Department of Energy & Climate Change

ECO: HELP TO HEAT – TRANSITIONING TO A NEW FUEL POVERTY FOCUSSED OBLIGATION

CONSULTATION STAGE IMPACT ASSESSMENT

Title: Consultation Stage Impact Assessment: ECO: Help to Heat - Transitioning to a fuel poverty focussed obligation	Impact Assessment (IA)
IA No: DECC0215	**Date: 27/06/2016**
RPC Reference No: RPC16-DECC-3351(1)	**Stage:** Consultation
	Source of intervention: Domestic
Lead department or agency: Department of Energy and Climate Change	**Type of measure:** Secondary legislation
Other departments or agencies: None	**Contact for enquiries:** deccecoteam@decc.gsi.gov.uk

Summary: Intervention and Options

RPC Opinion: GREEN

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANDCB in 2014 prices)	**In Scope of One-In, Three-Out?**	**Business Impact Target Status** Measure qualifies as
£174m	-£620m	£TBC	Yes	Qualifying Provision

What is the problem under consideration? Why is government intervention necessary?

Upgrading the energy efficiency of homes addresses the root cause of fuel poverty, reduces greenhouse gas emissions, lowers energy bills, and improves security of energy supply. A number of market barriers and failures exist in the energy efficiency market, preventing the deployment of energy efficiency in the absence of Government intervention. They include externalities, imperfect information and information asymmetries, lack of access to capital, and misaligned incentives. Government intervention is required to overcome these barriers and in order to deliver on Government's fuel poverty and climate change commitments.

What are the policy objectives and the intended effects?

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. The intended effects are to: make progress against Government's statutory fuel poverty and climate change commitments; reduce energy demand in the residential sector, thereby lowering energy bills and improving energy security; improve thermal comfort levels and subsequent health outcomes; support jobs and economic growth.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Three main options have been considered. Changes are described compared to the current scheme:

Policy Option 1 (preferred): Increasing the relative size of the Affordable Warmth (AW) obligation that focuses on households in or at risk of fuel poverty; reducing the size of the Carbon Emissions Reduction Obligation (CERO); removing the Carbon Saving Communities Obligation (CSCO). This provides the greatest fuel poverty focus.

Policy Option 2: Retain the current relative size of the AW obligation; remove CSCO; increase the relative size of CERO. This provides the greatest focus on reducing greenhouse gas emissions at lowest cost.

Policy Option 3: Retain the relative balance of focus between AW, CERO and CSCO as under the current scheme. This would represent a broad rolling forward of the current scheme and therefore the simplest transition for the supply chain.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 10/2022

Does implementation go beyond minimum EU requirements?		N/A		
Are any of these organisations in scope?	**Micro** No	**Small** No	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)		**Traded:** -0.61	**Non-traded:** -2.76	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible minster: ..... Date: 21.6.2016

Summary: Analysis & Evidence — Policy Option 1

Description: The Energy Company Obligation is extended by one year, with an increased focus on the Affordable Warmth Obligation (AW); reducing the size of the Carbon Emissions Reduction Obligation (CERO); removing the Carbon Saving Communities Obligation (CSCO).

FULL ECONOMIC ASSESSMENT

Price Base Year 2015	PV Base Year 2016	Time Period Years 44	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High: Optional**	**Best Estimate: £174m**

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				**£441m**

Description and scale of key monetised costs by 'main affected groups'

The largest components of the costs are the material and labour costs associated with the installation of energy efficiency measures (PV £326m), costs of ECO scheme administration to suppliers (PV £77m), and hidden costs (PV £26m) associated with the installation of energy efficiency measures. Most of these costs are expected to be incurred by obligated energy suppliers.

Other key non-monetised costs by 'main affected groups'

There will be some small costs to DECC and the administrator, which have not been monetised.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				**£616m**

Description and scale of key monetised benefits by 'main affected groups'

Households that have energy efficiency measures installed are the main affected group. They will benefit from energy savings (carrying a value to society of PV £358m), and increased comfort from warmer homes (PV £92m). Society will also benefit from improved air quality (PV £23m), and reduced traded (PV £13m) and non-traded (PV £129m) carbon emissions.

Other key non-monetised benefits by 'main affected groups'

The UK is likely to benefit from lower energy imports, and lower costs of meeting peak demand.
Health impacts associated with the improved energy efficiency of properties treated under ECO have been estimated at PV £75m. This benefit is not included in the CBA tables due to potential overlap with comfort taking.

Key assumptions/sensitivities/risks	3.5 (years 1-30), 3.0 (>30 years)

The targets set in legislation will require suppliers to deliver a set volume of carbon savings and notional bill savings by installing energy efficiency measures. The precise cost to suppliers, and therefore the pass through of these costs onto energy bills, is uncertain.
When partial estimates of the distributional benefits of this policy option are included, the NPV increases to £784m.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	**Benefits:**	**Net:**	
£TBC	£TBC	£TBC	£TBC

Summary: Analysis & Evidence

Policy Option 2

Description: The ECO is extended by one year, with an increased focus on the Carbon Emissions Reduction Obligation (CERO); retaining the current relative size of the AW obligation; removing the CSCO.

FULL ECONOMIC ASSESSMENT

Price Base Year 2015	PV Base Year 2016	Time Period Years 44	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High: Optional**	**Best Estimate: £410m**

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				**£574m**

Description and scale of key monetised costs by 'main affected groups'

Costs are similar to policy Option 1, although installation (PV £433m), and hidden costs (PV £58m) are greater under this option, owing to more measures being installed.

Other key non-monetised costs by 'main affected groups'

There will be some small costs to DECC and the administrator, which have not been monetised.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate				**£984m**

Description and scale of key monetised benefits by 'main affected groups'

Benefits are similar to Option 1, although energy savings (PV £514m), comfort taking (PV £147m), air quality benefits (PV £30m), traded and non-traded carbon savings (PV £12m and PV £280m PV respectively) are in general higher owing to more measures being installed.

Other key non-monetised benefits by 'main affected groups'

Health impacts associated with the improved energy efficiency of properties treated under ECO have been estimated at £113m (PV). This benefit is not included in the CBA tables owing to potential overlap with comfort taking.

Key assumptions/sensitivities/risks | 3.5 (years 1-30), 3.0 (>30 years)

The targets set in legislation will require suppliers to deliver a set volume of carbon savings and notional bill savings by installing energy efficiency measures. The precise cost to suppliers, and therefore the pass through of these costs onto energy bills, is uncertain.

When partial estimates of the distributional benefits of this policy option are included, the NPV increases to £797m.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	**Benefits:**	**Net:**	
£TBC	£TBC	£TBC	£TBC

Summary: Analysis & Evidence **Policy Option 3**

Description: The ECO is extended by one year, with the balance between Affordable Warmth, CERO and CSCO obligations remaining in line with the current scheme.

FULL ECONOMIC ASSESSMENT

Price Base Year 2015	**PV Base Year** 2016	**Time Period Years 44**	**Net Benefit (Present Value (PV)) (£m)**		
			Low: Optional	**High: Optional**	**Best Estimate: £256m**

COSTS (£m)	**Total Transition** (Constant Price) Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	Optional	Optional	**Optional**
High	Optional	Optional	**Optional**
Best Estimate			**£532m**

Description and scale of key monetised costs by 'main affected groups'

Costs are similar to policy Option 1, although installation (PV £397m) and hidden costs (PV £52m) are greater under this option, owing to more measures being installed.

Other key non-monetised costs by 'main affected groups'

There will be some small costs to DECC and the administrator, which have not been monetised.

BENEFITS (£m)	**Total Transition** (Constant Price) Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	Optional	Optional	**Optional**
High	Optional	Optional	**Optional**
Best Estimate			**£788m**

Description and scale of key monetised benefits by 'main affected groups'

Benefits are similar to Option 1, although energy savings (PV £425m), comfort taking (PV £119m), air quality benefits (PV £21m), traded and non-traded carbon savings (PV £12m and PV £211m respectively) are in general higher owing to more measures being installed.

Other key non-monetised benefits by 'main affected groups'

Non Monetised Benefits are as option 1.
Health impacts associated with the improved energy efficiency of properties treated under ECO have been estimated at £97m (PV). This benefit is not included in the CBA tables owing to potential overlap with comfort taking.

Key assumptions/sensitivities/risks 3.5 (years 1-30), 3.0 (>30 years)

The targets set in legislation will require suppliers to deliver a set volume of carbon savings and notional bill savings by installing energy efficiency measures. The cost to suppliers, and therefore the pass through of these costs onto energy bills, is uncertain.
When partial estimates of the distributional benefits of this policy option are included, the NPV increases to £639m.

BUSINESS ASSESSMENT (Option 3)

Direct impact on business (Equivalent Annual) £m:			**Score for Business Impact Target (qualifying provisions only) £m:**
Costs:	**Benefits:**	**Net:**	
£TBC	£TBC	£TBC	£TBC

Contents

1. Introduction and description of the problem

1. This consultation stage Impact Assessment (IA) accompanies the Government consultation on extending the Energy Company Obligation by one year, as part of a transition to a longer term more fuel poverty focussed supplier obligation. It applies across Great Britain.

2. The aim of this document is to provide the Government's assessment of the main impacts of the one year transition (2017-18), including the number of households treated, the impact on fuel poverty, jobs supported, and energy bill impacts. It also provides a detailed assessment on the costs and benefits of the policy and the regulatory impact (the Equivalent Annualised Net Direct Costs to Business, or EANDCB, noting that the approach to accounting at this stage is yet to be agreed – see Section 10 for more details).

3. The remainder of this section outlines the problem Government is looking to address by intervening in the market.

1.1 Problem under consideration

4. Upgrading the energy efficiency of homes addresses a number of Government objectives by directly:

    1) Tackling the root cause of fuel poverty and making progress towards the Government's statutory fuel poverty targets;

    2) Reducing greenhouse gas emissions in the domestic sector, contributing to the Government's legally binding carbon reduction targets;

    3) Lowering energy bills, helping keep bills as low as possible for households; and

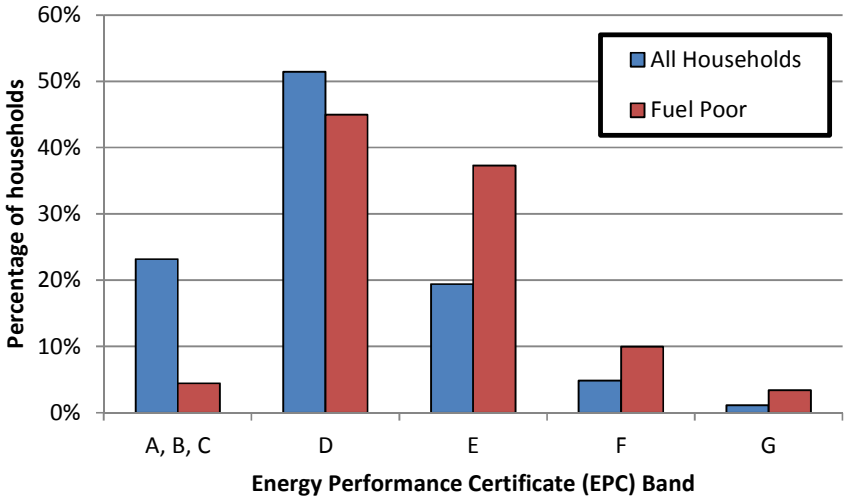
    4) Reducing energy demand and contributing to ensuring that the UK has a secure and resilient energy system.

5. The housing stock is responsible for a significant share of the UK's non traded[1] carbon emissions (around 25%)[2], and primary energy consumption (around 27%)[3]. Tackling the poor energy efficiency of the housing stock is therefore important in meeting the Government's legally-binding carbon targets.

6. Less than a quarter of the residential housing stock in England falls into the highest three Energy Performance Certificate[4] bands (A, B, and C), while broadly the same proportion fall into the lowest three bands (E, F and G), as shown in Chart 1 below. In Scotland and Wales, around 19% and 30% of the housing stock respectively fall into the lowest three energy efficiency bands[5,6].

[1] Emissions from electricity are covered by the EU Emissions Trading System (EU ETS), and these traded emissions do not count towards the UK's carbon Budgets
[2] DECC Energy and Emission Projections (2015): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/501292/eepReport2015_160205.pdf
[3] See domestic sector final consumption https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/450302/DUKES_2015.pdf
[4] Energy Performance Certificates are the Government's official procedure for energy performance of homes.
[5] http://www.gov.scot/Publications/2014/12/6903/4#t19
[6] Welsh EPC ratings are based on lodgements to 2015Q4 https://www.gov.uk/government/statistical-data-sets/live-tables-on-energy-performance-of-buildings-certificates

Chart 1: Energy Efficiency Ratings of the Residential English Housing Stock, All Households and Fuel Poor



Source: English Housing Survey and Fuel Poverty Dataset, 2013

7. The poor energy efficiency of the GB housing stock is largely a symptom of low levels of insulation – even though insulation levels have improved significantly, over the last decade, largely as a result of government policies[7]. DECC estimates, for example, that as of December 2015[8], across GB there are:

   - Around 7 million properties that could benefit from loft insulation – mainly topping up existing levels of insulation (29% of homes with lofts)[9].
   - Around 4.7 million[10] cavity wall properties that could benefit from some cavity wall insulation (29% of homes with cavity walls).
   - Around 7.5 million uninsulated solid walled properties (94% per cent of homes with solid walls).

8. Chart 1 also shows how fuel poor households in England (red bars) are disproportionately concentrated in the least energy efficient homes - more than half of fuel poor households live in homes rated Band E or below. The Government has a statutory target to raise as many fuel poor homes in England as reasonably practicable to energy efficiency Band C by 2030[11], with interim milestones of as many fuel poor homes in England as reasonably practicable to Band E by 2020 and Band D by 2025.[12]

9. Making progress against these fuel poverty commitments will need a range of energy efficiency interventions. Chart 2 shows the estimated potential to install measures in F and G-rated fuel poor homes in England, and the cost effectiveness of those measures compared to each other. It shows

[7] For example, since 2008, around 4m cavity walls, 7m lofts and 0.3m solid walls have been insulated – the majority of which were treated under the Carbon Emission Reduction Target (CERT), the Community Energy Saving Programme (CESP) and the Energy Company Obligation. Source: Ofgem.

8 Source DECC Household Energy Efficiency National Statistics https://www.gov.uk/government/statistics/household-energy-efficiency-national-statistics-detailed-report-2015

[9] Around 1 per cent of all properties with a loft are estimated to have no insulation.

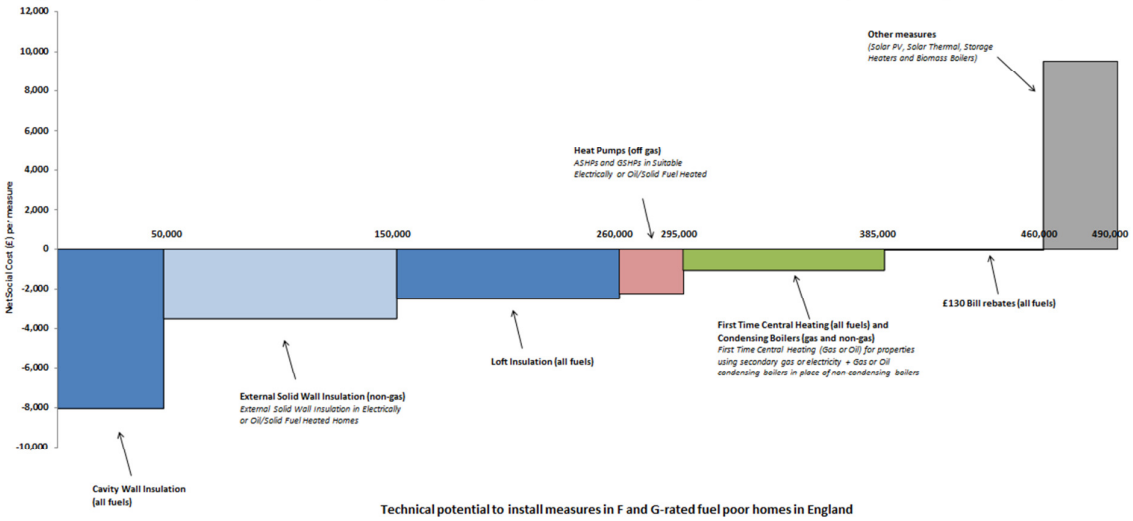
[10] The remaining potential for cavity wall insulation has been updated to reflect emerging evidence and the figure quoted will differ to current published statistics. An explanation behind the methodology can be found in Annex C.

[11] More detail on measuring fuel poverty in England, the statutory target, and fuel poverty strategy for England see: https://www.gov.uk/government/publications/cutting-the-cost-of-keeping-warm

[12] It is important to note that in relation to the fuel poverty target for England, energy efficiency is defined by the Fuel Poverty Energy Efficiency Rating (FPEER), which is a variation on the EPC. More detail can be found here: https://www.gov.uk/government/publications/fuel-poverty-england-regulations-2014-and-methodology

that supporting F and G-rated fuel poor households in upgrading their energy efficiency in a cost-effective way requires a diverse mix of measures, focusing primarily on insulation with an important role for heating measures. This analysis acts as a broad guide and does not prescribe a particular number of installations of any one measure. A range of considerations need to be taken into account, such as gross costs and the ability to identify cost-effective opportunities on the ground.

Chart 2: Fuel Poverty Marginal Alleviation Cost Curve for F and G-rated fuel poor homes in England



Source: DECC analysis of the English Housing Survey

10. Tackling the poor energy efficiency of the housing stock is also likely to lead to wider benefits. For example, improving the housing stock's energy efficiency will also:

- **Help lower household energy bills**

  Improving the energy efficiency of properties can lead to significant household bill savings. Households can save between £30 and £300 a year off their energy bills if they insulate their homes.[13]

- **Reducing the costs of meeting energy demand**

  The cheapest form of energy is the energy we do not use. International evidence suggests that energy efficiency can, in many cases, have a lower capital outlay and a lower levelised cost[14] than any form of fossil fuel or renewable generation.[15]

- **Greater security of energy supply**

  At present around 80% of the fuels (predominantly coal, gas, and oil) required to meet primary energy demand are imported.[16] Improving the energy efficiency of the housing stock reduces both domestic energy demand and the volume of energy imports needed, thereby improving the security of the nation's energy supplies. The International Energy Agency (IEA) estimate that

[13] DECC Prices and Bills Report 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384404/Prices__Bills_report_2014.pdf (see page 7).
[14] The levelised cost of energy is an attempt to measure different forms of generation on a comparable basis.
[15] International Energy Agency, Energy Efficiency Market Report (2015) http://www.iea.org/publications/freepublications/publication/MediumTermEnergyefficiencyMarketReport2015.pdf
[16] DECC's Digest of UK Energy Statistics (DUKES) shows that in 2014, the UK imported around 80% of the energy needed to meet demand.

since 1990, energy efficiency improvements have reduced the UK's energy imports by around 25 million tonnes of oil equivalent, and reduced the UK's import bill by around $7 billion.[17]

- **Improve health outcomes and reduce costs to the public of providing health care**

  Living in accommodation that is not adequately heated can lead to a range of physical and mental health conditions, from cardiovascular disease in elderly householders to asthma in children.[18] Improved internal temperatures from better insulated and adequately heated homes can reduce the risk of suffering cold-related mortality or morbidity, with significant benefits to the householders and potentially avoiding health treatment costs (see Section 8.5). For example, excess hospital bed days in England cost the NHS around £300 each[19], the equivalent of the approximate cost of installing loft insulation.

- **Supporting economic growth and jobs**

  Reducing domestic energy bills will increase the disposable income of households[20], which could lead to higher economic growth by maintaining thermal comfort from energy while supporting increased spending on other goods and services.[21] Furthermore, by increasing demand for measures, energy efficiency policies can help support growth and sustain jobs in the supply chain industry.[22]

[17] International Energy Agency, Energy Efficiency Market Report (2015) http://www.iea.org/publications/freepublications/publication/MediumTermEnergyefficiencyMarketReport2015.pdf
[18] For more detail see Chapter 3 of the Hills Fuel Poverty Review Interim Report: http://eprints.lse.ac.uk/39270/1/CASEreport69%28lsero%29.pdf
[19] Department of Health (2015), Reference Costs 2014-15, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/477919/2014-15_Reference_costs_publication.pdf
[20] This effect may be more likely in able to pay households, as fuel poor households may realise a greater share of the benefits from energy efficiency measures through warmer homes rather than lower energy bills.
[21] Particularly amongst households with lower household disposable income, as these households are likely to spend a greater proportion of their income on essentials (and therefore have a higher marginal propensity to spend any increases in their disposable income).
[22] The estimated number of jobs the ECO transition could sustain is outlined in Section 8.

2. Rationale for Government Intervention

11. This section provides an overview of the rationale for extending the existing Energy Company Obligation by one year, as part of a transition to a fuel poverty focused scheme from 2018. It is divided into the market barriers and failures (Section 2.1) and equity considerations (Section 2.2) that support intervention in the market.

11.1 Market barriers and failures

12. A number of market barriers and failures exist in the energy efficiency market, preventing the deployment of energy efficiency in the absence of government intervention. These have been extensively detailed in past ECO impact assessments and related documents. To recap, the key market barriers and failures for intervention in the domestic energy efficiency market are:

- **Externalities** - Households generate carbon emissions through using energy in the home (e.g. heating). They experience the benefit of doing so (e.g. a warm home), but the climate change costs resulting from the emissions are under-priced.[23] This leads to overconsumption of energy and low demand for energy efficiency because the costs and benefits to society of energy use are not aligned.

- **Access to capital** – the upfront cost of energy efficiency measures means households must choose between investing in them or using the same money for other purposes (the 'opportunity cost'). For some households the choice may be between measures and funding essentials such as food, or borrowing at high interest rates. In these circumstances households might choose not to invest even where bill savings outweigh upfront cost due to the 'opportunity cost' of investing.

- **Incomplete or asymmetric information** - the energy efficiency market is characterised by a lack of trusted information for consumers who are not well informed in relation to energy efficiency measures. Householders may not be aware of the potential benefits, or be less well informed about the performance of measures than those looking to sell them. As a result, households may heavily discount the potential benefits to them from energy efficiency improvements and choose not to take them up.

- **Misaligned Incentives** – For significant sections of the housing stock, the party responsible for the property may not be the same as those living in it. This can lead to underinvestment in energy efficiency measures, because the former would be responsible for funding them while the latter would experience the benefits of lower bills and improved thermal comfort.

12.1 Equity

13. As well as the summary of the market barriers above, there is a rationale for Government intervention on the following equity grounds.

Fuel poverty

14. Households in England are considered to be in fuel poverty if they face above average energy costs and if they met those costs would be left with a residual income below the poverty line. In Scotland and Wales households are considered fuel poor if they need to spend more than 10% of their income on household energy.

[23] The exception here would be electrically-heated homes, as electricity generation is subject to the EU Emissions Trading System which places a price on carbon emissions generated.

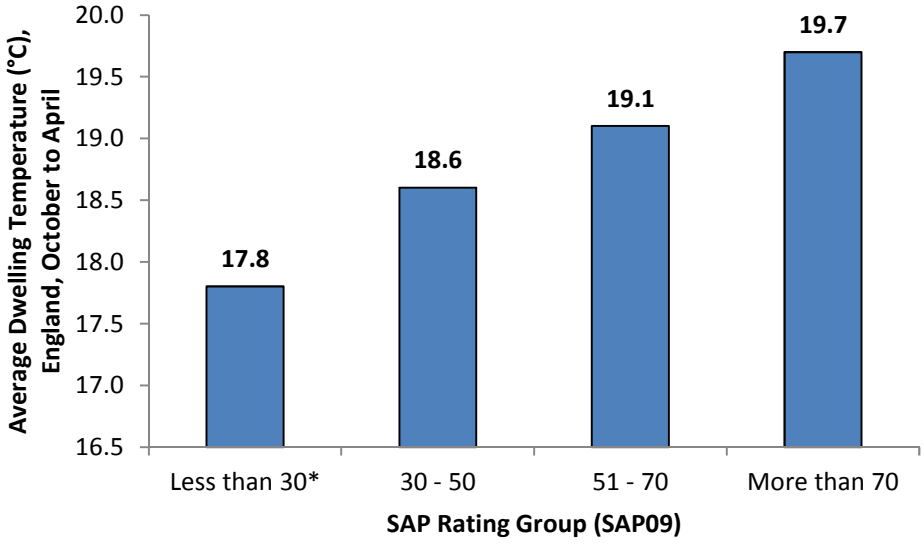
15. For low income households, and for the fuel poor in particular, the above market barriers are compounded by two factors. First, energy is a necessity and fuel poor households are among those with the highest needs despite being on lower incomes, making energy costs regressive. Further, most of these households lack the means to fund energy efficiency improvements to tackle the underlying problem. For example, in England the typical fuel poor household has required energy costs around 20% higher than the average, coupled with a household income less than half of the average.[24]

Health outcomes

16. Living at low temperatures poses a risk to health, with a range of negative morbidity and mortality impacts associated with exposure to the cold. The Marmot Review Team report on cold homes and health[25], in addition to the Hills Fuel Poverty Review[26], set out the strong body of evidence linking low temperatures to these poor health outcomes – in particular the cardiovascular and respiratory illnesses that drive the number of excess winter deaths each year.

17. High energy costs driven by poor energy efficiency have been shown to be robustly linked to lower indoor temperatures[27].The EHS Energy Follow Up Survey to the shows a clear correlation between low energy efficiency (for example, those with a SAP rating of 50 or below, roughly equivalent to an EPC band below D) and low average dwelling temperatures during the winter heating season (Chart 3). Those living in energy inefficient dwellings, vulnerable to the effects of the cold and without the means to fund or access energy efficiency measures, therefore risk being 'locked in' to low temperatures and the subsequent negative health outcomes.

Chart 3: Average dwelling temperatures during winter heating season (2011), by SAP rating band



Source: Energy Follow Up Survey to the 2011 English Housing Survey
** Small samples mean potentially high sampling errors*

[24] Fuel Poverty Statistics (2015), available at: https://www.gov.uk/government/collections/fuel-poverty-statistics
[25] Marmot Review Team (2011). *The Health Impacts of Cold Homes and Fuel Poverty*. Available at: http://www.instituteofhealthequity.org/projects/the-health-impacts-of-cold-homes-and-fuel-poverty
[26] Hills (2011). *Fuel Poverty: The Problem and Its Measurement*. Available at: http://eprints.lse.ac.uk/39270/1/CASEreport69%28lsero%29.pdf
[27] See Wilkinson et al (2001). *Cold Comfort: the social and environmental determinants of excess winter deaths in England, 1986-96*.

3. Policy Objectives

3.1 The ECO Transition to a new supplier obligation

18. The current ECO scheme runs to March 2017, and comprises 3 obligations:

- The **Carbon Emissions Reduction Obligation (CERO)**, which seeks to reduce lifetime carbon emissions through the deployment of primarily insulation measures where they can be delivered most cost-effectively;

- The **Carbon Saving Communities Obligation (CSCO)**, which again seeks to reduce lifetime carbon through mainly insulation measures, with delivery restricted to the lowest scoring 25% Lower Layer Super Output Areas or Data Zones of Great Britain according to the Index of Multiple Deprivation[28]; and

- The **Affordable Warmth (AW)** obligation, which looks to reduce lifetime notional heating costs[29] in low income and vulnerable households in or at risk of fuel poverty, through a mixture of insulation and efficient heating systems.

19. Suppliers are also required to deliver a minimum share of their obligations through deploying Solid Wall Insulation (SWI), which broadly translates into the equivalent of around 25,000 homes per year. As set out in the 2014 ECO Impact Assessment[30], from April 2015 to March 2017 each of the 3 obligations are estimated to be worth around 1/3 of the estimated £820m of supplier expenditure per year (2013 prices).

20. The 2015 Spending Review announced plans for ECO to be replaced with a new, cheaper scheme from April 2017. This is subject to consultation and Parliamentary approval. The new scheme would run for 5 years in total (to end March 2022), and look to address the root causes of fuel poverty. It will also be the primary vehicle through which Government will look to meet its manifesto commitment to insulate one million homes over this Parliament.

21. With a much greater focus on fuel poverty combined with a drive to simplify delivery in order to reduce costs, the new scheme is likely to have significantly different administrative rules and eligibility criteria to the present ECO scheme. As such, the Government is proposing to extend the current ECO scheme by one year (to April 2018), but with a greater fuel poverty focus, to act as a bridge between the current ECO scheme and its replacement.

22. By introducing the new scheme more gradually, this 'transition year' intends to help smooth the changes, thus avoiding the sudden changes seen between past schemes[31], and making it easier for suppliers to adjust to the new scheme requirements.

23. The one-year transition from April 2017 to March 2018 is the subject of this Impact Assessment (IA). The impact of the future scheme beyond the transition year (from 2018 onwards) will be addressed in future impact assessments.

3.2 Main policy objectives

24. The full policy proposal, set out in the consultation that accompanies this IA, will seek to put low income and fuel poor consumers at the heart of a new framework for delivery of energy efficiency

[28] More information on the eligible areas for CSCO can be found here: https://www.ofgem.gov.uk/publications-and-updates/csco-tool
[29] Notional heating costs are the estimated costs of space and water heating costs according to the Standard Assessment Procedure (SAP) – Government's official measure of the energy performance of domestic buildings.
[30] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/373650/ECO_IA_with_SoS_e-sigf_v2.pdf
[31] Such as the move from CERT and CESP to ECO

measures. Key outcomes are to extend the current regulatory framework, amending to put vulnerable consumers first by:

- controlling costs and getting better value for money;
- simplifying and removing complexity;
- focusing on those most in need;
- giving long term certainty to support investment;
- working with local actors; and
- aligning the policy approach with long-term strategy around carbon budgets and tackling fuel poverty.

3.3 Broader policy objectives

25. Improving the thermal efficiency of domestic properties should improve internal comfort in domestic properties and reduce domestic demand for energy. These outcomes will help the Government to achieve its broader objectives, to:

- Make progress towards its statutory fuel poverty targets;
- Reduce UK greenhouse gas emissions;
- Increase the security of energy supply (which also decreases peak demand and price volatility);
- Improve health outcomes related to living in cold homes; and
- Support economic growth, jobs in the green construction industry and investment in domestic dwellings.

26. Further details on the broader objectives can be found in Annex B.

4. Policy Options

27. This section of the IA outlines the policy options that have been considered and assessed. They are based on the proposals set out in the accompanying consultation document and where appropriate demonstrate the impact against plausible alternatives.

28. Three policy options are considered, which are assessed against the 'Do Nothing' option.

28.1 Policy Option 0 – the 'Do Nothing' option

29. Under this option, the current ECO ends in March 2017 and obligated energy companies are no longer required to deliver heating and insulation measures to residential homes. With no other GB-wide policies geared towards improving the energy efficiency of the residential housing stock from March 2017, there would be no vehicle through which the Government can drive delivery on its manifesto commitment to insulate 1 million homes over the course of this Parliament. Moreover, the poor thermal efficiency of the residential building stock would not be tackled (due to the market barriers and failures outlined in Section 2), resulting in a lack of progress towards the Government's fuel poverty obligations. A small number of energy efficiency measures are estimated to be installed in the absence of Government intervention under this option.

