,582	
Average Fuel Poverty gap (FP households)	£485	£407	£260	£503	
Tenure	Private renters (48%) and owner occupiers (40%)	Private renters (43%) and owner occupiers (47%)	Owner occupiers (50%), private renters (25%), social renters (25%)	Owner occupiers (80%)	
Rurality	Urban (84%)	Urban (82%)	Urban (78%)	Urban (78%)	
Age	Mixed: 24% under 35 years, 31% 65 years or older	All working age (70% 25-45 years)	Older households: 80% over 45 years 55% over 65 years	All aged between 45 and 65	
Household type	Single adults (50%) and couples (40%)	Families with children (52%), couples (20%) or single adults (20%)	Single adults (70%) and couples (16%)	Couples (40%), single adults (29%), families (18%)	
Income	Low (average income = £14,800) 59% on means tested benefits	Average income (£24,500)	Very low (average income = £13,600) 52% on means tested benefits	Average income (£25,800) only 5% on means tested benefits	
Employment status	Retired (37%), unemployed (19%) or other inactive (13%)	Full time (77%) or part-time work (11%)	Retired (60%) or inactive (17%) or part-time work (10%)	Full time (76%) or part-time work (10%)	
Ethnic origin of households	15% from BAME backgrounds	19% from BAME backgrounds	8% from BAME backgrounds	9% from BAME backgrounds	
Long term illness or disability	35%	23%	49%	34%	
Method of paying for electricity	46% Direct Debit, 25% PPM	59% Direct Debit, 23% PPM	50% Direct Debit, 29% PPM	75% Direct Debit, 12% PPM	
Dwelling type	65% terraced houses, 18% converted flats	40% terraced houses, 32% semi-detached	32% semi-detached, 25% bungalows	33% terraced houses, 38% semi-detached	
Dwelling age	Very old: All dwellings built before 1919	Mixed: 40% built before 1919, 33% since 1945	Newer homes: All dwellings built from 1919 onwards (33% since 1945)	Newer homes: Most built from 1919 onwards, 40% since 1945	
Wall type	Solid walls	60% solid walls, 32% uninsulated cavities	Mostly cavity walls, but over a half these uninsulated	50% solid walls, 35% uninsulated cavities	
Heating fuel	Mains gas (85%)	Mains gas (85%)	68% Mains gas, 23% electricity, 6% oil	Mains gas (84%)	
Loft insulation	Poor - 16% with no insulation	Poor - 13% with no insulation	OK - 40% with full insulation, 62% more than 100mm	OK - 60% more than 100mm, but only 21% with full insulation	

Figure 4.4: Summary of fuel poor archetypes living in dwellings rated in EPC band D

	D1 Younger non-working BAME households on low incomes living in urban locations privately renting older solid wall terraces or converted flats	D2 Average earning young families with high housing costs privately renting or owning very old terraces or semi-detached houses	D3 middle aged renters in low income employment living in newer urban homes with poor levels of insulation	D4 Older owner occupier households on higher than average incomes but with long term health conditions living in old solid wall terraced housing	All D archetypes
Size of group	357,300	501,900	2,396,000	279,200	3,534,400
Proportion in Fuel Poverty	44%	17%	23%	12%	23%
Numbers in Fuel Poverty	155,900	84,300	550,400	33,100	823,700
Total aggregate fuel poverty gap	£33,988,601	£21,845,025	£89,584,633	£9,399,888	
Average Fuel Poverty gap (FP households only)	£218	£259	£163	£284	
Tenure	Private renters (60%)	Private renters (49%) and owner occupiers (40%)	Social renters (37%) and Private renters (29%)	Owner occupiers (82%)	
Rurality	Urban (94%)	Urban (92%)	Urban (87%)	Rural (23%) and urban (77%) locations	
Age	Young households: 30% under 25 years, 50% 25-54.	57% aged between 25 and 35 30% aged between 35 and 54	75% aged between 35 and 65	Older households: 78% over 45 years, 34% over 65 years	
Household type	HMOs (35%), single adults (27%) and lone parents (18%)	Families (40%) - including lone parents (13%), and couples (33%)	Families (43%) - lone parents (21%), single adults (27%) and couples (18%)	Couples (46%) and families (32%)	
Income	Low (average income = £14,800) 54% on means tested benefits	Average income (£28,800)	Low (average income = £18,900) 46% on means tested benefits	Above average income (£30,600)	
Employment status	Unemployed (20%), other inactive (31%) or full-time eduction (24%)	Full time (63%) or part-time work (16%)	In employment (62%), unemployed (10%) or other inactive (24%)	In employment (51%) or retired (34%)	
Ethnic origin of households	26% from BAME backgrounds	23% from BAME backgrounds	15% from BAME backgrounds	7% from BAME backgrounds	
Long term illness or disability	32%	28%	38%	100%	
Method of paying for electricity	34% Direct Debit, 43% PPM	57% Quarterly, 43% PPM	50% Direct Debit, 36% PPM	100% Direct Debit	
Dwelling type	50% mid-terraced houses, 28% converted flats	60% mid-terraced houses, 20% converted flats	33% terraced, 30% semi-detached, 20% lowrise purpose-built flats	64% terraced, 17% semi-detached, 9% converted flats	
Dwelling age	Very old: All houses built before 1919	Very old: All houses built before 1919	Newer: All dwellings built after 1919, 75% built since 1945, 12% since 1990	Very old: All houses built before 1919	
Wall type	80% solid wall	84% solid wall	45% insulated cavity walls 36% uninsulated cavity walls	72% solid walls 16% uninsulated cavity walls	
Heating fuel	98% mains gas central heating	97% mains gas central heating	89% mains gas central heating (8% storage heaters)	96% mains gas central heating	
Loft insulation	OK - 50% more than 100mm, but only 25% with full insulation	OK - 61% more than 100mm, but only 35% with full insulation	OK - 38% with full insulation, 62% more than 100mm	Good - 45% with full insulation, 77% more than 100mm	

5 Modelling Scenarios: Current and future options

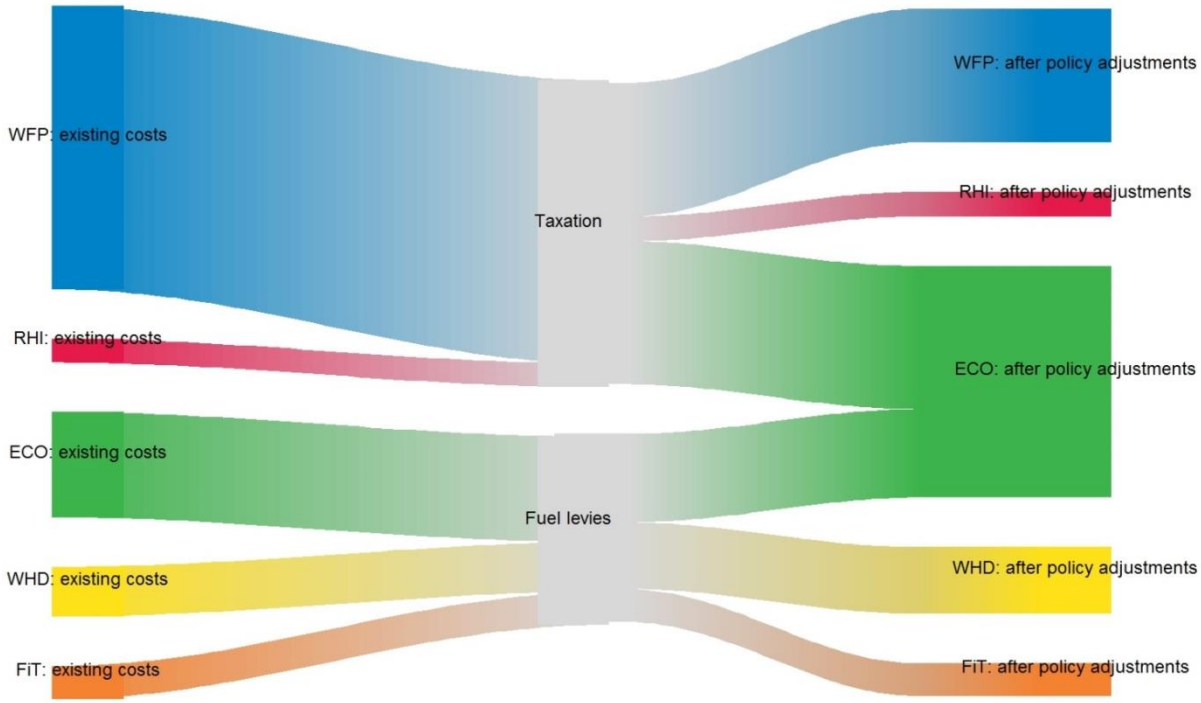
This section presents a series of headline results from the modelling of policies as they currently exist, and following the proposed changes outlined in Section 3. Some of the results are presented broken down by the fuel poor archetypes as described in Section 4.

5.1 Financial changes

The most significant change in the financing of the policies was the reduced public expenditure on the WFP, and the re-allocation of this money to provide additional funding to ECO. This resulted in an approximate doubling of the total expenditure on ECO (to both CERO and HHCRO elements). In addition, changes to the WHD resulted in increased costs for this policy, with a resulting increase in the total amount of funding required from fuel levies. In order to balance this and ensure that the total fuel levies remained approximately constant before and after the proposed policy changes, the amount of ECO funding obtained from fuel levies was reduced to compensate for the additional funding requirement for the WHD. An alternative approach here could have been to partially subsidise the WHD from some of the general taxation gains resulting from the reduction in scale of the WFP. However, the former approach is more straightforward in administering and requires only one additional stream of financing (from taxation to ECO). The funding streams of the RHI and the FiT were unchanged, both in the amount of funding and the sources of the funding.

These changes are summarised below in Figure 5.1. The PPM price cap and the MEES in the PRS are not included in the diagram as they are categorised as regulatory instruments rather than funded policies, and do not require finance streams from either taxation or fuel levies. (Policy adjustments for MEES required landlords to make investments in improvements.)

Figure 5.1: Funding of policies and proposed changes to the funding amounts and sources



5.2 Households targeted by policies

Eligibility changes and fuel poor targeting

Certain policies had their eligibility criteria altered and for some policies not all eligible households will have received support over the modelling run (e.g. ECO). Table 5.1 below shows how means tested eligibility status of households changed as a result of proposed changes to ECO (HHCRO only), the WHD and the WFP. Other policies did not have means tested eligibility criteria in the same manner as these policies and thus were not included here, but further results on these are presented below.

A review of current targeting efficiency of ECO suggested that that one in four households eligible for ECO live in fuel poverty (a targeting efficiency of 25%). This dropped to 18% when ECO was targeted at all homes rated in EPC bands E or below, but the increase in total numbers of eligible households meant that a higher number of fuel poor households were eligible overall, when compared to the current policy. Adding a more targeted eligibility to ECO (being on means tested benefits and in dwellings rated in EPC band D or below) increased the targeting efficiency to 23%, but was still lower than the current targeting efficiency. As the means tested benefit element of the eligibility criteria in this scenario was similar to the current policy, this suggests that there were a number of fuel poor households on these benefits in homes rated in EPC band C or above. Changes to the WFP and the WHD had a small opposite effect with fuel poverty targeting efficiency increasing slightly for these policies from 6% to 7% and 14% to 15%, respectively.

The overall combined impact of the changes to these three policies was an increase in the number and proportion of fuel poor households eligible for assistance. The changes to ECO enabled a significant increase in the number of fuel poor homes who qualified for the scheme (although at a reduced targeting efficiency), and the reduction in the scale of the WFP removed millions of non-fuel poor households from qualifying for the payment. Finally, changes to the WHD increased both the number and the proportion of fuel poor households that qualified for a bill discount.

