Title: Consultation stage Impact Assessment ECO4 **IA No:** ECO4 - BEIS025(C)-21-EEL	**Impact Assessment (IA)**
RPC Reference No: N/A	**Date:** 25/06/2021
Lead department or agency: Department for Business, Energy and Industrial Strategy.	**Stage:** Development/Options
Other departments or agencies: None	**Source of intervention:** Domestic
	Type of measure: Secondary legislation
	Contact for enquiries: beisECOteam@beis.gov.uk

Summary: Intervention and Options

RPC Opinion: N/A

Cost of Preferred (or more likely) Option (in 2021 prices)

Total Net Present Social Value	Business Net Present Value	Net cost to business per year	Business Impact Target Status
-£30m	£2-4bn	£0.5-1bn	Qualifying provision

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

Upgrading the energy efficiency of homes is the most effective way of tackling fuel poverty. The residential sector is responsible for a significant share of the UK's greenhouse gas emissions and primary energy consumption. Therefore, tackling the poor energy efficiency of the housing stock is critical in meeting the Government's legally binding carbon targets. Several market barriers and failures exist in the energy efficiency market, preventing the deployment of energy efficiency in the absence of Government intervention. Government intervention is required to overcome these barriers to deliver on its fuel poverty and climate change commitments.

What are the policy objectives of the action or intervention and the intended effects?

The policy is intended to drive uptake of energy efficiency measures among low income and vulnerable households in or at risk of fuel poverty that would not have occurred in the absence of intervention. 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 and subsequent health outcomes; and support jobs and growth.

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

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

Policy Option 4 (preferred): Extend ECO for 4 years (to March 2026).

- Narrow the focus of the scheme to mainly support owner occupiers in band D, E, F and G properties. With support provided to social housing and PRS properties under certain conditions
- Increase the proportion of the scheme that suppliers can deliver with Local Authorities (Flexible Eligibility) to 50% of obligation
- Place further incentives on supporting the worst properties, with a minimum requirement for 100,000 EFG properties upgrade across the four-year scheme

Policy Option 1: Limit the scheme to only Band E, F and G properties, with 50% of the scheme able to be delivered through Flexible eligibility.

Policy Option 2: as with option 1 but expand eligibility to low band D properties.

Policy Option 3: as with option 2 but expand eligibility to all band D properties.

Policy Option 5: as with option 4 but reduce Flexible Eligibility to around 30% of the scheme.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** March 2026

Is this measure likely to impact on international trade and investment?		No		
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:** 0.62	**Non-traded:** 11.48	

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 SELECT SIGNATORY: ..... Date: .....

Summary: Analysis & Evidence

Policy Option 1

Description: Extend ECO for 4 years from March 2022 to March 2026. Narrow the focus of scheme to owner occupiers in the least energy efficient homes (Band E, F and G). Increase the proportion of the scheme that suppliers can deliver with Local Authorities (Flexible Eligibility) to 50% of obligation

FULL ECONOMIC ASSESSMENT

Price Base Year 2021	**PV Base Year** 2022	**Time Period Years** 46	**Net Benefit (Present Value (PV)) (£m)**		
			Low: Optional	**High:** Optional	**Best Estimate:** 120

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				**2,040**

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

The largest societal costs are the installation costs of energy efficiency measures (PV, £1,110), ECO scheme administration (PV, £360m), PAS costs (PV, £50m) and the search costs in finding eligible households (PV, £60m). These costs are expected to be incurred by energy suppliers, which suppliers then recoup through their consumer's energy bills. Costs faced by households include the reinstallations costs for measure (PV, £440m), hidden costs associated with the installations (PV, £40m), avoided costs of replacement boilers (PV, -£30m), and opex costs (PV, £7m).

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

There will be some small costs to BEIS and the administrator (Ofgem), 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				**2,160**

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 (PV £930), and increased comfort from warmer homes (PV, £260m). Society will also benefit from improved air quality (PV £260m), and reduced traded (PV £30m) and non-traded (PV £670m) greenhouse gas 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 energy demand, and health costs

Key assumptions/sensitivities/risks	**Discount rate (%)**	3.5

The targets set in legislation will require suppliers to deliver a set volume of notional bill savings by installing energy efficiency and heating measures. The precise cost to suppliers, and therefore the pass through of these costs onto energy bills, is uncertain. The small eligible pool for the policy increases the uncertainty in results. This option carries significant delivery risks given the size of the eligible pool, modelling was unable to find sufficient properties to spend £4bn in four year –this highlights how challenging it would be for suppliers to find properties under this option.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			**Score for Business Impact Target (qualifying provisions only) £m:**
Costs: 60-90	**Benefits:**	**Net:** 60-90	290-440

Summary: Analysis & Evidence

Policy Option 2

Description: Extend ECO for 4 years from March 2022 to March 2026. Narrow the focus of scheme to owner occupiers in the least energy efficient homes (low band D and band E, F and G). Increase the proportion of the scheme that suppliers can deliver with Local Authorities (Flexible Eligibility) to 50% of obligation

FULL ECONOMIC ASSESSMENT

Price Base Year 2021	PV Base Year 2022	Time Period Years 46	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate: -130**

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				**2,540**

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

The largest societal costs are the installation costs of energy efficiency measures (PV, £1,400), ECO scheme administration (PV, £360m), PAS costs (PV, £90m) and the search costs in finding eligible households (PV, £80m). These costs are expected to be incurred by energy suppliers, which suppliers then recoup through their consumer's energy bills. Costs faced by households include the reinstallations costs for measure (PV, £540m), hidden costs associated with the installations (PV, £60m), avoided costs of replacement boilers (PV, -£3m), and opex costs (PV, £6m).

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

There will be some small costs to BEIS and the administrator (Ofgem), 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				**2,400**

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 (PV £1,020), and increased comfort from warmer homes (PV, £310m). Society will also benefit from improved air quality (PV £170m), and reduced traded (PV £20m) and non-traded (PV £880m) greenhouse gas 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 energy demand, and health costs

Key assumptions/sensitivities/risks	Discount rate (%)	3.5

The targets set in legislation will require suppliers to deliver a set volume of notional bill savings by installing energy efficiency and heating measures. The precise cost to suppliers, and therefore the pass through of these costs onto energy bills, is uncertain. The small eligible pool for the policy increases the uncertainty in results. This option carries significant delivery risks given the size of the eligible pool, modelling was unable to find sufficient properties to spend £4bn in four year –this highlights how challenging it would be for suppliers to find properties under this option.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: 70-130	**Benefits:**	**Net: 70-130**	**360-650**

Summary: Analysis & Evidence

Policy Option 3

Description: Extend ECO for 4 years from March 2022 to March 2026. Narrow the focus of scheme to owner occupiers in the least energy efficient homes (all band D, E, F and G). Increase the proportion of the scheme that suppliers can deliver with Local Authorities (Flexible Eligibility) to 50% of obligation

FULL ECONOMIC ASSESSMENT

Price Base Year 2021	PV Base Year 2022	Time Period Years 46	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:** -130

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			**2,650**

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

The largest societal costs are the installation costs of energy efficiency measures (PV, £1,470), ECO scheme administration (PV, £360m), PAS costs (PV, £150m) and the search costs in finding eligible households (PV, £110m). These costs are expected to be incurred by energy suppliers, which suppliers then recoup through their consumer's energy bills. Costs faced by households include the reinstallations costs for measure (PV, £530m), hidden costs associated with the installations (PV, £90m), avoided costs of replacement boilers (PV, -£70m), and opex costs (PV, £6m).

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

There will be some small costs to BEIS and the administrator (Ofgem), 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			**2,520**

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 (PV £1,060), and increased comfort from warmer homes (PV, £330m). Society will also benefit from improved air quality (PV £160m), and reduced traded (PV £20m) and non-traded (PV £950m) greenhouse gas 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 energy demand, and health costs

Key assumptions/sensitivities/risks	Discount rate (%) 3.5

The targets set in legislation will require suppliers to deliver a set volume of notional bill savings by installing energy efficiency and heating measures. The precise cost to suppliers, and therefore the pass through of these costs onto energy bills, is uncertain. The small eligible pool for the policy increases the uncertainty in results.