30. This option represents the counterfactual against which the costs and benefits of the policy options considered below are assessed. More details on what is included in the counterfactual can be found in Section 6.

4.2 Policy Option 1 - the preferred option

31. The Government's preferred option mirrors the provisions set out in the consultation document. It involves increasing the fuel poverty focus of ECO, while retaining some of the 'able to pay' element of the present ECO scheme for the transition year. The main details of the policy proposal are set out below.

Targets for obligated suppliers

32. The following provisional targets are proposed for the transition year:

- The CERO target is increased by 3.0MtCO_2 by end of March 2018;
- The CSCO target (including the 15% of the obligation required to be delivered in rural areas) would not be increased. This would in effect mean a removal of CSCO for the transition year.
- The AW target is increased by £1.84bn of lifetime notional bill savings by end of March 2018.

33. It should be noted that the increases to the CERO and AW targets are provisional and based on the latest evidence around measure and delivery costs, and most importantly illustrative estimates of the deemed scores. We are currently updating a number of key areas of the evidence base for ECO, including the latest cost estimates for major insulation measures, and Ofgem are currently producing provisional versions of the deemed scores. We intend to draw upon the improvements in the evidence base and Ofgem's deemed scores for the final stage Impact Assessment and setting of the targets in regulations.

Measures

34. Eligible measures will remain largely the same as under the present ECO scheme. Under Affordable Warmth the uplifts that currently apply to insulation in homes not using mains gas and to non-gas boilers will be retained at their current levels, as will the gas boiler deflator.[32]

35. The solid wall minimum[33] under the present ECO scheme will be increased, from 4MtCO_2 by March 2017 to 4.74MtCO_2 by March 2018. This is broadly the equivalent of an additional 17,000 solid wall installations during the transition year[34], and while specified in terms of carbon can be delivered against either of the obligations.

36. To reduce the prevalence of replacement gas boiler deployment under Affordable Warmth, measures would be put in place to encourage no more than approximately 25,000 qualifying gas boilers replacements as a result of the transition year. Boiler installations will continue to be limited to private tenure households.

Household Eligibility

37. There would continue to be no restriction on which households were eligible to receive support under CERO. Under Affordable Warmth, however, in order to improve the targeting of fuel poor households, a number of changes to eligibility are proposed. These include:

- Introducing income thresholds to some of the benefits (universal credit and tax credits), which reflect both the level of household income and household composition.[35]

- Removing the restriction to only those having a disability or pensioner sub-component of Income Support, income-based Employment and Support Allowance or income-based Jobseekers Allowance; or the need to have a child in the household. This is to improve the simplicity of the scheme.

- Aligning the eligibility criteria for pensioner households with the Warm Home Discount (WHD) Core Group[36], and restricting it to those on Pension Credit Guarantee Credit.

- Extend eligibility to all social tenure households[37] that are most likely to be fuel poor (those living in EPC Band E and below).

- For a certain proportion of the obligation, enable Local Authorities (and possibly other local partners) to determine households as eligible. For example, those that are vulnerable or fuel poor but not on benefits. This is termed 'flexible eligibility'.

Streamlining the scheme

[32] For more information on ECO eligible measures, see: https://www.ofgem.gov.uk/ofgem-publications/83100/energycompaniesobligation-measures-pdf
[33] Also known as the Provisional Solid Wall Requirement (PSWR).
[34] A solid wall minimum of 4MtCO_2 was set under ECO to March 2017, which was estimated to be the equivalent of 100,000 solid walled homes being insulated.
[35] This is referred to as 'equivalised income', whereby it is recognised that a larger household on the same income as a smaller household will have a lower disposable income because it is spread across more people. In practice this means setting different income thresholds for different household composition groups.
[36] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/514325/FINAL_Warm_Home_Discount_2016-17_extension_consultation_IA_CONSULTATION.pdf
[37] Affordable Warmth is currently only available to private tenure households.

38. The administrative complexity of the current ECO scheme would be reduced, removing some of the administrative requirements for suppliers and the supply chain. The principal changes are to:

- Reduce the complexity of the scoring system by replacing the existing Standard Assessment Procedure scoring system with 'deemed scoring'. This means installers would no longer need to conduct a full assessment of a property (involving around a hundred data inputs) before being able to gauge whether a measure would create a sufficient score in order to justify the subsidy on offer.

- Remove the requirement for measures delivered under CERO and CSCO to be recommended on a Green Deal Advise Report (GDAR) or Chartered Surveyors' Report (CSR).[38]

- Relax the 1-month reporting rule in some instances, allowing suppliers more time to report installed measures to the scheme administrator.

- Enabling suppliers to trade their obligations with each other and between their supply licences.

39. More details on these changes are set out in Annex A.

4.3 Rationale for preferred option

40. Here we provide a summary of the policy rationale and analysis of the proposals set out above. A more detailed discussion can be found in Annex A.

41. The preferred option looks to strike a balance between taking the first step towards a fuel poverty focused obligation, while also ensuring that the changes do not involve a large step change in the ECO scheme design, causing disruption and increasing costs for suppliers and the supply chain. In terms of the specific components:

- **Size of the overall obligation** – the provisional targets for the transition year equate to an estimated level of supplier expenditure of £600m per year in 2013 prices (£640m in 2017/18 prices), a reduction of over £200m compared to estimated level of the current scheme at around £820m per year. This reduction in supplier spend reflects Government desire to minimise the costs of policies on consumers' energy bills and the regulatory burden on business.

- **Increasing the focus on fuel poverty** - the Government is clear that it is unacceptable that some households living on a low income should have to do so in properties that cannot be kept warm at reasonable cost. Founded in the equity considerations outlined above, Government proposes to focus subsidy on those who are most in need by focusing around 70% of supplier effort on Affordable Warmth compared to 30% on CERO in the transition year, and also improving the eligibility criteria of the Affordable Warmth group. The impact of this against alternative options is examined in Section 8.

- **Not extending the Carbon Saving Communities Obligation (CSCO) targets** – CSCO currently targets households living in the 25% most deprived Lower Layer Super Output Areas or Data Zones according to the Index of Multiple Deprivation. In doing so, however, it attempts to simultaneously address distributional concerns and seek to reduce carbon emissions. But our analysis finds that the prevalence of fuel poverty in CSCO areas in England differs little from the national average (around 12% compared to 10% nationally).[39] By constraining the eligible areas,

[38] These requirements are not required under Affordable Warmth.
[39] Derived from the fuel poverty data set and cross-checked by matching with the sub-regional fuel poverty statistics.

the availability of the most cost-effective measures is restricted with little targeting benefit, and as a result on a like-for-like basis CSCO is on average more expensive in terms of carbon abatement than the unconstrained CERO. For example, from July 2014 – December 2015, CSCO cost suppliers £48/tonne compared to £39/tonne under CERO.[40]

CSCO also currently requires suppliers to deliver 15% of their CSCO obligation in rural areas. ECO delivery statistics show that approximately 15% of delivery under both CSCO and CERO occurs in rural areas – suggesting that there are sufficient incentives under CERO to encourage cost-effective rural delivery without requiring a regulated requirement. It is therefore proposed not to extend the main CSCO or CSCO-rural targets for the transition year.

- **Solid Wall Insulation (SWI) Minimum** – SWI can for many properties generate substantial energy savings and wider societal benefits (such as improved comfort), but it typically has higher upfront costs than other energy efficiency measures. As a result, suppliers tend to need to offer higher subsidy rates (or involve match funding from third parties) than for other measures, and therefore face little incentive to deliver SWI in the absence of a minimum. SWI is an important measure for saving carbon, and alleviating fuel poverty. For example, in England, almost half of fuel poor households live in solid walled homes, a figure that rises to more than 70% in F and G-rated properties which are the focus for the Government's 2020 fuel poverty target milestone.[41]

  Solid wall insulation measures are more expensive than other types of insulation, and as such retaining a solid wall insulation minimum threshold for 2017-18 would increase the cost of the scheme relative to the number of measures installed. However, many fuel poor households live in solid walled properties and there are potentially benefits in ensuring a minimal level of support for this measure, in order to make progress towards our long-term fuel poverty targets and to maintain the supply chain.As such, it is proposed to maintain an SWI minimum from the current scheme into the transition year. Given the reduction to the overall size of the scheme, it is proposed to reduce the minimum from the equivalent of around 25,000 SWI installations per year under the current scheme42 to around 17,000 installations in the transition – broadly a pro-rata reduction in line with the overall size of the scheme.

- **Limiting Qualifying gas boiler replacements** – to date around 90% of Affordable Warmth delivery has comprised replacement boilers (virtually all gas) and accompanying heating controls. This is primarily a result of the current delivery incentives and high consumer demand for boilers. However, as Chart 2 in Section 1 above shows, in order to make progress against the Government's fuel poverty targets in the most cost-effective way a more diverse mix of measures is needed – particularly insulation.

  While replacing broken boilers generates benefits (given the alternative can mean resorting to expensive plug-in heaters or other coping mechanisms), there is often little improvement in the overall energy efficiency of the property. Furthermore, the evidence outlined in Annex C implies that fuel poor homes tend to replace broken boilers eventually, whereas uninsulated walls and first time central heating are unlikely to occur at scale without additional support.

  The proposal is therefore to allow replacement gas 'qualifying boilers' to continue to be installed under Affordable Warmth, but with measures to encourage no more than approximately 25,000

[40] Based on data underlying DECC Household Energy Efficiency Statistics, available at: https://www.gov.uk/government/collections/household-energy-efficiency-national-statistics
[41] Fuel Poverty Statistics (2015), available at: https://www.gov.uk/government/collections/fuel-poverty-statistics
[42] The current scheme's minimum was estimated to be the equivalent of 100,000 solid walled homes over approximately 4 years, implying around 25,000 homes per year.

installations as a result of the transition year. This will be achieved in legislation by giving a lower score to installations over the limit. Qualifying gas boiler replacements will continue to be restricted to private housing only, as social landlords are already under a duty to replace non-functioning boilers and therefore the additionality would be minimal. Annex A outlines the rationale for setting a limit on qualifying boilers equivalent to 25,000 in the transition year, and the impact of alternative boiler restriction options.

- **Eligibility** – alongside increasing the share of the overall ECO comprised of Affordable Warmth, Government proposes to amend the AW eligibility criteria in order to better target the fuel poor. The current AW eligibility criteria – based on private tenure households in receipt of a subset of means-tested benefits and tax credits – were set in 2012, before the conclusions of the Hills Fuel Poverty Review were enacted.[43] This review led to a new indicator for fuel poverty in England in 2013. Based on analysis of the English Housing Survey we estimate that currently around 29% of AW eligible households are fuel poor, and these households represent around 32% of all fuel poor households in England. Annex A outlines the alternative options considered for amending and improving the accuracy of AW eligibility.

  The proposed changes to eligibility would in combination improve the estimated percentage of AW eligible households in England that are fuel poor from 29% to up to 36% (increasing accuracy by a quarter). Further, the fuel poor homes eligible for AW would account for up to 53% of all fuel poor households in England.[44] These are provisional estimates, as the eligibility criteria are yet to be finalised. It should be noted that for the transition year, changes to eligibility for improving targeting accuracy have to be balanced with other factors such as ensuring a sufficiently large pool of eligible households to allow suppliers to find cost-effective opportunities and delivering on the Government's commitment to insulate 1 million homes over this Parliament. Government will continue to work to improve targeting options for the future scheme from 2018.

- **Delivery and administration** – the proposals to remove the requirement to calculate carbon scores based on a full house survey, produce Green Deal Advice Reports (GDARs) or a Chartered Surveyor's Report (CSR) could lead to savings of in the region of several hundred pounds per installation. We have gathered evidence from suppliers on the extent to which these proposals will result in reductions in admin burden, freeing up greater resources for installing measures (see Section 8), and will continue to engage with suppliers over the likely impact of the proposals between now and the final stage Impact Assessment that will accompany the Government response to the consultation.

4.4 Alternative policy options

Policy Option 2 – Smaller shift towards fuel poverty during the transition year

42. Policy option 2 mirrors Option 1 apart from having a relatively smaller fuel poverty focus during the transition year. Under this option the CERO targets to be achieved by March 2017 would be increased by 6.5 $MtCO_2$, while the AW target would increase by £1.35bn of notional lifetime bill savings. The other changes would remain the same as those outlined in the preferred option above.

43. The advantage of this approach is that by retaining a larger able to pay element of the scheme, it would increase the number of properties that can be insulated during the transition year within the supplier spend envelope, and make more substantial progress towards the Government's 1 million homes commitment and carbon reduction targets. However, it would not align with this

[43] Hills (2012). Getting the measure of fuel poverty – final report of the fuel poverty review. Available at: https://www.gov.uk/government/publications/final-report-of-the-fuel-poverty-review

[44] Equivalent estimates are not available for Scotland and Wales, although we would expect the improvements in measuring household income and the inclusion of inefficient social housing to boost accuracy rates across GB.

Government's objectives of focusing subsidy on those who need it most, and it would make less progress towards fuel poverty objectives. Further, by not moving towards an increased focus on the fuel poor in the transition year, there would be a larger step change for suppliers and the supply chain under a fuel poverty focused future scheme from April 2018 (subject to future consultation).

Policy Option 3 – retain CSCO during the transition year

44. Policy option 3 retains the broad balance between CERO, CSCO and AW as under the current scheme. The CSCO element of ECO during the transition year – like the preferred option – sees the removal of the rural minimum sub obligation. This option would mark the smallest departure from the existing ECO structure, retaining roughly the same spend proportions as under the existing ECO obligation. It is therefore likely to be the easiest option for suppliers to implement.

45. The drawback of this option is that it would be the least fuel poverty focussed and involve the largest step change for suppliers following the transition year.

46. Table 1 summarises the policy options. Each retain the same limit on boilers, same solid wall insulation minimum, the same eligibility criteria under Affordable Warmth, and the same administrative simplifications in relation to removing the requirements around Green Deal Advice Reports (GDARs) and moving to a system of deemed scoring of measures.

Table 1: Summary of Policy Options

Measure	Policy Option 1 (preferred option)	Policy Option 2	Policy Option 3
CERO Target	3.0 MtCO2	6.5 MtCO2	3.9 MtCO2
CSCO Target	N/A	N/A	1.3 MtCO2
AW Target	£1.84bn notional lifetime bill savings	£1.35bn notional lifetime bill savings	£1.35bn notional lifetime bill savings
SWI Minimum	0.74 MtCO2 (broadly equivalent to 17,000 SWI)	0.74 MtCO2 (broadly equivalent to 17,000 SWI)	0.74 MtCO2 (broadly equivalent to 17,000 SWI)
Qualifying gas boilers Limit	25,000	25,000	25,000
Recommended Measures	No GDAR or CSR Requirement	No GDAR or CSR Requirement	No GDAR or CSR Requirement
Eligibility	Eligible pool of 4m households; equivalised income for tax credit recipients; E, F or G-rated social housing included.	Eligible pool of 4m households; equivalised income for tax credit recipients; E, F or G-rated social housing included.	Eligible pool of 4m households; equivalised income for tax credit recipients; E, F or G-rated social housing included.
Scoring	Deemed scores	Deemed scores	Deemed scores

Coverage

47. The extension of ECO by one year will apply across Great Britain from April 2017 to March 2018. However, under the Scotland Act 2016, Scotland will have greater powers over the design and delivery of the future scheme from April 2018.

5. Analytical approach

5.1 Summary

48. This section of the IA outlines the way that the policy options have been appraised. The aim of the analysis is to:

    (i) Estimate the uptake of energy efficiency measures within domestic dwellings during the transition year;

    (ii) Assess the impact on society of the ECO one year transition, in terms of energy saved, the carbon abatement, improvement in air quality, and health impacts;

    (iii) Estimate the distributional impact of the policy, including the costs to energy suppliers and bill payers; and

    (iv) Estimate progress against fuel poverty targets.

49. The impacts have been appraised according to Green Book[45] and supplementary guidance[46] and are presented in discounted real 2015 prices, against a counterfactual of ECO ending in March 2017 (see Section 6 for more information).

50. DECC has used two main models to analyse the one year transition for this consultation stage IA:

    i. The National Household Model (NHM), which is used to appraise the impact of the CERO and CSCO obligations[47]; and

    ii. A new Affordable Warmth model, which is used to appraise the AW obligation.

51. The models simulate the number and types of energy efficiency measures suppliers could deploy to meet their obligations, before then estimating the costs and benefits of each option relative to the counterfactual. More detailed descriptions of the models used for the cost-benefit analysis are included in Annexes C, D and E.

The National Household Model – CERO and CSCO

52. The NHM provides a simulation environment to model the energy and carbon savings from installing measures to homes across the GB housing stock. It runs primarily off the English and Scottish Housing Surveys, which are detailed datasets of the housing stock. An adjusted version of the English housing stock is used to represent homes in Wales. The housing stock is updated to reflect recent delivery of measures.

53. The NHM has an in-built energy calculator which enables the model to broadly replicate the 'deemed' carbon savings that ECO installers will be expected to use when engaging households to install measures, and is combined with data on the capital and hidden costs of measures to simulate the choices faced by suppliers and households. The model calculates the estimated level of subsidy required to incentivise a level of uptake needed to achieve a certain level of lifetime carbon savings (the CERO and CSCO obligation compliance metrics).

[45] HM Treasury, The Green Book, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf

[46] The Interdepartmental Analysts' Group, Supplementary Guidance on Valuing Changes in Energy and Greenhouse Gases: https://www.gov.uk/government/policies/using-evidence-and-analysis-to-inform-energy-and-climate-change-policies/supporting-pages/policy-appraisal

[47] In previous ECO Impact Assessments CERO and CSCO have been modelled using the Green Deal Household Model (GDHM). For this IA the GDHM has been superseded by the National Household Model (NHM).

54. The NHM model for CERO and CSCO has been calibrated to model levels of uptake and spend that occurred during the second year of the current ECO (Apr 2014 – Mar 2015) when the same subsidy level is offered to households. This means that modelled uptake for the ECO transition year assumes similar behaviour among suppliers, installers and householders as under ECO in the recent past.

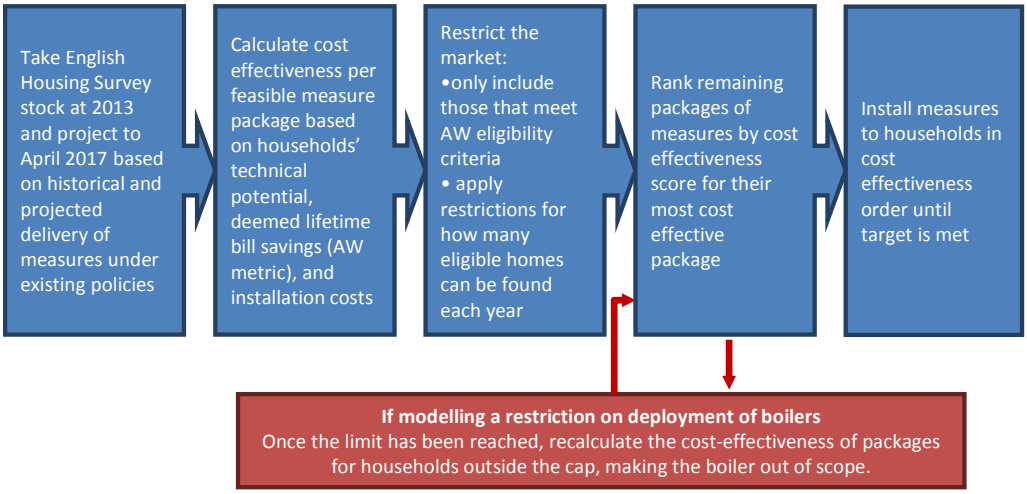
The Affordable Warmth Model

55. The AW model simulates the delivery of measures that reduce the cost of notional heating costs for households that meet the Affordable Warmth eligibility criteria. It is an Excel-based micro simulation model which mirrors the granularity of the NHM, and simulates take-up of heating and insulation measure packages in different households. It runs off the English Housing Survey and fuel poverty supplementary dataset, with weights applied to make the housing stock broadly representative of GB.

56. The model simulates uptake based on the relative cost-effectiveness of single measures or packages in reducing notional energy bills, with suppliers fully subsidising the cost of the measures. Measure packages are delivered in cost-effectiveness order until the proposed obligation target has been reached. The total notional lifetime bill savings from delivering these packages is an output from the model, which is used to set the obligation target.

57. Chart 4 provides a high level summary of the modelling process. More detail on the approach and key assumptions can be found in Annexes C and E respectively.

Chart 4: High level summary of the Affordable Warmth Model



5.2. Appraisal period

58. The policy is appraised over the period 2016 to 2059, an appraisal period of 44 years. This reflects the lifetime of the energy efficiency measures that are expected to be installed during the transition year, the longest-lived of which (cavity wall and loft insulation) are estimated to last for 42 years. With measures deployed during the transition year, the appraisal period would therefore need to run to 2059 (42 years after 2017/18) in order to ensure that all of the energy saving-related benefits from these long lived measures are captured. This approach of ensuring that the benefits are captured over the full lifetime of the measures is in line with Green Book Guidance.[48]

[48] A shorter appraisal than to 2059 would exclude some of the benefits associated with these long-lived measures from the impact analysis. As the costs are generally incurred earlier in the appraisal period than benefits, this would also lead to be unequal treatment of costs and benefits (that is, skewing the analysis towards the costs), reducing the potential estimated benefits of the policy. Similarly, as no costs or benefits are realised after 2059 (as all of the measures installed are assumed to have expired) there is no justification for a longer appraisal period.

59. We do not assume that measures are re-installed once they expire (as was assumed in the IA for the PRS Regulations).[49] Unlike the PRS Regulations, obligated suppliers are not required to *maintain* the energy efficiency of the property over the very long term[50] (that is, they are not required to re-install measures once they expire).

60. In reality, we might expect some households to maintain the energy efficiency measures installed to ensure that the measures do not expire. However, as this is a voluntary decision by households, neither the costs nor benefits of doing so are captured within this IA.

[49] More detail on the PRS Regulations is given in Section 6.
[50] Suppliers are required to undertake technical monitoring of a sub sample of measures post installation (to ensure they are working correctly). However, these are to ensure the measures are installed correctly at the point of (first) installation.

6. Counterfactual

61. The policy options are assessed against what would be expected to happen in the absence of intervention, ensuring that only the additional impacts of the policy are captured within the assessment. The counterfactual takes into account uptake in the absence of *any* Government intervention. Delivery under devolved energy efficiency schemes in Scotland and Wales are also discussed below.

62. In contrast to past ECO IAs, we do not include Green Deal uptake in the absence of ECO; this reflects the Government's decision in 2015 not to invest additional money in the Green Deal Finance Company.[51] As a consequence, we do not currently expect any new Green Deal uptake.

Uptake in the Absence of Government Intervention

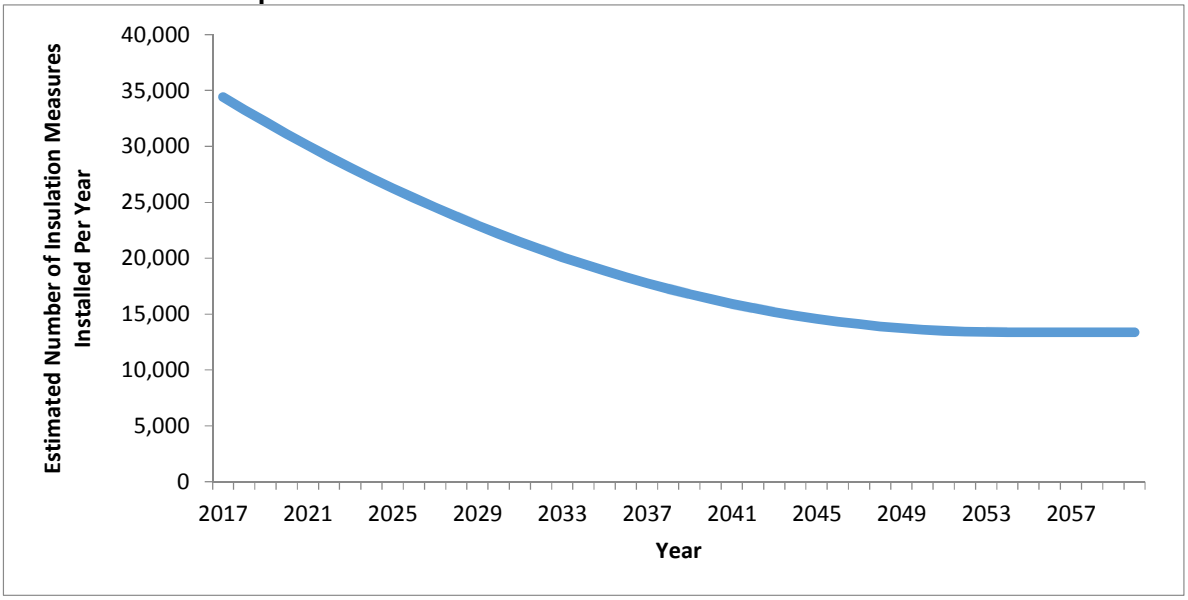
63. Section 2.1 set out the market barriers and failures that hold back deployment of energy efficiency improvements in the absence of Government intervention, and an Office of Fair Trading study in 2012 concluded that these are observed in practice.[52] However, a relatively small amount of insulation uptake may still be expected in the absence of the ECO policy, particularly amongst able to pay private tenure households and through improvements in the quality of social housing. The exact level of uptake will depend on factors such as energy prices, measure costs, technological improvements, and customer awareness, which are inherently uncertain. However, as the scheme is targeted primarily at a combination of measures and households where energy efficiency may be less likely to improve in the absence of Government intervention, we expect this uptake to be relatively small.

64. The National Household Model was used to simulate the uptake of insulation in the counterfactual, which is shown in Chart 5.[53] We estimate that nearly 35,000 insulation measures would be installed during 2017/18 in the absence of Government intervention. It is important to note that this considerably lower than uptake seen over the ECO period to date, which has averaged around 500,000 insulation measures per annum since the scheme's inception in January 2013.

65. Uptake in the years after the transition year are also shown in the chart below for illustrative purposes, and shows a year on year decline in uptake, due to a declining number of households that are willing to install energy efficiency measures in the absence of a market subsidy.

[51] For more information see: https://www.gov.uk/government/news/green-deal-finance-company-funding-to-end
[52] Office of Fair Trading's (OFT) 2012 report on home insulation concluded that insulation measures in existing buildings were "strongly driven" by government targets and schemes: http://webarchive.nationalarchives.gov.uk/20140402142426/http://www.oft.gov.uk/shared_oft/markets-work/energy-efficiency/oft1433.pdf
[53] This has been determined by setting the subsidy level on offer to households within the model to zero.

Chart 5: Modelled uptake of insulation measures in the absence of Government intervention



66. The derivation of the counterfactual uptake shown in the chart above can be found in Annex C.

67. In the modelling of replacement boilers under Affordable Warmth, estimates are also made in relation to when these same boilers would have been replaced in the absence of ECO. Detail on the analysis of natural boiler replacement cycles and how they vary by boiler type and household characteristics is in Annex C.

68. This analysis implies that in private tenure fuel poor households, gas boilers are replaced on average every 15 years, compared to an average gas boiler lifetime of 12 years.[54] Current Affordable Warmth scoring rules mean that boilers are typically only replaced under the scheme if they are broken or not operating efficiently, and cannot be repaired economically. These are referred to as 'qualifying boilers'.[55] As a result, we assume that when qualifying replacement boilers are installed under ECO, they are replacing broken systems which in the absence of the policy would have been naturally replaced 3 years after the point at which it broke. This means that replacement boilers under ECO will have between 0 and 3 years of 'additionality' compared to the counterfactual.

Private Rented Sector Regulations

69. The secondary legislation for the Private Rented Sector Regulations was laid in 2015.[56] These stipulate that:

- From April 2016 landlords owning a domestic property within the private rented sector cannot unreasonably refuse a tenants' request to undertake energy efficiency improvements to their rented properties; and

- From April 2018 landlords owning properties in either the domestic or non-domestic private rented sector with an Energy Performance Certificate (EPC) rating of F or G must attempt to

[54] In contrast, the analysis suggests that social tenure households replace their gas boilers on average every 12 years (i.e. at the point when the boiler breaks on average), and private tenure non-fuel poor households replace on average every 10 years (before the boiler breaks completely).
[55] These have a different set of scoring rules to upgrading a functioning inefficient boiler with a new efficient boiler. For more information see: https://www.ofgem.gov.uk/publications-and-updates/energy-company-obligation-2015-17-eco2-guidance-delivery
[56] See: https://www.gov.uk/government/consultations/private-rented-sector-energy-efficiency-regulations-domestic

improve their EPC rating to at least an E rating before granting a new tenancy or extending an existing tenancy.

70. The final stage impact assessment for the PRS Regulations accompanying the Government Response to the consultation on the secondary legislation[57] assessed that up to 70% of private rental landlords would attempt to do so using ECO to fund the improvements. A comparatively small proportion of these landlords were expected to act early before the minimum standards come into force in 2018, and these early-movers are captured in the counterfactual for this IA.

71. Since the publication of the final stage IA for the PRS Regulations, the Government has announced that ECO will be more fuel poverty focussed. However, landlords will still be able to obtain ECO funding during the transition year through the CERO, and through Affordable Warmth where tenants meet the eligibility criteria.

72. Consistent with the 2015 final stage PRS IA, we therefore assume a proportion of PRS properties are treated early (that is, between April 2017 and March 2018 – the ECO transition period).

Regional Funding

73. The Scottish Government and Welsh Assembly Government currently have energy efficiency schemes running in parallel to ECO – most notably the Home Energy Efficiency Programme Scotland (HEEPs)[58], and Arbed and Nest[59] in Wales. These devolved schemes focus on improving the energy efficiency of the Scottish and Welsh housing stock.

74. We have not explicitly taken account of delivery under devolved schemes under the counterfactual for the following reasons:

    - Scottish Government and Welsh Assembly elections are due to take place this year, and therefore it is not yet certain the extent to which funding for these schemes will be available during the ECO transition year;
    - We do not expect the entire uptake generated from devolved schemes to be additional to ECO. Some are designed to 'lever' ECO supplier funding, providing seed funding for obligated suppliers to 'top up'. This can attract ECO delivery to particular parts of the country, and reduce the cost to suppliers of meeting their obligation[60], but does not imply that all of these installations would have occurred in the absence of ECO.

75. This also means that the costs of delivering measures to Scotland and Wales are assumed to be higher than if we assumed that devolved funding was available. As suppliers would be unable to leverage devolved funding in order to lower the costs of delivering the policy, they are assumed to fund the 'gap' themselves. We have therefore taken a cautious approach in assessing the costs of delivering the proposed ECO extension year targets.

[57] For more detail please see: https://www.gov.uk/government/consultations/private-rented-sector-energy-efficiency-regulations-non-domestic
[58] Details of HEEPs can be found here: http://www.gov.scot/Topics/Built-Environment/Housing/warmhomes/eap
[59] Details of Arbed and NEST can be found here http://gov.wales/topics/environmentcountryside/energy/efficiency/arbed/?lang=en, and here: http://www.nestwales.org.uk/
[60] ECO-obligated suppliers are able to claim the full carbon savings generated from such installations, but only have to pay the top up required to induce the household to take up the measure.