When considering the policies together collectively, the overall impact for the first set of proposed policy changes (with a less targeted ECO) was that the number of fuel poor households that qualified for at least one of the policies increased from 927,000 to 1.41 million, while the total number of households eligible for one or more of these policies reduced from 9.9 million to 9.1 million, resulting in the fuel poverty targeting efficiency increasing from 9% to 12%. For the second set of proposed changes (a more targeted ECO), the number of fuel poor households eligible reduced from 927,000 million to 644,000 million, but the total number of households eligible also dropped to 5.5 million. In this instance, the resulting fuel poverty targeting efficiency also increased to 12%.

Figure 5.2, Figure 5.3 and Figure 5.4 below show the proportion of each fuel poor archetype that received energy efficiency measures or a financial benefit from the eight policies modelled in the NHM over a five year period. For ECO, MEES in the PRS, FiT and RHI, the modelling has selected a subset of the population to receive energy efficiency measures so not all those eligible were included in these results. (All households are theoretically eligible for the FiT or the RHI, but many are excluded due to lack of personal resources to fund these installations.) For the WFP, WHD and PPM price cap (and additional safeguard tariff), all eligible households benefited from these policies thus the proportion receiving a benefit from the policy is equal to the proportion eligible.

Table 5.1: Policy eligibility and fuel poverty targeting efficiency

Policy	Fuel poor status	Estimation of current households eligible		Estimation of households eligible after changes		Estimation of households eligible after changes with a more targeted ECO	
		Number (000s)	%	Number (000s)	%	Number (000s)	%
ECO-HHCRO	Not fuel poor	1,615	75%	4,171	82%	1,604	77%
	Fuel poor	528	25%	890	18%	479	23%
	Total	**2,144**	**100%**	**5,061**	**100%**	**2,083**	**100%**
Winter Fuel Payment	Not fuel poor	7,436	94%	3,367	93%	3,367	93%
	Fuel poor	472	6%	237	7%	237	7%
	Total	**7,908**	**100%**	**3,604**	**100%**	**3,604**	**100%**
Warm Home Discount	Not fuel poor	1,902	86%	2,090	85%	2,090	85%
	Fuel poor	300	14%	364	15%	364	15%
	Total	**2,203**	**100%**	**2,454**	**100%**	**2,454**	**100%**
Combined policies (eligible for one or more)	**Not fuel poor**	9,005	91%	7,991	88%	4,898	88%
	Fuel poor	927	9%	1,141	12%	644	12%
	Total	**9,932**	**100%**	**9,132**	**100%**	**5,542**	**100%**

Note: fuel poverty status as presented in this table has been calculated using the National Household Model (NHM). As mentioned in Section 2.3, this does not exactly match the methodology used to produce the official national fuel poverty statistics determined in the EHS, thus proportions of fuel poor households eligible for the policies above may vary to other reported fuel poverty targeting efficiencies.

Figure 5.2: Percentages of fuel poor archetype estimated to be benefiting from current policies

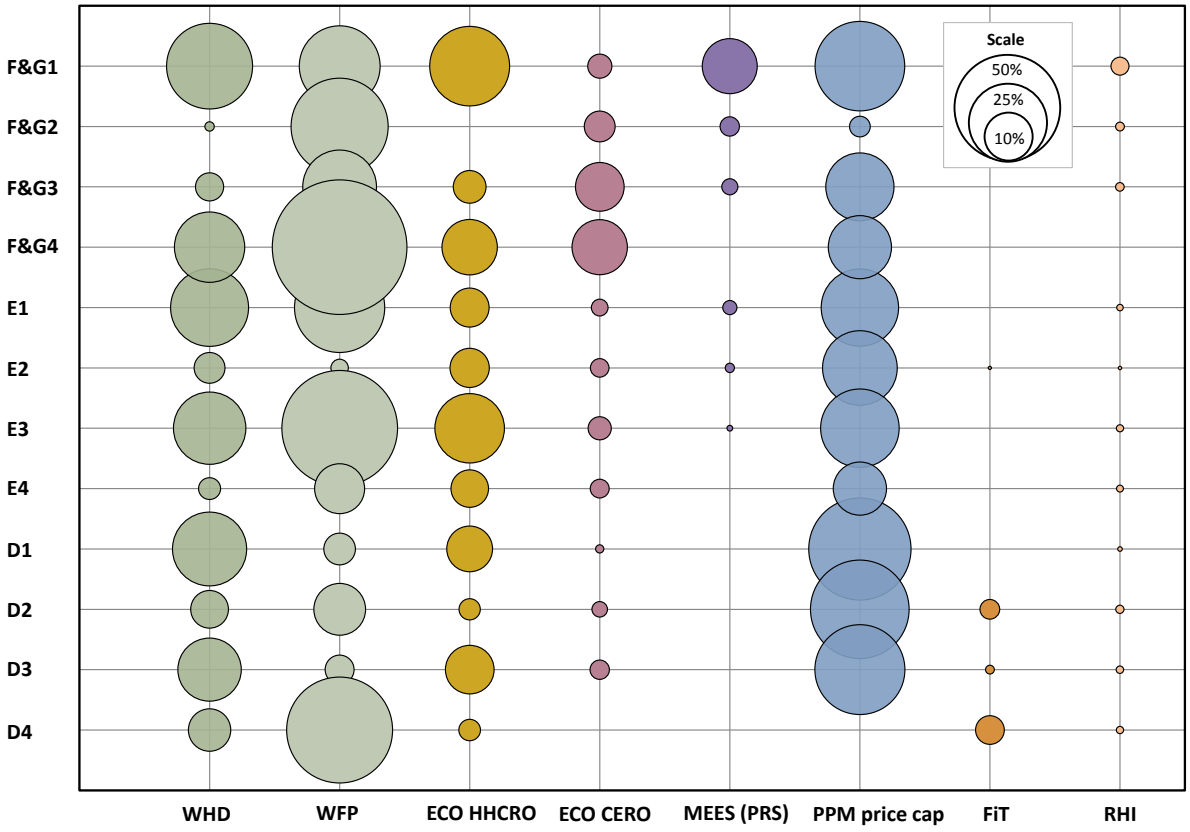


Figure 5.3: Percentages of each fuel poor archetype benefiting after modelling proposed policy change scenarios

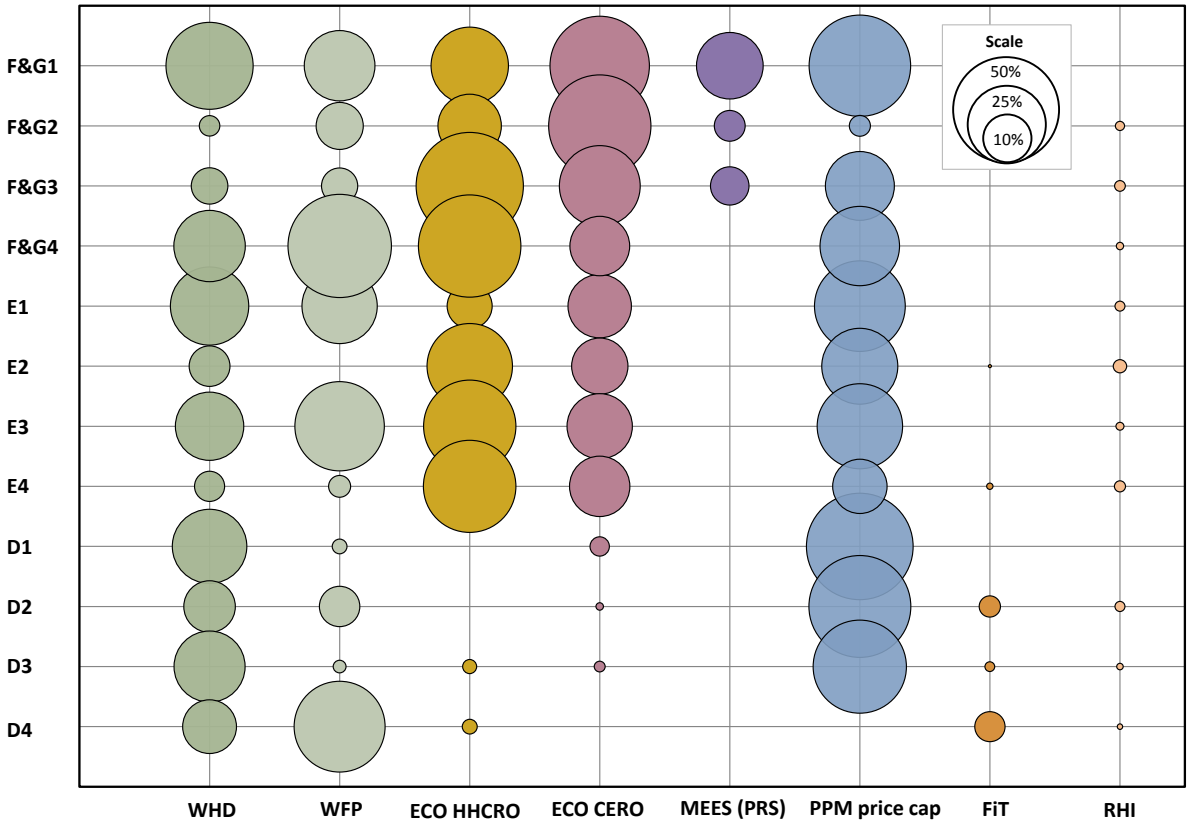
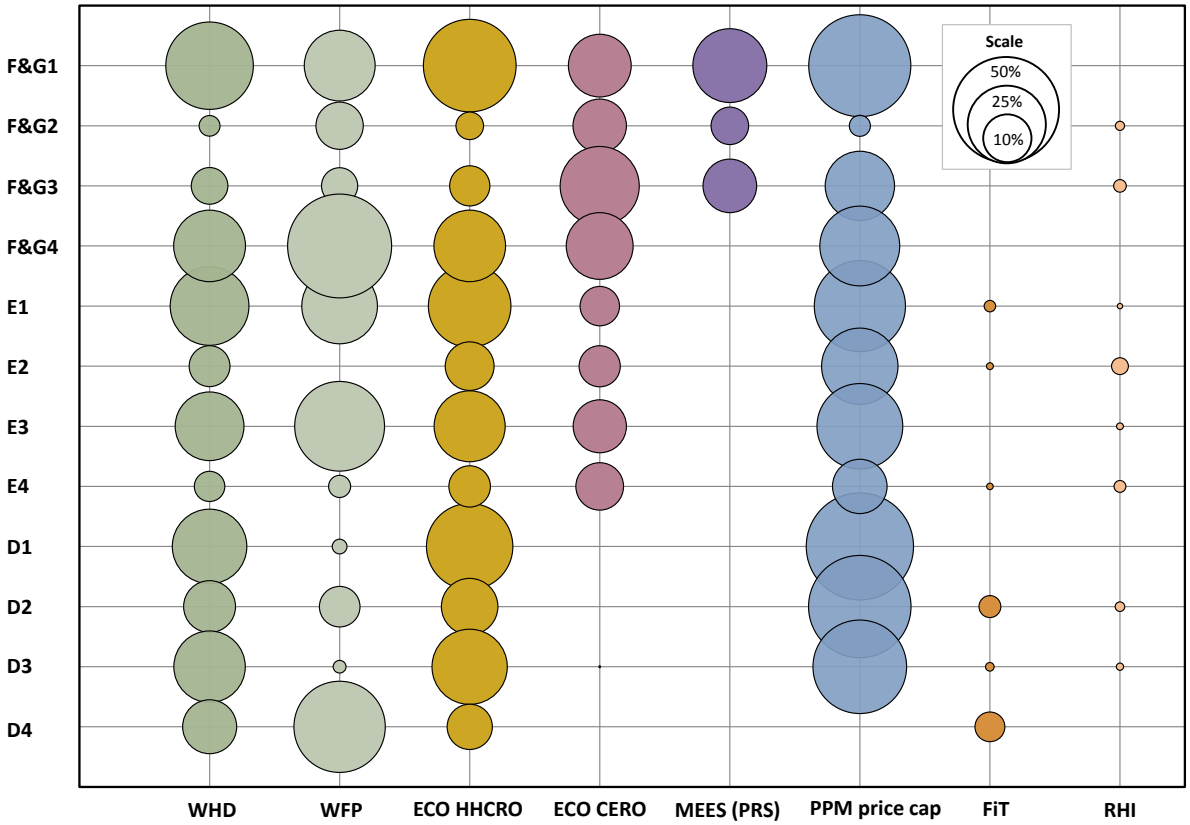


Figure 5.4: Percentage of each fuel poverty archetype benefiting from each policy after modelling proposed policy change scenarios with a more targeted ECO



When the results from the current policies modelling were compared with the proposed policy change modelling, the impacts of the main policy adjustments were clearly observable. The proportion of households who received the WHD payment increased across all the archetypes, but most noticeably for those which have working age families (e.g. F&G1, E1, D1 and D3) who previously may only been eligible for the broader group and were not guaranteed a payment. Conversely, the proportion of households who received the WFP diminished, most significantly for archetypes F&G2 and F&G3. The biggest change occurred in the scale and distribution of recipients of ECO, with benefiting households concentrated in the F&G and E fuel poor archetypes, with significant numbers of each of these groups receiving energy efficiency measures through the scheme. Archetypes F&G3 and F&G4 were the biggest beneficiaries of this remodelled policy with over 50% of these archetypes benefitting from ECO.