BUSINESS ASSESSMENT (Option 3)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: 80-150	**Benefits:**	**Net: 80-150**	**390-750**

Summary: Analysis & Evidence

Policy Option 4

Description: Extend ECO for 4 years from March 2022 to March 2026. Narrow the focus of scheme to owner occupiers in the least energy efficient homes (Band D, E, F and G), with support for social housing in band E, F and G homes for certain measures. Increase the proportion of the scheme that suppliers can deliver with Local Authorities (Flexible Eligibility) to 50% of obligation and further incentivise delivery to worst properties (E, F and Gs), with a minimum requirement for 100,000 EFG properties upgrade across the four-year scheme.

FULL ECONOMIC ASSESSMENT

Price Base Year 2021	**PV Base Year** 2022	**Time Period Years** 46	**Net Benefit (Present Value (PV)) (£m)**		
			Low: Optional	**High:** Optional	**Best Estimate:** -30

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				**2,940**

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

The largest societal costs are the installation costs of energy efficiency measures (PV, £1,620), ECO scheme administration (PV, £360m), PAS costs (PV, £140m) and the search costs in finding eligible households (PV, £110m). These costs are expected to be incurred by energy suppliers, which suppliers then recoup through their consumer's energy bills. Costs faced by households include the reinstallations costs for measure (PV, £620m), hidden costs associated with the installations (PV, £90m), avoided costs of replacement boilers (PV, -£10m), and opex costs (PV, £5m).

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

There will be some small costs to BEIS and the administrator (Ofgem), 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				**2,900**

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 (PV £1,290m), and increased comfort from warmer homes (PV, £400m). Society will also benefit from improved air quality (PV £200m), and reduced traded (PV £40m) and non-traded (PV £970m) greenhouse gas emissions. The households treated under ECO4, the policy could deliver an average saving on their annual dual fuel bill of around £300.

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 energy demand, and health costs

Key assumptions/sensitivities/risks	**Discount rate** 3.5

The targets set in legislation will require suppliers to deliver a set volume of notional bill savings by installing energy efficiency and heating measures. The precise cost to suppliers, and therefore the pass through of these costs onto energy bills, is uncertain. The small eligible pool for the policy increases the uncertainty in results.

BUSINESS ASSESSMENT (Option 4)

Direct impact on business (Equivalent Annual) £m:			**Score for Business Impact Target (qualifying provisions only) £m:**
Costs: 80-150	**Benefits:**	**Net: 80-150**	**410-730**

Summary: Analysis & Evidence

Policy Option 5

Description: Extend ECO for 4 years from March 2022 to March 2026. Narrow the focus of scheme to owner occupiers in the least energy efficient homes (Band D, E, F and G), with support for social housing in band E, F and G homes for certain measures. Limit the proportion of the scheme that suppliers can deliver with Local Authorities (Flexible Eligibility) to around 25% of obligation and further incentivise delivery to worst properties (E, F and Gs).

FULL ECONOMIC ASSESSMENT

Price Base Year 2021	**PV Base Year** 2022	**Time Period Years** 46	**Net Benefit (Present Value (PV)) (£m)**		
			Low: Optional	**High:** Optional	**Best Estimate:** -370

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			**2,420**

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

The largest societal costs are the installation costs of energy efficiency measures (PV, £1,340), ECO scheme administration (PV, £360m), PAS costs (PV, £70m) and the search costs in finding eligible households (PV, £90m). These costs are expected to be incurred by energy suppliers, which suppliers then recoup through their consumer's energy bills. Costs faced by households include the reinstallations costs for measure (PV, £500m), hidden costs associated with the installations (PV, £70m), avoided costs of replacement boilers (PV, -£50m), and opex costs (PV, £5m).

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

There will be some small costs to BEIS and the administrator (Ofgem), 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			**2,050**

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 (PV £940m), and increased comfort from warmer homes (PV, £290m). Society will also benefit from improved air quality (PV £90m), and reduced traded (PV £30m) and non-traded (PV £700m) greenhouse gas emissions. The households treated under ECO4, the policy could deliver an average saving on their annual dual fuel bill of around £300.

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 energy demand, and health costs

Key assumptions/sensitivities/risks	**Discount rate (%)**	3.5

The targets set in legislation will require suppliers to deliver a set volume of notional bill savings by installing energy efficiency and heating measures. The precise cost to suppliers, and therefore the pass through of these costs onto energy bills, is uncertain. The small eligible pool for the policy increases the uncertainty in results.

BUSINESS ASSESSMENT (Option 5)

Direct impact on business (Equivalent Annual) £m:			**Score for Business Impact Target (qualifying provisions only) £m:**
Costs:70-150	**Benefits:**	**Net: 70-150**	**350-740**

Evidence Base

1. Overview and problem under consideration

1. This consultation stage Impact Assessment (IA) accompanies the consultation on the Government's proposals for a four-year Energy Company Obligation (ECO) scheme from April 2022 to March 2026 (ECO4). The scheme will continue to focus on low income, vulnerable and fuel poor households but with a narrower focus on supporting the least energy efficient homes.

2. ECO requires energy suppliers to deliver a target of notional annual bill savings by installing energy efficiency and heating measures to homes in Great Britain. These measures help households to keep their homes warmer, reduce their energy bills and carbon emissions.

3. ECO was launched in 2013 and has evolved over time[1] with an increased focus on low income households in more recent schemes. The current policy ECO3 commenced in December 2018 and will come to an end in March 2022[2]. ECO3 is solely focused on low income, vulnerable and fuel poor households. Under ECO3 households may be eligible if they are in receipt of certain benefits, or in the least efficient social housing, or referred by local authorities participating in ECO Flexible Eligibility – a household targeting mechanism[3].

1.1 Problem under consideration

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

    - Tackling the root cause of fuel poverty and making progress towards the Government's statutory fuel poverty targets;
    - Reducing greenhouse gas emissions in the domestic sector, contributing to the Government's legally binding carbon reduction targets;
    - Lowering energy bills, helping keep bills as low as possible for households; and
    - Reducing energy demand and contributing to ensuring that the UK has a secure and resilient energy system.

5. Upgrading the energy efficiency of homes is the most effective way of tackling fuel poverty. The Government uses Low Income Low Energy Efficiency (LILEE) as the metric for measuring fuel poverty in England. These are homes with incomes below the poverty line and with an energy efficiency rating below Fuel Poverty Energy Efficiency Rating (FPEER) Band C. FPEER is a measure of the energy efficiency of a property, it is based on the Government's Standard Assessment Procedure[4] (SAP) for assessing the energy performance of domestic

[1] Ofgem overview of different ECO schemes. https://www.ofgem.gov.uk/environmental-programmes/eco/overview-previous-schemes
[2] ECO3 final impact assessment: https://www.gov.uk/government/consultations/energy-company-obligation-eco3-2018-to-2022
[3] Eligibility criteria described here: https://www.ofgem.gov.uk/environmental-programmes/eco/support-improving-your-home
[4] SAP is the methodology used by the Government to assess and compare the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin energy and environmental policy initiatives.

properties but accounts for the impact of policy interventions that directly affect household energy costs (such as rebates given).

6. In England there are 3.2 million fuel poor households[5] of which the largest pool (1.2 million) are owner occupier households, 1.2 million are privately rented and 700,000 are social housing[6]. The Government has a statutory duty to raise as many fuel poor homes in England as reasonably practicable to FPEER C by 2030[7], with interim milestones of as many fuel poor homes in England as reasonably practicable to FPEER E by 2020 and FPEER D by 2025[8].

7. Fuel poverty rates within tenures are highest within private rented homes and social housing, 27% and 18% of households within these tenures respectively are fuel poor, compared to 8% of owner-occupied homes being fuel poor.