7. Categories of Costs and Benefits

76. This section of the IA discusses the resource costs and societal benefits stemming from the one-year extension to ECO. Costs and benefits are divided into the societal impacts, and the transfers between different groups in society. The societal impacts are included in the cost benefit analysis tables presented in Section 8, while the transfers between different groups within society (including the regulatory burden the ECO transition imposes on suppliers) are presented in Section 10.

77. Table 2 below summarises the key costs and benefits included in this IA, followed by a description of each component.

Table 2 – Summary of key costs and benefits

Group	Costs	Benefits
Society	Installation costs	Societal energy savings
	Hidden costs	Increase in security of supply (not monetised)
	Operational Costs	Carbon savings
	Supplier administration costs	Air quality improvements
		Improvement in fuel poverty (not monetised)
		Wider economic benefits, for example supporting the energy efficiency supply chain, creating green jobs (not monetised)
		Community impacts (not monetised)
		Resource savings from replacement boilers at scale
Households	Supplier delivery and admin costs (assumed to be passed through to consumers) if they receive their electricity or gas from an obligated supplier	Energy bill savings from the installation of energy efficiency measures
	Borrowing costs or forgone investment returns for households who contribute to the cost of measures	Comfort taking (also societal benefit)
		Improved health outcomes (quantified, but not included in cost-benefit analysis)
Obligated Suppliers	Delivery and administration costs	Brand recognition from engaging households with offer of support.
Energy Efficiency Supply Chain		Increase in business as a result of increased demand for measures (not monetised)

7.1 Costs

78. The costs below are the societal resource costs that are included in the cost benefit analysis tables presented in Section 8. The cost assumptions used in the economic analysis are shown in Annex C.

Costs included in the cost-benefit analysis

- **Installation costs:** These cover the physical costs of the materials and labour required to install the energy efficiency measure in the home. We do not assume any reductions in the real costs of installations over time. Over time, technological improvements and increased competition

may lower the costs of installing energy efficiency measures and therefore lower the costs of the policy. Similarly we do not assume costs increase over time, as it is assumed that the supply chain can meet the additional demand for energy efficiency measures without hitting supply chain constraints.[61]

- **Hidden costs[62]:** These include the time taken by householders to liaise with the installer, prepare the property for installation and any oversight, as well as clean-up or redecoration costs associated with the installation. These costs are estimated to be small in the majority of cases.

- **Operational costs/expenditure (Opex):** Covers the annual cost of running heating measures, and includes servicing and maintenance costs, but not the fuel costs.

- **Administrative costs:** In delivering their ECO transition obligation, suppliers will incur administrative costs. These will vary by supplier, depending on their setup[63], but include items from lead generation[64] to maintaining and running IT databases, and reporting measures installed to the administrator (Ofgem). They will also include indirect costs, such as a share of the suppliers' accommodation costs, Human Resources and legal costs.

  Administration costs, as reported by suppliers, are around £85m per annum under the present ECO scheme. These costs are expected to fall under the transition year[65], as a result of the proposals designed to reduce the administrative complexity of ECO during the transition year.

- **Additional search costs for Affordable Warmth:** Where suppliers are obligated to deliver measures to households eligible for AW support, they incur costs of not only identifying suitable properties but also in searching for eligible households and verifying they are indeed eligible. In many cases these costs will be first incurred by the installer who will pass on the costs to the supplier. This can entail paying third parties for referrals and additional specifically-targeted marketing, among other approaches.

- **Natural boiler replacement cost savings (negative costs):** As outlined in Section 6, households are assumed to replace their boilers once they reach a certain age, with or without policy intervention (see Annex C for boiler replacement age assumptions, which vary by boiler type and household characteristics). We refer to boiler replacements made by households rather than through policy intervention as 'natural replacements'. These replacements will be sourced and funded by individual households, which are likely to be more costly than if the replacement were installed through the supplier obligation. This is because individual households are not able to benefit from bulk delivery discounts that are available to suppliers and installers that can deploy boilers at scale.

  We count the avoided costs of households replacing boilers themselves as a negative cost (i.e. a saving), and the cost of replacing boilers through Affordable Warmth as a positive cost.

79. More detail on the scheme's admin costs are presented in Annex A.

Costs included in the distributional analysis

[61] As all prices are in real 2015 prices, they are implicitly assumed to rise with inflation.
[62] See the ECOFYS (2009) "The hidden costs and benefits of domestic energy efficiency and carbon saving measures" report for further details http://webarchive.nationalarchives.gov.uk/20121217150421/http:/www.decc.gov.uk/assets/decc/what%20we%20do/supporting%20consumers/saving_energy/analysis/1_20100111103046_e_@@_ecofyshiddencostandbenefitsdefrafinaldec2009.pdf
[63] For example, some suppliers may have their own installation arms, which may reduce the administration costs the supplier directly incurs.
[64] Lead generation refers to the finding of ECO suitable households.
[65] The extent to which the administration costs might fall during the transition year is uncertain. We have therefore included supplier admin costs as one of the assumptions we vary in the sensitivities under Section 9.

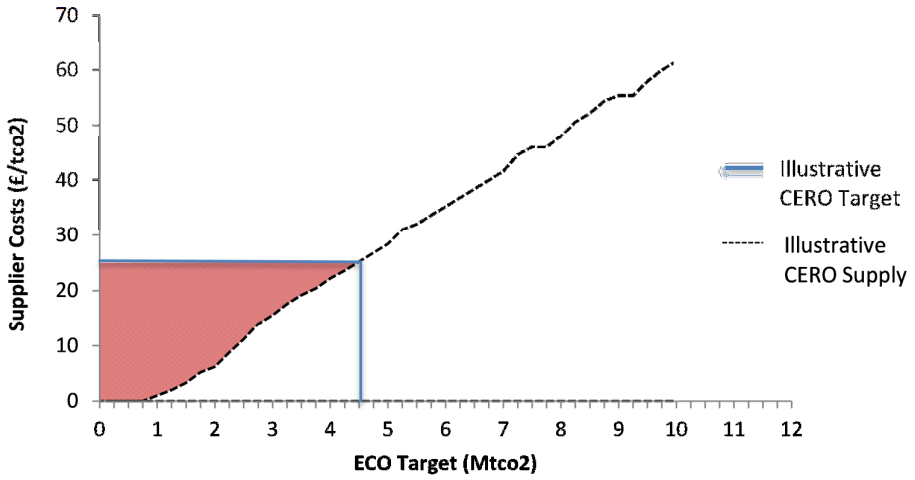
80. The following costs and benefits are treated as transfers between different groups in society, where the costs and benefits are equal to each other. They have therefore been excluded from the main cost benefit analysis in Section 8. They are, however, included when looking at the distribution of costs and benefits in Section 8, and also in Section 10, which considers the wider distributional and regulatory impacts of the policy proposals.

Supplier delivery costs (economic rents)

81. The presence of the market barriers and failures (discussed in Section 2) mean that suppliers must subsidise the installation and hidden costs of energy efficiency measures in order to induce eligible households to install measures. The larger the size of their ECO targets, typically the higher the subsidy levels suppliers have to offer in order to make the offer attractive enough for households to take up the required level of measures. As a result, suppliers may need to offer some households subsidy levels above that which they would normally need in order to take up measures. This 'excess subsidy' is referred to as 'economic rent', and can potentially accrue to the household, the installer, or the energy supplier.[66]

82. The concept of economic rents is illustrated in Chart 6 below, using CERO as an example. The blue vertical line shows the demand (from suppliers) for carbon savings in order to meet their CERO obligation. The upward sloping dotted black line, meanwhile, shows the supply of carbon savings, achieved by promoting and installing energy efficiency measures into ECO-eligible homes – the 'supply curve'. The supply curve is upward sloping because for low carbon targets, suppliers can promote and install the most cost effective measures, and can target the most amenable households. As the level of the carbon target increases, however, the more cost effective potential is exhausted, and suppliers have to pay larger subsidies to less amenable households; these act to increase the subsidy that suppliers have to pay.

Chart 6: Illustrative CERO Supply Curve



83. For the purposes of this IA it is assumed that suppliers cannot price discriminate between different households, in that they cannot infer the minimum subsidy level needed to induce each household to install energy efficiency measures. This means we assume that they pay the same subsidy to all households in order to meet their obligation, implying that some households are paid a subsidy

[66] If the householder demands or is offered a higher level of subsidy than they require, the rent will accrue to them. If an installer can persuade a household to accept a lower subsidy rate and sell the ECO compliance from the measures installed to the supplier at the higher subsidy rate, the rent will accrue to them. Alternatively, if a supplier funds the installation of measures at a level lower than they would ultimately be willing to offer, they could sell that compliance to another supplier and the rent would accrue to them.

larger than they would have needed in order to induce them to take up the measure (this is also counted as a benefit when undertaking distributional analysis – see section 8.1). This is illustrated by the shaded area in Chart 6, and represents an additional cost to suppliers in meeting their obligation.

Consumer bill impacts

84. Suppliers are assumed to pass the costs of delivering their obligation on to all of their customers through the variable element of gas and electricity prices. This cost pass through means that suppliers have an incentive to minimise the cost of delivering their obligation, as the greater the costs a supplier passes onto their consumers, the stronger the incentive their customers will have to switch suppliers. This would lose customers and potentially have a detrimental impact on a supplier's market share.

7.2 Benefits

Benefits included in the cost-benefit analysis

Here we provide an overview of the monetised benefits included in the analysis, all of which are valued in line with the Green Book and supplementary guidance on valuing changes in energy and greenhouse gas emissions.[67]

- **Energy Savings**: The installation of energy efficiency measures reduces the resources needed to meet the demand for energy services, such as heating. Energy savings mean fewer resources are required to meet energy demand for the lifetime of the measures installed. This is a benefit to society in the short run as it frees up energy to be used elsewhere immediately, but it also benefits society in the long run in that long term reductions in energy demand can bring down the long run variable costs of energy supply (for example, avoiding the need to build an extra power plant in order to provide electricity).

- **Air Quality Improvements and Carbon Savings:** Similarly, lower energy use improves air quality and reduces carbon emissions.[68] Reductions in carbon emissions help meet the nation's Carbon Budgets, while improvements in air quality reduce adverse health impacts (including mortality and morbidity). Carbon savings are valued using the benchmark carbon values published in the Green Book supplementary guidance; while air quality improvements are valued using the relevant damage factors in the same publication.

- **Comfort taking**: Efficient heating and insulation measures reduce the amount of energy required to heat the home (or in the case of first time central heating provide the means to fully heat the home for the first time). This means that following the installation, some households will choose to heat their homes to a higher temperature, for a longer period, or heat more rooms in the house. This can be measured in the form of a change in energy used to reach a higher temperature, and valued using the retail price of energy as this reflects a household's willingness to pay for the extra warmth.

[67] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/254083/2013_main_appraisal_guidance.pdf.
[68] Carbon savings are divided into those that are traded (i.e. emissions covered by the EU Emissions Trading System) and non-traded (i.e. emissions outside of the Emission Trading System). More details on the EU ETS can be found here: http://ec.europa.eu/clima/policies/ets/index_en.htm

Additional benefits assessed in distributional analysis

- **Value to society of lower energy bills in low income households**: Energy bill savings are a private benefit – only the householder enjoys the direct benefits of paying less for energy. However, energy is a necessity and high energy costs faced by low income households can be regressive. When taking into account the distribution of energy bill savings, the benefit to low income households can be valued more highly than had the benefit flowed to those with higher incomes. This effect can be valued through the use of equity-weighting.[69] More detail is available in Annex C.

- **Wider benefits:** There are also likely to be a range of benefits associated with improved health outcomes[70], potentially savings for health service provision, and improvements in productivity that it has not been possible to monetise.

[69] Equity-weighting is an approach outlined in the Green Book to monetising the distributional costs and benefits of policy options. It allows us to reflect that £1 of cost or benefit is worth more to those on lower disposable incomes than those in higher income groups.

[70] Estimates of the monetised health impact for households of energy efficiency measures are included in Section 8.5, however the overlaps with comfort taking are at present unclear, therefore we do not include these benefits in the cost-benefit analysis to avoid double-counting.

8. Impact Analysis

85. This section of the IA outlines the main impacts of the policy proposals outlined in the consultation document. The impacts are divided into impacts to society, and to individual parties (principally suppliers). Throughout the tables in section, totals may not sum due to rounding.

8.1 Costs and benefits

86. The overall monetised costs and benefits of the policy options to society, net of the counterfactual and discounted to 2016, are shown in Table 3.

Table 3: Aggregate costs and benefits of the ECO transition, by policy option, 2017 – 2059 (2015 prices)

Present Value, £m Unless otherwise stated	Policy Option 1 (preferred option)	Policy Option 2	Policy Option 3
Installation Costs	326	433	397
Hidden Costs	26	58	52
Finance Costs	13	21	21
Administration Costs	77	77	77
Boiler warranties	3	3	3
Search costs (Affordable Warmth)	24	17	17
Operational Costs	19	12	12
Natural boiler replacement costs	*-47*	*-47*	*-47*
Total Costs	**441**	**574**	**532**
Value of energy saved	358	514	425
Value of air quality improvements	23	30	21
Value of change in traded carbon savings	13	12	12
Value of change in non-traded carbon savings	129	280	211
Value of comfort taking	92	147	119
Total Benefits	**616**	**984**	**788**
Overall Net Present Value	***174***	***410***	***256***

87. The installation costs of the energy efficiency measures, which do not include any 'excess subsidy' / economic rent (as this is a transfer), represent the largest component of the costs across all three options. The installation costs are highest under Option 2 and smallest under Option 1. The smaller installation costs under the preferred option reflect the greater focus on Affordable Warmth, where suppliers are expected to fully subsidise measures to a restricted pool of eligible households. They are therefore estimated to have to pay a higher subsidy per household treated compared to the less targeted Options 2 and 3, meaning fewer households are treated with measures within the supplier spend envelope.

88. Similarly we see higher hidden costs in Options 2 and 3 compared to Option 1, as the greater focus on the unconstrained 'able to pay' households outside of Affordable Warmth leads to more measures being taken up and increasing the total level of hidden costs incurred.

89. Administration represents the second largest component of the costs. These comprise supplier administrative costs, boiler warranties (a requirement under Affordable Warmth), and additional search costs associated with finding eligible households under Affordable Warmth. The supplier admin costs do not vary significantly across the options, reflecting the fact that much of the scheme administration is fixed and likely to be invariant to the exact split of the scheme between CERO,

CSCO and Affordable Warmth. There is a reduction in the administration costs of around £5m per year[71] relative to those presented in the 2014 ECO IA, however, reflecting the simplifications to the scheme (which are common to all options), as outlined in Section 4.

90. Similarly, boiler warranties do not vary as the same number of replacement boilers are taken up across the three Options. Search costs for Affordable Warmth households vary depending on the extent to which the policy option focuses on Affordable Warmth. Therefore we observe higher search costs under Option 1 than Options 2 and 3.

91. Under CERO and CSCO either the householder or a third party (for example, a Local Authority) are estimated to co-finance measures to a certain degree (around 20% of the cost of SWI, and 5% - 10% on average for cavity wall and loft insulation). These contributions are assumed to either be financed through borrowing, or from forgoing the opportunity to invest those funds elsewhere. These 'finance costs' are included in the cost-benefit analysis as societal costs, consistent with their treatment in past Regulatory Policy Committee validated IAs.[72] However, they represent a small cost, relative to the others shown in the table below, ranging from around £13m - £21m across the options, depending on the volume and type of measures deployed under each option.

92. Natural boiler replacement costs enter the Net Present Value calculations in Table 3 as a negative cost. This reflects that due to the deployment of replacement boilers under Affordable Warmth (which are accounted for under the installation costs), an equivalent number of boilers no longer need to be replaced by the householders themselves. As described in Section 7.1, this leads to a net impact of reduced resource costs because of economies of scale achieved through the bulk buying of boilers under the ECO scheme. Under the counterfactual householders would have paid a higher price for a replacement boiler at a later date.

93. Turning to the benefits of the policy, the value to society of the energy savings associated with the installation of the energy efficiency measures represent the largest component of the benefits. These are lowest under the preferred Option 1, and largest under Option 2. This is primarily again a result of the relatively lower number of measures deployed under Option 1 due to the higher subsidy needed under Affordable Warmth.

94. As can be seen, the monetised value of non-traded carbon savings is much larger than the traded carbon savings. This reflects the fact that the bulk of properties that are treated use fuels other than electricity to heat their homes (electricity generation falls into the traded sector), which is to be expected with less than 10% of the housing stock heated using electricity.

95. Combining the costs and benefits shows that the largest net benefits included in the cost-benefit analysis occur under Option 2 (around £410m) and are lowest under Option 1 (the preferred option) at around £174m. All options therefore show that the policy is net beneficial from a social perspective.

96. As might be expected, the largest net benefits are estimated to occur under Option 2 (focus on CERO), where suppliers would focus on installing measures anywhere across the entire GB housing stock in search of reducing carbon. Option 1, which provides the greatest focus on Affordable Warmth, has explicit distributional aims to make progress against fuel poverty objectives and deliver on the Government's commitment to target support to those who need it most.

97. The benefits associated with these distributional aims are not straight forward to incorporate in a monetised cost-benefit analysis. Unlike carbon emissions, where we are able to include an explicit estimate of the value society places on emissions saved (a 'carbon price'), at present there is no equivalent value we can use for progress made on fuel poverty. Therefore the Net Present Value of

[71] Savings will be slightly smaller than £5m in Table 3 due to discounting.
[72] For example, see the Private Rented Sector Regulations Impact Assessment, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401382/150202_PRS_Final_Stage_Revised_For_Publication.pdf

Option 1, where focus on the fuel poor is greatest, is likely to be an underestimate relative to Options 2 and 3.

98. We can look to reflect the differences in distributional focus across the policy options by applying equity weights, consistent with the Green Book guidance.[73] Table 4 shows the same costs and benefits as in Table 3, but after applying equity weights to the appropriate components (see Annex C for detail on how equity weights are derived and applied).

Table 4: Equity-weighted costs and benefits, by policy option, 2017 - 2059 (2015 prices)

Present Value, £m Unless otherwise stated	Policy Option 1 (preferred option)	Policy Option 2	Policy Option 3
Installation Costs (*now including cost of economic rents*)	611	631	587
Hidden Costs	26	58	52
Finance Costs	16	26	26
Administration Costs	96	96	96
Boiler warranties	4	4	4
Search costs (Affordable Warmth)	30	21	21
Operational Costs	38	22	22
Natural boiler replacement costs	*-125*	*-125*	*-125*
Total Costs	**695**	**732**	**682**
Value of energy saved	358	514	425
Value of air quality improvements	23	30	21
Value of change in traded carbon savings	13	12	12
Value of change in non-traded carbon savings	129	280	211
Value of comfort taking	160	204	172
Extra utility from lower bills in low income households	*439*	*329*	*321*
Value of economic rent to low income households	*357*	*159*	*159*
Total Benefits	**1,479**	**1,530**	**1,321**
Equity-weighted Net Present Value	***784***	***797***	***639***
Proportional change in NPV from equity weighting	*+350%*	*+90%*	*+150%*

99. The equity weighting tends to increase both the costs and benefits of the policy options outlined in Table 4[74], but with a more significant increase in benefits. This is because the majority of the costs are paid for by all energy consumers, who are relatively evenly distributed across income groups; but the benefits – particularly under Option 1 – are focused on lower income households. For lower income households the value of each pound spent or saved is valued more highly from a social

[73] Equity-weighting is an approach outlined in the Green Book to monetising the distributional costs and benefits of policy options. It allows us to reflect that £1 of cost or benefit is worth more to those on lower disposable incomes than those in higher income groups.

[74] In terms of costs the weighting primarily increases the value of the installation costs (which now also reflect the value of 'excess subsidy' / economic rent, as transfers are taken into account in distribution analysis) and Administration costs, reflecting the fact that all energy customers bear the majority of these costs as suppliers pass them through. In terms of benefits, equity weights are applied to comfort taking (reflecting the social value of low income households being able to heat their homes to a higher temperature), the avoided costs of natural boiler replacements (now including the avoided VAT, which is a transfer), as well as introducing additional distributional benefits relating to the extra utility derived from low income households experiencing lower bills, and the value of economic rent to low income households.

perspective, because £1 of cost or benefit is worth more to household on a lower income than a higher income. Around 75% of households supported under Affordable Warmth are estimated to be among the poorest 30% of households, whereas the estimated equivalent for CERO is around 25%. As a result, the equity-weighting has the largest impact on Option 1, increasing the net benefits by 350%, compared to 90% under Option 2 and 150% under Option 3.

100. The equity-weighting changes the ordering of the options in terms of Net Present Value, with Option 1 generating a greater NPV than Option 3, and closes the gap between Options 1 and 2 such the NPV of the later is less than 2% higher than the former. This means that from an equity perspective, in monetised terms, Option 1 is comparable with Option 2.

101. Policy Option 1 is the preferred option for the following reasons:

- It is estimated to make most progress against Government's fuel poverty commitments (see Section 8.7);
- It begins the transition to a new cheaper supplier obligation, tackling the root causes of fuel poverty and delivering on the government's commitment to help 1m more homes this Parliament, as announced in the 2015 Spending Review[75];
- It is the option most aligned with Government's commitment to target support at those who need it most. Applying equity-weighting to the cost benefit analysis reflects the relative value in NPV terms as comparable to Option 2, which focuses on delivering carbon savings at lowest cost.

8.2 Costs to suppliers

102. The social impacts of the policy shown in Section 8.1 are not expected to be shared equally across society, with obligated suppliers in particular expected to incur most of the costs presented in Table 3. Suppliers are in turn assumed to recoup these costs from their gas and electricity customers. In this Section, we therefore present the costs that suppliers are expected to incur during transition year, in order to deliver carbon and notional bill savings outlined in section 4, as well as the social benefits that are outlined in Section 8.1.

103. Table 5 below shows suppliers' costs broken down by obligation under the preferred option, and how these costs compare to the annual supplier costs expected to be incurred under the final 2 years of the current scheme between April 2015 and March 2017.[76]

104. Under the preferred option, CSCO costs are expected to fall to zero during the transition year, as the CSCO targets are not increased or extended during the transition year. The delivery costs of AW increase by around 40%, reflecting the greater emphasis on this part of the scheme. CERO costs decrease by around a third to reflect the greater focus on AW and smaller overall supplier spend during the transition year, compared to the current scheme. The £160m of supplier spend on CERO, however, is likely to slightly understate the total spend on CERO measures, as able to pay customers or third parties (such as Local Authorities) are assumed to co-finance some of the costs of the measures installed (estimated at around 20% for SWI, and between 5% and 10% for CWI and loft insulation).

105. The alternative policy options show the same overall supplier spend as the preferred option during the transition year, although spending shifts slightly across the different obligations, consistent with different targets presented in Section 4.

[75] The Spending Review 2015, available at: https://www.gov.uk/government/publications/spending-review-and-autumn-statement-2015-documents

[76] These costs are slightly higher than those presented in the final-stage Future of ECO Impact Assessment (£820m), as they have been adjusted for inflation using HMT GDP deflators to convert them from 2013 to 2015 prices, making them consistent with other costs presented in this IA.

106. Across all options, the administration costs fall slightly during the transition year compared to the current scheme – which reflects the scheme simplifications outlined in Section 4, resulting in around £5m per annum of admin cost saving. Overall we see a reduction in spending of around £220m per annum for suppliers compared to the estimated cost of the current ECO. In keeping with previous ECO impact assessments, all costs presented below are expected to be passed onto customers through their energy bills.

Table 5: Supplier Costs during the ECO Transition (real 2015 prices, undiscounted)

Cost Component	Policy Option 1 (preferred option)	Policy Option 2	Policy Option 3	Costs (£m) per annum under current ECO
CERO Delivery Costs	£160m	£340m	£180m	£260m
CSCO Delivery Costs	£0m	£0m	£160m	£230m
AW Delivery Costs	£380m	£200m	£200m	£270m
Administration	£80m	£80m	£80m	£85m
Total Costs	**£620m**	**£620m**	**£620m**	**£840m**

8.3 Measure Uptake

107. In this section we present breakdowns of the modelled measure uptake under the preferred option. It is important to note that these are gross estimates of uptake, and not net of the counterfactual. This is so as to demonstrate what the policy would be estimated to deliver, rather than additional delivery the policy would deliver above and beyond what would have been delivered in the absence of Government intervention. The counterfactual uptake outlined in Section 6 has been taken into account in the cost-benefit analysis outlined in Section 8.1, however.

108. Table 6 below shows gross measure uptake under the preferred option. The most frequently installed measures are loft (over 80,000) and cavity wall insulation (148,000), with the proposed measures to limit deployment of replacement boilers to approximately 25,000.[77] A higher number of hard to treat cavities are treated during the transition year than easy to treat, reflecting the diminishing stock of technical potential for easy to treat. Around 16,000 first time central heating systems are also installed – one of the highest impact measures for F or G-rated properties in moving into a higher energy efficiency band.

109. Around 17,000 Solid Wall Insulation (SWI) installations are made in order for suppliers to meet their solid wall minimum. However, the high cost of installing solid wall insulation to suppliers means the solid wall minimum tends to be binding, in that they would not choose to install as much SWI without the minimum in place. The solid wall installations are primarily delivered within the CERO market, as customer contributions (likely to be a feature of CERO but less so under AW) reduce the costs to suppliers of meeting the solid wall minimum. However, the ability to install SWI to social housing from 2017 under AW means that we still expect some installations under this part of the scheme, particularly given proposals around flexible eligibility (see Section 8.11).

[77] In practice suppliers may seek to deliver the full maximum of 25,000 replacement boilers, as this has been the most prevalent measure to date under Affordable Warmth. The modelled results show slightly fewer than 25,000 boilers delivered, as a result of the granularity of the modelling – delivering any more boilers would go over the 25,000 threshold.

Table 6: Modelled uptake of energy efficiency measures, by obligation, preferred option, 2017/18

	Affordable Warmth	CERO	Total
Easy to Treat Cavity Wall Insulation	39,000	17,000	55,000
Hard to Treat Cavity Wall Insulation	33,000	60,000	93,000
Loft insulation	47,000	36,000	82,000
Solid wall insulation - external	4,000	14,000	17,000
Replacement boiler	23,000	-	23,000
First time central heating	16,000	-	16,000
Heating controls	21,000	-	21,000
Total measures	**182,000**	**126,000**	**308,000**

8.4 Homes Treated

110. The number of homes treated under the one year transition period is uncertain, as suppliers may begin to deliver against their transition obligation prior to April 2017, reducing the number of homes treated during the transition year itself.[78] How suppliers choose to comply with their transition obligation, however, is a commercial decision for obligated suppliers, and we have not attempted to estimate how many might be delivered in advance of the scheme coming into force from April 2017.

111. For simplicity we assume that all installations used to comply against the ECO transition target take place in 2017/18. These are in addition to the homes treated in the build-up to the transition year as suppliers fulfil their obligations under the current ECO.

112. The 2014 ECO IA estimated 840,000 homes would be treated under ECO from April 2015 to March 2017 (the period known as 'ECO 2'), on top of the 1 million homes treated during ECO 1 (January 2013 – March 2015). DECC's Household Energy Efficiency Statistics, however, show that around 1.2m homes were actually treated under ECO 1, with suppliers exceeding their ECO 1 targets.

113. The carrying over of ECO 1 'excess actions' into ECO 2 reduces the number of homes that need to be treated under ECO 2, meaning we now estimate that just over 500,000 homes will be treated under ECO 2 (April 2015 – March 2018), as shown in Table 7. If we consider only the homes that are insulated this figure reduces to just over 350,000, as the majority of homes treated under Affordable Warmth are expected to receive replacement boilers or heating controls, rather than insulation[79].

[78] Although increasing the number that are treated under the current ECO scheme.
[79] Household Energy Efficiency Statistics show that around 98% of measures installed within Affordable Warmth in the year to September 2015 were heating rather than insulation measures.

Table 7: Estimated number of homes treated under the current ECO and the Preferred Option (March 2015 – March 2018)

Number of Homes Insulated / Treated	AW	CERO/CSCO	Total
Homes Insulated			
April 15 – March 17 (Current ECO)	20,000	345,000	365,000
April 17 – March 18 (ECO Transition)	122,000	110,000	232,000
Total April 2015 - March 2018	**142,000**	**455,000**	**597,000**
Number of Homes Treated			
April 15 – March 17 (Current ECO)	175,000	345,000	520,000
April 17 – March 18 (ECO Transition)	160,000	110,000	270,000
Total April 2015 - March 2018	**335,000**	**455,000**	**790,000**

114. In addition to the homes treated under ECO 2 to March 2017, we estimate that around 270,000 homes will be treated (230,000 homes insulated) as a result of the one year extension to ECO. Slightly more homes are treated under Affordable Warmth, reflecting the increase in the size of this obligation during the transition year. However, the split is slightly more even when stripping out boilers and heating controls installed.

8.5 Uptake of measures by dwelling and household characteristics

115. This section summarises the projected delivery of measures under the preferred option across tenure, fuel type, dwelling type, rurality and whether the dwelling is on or off the gas grid. The mix of measures delivered and the estimated delivery of these across different household characteristics should be read as illustrative only, as ECO regulations neither control nor regulate for this.

116. There is considerable uncertainty about what the actual distribution of measures will be, in part because it is not known whether historic delivery (on which the models have been calibrated) will be illustrative of future delivery, particularly given changes to the policy design. In addition, our modelling assumes that suppliers will target the cost-effective opportunities, whereas the extent to which suppliers are able to do so in practice is uncertain.

117. **Tenure.** We project that the majority (around 60%) of measure uptake will be to the owner occupied sector and that around a further quarter of measures will be installed in the private rental sector. That owner occupiers is the largest group is not surprising given that this makes up the largest tenure group in the housing stock.

118. It is notable that delivery to privately rented homes is disproportionately high as the sector makes up around 18% of the stock. This is likely to be driven in part by private-rented homes being on average significantly less energy efficient than other tenures, and therefore having disproportionately high cost-effective potential; and also that the focus under the preferred option is on Affordable Warmth, where social housing is restricted to only the most inefficient properties, and therefore the bulk of delivery by definition has to occur in private tenure housing.

Table 8: Estimated uptake of measures by housing tenure, preferred option (April 2017 – March 2018)

Housing Tenure	AW	CERO	Total
Owner-occupied	56%	68%	61%
Rented (private)	33%	11%	24%
Rented (social)	11%	21%	15%

119. **Fuel type.** The modelling suggests that around one quarter of delivery will be to households heated by non-gas fuels. In contrast, 15% - 20% of households overall are heated using non-gas fuels (including electricity). The skew in modelled delivery towards non-gas fuelled households is driven by our assumptions that, everything else being equal, the obligated suppliers should have a strong incentive to deliver measures to non-gas heated households. For CERO this is because a greater volume of carbon savings (and therefore ECO carbon target compliance units) will be realised from a unit of energy saving from these properties.

120. For Affordable Warmth there are additional incentives to deliver to non-gas fuelled households, due to uplifting the score achieved by delivering insulation measures to non-gas fuelled households, and deflating the score achieved by gas fuelled qualifying boilers. These uplifts are in place because fuel poor households disproportionately use non-gas fuels to heat their homes. Tempering these incentives is the assumption that the cost of finding households with potential for delivery will be higher for those off the domestic gas grid.