Modelling the MEES in the PRS with a minimum spending cap of £5,000 increased the numbers of private rented dwellings receiving improvements, with archetype F&G1 (80% of which were living in private rented accommodation) benefiting the most from these changes. There was a relatively uniform increase in the proportion of households in each archetype eligible for an extended safeguarding tariff (beyond the existing PPM price cap) and a small increase in the numbers of households in the fuel poor archetypes able to benefit from the domestic RHI after adjustments were made.

Finally, the second set of proposed changes to ECO, targeting measures at means tested benefit recipients living in dwellings with an EPC band of D or less, resulted in the beneficiaries of ECO being more widely distributed across the 12 fuel poor archetypes - not solely concentrated in the E and F&G archetypes. It also had the impact of concentrating improvements at households in some of the lowest income archetypes, particularly F&G1, F&G4, E1, E3, D1 and D3.

Additional information on the numbers and proportions of fuel poor archetype households who received measures is summarised in Table 5.2. The current policy modelling suggests that of all households in the archetypes just over half (55.1%), or 3.3 million, are benefiting in one way or another from one or more of the eight policies modelled. This is comparable to the proportion of households not included in any of the fuel poor archetypes ("All other households") (55.2%) and the overall proportion of households benefiting from these policies across England (52.2%). In total, it was estimated that – over a five year period – 12.9 million households would benefit from at least one of the eight policies.

After modelling the proposed policy changes, the number of fuel poor archetype households who received at least one policy benefit increased to 3.6 million (up by 300,000 compared to the current policy modelling results), while the overall total number of households benefiting dropped to 10.8 million, reducing the number of households targeted by policies by 2.1 million (from 12.9 million compared to current policies). Essentially the policy adjustments focused policies more towards households in the fuel poor archetypes. Over 60% of households in the fuel poor archetypes received a benefit from one or more of these policies, whereas 41% of "All other households" received a policy benefit after these changes.

Table 5.2: Number and proportion of households in fuel poor archetypes receiving policies

Scenario	Household type	Total number of households	Proportion in fuel poverty (%)	Hhlds not targeted by policies (M)	Hhlds targeted by at least one policy (M)	Hhlds receiving at least one policy (%)
Current policy modelling	Fuel poor archetypes	6.0	29.8%	2.7	3.3	55.1%
	All other households	17.4	3.5%	7.8	9.6	55.2%
	All households	**23.4**	**10.6%**	**10.5**	**12.9**	**55.2%**
Policy change scenario modelling	Fuel poor archetypes	6.0	29.8%	2.4	3.6	60.5%
	All other households	17.4	3.5%	10.2	7.2	41.1%
	All households	**23.4**	**10.6%**	**12.6**	**10.8**	**46.1%**
Policy change scenario modelling – ECO targeted	Fuel poor archetypes	6.0	29.8%	2.8	3.1	52.7%
	All other households	17.4	3.5%	11.1	6.3	36.3%
	All households	**23.4**	**10.6%**	**13.9**	**9.5**	**40.5%**

The second policy change scenario (the bottom three rows in Table 5.2, "Policy change scenario modelling – ECO targeted") reduced further the total numbers of households that received benefits. This was a result of reducing the pool size of total eligible households for ECO and thus encouraging more of a 'whole-house' approach, whereby more measures were installed in individual homes. The result still ensured a concentration of beneficiaries in the fuel poor archetypes but to a lesser extent.

Table 5.3 summarises the total number of energy efficiency measures and low carbon generation technology installed through ECO, the MEES in the PRS, the FiT and the RHI over five years of each policy. The current design of ECO means that the most commonly installed measures under this policy are cavity wall insulation and loft insulation. The CERO element of ECO also ensures that a number of solid wall insulations are installed at a rate of around 20,000 a year with an additional 8,000 being funded through the HHCRO element of ECO. Currently, the number of qualifying boilers are effectively capped each year which results in no more than 100,000 being installed over a five year policy scenario. Other measures are installed in smaller numbers and include floor insulation, storage heaters, triple glazing and draught proofing.

Table 5.3: Energy efficiency measures and low carbon generation technology installed over a five year modelling run for the three different policies scenarios

Measure	Current policies	Policy change scenarios	Policy change scenarios with a more targeted ECO
External wall insulation	138,694	334,639	381,443
Cavity wall insulation	1,449,656	1,620,908	1,130,181
Floor insulation	27,013	165,680	233,921
Loft insulation	318,655	1,396,871	1,416,978
A-rated mains gas boiler	69,952	171,891	250,467
A-rated oil combi boiler	11,290	44,506	35,865
A-rated LPG boiler	0	995	1327.2
Modern fan storage heater	12,721	22,249	31,435
Triple glazing	984	0	0
Draught-proofing	8,629	87,486	46,385
Air source heat pump (ASHP)	59,711	59,629	59,619
Ground source heat pump (GSHP)	17,191	17,102	17,259
Solar domestic hot water system	16,937	17,238	17,305
Biomass boiler	7,253	24,287	24,384
Solar Photovoltaic	1,099,465	1,099,670	1,099,545
All measures	**3,238,153**	**5,063,152**	**4,746,113**

After modelling the proposed policy adjustments, the measure which saw the most significant increase in installations was loft insulation. Although loft insulation levels are generally good across all dwellings in England, there remain a significant number of lofts with low levels of insulation – something which was highlighted in the fuel poverty segmentation analysis (many of the fuel poor archetypes had poor levels of insulation). After modelling the policy change scenarios, the numbers

of lofts topped up to a full 300mm of insulation increased from 440,000 to 1.4 million. The numbers of solid wall insulation installations also increased from approximately 142,000 under the current policy to 335,000 in the main policy change scenario and 381,000 in the policy change scenario with a more targeted ECO HHCRO. This noteworthy increase in loft insulation levels is likely to require significant developments in the supply chain and skilled work force to enable their successful installation. To a lesser extent, the solid wall insulation market will also need to increase its capacity in order to triple the rate of installations on solid walled dwellings. However, the need for higher rates of installation of solid wall insulation is consistent with the recommendations from the Committee on Climate Change[19].

There were no significant changes in the number of FiT or RHI measures installed in each of the scenarios, as there were no changes to the funding of these policies. The exception was a small increase in the number of biomass boilers installed, which occurred under ECO in order to help meet the increased rural installation targets (which were increased in line with increase funding levels).

Overall the higher level of funding for policies installing energy efficiency measures resulted in the total number of measures being installed over five years increasing from approximately 3.3 million to over 5 million for the main policy change scenario (or 4.75 million for a more targeted ECO approach).

5.3 Impact on household bills

Table 5.4, Table 5.5 and Table 5.6 show the average fuel bills before and after policies for targeted and non-targeted households (those who received benefits from policies and those who didn't) for each fuel poor archetype. The data is also summarised for all households in the last row of each table.

Table 5.4 shows how the average fuel bill for households targeted by policies (but before those policies are modelled) is £1,378, while for those who are not targeted by policies the average fuel bill is £1,444. For non-targeted policies, the model applied policy levies to fuel bills which increased fuel bills by £52 for all households. For households targeted by policies, the average net fuel bill change (after both the policies levy and policy benefit has been accounted for) was a reduction of £51 on the average fuel bill. However, as the results in the table show the average bill changes varied for different archetypes. For example, the 98,000 households in archetype F&G1 (*Private rented low income tenants living in the least efficient solid walled and electrically heated dwellings*) who benefited from policy experienced an average bill reduction of approximately £233. Referring back to Figure 5.2, these households received ECO measures, were improved through the MEES in the PRS regulations and a significant proportion benefitted from the PPM price cap. Other archetypes who experienced significant bill reductions included archetypes E2 (*Average earning families privately renting or owning older EPC band E terraces or semi-detached houses*), and F&G3 (*Off-gas empty nesters in low paid employment living in old solid wall dwellings*). However, less than half of households in these archetypes experienced this benefit.

[19] 2017 Report to Parliament – Meeting carbon budgets: Closing the policy gap, Committee on Climate Change, June 2017 - www.theccc.org.uk/publication/2017-report-to-parliament-meeting-carbon-budgets-closing-the-policy-gap/

In contrast, the significant majority of F&G4 households (*Off gas, retired households in more rural locations on very low incomes but who own their larger houses outright*) were targeted by policies (over 90%), but the average net fuel bill reduction for these households was just £4. The policy that most benefited this group was the WFP (Figure 5.2) – which makes no direct fuel bill reduction. These households also benefitted from the WHD and ECO measures, but to a lesser extent that the WFP.

Comparing Table 5.5 with Table 5.4 shows the impact of the proposed policy adjustments on fuel bills. Modelling the proposed changes produced several headline results: the households targeted by these policies had a higher initial average bill before policies (£1,443) than the initial average fuel bill of households not targeted by policies (£1,377) and the average net bill reduction of £161 for all households receiving measures was significantly higher than for current policies (see above). These results indicate that the proposed changes focused policies towards households with higher fuel costs and made bigger inroads in to reducing them. However, it is also worth observing that fewer households overall were being targeted by policies.

For all but two of the archetypes, the average bill reduction for those receiving policies was at least £100 and for all of the F&G archetypes the average bill reduction was greater than £200. Households in F&G1 (*Private rented low income tenants living in the least efficient solid walled and electrically heated dwellings*) and F&G3 (*Off-gas empty nesters in low paid employment living in old solid wall dwellings*) benefiting from policies experienced net average bill reductions of over £400. However, for some of the archetypes there were fewer households receiving measures as a result of the proposed changes. For instance, F&G4 households (*Off gas, retired households in more rural locations on very low incomes but who own their larger houses outright*) targeted by policies experienced an average bill reduction of £208, but 13,000 fewer households in this archetype benefitted from policies. Also, there was a significant increase in the numbers of households in archetype F&G2 (*Wealthier middle age or retired household living in villages/hamlets in solid walled, oil heated detached houses with very high fuel costs*) receiving measures, predominantly through ECO CERO but also through ECO HHCRO, as a result of relaxing the means tested benefit eligibility criteria.

Finally, Table 5.6 shows the impact of modelling a more targeted ECO. This distributes higher bill savings across more fuel poor archetypes, with more households in the D archetypes benefiting from policies and experiencing higher annual average bill reductions. In addition, households in E1 (*Low income non-working or retired adult only households living in old solid wall gas heated urban terraces*), E2 (*Average earning families privately renting or owning older EPC band E terraces or semi-detached houses*) and E4 (*Middle-aged working adults on reasonable incomes living in larger solid wall or uninsulated cavity wall houses*) that were targeted by policies all experienced an average bill reduction of over £200. However, while fewer households in E3 (*Older very low income households living in post war bungalows and semi-detached houses*) benefited from policies, and the average fuel bill reduction for this group was only £84 – significantly less than households in other E archetypes who benefitted from policies.