8. There is a need for an energy efficiency scheme to focus mainly on low-income owner-occupied households, with support to other tenures designed to complement the various other government policies. For the privately rented sector (PRS), the Domestic Minimum Energy Efficiency Standard (MEES) regulations set a minimum energy efficiency level for domestic private rented properties. In September 2020, the Government launched a consultation on policy proposal for getting as many PRS homes to FPEER Band C by 2030 as possible. Therefore, any support ECO provides to private tenants will need to be subject to landlord cost caps agreed under the updated MEES regulations. The Government is proposing ECO4 also support social housing, but this may be reviewed if funding is secured for a separate social housing scheme in future.

9. The energy efficiency of fuel poor households by tenure is shown in Figure 1, below.

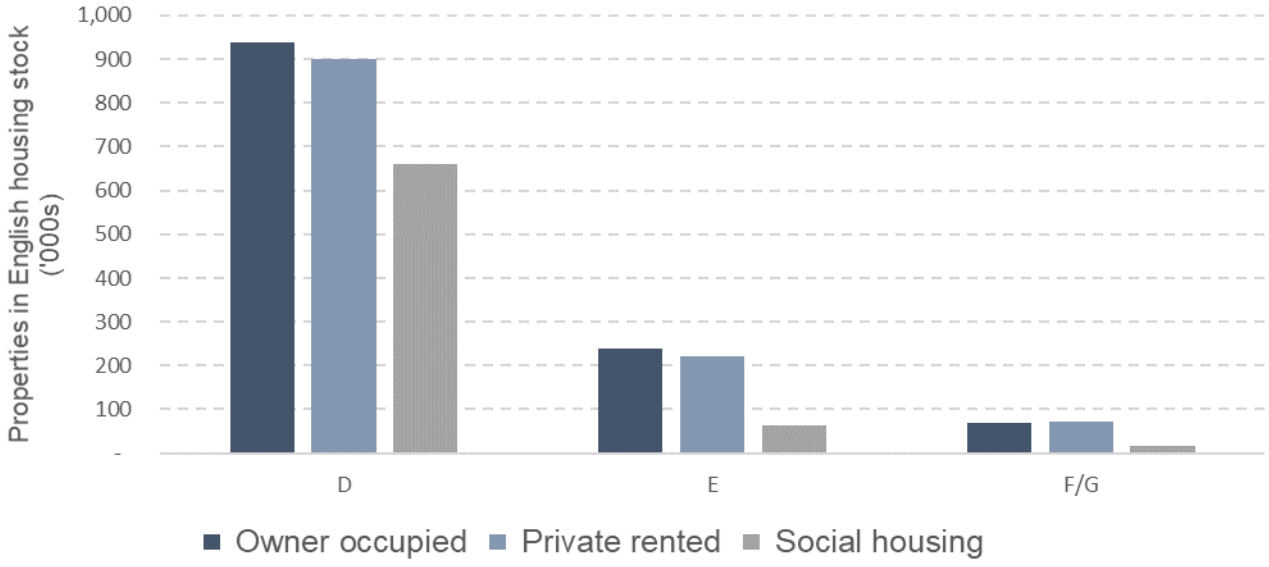
[5] BEIS Fuel Poverty Statistics, 2021 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966471/Fuel_poverty_detailed_tables_2019_data_LILEE.xlsx See Table 1.

[6] BEIS Fuel Poverty Statistics, 2021 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966471/Fuel_poverty_detailed_tables_2019_data_LILEE.xlsx. See Table 18

[7] More detail on measuring fuel poverty in England, the statutory target, and fuel poverty strategy for England see: https://www.gov.uk/government/publications/sustainable-warmth-protecting-vulnerable-households-in-england

[8] 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

Figure 1: Energy performance rating of fuel poor properties in the residential English housing stock by tenure [9]



10. The residential sector is responsible for a significant share of the UK's greenhouse gas emissions (around 15%)[10], and primary energy consumption (around 29%)[11]. Tackling the poor energy efficiency of the housing stock is therefore important in meeting the Government's legally-binding carbon targets.

11. Tackling the poor energy efficiency of the housing stock is also likely to lead to wider benefits, including:

- **Lower household energy bills** – households can save hundreds of pounds on their energy bills per year. For example, BEIS modelling in the 'Energy White Paper' and 'Sustainable warmth: protecting vulnerable households in England' policy paper provided illustrative scenarios[12].

- **Reduced costs of meeting energy demand** - international evidence suggests that energy efficiency can enable lower energy prices by reducing the need to add expensive new power generation or transmission capacity and by reducing pressure on energy resources[13].

- **Improved security of energy supply** - the International Energy Agency (IEA) analysis shows that energy efficiency is one of the most cost-effective ways to enhance security

[9] BEIS Fuel Poverty Statistics, 2021 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966471/Fuel_poverty_detailed_tables_2019_data_LILEE.xlsx. See Table 18

[10] BEIS Provision UK greenhouse gas emissions, 2019, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/875488/2019_UK_greenhouse_gas_emissions_provisional_figures_data_tables.xlsx

[11] BEIS Energy Consumption in the UK, 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/928354/2020_consumption_tables_-_web_copy.xlsx. See Table C1

[12] See BEIS Energy White Paper 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf and BEIS sustainable warmth: protecting vulnerable households in England 2021 https://www.gov.uk/government/publications/sustainable-warmth-protecting-vulnerable-households-in-england

[13] International Energy Agency, Multiple Benefits of Energy Efficiency (2019) https://www.iea.org/reports/multiple-benefits-of-energy-efficiency/energy-prices#abstract

of energy supply, to boost competitiveness and welfare, and to reduce the environmental footprint of the energy system[14].

- **Improved outcomes and reduced costs to the public of providing health care** – living at low temperatures as a result of fuel poverty is likely to be a significant contributor not just to the excess winter deaths that occur each year (a total of 27,000 each year over the last decade in England and Wales), but to a much larger number of incidents of ill-health and demands on the National Health Service and a wider range of problems of social isolation and poor outcomes for young people[15].

2. Rationale for intervention

Market Barriers and Failures

12. 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[16]. The key market barriers and failures in the domestic energy efficiency market are:

    a. **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'). This lack of access to capital will be particularly acute for low income, vulnerable and fuel poor households, which ECO4 is designed to assist.

    b. **Incomplete or asymmetric information** – not all households are well informed about the potential savings from the installation of energy efficiency measures.

    c. **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[17]. This can lead to overconsumption of energy and low demand for energy efficiency because the costs and benefits to society of energy use are not aligned

Equity Considerations

13. Intervention is also justified on equity grounds by directing government support to improving the comfort and health outcomes of those who are vulnerable or on low incomes.

    - **Fuel poverty**[18] - energy is a necessity good and the fuel poor are among those with the highest needs (usually driven by poor energy efficiency) despite being on lower incomes.

[14] International Energy Agency, World Energy Outlook (2019) https://www.iea.org/reports/world-energy-outlook-2019/energy-efficiency#abstract
[15] For more detail see the Hills Fuel Poverty Review Final Report 2012: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48297/4662-getting-measure-fuel-pov-final-hills-rpt.pdf
16 For example, see the 2014 ECO IA https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/373650/ECO_IA_with_SoS_e-sigf_v2.pdf and 2012 IA https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42984/5533-final-stage-impact-assessment-for-the-green-deal-a.pdf
[17] The carbon content of fuels is not fully reflected in their price.
18 Households in England are in fuel poverty if they live in a property with an energy efficiency rating of Band D or lower 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.

However, given their low-income, most of these households lack the means to fund energy efficiency improvements to tackle the underlying problem[19].

- **Health outcomes** - 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 on cold homes and health[20], in addition to the Hills Fuel Poverty Review[21], set out the strong body of evidence linking low temperatures to these poor health outcomes.

3. Policy options

14. The objective of ECO4 are to:

- **Contribute to the Government's statutory target to improve as many fuel poor homes as is reasonably practicable to a minimum FPEER rating of Band D by the end of 2025 and Band C by the end of 2030[22].** The scheme will aim to do this by targeting the worst homes by restricting ECO4 eligibility to households with an Energy Performance Certificate (EPC) band D, E, F or G and continuing to focus 100% of support on low income and vulnerable households to better target the fuel poor. To ensure ECO4 contributes to statutory targets, a minimum improvement requirement will be put in place to ensure as may homes are upgraded to C or D as possible.