Table 9: Estimated uptake of measures by housing tenure, preferred option (April 2017 – March 2018)

Main Heating Fuel	AW	CERO	Total
Gas	72%	80%	76%
Electricity	23%	13%	19%
Oil	3%	5%	4%
Solid	2%	1%	1%

121. **Dwelling type.** The majority of measures are predicted to be delivered to larger properties, with delivery to houses accounting for over 80% of uptake. Again, this reflects our underlying modelling assumptions that suppliers will target the more cost-effective measures potential before the less cost-effective potential, since larger properties generally achieve greater progress towards the obligation targets relative to the greater cost of installing measures in these homes. All things being equal, larger homes tend to require high costs of achieving adequate temperatures. As a consequence, the most severely fuel poor households also tend to be those living in larger, inefficient properties.

Table 10: Estimated uptake of measures by dwelling type, preferred option (April 2017 – March 2018)

Dwelling type	AW	CERO	Total
Detached	21%	12%	18%
Semi Detached	25%	32%	28%
End Terrace	11%	10%	11%
Mid Terrace	21%	20%	21%
Bungalow	6%	7%	6%
Flat	16%	20%	17%

122. **Domestic Gas Grid.** We project that the vast majority of delivery (around 80%) will be to households on the domestic gas grid. Across Great Britain as a whole around 85% of households are on the gas grid. As above, this relative skew in modelled delivery to off-gas grid properties reflects our underlying assumptions that there are stronger incentives to deliver to non-gas fuelled properties because of their greater cost-effectiveness.

Table 11: Estimated uptake of measures by whether on gas grid, preferred option (April 2017 – March 2018)

Gas grid status	AW	CERO	Total
Connected to gas grid	80%	85%	82%
Not connected to gas grid	20%	15%	18%

123. **Rurality.** Around 20% of delivery is projected to be to rural households.[80] There is a correlation here with delivery to homes off the domestic gas grid, given that rural households are less likely to have a gas connection. Therefore the incentives that drive delivery to non-gas heated propertied have a similar effect in driving delivery towards rural homes.

Table 12: Estimated uptake of measures by rurality, preferred option (April 2017 – March 2018)

Rural status	AW	CERO	Total
Rural	21%	16%	19%
Urban	79%	84%	81%

8.6 Health Impacts

124. As outlined in Section 2, making energy efficiency improvements in homes can improve the health of the occupants, for example by reducing their risk of cardiovascular and respiratory diseases from warmer internal temperatures.

125. We have monetised the health benefits associated with making these energy efficiency improvements under the one year extension using DECC's Health Impacts of Domestic Energy Efficiency Measures (HIDEEM) model (more details on this model can be found in Annex G). HIDEEM simulates the change in relative risk of a range of cold-related morbidity and mortality risks for people living in homes receiving energy efficiency improvements. The changes in relative risk are then converted into Quality Adjusted Life Years (QALYs) and monetised in accordance with Department of Health guidance on health valuation.[81]

126. There are potential overlaps with the comfort taking benefits included in the net present values set out in Section 8.1, therefore we do not include the monetised health impacts in the cost-benefit analysis. At present we are not able to quantify the potential savings to health provision services (such as the NHS) from improving the energy efficiency of homes, although we expect these in reality to potentially be significant.

127. Table 13 presents the results for each of the policy options considered. Mirroring the overall NPVs of the policy, the monetised health benefits are expected to be largest under Option 2 at around £113 million and smallest under Option 1 (the preferred option), with installation of cavity and loft insulation making up the majority of these benefits under all options (for example, these are estimated to lead to monetised benefits of around £50m and £20m respectively under the preferred option). The differences are driven primarily due to a higher deployment of insulation measures under Options 2 and 3, where delivery is less constrained than compared to Affordable Warmth.

Table 13: Health Benefits by policy option

Present Value, £m	Option 1 - Preferred Option	Option 2	Option 3
Cavity wall Insulation	51	77	65
Loft Insulation	17	30	25
Solid Wall Insulation	6	6	6
Boiler upgrades	0.3	0.3	0.3
First time central heating	0.7	0.5	0.5
Total	**75**	**113**	**97**

[80] Rural homes are defined as areas that are outside settlements of 10,000 or more. For more information see: https://www.gov.uk/government/collections/rural-urban-definition

[81] See: https://www.gov.uk/government/publications/green-book-supplementary-guidance-health

8.7 Supplier Administrative costs

128. As discussed in Section 4, the ECO transition includes provisions designed to reduce administrative costs under the new supplier obligation. In order to assess the impact of simplifying the administration regime, we asked suppliers to complete a short survey detailing their overall ECO administration costs, and how those items might be affected by the simplification proposals; returns from suppliers were received at the end of January 2016.

129. Responses were received from all obligated suppliers, and, on aggregate, indicated that suppliers expected the proposals would reduce their administration costs by around 7.5% on average. This reduction would represent a decline in administrative costs of around £5m during the transition year, taking the administration costs to around £80m during 2017/18. These are reflected in the supplier delivery costs outlined in Section 8.2 above.

130. It should be noted that the administration costs associated with ECO are not limited to suppliers. Suppliers often procure ECO compliance through third parties (rather than through integrated delivery arms) – for example through installer companies, managing agents or Green Deal Providers on the ECO brokerage platform. Under these circumstances, many of the administration costs will be incurred within the supply chain, and would therefore appear as supplier delivery costs rather than administration when reported to DECC.

131. In line with the provisions in the consultation, we have also removed the costs associated with Green Deal Advice Reports (GDAR) from our CERO modelling assumptions, which is also expected to reduce some of the supply chain's administration costs. Under the preferred option, for example, CERO delivers just over 100,000 measures during the transition year, and with GDARs costing an estimated £180 per measure installed[82], this would save up to £20m compared to the current scheme. These savings do not appear as reduced admin savings, however, as they are assumed to be recycled into additional installations under the transition year.

132. It is possible that some of the GDAR costs are incurred by suppliers rather than the supply chain, meaning that the reduction of supplier admin costs may lead to a small amount of double counting of the savings. Anecdotal evidence suggests that GDAR costs are mostly incurred in the supply chain, however, suggesting that double counting within the £5m supplier admin savings is likely to be limited.

133. Further, the consultation includes other provisions expected to save on administration costs in the supply chain that we have not been able to capture. It is difficult, however, to determine these additional supply chain cost savings, as suppliers do not have sufficient visibility on the supply chain administration costs.

Non Monetised Impacts

8.8 Fuel Poverty Impact

134. Table 14 shows the estimated impacts of the ECO transition year on fuel poverty in England. Due to modelling and data limitations it has not been possible to undertake equivalent estimates for Scotland or Wales, although we would anticipate the direction of travel to be similar to that in England.

135. The changes in the headline fuel poverty indicators (number of households in fuel poverty and the fuel poverty gap) as a direct result of the single-year ECO transition are difficult to estimate, in particular because the fuel poverty gap is sensitive to energy prices and there is uncertainty about the timing of any reduction in energy prices in the counterfactual. We therefore do not estimate the

[82] Note – this assumes 3 GDARs required per successful installation, with the first 2 not leading to a measure being installed.

headline fuel poverty estimates here, but will seek to do so for the 4-year successor scheme to ECO from 2018.

136. However, a more stable set of indicators that can be estimated with more confidence in relation to a one-year transition scheme is progress towards the fuel poverty target and milestones. These estimates are reported in Table 14, alongside the latest fuel poverty statistics for England (2013), to demonstrate the cumulative progress since the start of the ECO until the end of the transition year. The results show, as expected, that Option 1 makes the most progress against each of the milestones, due to the greater fuel poverty focus and the greater diversity of measures needed to make fuel poverty progress.

Table 14: Estimated impact of transition year on fuel poverty (England only), 2017

	Latest Fuel Poverty Statistics (2013)	Option 1 - Preferred Option (2017)	Option 2 (2017)	Option 3 (2017)
% of fuel poor households at Band E or above	87%	91%	90%	90%
% of fuel poor households at Band D or above	51%	65%	64%	64%
% of fuel poor households at Band C or above	5%	12%	12%	12%

8.9 Carbon Savings

137. Table 15 below shows the traded and non-traded carbon savings[83] under the preferred policy option for Carbon Budget 3 (2018-2022), Carbon Budget 4 (2023 – 2027) and Carbon Budget 5 (2028 – 2032)[84] Savings in the non-traded sector are estimated to be broadly similar across the CB3 and CB4 periods, with traded savings declining slightly over time as the impact of replacement boilers tails off (replacement boilers are estimated to bring forward up to 3 years' worth of savings relative to the counterfactual). This trend continues out to CB5 where the impact of first time central heating (which in many cases saves electricity and increases gas use) tails off, reflecting its 12 year estimated lifetime. Insulation measures, which predominantly save non-traded fuels such as gas, are estimated to have lifetimes beyond 35 years and therefore continue to make savings in CB5 and beyond.

Table 15: Estimated greenhouse gas savings, by obligation and carbon budget period

MtCO2e	CB 3 (Traded)	CB 3 (Non-Traded)	CB4 (Traded)	CB4 (Non-Traded)	CB5 (Traded)	CB5 (Non-Traded)
CERO	0.04	0.24	0.03	0.24	0.02	0.24
AW	0.20	0.01	0.14	0.01	0.04	0.10
Total	**0.24**	**0.25**	**0.17**	**0.26**	**0.06**	**0.34**

[83] Savings presented do not adjust for counterfactual measure uptake, except where there are overlaps with other policies. This is to avoid
00double counting of carbon savings across policies (for example, savings from boilers are adjusted to avoid double counting of carbon savings with the Building Regulations).
[84] An updated assessment of the impact of policies on carbon emissions will be published in the 2016 Energy and Emissions Projections (EEP). The EEP estimate impacts could differ from the ones presented here because of potential differences in final energy use and emissions factor assumptions underpinning the forthcoming projections.

8.10 Impact on Energy Bills

138. The costs incurred by energy suppliers in meeting their obligation are expected to be passed onto domestic customers through the variable element of their gas and electricity energy prices. This means that suppliers have an incentive to deliver their obligation as cost effectively as possible, and thus minimise the cost pass through.

139. While the scheme is in operation, the net impact of the policy on energy bills depends on whether a household has a measure installed under the scheme. The average cost of ECO on an annual household dual fuel bill is estimated to be around £27 during 2017/18. However, for those households treated under ECO, the policy could deliver a net saving on their annual dual fuel bill of up to £300[85], meaning that, for these households, the energy savings resulting from the measures installed are expected to significantly outweigh the costs the policy imposes on their energy bills.

140. Once the impact of households benefitting from measures cumulatively installed under ECO since 2013 is taken into account, the average net cost on bills, across all households, is estimated to be around £16 in 2017/18. After the ECO transition scheme ends (and assuming no continuation of the policy after that period), this is estimated to become a net saving of around £10 a year. This is because suppliers are no longer expected to incur costs from the scheme, while the bill savings from measures installed under the scheme will continue to be realised until the measures expire – often several decades after the scheme has ended.

8.11 Employment

141. As identified in Section 2, market barriers and failures prevent large scale uptake of energy efficiency measures in the absence of Government intervention. As such, the transition of the scheme is expected to directly support a significant number of jobs within the supply chain.

142. We estimate that between 16,000 and 20,000 jobs will be supported as a result of the one year ECO transition scheme. These estimates are shown in Table 16.

Table 16: Estimated gross number of jobs supported under the preferred policy option

	Installers	Supply Chain	Total
Method A	3,000	13,000	16,000
Method B	20,000		20,000

143. Consistent with past ECO IAs, we have estimated the gross jobs sustained by the policy package using two different methodologies; these are outlined below.

Method A

144. Under this methodology, the number of installers is estimated by multiplying the number of measures installed during the transition year by the labour hours required to install a particular insulation technology. The number of supply chain jobs (involved in manufacturing, supply, distribution and development) are based on evidence from Innovas, and assumes a ratio of 4.75 supply chain jobs for every installer job.[86]

[85] Figure of up to £300 is based on installing solid wall insulation, estimated in the 2012 ECO Impact Assessment. Figure is adjusted for inflation.
[86] Innovas (2009) *Low Carbon Good and Services: an industry analysis,* http://www.bis.gov.uk/files/file50253.pdf

Method B

145. Under this methodology, the number of jobs supported in the supply chain is based on evidence from the sector Skills Council for construction[87] and assumes 32.6 jobs per £1m of capital spend. The estimate is therefore derived by taking the estimated total capital spend and multiplying this figure by 32.6 in order to derive the gross number of jobs supported.

Non Quantified Impacts

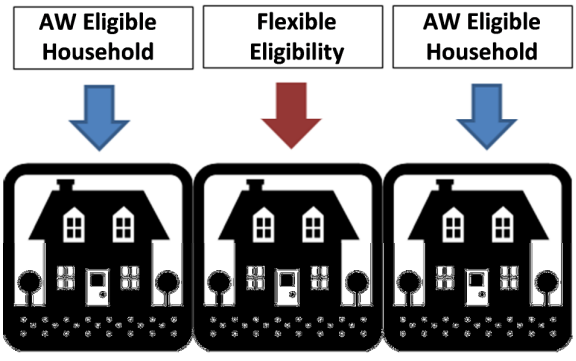
8.12 Flexible eligibility

146. Improved eligibility criteria under Affordable Warmth will allow ECO to reach more, but not all, fuel poor homes. DECC estimates that around 20% of fuel poor homes in England are not registered in the Government benefits or tax credits system, making their identification and eligibility for ECO support difficult. Others who may not be eligible may still be vulnerable to the effects of living in a cold home. The consultation therefore proposes to give power to LAs, and potentially other trusted organisations, some discretion in determining eligibility under the scheme, allowing them to make use of their local data, knowledge and links.

147. This proposal for some 'flexible eligibility' would provide for an optional route for delivery, rather than mandating it. This would enable more fuel poor or vulnerable households to be eligible without restricting the market from delivering in the most cost-effective way. The consultation proposes limiting the use of this route to 10% or 20% of the ECO transition target. This may be increased in the post transition period once delivery routes have had time to establish and we have confidence that this route aligns with our objectives.

148. There are several different options in the consultation for how flexible eligibility might work. For example, as well as allowing LAs some discretion in designating households as fuel poor, another variant would allow suppliers some discretion over the treatment of homes. An illustration of how suppliers might use the flexibility in this manner is shown in Chart 7. In the diagram, two non-adjacent households are eligible for Affordable Warmth, but the middle house is not. Under these circumstances, the energy supplier may be able to use flexible eligibility in order to treat the middle house, allowing all households to be treated. This is likely to be used for measures where there are significant economies of scale in adopting a street-by-street approach, for example solid wall insulation.

Chart 7: Example of the use of the flexible eligibility



149. Flexible eligibility is a relatively new proposal open to consultation, meaning it has not been possible to quantify its impact at this stage. However, four main benefits from the introduction of a flexible eligibility have been identified:

[87] Approach is set out in the 2014 ECO Impact Assessment: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/373650/ECO_IA_with_SoS_e-sigf_v2.pdf

1. **Reducing supplier search costs.** If local authorities identify households in or at risk of fuel poverty and designate them eligible for Affordable Warmth, suppliers will have to spend less finding AW qualifying homes, reducing the costs to them of meeting their obligation targets. The extent to which they affect the search costs, however, will depend on the exact design of flexible eligibility.
2. **Increases the eligible pool.** Related to the point above, flexible eligibility may increase the eligible pool offering suppliers more discretion in the homes they treat.
3. **Realising economies of scale.** The proposal may allow suppliers to treat multiple homes on a street, even if only some of them are eligible for Affordable Warmth. This could be more significant for measures such as solid wall insulation, which have large fixed costs (such as scaffolding), which can be spread across multiple properties.
4. **Reduces compliance costs**. Suppliers won't need to check eligibility with the Department of Work and Pensions, helping to reduce bureaucracy.

8.13 Trading of obligations

150. The consultation includes provisions for trading of obligation between different suppliers. Under trading, a supplier can pay another company to take on the liability for its obligation, accepting any risks associated with delivery and enforcement. This could allow smaller suppliers a cost effective route to discharging their obligations, and it could allow companies to specialise in certain kinds of delivery, improving the efficiency of the overall scheme.

151. Many suppliers are also obligated on multiple licences, which can cause administrative burden and additional risks as they have to meet each scheme requirement (including obligations, maximum and minimum thresholds) on each of these licences. If they do not, the licence will be non-compliant even if, in aggregate, the parent company has delivered sufficient savings to be compliant across its licences. Trading of obligations would allow suppliers to concentrate their obligations onto single licences, reducing administrative hassle.

152. As the consultation introduces the option (but not an obligation) to trade, the use of trading during the transition year is a commercial decision for individual suppliers, making it difficult to quantify the impact. Our modelling approach above therefore does not assume any trading of the obligation.

153. As energy suppliers will only trade where they have an incentive to do so, trading may help reduce the delivery costs compared to those presented in the costs and benefits section outlined above.

9. Sensitivity analysis

154. The estimates contained in Section 8, above, are inherently uncertain. The costs to suppliers of meeting their obligations (and the wider costs and benefits to society) depend on a range of factors – only some of which obligated suppliers will be able to control. In this section, we therefore vary some of the key assumptions underpinning Section 8 to determine the likely impacts.

155. A full list of sensitivities included in this impact assessment are shown in Table 17; each assumption category is varied by the shown amount, holding all other assumptions constant, to determine the impact on the cost to suppliers of meeting their targets. All sensitivities are presented relative to the central scenario – which are the impacts presented under the preferred option. In certain cases there may appear to be no difference between scenarios, however this is due to rounding. More detail on each of the sensitivities can be found in Annex C.

Table 17: Sensitivity assumptions

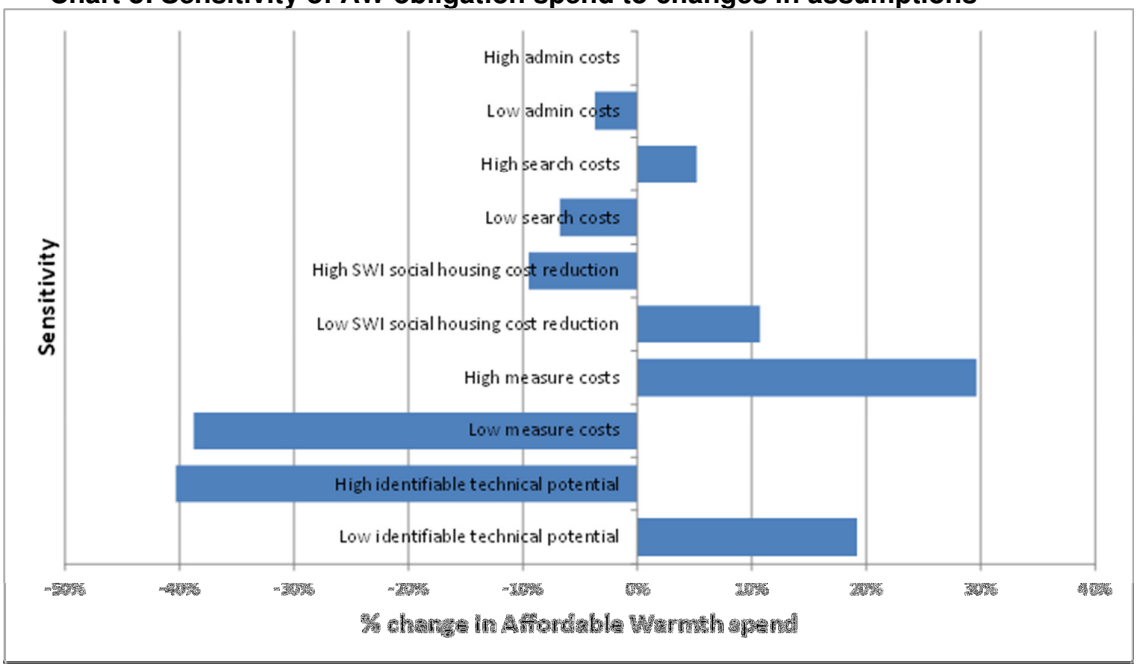
Sensitivity category	Sensitivity detail	Low	Central	High
Identifiable technical potential (AW)[88]	Cavity Wall Insulation – Easy to Treat	14%	15%	17%
	Cavity Wall insulation – Hard to Treat	6%	11%	17%
	Loft Insulation	19%	20%	20%
	First time central heating	50%	67%	15%
Identifiable technical potential (CERO/CSCO)	Cavity Wall Insulation	2.1% - 3.2%	2.7% - 4.0%	3.2% - 4.8%
	Loft Insulation	0.3% - 3.5%	0.4% - 4.4%	0.5% - 5.2%
	Solid Wall Insulation - External	1.1% - 3.6%	1.4% - 4.5%	1.6% - 5.4%
Measure costs	Insulation	20% Lower	-	20% Higher
	Replacement boilers	~25% Lower	-	~25% Higher
	First time central heating	32% to 43% Lower	-	32% to 43% Higher
Search costs (AW only)[89]	Qualifying boiler replacements – on gas grid	£50	£50	£50
	Qualifying boiler replacements – off gas grid	£300	£300	£300
	Other measures – on gas grid	£50	£125	£200
	Other measures – off gas grid	£300	£400	£500
Energy prices p/kwh (CERO/CSCO only)	Fuel type	SAP Prices deflated by IAG 'low' Series	SAP Prices inflated by IAG 'central' estimate	SAP Prices Inflated by IAG 'high' Series
Installation cost reduction factor for installing SWI in social housing	-	25%	33%	40%
Administration costs	-	29% Lower	£80m	N/A

[88] For the purposes of this IA, we assume that suppliers cannot identify all of the technical potential, so this flexibility tests the impact of varying the 'findability' of eligible households.
[89] The search costs are closely rated the identification of technical potential. However, the search costs that suppliers pay for each 'lead' depends, in part, on the level of competition within the market for lead generation.

9.1 Affordable Warmth Sensitivities

156. Chart 8 below shows the impact of varying each of the assumption categories above on the costs to suppliers of meeting their Affordable Warmth obligation. Each sensitivity is discussed in turn.

Chart 8: Sensitivity of AW obligation spend to changes in assumptions



Measure costs

157. Chart 8 shows that increasing measure costs leads to a roughly 30% increase in supplier spend, while decreasing them reduces supplier spend by around 40%. The greater impact from decreasing measure costs occurs due to changes in the volume and composition of measures deployed, as illustrated in the table below.

Table 18: Volume of measure installed under the High and Low measure cost scenarios

	Low measure costs	Central measure costs	High measure costs
Easy to Treat Cavity Wall Insulation	37,000	37,000	37,000
Hard to Treat Cavity Wall Insulation	24,000	32,000	32,000
Loft Insulation	23,000	42,000	44,000
Solid Wall Insulation	-	3,000	4,000
Central heating	24,000	16,000	15,000
Replacement boilers	23,000	23,000	23,000
Heating controls	29,000	21,000	19,000
Total	**160,000**	**174,000**	**174,000**

158. Table 18 shows that under the low measure cost scenario, more heating measures (central heating systems and heating controls) are installed to meet the Affordable Warmth obligation, as the cost of heating measures is assumed to fall by comparatively more than insulation measures, allowing more heating measures to be deployed cost effectively.

159. The substitution effect between heating and insulation measures also occurs under the high measure cost scenario – although, in this instance, suppliers substitute away from comparatively expensive heating measures towards cheaper insulation measures. The substitution effect is not quite as marked, however, suggesting that many of the heating measures installed under the central scenario are highly cost effective, and remain cost effective even when the measure costs increase. Suppliers therefore install broadly the same volume of measures as under the central scenario in order to meet their obligation, and this lack of 'volume effect' explains why the overall impact on supplier costs is less marked.

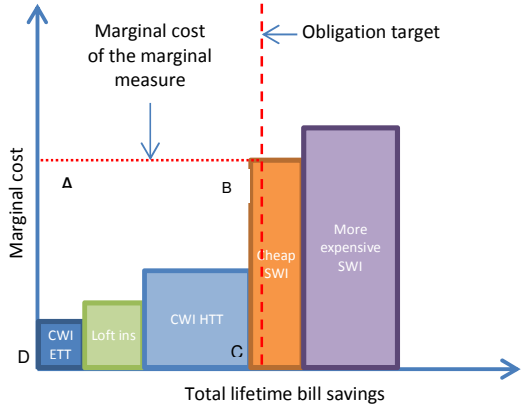
Identifying Technical Potential

160. Similar to the measure cost sensitivities, varying the amount of 'identifiable' technical potential also has an asymmetric impact on suppliers' costs. In this case, increasing the identifiable technical potential decreases supplier spend by more than they increase (around 40% compared to 20%) when the technical potential is smaller.

161. To help explain why varying the technical potential can lead to an asymmetric outcome, we have produced a range of illustrative charts showing the volume of measures available, and their costs, under each of the central, low and high sensitivities. It is important to stress that these are purely an illustrative means of demonstrating concepts.

162. Chart 9 shows the technical potential available to suppliers under the central scenario. As shown, suppliers treat the cheap loft and cavity wall insulation potential first, before turning to more expensive low cost solid wall insulation in order to meet their obligation. As the marginal measure, low cost solid wall insulation determines the market clearing price for the Affordable Warmth obligation, and supplier spend is given by the area ABCD.

Chart 9: Central Scenario (illustrative supply curve)



163. Charts 10 and 11 illustrate how the identifiable technical potential changes under the low and high scenarios. Under the low scenario fewer low cost measures are available, meaning that suppliers have to install all of the lower cost solid wall insulation, and a small amount of expensive solid wall insulation, in order to meet their obligation. Therefore this more expensive solid wall insulation becomes the marginal measure, and determines the market clearing price. Supplier spend is given by the area EFGH.

164. Under the high scenario, by contrast, greater technical potential is available, meaning that suppliers have a greater volume of cheaper measures available in order meet their obligation. This time, suppliers are able to meet their obligation installing cavity and loft insulation, with hard to treat cavity wall insulation determining the marginal measure. In this case, supplier spend is given the area IJKL.

Chart 10: Low Technical Potential (Illustrative supply curve)

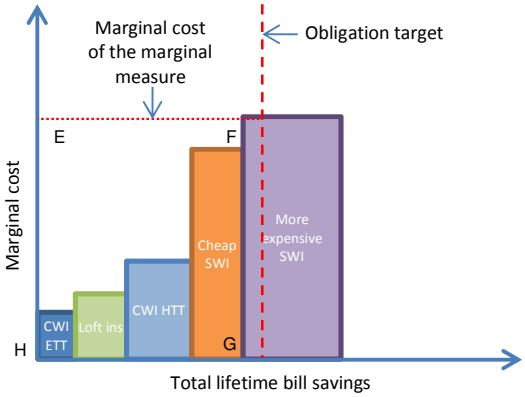
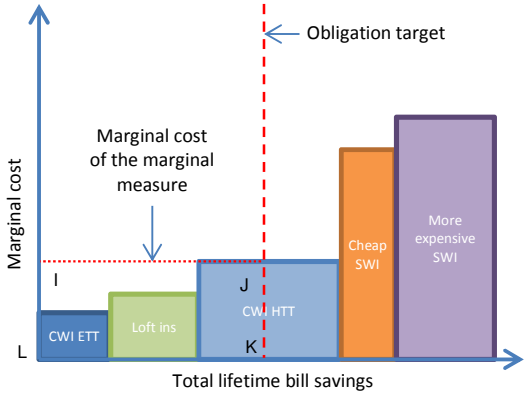


Chart 11: High Technical Potential (Illustrative supply curve)



165. The illustrative charts show that the difference in height between the hard to treat cavities and cheap solid walls is greater than that between expensive solid walls, leading to uneven changes in supplier spend under the low and high scenarios.

Other sensitivities

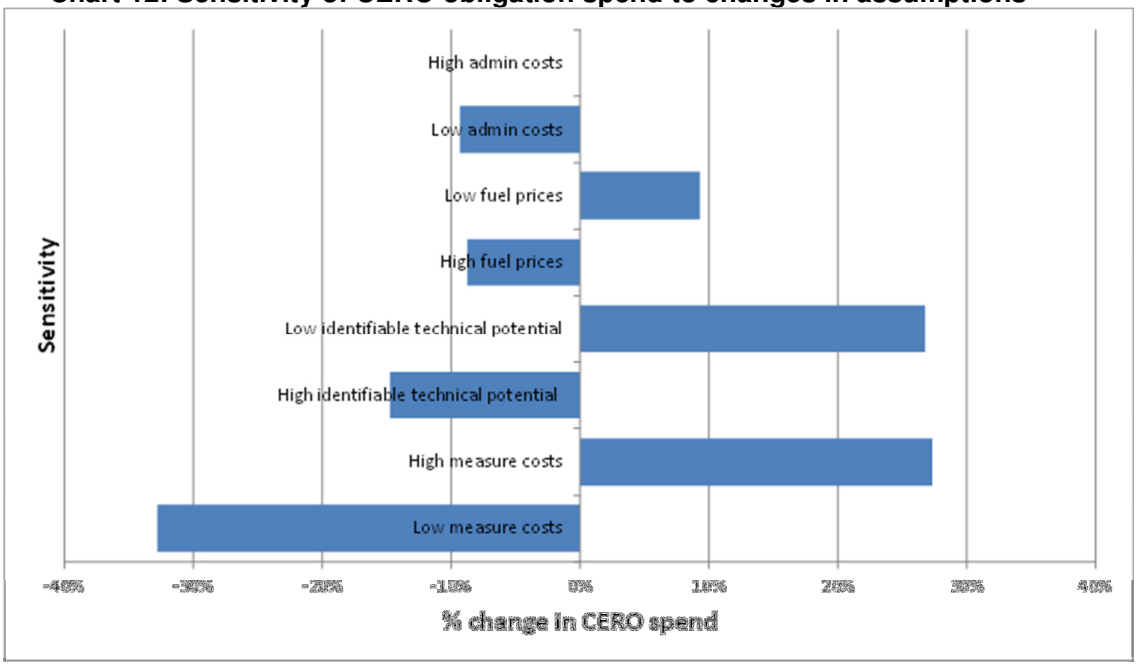
166. Chart 8 also shows the impact of varying the assumed reduction in solid wall insulation installation costs for social housing, the search costs suppliers incur in finding Affordable Warmth households, and supplier administration costs. These sensitivities show a lower variance (generally leading to variance in supplier costs of less than 10%), and have broadly symmetric outcomes when the assumptions are increased and decreased.

167. The exception is the administration costs, where supplier administration costs fall under the low administration costs scenario, but do not increase high scenario. These high and low administrative cost scenarios were based on the highest and lowest of the supplier estimates discussed in Section 8.4, and reflect that some suppliers expected admin costs to fall more substantially than we assumed in our central scenario, but no suppliers expected them to be much higher

9.2 CERO Sensitivities

168. Chart 12 shows the impact of varying the CERO assumptions. Similar to the Affordable Warmth sensitivities, the largest variance occurs when changing the assumed measure costs, and varying suppliers' ability to identify the remaining technical potential. As before, these are discussed, in turn, below.

Chart 12: Sensitivity of CERO obligation spend to changes in assumptions



Measure Costs

169. Under CERO, increasing measure costs leads to a 27% increase in CERO supplier spend, while decreasing the measure costs reduces spend by 33%. As with Affordable Warmth, this suggests a slight asymmetry in impacts.

170. Unlike the Affordable Warmth, however, heating measures are not eligible under CERO, meaning the substitution effect between heating and insulation measures does not occur. Instead, the variance is driven by the householders' willingness to take up measures when measure costs change.