Overall, modelling this second set of policy adjustments (more targeted ECO) increased the numbers of households in D-rated archetypes receiving measures through ECO and reduced the numbers of E and F&G archetypes receiving measures, when compared to the first set of policy change scenarios.

Table 5.4: Current policies: Average bills before and after policies by fuel poor archetypes and by targeted and non-targeted households

Household type	Non-targeted households			Targeted households			Number of households	
	Average bill without policies	Average bill after policies (no measures)	Average bill change as a result of policies*	Average bill without policies	Average bill after policies and measures	Average bill change as a result of policies	Non-targeted households	Targeted households
D1	£1,341	£1,392	£52	£1,141	£1,053	-£88	134,823	215,708
D2	£1,514	£1,566	£52	£1,368	£1,279	-£89	213,028	277,992
D3	£1,163	£1,215	£52	£1,196	£1,106	-£90	1,123,886	1,237,267
D4	£1,556	£1,607	£52	£1,568	£1,575	£7	117,818	159,799
E1	£1,494	£1,545	£52	£1,495	£1,458	-£37	76,218	193,385
E2	£1,607	£1,659	£52	£1,693	£1,511	-£182	477,564	230,217
E3	£1,333	£1,385	£52	£1,326	£1,326	£0	52,120	445,212
E4	£1,737	£1,788	£52	£1,853	£1,758	-£95	287,182	123,635
F&G1	£1,967	£2,018	£52	£1,909	£1,676	-£233	27,856	98,087
F&G2	£3,400	£3,451	£52	£3,301	£3,271	-£30	99,212	93,165
F&G3	£2,871	£2,923	£52	£2,069	£1,920	-£149	64,129	79,001
F&G4	£1,565	£1,616	£52	£1,870	£1,866	-£4	9,996	137,859
OTHER	£1,423	£1,475	£52	£1,354	£1,311	-£43	7,794,173	9,601,619
All hhlds	£1,444	£1,495	£52	£1,378	£1,327	-£51	10,478,005	12,892,946

Note: Bills without policies show average costs without the impact of policies and do not include any policy levies

**Average bill change for non-targeted households is the fuel levies applied to these households for all policies modelled. (For targeted households the bill change is the net change after levies have been applied and the reduction in fuel bills from policies benefits has been calculated.)*

Table 5.5: Policy change scenario modelling: Average bills before and after policies by fuel poor archetypes and by targeted and non-targeted households

Household type	Non-targeted households			Targeted households			Number of households	
	Average bill without policies	Average bill after policies (no measures)	Average bill change as a result of policies*	Average bill without policies	Average bill after policies and measures	Average bill change as a result of policies	Non-targeted households	Targeted households
D1	£1,339	£1,391	£51	£1,121	£1,005	-£115	156,098	194,433
D2	£1,496	£1,548	£51	£1,381	£1,270	-£110	213,957	277,063
D3	£1,162	£1,214	£51	£1,199	£1,091	-£108	1,197,474	1,163,679
D4	£1,717	£1,768	£51	£1,403	£1,385	-£18	141,241	136,376
E1	£1,591	£1,643	£51	£1,455	£1,285	-£170	78,225	191,378
E2	£1,542	£1,594	£51	£1,688	£1,485	-£203	255,568	452,213
E3	£1,253	£1,304	£51	£1,335	£1,256	-£80	52,388	444,944
E4	£1,918	£1,969	£51	£1,681	£1,442	-£239	158,083	252,734
F&G1	£2,132	£2,183	£51	£1,903	£1,460	-£443	10,101	115,842
F&G2	£3,761	£3,813	£51	£3,190	£2,815	-£375	54,608	137,769
F&G3	£2,150	£2,201	£51	£2,469	£2,013	-£456	18,129	125,001
F&G4	£2,342	£2,393	£51	£1,745	£1,536	-£208	25,957	121,898
OTHER	£1,365	£1,416	£51	£1,414	£1,253	-£161	10,242,516	7,153,276
All hhlds	£1,377	£1,429	£51	£1,443	£1,282	-£161	12,604,346	10,766,605

Note: Bills without policies show average costs without the impact of policies and do not include any policy levies

**Average bill change for non-targeted households is the fuel levies applied to these households for all policies modelled. (For targeted households the bill change is the net change after levies have been applied and the reduction in fuel bills from policies benefits has been calculated.)*

Table 5.6: Policy change scenario modelling – targeted ECO: Average bills before and after policies by fuel poor archetypes and by targeted and non-targeted households

Household type	Non-targeted households			Targeted households			Number of households	
	Average bill without policies	Average bill after policies (no measures)	Average bill change as a result of policies*	Average bill without policies	Average bill after policies and measures	Average bill change as a result of policies	Non-targeted households	Targeted households
D1	£1,378	£1,430	£52	£1,110	£973	-£137	141,115	209,416
D2	£1,499	£1,550	£52	£1,383	£1,261	-£122	204,218	286,802
D3	£1,167	£1,219	£52	£1,193	£1,051	-£141	1,123,780	1,237,373
D4	£1,747	£1,799	£52	£1,359	£1,330	-£29	145,517	132,100
E1	£1,571	£1,623	£52	£1,452	£1,232	-£220	96,270	173,333
E2	£1,608	£1,659	£52	£1,679	£1,454	-£225	435,714	272,067
E3	£1,335	£1,386	£52	£1,323	£1,239	-£84	152,753	344,579
E4	£1,808	£1,860	£52	£1,687	£1,462	-£226	287,731	123,086
F&G1	£2,054	£2,106	£52	£1,898	£1,420	-£479	18,882	107,061
F&G2	£3,570	£3,621	£52	£2,908	£2,439	-£468	129,061	63,316
F&G3	£2,930	£2,982	£52	£2,118	£1,631	-£488	54,639	88,491
F&G4	£2,068	£2,119	£52	£1,776	£1,582	-£194	37,169	110,686
OTHER	£1,418	£1,469	£52	£1,328	£1,185	-£143	11,078,196	6,317,596
All hhlds	£1,444	£1,496	£52	£1,354	£1,201	-£153	13,905,045	9,465,906

Note: Bills without policies show average costs without the impact of policies and do not include any policy levies

**Average bill change for non-targeted households is the fuel levies applied to these households for all policies modelled. (For targeted households the bill change is the net change after levies have been applied and the reduction in fuel bills from policies benefits has been calculated.)*

5.4 Impact on progress towards fuel poverty targets

One measure of reviewing progress on fuel poverty reduction is to analyse how many fuel poor dwellings are still living in the most energy inefficient dwellings. The first interim milestone for the fuel poverty strategy is to ensure that, as far as is reasonably practicable, no fuel poor households are living in F and G rated dwellings by 2020.

Table 5.7 and Figure 5.5 show the estimated number and proportion of fuel poor households by energy efficiency bands, respectively. The results show the combined impacts of current policies and policy change scenarios over five years. The data suggests that, of the three scenarios modelled, the proposed policy changes whereby the ECO is open to all homes rated in EPC bands E, F or G made the most progress on reducing the number of fuel poor households living in EPC bands F or G. It was also the most successful at shifting more fuel poor households into EPC band D rated homes. Under this scenario more than half of fuel poor households were living in homes rated D or above after five years of policy. However, the more targeted ECO approach made the most significant impact on the total number of fuel poor households (Table 5.7). It was estimated that after 5 years, current policies reduced the number of fuel poor to 1.93 million. Modelling the first set of proposed policies reduced this slightly further to 1.91 million, whereas the proposed policy changes with more targeted ECO reduced the total number of fuel poor households further to 1.87 million.

Overall, targeting energy efficiency measures at dwellings rated in EPC bands E or below moved more fuel poor households into D rated dwellings or above. Targeting measures at households on means tested benefits in homes rated in EPC band D or below reduced the total number of fuel poor households, but shifted fewer households out of dwellings in EPC bands E, F and G.

Figure 5.5: Modelled impact on proportion of fuel poor households by energy efficiency band for current policies and after modelling policy change scenarios.

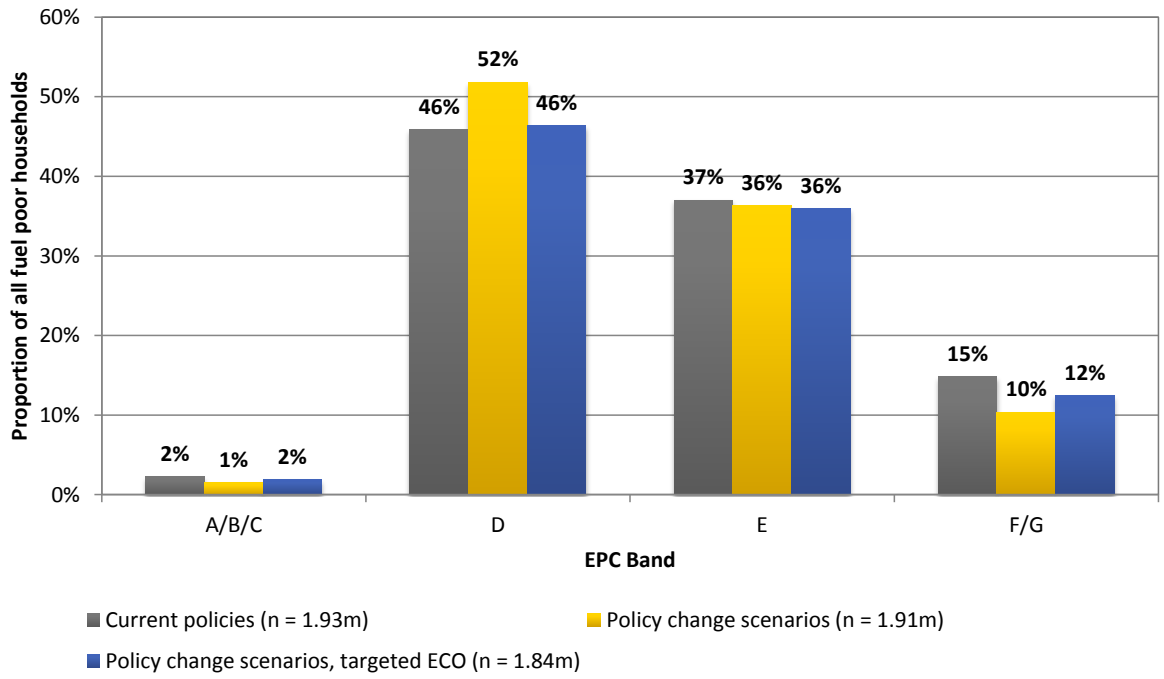


Table 5.7: Total number of fuel poor households by energy efficiency rating after five year policy runs for each of the three policy scenarios

SAP rating	Current policy modelling	Policy change scenario modelling	Policy change scenario modelling – ECO targeted
A/B/C	44,000	28,000	37,000
D	887,000	988,000	884,000
E	715,000	693,000	686,000
F/G	287,000	198,000	237,000
All dwellings	1,933,000	1,907,000	1,844,000

Table 5.8: Aggregate fuel poverty gap for fuel poor households by energy efficiency rating after five year policy runs for each of the three policy scenarios

SAP rating	Current policy modelling	Policy change scenario modelling	Policy change scenario modelling – ECO targeted
A/B/C	£12M	£9M	£11M
D	£232M	£274M	£231M
E	£408M	£384M	£405M
F/G	£475M	£342M	£402M
All dwellings	**£1,127M**	**£1,009M**	**£1,049M**

However, despite the improvements the proposed changes have on total numbers of fuel poor households and the numbers of fuel poor households living in homes rated in EPC bands F or G, there still remain significant number of fuel poor households in F and G. The nature of the fuel poverty calculation (particularly the recalculation of median fuel costs each year) means that some previous non-fuel poor households will have be categorised as being in fuel poverty at the end of the policy scenario model runs. As the bills of some households targeted by policies are reduced and the overall median fuel cost threshold for all English dwellings lowers, this can draw some households into fuel poverty if they haven't been targeted by policies that reduce fuel bills. In addition, some of the most inefficient homes and the hardest to treat will have seen some improvements but not sufficient enough to improve their energy efficiency above a rating of EPC band F. Thus, their fuel costs will have reduced but they still remain in homes categorised in the lowest EPC bands.