- **Reduce bills for low income and vulnerable households.** By imposing a minimum improvement requirement, the scheme aims to deliver larger reductions in bills for recipients than a single measure approach.

- **Helps towards our Net Zero future by reducing carbon emissions from our housing stock.** By targeting the worst homes, the scheme will achieve larger carbon reductions. New fossil fuel-based heating systems will also be limited under ECO4 to help make progress towards the Government's goal of Net Zero by 2050.

- **Focus support mainly on owner occupied households and those living in the least efficient social housing, aligned with other Government energy efficiency policies**. ECO could support tenants living in D, E, F and G private rented homes, subject to any landlord cost caps agreed under the updated MEES regulations. Tenants living in E, F and G social housing will be supported for specific measures. ECO4 will be available across England, Scotland and Wales. In England, the Home Upgrade Grant will support upgrades to inefficient off-gas grid homes. In principle measures should not be blended using HUG and ECO4 funding.

-

To understand how ECO4 can deliver on the policy objectives we have developed an initial Theory of Change, which is presented in full in section 13.

[19] BEIS Fuel Poverty Statistics 2021: https://www.gov.uk/government/collections/fuel-poverty-statistics
[20] Marmot Review Team (2020). *Health equity in England: The marmot Review 10 years on*. Available at: https://www.health.org.uk/publications/reports/the-marmot-review-10-years-on
[21] Hills (2012). *Getting the measure of fuel poverty* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48297/4662-getting-measure-fuel-pov-final-hills-rpt.pdf
[22] As measured by the Fuel Poverty Energy Efficiency Rating (FPEER) system. FPEER is a measure of the energy efficiency of a property based on the Standard Assessment Procedure (SAP) but accounts for policies that directly affect the cost of energy.

Lessons learnt from ECO3

15. Several lessons have been learnt from ECO3 which have influenced the design of ECO4 – more detail is provided within the consultation document, but a summary of the key learnings has been provided below.

16. ECO3 has so far seen on average 1.9[23] measures per home with over half of homes receiving a boiler measure[24]. Only around a third of homes have received wall insulation measures. ECO4 aims to focus more on multiple measure delivery and incentivise greater investment to ensure homes are improved to a minimum level – this will drive more insulation measures such a wall insulation.

17. ECO3 uses a measure-specific scoring approach which does not factor in the starting SAP band of the property and therefore puts a weak incentive on improving homes further up SAP bands and does not specifically reward the treatment of lower SAP-rated properties. The current ECO3 approach, is therefore less suited to delivering against our overarching objectives. As such, for ECO4, the government is proposing a revised scoring methodology for scores to be based on the difference in fuel expenditure between the starting and finishing SAP rating of the home, with further regard to floor area. More detail on the scoring framework proposals is provided in the consultation document as well as more technical detail on modelling provided in 'Annex A – Modelling approach'.

3.1 Summary of options

18. This section set out the options considered for ECO4. The Government has considered different options around which EPC bands support should be limited to, the support available to social housing and the percentage of the scheme that suppliers can deliver with local authorities (Flexible Eligibility), in order to strike a balance between focusing support on the worst energy efficient properties whilst making sufficient progress toward fuel poverty targets and carbon reduction targets by upgrading as many properties as possible.

19. Current proposals are to limit ECO4, in the most part, to owner occupiers in receipt of means tested benefits with the exception of Flexible Eligibility, which is proposed to be open to those earning below £31,000[25] or referred via one of the low-income and vulnerable proxies[26]. There is a larger pool of eligible properties under Flexible Eligibility than on means tested benefits (as shown in Table 1). Under ECO3, Flexible Eligibility is limited to 25% of the supplier obligation, however given the narrower focus of ECO4, the Government is proposing expanding the use of Flexible Eligibility. This would allow suppliers to make greater use of the larger eligible pool under this section of the scheme.

20. There is a clear trade-off between exclusively targeting homes in the worst three EPC bands and upgrading enough homes to make sufficient progress toward fuel poverty targets, carbon reduction targets and ensuring a large enough eligible pool to make the scheme deliverable for suppliers.

21. Focusing solely on the worst three EPC bands would result in an eligible pool for ECO4 of 300,000 homes on means tested benefits and 500,000 potentially eligible through Flexible

[23] BEIS Household Energy Efficiency Statistics April 2021 – Table T2.8
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/978937/Headline_HEE_tables_22_APR_2021_FINAL.xlsx

[24] Includes broken boiler replacement, boiler upgrade repair and first time central heating

[25] This amount has been chosen based on it being around £5,000 above means tested benefits threshold for a family with multiple children.

[26] Limited to Band E-G homes - An example might be where the Lower Super Output Area (LSOA) 1-3 and Council Tax reductions beyond a single person rebate is combined. Proxies must demonstrate that a householder is low income or both low income and vulnerable.

Eligibility[27]. This option would focus on the very worst properties but would result in fewer homes upgraded overall and given the small eligible pool would significantly increase the delivery risks for suppliers.

22. Alternative options have also been considered to increase this eligible pool, by expanding the scheme eligibility out to include EPC D properties, including social housing, and how to incentivise as many E, F and G properties whist including Ds.

Policy Option 0 – the 'Do Nothing' Option

23. Under this option, the current ECO scheme ends in March 2022 and obligated energy suppliers are no longer required to deliver heating and insulation measures to homes. Households targeted under ECO4 have low income and tend to suffer from a lack of access to credit, meaning they would not generally be expected to install measures, other than replacing broken boilers, in the absence of Government intervention.

24. This option represents the counterfactual against which the costs and benefits of the consultation options are assessed (more details on the counterfactual can be found in Section 5.2).

Policy Option 1 – Scheme open to all E, F and Gs

25. This option involves continuing ECO for an additional 4 years to March 2026 and increasing the level of spend to £1bn per year as announced in the Energy White Paper[28]. The scheme will continue to focus on low income, vulnerable and fuel poor households. Unlike ECO3, the eligibility criteria will be limited to E, F and G homes, with a minimum energy efficiency requirement imposed to ensure as many homes as possible are upgraded to EPC band C.

26. Flexible eligibility would be expanded, to allow up to £1.2 billion of the ECO4 spend envelope (30% of total) to be spent on properties referred via Flexible Eligibility.

Policy Option 2 – Scheme open to low band Ds and all E, F and Gs

27. This option is the same as Option 1 but would include low band D properties. Band D properties have a SAP score of between 55 to 68, the mid-point of under 62 is taken to define low band D properties. Including only the bottom half in terms of SAP score for band D properties results in 700,000 properties eligible due to receiving means tested benefits and 1 million potentially eligible through local authorities[29].

Policy Option 3 – Scheme open to all band D, E , F and Gs

28. This option is the same as Option 2 but would further increase the eligible pool by opening eligibility up to all band D properties. Including all EPC D properties increases the eligible pool to 1.5 million under means tested benefits and 2 million under local authority flexibility[30].

Policy Option 4 – Scheme open to all band D, E , F and G owner occupier properties, with a minimum requirement of E, F and G private tenure homes upgraded. Support provided for social housing at E, F and G.

27 See modelling annex for more detail on methodology. Eligibility estimates are based on EHS data feeding into the NHM and they include only owner occupier properties. Flexible eligibility estimates are particularly uncertain given uncertainty around how many Local Authorities (LA) may particate in ECO4. Estimates have been reduced by 50% to align with latest ECO3 delivery figures which suggest 193 LAs are actively participating in ECO3 (defined as having delivered over 50 measures each).

28 https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

29 See modelling annex for more detail on methodology behind eligibility estimates.

30 See modelling annex for more detail on methodology behind eligibility estimates.

29. This is the preferred option. This option is the same as option 3 but aims to maximise delivery to E, F and G properties by imposing a minimum requirement of 100,000 E, F and G homes upgraded over the four years[31]. This option also extends support to social housing tenants in E, F and G properties – increasing the eligible pool for the least energy efficient properties by 200,000.