171. To demonstrate this, assume firstly that the supplier subsidy rises by the same proportion as the increase in measure cost. Under these circumstances the household will be required to pay more meaning the marginal household may no longer be willing to take up the measure. Suppliers are therefore required to increase the subsidy further in order to induce the household to take up the measure, which increases their costs further.

172. To illustrate this, assume that a household is willing to pay £100 towards a £500 measure. In this instance, the household contributes 20% of the cost of a measure. When we increase the measure cost by 20%, the measure cost rises to £600. If the supplier continues to pay the same proportion of the measure costs, their subsidy rises to £480.

173. The household, however, is only willing to take up the measure when they pay £100. After the assumed increase in measure cost, they are now asked to pay £120, and are no longer willing to take up the measure. As a result the supplier must increase their subsidy to £500, in order to reduce the measure cost to £100 and induce the household to install the measure. Supplier costs therefore increase by more than 20%.

174. When measure costs decrease, in contrast, suppliers can lower both the absolute level of their subsidy, and the proportion of the measure they subsidise, for similar reasons to those set out above. However, when measure costs fall, more households become willing to install measures, allowing suppliers to lower their subsidy, and thus reduce their costs even further.

Identification of Technical Potential

175. Chart 9 above shows that reducing the 'identifiable' technical potential increases the supplier spend by 27% while increases reduces supplier spend by 15% - an asymmetry that runs in the opposite direction to Affordable Warmth.

176. The reason for the differing result is the smaller obligation size, and greater number of households eligible under CERO. Under the central scenario this means that the marginal measure is more likely to be one of the cheaper measures – making the starting point more analogous to the low scenario under Affordable Warmth. This means that increasing the identifiable technical potential shifts the marginal measure further to the left (for example, to loft insulation), whereas reducing it moves the marginal measure to cheap solid wall insulation. Reducing the technical potential under CERO therefore leads to a smaller step change in the market clearing price, than increasing it.

Other Sensitivities

177. The other sensitivities above show the impact of varying the assumption around the fuel costs and supplier administration costs. Varying the fuel costs increases and decreases supplier spend by around 10%, while assumed supplier administration costs reduces costs by nearly 10% under the low administration costs scenario. Administration costs do not increase under the high administration cost scenario for the same reason as outlined in the Affordable Warmth sensitivity section above.

10. Wider Impacts (including costs and benefits to business)

10.1 Equivalent Annualised Net Direct Cost to Business (EANDCB)

178. This section of the IA discusses the direct costs and benefits to businesses, in relation to the calculation of the Equivalent Annualised Net Direct Cost to Business (EANDCB), following the One-In-Three-Out methodology. Direct costs or benefits are defined in Better Regulation Executive (BRE) guidance as costs or benefits resulting directly from the implementation or removal/simplification of a regulation.[90] Here we discuss the direct costs and benefits but do not calculate the EANDCB for this consultation stage IA. This approach reflects the ongoing work between the RPC and BRE to finalise how these specific transition measures are accounted for the purpose of the Business Impact Target and the EANDCB position.

Businesses affected under the EANDCB

179. Businesses that face a direct regulatory impact as a result of the ECO transition are large domestic energy suppliers with more than 250,000 customer accounts and that supply more than 400GWh of electricity or 2,000GWh of gas to domestic customers a year. For suppliers that exceed this threshold, their share of the overall obligation increases with their size.

180. While the costs suppliers incur are expected to be passed on from suppliers to customers through energy bills, we treat these costs as direct for EANDCB purposes, consistent with their treatment in past ECO IAs.

181. The supply chain will also be affected by the obligation, as demand from energy suppliers for installation and heating measures in order to meet their ECO targets benefits them. However, following BRE guidance, this IA only includes the direct costs and benefits of the policy within the EANDCB, meaning the benefits to the supply chain are not captured here.

182. The direct costs and benefits of the policy are outlined in more detail below.

Direct Costs and Benefits

Direct Costs

183. All of the direct monetised costs that are incurred by suppliers would be counted as direct costs for the purposes of calculating the EANDCB. These broadly fall into two categories – supplier delivery costs and supplier administration costs; both of these cost components are outlined in more detail in Section 7 above.

184. Section 7 also outlines that the market clearing subsidy is assumed to be the last (or marginal) measure installed for suppliers to meet their obligation – a subsidy level which is then assumed to be paid to households. As some households would be willing to install measures for a lower level of subsidy than the one they receive, these households are assumed to receive economic rents. This increases the cost to suppliers of meeting their obligation.

185. Consistent with the 2012 and 2014 ECO IAs, we have assumed (in the absence of evidence to the contrary) that households capture all of the economic rents. In practice it is possible that suppliers (and installers) may also capture some of the economic rents. This means our approach represents the most conservative when calculating the direct costs to suppliers.

[90] Definitions of direct costs and benefits can be found within the Better Regulation Framework Manual, along with the methodology used to calculate the annualised equivalent net cost to business. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211981/bis-13-1038-better-regulation-framework-manual-guidance-for-officials.pdf

Direct benefits

186. No direct benefits to obligated parties in complying with the regulations have been identified, meaning there would be no direct benefits to businesses contained within the EANDCB. Suppliers will 'benefit' from a reduction in the overall size of the obligation relative to the existing ECO scheme (which runs to the end of March 2017), which in 2015 prices is a reduction from around £840m per year to around £620m per year (see Table 5). However, as set out in the following section, the approach to treating this cost reduction is to be agreed.

EANDCB position and Business Impact Target Status

187. The EANDCB position and the scoring under the Business Impact Target are not calculated for the consultation stage of this IA. The change in the regulatory burden from the lower supplier obligation of the new ECO as well as the BIT scoring will be assessed in the IA at final stage. This approach reflects the ongoing work between RPC and BRE to finalise how these specific transition measures are accounted for the purpose of the Business Impact Target and the EANDCB position.

10.2 Small and Micro Business Assessment

188. Businesses that are directly affected by the extension to ECO are large energy suppliers – those with over 250,000 customer accounts and supplying over 400GWh of electricity or 2,000GWh of gas per year. Some small and micro businesses in the supply chain may also be indirectly affected by the increased level of supplier demand for their services as a result of the extension to ECO. This is expected to have a positive impact on these companies' gross profits compared to a counterfactual of no ECO[91]. On the grounds of proportionality, however, we have not attempted to calculate these gross or net profits resulting from this one-year extension.

189. Given the growth of independent suppliers since the inception of ECO, this IA includes an independent supplier assessment, which is set out below.

Independent Supplier Assessment

Background

190. Energy suppliers are only obligated under ECO if they are over a certain size, meaning that many smaller, independent suppliers are exempt from ECO. This small supplier exemption recognises that ECO is likely to bear disproportionate costs of smaller suppliers of complying with ECO (due to the fixed costs of compliance), as they have a lower customer base to spread the costs of compliance. It is also consistent with Government regulatory guidance that small and micro businesses should be exempt from regulations unless the disproportionate burden these businesses face can be fully offset[92]

191. The minimum threshold for ECO meant that at the start of ECO in January 2013, only the Big Six[93] energy suppliers were obligated.

192. As ECO has progressed independent suppliers' domestic energy market share has grown significantly - from around 2% just prior to the launch of ECO in 2013 to around 12% towards the end of 2015[94]. Growth in 2015 amongst the smaller suppliers has been supported by significant

[91] However, at an estimated supplier spend of around £620m during the transition year, demand is expected to be lower than under the previous phase of the obligation (which was estimated to be around £820m per annum).
[92] Source: Better Regulation Executive Guidance https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/468831/bis-13-1038-Better-regulation-framework-manual.pdf (see page 27)
[93] The Big Six are British Gas, Scottish Power, SSE, E.ON, NPower, and EDF
[94] Source: Energy UK/ Cornwall Energy (http://www.energy-uk.org.uk/publication.html?task=file.download&id=5621)

levels of switching, with 15% of customers changing suppliers, 40% of which were to independent suppliers, the highest level of switching since 2011.[95]

193. The growth in independent suppliers meant that by the start of the first year of ECO 2 (April 2015 – March 2016, referred to as 'phase 1'), 5 independent suppliers had become sufficiently large[96] that they became obligated[97]. Allocations for the second year have not been announced, although 6 independent suppliers are expected to be obligated.

ECO Taper

194. The Government recognises that crossing the ECO threshold and becoming obligated can result in additional costs being borne by independent suppliers, and these costs will be passed onto their customers through their bills; it can also take time for suppliers to put the systems and expertise in place to deliver the obligation on a large scale.[98]

195. In recognition of the additional challenges faced by newly-obligated suppliers, ECO operates with a taper, whereby newly obligated suppliers are only obligated on the parts of their size that exceeds the ECO threshold. For example, the tapering approach means that where a supplier reaches 401 GWh of electricity, the full amount will not count towards its obligation share, only the volume above 400 GWh multiplied by 2 will count (i.e. only 2 GWh will count in this case). The full volume of supply is counted when the supplier reaches 800 GWh of electricity or 4,000 GWh of gas.

196. The impact of the ECO Taper is illustrated in the figure below. The red line shows how a newly obligated independent supplier's obligation share would grow assuming that ECO did not operate with a taper. Under this scenario, supplier's obligation share jumps upon crossing the threshold, and continues to grow in line with the growth in their market size. The blue line, meanwhile, shows how the obligation share changes with the taper. As can be seen, there is no sudden jump in their share of the obligation under this scenario –although newly-obligated suppliers see their obligation size grow more rapidly up until the upper 4000GWh limit as their market size grows.

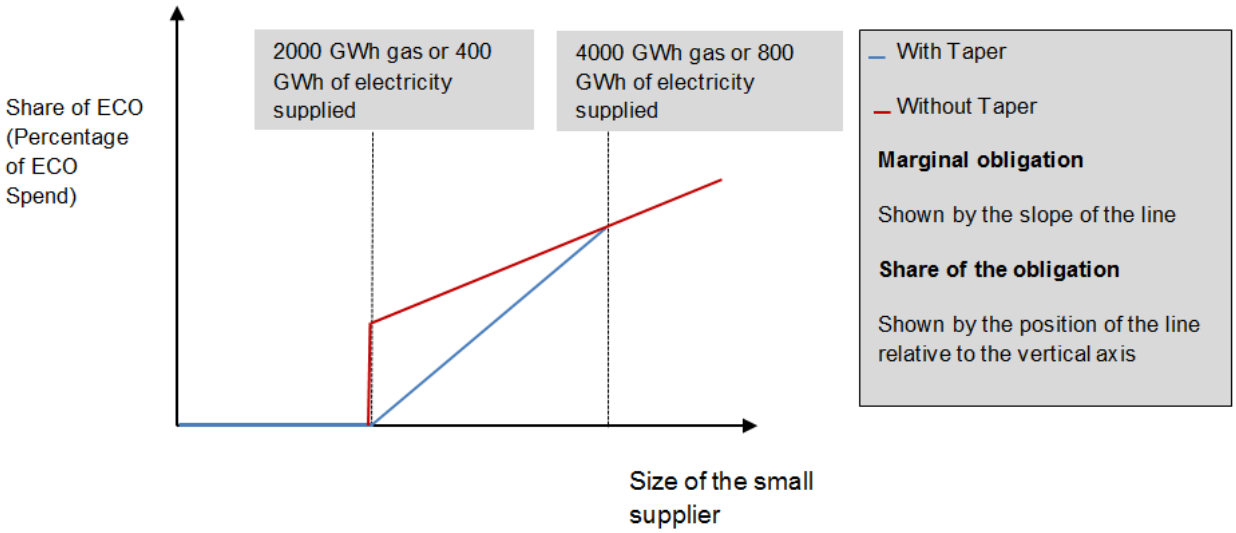
[95] Source: Ofgem https://www.ofgem.gov.uk/publications-and-updates/more-consumers-are-shopping-around-over-six-million-energy-switches-2015-says-ofgem

[96] These suppliers now have between 500 – 1000 employees. This means that they no longer quality as small or micro businesses under the Better Regulation Executive definition – see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/468831/bis-13-1038-Better-regulation-framework-manual.pdf (page 27)

[97] 11 suppliers were obligated for phase 1 of ECO 2 – RWE Npower, British Gas, EDF Energy, EON, SSE, Scottish Power, OVO, First Utility, Utilita, Co-operative Energy and Utility Warehouse.

[98] Independent suppliers have the option of outsourcing some elements of the admin costs. However, some costs will still be incurred.

Chart 13: Share of the obligation for a small supplier participating in the ECO



197. Some smaller suppliers have argued that the current level of the threshold and taper still represents a barrier to growth, and that in order for small suppliers to grow (and compete with the large, established suppliers) the threshold should be increased - or the taper extended. Conversely, the larger, established suppliers have argued that exempting small suppliers from the cost of delivering ECO gives them an unfair competitive advantage, arguing that the majority of ECO compliance costs are variable and that there is no evidence that the variable costs differ materially by size of supplier.

198. The Competition and Markets Authority (CMA) has considered whether the small supplier exemptions constitute an adverse effect on competition during its investigation into the retail energy market. In the CMA's decision on remedies report (published in March 2016), these exemptions are not stated as having an adverse effect on competition[99].

199. The provisional findings also suggest that the thresholds do not act as a material barrier to growth for small suppliers. This is supported by the number of suppliers that have crossed the threshold and continue to grow.

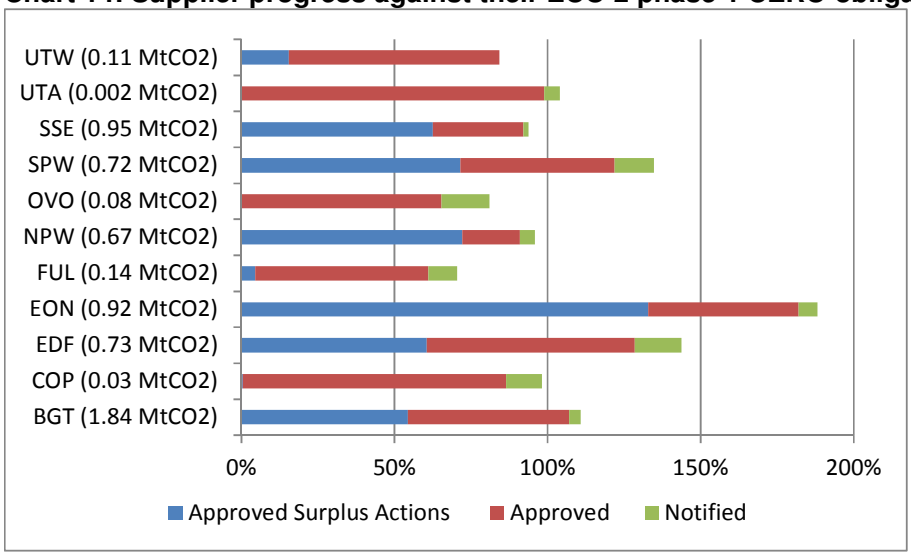
Performance of independent suppliers under ECO

200. Independent suppliers currently have around a 5% share of the obligations - around half of independent suppliers' overall market share[100].

201. The charts below show the independent suppliers performance against their CERO, CSCO and Affordable Warmth targets respectively, showing that they have achieved 80% CERO targets, 60% of their CSCO and nearly 65% of the Affordable Warmth targets by December 2015, and suggesting they are broadly on course to meet their phase 1 obligations. Larger, more established suppliers are further ahead in their obligations. However, unlike the Big Six, independent suppliers have not benefitted, or only benefitted marginally, from surplus actions from ECO 1.

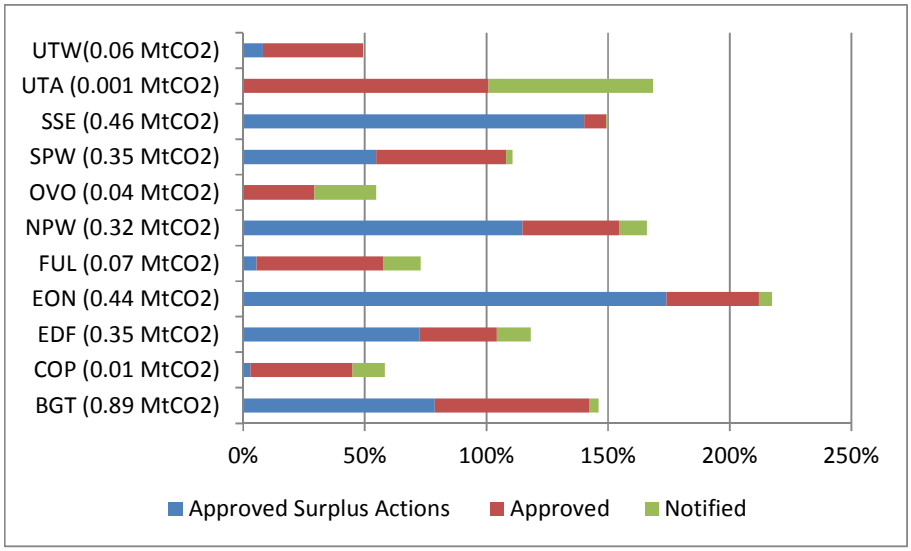
[99] https://assets.digital.cabinet-office.gov.uk/media/56efe79040f0b60385000016/EMI_provisional_decision_on_remedies.pdf
[100] Customer account numbers for individual suppliers is not publically available, meaning it not possible to compare the obligated suppliers' market share to their share of the ECO obligation.

Chart 14: Supplier progress against their ECO 2 phase 1 CERO obligation



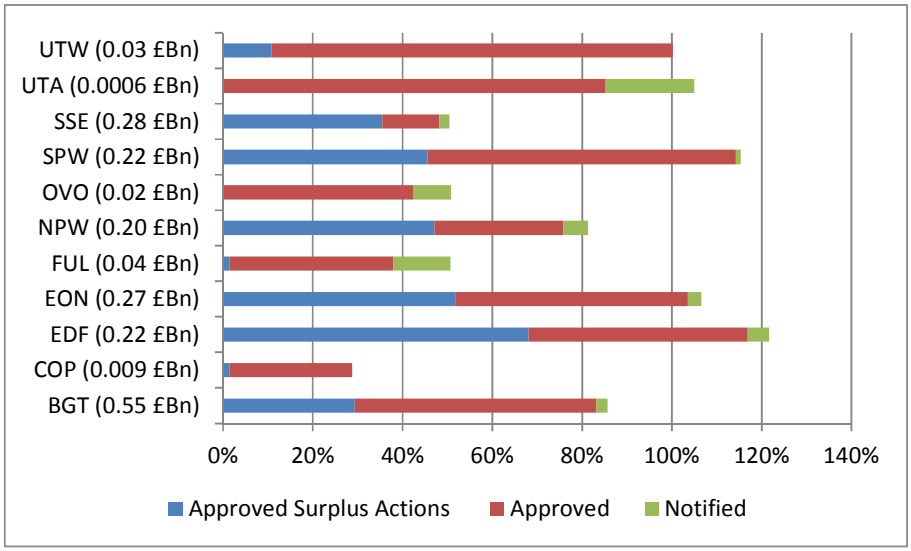
Source: Ofgem (measures notified to the end of December 2015)

Chart 15: Supplier progress against their ECO 2 phase 1 CSCO obligation



Source: Ofgem (measures notified to the end of December 2015)

Chart 16: Supplier progress against their ECO 2 phase 1 Affordable Warmth obligation



Source: Ofgem (measures notified to the end of December 2015)

Outlook for independent suppliers under the ECO transition

202. We are not proposing to alter the customer number account threshold during the ECO transition. Reducing the threshold would, as outlined above, bear down disproportionately on smaller suppliers who would be required to set up compliance mechanisms (for example IT systems) from scratch. Newly obligated suppliers would also need time to factor new costs into their tariffs. This is particularly important for suppliers offering fixed term, fixed price tariffs, who are not able to raise their prices. Any unanticipated changes in costs are more difficult for smaller suppliers to absorb as they have fewer customers over which to spread these costs and much smaller balance sheets than the large suppliers.

203. Increasing the threshold, meanwhile, would result in higher costs for obligated suppliers. Obligated suppliers would also need time to factor higher costs into their tariffs, but the larger obligated companies are more able to absorb these costs. Some of the smaller obligated suppliers, however, would find it more difficult to absorb these unanticipated costs.

204. Leaving the taper means that more independent suppliers are likely to cross the ECO threshold and become obligated under ECO. Due to the commercial restrictions on customer account numbers and the amount of electricity and gas supplied, it is not possible to come up with an estimate for how many additional suppliers might be obligated during the ECO transition year.

205. The consultation is considering introducing a trading mechanism to the obligation that may mitigate some impacts on smaller suppliers, which is discussed in more detail in Section 8.

10.3 Justice Impact

206. There will not be a significant impact on the legal system or the volume of cases going through the courts, as DECC is not making significant changes to the enforcement regime. The justice system would only become involved were someone to seek to challenge an Ofgem enforcement action for a breach of the obligation or potentially where Ofgem were to seek a court order – although the latter has not occurred under supplier obligations since they began in the 1990s.

Annexes

Annex A – Further Policy Details

Household Eligibility and targeting

1. The consultation sets out an intention to amend the eligibility under ECO to bring it more in line with fuel poverty as we now understand it.[101] The proposals in this consultation will increase the percentage of eligible households that are fuel poor. For example, in England this will increase from the current 29% to up to 36%.[102] In turn, again in England, we estimate that these changes would increase the total percentage of all fuel poor homes that are eligible from around 32% to up to 53%, while increasing the total number of homes eligible overall (to 4m in GB[103]).

2. The proposals are made up of essentially two components:

   1) **Private tenure households**, eligible through being in receipt of particular means-tested benefits; and

   2) **Social tenure households**, eligible through their tenure and the energy efficiency rating of their home.

   This section sets out the detail of the proposals and accompanying analysis.

Private tenure households, eligible through means-tested benefits

3. The current Affordable Warmth eligibility criteria are solely based on households who are in private tenure (owner occupier or private rented); are in receipt of one of a list of qualifying means-tested benefits (including tax credits below an income threshold); and either are responsible for a child, have a disability, or are elderly.[104] According to the English Housing Survey, and adjusting for Scotland and Wales, this is estimated to make around 3m households eligible across Great Britain.

4. The proposed changes to the eligibility criteria for private tenure aim to achieve three objectives:

   1) To simplify the sub-components of benefits required to be eligible under the current criteria. For example, moving from:
      - Needing to receive income-related employment and support allowance *and* a disability premium, enhanced disability premium or severe disability premium; to
      - Needing to receive income-related employment and support allowance.

   2) To improve the accuracy of low income targeting through means-tested benefits. At present, child tax credit and working tax credit recipient households are subject to an income threshold in order to be eligible. The new proposal is to adjust this income threshold dependent on the composition of the household – a process called 'equivalisation'. This reflects that a family of four on an income of, say, £20,000 will have a lower disposable income than a single-person household with the same income. Therefore larger households on tax credits would have a higher income threshold than smaller households.

   3) To expand the eligible pool of households. Affordable Warmth covers a relatively small proportion of the fuel poor population at present. In England, around a third of the fuel poor are eligible – similar or slightly larger proportions might be expected in Wales and Scotland. Expanding the size of the eligible pool would:
      - Increase the percentage of all fuel poor households eligible for the scheme;

[101] Fuel poverty is identified differently in each part of Great Britain. The majority of the analysis undertaken here uses England there are significant similarities between the characteristics of households deemed to be in fuel poverty across GB.
[102] This is an initial estimate based on current proposals. DECC will be working with delivery partners to refine this estimate, and we intend to provide an updated estimate in the final stage Impact Assessment.
[103] We estimate that approximately 360k of these would be in Scotland and around 3.64m in England and Wales.
[104] More detail is available in the current ECO regulations: http://www.legislation.gov.uk/ukdsi/2012/9780111525456/contents

- Ensure that obligated suppliers have a sufficiently large pool of households to contact and deliver measures to in a cost-effective way;
- Mirror the increased share of total ECO expenditure on Affordable Warmth; and
- Provide 'new doors' for suppliers and installers to knock on, given that the current Affordable Warmth eligible group has been fixed for more than 4 years.

Proposed changes to eligible benefits

5. The above changes apply to all the benefits currently part of the existing eligibility criteria. There is one proposed to change in terms of which benefits make a household eligible. This relates to Pension Credit Savings Credit.

6. Currently, any person in receipt of Pension Credit (whether the guarantee credit component, savings credit component, or both) is considered to be eligible for Affordable Warmth. However, based on analysis of the English Housing Survey, we estimate that households who are solely in receipt of Pension Credit Saving Credit (PCSC) are no more likely to be in fuel poverty than the average household in the English population (only around 10%), and on average tend to have higher disposable incomes than other benefit recipients. The consultation therefore proposes to remove PCSC as an eligibility criterion for Affordable Warmth, as one of the key aims of amending Affordable Warmth eligibility is to improve the fuel poverty targeting of the scheme, and PCSC has a fuel poverty 'hit rate' of just 10%, the same as the national average across all households.

Social housing

7. Social housing has not previously been eligible under Affordable Warmth, owing to the relatively higher energy efficiency of the social housing stock. For example, only 4% of the most inefficient housing (EPC bands F & G) are in social housing according to the English Housing Survey, and many social homes have benefitted from previous investment programmes such as the Decent Homes Standard. Consequently, only 18% of fuel poor in England are in social housing.

8. However, compared to private tenure households on the qualifying benefits outlined above, households who live in the least efficient social housing are more likely to be fuel poor. Simply using the two criteria of being a social tenant and being in an E, F or G-rated home, the proportion of households in scope that are fuel poor is around 45%. This is perhaps unsurprising as a large majority of social tenants are on low incomes, living in an inefficient property vastly increases the likelihood of being 'high cost', and fuel poverty is characterised by 'low income, high cost' households.

9. There are around 480,000 households in social housing that live in homes with an EPC of E or below. None of these have been eligible for Affordable Warmth, and we anticipate that the majority will already have or have relatively easy access to an EPC. The simplicity of the eligibility criteria should also mean that the search costs involved in identifying these households as eligible should be low compared to private tenure households.

Consideration

10. Table A1 summarises key metrics in comparing the current Affordable Warmth eligibility criteria against the proposed criteria with and without the inclusion of Pension Credit Savings Credit. It shows that the proposed changes (excluding PCSC) increase the eligible pool by 1m households, but brings a total of 1.8m households into the scheme that were not previously eligible. The changes to the tax credit income thresholds and proposals to remove PCSC mean that the total number of 'new homes' (1.8m) is greater than the total increase in the size of the eligible pool (1m). The proposal also increases the proportion of eligible households that are fuel poor (in England) from around 29% to up to 36%, and would mean that more than half of the total fuel poor population would be eligible compared to only around a third at present. While the same data and analysis are not available for Scotland and Wales, we would expect the improvements to also lead to improvements in accuracy and coverage of the fuel poor.

11. The impact of excluding PCSC is also shown, whereby a greater level of accuracy in fuel poverty targeting is achieved (36% versus 32%), and a greater share of the fuel poor are eligible overall

(53% versus 47%). This is the result of PCSC being substituted with households on tax credits, who have a higher likelihood of being fuel poor than PCSC-only households.

Table A1: Comparison of Affordable Warmth Eligibility Criteria Options

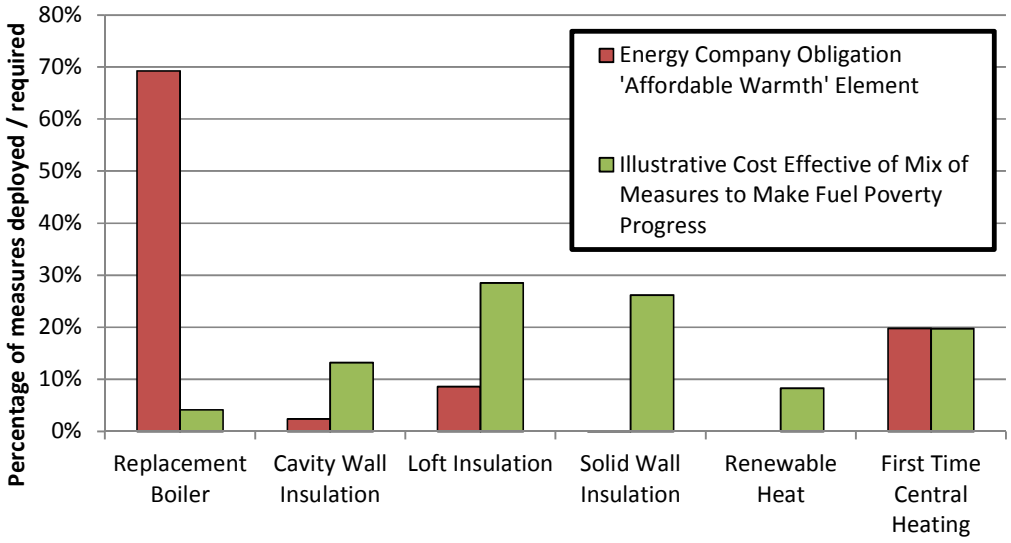
	Current Scheme	Proposed Scheme excluding PCSC	Proposed Scheme including PCSC
Total homes eligible (eligible pool)	3m	4m	4m
% of eligible group that are fuel poor (England only)	29%	36%	32%
% of fuel poor in England that are eligible	32%	53%	47%
Number of households eligible that are not under current scheme	N/A	1.8m	1.6m

12. It should be stressed that these are **illustrative** estimates at present, as the precise operational decisions are yet to be taken. Further work will be undertaken in time for the final stage Impact Assessment.

Limiting boilers under Affordable Warmth

13. This section of the annex provides more detail on the rationale for limiting the deployment of replacement boilers under Affordable Warmth at 25,000 during the transition year, as well as considering the impacts of varying the level of that limit. Chart A1 compares the mix of measures delivered under Affordable Warmth to date, to the mix of measures our analysis suggests would be cost effective for making progress in tackling fuel poverty. This shows how historical deployment under Affordable Warmth has been predominantly replacement boilers, whereas our analysis would point to a much more diverse mix of measures in order to make progress towards fuel poverty objectives in the most cost-effective way.

Chart A1: Comparison of historical AW delivery and illustrative mix of measures for making cost-effective progress on fuel poverty



14. Around 90% of Affordable Warmth delivery to date has been replacement boilers and accompanying heating controls; since April 2014 this has equated to the delivery of around 75,000 boilers per year.

15. Section 4.3 outlined that deploying boilers does not ensure substantial and lasting progress towards Government's fuel poverty commitments. In fact, the improvement in energy efficiency from installing a more efficient boiler is only slight when compared to other measures such as insulation or first time central heating. They do help ensure that low income households have a functioning heating system, but are unlikely to improve the energy efficiency rating of the property and therefore have a limited impact on key fuel poverty objectives, such as the statutory target for England and its interim milestones. There is therefore a strong case for rebalancing Affordable Warmth in order to deploy a more varied mix of measures, particularly insulation.