The aggregate (total) fuel poverty gap after each modelling run is also shown in Table 5.8, with the data split by EPC band. These results show the impact of targeting households living in homes in EPC bands E or below, with the total fuel poverty gap for households in EPC bands F or G reduced to £342M over five years. Under current policies it was estimated that the total fuel poverty gap for households in dwellings rated in EPC bands F or G would be £475M. The policy change scenario targeting households living in homes in EPC bands E or below also had the biggest impact on the

total fuel poverty gap for all dwellings, reducing it to £1,009M. For current policies the resulting total gap was £1,127M. This is predominantly the result of prioritising improvements at the least efficient dwellings with, on average, the highest fuel bills.

Finally, it should be noted that the NHM does not currently model fuel poverty statistics using the same model and exact methodology that national fuel poverty statistics are produced. Furthermore, no attempt has been made to predict fuel price changes or income changes over a five year period. Thus the results here should be treated as indicative and comparable with each other only, rather than comparable to other fuel poverty statistics produced externally from this study.

5.5 Impact on progress towards national carbon emissions targets

The overall impacts on domestic carbon emissions of policies were also analysed. This was done using two approaches: the first kept all carbon factors for all domestic fuels at published 2017 levels[20], while the second used projected emissions factors published in the 'Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal'[21], which diminish over time and predict the decarbonisation of the electricity grid to 2100.

The first approach was used to illustrate and isolate the impacts of the different modelling scenarios – predominantly as a result of reducing energy consumption or switching to less carbon intense fuels, or both, and compare the impacts of the proposed changes to the policies. The second approach illustrated the combined impact of the policies and a decarbonising grid to show the likely overall reduction in carbon emissions from housing over five years. The summary results are shown in Figure 5.6, using the first year of the modelling scenarios as a baseline.

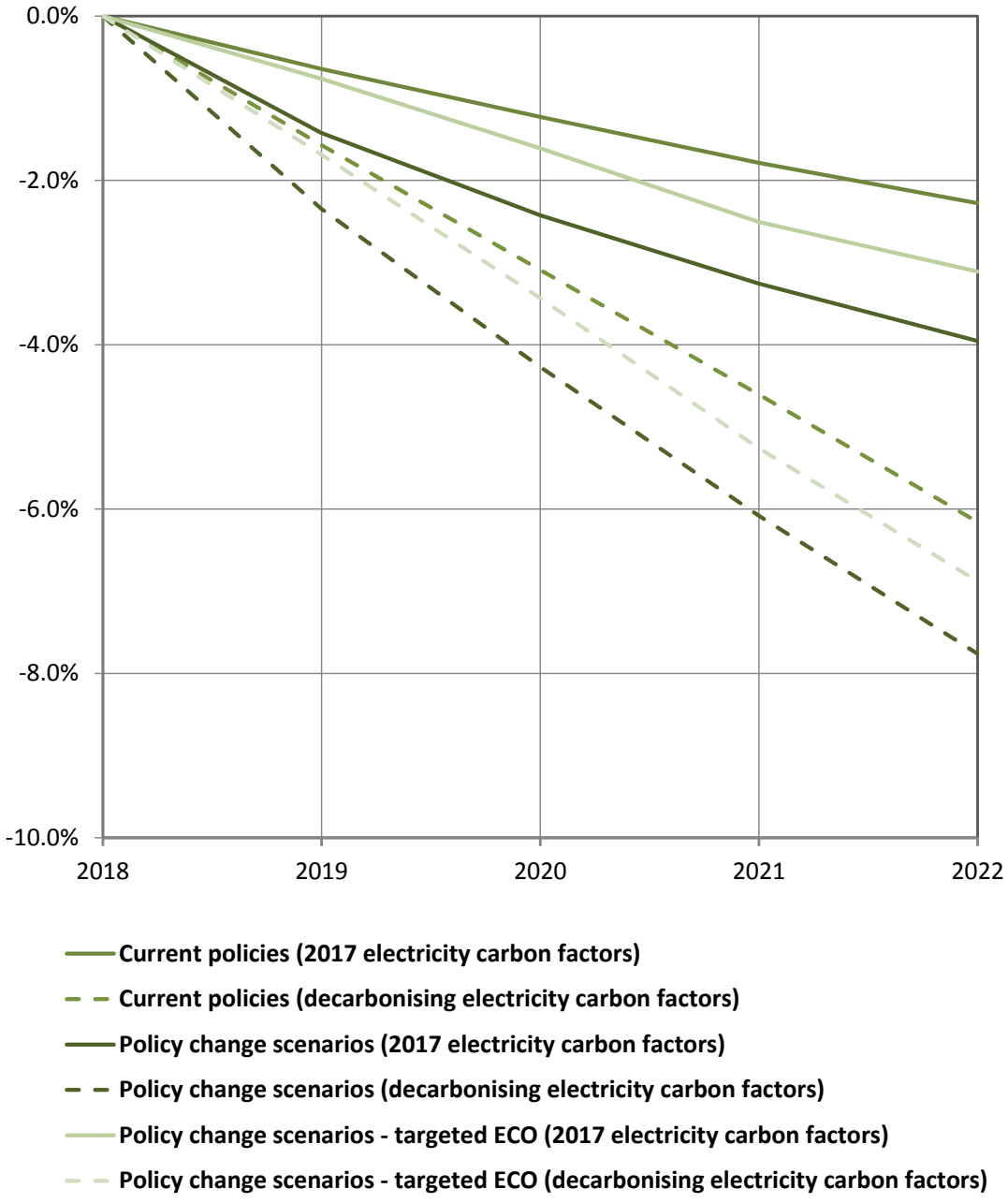
Excluding the impact of decarbonised electricity, the modelling suggested that current policies would reduce emissions in the housing sector by 2.3% over a five year period. The results indicated that the proposed changes to policy resulted in almost twice the carbon emissions reduction, reducing emissions by 4% over five years, compared to a situation with no policies. Once the predicted decarbonisation factors for electricity are taken into account, the modelled emissions reductions increased to 6.2% for current policies and 7.8% after the proposed policy changes have been modelled.

Modelling a more targeted ECO policy in the set of policy adjustment scenarios resulted in increased carbon savings, when compared to the current set of policies, but not as significantly as the first set of policy adjustments. The results suggested that carbon emissions would reduce by 3.1% after five years, or 6.9% once electricity decarbonisation was factored into the calculations.

[20] Government emission conversion factors for greenhouse gas company reporting, May 2013 - www.gov.uk/government/collections/government-conversion-factors-for-company-reporting#conversion-factors-2017

[21] Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Figure 5.6: Carbon emissions reductions over five years for current policies and after modelling policy change scenarios, including an adjusted targeted ECO. Data shows the net impacts of all policies combined for each scenario.



Note: Data includes modelling using both 2017 electricity carbon factors throughout the scenario – solid lines, and projected electricity decarbonisation factors for 2017-2022 – dashed lines.

5.6 Summary of policy adjustment impacts

A summary of the impacts of modelling the three policy scenarios is shown below in Table 5.9, reflecting overall impacts of each of the policy modelling scenarios on fuel bills, fuel poverty and carbon emissions.

When compared with the impacts of current policies, an effect of the policy adjustments was to reduce the number of households being targeted by at least one of the policies, but to make a more substantial impact on reducing the bills of those who were targeted by the adjusted policies. This reduction in the number of households targeted by policies was predominantly the effect of reducing the scale of the WFP.

The estimated average net bill reduction for the 12.9 million households targeted by current policies was calculated to be £51 (after fuel bill levies were taken into account). After modelling the policy adjustments the number of households targeted by policies reduced to 10.8 million, but it was estimated that these households experienced a net bill reduction of £161 as a result of these adjustments. Partially, this was a result of focusing energy efficiency improvements through ECO at the least efficient dwellings (in EPC bands E, F or G). The low energy efficiency performance of these dwellings means that they have the largest potential capacity for improvements (both bills reductions and carbon savings).

Table 5.9: Summary impacts of modelling current policies and policy change scenarios

Indicator	Current policies	Adjusted policies	Adjusted policies – targeted ECO
Number of households targeted by policies over five years	12.9M	10.8M	9.5M
Net bill reduction of households targeted by policies	-£51	-£161	-£153
Estimated total number of fuel poor households after five years of policies	1.93	1.91	1.84
Estimated number of fuel poor households in F and G after five years of policies	287,000	198,000	237,000
Overall aggregate FP gap after five years of policies	£1,127M	£1,009M	£1,049M
Net carbon emission changes - 2017 electricity carbon factors	-2.3%	-4.0%	-3.1%
Net carbon emission changes – decarbonising electricity carbon factors	-6.2%	-7.8%	-6.9%
Total annual policy spend on energy efficiency measures or low carbon technologies	£990M	£1,748M	£1,748M
Total annual policy spend on fuel bill assistance	£1,825M	£1,067M	£1,067M
Total number of energy efficiency measures or low carbon technologies installed over five years	3,240,000	5,060,000	4,750,000

For the policy change scenarios including a more targeted ECO, the energy efficiency eligibility criteria was widened to include dwellings in EPC band D. As a result, the average net bill savings across all households targeted by policies were slightly lower (the inclusion of these dwellings reduced the average potential improvement capacity). In tackling the most inefficient dwellings, the less targeted ECO approach had a more significant impact on reducing the number of fuel poor households living in dwellings rated in EPC F or G and the total aggregate fuel poverty gap. It also had the biggest impact on carbon emissions reductions – for the reasons outlined above. However, the second set of policy adjustments – which includes a more targeted version of ECO – had the biggest impact on reducing the total number of fuel poor households.

Thus the results summarised here suggest that the adjustments made to policies in which ECO is targeted at dwellings in EPC bands E, F or G align better with the milestones of the fuel poverty strategy, in terms of the impacts on numbers of fuel poor households in F and G dwellings. It suggests that similarly designed policies will be needed for the 2025 and 2030 fuel poverty strategy targets. It also has implications when considering the policy gap for achieving the Clean Growth Strategy energy efficiency objectives.

As Table 5.9 summarises, the total annual spend of policies that install energy efficiency measures or low carbon technologies in dwellings was £990M compared to a total annual spend of £1,825M on policies that provide a direct financial benefit. The policy adjustments reversed this balance. Funding for policies installing measures increased to £1,758M while funding for fuel bill assistance policies reduced to £1,067M. This boosted the number of energy efficiency measures or low carbon technologies being installed from 3.2 million to 5.1 million. This also helps to underline the reasons behind increased carbon emissions and bills savings under the adjusted policy modelling scenarios.

6 High level principles

One of the tasks for this study was to develop a set of high level principles which could guide (and hopefully improve) future policy-making associated with both tackling fuel poverty and cutting carbon emissions.

Both the Committee on Fuel Poverty and the Committee on Climate Change have independently adopted their own sets of policy-making principles, each focusing on their core policy objectives. These principles therefore provide little guidance on how best to develop policy with both objectives in mind.

The Committee on Fuel Poverty has embraced the principles adopted by the government in its Fuel Poverty Strategy for England[22], published in 2015:

- Prioritisation of the most severely fuel poor.
- Supporting the fuel poor with cost-effective policies.
- Reflecting vulnerability in policy decisions.

The Committee on Climate Change laid out the principles guiding its policy advice in its 2017 Progress report to Parliament[23]:

- The plans must enable the carbon budgets to be met and prepare for the 2050 target.
- Policy proposals should be flexible, robust, and joined-up with other priorities.
- There should be a clear process to turn proposals into action.

In drawing up the high level principles for future policy making outlined here, the study team considered:

a. The existing high level principles of the two committees
b. The results of the modelling for this study and what they reveal about the nature of existing and potential policy synergies and policy tensions
c. A two-hour workshop with members of the Committee on Fuel Poverty, members of the steering group and other BEIS officials
d. Discussion of draft principles with the Committee on Fuel Poverty.