30. The policy also involves:
    a. Setting the solid wall insulation minimum requirements to 22,000 per year.
    b. A cap on broken efficient heating systems of 10,000 per year; 5,000 for repairs and 5,000 for replacements
    c. Permitting between 10% of the scheme to be met through innovative measures.
    d. Maintaining the supplier threshold (at which suppliers become obligated under ECO at 150,000 customer accounts) but reducing the supplier allowance to redistribute the obligation. This is intended to create a more level playing field by reducing the share of obligation placed on larger suppliers.

31. More detail on the overarching vision for the policy can be found in the accompanying consultation document.

Policy Option 5 – Scheme open to all band D, E , F and G owner occupier properties, with a minimum requirement of E, F and G private tenure homes upgraded. Support provided for social housing at E, F and G. Limit the use of Flexible Eligibility.

32. This option is the same as Option 4 but limits the proportion of obligation able to be delivered via Flexible Eligibility to a similar level as the current scheme (25% under ECO3). This is done by reducing spend on these households to £200 million or around 5% of the total spend envelope. As the pool for Flexible Eligibility is larger than that for households on benefits, it would be easier for suppliers to seek out the most cost-effective properties from this group. This allows suppliers to deliver greater levels of obligation for a reduced cost, meaning even when spend on Flexible Eligibility is limited a significant proportion of the obligation can still be delivered via this route – roughly 25%.

Table 1: Estimated eligible pool under each option[32]

Eligible pool	Option 1	Option 2	Option 3	Option 4	Option 5
On benefits	300,000	700,000	1,500,000	1,500,000	1,500,000
Social housing				200,000	200,000
Flexible eligibility	500,000	1,000,000	2,000,000	2,000,000	2,000,000
Total	**800,000**	**1,700,000**	**3,500,000**	**3,700,000**	**3,700,000**

4. Targets for Obligated Suppliers

[31] The maximum number of E, F and G properties able to be upgraded is modelled by deflating the scores for band D homes by 40% to further incentivise E, G and Gs. However, we do not intend to include score deflations within the final policy. This will not affect the costs and benefits of the scheme but will increased the required level of notional bill savings.

[32] Estimates are based on modelling from the National Household Model (NHM), with pplied to account for increases in UC recipients due to covid-19. See 'Annex A – Modelling approach' for more details.

33. The provisional targets for ECO4 (based on the preferred option) are:

- **The proposed target is £94 million in notional annual bill savings to be achieved by March 2026. This target is provisional and should be seen as purely illustrative at this stage**. The final target will depend on the final scoring framework decisions made by Ofgem. Under ECO4, the target is set based on the annual bill savings achieved as opposed to lifetime bill savings as a result the ECO4 target is in millions as opposed to billions (like under ECO3). The reason for this change is scores under for ECO4 are awarded based on the overall package as opposed to scores awarded for individual measures as under ECO3. Determining the lifetime savings of a package of measures is complicated by different measures within a package having different useful lifetimes. For simplicity, the scoring framework has moved away from measuring scores in terms of lifetime bill savings[33].
- Set a band E, F and G minimum at 100,000 private tenure homes between March 2022 to March 2026
- Set a solid wall minimum at 88,000 solid walls being insulation over the March 2022 to March 2026
- Limit the repair and replacement of broken efficient heating systems to 5,000 per year each (10,000 measures in total).

5. Analytical approach

34. The policy options assessed in this Impact Assessment are modelled using the National Household Model (NHM). The NHM is a discrete event simulation model that allows the user to model supplier actions by installing various measures in different houses and estimating the impact. For example, all uninsulated lofts could be insulated, and the associated costs and energy savings assessed. The model is based on the English Housing Survey (EHS), an annual survey of 13,000 face-to-face interviews and 6,000 physical surveys of households in England which, when taken together, represent all the different types of house in the country. To estimate impacts for Great Britain as a whole, outputs have been scaled up based on the ratio of the number of households in England to Great Britain, calculated from official statistics[34].

35. The different policy options have been modelled by selecting properties which meet the eligibility criteria and installing measures to reach the required level of SAP improvement in descending order of cost effectiveness until the spend envelope for that year (or the whole scheme) has been reached. The impacts of the proposed ECO4 are assessed against a 'business as usual' baseline – the counterfactual. More detail on the counterfactual is provided in section 5.2 below and full details on the modelling is provided in 'Annex A – Modelling approach'.

36. There is a large amount of random variation within results, this is due to the limited eligible pool but also the assumed proportion of this pool suppliers can find each year, which is based on random probability. As relatively few homes are treated, the costs and benefits of the scheme are highly sensitive to the properties chosen and their characteristics. The costs and benefits of treating properties can vary greatly depending on the characteristics of a property, such as the fuel being replaced. For example, moving a property away from biomass fuel usage can result in air quality improvements almost three times those when coal usage is

[33] More detail on the approach and options considered for scoring is provided within the consultation document
[34] Ratio of 1.167
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland

reduced[35]. As a result, modelling should be considered in the context of this large variability in costs and benefits which will make results uncertain.

37. Modelling provided in section 7 is focused on owner occupied properties in bands D, E, F and G and social housing in bands E, F and G only. Modelling does not cover homes permitted under 'in-fill' where a purpose-built block of flats includes mixed tenure occupants nor does it include PRS properties that may qualify where aligned with the proposed cost cap for landlords. We are unable to model delivery to PRS properties as the landlord cost cap and level of contribution required under ECO4 are still to be determined. Landlords will also have alternative options to ECO support (which is likely to require a contribution), such as funding installations themselves or applying for an exemption on affordability grounds. This behavioural element would make modelling delivery to PRS properties highly uncertain. We are also unable to model delivery through in-fill as the NHM does not account for the location of homes relative to one another. Delivery through in-fill or to PRS homes may facilitate more cost-effective delivery, which may mean analysis within this IA underestimates the number of homes which could be upgraded under ECO4.

5.1 Appraisal period

38. The policy is appraised over the period 2022 to 2067, an appraisal period of 46 years. This reflects the lifetime of the energy efficiency measures that are expected to be installed during ECO4, the longest-lived of which (cavity wall and loft insulation) are estimated to last for 42 years[36].

39. In reality, we might expect some households to maintain the energy efficiency measures installed to ensure that they last longer than expected. However, as this is a voluntary decision by households, neither the costs nor benefits of doing so are captured within this IA.

5.2 Counterfactual

40. Low income and vulnerable households have (by definition) low incomes, with likely low levels of savings and little access to cheap credit. This means that they would not be expected to be able to finance energy efficiency improvement measures in the absence of Government invention. However, given the importance of hot water and heating, we do expect households to prioritise broken boiler replacements.

41. ECO eligible households are assumed to replace their boilers when broken, with or without policy intervention, which we refer to as 'natural replacements'. This means some of the boilers replaced or repaired under ECO4 may have otherwise been repaired in the absence of policy intervention under the counterfactual (although not necessarily with the same measures[37]) but at a cost to the household as opposed to suppliers. As with past ECO IAs, BEIS assumes that households would face higher costs when replacing boilers than suppliers, who are assumed to pay 75% of the cost that householders would face if replacing the boiler themselves. This is based on the assumption that suppliers would benefit from economies of scale achieved through the bulk buying of boilers under the ECO scheme.

[35] See Green book supplementary guidance on valuation of energy use and greenhouse gas emissions for appraisal. Table 15 Domestic: Urban small air quality damage costs https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/873679/toolkit-for-valuing-changes-greenhouse-gas-emissions.xlsm

[36] Given measures are deployed until March 2026, the appraisal period would need to run to march 2068 (42 years after the last year of ECO4) in order to ensure that all of the energy saving-related benefits from these long-lived measures are captured. The approach of ensuring that the benefits are captured over the full lifetime of the measure is in line with Green Book Guidance.

[37] For example, under ECO4 a heat pump may be installed which saves a household replacing a boiler or storage heater further down the line

42. The costs and benefits presented below represent the additional costs and benefits net of the counterfactual scenario. Further detail on the counterfactual can be found in Annex A – Modelling approach.