16. There is clear evidence, however, that there is additionality from installing boilers under AW, and that this has helped people who are often unable to replace their broken boilers for some considerable period of time. Annex C outlines the analysis of when particular groups of fuel poor households are able to replace their boilers without Government support. It shows that typically these homes replace their boilers after around 15 years, which is 3 years beyond the typical lifetime of a boiler, and 5 years later than non-fuel poor households.[105] Intervening at the point of the boiler breaking can mean avoiding resorting to coping mechanisms in the absence of a working heating system, while the householder gathers the means to replace the boiler themselves. The recent evaluation of the Warm Front scheme provides examples of the types of coping mechanisms low income households can resort to when their boiler breaks and they do not have the means to replace it – such as using expensive plug-in heaters for warmth and a kettle for hot water.[106]

17. Further, the scale of boiler replacements under the scheme at present also means that significantly restricting volumes and altering the rules at the same time would risk making the scheme undeliverable. For these reasons, the consultation proposes that suppliers be allowed to continue to deliver boilers towards their AW targets, up to a limit.

[105] Social housing tenants typically see their boilers replaced every 12 years, the average estimated lifetime of a typical boiler.
[106] Warm Front Process Evaluation, available at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/322901/Warm_Front_Evaluation_Report.pdf

18. The consultation proposes that the measures are put in place to encourage no more than around 25,000 gas boiler replacements under the transition – around a third of the current delivery rate. This level has been proposed to strike a balance between ensuring progress against our fuel poverty objectives, continuing to support low income households with broken boilers, and avoiding large step changes in the ECO scheme during the transition year. The consultation seeks views on whether this is the right level for the threshold.

19. Two variants on the 25,000 limit have been analysed: a 50,000 limit, and no threshold at all. Each is assessed to determine the impact on the number of homes insulated, and the fuel poverty impact, during the transition year. The three sub-options are set out in Table A2. This analysis shows that it is likely that limiting gas boiler replacements will have a notable impact on 2017-18 delivery outcomes. It suggests that setting a boiler limit of 25,000 means that an additional 40,000 homes are insulated under Affordable Warmth during the transition year, compared to having no limit on boiler deployment. Compared to a 50,000 limit, the preferred limit is estimated to lead to over 10,000 extra homes insulated. It should be noted that under the 'no limit' scenario, it is possible that boilers would dominate insulation to a greater degree that estimated here. The modelling assumes that boilers are fully subsidised by suppliers, however in reality households can and in some cases do contribute to the cost of a boiler replacement. This means that suppliers can achieve more of their AW targets for the same cost through boilers, and in turn lead to a greater level of boiler deployment than estimated here. So these estimates should be treated as conservative.

20. The impact of the proposed limit on boilers is also estimated to have a positive impact on fuel poverty objectives, with a larger number of F/G-rated fuel poor households lifted to Band E compared to the 50,000 limit and no limit scenarios. It should be noted that for a one-year transition this effect does not appear to vary significantly, although we would anticipate a far greater difference over a longer time horizon – we expect to analyse this when assessing the design of the future scheme post-transition year.

Table A2: Impacts of limiting boiler delivery within Affordable Warmth on scheme objectives

	25k limit	50k limit	No limit
Number of homes insulated under Affordable Warmth (transition year only)	122,000	110,000	82,000
Number of F/G-rated fuel poor households lifted to Band E (England only)	16,000	13,000	12,000

21. Finally, the consultation proposes to continue to restrict boiler replacements to private tenure only. The evidence on boiler lifecycles in Annex C suggests that in the absence of subsidy support boilers in social housing are replaced in line with the average boiler lifetime. This would imply limited or zero additionality from supporting replacement boilers in social housing.

Scotland and Wales

22. The Scotland Act 2016 will devolve powers to the Scottish Government over the design and delivery of energy supplier obligation schemes relating to energy efficiency and fuel poverty.

23. The energy efficiency and fuel poverty provisions will give Scottish Ministers powers to determine how the Energy Company Obligation is designed and implemented in Scotland. Responsibility for setting the way the money is raised (the scale, costs and apportionment of the obligations as well as the obligated parties), however, will remain reserved as set out in the Smith Commission Agreement.

24. Should the Scottish Government wish to take up its powers, it is anticipated that this would happen from 2018, to coincide with the start of the new supplier obligation in England and Wales, following the ECO transition year. Therefore for the purposes of this consultation we assume that Scotland remains within the GB-wide scheme for 2017/18.

More detail on proposed administrative simplifications to ECO

25. This section discusses in more detail the of the consultation's proposals designed to help simplify delivery, reducing administrative burden and complexity, where possible, while continuing to support the delivery of measures to an appropriate quality.

26. For continuity with the current scheme, the one-year extension will be administered by Ofgem.

Measure recommendation reports

27. Measures installed under the current CERO and CSCO obligations must be recommended on either a GDAR or a chartered surveyor's report (CSR)[107]. This requirement was intended to ensure that consumers were given appropriate advice about the range of measures they could install, in order to drive demand for additional measures (and in the case of GDARs, specifically for Green Deal finance) and also to encourage householders to install those measures which provided the most benefit. CSRs were intended to be used where a GDAR was not technically viable – though CSRs have been used quite extensively in practice.

28. Delivery statistics have shown that, in spite of multiple measures being recommended on GDARs, homes are in the majority of cases treated with a single measure under ECO and, before funding for the Green Deal Finance Company ended in July 2015, there was not a significant volume of blending with Green Deal finance. Therefore, Government believes that the current recommendation requirements are not justifying their cost in the current scheme. In order to reduce administrative costs, we propose to remove the requirement for measures to be recommended on either a GDAR or a CSR.

29. We are aware that a key theme emerging from stakeholder dialogue through the Every Home Matters review is that the quality of technical pre-installation surveys which assess suitability of measures for a property prior to installation and the subsequent design stage are insufficient in many cases, particularly when considering external wall insulation, which may have an adverse effect on quality. Pre-installation surveys are a requirement of the quality framework underpinning ECO (PAS 2030) and are separate to the assessment required to recommend measures. Government believes that the existing recommendation requirements do not provide assurances as to the technical suitability of particular measures in particular properties. But, Government is seeking views on whether there are any appropriate steps that can be taken to ensure that measures are installed in suitable properties, particularly in light of the outputs of the Every Home Matters review (discussed in more detail later in this Section).

Scoring of measures

Deemed scores

30. In order for suppliers to meet their obligations, they must deliver measures to eligible homes. Each measure is awarded a 'score' based on the anticipated carbon or notional bill saving that will be achieved over the measure's lifetime. The current ECO scoring system requires a unique score to be calculated for each measure in every property treated under the scheme, using the Standard Assessment Procedure (SAP) or reduced data Standard Assessment Procedure (RdSAP). Under this system, certified domestic energy assessors are required to carry out a full house assessment of each property in order to determine a savings score for a measure. The use of SAP and RdSAP under ECO is consistent with the methodology used under the Green Deal, where a bespoke estimate of savings was required to ensure that the golden rule was met.

31. The requirement to use individual household SAP and RdSAP assessments has been cited as a particular cause of complexity within the scheme, due to the need to collect and evidence a large quantity of data for every measure installed. We have heard that installers would typically be

[107] There is no equivalent requirement under Affordable Warmth.

uncertain of the commercial value of a measure until the assessment had been completed – making it difficult to make a standard offer to all households in a particular area, and meaning that sometimes an installer would decide not to proceed with a measure once the assessment had been carried out. This reduces the cost effectiveness of the scheme and could be potentially frustrating for householders.

32. In addition, there have been some concerns regarding the accuracy of the information collected during property assessment, which has undermined confidence in the savings being awarded in some instances. In order to gain assurance in the scores, a number of compliance checks have been introduced by the scheme administrator (Ofgem). Under ECO1, these checks resulted in over 840,000 tCO_2 savings and over £6m cost savings being removed from the scheme. The checks themselves have increased administrative complexity.

33. In line with our aims to simplify the scheme and improve value for money, the Government is proposing that measures installed from 1 April 2017 should be scored using 'deemed scores'. This would entail the production of a finite set of scores based on a limited number of predictable and checkable inputs, such as property type, number of bedrooms and heating type, that would simplify scheme delivery and administration, and reduce costs. The Government proposes that these scores would be determined by Ofgem, who would consult on the methodology used to calculate the scores prior to the start of the scheme.

34. The Government proposes that the deemed scores should be calculated using the national standard model, SAP. This will provide confidence that the set of savings produced is fair and representative of potential in typical GB homes. It will also provide a level of consistency with national fuel poverty targets and current ECO scores, both of which are based on the same methodology. In addition, the underlying assumptions used to inform the calculation of deemed scores should be made available as part of Ofgem's consultation.

35. To calculate a final score for notification, deemed scores will be subject to the same multiplication factors currently applied in ECO:

- **Lifetime** – the number of years that a measure is expected to continue delivering savings at the calculated level. Current ECO lifetimes range from one to 42 years

- **Weighted average factor** of 0.925 (for all CERO measures) – converts the savings calculated using SAP methodology from carbon dioxide equivalent (CO_2e) to carbon dioxide (CO_2)

- **In-use factors** (for CERO measures only) – reduces the savings calculated using SAP to take account of likely measure performance in use. Affordable Warmth does not require these corrections as the unadjusted savings calculated in SAP are consistent with the way that fuel poverty is measured under Government targets

- **Non-gas uplifts** (for Affordable Warmth insulation and qualifying boiler measures) – these are an incentive mechanism which increases the savings for measures delivered to homes not heated using gas. This is currently in place under ECO and will remain appropriate under the extension to help incentivise delivery to those homes which are most expensive to heat

- **Qualifying gas deflator** (for Affordable Warmth gas boiler replacement measures) – reduces the savings for qualifying boiler measures which replace one mains gas-fuelled boiler with another. As above, this is currently in place under ECO and will remain appropriate under the extension to help encourage delivery to those homes which are most expensive to heat

36. Deemed scores should be calculated for all measure types currently carried out under ECO, with the exception of large scale district heating system (DHS) measures, for which we consider that a bespoke SAP assessment would be more appropriate. We consider this a suitable exception for two key reasons; (i) the particular configuration of DHS measures varies considerably from scheme to

scheme, suggesting that a set of deemed scores would not be widely applicable; and (ii) the higher costs, detailed planning requirements and larger scale of these schemes is better suited to the production of bespoke SAP assessments than for other ECO measures, as such assessments are much less likely to be prohibitively burdensome for industry.

37. Where other measures meet all ECO eligibility criteria but do not have a deemed score available, the consultation is interested in views on whether there should be a mechanism through which an appropriate score can be produced.

The one-month reporting rule and extension of the deadline

38. The current ECO legislation requires that measures are notified to the administrator by the end of the month following the month of installation. The administrator may grant extensions to this deadline, but not in instances where the supplier's administrative oversight has caused the delay in notification.

39. The current rule ensures that suppliers report progress towards their obligation promptly and ensures that measures are not notified in a spike towards the end of the scheme, as experienced under ECO's predecessors (the Carbon Emissions Reduction Target and the Community Energy Savings Programme). We view regular monthly reporting as essential to providing transparency to both Government and industry on how the scheme is operating. As such, Government believes that it is desirable to maintain the current deadlines in the majority of circumstances. However, there are concerns that the current deadlines can sometimes be too strict, which may lead to poor quality reporting of information and measures not being accepted or approved, leading to issues of non-payment to installers.

40. We intend that simplifications to the scheme, in particular a move to deemed scores, should significantly reduce evidence requirements, making it easier for the supply chain to meet the one-month reporting deadline. In addition to this, we are proposing to relax the circumstances in which the scheme administrator may grant an extension to a reporting deadline. We are proposing two ways in which this could be achieved:

41. Firstly, we propose that a proportion (5%) of a supplier's measures may be notified up to three months later than the standard reporting deadline, without the need for an extension request to be approved by the Administrator. This will provide time to resolve small administrative issues with small volumes of measures, whilst ensuring the majority of measures are notified on time. Suppliers will still be able to apply to the scheme administrator for extension of measures which exceed the 5% threshold; however (as per current practice), approval of such requests will be at Ofgem's discretion.

42. Under the first obligation phase of ECO (2013-2015), the number of measures with accepted extension requests equalled 4.8% of all approved measures. Therefore, we propose that a limit of 5% for automatic extensions would provide sufficient flexibility for energy suppliers to overcome issues with small batches of measures, whilst ensuring that the majority of measures are still notified in accordance with the usual monthly reporting requirements.

43. We are also proposing to allow energy companies to request an extension in instances where they have made an administrative error. We intend this relaxation to enable energy suppliers to make extension requests for measures which have narrowly missed the notification deadline for administrative reasons, and are otherwise compliant. Please note, we intend for the Administrator to retain overall discretion in whether an extension request should be accepted.

Brokerage

44. The ECO Brokerage platform has been in place since January 2013 and has facilitated the sale of over £450m worth of ECO delivery contracts to date. There have been fluctuations in the level of

trading over this time, including a slowdown of trading during 2014 and 2015. Following changes to the ECO Brokerage contract, which was implemented in November 2015, trading levels have increased once again.

45. ECO Brokerage is currently being evaluated to consider the extent to which it has met its objectives and whether there is benefit in having an auction platform in the ECO transition and longer term phases. It was originally designed primarily to support the Green Deal. The current route to access Brokerage requires seller participants to obtain authorisation as a Green Deal Provider. It is a 'double blind' platform which means that neither seller nor buyer knows who either party is until they enter into a contractual agreement, and therefore the Green Deal authorisation process also provides a due diligence test for access to Brokerage.

46. The ECO consultation includes proposals to permit some social housing to be eligible under Affordable Warmth and for local authorities to have a greater role in identifying and determining certain households as eligible. These organisations are not typically Green Deal Providers, and unless they obtain authorisation, or the entry route is changed, they will be unable to gain access to Brokerage through the current Brokerage authorisation process.

Annex B – Broad policy objectives

Reduce UK Greenhouse Gas (GHG) emissions

47. The Climate Change Act 2008 created a legal requirement for the Government to reduce UK GHG emissions by at least 80% by 2050 relative to 1990 levels. Within this overall target, the first three carbon budgets (2008-22) require GHG emissions to fall by at least 34% by 2020 relative to 1990 levels. The fourth carbon budget (2023-2027) requires at least a 50% reduction in emissions by 2025 relative to 1990 levels.

48. The housing stock is responsible for a significant share of the UK's non traded carbon emissions (25%)[108], and primary energy consumption (27%)[109]. Therefore, the UK's carbon budgets, and legally-binding 2050 carbon target, cannot be met without reductions in GHG emissions relating to buildings.

49. Meeting the UK's legally-binding target to reduce GHG emissions by 80% by 2050 should be achieved at the lowest cost to consumers, businesses and society. Improving the energy efficiency of buildings is one of the most cost effective ways of reducing emissions. For example, as mentioned in Section 1, evidence from the IEA suggests that energy efficiency can, in many cases, have a lower capital outlay and a lower levelised cost[110] than renewable generation.[111]

Increase security of energy supply

50. The UK is becoming increasingly dependent on fossil fuel imports, leaving the UK more exposed to risks from rising global demand, limitations on production and price volatility. UK production of oil and gas has fallen from 134% of national demand in 2000 to 71% of demand in 2010. Published projections show a further fall to 48% in 2020[112].

51. Maintaining security of supply against the backdrop of rising reliance on imports requires three complementary actions:

    i. Ensuring that the UK has strong, resilient markets and infrastructure

    ii. Securing our energy supplies through greater use of domestic supplies and managing our relationships with other countries

    iii. Reducing domestic demand for energy.

52. Increasing the energy efficiency of homes should help reduce energy demand and thus reduce our reliance on fossil fuels.

Drive economic growth, innovation, and sustaining jobs

53. Increased demand for energy efficiency measures will likely support growth and jobs within the green construction industry and the wider supply chain for energy efficiency measures. Greater competition within these markets may also spur innovation, lowering the end costs of installing measures to households, and help sustain jobs. The estimated jobs sustained as a result of the extension to ECO are outlined in Section 8.

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[108] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/501292/eepReport2015_160205.pdf
[109] See domestic sector final consumption https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/450302/DUKES_2015.pdf
[110] The levelised cost of energy is an attempt to measure different forms of generation on a comparable basis.
[111] International Energy Agency, Energy Efficiency Market Report (2015) http://www.iea.org/publications/freepublications/publication/MediumTermEnergyefficiencyMarketReport2015.pdf
[112] Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249323/production_projections.pdf

Annex C – Input Assumptions

Capital cost assumptions

54. The following section sets out the capital expenditure (capex) assumptions using in the modelling. These cover both material and labour costs.

Capex – Insulation measures

55. Table C1 shows the capex assumptions for insulation measures, covering both the materials and labour, by dwelling type. The underlying cost data are the same as those used in the 2014 ECO Impact Assessment, with adjustments made by house type. These insulation assumptions are used across both the National Household Model and Affordable Warmth Model.

56. For the purposes of this IA, we do not assume any reductions in the real costs of installations over time. In practice, technological improvements and increased competition may lower the costs of installing energy efficiency measures and therefore lower the costs of the Regulations. We also do not expect the costs to rise over time, either, as it is assumed that the supply chain can meet the additional demand for energy efficiency measures without hitting capacity constraints.

Table C1: Capex Assumptions – Insulation measures (£, 2015 prices)

Dwelling Type	Cavity Wall Insulation (Easy To Treat)	Cavity Wall Insulation (Hard To Treat)	Loft Insulation	Solid Wall Insulation - External	Floor area (m^2)
Detached/Bungalow - Large	1,140	2,850	643	13,800	>117.03
Detached/Bungalow - Small	555	1,388	313	10,300	<117.03
Semi-detached/End of Terrace – Large	613	1,533	368	10,650	>80.45
Semi-detached/End of Terrace - Small	387	968	232	9,100	<80.45
Mid Terrace - Large	350	875	341	9,400	>75.5
Mid Terrace - Small	223	558	217	7,950	<75.5
Flat - Large	204	510	491	9,800	>54.29
Flat - Small	119	298	288	8,100	<54.29

Solid Wall Insulation in social housing properties

57. Feedback from obligated energy suppliers and members of the supply chain indicate that economies of scale can be achieved in the deployment of Solid Wall Insulation (SWI) when multiple properties are insulated as part of a single project. Similarly, market intelligence suggests that the majority of multi-property projects are likely to occur in social housing, where a single social landlord or Local Authority can agree to insulate a number of properties at a time.

58. The extent to which economies of scale can be achieved will depend on the particular project; however we make assumptions based on the market intelligence received as listed in Table C2. This range is tested as part of the sensitivities in Section 9 above.

Table C2: Discount applied to SWI in social housing due to economies of scale

Scenario	Cost reduction factor
Low Scenario	25%
Central Scenario	33%
High Scenario	40%

Capex assumptions – Conventional Heating

59. Table C3 lists our central capex assumptions for conventional heating measures, which are only modelled under Affordable Warmth. This is based on evidence of delivery costs observed under previous Government sponsored energy efficiency schemes. Heating system costs are dependent on the size required to service the heat demanded in a type and size of property. Costs therefore vary by the number of kW of heat output required. The source data provides costs for heating measures with capacities up to 28kW. We have estimated the capex for heating measures above 28kW capacity by assuming the same cost per kW as for 28kW capacity measures.

Table C3: Conventional heating capex assumptions (£, 2015 prices)

Capacity (kW)	Gas Boiler (£)	Oil Boiler (£)	Gas Central Heating (£)	Oil Central Heating (£)
12	1,358	2,240	1,924	2,700
15	1,454	2,260	2,061	2,724
18	1,519	2,354	2,152	2,837
24	1,739	2,864	2,465	3,452
28	2,205	3,342	3,124	4,028
32	2,519	3,819	3,571	4,603
36	2,834	4,296	4,017	5,179
40	3,149	4,774	4,463	5,754
44	3,464	5,251	4,909	6,329
48	3,779	5,728	5,356	6,905
52	4,094	6,206	5,802	7,480
56	4,409	6,683	6,248	8,056
60	4,724	7,160	6,695	8,631

Capex assumptions – Renewable Heating

60. Table C4 shows our central capex assumptions for domestic 10kW heat pumps used in the Affordable Warmth modelling. This is based on Sweett Group evidence collection from 2013,[113] and is consistent with the assumptions used in the most recent Renewable Heat Incentive Impact Assessment.[114] Due to the relatively high upfront cost the modelling does not lead to any anticipated deployment in the transition year, therefore we only show an illustration of the costs assumed here.

[113] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/204275/Research_on_the_costs_and_performance_of_heating_and_cooling_technologies__Sweett_Group_.pdf

[114] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/505132/Consultation_Stage_Impact_Assessment_-_The_RHI_-_a_reformed_and_refocussed_scheme.pdf

Table C4: Illustration of the capex assumed for renewable heat measures (£, 2015 prices)

Capacity (kW)	Ground Source Heat Pump (£)	Air Source Heat Pump (£)
10	19,740	9,918

Heating measure capex methodology

61. In order to heat homes effectively, households require heating systems that meet their peak load demands. Peak loads refer to the maximum level of heat that the household needs at any one time. However, market intelligence suggests that households typically install larger boilers than technically required, in part to avoid the risk of ever having too little capacity in place.

62. We have applied the assumption that installers install larger boilers than the household's estimated peak load, which is itself calculated using the National Household Model.

Average measure costs – Affordable Warmth modelling

63. The National Household Model is used to only model insulation measures targeted at the general population, the costs of which are shown in Table C1. In the Affordable Warmth modelling, a more diverse mix of insulation and heating measures are modelled in relation to a sub-set of eligible households (see Annex A for more details of Affordable Warmth eligibility criteria). Table C5 therefore shows the average capex for measures when applied to the housing stock in the Affordable Warmth model.

64. As the Affordable Warmth model is a micro-simulation model, the modelled cost of measures delivered in the modelling vary depending on which homes the model selects to install measures to. Therefore the costs in Table C5 should be interpreted as an illustration of cost per measure in the Affordable Warmth group only.

Table C5: Average measure costs across the Affordable Warmth Eligible Group (£, 2015 prices)

Measure	All Affordable Warmth Eligible population	3 bed semi-detached – Affordable Warmth Eligible Population
Cavity Wall Insulation – Easy to Treat	370	470
Cavity Wall Insulation – Hard To Treat	1,180	1,420
Loft Insulation	350	330
Solid Wall Insulation	9,550	10,120
Ground Source Heat Pump	15,200	15,740
Air Source Heat Pump	8,740	9,190
Heating Controls	Included in cost of other heating measures	Included in cost of other heating measures
First Time Central Heating - Gas	3,100	2,600
First Time Central Heating - Oil	3,250	3,530
Replacement Boiler - Gas	2,080	1,980
Replacement Boiler - Oil	4,380	3,050

Natural Boiler Replacement costs

65. Households are assumed to replace their boilers once they reach a certain age, with or without policy intervention, which we refer to as 'natural replacements' (see 'Other assumptions' section below for more detail on boiler lifecycles). These natural replacements will be sourced and funded by individual households, which are likely to be more costly than if the replacement were installed

through the supplier obligation. This is because individual households are not able to benefit from bulk delivery discounts that are available to suppliers and installers that can deploy boilers at scale. We assume that suppliers or their installers are able to deliver boilers at 75% of the cost that householders would face if replacing the boiler themselves. This is based on observed delivery cost data from previous Government sponsored energy efficiency schemes.

66. Additionally, we assume that households must pay VAT of 20% on top of the cost of the new boiler if replacing it themselves, whereas we assume that suppliers are not required to pay VAT on fully subsidised boilers under Affordable Warmth. We do not include the cost of VAT in regular cost benefit analysis calculations as it represents a transfer rather than a cost. However, we do include transfers in equity weighted cost benefit analyses as 'who pays' then becomes a consideration.

Administrative cost assumptions

67. Administrative costs fall into two categories – those faced directly by suppliers, and those that are likely to be faced by the supply chain in finding Affordable Warmth eligible households.

68. In terms of the administrative costs faced by obligated suppliers, as set out in Section 8.4 these are based on reported costs to DECC directly. Historically these costs have stayed relatively stable at around £80m per year. In late 2015 an evidence collection exercise was undertaken with suppliers to assess the extent to which the proposed scheme simplifications may lead to administrative cost savings. The average response across respondents was equivalent to around £5m per year in aggregate. We therefore assume a £5m reduction, resulting in supplier administrative costs of £75m per year.

69. In addition to the supplier admin costs, we also include the search costs involved in finding Affordable Warmth eligible households and also estimate separately the cost of warranties that accompany replacement boiler installations – a requirement under the scheme since 2014:

    - **Boiler warranty costs:** The cost of a warranty required with boiler replacements from 2017 onwards is estimated to be £130 per year, in line with assumptions from the 2014 ECO Impact Assessment.[115]

    - **Additional search costs for Affordable Warmth:** Where suppliers are obligated to deliver measures to households eligible for AW support, they incur costs of not only identifying suitable properties but also in searching for eligible households and verifying they are indeed eligible. In many cases these costs will be first incurred by the installer who will pass the cost on to the supplier. This can entail paying third parties for referrals and additional specifically-targeted marketing, among other approaches.

70. Table C6 shows the assumed search costs. Given the restrictions on boiler delivery we have taken more conservative search cost assumptions than in the 2014 ECO IA, by assuming that the previous 'central' search cost assumptions would be more reflective of a 'low' scenario in the transition year. The 'high' search cost assumptions remain the same. Taking the central estimate as the mid-point between the two gives central estimates of £125 and £400 for on and off gas grid households respectively for non-qualifying boiler replacements, compared to previous estimates of £50 and £300.

71. Search costs for qualifying boiler replacements have been maintained at the 2014 ECO IA levels, given there is no reason to believe search costs would increase for this measure when a boiler limit is in place.

[115] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/373650/ECO_IA_with_SoS_e-sigf_v2.pdf

Table C6: Assumed search costs of finding and verifying Affordable Warmth eligible homes (£, 2015 prices)

Measure	Search cost per household successfully delivered to (£)
Qualifying boiler replacements – on gas grid	50
Qualifying boiler replacements – off gas grid	300
Other measures – on gas grid	125
Other measures – off gas grid	400

Other costs

Hidden costs of installing measures

72. Table C7 shows the estimated hidden costs of installing measures, which are applied in both the National Household Model and Affordable Warmth model. These include the time taken by householders to liaise with the installer, prepare the property for installation and any oversight, as well as clean-up or redecoration costs associated with the installation. These estimates are based on the ECOFYS report of domestic energy, uprated to 2015 prices.[116]

Table C7: Estimated hidden costs of installing measures (£, 2015 prices)

Measure	Hidden Cost (£/installation)
Cavity Wall Insulation	115
Loft Insulation	145
Solid Wall Insulation - External	235
Replacement Boiler	70
First Time Central Heating	125
Ground Source Heat Pump	255
Air Source Heat Pump	200
Heating Controls	Included in hidden costs for other heating measures

73. For Affordable Warmth modelling, these costs are only included in cost benefit analyses – they do not form part of supplier delivery costs. For CERO and CSCO modelling, these costs are factored into the households' decision as to whether to take up a measure (see Annex D for more details), although they again they do not form part of supplier delivery costs.

Operation costs/expenditure (Opex)

74. Opex relates to the annual cost of running heating measures, and includes servicing and maintenance costs, but not the fuel costs. Opex is assumed to be fixed at £100 per year for each heating measure (excluding heating controls). These costs are included in cost benefit analyses only – they do not form part of supplier delivery costs, as they are assumed to fall to the householder.

Other Key Assumptions

Measure Lifetimes

[116] ECOFYS (2009). *The Hidden Costs and Benefits of Domestic Energy Efficiency and Carbon Saving measures.* Available at: http://webarchive.nationalarchives.gov.uk/20121217150421/http:/www.decc.gov.uk/assets/decc/what%20we%20do/supporting%20consumers/saving_energy/analysis/1_20100111103046_e_@@_ecofyshiddencostandbenefitsdefrafinaldec2009.pdf

75. The assumed lifetimes of measures are a key assumption as they determine the extent to which measures continue to have an impact beyond their initial installation, and therefore the overall costs and benefits. Table C8 shows the assumed measure lifetimes for cost benefit analysis.

Table C8: Assumed lifetimes of measures

Measure	Lifetime (years)
Cavity Wall Insulation	42
Loft Insulation	42
Solid Wall Insulation – External	36
Replacement Boiler – Gas	12
Replacement Boiler – Oil	14
First Time Central Heating – Gas	12
First Time Central Heating - Oil	14
Ground Source Heat Pump	20
Air Source Heat Pump	15
Heating Controls	Same as heating measure the controls are installed with

76. These assumptions are the same as those used in the 2014 ECO Impact Assessment[117] and are also those published by OFGEM in the ECO Measures Table[118], except for oil boilers and oil central heating where we have based the lifetimes on analysis of boiler lifecycles in the English Housing Survey (see next section below). Gas boiler and gas first time central heating lifetimes are 12 years for scoring and cost-benefit analysis purposes.

Boiler Lifecycles

77. An analysis of English Housing Survey data has been undertaken to inform our assumptions around the age at which boilers are replaced, for different boiler types and household characteristics. Households eligible for Warm Front or Affordable Warmth were excluded to remove any potential effect from the delivery of boilers through DECC policies. Table C9 summarises the average boiler replacement rates, by housing tenure and fuel poverty status.

Table C9: Estimated natural gas boiler replacement rates, by tenure and fuel poverty status

Population segment	Boiler replacement age (years)
Non-fuel poor in gas fuelled private tenure housing	10
Fuel poor in gas fuelled private tenure housing	15
Fuel poor in gas fuelled social housing	12

78. This analysis highlights that the general non-fuel poor population appear to replace their boiler after 10 years. This is two years before DECC's estimate of the technical lifetime of a gas boiler (12 years). This difference is likely to be driven by households replacing their boiler before it is broken, for example during renovation periods; because the boiler may have already begun to show signs of unreliability or inefficiency; or to upgrade their boiler.

79. The results also show that private tenure fuel poor households appear to replace their boilers 3 years after the technical lifetime of boilers (15 years as opposed to 12 years). This suggests that these households may resort to using expensive plug-in heaters or other coping mechanisms for a

[117] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/373650/ECO_IA_with_SoS_e-sigf_v2.pdf
[118] https://www.ofgem.gov.uk/sites/default/files/docs/2014/12/energy_companies_obligation_-_measures_0.pdf

period of 3 years whilst their boiler is broken before replacing it.[119] The analysis suggests that fuel poor households in social housing replace their boilers when they reach around 12 years old, i.e. the technical lifetime of the boiler. This is likely to be because social landlords would replace the boiler themselves once a boiler breaks in their properties.

80. Similar analysis was carried out on boiler replacement rates and ages for a range of heating fuels. This found that, on average and across the entire English housing stock, the replacement age for oil boilers is around 2 years greater than the replacement age for gas boilers.

81. Based on the above analysis, and assuming a similar relationship between replacement ages across tenure and fuel poverty status for oil boilers as observed for gas boilers, we assume the boiler replacement cycles outlined in Table C10.

Table C10: Estimated natural boiler replacement cycles, by tenure

	Age boiler breaks	Natural replacement age - social housing	Natural replacement age - owner occupiers in eligible pool	Natural replacement age - other
Gas Boiler	12	12	15	10
Oil Boiler	14	14	18	12

82. Note that in Table C10 we assume that the replacement ages for private tenure fuel poor households can be applied to owner occupiers in the Affordable Warmth eligible pool. The rationale for this is that, by definition, those in the eligible pool are on low incomes and therefore less able to pay for a new boiler when their existing boiler breaks. We have restricted this assumption to owner occupiers within the eligible pool on the grounds that the analysis above suggests social tenure landlords replace boilers at the point at which they break, and churn in the private rental sector market should mean that private tenure landlords have strong incentives to replace boilers when they break.