The high level principles which emerged from this process, for the consideration of the Committee on Fuel Poverty, the Committee on Climate Change and the government, are:

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[22] Cutting the cost of keeping warm: a fuel poverty strategy for England, Department of Energy & Climate Change, March 2015 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408644/cutting_the_cost_of_keeping_warm.pdf See page 26 for a detailed description of the principles adopted by the Committee on Fuel Poverty.

[23] Meeting Carbon Budgets: Closing the policy gap, Committee on Climate Change, June 2017 - https://www.theccc.org.uk/wp-content/uploads/2017/06/2017-Report-to-Parliament-Meeting-Carbon-Budgets-Closing-the-policy-gap.pdf. See page 12 for a detailed description of the principles adopted by the Committee on Climate Change for the government's plans for meeting the carbon budgets.

1. Choose the sweet spot (and minimise tensions).
2. Prepare the ground for future action.
3. Be clear who foots the bill – and who gains the benefits – and why.
4. Look across the whole suite of relevant policies to reveal impacts and options.

The meaning and implications of each principle are described in more detail in the following sections.

6.1 Choose the sweet spot (and minimise tensions)

Prioritise policies which both reduce carbon emissions and alleviate fuel poverty and, across both fuel poverty and climate change policy arenas, ensure policy programmes at least avoid impeding progress in the other.

The analysis for this study demonstrates that policies can be designed to address fuel poverty which result in greater reductions in carbon emissions and fuel poverty than existing approaches, without additional cost. By deliberately seeking out these 'sweet spots' between the fuel poverty and climate change policy arenas, impacts in both can potentially be increased and overall policy efficiency enhanced. Finding the sweet spots will require more routine assessments of these different impacts (measurable impacts on carbon emissions, affordability of energy bills, and fuel poverty, gap and number) for all policy options in each arena.

Adopting this principle will tend to favour initiatives in both policy arenas which improve the energy performance of homes, particularly through fabric improvement (i.e. better insulation). It will push fuel poverty policies towards ones which support (or require) investment in upgrading poorly performing homes ahead of those that directly subsidise energy bills (such as WFPs). It would also encourage better targeting of any continuing energy bill subsidies so that they reach those actually suffering fuel poverty rather than providing a generalised subsidy for energy use (which, if received by better off households, may lead to higher carbon emissions for little additional welfare).

The principle would also push carbon reduction policies away from policies which tend to result in higher energy bills (e.g. very high levels of consumer-funded subsidy for some zero carbon generation technologies), prioritising instead lower cost alternatives (e.g. lower cost zero carbon generation options and/or lower cost domestic carbon emission reduction options).

6.2 Prepare the ground for future action

Ensure plans to meet near term targets are laying foundations which make it easier to meet longer-term targets.

This principle is a read across from the Committee on Climate Change's principle that the government's carbon emission reduction plans should both (a) ensure specific carbon budgets are met and (b) prepare for the further reductions required in the future.

Applied to fuel poverty policy, this principle would encourage more detailed assessment in the policy-making process of the potential gains (on fuel poverty, carbon emissions, health and associated costs etc.) from 'leapfrogging' Energy Performance Certificate (EPC) upgrades. This would involve targeted properties being improved enough 'in one go' to meet the standard for a longer-

term fuel poverty alleviation target, not just the near-term one. Such assessment would include the value of avoiding the need to return to a property and the considerable cost of having to re-engage the household, the building owner, contractors etc. to do further works which are already known to be required to meet future targets. Bringing forward such improvement works would tend also to have additional climate change benefits, given the lifetime impact of carbon emissions.

The assessment should thus reveal the costs and benefits of making investments sooner rather than later (given that the investment is going to be needed in due course) and enable better long-term policy choices to be made.

6.3 Be clear who foots the bill – and who gains the benefits – and why

Be clear in policy making about: (a) who pays for carbon reduction and fuel poverty policies [whether consumers (via energy bills), or citizens (via taxes), or building owners or direct beneficiaries (through their own investment), or some combination], (b) who gains the policy benefits (in reduced costs, greater comfort, additional income, new assets etc.) and (c) <u>why</u> these policy choices have been made.

This principle addresses three different aspects of policy making:

i. the decision about how a policy should be funded
ii. the distributional impacts of policies (and whether they are understood and justified)
iii. the value in looking beyond 'average' impacts to understand better which groups may be disproportionately benefitting from policies (with benefits 'stacking' due, for example, to shared eligibility criteria across policies) and those in need who are regularly neglected.

These are all important considerations: policies generally garner more public (and political) support if they can be shown to be both fair and effective, supporting those considered in need without generating costs for those who can't afford them or who have no obvious responsibility to pay. Each of these is explored in more detail below.

i. How a policy should be funded

There appears to be no consistent principle applied to how a policy should be funded, with a strong tendency in the past to use energy bills (which are generally a highly regressive way to fund policy and will tend to increase fuel poverty) without a clear rationale as to why.

Making this choice about the source of funding requires some criteria for why each type of funding mechanism might be used. A suggested set of criteria which establishes such a rationale is outlined in the box below:

Taxpayers (citizens) should carry the principal burden of cost when:

- the principal beneficiaries are future generations (e.g. innovation and technology development and market making for under-adopted technologies)
- the costs to be met are the result of the failure of previous generations to pay real costs (e.g. the nuclear decommissioning legacy, coal mining subsidence and health impacts)
- the problem being addressed are largely caused by factors outside the energy system (which is what bills pay for) (e.g. fuel poverty)

Energy consumers (or more specifically energy bill payers) should carry the cost of:

- their fair share of the costs of energy supply and distribution and maintaining a specified standard of energy 'reliability'
- ensuring that all consumers have equal opportunities to participate from the benefits of competition and regulatory obligations
- the environmental damage caused by their energy use (and/or cost of avoiding the damage such as carbon floor price)

Building owners and/or direct beneficiaries of policies should carry the cost of:

- investments in their buildings which they can afford and which generate direct returns in terms of increased asset value and/or future income earning potential, not including any subsidies.

Applying these criteria, within this principle, would be likely to see a smaller burden placed on energy bills than has been the case in the past. For example, general taxation would be funding subsidies to stimulate early-stage deployment of pre-market technologies to drive cost-reduction and develop supply chains– like the early stages of offshore wind or solar – with energy bill payers only picking up the value of the carbon-related benefit of the zero-carbon electricity being generated. In the past, energy bill funded subsidies like the Renewables Obligation and the Feed-in Tariff have been used to achieve both of these objectives.

The criteria would also lead to a greater emphasis on better-off households and landlords using their own resources to fund energy efficiency improvements in their own buildings which are in their own long-term interests. While there may be a need for additional policies which require such investment, these criteria would suggest that such policies should not involve grants or subsidies funded by either energy bills or general taxation.

ii. Understanding the distributional impacts of policies

There are considerable differences in the distributional impacts of policies funded through taxation and those funded through energy bills, with the latter generally being more regressive. However, the net distributional impacts of policies also depend on who gains the policy benefits. A policy funded through energy bills may be regressive but if all of the benefit is received by low income households (as is the case with the WHD), the average net distributional impact will be much less regressive (and potentially progressive).

Policy makers – and the impact assessments they rely upon – should seek to understand (a) the distributional consequences of policies (both costs and benefits) and (b) the capabilities/ circumstances required to benefit from policies (e.g. capital to invest). By establishing this understanding, policy makers will be better placed to avoid more regressive policies – or mitigate their impacts – and to make clearer decisions about which households might be justifiably supported to participate.

To develop such understanding will also require the application of the fourth high level principle (see Section 6.4 below) of looking across the whole suite of policies so that the impacts of individual policies are understood within the overall cumulative impact of all relevant policies.

iii. Looking beyond the 'average' impacts

As the segmentation produced for this study reveals, because some policies share eligibility criteria (such as the WHD and the vulnerable households price cap), policy benefits typically 'stack' on certain groups of households. Others receive little in spite of obvious need, but may still have to contribute to the policy costs. To understand these effects, policy-makers should consider not just the 'average impact' but also the 'winners' and losers' for each policy (and overall from the suite of policies), based on a meaningful segmentation. This will reveal more clearly the regularly neglected and guide future targeting and efforts to mitigate negative impacts where appropriate.

6.4 Look across the whole suite of relevant policies to reveal impacts and options

Regularly review the cumulative effect of the whole suite of relevant policies against a consistent set of indicators relating to carbon emissions, affordability, distributional consequences and fuel poverty impacts.

To increase the chances of finding the sweet spots (for the first principle) and to reveal the cumulative rather than just incremental impacts of policies, policy makers need to look right across the whole suite of relevant policies that relate to carbon emissions, affordability and fuel poverty.

Applying this principle would result in those with responsibilities for any or all of these policy objectives undertaking (preferably jointly) a regular assessment of the impacts of the full suite of policies against a consistent set of indicators. This set should include: carbon emissions, affordability (including socio-demographic distribution of costs and benefits), fuel poverty number/gap, and wider (e.g. health) impacts.

7 Discussion and recommendations

This study has reviewed a suite of policies that aim to reduce carbon emissions, tackle fuel poverty and keep fuel bills affordable and has shown that there exist several tensions between and within these policies that prevent optimum progress towards these goals. Suggested proposals to adjust the policies in order to reduce these tensions have been identified, and modelling was undertaken to analyse what impacts these proposed changes could have towards better carbon reduction and fuel poverty alleviation outcomes. The tensions are essentially threefold:

- Certain policies work to alleviate fuel poverty by providing financial benefits that support vulnerable households and make fuel bills more affordable but simultaneously encourage many more to increase their energy consumption and thus carbon emissions
- Several policies heap (or 'stack') benefits on certain households and fail to target other households for whom the inability to afford bills leads to vulnerable living conditions
- There is an imbalance of funding directed towards short-term financial measures (which subsidise bills) compared with policies that install energy efficiency measures and low carbon technologies that make a lasting difference to annual fuel costs and the ability to keep warm affordably and which help support the transition to a low carbon future.

The policy adjustments developed and modelled for this study attempted to address these tensions. These included introducing more stringent eligibility criteria for poorly targeted policies, broadening the eligibility criteria for others to avoid policy stacking, and channelling more funds towards policies that reduce the energy consumption, fuel costs and carbon emissions of the housing stock in the long term, and that are targeted at the least efficient dwellings. The benefits, disadvantages and barriers to implementing these changes are discussed below.

The final output of the project was a set of four high level principles which were derived from the review of policies, the identification and attempted remedy of policy tensions, and other insights and considerations accrued during the course of the study. Recommendations on these principles are also presented below.

7.1 Benefits of proposed changes

The headline results from the modelling suggest that it is possible to make a series of changes to a set of existing policies that ensure that they align better to achieve the government's combined aims, while not removing the existing benefits from the majority of vulnerable people and not increasing the total combined costs of these policies or the levies on fuel bills. The proportion of fuel poor households living in dwellings in EPC bands E, F and G rated dwellings can be reduced and further headway can be made in reducing emissions from the housing stock through targeting more energy efficiency measures at these dwellings.

The largest overall adjustment to these policies, was the scaling down of the WFP by limiting eligibility to pensioners on low incomes or with long term health conditions, and an increase in funding for ECO from the resulting 'freed up' public finances. Redirecting government spending in this way, while not an easy political exercise (as discussed below) would effectively be shifting funding from revenue (annual fuel bill subsidies) to investment in infrastructure (improved housing energy performance). It would significantly boost the scale and impact of the ECO programme and

simultaneously ensure a more progressive funding system for ECO and increase the targeting efficiency of the WFP.

That is not to say these changes are all optimised. For example, ECO is not without its critics and some may wish such additional government spending to be channelled through delivery routes other than the energy suppliers. Similarly, the implementation of such changes may come across some noteworthy barriers. However, the point of the analysis here is to reveal both the fuel poverty alleviation and carbon emission reduction benefits of shifting expenditure in this manner so that policy-makers and their advisors can make more informed choices.