6. Categories of Costs and Benefits

6.1 Summary of costs and benefits

43. This section of the IA discusses the resource costs and societal benefits stemming from ECO4. More details on each component used in the cost benefit and distributional analysis can be found in 'Annex A – Modelling approach'. 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
Costs and Benefits included in the Cost – Benefit Analysis (monetised)	Energy efficiency and heating measure installation costs	Societal energy savings
	Hidden costs associated with installing measures	Carbon savings
	Heating measure ongoing operational costs	Air quality improvements
	Supplier administration costs	Comfort taking (the benefit of warmer home)[38]
	Additional supplier search costs under ECO4	
Distributional costs and benefits (included in the distributional analysis)	Supplier delivery costs (including economic rent)	Value to society of lower energy bills in low income, vulnerable and fuel poor households
	Consumer bill impacts	
Non modelled/ non monetised impacts	Justice Impact (no significant impact on the justice system expected)	Flexible eligibility (potential reduction in search costs and economies of scale)
		Increase in innovation for energy efficiency fabric and installation techniques
		Improvement in security of energy supply
		Wider economic benefits, for example supporting the energy efficiency supply chain, creating green jobs
		Community impacts
		Reduction in energy system costs
		Health impacts

[38] Comfort taking is estimated to be 15 per cent of the energy savings from the installed measure. See: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/43000/3603-green-deal-eco-ia.pdf p.132 for more details.

6.2 Excess subsidies ('Economic Rent')

44. Under ECO, medium and larger energy suppliers fund the installation of energy efficiency measures in households – resulting in an annual bill saving per home. Each obligated supplier has an overall target, in terms of the amount of notional annual bill savings they must deliver for households. Each supplier's target is based on their share of the domestic energy market in Britain. The obligated energy suppliers work with installers to introduce certain efficiency measures into eligible homes, such as loft or wall insulation, or heating measures. Suppliers will receive a 'score' for every home upgraded, based on the notional bill saving achieved, which will count toward meeting their total obligation.

45. The modelling assumes households, local authorities or devolved administrations do not need to contribute toward the installation of measures (although in some cases a contribution will be required – such as for landlords). As observed under previous ECO schemes, installers are expected to sell notional annual bill savings to suppliers. Installers are then expected to seek out the most cost-effective properties, looking to achieve these annual bill savings for the lowest price.

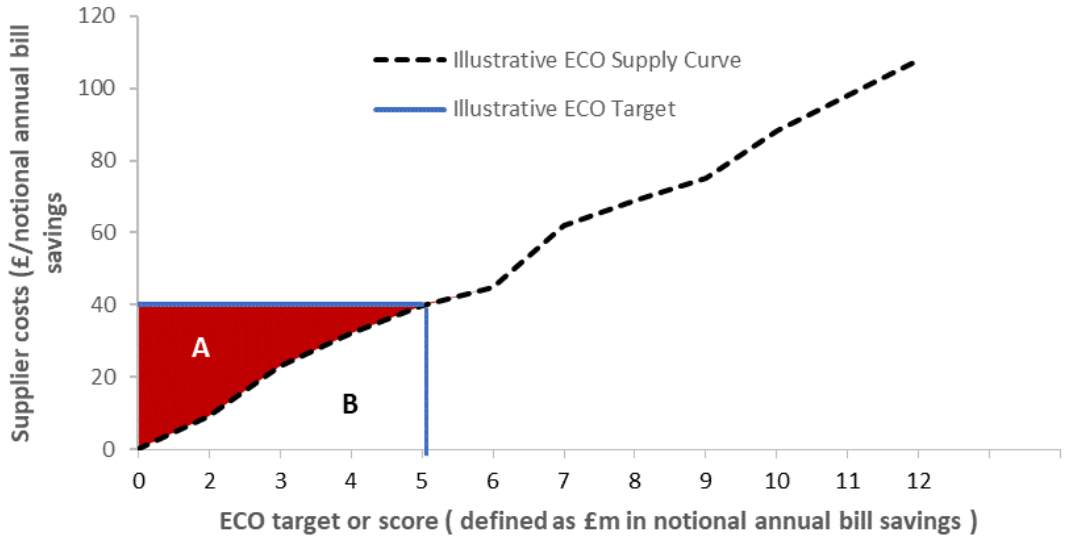
46. There is scope for excess subsidies called economic rent to accrue under ECO4, as in previous iterations of the scheme. There are several ways in which this excess subsidy could occur, benefiting different groups and the true distribution is unknown. The concept of economic rent is illustrated in Figure 2 below. The blue vertical line shows the demand (from suppliers) for a purely illustrative level of obligation, measured in notional annual bill savings. The upward sloping dotted black line, meanwhile, shows the supply of notional annual bill 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 bill savings targets, suppliers can promote and install the most cost-effective measures and can target the most amenable households.

47. As the level of the target increases, suppliers must move up the supply curve, and consequently pay larger subsidies to less amenable households or install higher cost measures; these act to increase the market clearing subsidy that suppliers must pay to meet their obligation.

48. Economic rent could accrue to businesses, for example, the supply chain could benefit if installers achieve excess profits when selling notional bill savings to energy suppliers. If the price installers charged suppliers for delivering notional bill savings was equal to the cost of installing the measures in each specific home, the cost of the scheme would be the area under the supply curve (area B in Figure 2) and installers would make no additional profit. However, if installers charge suppliers at the marginal price for bill savings (horizontal blue line in Figure 2) the actual costs of delivering the scheme for suppliers will be area A + B, with installers accruing area A as economic rent. Energy suppliers themselves could also capture excess subsidy if they pass higher costs onto their consumers than they incur from delivering ECO.

49. Alternatively, households could benefit by the fact suppliers and installers 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. If they therefore must pay the same subsidy to all households to meet their obligation (horizontal blue line in Figure 2)), some households may receive a subsidy larger than they would have needed to induce them to take up the measure. This means the household would benefit from area A.

Figure 2: Illustrative ECO Supply Curve



50. Given this uncertainty around the distribution of economic rent, two scenarios have been provided within this IA. The first assuming all economic rent accrues to households and the second assuming it accrues to businesses (via suppliers). These assumptions do not affect the non-weighted NPVs (as it is reflected as a transfer between economic agents) but will affect the estimated cost to business and the equity weighted NPV which weights economic rent differently depending on who pays or benefits.

51. Modelling accounts for the economic rent when calculating the volume of measures and targets suppliers are expected to be able to achieve within the £1bn per annum spend envelope. In other words, when determining what target suppliers can achieve at a spend level of £1bn per year, the model will use the combined costs of areas A and B – rather than just B.

7. Monetised and non-monetised costs and benefits of each option (including administrative burden)

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

Table 3: Aggregate costs and benefits of ECO4, 2022 – 2067 (£m, 2021 prices)

Description of costs and benefits	Present Value				
	Option 1	Option 2	Option 1	Option 4 (Preferred Option)	Option 1
	EFG No D Flex 50%	EFG Low D Flex 50%	EFG Any D Flex 50%	EFG Any D Min+SH Flex 50%	EFG Any D Min+SH Flex 25%
Installation costs	1,110	1,400	1,470	1,620	1,340
Reinstallation costs - paid by households once measures reach the end of their useful lifetime	440	540	530	620	500
Natural boiler replacement costs - household saving from not having to replace existing boilers	-30	0	-70	-10	-50
Hidden costs – hassle costs for household associated with installations	40	60	90	90	70
Supplier administration costs	360	360	360	360	360
PAS costs – retrofit assessor costs	50	90	150	140	110
Search costs	60	80	110	110	90
Operational costs of running measure	7	6	6	5	5
Value of economic rent *(assumed to be paid by the suppliers) - [not included in NPV]*	760	1,510	1,940	1,720	2,090
Total Costs (excluding rent)	**2,040**	**2,540**	**2,650**	**2,940**	**2,420**
Value of energy saved	930	1,020	1,060	1,290	940
Value of air quality improvements	260	170	160	200	90
Value of change in traded carbon savings	30	20	20	40	30
Value of change in non-traded carbon savings	670	880	950	970	700
Value of comfort taking	260	310	330	400	290
Total Benefits	**2,160**	**2,400**	**2,520**	**2,900**	**2,050**
Overall Net Present Value	**120**	**-130**	**-130**	**-30**	**-370**
Total supplier spend	**2,300**	**3,400**	**4,000**	**4,000**	**4,000**

53. Most of the options considered above have a negative NPV compared to ECO3 which had a positive NPV of £718m in 2017 prices. The preferred option for ECO4 results in a similar level of benefits compared to ECO3[39] but larger costs, resulting in a negative NPV. These larger costs are driven by the increased size of the obligation placed on suppliers, the spend envelope has increased from £640m per year to £1bn, with a focus on improving the least energy efficient properties, improving them by at least two EPC bands and to at least a D. This results in more spend per home, meaning fewer homes treated but greater benefits per home. All options are relatively close to the zero mark with only small changes needed to switch from positive to negative and vice versa.