Deemed Scores

83. One of the main simplification proposals in the transition year is to introduce a set of 'deemed scores', in order to avoid the necessity to complete a full dwelling survey before an installer can determine whether it would be cost-effective to install a measure in that particular dwelling. The ECO administrator, Ofgem, is currently undertaking a project to calculate proposed deemed scores for use in the transition year, which will be consulted on in due course.

84. As a result, we are at this stage unable to use the confirmed deemed scores in the modelling, and the National Household Model has not explicitly used deemed scores for the purposes of estimating impacts and uptake in this consultation impact assessment. The NHM energy calculator, however, is able to broadly replicate deemed scores. For the Affordable Warmth model, a set of illustrative deemed scores has been used, and both models will apply Ofgem's proposed deemed scores for the final stage impact assessment later this year.

85. The Affordable Warmth model uses a deemed score (notional lifetime bill savings, based on SAP assumptions for energy usage and fuel prices) for each measure and dwelling archetype to calculate the cost-effectiveness of installing different measures and packages of measures. These deemed scores have been derived by using the National Household Model (NHM) to calculate annual energy use before and after installing each measure.

[119] As detailed in previous ECO IAs, evidence from the Warm Front scheme in England showed that when installers arrived to replace a broken boiler, around 60% of households were heating their homes using electric plug-in heaters whereas around 40% were using their broken boiler intermittently. Further, the Warm Front Process Evaluation illustrates through case studies the coping mechanisms some households resorted to: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/322901/Warm_Front_Evaluation_Report.pdf

86. The energy savings are converted to annual bill savings by applying SAP prices (SAP 2015 prices uprated to 2017 prices, using the Interdepartmental Analysts' Group projection of energy price changes).[120] These are then converted into lifetime notional bill savings – the Affordable Warmth Target metric – by multiplying by the lifetime of the measure as specified in the Ofgem ECO Measures Table.[121] For some measures and dwelling types, uplifts are applied in line with current ECO scoring methodology:
    - Scores for replacing qualifying gas boilers are deflated by a factor of 0.8 (i.e. the replacement of a qualifying gas boiler that originally scored 100 would score 80 after applying the deflator)
    - Scores for replacing qualifying non-gas fuelled boilers are inflated by a factor of 1.45
    - Scores for installing insulation in households whose main heating fuel is not gas are uplifted by a factor of 1.35.

87. The deemed scores used in the Affordable Warmth model are created by averaging the lifetime bill savings over different dwelling archetypes, based on the following categories:
    - Built form (e.g. semi-detached, mid-terrace etc.)
    - Fuel type (gas, electricity etc.)
    - Number of bedrooms (1 to 10)

88. Table C11 shows the illustrative average deemed scores used in Affordable Warmth modelling for each measure, for different populations. These include uplifts and deflators to scores that are applied to certain households in line with current ECO scoring.

Table C11: Illustrative deemed scores used in Affordable Warmth modelling (Lifetime notional fuel bill savings, estimated 2017 SAP prices)

Measure	Affordable Warmth Eligible population (£)	3 bed semi-detached house – Affordable Warmth eligible population (£)
Cavity wall insulation	9,932	10,184
Loft insulation	1,392	1,085
Solid wall insulation	14,849	15,543
Ground Source Heat Pump	- 13,007	- 18,211
Air Source Heat Pump	- 10,794	- 13,778
Heating Controls	1,022	1,237
First time Central Heating - Gas	11,017	3,223
First Time Central Heating - Oil	13,844	15,312
Replacement non-qualifying boiler - Gas	2,590	2,671
Replacement non-qualifying boiler - Oil	5,355	4,255
Replacement qualifying boiler - Gas	13,041	13,891
Replacement qualifying boiler - Oil	16,368	14,516

89. It should be stressed that these scores are **illustrative estimates only**, for use in modelling the Affordable Warmth obligation at this consultation stage. Ofgem will be providing finalised deemed scores in time for the Final Stage Consultation.

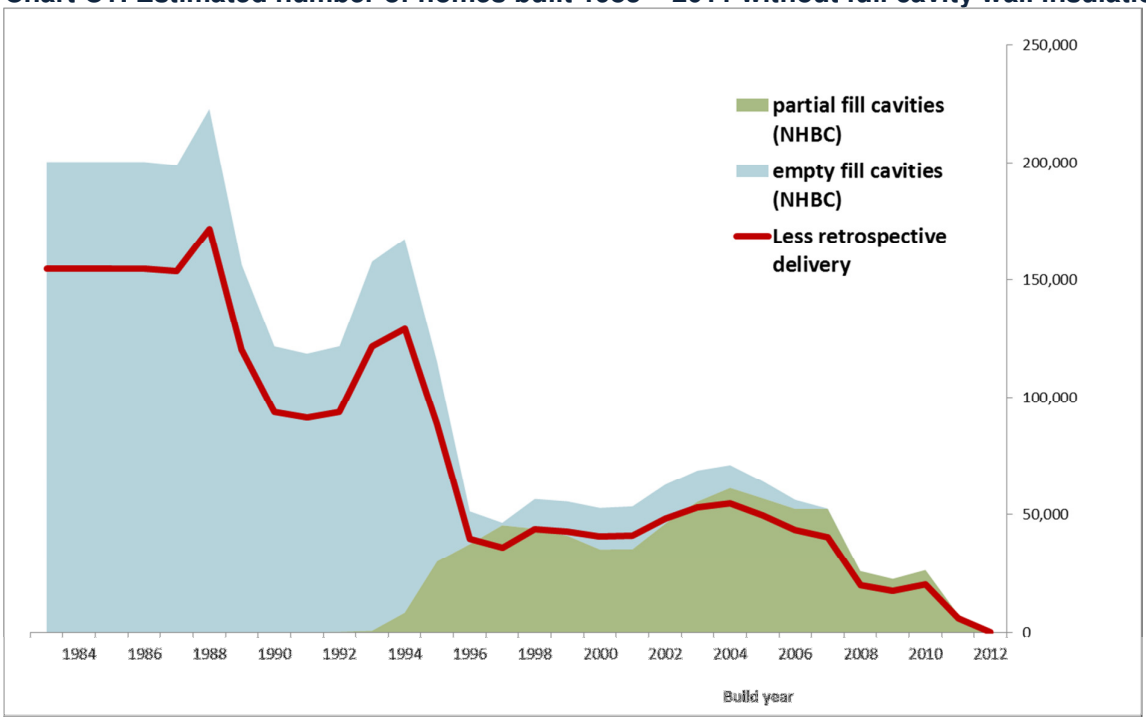
[120] Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[121] Available here: https://www.ofgem.gov.uk/sites/default/files/docs/2014/12/energy_companies_obligation_-_measures_0.pdf

Technical potential

90. The number of households with remaining technical potential for measures has been calibrated to published DECC National Statistics[122] in both models, with the exception of cavity wall insulation. These statistics at present assume that homes built during 1983-1995 without cavity wall insulation are limited in their potential and homes built from 1996 onwards have partial / full cavity wall insulation in order to comply with building regulations, and are therefore not included in the technical potential estimates. However, emerging evidence from the NHBC, a provider of insurance and warranties for new homes, suggests that a significant number (approximately 2.9 million) homes built since 1983 (see chart C1) did not have cavity wall insulation fitted when they were first built. Further analysis using the National Energy Efficiency Data-framework (NEED)[123] showed that cavity walled homes built in the period 1983 – 2011 were performing, in energy use terms, similarly to homes with no cavity wall insulation installed. It also showed that a number of homes built in this period have since had cavity wall insulation installed, demonstrating the potential to install retrofit insulation in these properties. This means that many of the empty cavity wall properties built since 1983 are suitable for retro-fitted cavity wall insulation.

91. For the purpose of this impact assessment, therefore, we have included an additional 2.3 million homes (once retrospective installations are accounted for) in the remaining cavity wall remaining. This additional potential is shown in Chart C1, and is estimated to all be 'easy to treat'.

Chart C1: Estimated number of homes built 1983 – 2011 without full cavity wall insulation



92. This figure of 2.3 million represents DECC's initial estimate of the additional technical potential available, and will be revisited in the final stage IA. An official estimate of this additional potential will also be included in revised in forthcoming DECC National Statistics.

[122] For the latest estimated remaining potential please see: https://www.gov.uk/government/statistics/green-deal-energy-company-obligation-eco-and-insulation-levels-in-great-britain-detailed-report-to-june-2015

[123] For more information on the National Energy Efficiency Data-framework (NEED), see: https://www.gov.uk/government/collections/national-energy-efficiency-data-need-framework

93. Taking into account this provisional figure for the additional potential, Table C12 shows the estimated remaining technical potential across the GB housing stock as used in both the Affordable Warmth modelling and the National Household Model.

Table C12: Estimated remaining technical potential for insulation measures across the GB stock

Date	Cavity wall insulation	Solid wall insulation	Loft insulation
01/01/2012	6.9m	7.6m	7.3m
01/01/2013	6.3m	7.6m	5.7m
01/01/2014	6.1m	7.5m	5.6m
01/01/2015	5.8m	7.5m	5.5m
01/01/2016	5.6m	7.4m	5.4m
01/01/2017	5.4m	7.4m	5.3m

94. Loft insulation remaining potential figures exclude lofts defined in DECC statistics as being hard to treat (these includes lofts which are unfillable, this can occur in properties with a flat roof or in properties where the roof has a very shallow pitch which makes the loft space inaccessible).

95. Cavity wall insulation remaining potential figures exclude cavities defined in DECC statistics as having limited potential, but includes the additional potential in homes built post 1983.

96. Given the restrictions on eligibility, technical potential in the Affordable Warmth group is lower than across the GB housing stock. Table C13 shows the estimated remaining technical potential after applying the Affordable Warmth eligibility criteria (see Annex A for further detail on eligibility), again taking into account the additional cavity wall insulation potential.

Table C13: Estimated remaining technical potential for measures in the AW eligible group across the GB stock

Millions of measures	Technical potential in AW eligible group
Easy to Treat Cavity Wall Insulation	0.3
Hard to Treat Cavity Wall Insulation	0.4
Loft Insulation	0.9
Solid Wall Insulation - external	1.5
Boiler upgrades - gas	0.8
Boiler upgrades - non-gas	0.1
Qualifying boiler replacements - gas	0.4
Qualifying boiler replacements - non-gas	0.02
First time central heating - gas	0.08
First time central heating - non-gas	0.1
Heating controls	0.4
Ground Source Heat Pump	0.8
Air Source Heat Pump	1.1

Proportion of technical potential that is identifiable

97. In both the NHM and Affordable Warmth modelling restrictions are placed on how much of the technical potential the supply chain can identify and install in any single year, i.e. they don't have perfect sight of the market. To account for this we assume that each year suppliers can only target a random proportion of available potential, with this proportion varying by measure (and additionally

for NHM modelling, by tenure). The assumed proportion of technical potential that is identifiable in each model is shown in Table C14, under central, low and high scenarios.

Table C14: Estimated proportion of technical potential that is identifiable in the transition year

Obligation	Measure	Low	Central	High
Affordable Warmth	Cavity Wall Insulation – Easy to Treat	14.0%	15.3%	16.7%
	Cavity Wall insulation – Hard to Treat	6.0%	11.3%	16.7%
	Loft Insulation	19.0%	19.6%	20.2%
	First time central heating	50.0%	67.5%	85.0%
CERO/CSCO	Cavity Wall Insulation	2.1% - 3.2%	2.7% - 4.0%	3.2% - 4.8%
	Loft Insulation	0.3% - 3.5%	0.4% - 4.4%	0.5% - 5.2%
	Solid Wall Insulation - External	1.1% - 3.6%	1.4% - 4.5%	1.6% - 5.4%

98. For Affordable Warmth modelling, the Low, Central and High values have been derived as follows:

- **Low** values are based on calibrating the AW model such that it mirrors historical delivery (after setting model parameters to mimic the current AW obligation design). Given that the delivery under Affordable Warmth to date has been dominated by boiler replacements with less incentives to deliver (and identify) other types of measure, we have assumed that this reflects a scenario where the ability to identify potential for others measures is towards the low end of the scale.

- **High** values are based on the proportion of technical potential that is identifiable under CERO modelling (see below for how CERO and CSCO proportions are derived). CERO represents an unconstrained market and we have therefore assumed that these proportions are reflective of a reasonable 'high' scenario.

- **Central** values are taken as the mid-point between low and high values.

- It was not possible to apply the above approach to first time central heating as a) delivery under AW has been so limited, and b) central heating is not an eligible measure under CERO (or CSCO). In the absence of available data we have therefore assumed that suppliers would be able to identify half of all first time central heating potential under the low scenario, and 85% under the high scenario, from which the central estimate of 67.5% is derived. While this is an assumption, it is anticipated that the lack of a central heating system is relatively straight forward to identify, particularly compared to alternative measures.

- We have not applied constraints to solid wall insulation potential under Affordable Warmth at present, as it has been assumed that technical potential for this measure is easy to identify given the relatively high starting technical potential.

- We also have not applied constraints to replacement boiler potential, as previous delivery under Affordable Warmth indicates that suppliers can identify this potential easily and deploy at scale – i.e. 75,000 – 100,000 boilers per year, relative to a proposed boiler limit of 25,000 in the ECO transition year.

99. For CERO and CSCO modelling, central values have been derived by calibrating the model such that it matches delivery under these obligations in 2014 and 2015, split by measure type and tenure. Low and High values are then found by adding ± 20% to the central values.

Energy savings from installing measures

100. Both the National Household Model and the Affordable Warmth model use underlying energy calculations based on building physics models, which for the purposes of the cost-benefit analysis

and associated results are calibrated to observed energy use and energy savings from installing measures.

101. The NHM has its own energy calculator, which is based on the Standard Assessment Procedure (SAP),[124] and this means a property's theoretical energy use before and after a measure is installed can be calculated within the model. The theoretical saving that results is then calibrated using an 'In Use Factor',[125] as well as a 10% underperformance factor (reflecting that perfect installation, such as fully insulating 100% of a wall, is not always possible to achieve), and comfort taking (see next section).

102. The Affordable Warmth model, similarly, begins with estimates of the energy needed by households to achieve the heating regimes set out in the fuel poverty methodology manual[126] according to the BREDEM2012 energy model – a similar method to SAP, more tailored to the household in the property. These energy use estimates are the same as those used to calculate fuel poverty in England. Theoretical savings from measures are calculated using a range of bespoke savings factors created especially for the fuel poverty dataset, which are in turn adjusted such that they are consistent with the post-In Use Factor savings described above in relation to the NHM.

Comfort Taking

103. When a measure is installed in a home, observed data (for example, from the National Energy Efficiency Data-framework – NEED) typically shows a lower energy saving than standard buildings models would predict. Part of the reason for this is that energy efficiency measures either reduce the cost of achieving the same degree of comfort in the home, and therefore households choose to take some of this saving in the form of increased thermal comfort; or they allow a greater degree of warmth to be achieved as a result of the installation (for example, first time central heating). The additional warmth households choose to take is referred to as 'comfort taking'. This is valued at the retail price of energy, because this reflects households' willingness to pay for additional warmth.

104. Consistent with previous ECO impact assessments, Table C15 lists the comfort taking assumptions used in the two models. We do not assume any comfort taking in relation to boiler upgrades (where the existing system is functional) as there is at present limited evidence in relation to this, with the same applying to heat pumps.

105. In the case of replacement boilers where the existing system is broken and the low income householder cannot immediately afford to replace it, we draw on evidence from the 2008 Warm Front Evaluation,[127] which showed that after the installation of heating measures (a pre-requisite for Warm Front was having either a broken boiler or no central heating system at all) homes were on average 1.5˚C to 2.5˚C warmer due to the level of underheating when the boiler was broken. The same assumption is made for first time central heating, given that in both instances households are likely to be heating only a section of the home.

[124] The Standard Assessment Procedure is the Government's methodology for assessing the energy performance of domestic buildings. More information is available here: http://www.bre.co.uk/sap2012/page.jsp?id=2759
[125] A list of the In Use Factors used in CERO and CSCO analysis is available here: https://www.ofgem.gov.uk/sites/default/files/docs/2015/10/eco2_measures_table_-_oct_2015-_v2_3_-_final.pdf
[126] More information is available here: https://www.gov.uk/government/publications/fuel-poverty-methodology-handbook-2013
[127] Warm Front, Better Health – available at: http://www.apho.org.uk/resource/item.aspx?RID=53281

Table C15: Comfort taking assumptions, by measure (expressed as % of saving forgone, unless otherwise stated)

Measure	Affordable Warmth Model	National Household Model
Cavity Wall Insulation	15%	15%
Loft Insulation	15%	15%
Solid Wall Insulation	15%	15%
Non-condensing to condensing boiler	0%	N/A
Replacement for a broken boiler	Equivalent to 2˚C improvement in internal temperature	N/A
Air Source Heat Pump	0%	N/A
Ground Source Heat Pump	0%	N/A
First Time Central Heating	Equivalent to 2˚C improvement in internal temperature	N/A

Fuel prices used in uptake modelling

106. Fuel prices do not feed directly into the Affordable Warmth uptake methodology, as measures are assumed to be offered with full subsidy and so the householder is not expected to need to weigh up whether the measure will provide them with bill savings necessary to outweigh any contribution they may be required to make.

107. Within the NHM modelling of CERO and CSCO, however, households face a choice in relation to whether they choose to take up measures based on the level of subsidy offered to them (more detail in Annex D). Historically under ECO, a Green Deal Advice Report (GDAR) or Chartered Surveyor's Report (CSR) was typically used to inform the household of the potential energy and bill savings that could be achieved over the lifetime of the measures on offer. This would use price assumptions from SAP. While it is proposed that the requirement to have a GDAR or CSR is no longer required in the ECO transition year, we assume that any bill saving information obtained by households continues to be based on the use of SAP prices. These prices are updated over time, and therefore we estimate these by uprating the 2012 SAP unit costs using the energy price trajectories listed in the Interdepartmental Analysts' Group (IAG) guidance to convert them to 2017 prices. These are listed in Table C16.

Table C16: Estimated SAP prices for use in NHM uptake modelling, p/kWh

Fuel	Unit price (excluding s/c) - 2012 prices	Estimated 2017 central value
Mains Gas	4.25	4.31
bulk LPG	8.46	8.58
bottled LPG	10.61	10.76
heating oil	5.43	6.07
house coal	4.01	3.87
Electricity (standard)	15.06	16.59
Economy 7 (day rate)	17.81	19.62
Economy 7 (night rate)	6.67	7.35
Biomass wood	4.65	5.20
Biomass pellets	5.70	6.38
Biomass wood chips	3.36	3.76

Interest rates

108. As outlined in Section 8, under CERO and CSCO where householders may be required to contribute to the cost of measures we assume that they either borrow the funds or forgo interest/investment returns in order to invest in the measure(s). The assumed interest rate within the

NHM is around 7%, based on the interest rate for energy efficiency measures estimated under the Green Deal.

Scaling data to represent Great Britain

109. The National Household Model is based on the 2012 English Housing Survey and 2012 Scottish House Condition Survey, with historical delivery used to bring the housing stock up to date. The Welsh component of the housing stock is based on an adjusted sample of the English stock, due to the lack of available recent data on the former.

110. The Affordable Warmth model is based on data from the 2013 English Housing Survey. To estimate impacts for Great Britain as a whole, outputs have been scaled up based on the ratio of the number of dwellings in England to Great Britain (1.168), calculated from official statistics.[128]

Fuel poverty calculations

111. The fuel poverty impacts estimated in Section 8 are made using the methodology set out in the analytical annex to *Fuel Poverty: A Framework for Future Action*.[129] Given data constraints, the fuel poverty estimates are for England only, although we expect that similar if not greater impacts to be observed in Scotland and Wales.

Equity-weighting

112. In line with the *Green Book*[130] we apply equity-weights to our cost-benefit analysis to value the distributional impact of the main policy options. Equity weighting accounts for the difference in value that a household in a lower income group places on £1 of cost or benefit compared to a household in a higher income group.

113. The equity weights used are shown in Table C17. They are based on After Housing Cost Equivalised (AHCeq) income. AHCeq income is estimated using data from the 2013 Fuel Poverty Analytical Dataset, which itself is based on the 2013 English Housing Survey.

Table C17: Equity Weights using After Housing Cost Equivalised Income

Income Decile Group	1	2	3	4	5	6	7	8	9	10
Equity Weight	3.6	2.0	1.5	1.3	1.1	0.9	0.8	0.7	0.5	0.4

114. Using the equity weights, an additional £1 for *any* household in the lowest income decile group would be valued at £3.6, whereas an additional £1 to *any* household in the highest income decile group would be valued at £0.4.

115. Table C18 provides a summary of where equity-weights are applied in the cost-benefit analysis. Equity weights are applied to the costs passed through to energy consumers (installation costs (including economic rents / 'excess subsidy') and administration costs), and also to comfort taking, economic rents / 'excess subsidy' accruing to households, and the societal benefit from lower income households benefiting from lower energy bills.

[128] https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants
[129] Fuel Poverty: A Framework for Future Action, available at: https://www.gov.uk/government/publications/fuel-poverty-a-framework-for-future-action
[130] HM Treasury (2003). *The Green Book*. Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

Table C18: Summary of differences between NPV and equity-weighted NPV

Cost / benefit category	NPV (not weighted)	Equity-weighted NPV
Installation Costs	This covers just the capital cost of measures installed. No economic rent / 'excess subsidy' is counted, as this represents a transfer from one group to another with no net cost or benefit.	This is now: [capital costs of measures] + [economic rent / 'excess subsidy'], as the rent represents a transfer from bill payers to households receiving measures. This is weighted according to the distribution of gas and electricity bill payers across the income scale (Table C19).
Administration Costs (including boiler warranties and search costs under Affordable Warmth)	Administration costs are virtually all ultimately paid for by suppliers, and so this forms part of the costs passed on to gas and electricity consumers.	Administrative costs are part of the total scheme costs passed back to consumers, so this is weighted according to the distribution of gas and electricity bill payers.
Hidden Costs	Hidden costs of installing energy efficiency measures	No change, as unclear the extent to which value of time varies across recipient households.
Value of Change in CO2e	Energy changes x emissions factors x carbon values	No change, as all households benefit equally.
Value of Change in Air Quality	Energy changes x AQ damage factors	No change, as all households benefit equally.
Change in Energy Use (Societal)	Energy changes x Long Run Variable Cost of Energy Supply[131]	No change, as all households benefit equally.
Comfort taking	Comfort taking kWh x retail price	Comfort taking is achieved by forgoing bill savings in favour of greater warmth, and lower income households have a higher marginal utility of income. This is therefore weighted according to the income distribution of the households taking comfort.
Extra utility from lower bills in low income households	Forms no part of the regular NPV, as this is purely distributional	Energy bill savings are a private benefit, however society derives a benefit from the knowledge that low income households are benefiting from lower energy bills. This is because energy is a necessity and lower income households are constrained in how well they can meet basic energy needs, such as heating. This distributional benefit is therefore calculated as: *[Energy savings x Retail price x Equity-weight of recipient households] – [Energy savings x Retail price]*

[131] In line with the supplementary Green Book guidance on valuing changes in energy and greenhouse gas emissions: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Value of economic rent to low income	Forms no part of the regular NPV, as economic rents are a transfer.	For the purposes of this IA, we assume that any 'excess subsidy' or economic rent accrues to households receiving measures. Where this accrues to lower income households, this generates a distributional benefit. Therefore the rent (which is also weighted as part of the costs above), is weighted according to the distribution of recipient households.

116. Table C19 lists the estimated income distributions of:

i. Gas and electricity consumers, who are assumed to bear the costs of the scheme as a result of energy suppliers passing the costs through;

ii. Households receiving measures under the Affordable Warmth obligation; and

iii. Households receiving measures under CERO.

117. The distributions show that among energy consumers overall there is a slight skew towards higher income households, due to them being unconstrained in their consumption of energy. However, because energy is a necessity, the overall distribution is relatively even and generates an equity-weight of 1.2 because lower income households feel the costs of energy disproportionately. The distributions for recipients show a heavy skew towards lower income groups under Affordable Warmth (as expected), and a mixed distribution for CERO recipients where the majority of measures are expected to fall to middle and higher income households.

Table C19: Estimated After Housing Cost (AHC) Equivalised Income distributions used in equity-weighting

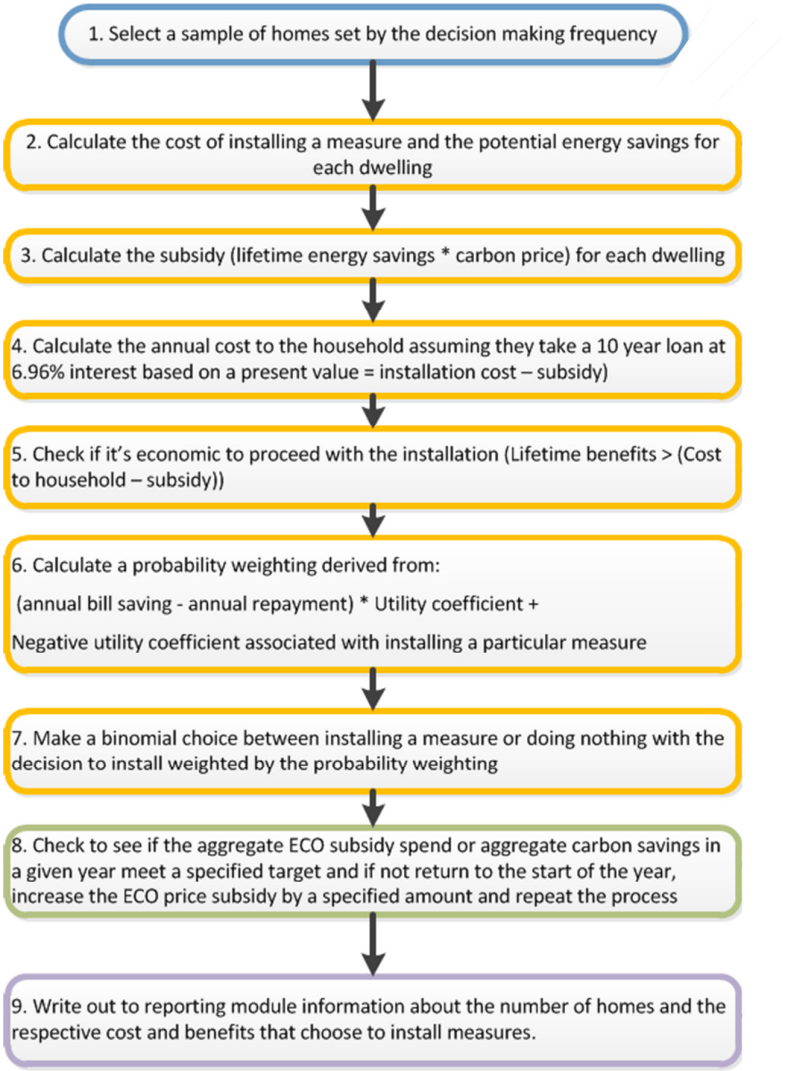
AHC Equivalised Income Decile Group	Proportion of domestic gas and electricity demand	Affordable Warmth Recipients	CERO Recipients
1	9%	34%	7%
2	10%	25%	7%
3	9%	16%	9%
4	10%	5%	10%
5	10%	4%	13%
6	10%	5%	11%
7	10%	8%	13%
8	10%	2%	9%
9	11%	1%	11%
10	12%	0%	11%
Average equity weight	**1.2**	**2.2**	**1.2**

Annex D – National Household Model

Model overview

1. The CERO and CSCO modelling is undertaken using the National Household Model (NHM). The NHM provides a simulation environment to model the energy and carbon savings from installing measures to homes across the GB housing stock. The CERO and CSCO model within the NHM estimates the subsidy cost to suppliers of delivering insulation measures to the domestic housing stock in GB (in terms of £/tonne CO_2). The NHM is then used to simulate uptake of insulation measures by deriving the resulting energy savings of installing loft and wall insulation to homes and the level of subsidy required to meet either a carbon saving or spend obligation. Chart D1 provides an outline summary of the steps taken in the modelling.

Chart D1: Summary of steps taken in CERO/CSCO modelling in the NHM



Key Inputs

2. The key model inputs are outlined in Annex C. The CERO/CSCO model uses a housing stock derived from the 2012 English housing survey[132], combined with the Scottish House Condition Survey. The properties vary by fuel type, build type and size.

3. The model derives the energy savings using an interpretation of the BRE SAP 2009 methodology[133] but deviates from SAP assumed parameters where the NHM model uses specific details about a house such as the efficiency of heating appliances. The energy calculator also uses projected SAP 2017 fuel prices[134] to calculate the fuel bill savings that households perceive when deciding whether to take up a measure or not. Lifetime energy savings are used in the derivation of subsidies and these have been adjusted by the use of in-use factors.[135]

Methodology

4. The model estimates the level of subsidy suppliers need to offer per tonne of lifetime carbon saved in order to meet their CERO/CSCO targets – which we refer to as the 'carbon price'. The total cost of subsidy to the energy company is calculated as:

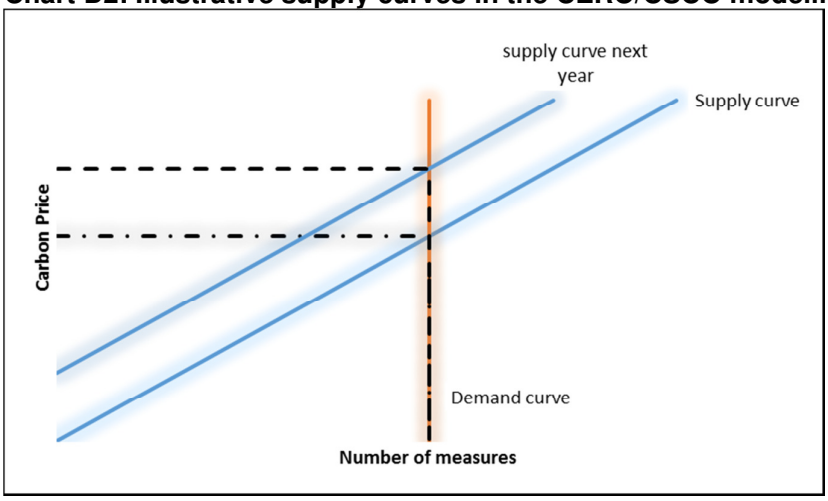
*Total Subsidy = carbon price * [annual energy savings * carbon intensity of fuels saved] * measure lifetime * (1 - In Use Factor)*

5. The model tests offering different levels of subsidy to households and tests whether they are sufficient to generate enough carbon savings to meet a given target. Increasing the subsidy not only increases the amount spent per property; it also increases the number of properties installing a measure because the model employs a utility function (see below) to decide which homes decide to install measures by assigning. Increases to the subsidy increase the propensity of take up because a home is more likely to install a measure in situations where a subsidy covers most, if not all, of the cost of a measure.

6. In this way the model is able to identify the carbon price / subsidy level required in a given year that meets the obligation. In subsequent years the supply curve shifts to the left because the remaining technical potential diminishes over time as measures are installed to homes with higher potential energy savings, leaving homes with lower returns to be targeted in subsequent years (see Chart D2). This makes it more expensive (higher subsidies are required) to deliver equivalent energy savings going forward.