7.2 Disadvantages of proposed changes

Barriers to implementing the changes proposed

There is likely to be significant lack of political will to implement many of the changes proposed here, particularly in reducing the scale of the WFP. Even in a decade which has seen significant cuts to welfare benefits for non-pensioner households and other means-tested benefits, similar proposals to cut universal pensioner benefits have received negative responses and been shelved.

In additional, both the policy change scenarios modelled in this study reduced the number of households benefiting from policies (albeit many of those who do benefit do so more and for much longer). Moreover, while attempts were made to ensure the policies were better targeted at more vulnerable households, there remain a number of vulnerable households who currently benefit from policies that would miss out as a result of some of the changes modelled in this study (for example, households in F&G4 (*Off gas, retired households in more rural locations on very low incomes but who own their larger houses outright*), fewer of whom receive policies as a result of the changes - see Section 5.2 and Section 5.3).

Fuel poverty targeting efficiency

Accurately targeting fuel poverty is difficult using eligibility criteria that typically require households to demonstrate their low income situation through being on means tested benefits. This proved the case even when specifying that eligible households must be living in the least efficient homes (which have higher fuel costs and higher rates of fuel poverty). Despite the policy adjustments modelled here resulting in slightly increased efficiency in targeting fuel poor households overall and making further progress towards fuel poverty targets than existing policies, systematic approaches to limit eligibility much more tightly on to the intended beneficiary households remain relatively inefficient at targeting fuel poor households.

The modelling results suggested that targeting using just the energy efficiency rating of the dwellings would appear to have some benefits, but should be considered with caution. There is no guarantee that the most vulnerable or low income households living in these homes would proportionally benefit from such a scheme as, depending on the design, it is likely to require either proactive engagement or effective support or referral systems for many of these households. It is a well-known feature of such non-means tested schemes that better-off households who turn out to be eligible (as would occur with a focus on energy efficiency of the dwelling) tend to capture the benefits of schemes if they are available (because, for example, they can afford any client contributions), even if they were not really the intended target.

However, it is worth noting that improving fuel poverty targeting efficiency was not a main objective in this analysis – the key concern was to research potential for policies to improve on the progress towards the fuel poverty strategy targets. While better targeting of policies at fuel poor households is important, the interim targets and final 2030 target of the strategy are focused on improving the energy efficiency of the most inefficient homes inhabited by fuel poor households. This should also be considered in the context of the ambitions of the Clean Growth Strategy[24] which aspires to improve all dwellings to EPC band C by 2035.

In addition, it is likely that in the coming years, increased data sharing and more advanced data matching processes (for example, as provided for in the Digital Economy Act 2017) will enable targeting of fuel poor households to improve, particularly with regard to installing energy efficiency measures but also for direct payments such as the WHD. This should be an important focus of future studies looking to improve fuel poverty targeting efficiency.

Risks to the implementation of the changes proposed

Funding policies through general taxation is less regressive than funding policies through fuel bills and the changes proposed here would allow more government funds to be made available for energy efficiency improvements in the housing stock without increasing fuel bills. However, this can also be an insecure source of funding; changing political priorities or ideologies within government could shift spending priorities and leave the funds earmarked here for addition ECO spending being reduced or switched to another area altogether leaving ECO underfunded or even unfunded. Nevertheless, the scale of the task of reducing carbon emissions and alleviating fuel poverty mean that public funding of energy efficiency measures in the domestic sector, particularly for lower income households, could be an essential requirement to meet the respective targets.

Progress towards targets

Modelling the set of proposed changes to the eight policies reviewed in this study has shown that there exist as series of possible policy adjustments that could be made that help improve progress towards meeting fuel poverty and carbon emissions targets. These adjustments could also make a more substantial and lasting impact on the affordability of fuel bills for households in England. However, it is clear from the results that the proposed adjustments themselves would not go far enough towards these targets and in helping the government achieve the three household energy policy objectives. In particular, the results suggest that further interventions and programmes will be needed to meet interim and final fuel poverty strategy targets. In addition, while the aspirations of the Clean Growth Strategy are to be commended, it is clear that there is a need for a concerted increase in efforts (as well as programmes and funding) to deliver the substantial improvements that are required to increase energy efficiency levels and reduce carbon emissions of all homes in England.

[24] Clean Growth Strategy, Department for Business, Energy & Industrial Strategy, October 2017 - www.gov.uk/government/publications/clean-growth-strategy

7.3 Recommendations for High Level Principles

It is recommended that the four high level principles derived from this study are adopted by the Committee on Fuel Poverty, the Committee on Climate Change, BEIS and the Government. The four principles are:

1. Choose the sweet spot (and minimise tensions).
2. Prepare the ground for future action.
3. Be clear who foots the bill – and who gains the benefits – and why.
4. Look across the whole suite of relevant policies to reveal impacts and options.

In addition, and with particular reference to the fourth principle, we recommend that a study similar to this one is repeated regularly across government (potentially overseen by the Committees on Fuel Poverty and Climate Change) to provide overarching insight into the suite of policies that together seek to tackle fuel poverty, keep fuel bills affordable and reduce carbon emissions. It should primarily look to highlight where existing tensions remain or have reappeared and identify any new tensions. This will ensure that, as policies continue to evolve, they are designed to work more effectively together towards the shared objectives of meeting fuel poverty obligations, meeting statutory climate change targets, and keeping household bills affordable across the wider population.

Appendix A Summary of policies modelled in the NHM

Appendix A provides a brief overview of each of the policies that were modelled in the NHM. With the exception of the FiT, these policies were also subject to a series of adjustments (as outlined in Section 3 of the main report).

Warm Home Discount Scheme (WHD)

Summary: A discount applied to fuel bills of eligible households, **paid for through fuel bills**.

The Warm Home Discount Scheme (WHD) has three elements; two of these involve a discount of £140 off fuel bills – one for a core group of households and the second for a broader group. The third element, Industry Initiatives, is a series of additional measures offered by energy suppliers that include energy advice, debt relief, income checks, and heating controls as well as other measures. As mentioned in the main report, however, insufficient information is gathered by BEIS or Ofgem to understand who are the actual beneficiaries of Industry Initiatives and what the actual benefit is that they have received.

The **core group** is comprised of people in receipt of the Guaranteed Element of Pension Credit, and for the majority of this group the benefit is applied through an automatic data matching process. This reaches approximately 85% of all Pension Credit Guaranteed Element recipients (around about 1.3m people across the UK). An additional processing step mails the remainder of the group in an attempt to include them where data matching has failed to capture them. There is no spending cap on this element.

The **broader group** of households is more varied and constitutes an additional ~800,000 people eligible through being on a wider set of benefits and who are awarded the WHD on a first come first served basis. The eligibility criteria vary as each supplier has a level of freedom to set the criteria (with approval from Ofgem). However, broadly speaking these criteria are similar to the Cold Weather Payment eligibility criteria and attempt to capture households who are both low income and in an additional vulnerable situation.

The WHD is seen as complementary to energy efficiency installation schemes. These can take longer to reach the numbers of people that the WHD reaches every year. However, while the WHD reaches over two million people each year, it only has a short term impact – i.e. a bill rebate in the winter it is received. With the exception of a small number of measures installed under the Industry Initiatives part of the policy, there are no further impacts that help to reduce fuel poverty over a longer term period. Nevertheless, it is perceived as a safety net that can help people immediately in the middle of winter. As one BEIS policy lead states "*we will always need a safety net for some households, the key is to make sure that the Warm Home Discount really is a safety net for those who need it most*".

Background to eligibility criteria specification

The historical context of this policy is the desire to offer an immediate payment in the winter months to a set of vulnerable fuel poor households. At the time of the inception of this scheme, the 10% definition of fuel poverty was still in force. Under this definition, elderly people were disproportionately affected by fuel poverty than other households and thus the awarding of a

benefit to low income pensioners aligned satisfactorily with the targeting of a significant section of the fuel poor.

However, since 2013 the official definition of fuel poverty in England has been the Low Income High Cost (LIHC) definition. Under this definition, far fewer elderly households are in fuel poverty and disproportionately more working age families are in fuel poverty. Thus, with the changing definition of fuel poverty, the targeting efficiency of the WHD simultaneously reduced. But a realignment of the eligibility criteria of the core group to better target the scheme at the LIHC fuel poor, while at the same time maintaining a constant level of overall funding for the scheme, would involve a significant number of low income pensioners losing the annual winter rebate they have come accustomed to. As seen recently in the 2017 election campaign, a similar proposal to means test the WFP generally received negative comment.

To support these arguments, the Digital Economy Act could be instrumental in helping to reform the way future policies are targeted. For instance, data sharing agreements between DWP and other government departments, and organisations such as the Valuation Office Agency (VOA) could allow data on benefit recipients, income levels, housing characteristics, energy efficiency status to be automatically matched so that a) people no longer have to demonstrate these through several agencies and a considerable burden and process is removed and b) the theoretical targeting efficiency of could be increased with an automated payment (as currently provided to the existing core group) extended to a wider group of households.

Appendix Table A: Fuel poor households on Guaranteed Element of Pension Credit (core group of WHD) for different definitions of fuel poverty (EHS 2014)

	Fuel Poverty Definition	
	Fuel costs 10% or more of income	Low income, high cost
Number of households on Pension Credit in fuel poverty	152,747	85,739
Number of adults on Pension Credit in fuel poverty	178,817	137,747
Proportion of households on Pension Credit in fuel poverty	16%	9%
Proportion of people on Pension Credit in fuel poverty	13%	10%

Winter Fuel Payment (WFP)

Summary: An additional income paid to all people on state pension, **paid for from general taxation**.

According to policy leads, the Winter Fuel Payment (WFP) – introduced in 1998 – was originally intended as a nudge for the over 65 who at the time were the war time generation many of whom viewed themselves as self-reliant and reluctant to accept handouts from the government. The initial payment was £25 per year, received automatically as part of pension payments. This has since increased to £200 for pensioners aged up to 80 and £300 for pensioners over 80.

The payment is automated using data held by the DWP on State Pension recipients (or other pensioner benefits), date of birth and bank account details. These are made between November and December. The cost of the policy is in the order of £2 billion and is paid for out of general taxation.

The policy is considered by DWP as part of a series of policies and benefits that comprise an income increase to pensioners, aiming to ensure that pensioners do not fall below the income poverty threshold. (Other policies include Attendance Allowance, Pension Credit, Warm Home Discount and to a lesser extent, the Cold Weather Payment.)

It is estimated that Pension Credit is taken up by approximately 65% of those eligible, this means that 100,000s of low income pensioners who are eligible for this policy (and thus likely to be living below the income poverty line – 60% of the median national income) are not receiving something they are entitled to and something that could make a significant difference to their wellbeing and health, by heating their homes to a warmer temperature, or removing or reducing the heat or eat dilemma. One of the benefits is that the WFP reaches this group.

The flipside of this, the lack of means testing of the WFP, means that pensioners of all incomes received the payment – something that is essentially paid for by all tax payers, including low income households of working age. However, adding an eligibility criteria to the policy, for example through being in receipt of Pension Credit would cause those groups of eligible for Pension Credit but not claiming it to miss out on this payment there are entitled to and likely suffer significantly as a result. Furthermore, this example would result in additionality for the majority of Pension Credit households who already receive the Warm Home Discount, collected through levies on fuel bills.

Reaching this group of Pension Credit eligible but not claiming group is arguably one of the most successful aspects of the policy. However, it comes at a high cost and a low targeting efficiency. Reducing the scope of the WFP but ensuring inclusion of these households would require the introduction of a complex means tested system, which – as the National Audit Office (NAO) have identified[25] – is likely to incur significant additional administrative and financial burdens.

Given that there is evidence that many low income pensioners do not claim Pension Credit (which would give them automated access to the WHD), the WFP is seen as a mechanism for ensuring these households receive assistance. However, because the WFP is not means tested, it is poorly targeted at fuel poor households and an expensive way to reach the non-claimant low income pensioners.