54. The value placed on changes in greenhouse gas (GHG) emissions is currently under review, now the UK has increased its domestic and international ambitions. This means, current central carbon values are likely to undervalue GHG emissions, though the scale of undervaluation is still unclear. As Section 9 below illustrates, placing a higher value on GHG

[39] BEIS, ECO3 Final IA 2018
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749638/ECO_3_Final_Stage_IA__Final.pdf

emissions (using current Green Book high values) has the potential to turn the NPVs above positive.

55. It is important to note that the small eligible pool and findability rates lead to a large amount of variability within results – for example in the preferred option, the capex estimates have a range of £1bn between the highest and lowest estimates produced by different runs. Modelling shows that although estimates around the number of homes treated remain relatively stable in terms of relativity between the different options, there is a larger amount of volatility within the costs and benefits of the scheme, which affects the NPV estimates and their relativity between options. This is because results are highly sensitive to the properties chosen and their characteristics.

56. Under Options 1 and 2, modelling suggests suppliers would be unable to find enough properties to spend the full £4bn ECO4 spend envelope, meaning fewer homes are upgraded and benefits such as carbon savings are lower. This is a modelled outcome which may not reflect real life but does show how difficult it would be for suppliers to find homes in options which restrict band D properties, potentially making the scheme undeliverable under these options. Option 5 shows even with a larger pool, when Flexible Eligibility is limited to only 5% of supplier spend (resulting in around 25% of the obligation), suppliers are required to treat much less cost-effective properties. Compared to Option 4, this results in higher levels of economic rent and reduces the amount of spending available to treat households and produce energy savings.

57. The installation costs of the energy efficiency measures, which do not include any 'excess subsidy' or economic rent (as this is a transfer), represent the largest societal cost from ECO 4 under all polices. The second largest costs are the reinstallation costs which are assumed to be paid for by households once measures have reached the end of their expected lifetime.

58. Fixed admin (supplier administration costs) represents the second largest component of the costs for suppliers, at £360m across all options – these fixed costs incurred by suppliers do not vary across options. This estimate is based on the administrative costs seen under ECO2; this scheme was suggested by suppliers as providing a potential indicator of the level of administrative costs of ECO4. More detail is provided in 'Annex A – Modelling approach'.

59. Search costs under ECO4 are based on per measure costs used under ECO3[40]. There is significant uncertainty around these costs for several reasons. Given the move to a package approach under ECO4, applying search costs to each individual measure within a package may overinflate the work involved with finding homes suitable for a package of measures. Equally, data used to inform search costs estimates were collected under ECO2t which had a larger eligible pool than ECO4[41] and so may have had lower search costs than ECO4 will. Given the uncertainty around search costs we have conducted several sensitivity tests in Section 9. The Government is proposing to continue exploring ways to reduce search costs, to identify eligible households, homes needing upgrades and household demand.

Equity weighted NPV

60. It is important to consider the relative impacts on different subsets of society, their ability to afford the policy costs, and the additional utility received from the monetised policy benefits. The tables in this section show the same costs and benefits as in Table 3, but after applying equity weights to the appropriate components. Different equity weights have been applied for

[40] See Annex B – Modelling approach for more information on the assumed search costs

[41] Eligible pool under ECO2t was 4.7 million homes

recipients under each option based on the income distribution of recipients for that option. This reflects the distributional impacts of the scheme, consistent with the Green Book guidance[42] (see 'Annex A – Modelling approach for more information on the equity weights).

61. The equity weighting tends to increase both the costs and benefits of the policy outlined in Table 3, but with a more significant increase in benefits. This is because most of the costs are paid for by all energy consumers, who are evenly distributed across income groups; but the benefits 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 perspective, because £1 of cost or benefit is worth more to households on a lower income than to those on a higher income. The equity weighted NPV includes transfers such as economic rent and VAT on measures but considers the distribution impacts based on who pays.

62. Table 4 provides the equity-weighted NPV when economic rent is assumed to benefit recipients, therefore a higher weight is applied to the benefit of economic rent to reflect these households having a lower income distribution than the general public. Table 5 shows the equity weighted NPV under the alternative assumption that the benefit of economic rent accrues to business and therefore no weight is applied to the benefits.

63. If households are assumed to benefit from economic rent the equity-weighted NPVs tend to be higher than non-weighted NPVs. This is because the benefits of economic rent are weighted more heavily than the costs.

64. The reverse happens if this rent is assumed to accrue to installers and all the equity weighted NPVs turn negative as some of the largest benefits of the scheme go to businesses at the expense of bill payers. Table 5 shows that under this assumption Option 1 has the best equity weighted NPVs, this is mainly driven by the lower economic rent in this option. However, it should be noted that under Option 1 the eligible pool is so small that modelling suggests suppliers would not be able to find sufficient properties to spend the full ECO4 spend envelope of £4bn over 2022-2026.

[42] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

Table 4: Equity-weighted NPV of ECO4, 2022 – 2067 (£m, 2021 prices) – assuming economic rent accrues to recipients

Description of costs and benefits	Present Value				
	Option 1	Option 2	Option 3	Option 4 (Preferred Option)	Option 5
	EFG / No D / Flex 50%	EFG / Low D / Flex 50%	EFG / Any D / Flex 50%	EFG / Any D / Min+SH / Flex 50%	EFG / Any D / Min+SH / Flex 25%
Installation costs	1,650	2,080	2,180	2,390	1,990
Reinstallation costs (including VAT)	740	880	900	1,080	910
Natural boiler replacement costs *(including VAT paid by households)*	-50	-10	-130	-20	-110
Hidden costs	40	60	90	90	70
Supplier administration costs	530	530	530	530	530
PAS costs	80	130	220	210	160
Search costs	80	120	160	170	130
Operational costs of running measure	10	10	10	10	10
Value of economic rent *(assumed to be paid by the suppliers)*	1,130	2,240	2,880	2,550	3,090
Total Costs	**4,210**	**6,050**	**6,840**	**7,010**	**6,780**
Value of energy saved	930	1,020	1,060	1,290	940
Value of air quality improvements	260	170	160	200	90
Value of change in traded carbon savings	30	20	20	40	30
Value of change in non-traded carbon savings	670	880	950	970	700
Value of comfort taking	410	460	510	630	500
Extra utility from lower bills in low income households	*840*	*850*	*1,040*	*1,320*	*1,150*
Value of economic rent to low income households	*1,190*	*2,260*	*3,020*	*2,730*	*3,530*
VAT benefit to society	*30*	*50*	*30*	*60*	*30*
Total Benefits	**4,360**	**5,710**	**6,790**	**7,230**	**6,960**
Equity-weighted Net Present Value	**150**	**-330**	**-50**	**220**	**180**

Table 5: Equity-weighted NPV of ECO4, 2022 – 2067 (£m, 2021 prices – assuming economic rent accrues to business