[132] https://discover.ukdataservice.ac.uk/catalogue/?sn=7511&type=Data%20catalogue
[133] http://www.bre.co.uk/sap2009/page.jsp?id=1642
[134] http://www.bre.co.uk/filelibrary/SAP/2012/SAP-fuel-prices-July-2015-summary.xls
[135] https://www.ofgem.gov.uk/ofgem-publications/83100/energycompaniesobligation-measures-pdf

Chart D2: Illustrative supply curves in the CERO/CSCO modelling



Utility function

7. The model employs a utility function to determine whether a household will take up measures based on the subsidy on offer. The approach and coefficients used (Table D1) follow on from the social research undertaken for the 2012 ECO impact assessment.

8. The estimated utility (or satisfaction) a household perceives from the offer of subsidy is calculated as follows:

   [Upfront cost to householder after subsidy offered x Upfront cost coefficient] + [Hidden cost of measures x Hidden cost coefficient] + [£bill saving x bill savings coefficient] + [negative utility associated with a 10 year loan] + [negative utility associated with a particular measure]

9. The utility function score is transformed into a probability of the household taking up the measure(s) of between 0 and 1 using the following exponent transformation.

   $1/1+(-z)$

Table D1: Consumer choice coefficients used in the utility function

Category	Consumer coefficients
Upfront cost coefficient	-0.00028
Savings - fixed interest risk (£)	0.0034
Savings - variable interest risk (£)	0.0031
Repayment - 10 years	-0.123
SWI internal	-2.1666
SWI external	-2.0644
CWI	-1.3087
Loft Insulation	-0.8613

Annex E – Affordable Warmth Model

Model Overview

1. The Affordable Warmth model simulates the delivery of measures that reduce the cost of heating homes for households that meet the Affordable Warmth eligibility criteria. A summary of the modelling methodology applied in this Impact Assessment is set out in detail in this section.

   The modelling approach can be broken down into the following steps:

   1. **Identify the technical potential for installing measures in each household**
      The model firstly assesses the technical potential for installing a range of major insulation and heating measures in English households. It does this based on data from the 2013 English Housing Survey (which provides characteristics of the English housing stock at that point in time) combined with suitability criteria for the different measures, and predicted measure delivery between 2013 and the start of the transition year (from other DECC models). Modelled remaining potential at 2014 is calibrated to remaining potential according to published DECC ECO statistics for insulation measures[136] (after accounting for additional cavity wall potential in properties built post 1983 – see Annex C on technical potential).

      Potential for replacement boilers is treated slightly differently, to account for households replacing their boilers in the absence of receiving a boiler through ECO (referred to as 'natural replacement') and boilers breaking down. Modelling of boiler lifecycles is covered in more detail in the section below.

   2. **Identify the most cost effective package per household**
      The model calculates a cost-effectiveness score for each feasible measure and package of measures for each household, on the basis of the deemed lifetime bill savings score (Affordable Warmth metric) and the cost of installing each package (assuming that measures are fully subsidised). This gives the cost per Affordable Warmth point achieved by the package. These scores are compared across the feasible packages to find the most cost effective package (and corresponding score) per household.

   3. **Restrict the market to eligible, findable households and measures**
      Market restrictions are applied such that only households with identifiable potential and that meet the Affordable Warmth eligibility criteria are kept in the pool. The 'identifiable potential' restriction is implemented by assuming that only a certain proportion of technical potential for measures is identifiable each year, where this proportion varies by measure. For example, under central assumptions, 15% of households with potential for Easy to Treat Cavity Wall Insulation are assumed to be identifiable. The model therefore randomly selects 15% of households whose most cost effective measure package includes for cavity wall insulation to be kept in the pool. The remaining households whose most cost effective measure package includes Easy to Treat Cavity Wall Insulation are excluded. See Annex C for details on how the identifiable potential proportions have been derived.

   4. **Install to remaining households in cost effectiveness order until target is reached**
      Next, the remaining households are ranked in cost-effectiveness order based on the score for their most cost-effective package. This is based on the assumption that participating suppliers will seek to achieve the Affordable Warmth target at minimum cost. The model identifies an initial allocation of packages to households (before adjustments to ensure the limit on boiler delivery isn't breached), in cost-effectiveness order, until the target has been met.
      In the first round of model runs, the target is based on meeting a certain level of spend, and an output of these runs is the total deemed lifetime bill savings achieved from installing the packages.

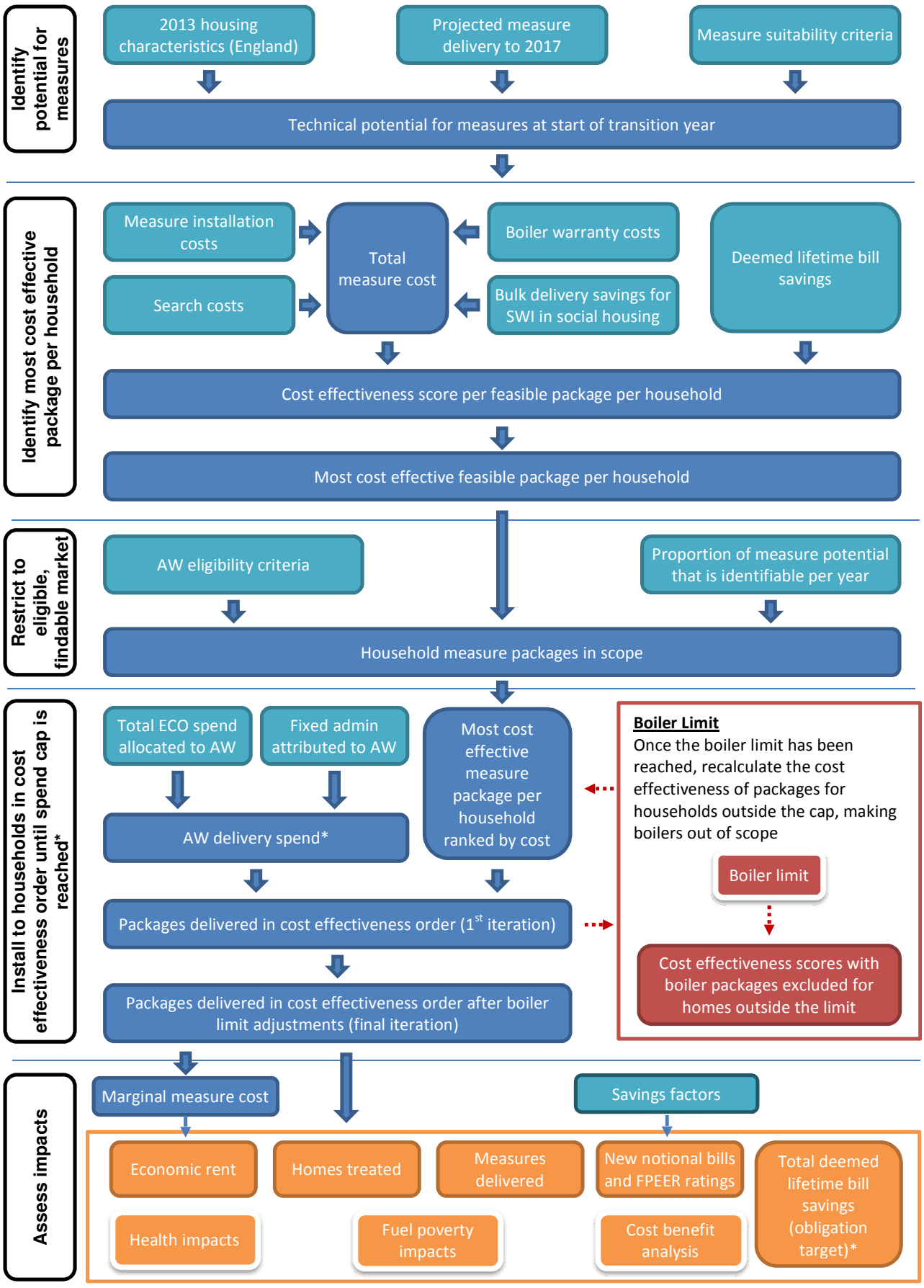
[136] https://www.gov.uk/government/statistics/green-deal-energy-company-obligation-eco-and-insulation-levels-in-great-britain-detailed-report-to-june-2015

This sets the Affordable Warmth target. In subsequent runs, households are allocated packages in cost-effectiveness order until the Affordable Warmth target has been met.

5. **Adjust for boiler limit**
   The model then adjusts the initial allocation of packages to households to ensure that the limit of boiler delivery isn't breached. This is done by simulating delivery of packages in cost-effectiveness order according to the initial allocation, until the boiler limit is met. For households outside the limit, packages which include boilers are given a new score of zero and the most cost-effective package and score is recalculated (effectively removing boiler packages from scope for these households). Households are then re-ranked, and the model simulates installing measures to the remaining households in cost-effectiveness order until the target is reached.

6. **Assess impacts of measure delivery**
   This results in a number of heating and insulation measures being installed and the generation of some economic surplus. The measures installed lead to changes in energy consumption in the domestic sector, where households receiving measures reduce their overall energy consumption if insulation is installed, and typically change the type of energy they consume where a heating measure is installed. As both types of measures typically reduce the cost of heating, households may choose to take some of the savings in costs as comfort by increasing the temperature they heat to (we term this 'comfort taking'). The overall changes in energy use result in energy bill savings, as well as reductions in energy use, greenhouse gas emissions and air quality, used in the cost benefit analysis of the policy. We also separately assess the impacts on health and fuel poverty.

   Modelled outputs (except fuel poverty impacts) are scaled up to figures for Great Britain based on the ratio of the number of dwellings in England compared to Great Britain. Fuel poverty impacts are reported for England only, given the difference in definition between the nations.



* The model can be run in two ways:
1. To match a certain level of spend. This outputs an equivalent obligation target in terms of Lifetime Bill Savings
2. To match a certain obligation target (lifetime bill savings). This outputs the level of spend required to meet this target.

Boiler Lifecycles

2. Within the technical potential of measures for delivery under Affordable Warmth two broad types of measures are delivered: 1) stocks – where the potential to install measures does not change over time unless measures are installed (e.g. opportunities to install insulation); and 2) flows – where over time more opportunities become available (e.g. heating systems breaking over time).

    - The technical potential *stocks* are reduced each year as Affordable Warmth installs insulation and new heating systems to households that previously had no heating system.

    - As boilers break, this adds to the technical potential in the target group. Similarly, as households replace broken and upgrade to more efficient boilers of their own accord ('natural replacements'), this reduces the technical potential in the target group. As such, boiler lifecycles provide a *flow* of opportunities.

3. These boiler lifecycles are modelled by simulating how boilers age over time which, together with assumptions around the age at which boilers break and are replaced by households (see Annex C for details), allows us to estimate the potential for delivering replacement boilers in the transition year.

4. This simulation process is illustrated in the diagram below, and can be broken down into the following steps:

    1. **Identify boiler characteristics at start of ECO transition year**

        The model uses data from the 2013 English Housing Survey to estimate the age and type of boilers in the English housing stock at the start of the ECO transition year, after accounting for:

        - boilers delivered under existing schemes between 2013 and April 2017
        - boiler ageing
        - natural boiler replacements, once boilers reach certain ages.

    2. **Identify potential for replacement boilers and determine which get replaced in the transition year**

        Based on their characteristics at the start of the transition year, the model identifies whether each boiler is:

        - Broken (i.e. it is older than the boiler lifetime) and therefore eligible to be replaced under ECO as a qualifying boiler;
        - Working, but less efficient than current standards[137]and therefore eligible to be replaced under ECO as a non-qualifying boiler; or
        - Working and efficient, and therefore ineligible to be replaced under ECO.

        The model allocates measures to households as outlined in the section above (accounting for the limit on boiler deliver). Households that did not receive a boiler under ECO are then modelled to replace them of their own accord if their boiler has reached its replacement age.

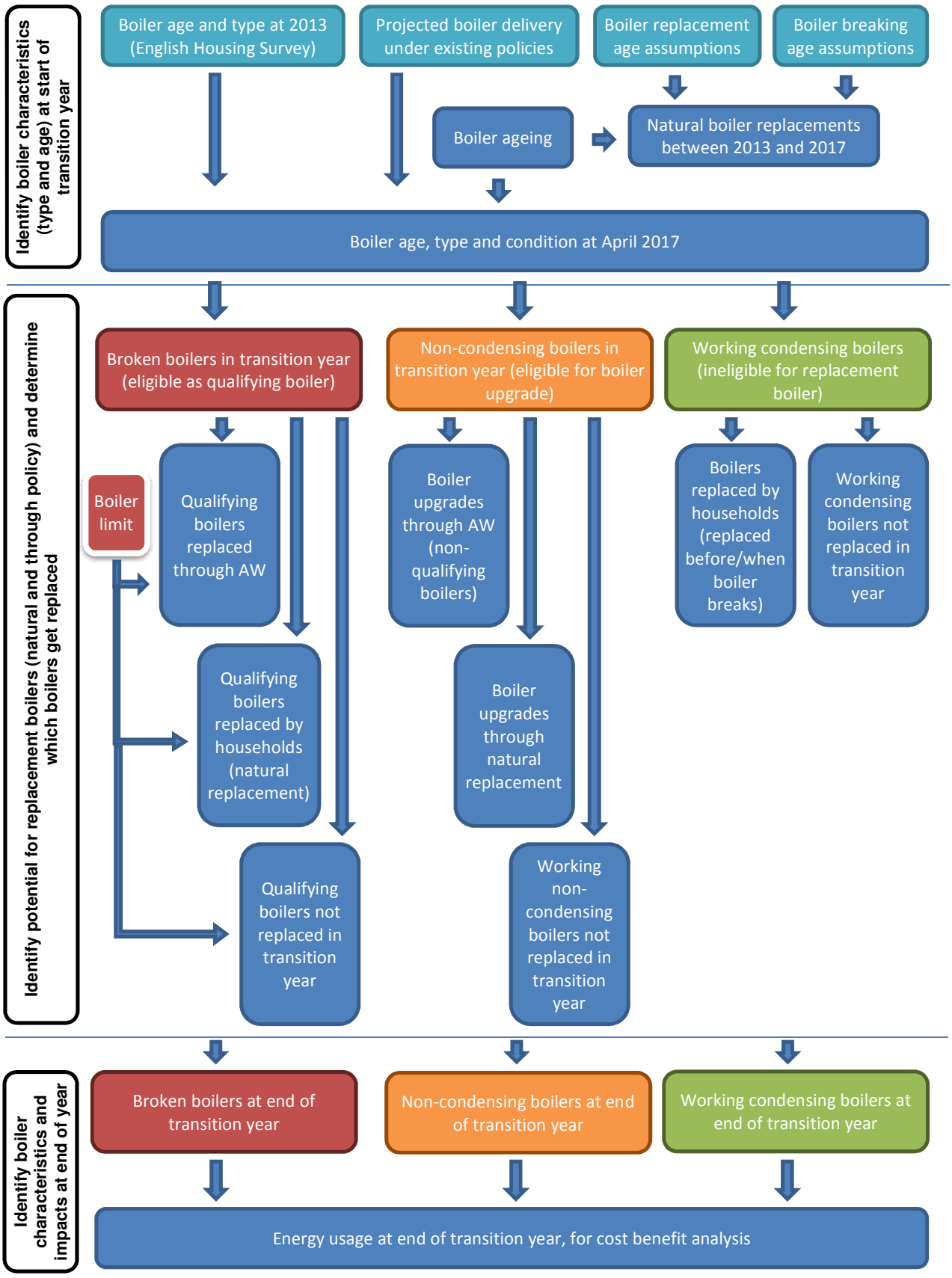
    3. **Identify boiler characteristics at end of year, for assessing impacts**

        The boiler characteristics at the end of the ECO transition year (together with other model outputs, including boiler characteristics under the counterfactual scenario), are used to estimate the impact of the scheme. For the cost benefit analysis we model what households would do in

[137] We assume boilers that are non-condensing are less efficient and therefore eligible to be replaced as a non-condensing boiler

the absence of intervention. The *counterfactual heating* assumption is that of those households that do not get their broken boiler replaced, 60% will be using secondary electric plug in heating, and 40% will be using either secondary heaters or an intermittent (not fully functioning) boiler. As such, changes in energy use and emissions are based on the movement away from a mixture of plug in electric heating and secondary/intermittent gas heating.

Insulation only benefits are calculated using the saving where the household has a functioning central heating system. Heating and insulation package benefits are calculated assuming that the saving of heating and insulation encompass the move from secondary heating to central heating first, and the additional saving from insulation once the household has a fully functioning central heating system.


Identify boiler characteristics (type and age) at start of transition year
Boiler age and type at 2013 (English Housing Survey)
Projected boiler delivery under existing policies
Boiler replacement age assumptions
Boiler breaking age assumptions
Boiler ageing
Natural boiler replacements between 2013 and 2017
Boiler age, type and condition at April 2017
Identify potential for replacement boilers (natural and through policy) and determine which boilers get replaced
Broken boilers in transition year (eligible as qualifying boiler)
Non-condensing boilers in transition year (eligible for boiler upgrade)
Working condensing boilers (ineligible for replacement boiler)
Boiler limit
Qualifying boilers replaced through AW
Qualifying boilers replaced by households (natural replacement)
Qualifying boilers not replaced in transition year
Boiler upgrades through AW (non-qualifying boilers)
Boiler upgrades through natural replacement
Working non-condensing boilers not replaced in transition year
Boilers replaced by households (replaced before/when boiler breaks)
Working condensing boilers not replaced in transition year
Identify boiler characteristics and impacts at end of year
Broken boilers at end of transition year
Non-condensing boilers at end of transition year
Working condensing boilers at end of transition year
Energy usage at end of transition year, for cost benefit analysis

Counterfactual boiler replacements

4. Boiler replacements under the counterfactual scenario are modelled in the same way as outlined above, i.e. boilers are simulated to age over time, with households replacing their boilers of their own accord once their boiler reaches a certain age. This age varies according to boiler type and household characteristics as outlined in Annex C.

Model Limitations

5. The Affordable Warmth modelling assumes that boilers (as well as all other measures) are fully subsidised by suppliers, however in reality households can and in some cases do contribute to the cost of a boiler replacement. Given that we are proposing to limit boiler delivery in the transition year, this assumption is not expected to significantly affect modelled results under the preferred options. However, for scenarios where the boiler limit is set at higher levels or not set at all, it means that suppliers could achieve more of their AW targets for the same cost through boilers, and in turn lead to a greater level of boiler deployment for the scenario where there is no cap than estimated in this impact assessment. Therefore estimates for these scenarios should be treated as conservative.

6. For the purpose of this impact assessment we have focussed on modelling the main Affordable Warmth measures, i.e.:

    a. Cavity Wall Insulation
    b. Loft Insulation
    c. External Solid Wall Insulation
    d. Replacement boilers
    e. First Time Central Heating
    f. Ground Source Heat Pumps
    g. Air Source Heat Pumps
    h. Heating Controls

    Some eligible measures such as electric storage heaters and biomass boilers have not been included in the modelling at this stage. This may affect the modelled results, although we do not expect the impact to be significant given that we do not expect these measures to be delivered at large scale during the transition year. We will look to model a wider range of measures and measure packages for the final stage impact assessment.

7. The deemed lifetime bill savings currently used in the modelling are based on internal modelling (see Annex C) and should be viewed as proxies for the official deemed scores which are currently being produced by Ofgem. Differences between our provisional deemed scores and the finalised scores produced by Ofgem may affect the relative cost-effectiveness of measures and measure packages, and so could impact on modelled delivery. We will update our modelling to reflect the official deemed scores for the final stage impact assessment.

8. The model uses data from the English Housing Survey 2013, which provides a breakdown of the English housing stock across ~12,000 household archetypes, with each archetype representing an average of ~2,000 households. Within the model, measures are delivered to archetypes rather than individual households, and so if a particular archetype is modelled to receive a measure, that measure will be delivered to all households within the archetype, incurring the same costs and energy savings[138]. As a result of this level granularity, the model predicts that the number of boilers that will be delivered is slightly less than the boiler limit, as installing the next case would mean breaching the limit.

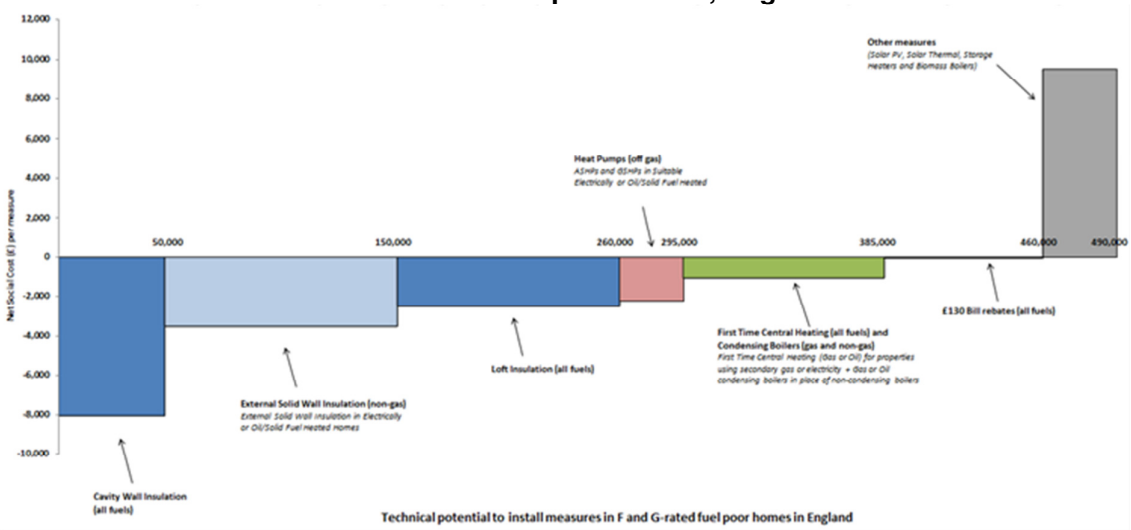
[138] The exception to this is the 'marginal archetype' (i.e. the final archetype modelled to receive a measure when ranked in cost-effectiveness order), which is split into the portion which receives the measure and the portion that doesn't, in order to meet the model target (spend or lifetime bill savings) exactly.

9. As stated above, the model is based on English Housing Survey data. In order to estimate impacts for Great Britain as a whole, we scale up modelled results based on the ratio of the number of dwellings in England to the number of dwellings in Great Britain. This is a relatively broad approach to adjusting English data to be representative of GB as a whole.

Annex F – Fuel Poverty Marginal Alleviation Cost Curves (FP-MACCs)

1. Support to the fuel poor can delivered in a host of different ways, from insulation to conventional heating, renewable heating to discounts on energy bills. In considering how to cost-effectively support the fuel poor, an update has been undertaken to the 'Fuel Poverty Marginal Alleviation Cost Curves' (FP-MACCs) that were first published in *Fuel Poverty: A Framework for Future Action* in 2013.[139] The latest FP-MACC, demonstrating the extent to which F and G-rated fuel poor households could be supported with cost-effective measures is shown in Chart F1.

Chart F1: FP-MACC for F and G-rated fuel poor homes, England



2. FP-MACCs enable us to weigh up the different types of intervention that could be delivered to fuel poor homes, as a means of improving their levels of energy efficiency. This can then act as a guide to what mix of measures policies such as ECO could look to deploy to make cost-effective progress on fuel poverty.

3. Measures that are cost-effective will generate net benefits (i.e. negative costs) and therefore be below zero on the vertical axis. For example, for F/G-rated fuel poor households in England, the most cost-effective intervention for raising them to Band E is cavity wall insulation and so on.

4. It should be stressed that the FP-MACCs **are a guide only**, and **do not reflect any single policy intervention**. For instance, the estimated mix is for England only, and the analysis does not consider the costs of delivery mechanisms as this is specific to choice of policy lever used. The FP-MACCs therefore assume perfect targeting (i.e. measures are installed only to fuel poor households in F/G-rated homes) and do not include delivery costs (admin costs + search costs). These act as a guide for policy choices, such as the degree to which ECO looks to deploy insulation compared to heating (see Annex A on limiting boiler deployment).

5. The FP-MACC analysis includes the technical costs of installation (parts + labour) and estimates of the 'hidden costs' (such as making good post-installation). The benefits include the value of energy saved, the value of greenhouse gas emissions saved, the improvement in air quality from reduced energy use, and the value of improved comfort levels as a result of having better insulated / heated homes. More information on FP-MACCs can be found in Section 5 of the analytical annex to *Fuel Poverty: A Framework for Future Action*.

[139] Fuel Poverty: A Framework for Future Action, available at: https://www.gov.uk/government/publications/fuel-poverty-a-framework-for-future-action

Annex G – Health Impacts of Domestic Energy Efficiency Model (HIDEEM)

1. Over recent years DECC has been collaborating with a team of leading experts from University College London and London School of Hygiene and Tropical Medicine to develop a model to estimate the change in occupants' health from the installation of energy efficiency measures (resulting from changes in the indoor temperature and pollutant exposure). The model that was developed is the HIDEEM model.

2. HIDEEM uses the English Housing Survey as a basis for the analysis. The model is built from a number of inter-related modules covering a building's permeability properties and individual health conditions. Pollutants included in the model that impact on health are: particulate matter, tobacco smoke, radon gas and mould growth. The health conditions linked to these pollutants include heart and circulatory diseases, cancers and strokes, as well as respiratory illness and common mental disorders. HIDEEM uses the Quality Adjusted Life Year (QALY) method to monetise these health impacts. This involves placing a value on the change in a person's health over time.

3. More details on HIDEEM can be found in Section 6 of the analytical annex to *Fuel Poverty: A Framework For Future Action*[140].

[140] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211137/fuel_poverty_strategic_framework_analytical_annex.pdf

Annex H – Cost Benefit Analysis Scenarios

1. The cost benefit analysis presented in Table 3 of Section 8.1 is based on our central assumptions for underlying factors such as measure costs, carbon prices and fuel prices. However, these estimates are inherently uncertain. We have therefore varied the key assumptions creating 'low' and 'high' scenarios, to assess the potential range of outcomes. These scenarios reflect best and worst cases in terms of the overall net present value of the ECO transition year, and are described in Table H1 below.

Table H1: Assumptions for generating Low, Central and High NPV estimates

NPV assumption category	NPV assumption detail	Low NPV scenario (worst case)	Central NPV scenario	High NPV scenario (best case)
Identifiable technical potential (AW)	Cavity Wall Insulation – Easy to Treat	14%	15%	17%
	Cavity Wall insulation – Hard to Treat	6%	11%	17%
	Loft Insulation	19%	20%	20%
	First time central heating	50%	67%	15%
Identifiable technical potential (CERO/CSCO)	Cavity Wall Insulation	2.1% - 3.2%	2.7% - 4.0%	3.2% - 4.8%
	Loft Insulation	0.3% - 3.5%	0.4% - 4.4%	0.5% - 5.2%
	Solid Wall Insulation - External	1.1% - 3.6%	1.4% - 4.5%	1.6% - 5.4%
Measure costs	Insulation	20% Higher	-	20% Lower
	Replacement boilers	~25% Higher	-	~25% Lower
	First time central heating	32% to 43% Higher	-	32% to 43% Lower
Installation cost reduction factor for installing SWI in social housing	-	25%	33%	40%
Search costs (AW only)	Qualifying boiler replacements – on gas grid	£50	£50	£50
	Qualifying boiler replacements – off gas grid	£300	£300	£300
	Other measures – on gas grid	£200	£125	£50
	Other measures – off gas grid	£500	£400	£300
Hidden costs	Cavity Wall Insulation	£195	£115	£35
	Loft Insulation	£250	£145	£35
	Solid Wall Insulation – External	£330	£235	£135
	Replacement Boiler	£95	£70	£40
	First Time Central Heating	£170	£125	£80
	Ground Source Heat Pump	£315	£255	£200
	Air Source Heat Pump	£300	£200	£105
	Heating Controls	Included in hidden costs for other heating measures		
Energy prices p/kwh (CERO/CSCO only, for uptake modelling)	Fuel type	SAP Prices deflated by IAG 'low' Series	SAP Prices inflated by IAG 'central' estimate	SAP Prices Inflated by IAG 'high' Series

Energy prices p/kWh (AW, CERO and CSCO, for monetising societal benefits)	Fuel type	IAG 'low' series	IAG 'central' series	IAG 'high' series
Administration costs	-	£80m	£80m	29% Lower

2. The overall low, central and high monetised costs and benefits of the preferred policy option to society, net of the counterfactual and discounted to 2016, are shown in Table H2. This shows a wide range in the overall net present value, ranging from -£154m to £656m. This wide range is to be expected when taking combinations of assumptions that result in 'worst' or 'best' case scenarios.

3. In general, cost elements are high under the 'low' NPV scenario and low under the 'high' NPV scenario, whereas benefit elements are low under the 'low' NPV scenario and high under the 'high' NPV scenario. Exceptions to this are operational costs and air quality benefits where the ordering is reversed. This is because the assumptions under the scenarios affect the mix of measures delivered with, for example, more heating measures being delivered under the 'high' NPV scenario.

Table H2: Low, Central and High aggregate costs and benefits of the ECO transition for Policy Option 1, 2017 - 2059 (2015 prices)

Present Value, £m Unless otherwise stated	Low NPV scenario	Central NPV scenario	High NPV scenario
Installation Costs	429	326	241
Hidden Costs	39	26	8
Finance Costs	13	13	13
Administration Costs	77	77	55
Boiler warranties	3	3	3
Search costs (Affordable Warmth)	30	24	13
Operational Costs	16	19	25
Natural boiler replacement costs	*-59*	*-47*	*-32*
Total Costs	**548**	**441**	**325**
Value of energy saved	280	358	556
Value of air quality improvements	23	23	19
Value of change in traded carbon savings	6	13	39
Value of change in non-traded carbon savings	22	129	233
Value of comfort taking	64	92	135
Total Benefits	**395**	**616**	**981**
Overall Net Present Value	***-154***	***174***	***656***

4. Table H3 shows the same costs and benefits as in Table H2 after applying equity weights to the appropriate components, to value the distributional impacts of the policy (see Annex C for detail on how equity weights are derived and applied). As discussed in Section 8.1, applying equity weights tends to increase both the costs and benefits, but with a great increase benefits. As a result the overall net present value under each of the low, central and high scenarios increases significantly, whilst maintaining the ordering of the scenarios.

Table H3: Low, Central and High equity-weighted costs and benefits for Policy Option 1, 2017 - 2059 (2015 prices)

Present Value, £m Unless otherwise stated	Low NPV scenario	Central NPV scenario	High NPV scenario
Installation Costs (*now including cost of economic rents*)	765	611	390
Hidden Costs	39	26	8
Finance Costs	16	16	16
Administration Costs	96	96	68
Boiler warranties	4	4	3
Search costs (Affordable Warmth)	37	30	16
Operational Costs	37	38	46
Natural boiler replacement costs	-156	-125	-83
Total Costs	**837**	**695**	**464**
Value of energy saved	280	358	556
Value of air quality improvements	23	23	19
Value of change in traded carbon savings	6	13	39
Value of change in non-traded carbon savings	22	129	233
Value of comfort taking	121	160	214
Extra utility from lower bills in low income households	615	439	470
Value of economic rent to low income households	405	357	149
Total Benefits	**1,471**	**1,479**	**1,680**
Equity-weighted Net Present Value	***634***	***784***	***1,216***