If consensus could be reached on perceiving the WFP as predominantly a means to help people with fuel bills, and there is a desire to target the policy better (and also reduce its overall cost), the debate then becomes one of who are the most deserving pensioners, who stands to benefit the most from receiving this payment, and how straightforward it would be to reach just these households without incurring significant additional administrative burdens (for both policy teams and households themselves). Is it those on the lowest incomes, those with the highest fuel bills, those in the worst housing, the oldest pensioners, or a combination of these, or something else entirely?

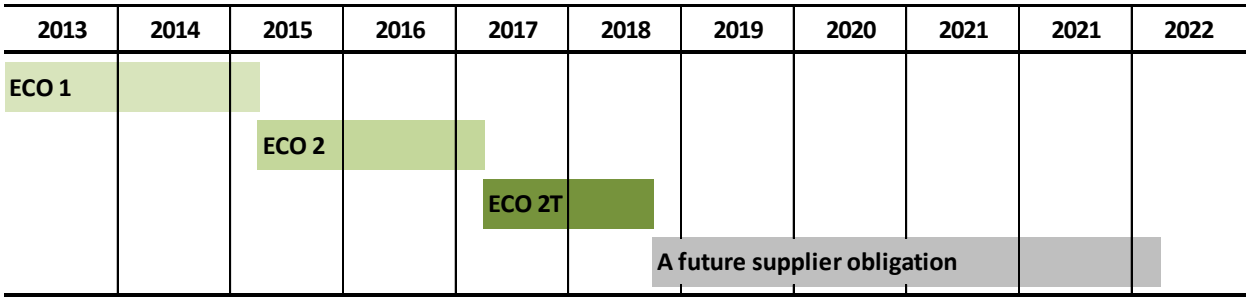
[25] Means testing - National Audit Office website - www.nao.org.uk/report/means-testing/

Energy Company Obligation (ECO)

Summary: An obligation on energy suppliers to deliver energy efficiency and heating measures in housing, **paid for from fuel bills**.

ECO is an obligation made on energy suppliers to deliver energy efficiency measures or heating technologies in housing across the UK. The policy is intended to drive uptake of energy efficiency measures in the residential sector that would not have occurred in the absence of intervention, in particular among households in or at risk of fuel poverty.

ECO originally ran alongside the Green Deal starting in 2013 after the Carbon Emissions Reduction Target (CERT) scheme ended in 2012. It was originally intended to provide additional support through measures not fully financeable through the Green Deal and focused on low income households. It is now in an extended second phase (ECO 2t), with ECO 3 (or a scheme of a similar nature) due to commence from September 2018. The government have made a commitment that suppliers will be obligated to install energy efficiency measures in domestic dwellings until at least 2021-22 (i.e. up to March 2022).



Energy efficiency measures

Large energy suppliers (known as obligated suppliers) are required to secure the installation of energy efficiency measures in domestic properties. Each supplier has targets based on its share of the domestic energy market.

The two main obligations are as follows:

1. Carbon Emissions Reduction Obligation (CERO). CERO aims to reduce carbon emissions by promoting 'primary measures', including roof and wall insulation and connections to district heating systems. Some CERO must also be delivered in rural areas. There is also a Solid Wall Minimum, which requires a proportion of the lifetime emissions savings resulting from insulation measures to come from insulating solid walls.

2. Home Heating Cost Reduction Obligation (HHCRO) – also known as Affordable Warmth. HHCRO aims to improve the ability of low income and vulnerable household to heat their homes. This includes insulation and efficient heating systems.

From 2015 until March 2017, there was also a Carbon Saving Communities Obligation (CSCO). CSCO targeted deprived communities, providing energy efficiency measures in the lowest IMD ranked 15% of areas.

When ECO began in 2013, it was predominantly a carbon reduction policy, but since then the carbon reduction element has been reduced and the fuel poverty aspect protected. Whilst the anticipated expenditure by suppliers is less than 50% of the original level, 70% of that funding now supports the Affordable Warmth (fuel poverty reduction) obligation.

Eligibility

The CERO obligation has no specific eligibility criteria, except that a certain proportion must be in rural areas. Households are eligible for the HHCRO if they live in private accommodation (rented or owner occupied) and receiving any of the following benefits:

- Income-related Employment and Support Allowance (ESA)
- Income-based Jobseeker's Allowance (JSA)
- Income Support
- Pension Credit Guarantee Credit
- Tax Credits (on the condition that the household's relevant income does not exceed maximum income, level varies depending on household size)
- Universal Credit (on the condition that the household's relevant income does not exceed maximum income, level varies depending on household size).

Alternatively, social housing that has an EPC rating of E, F or G can also qualify.

Feed-in Tariff (FiT)

Summary: A payment to households who have installed certified low carbon electricity generating technology, **paid for from fuel bills**.

Policy Aims

The Feed-In Tariff (FiT) was introduced in 2010 to encourage the widespread deployment of small scale, low-carbon electricity generation.

The main objectives of the FiT are to:

- Encourage deployment of small-scale (up to and including 5MW) low-carbon electricity generation
- Empower people and give them a direct stake in the transition to a low-carbon economy
- Foster behavioural change in energy use
- Help develop local supply chains and drive down technology costs.

Tariffs are paid to low carbon energy generators by energy suppliers participating in the scheme, based on the metered electricity generated. The technologies supported under FIT are: solar

photovoltaic (PV), onshore wind, hydropower, anaerobic digestion (AD) and micro combined heat and power (micro-CHP). Generation and export tariffs are paid for by suppliers and then passed on to consumers through electricity bills. Installations are required to be accredited by the Microgeneration Certification Scheme (MCS), and properties with an EPC rating of D or lower receive a lower tariff to incentive energy efficiency improvements.

Tariffs were set to give rates of return between 5-8% to encourage investment. Solar PV tariffs were reduced in 2011 after evidence they were overcompensating generators[26]. In 2012, tariffs were reduced across technologies to reduce the cost of the scheme. In 2010, the generation tariff for a 4-10kW capacity standard solar PV system was 44.19p/kWh. Over the years this has been reduced, partially due to the high uptake of solar PV and reducing capital costs of the technology. Some of current tariff rates are show below in Appendix Table B.

Appendix Table B: Current tariff rates for standard solar PV installation ('higher rate' is paid to households living in dwellings rated D or above)

Description	Total Installed Capacity (kW)	Tariff (p/kWh)
Standard solar photovoltaic receiving the higher rate	0-10	4.00
	10-50	4.22
	50-250	1.89

Domestic Renewable Heat Incentive (RHI)

Summary: A payment to households who have installed certified low carbon heating systems, **paid for from general taxation**.

The Renewable Heat Incentive (RHI) is a payment to owners of renewable heat installations. It was introduced in the non-domestic sector in November 2011 and the domestic sector in April 2014. The aim of the RHI is to incentivise the cost effective installation and generation of renewable heat in order to contribute to meeting carbon budgets, generate renewable energy to help meet the UK's 2020 renewable energy target, develop the renewable heat market and supply chain so that costs are reduced and to support the mass roll out of low carbon heating technologies.

The domestic RHI is open to owner occupier households, private rented landlords and social landlords. In addition, owners of heating systems who do not own a particular dwelling are also eligible for payments.

In order to qualify for the scheme, there must be an Energy Performance Certificate (EPC) that is less than 24 months old when applications are submitted for the scheme. If loft and/or cavity wall insulation is recommended in an EPC, it must be installed and a new EPC must be produced, which then reflects this newly installed insulation.

The eligible heating technology types for the Domestic RHI are:

[26] DECC, 2012, Feed-in Tariffs Scheme – Government response to Consultation on Comprehensive Review Phase 2A: Solar PV cost control, Department of Energy and Climate Change, London.

- Biomass boilers and biomass pellet stoves
- Air source heat pumps
- Ground source heat pumps
- Flat plate and evacuated tube solar thermal panels

Biomass boilers and heat pumps must be used to provide space heating or space heating and hot water, but not solely hot water. Solar thermal systems must only provide energy for hot water. If a solar thermal system and a qualifying heating system are installed in the same dwelling, the solar thermal system must feed into a separate water tank (i.e. not combined with space heating system); otherwise it will not be eligible for payments.

There must also be evidence that the technology has been paid for in full or in part by the owner of the dwelling. If the technology has been fully paid for by a grant, then the system is not eligible for the RHI.

Deeming and measuring heating demand

Typically, where the installed system is the main heating system in the dwelling (and any other heating system is used to heat a single room, such as an open fire or plug in electric heater), the heating requirement will be deemed from the EPC for that dwelling, and subsequently used to determine payment. In other situations, or where the property is occupied for less than half the year, then heat metering will need to be used to determine payment.

Appendix Table C: RHI annual budgets

	16/17	17/18	18/19	19/20	20/21
Budget cap	**£640m**	**£780m**	**£900m**	**£1010m**	**£1150m**
Current estimate of committed spend	**£546m**	**£716m**	**£774m**	**£811m**	**£834m**
Non-domestic	*£454m*	*£612m*	*£664m*	*£697m*	*£717m*
Domestic	*£92m*	*£104m*	*£110m*	*£114m*	*£117m*

Appendix Table D: Accreditations by tenure, Great Britain, April 2014 to August 2017

	Private Landlord	Social Landlord	Owner Occupier	Total
Air source heat pump	820	11,452	16,123	28,395
Ground source heat pump	315	974	7,199	8,488
Biomass systems	412	294	11,733	12,439
Solar thermal	135	721	7,495	8,351
Total	**1,682**	**13,441**	**42,550**	**57,673**

Appendix Table E: Accreditations by property type, Great Britain, April 2014 to August 2017

	Detached	Semi-detached	Terrace	Bungalow	Flat	Total
Air source heat pump	9,360	5,702	3,462	7,997	1,874	28,395
Ground source heat pump	5,889	848	246	1,416	89	8,488
Biomass systems	8,111	1,529	594	2,165	40	12,439
Solar thermal	4,414	1,283	654	1,921	79	8,351
Total	**27,774**	**9,362**	**4,956**	**13,499**	**2,082**	**57,673**

Minimum Energy Efficiency Standards in the Private Rented Sector (MEES in PRS)

All rented property having a new or renewed tenancy must have an EPC rating of at least "E" from 1 April 2018. From 1 April 2020, this will be extended to all rented domestic property (including existing tenancies). However, currently, landlords can register a number of exemptions allowing them to rent their properties at below "E" rating; most significantly where there is a cost to the landlord.

The Government has also launched a consultation suggesting an amendment to the minimum standard regulations to introduce some financial contribution from domestic landlords, subject to a cost cap, in instances where alternative funding may not be available. The Government's suggested cost cap is £2,500 per property; the amendments will likely come in to force on 1 April 2019. This means that there will be significant changes to PRS regulations in each year for the next three years: a 'soft' introduction in 2018, an introduction of some financial contribution in 2019, and a 'hard' backstop in 2020.

At the moment it is very difficult to predict how effective the minimum standard regulations will be in practice (including the two further amendments) and what areas will need more resource. The policy team at BEIS responsible for driving the roll-out have indicated an intention to fund some area pilots in England to better understand the impact and the resources needed to successfully deliver the minimum standard regulations, especially given the unpredictability, the annual changes over the next three years, and the overriding need to meet fuel poverty targets through action on energy inefficient homes in the worst performing tenure.

PPM price cap (and future tariff safeguarding extensions)

In 2016 the Competition and Markets Authority (CMA) reported on their investigation into the energy market, producing a series of recommended measures, or remedies, to help fix a series of problems identified. One of the problems identified was the high prices paid for electricity and gas by households using prepayment meters (PPM) to pay for these fuels, and the often vulnerable situations experienced by a disproportionately high number of these households. A proposed remedy was to introduce a price cap for prepayment meter tariffs, whereby energy companies could not charge more than a certain unit cost per kWh and above a certain annual standing charge. In April 2017, regulated by Ofgem, these price caps came into effect, affecting up to four million households using PPM and on some of the highest tariffs in the country.

Whilst this study has been conducted, Ofgem have proposed an additional safeguarding tariff estimated to include a further one million households who are not using PPM but are in receipt of the Warm Home Discount.

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