Description of costs and benefits	Present Value				
	Option 1	Option 2	Option 3	Option 4 (Preferred Option)	Option 5
	EFG / No D / Flex 50%	EFG / Low D / Flex 50%	EFG / Any D / Flex 50%	EFG / Any D / Min+SH / Flex 50%	EFG / Any D / Min+SH / Flex 25%
Installation costs	1,650	2,080	2,180	2,390	1,990
Reinstallation costs (including VAT)	740	880	900	1,080	910
Natural boiler replacement costs (including VAT paid by households)	-50	-10	-130	-20	-110
Hidden costs	*40*	*60*	*90*	*90*	*70*
Supplier administration costs	530	530	530	530	530
PAS costs	80	130	220	210	160
Search costs	80	120	160	170	130
Operational costs	10	10	10	10	10
Value of economic rent *(assumed to be paid by the suppliers)*	1,130	2,240	2,880	2,550	3,090
Total Costs	**4,210**	**6,050**	**6,840**	**7,010**	**6,780**
Value of energy saved	930	1,020	1,060	1,290	940
Value of air quality improvements	260	170	160	200	90
Value of change in traded carbon savings	30	20	20	40	30
Value of change in non-traded carbon savings	670	880	950	970	700
Value of comfort taking	410	460	510	630	500
Extra utility from lower bills in low income households	*840*	*850*	*1,040*	*1,320*	*1,150*
Value of economic rent (assumed to accrue to supply chain)	*760*	*1,510*	*1,940*	*1,720*	*2,090*
VAT benefit to society	*30*	*50*	*30*	*60*	*30*
Total Benefits	**3,930**	**4,970**	**5,710**	**6,220**	**5,510**
Equity-weighted Net Present Value	**-270**	**-1,070**	**-1,120**	**-780**	**-1,260**

7.1 Annual costs to suppliers

65. The social impacts of the policy shown above are not expected to be shared equally across society, with obligated suppliers expected to incur most of the costs presented in Table 3. ECO4 has a spend envelope of £1 billion per year, rising with inflation, until March 2026. Suppliers are in turn assumed to recoup the costs they incur from meeting their obligation from their gas and electricity customers.

66. Table 6 below, shows suppliers' costs during ECO4, and how these compare to the expected annual supplier costs under current scheme[43].

[43] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749638/ECO_3_Final_Stage_IA__Final.pdf

Table 6: Expected supplier costs during the current ECO scheme (ECO3) and ECO4 (real 2021 prices, undiscounted)

Cost Component	Cost (£m) per annum under ECO4 (all options)	Costs (£m) per annum under ECO3 IA
Delivery Costs	£906	£585
Administration	£94	£55
Total Costs	**£1,000**	**£640**

67. It is expected that administration costs for ECO4 will be higher than under ECO3, not only due to the larger obligation but also because of changes to the scoring mechanism and the move towards a package approach.

7.2 Measure uptake

68. Table 7 below shows modelled gross energy efficiency measure uptake during ECO4. Under nearly all options external wall insulation is the insulation measure with the highest uptake rate. This reflects the importance of solid wall insulation in meeting the minimum improvement requirement of the scheme, which aims to improve all F and G households to at least a Band D and to improve all Band D and E homes to at least a Band C.

69. Results for Option 1 to Option 3 show that the larger the eligible pool the more measures are delivered (as more homes are upgraded). The preferred option results in slightly fewer measures delivered than Option 3. This is because Option 4 focuses more support on E, F and G households, which are more expensive to treat, resulting in fewer properties treated overall than Option 3. Option 5 shows that if the use of Flexible Eligibility is limited, fewer properties get treated.

Table 7: Modelled uptake of energy efficiency measures between March 2022 – March 2026

	Option 1	Option 2	Option 3	Option 4 (Preferred Option)	Option 5
	EFG + No D + Flex 50%	EFG + Low D + Flex 50%	EFG + Any D + Flex 50%	EFG + Any D + Min+SH + Flex 50%	EFG + Any D + Min+SH + Flex 25%
Floor insulation	20,000	40,000	80,000	65,000	50,000
Filled Cavity wall insulation	20,000	60,000	105,000	105,000	65,000
Loft insulation	20,000	35,000	75,000	80,000	45,000
External wall insulation	75,000	100,000	105,000	110,000	100,000
Broken heating systems repair/replacements	15,000	25,000	30,000	25,000	15,000
First time gas central heating	15,000	20,000	15,000	20,000	15,000
Storage heaters[44]	-	-	-	-	-
Heat Pumps	20,000	20,000	15,000	25,000	20,000
Heating controls	60,000	110,000	165,000	150,000	115,000
Draught-proofing	15,000	15,000	25,000	25,000	15,000
Solar Photovoltaic	5,000	5,000	5,000	5,000	5,000
HWT insulation + thermostat	15,000	15,000	20,000	25,000	15,000
Total measures	**285,000**	**445,000**	**640,000**	**630,000**	**470,000**

[44] Storage heaters are available under ECO4 but only for homes with electric heating– the modelling found that very few or none were delivered.

7.3 Homes Treated

70. The number of homes treated under ECO4 under the five policy options is shown in Table 8 below. The preferred option results in the greatest number of E, F and G properties treated, as well as the greatest number of fuel poor homes treated.

71. The preferred options treated slightly fewer fuel poor homes than Option 3, however less E, F and G properties are treated under this option.

Table 8: Estimated number of homes treated and insulated under ECO4[45]

	Option 1	Option 2	Option 3	Option 4 (Preferred Option)	Option 5
	EFG / No D / Flex 50%	EFG / Low D / Flex 50%	EFG / Any D / Flex 50%	EFG / Any D / Min+SH / Flex 50%	EFG / Any D / Min+SH / Flex 25%
Number of homes treated (GB)	115,000	190,000	315,000	305,000	225,000
Number of EFG homes treated (GB)	110,000	100,000	90,000	125,000	90,000
Homes getting CWI or SWI (GB)	95,000	160,000	210,000	215,000	165,000
Fuel Poor Homes treated (England Only)	30,000	40,000	70,000	75,000	65,000
Social housing homes treated (GB)	-	-	-	20,000	20,000

7.4 Fuel Poverty Impact

72. Table 8 shows 75,000 fuel poor homes are expected to be treated in England this equates to 29% of recipients in England being fuel poor. Table 9 shows progress towards the fuel poverty target and milestones, alongside the latest fuel poverty statistics for England (2021)[46], to demonstrate the contribution ECO4 is expected to make to fuel poverty targets. This is measured using the LILEE measure of fuel poverty.

73. The table shows that by the end of ECO4, 65,000 fuel poor properties are expected to be upgraded to Band C (thus FPEER C) and therefore no longer be in fuel poverty. Around 5,000 Band F and G properties are expected to move to Band D. It should be noted these estimates are subject to small sample sizes, so there is considerable uncertainty around them.

74. Due to modelling and data limitations, it has not been possible to undertake equivalent estimates for Scotland or Wales, although we would anticipate similar impacts on fuel poor households in Scotland and Wales, relative to population size.

Table 9: Estimated impact of ECO4 on fuel poverty (England Only), 2026[47]

Fuel poor households	Latest Fuel Poverty Statistics (2021) -	Option 4 – Preferred Option (end 2026)[48]	
		Upgraded to Band C	Upgraded to Band D
Band D	2,496,000	45,000	-
Band E	522,000	20,000	-

[45] Figures rounded to nearest 5,000

[46] Using 2019 data – see Table 3. https://www.gov.uk/government/statistics/fuel-poverty-detailed-tables-2021

[47] Modelled figures rounded to nearest 5,000 so may not sum to totals in table 9 or total fuel poor homes shown in Table 8.

[48] Number based on low sample count (between 10 and less than 30), inferences should not be made based on this figure.

Band F/G	158,000	<5,000	5,000
Total	**3,176,000**	**65,000**	**5,000**

7.5 Carbon Savings

75. Table 10 shows the traded and non-traded carbon savings under all options. Table 11 shows the traded and non-traded carbon savings under the preferred option for both Carbon Budget 5 and 6 and across the whole lifetime of the policy. Savings are larger in the non-traded sector, reflecting that a majority of homes treated are heated by non-traded fuels (gas, solid fuels or oil). 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 beyond Carbon Budget 6 (CB6).

76. The preferred option results in the greatest carbon saving.

Table 10: Estimated greenhouse gas savings over Carbon Budgets 5 for all options (MtCO2e)

	Option 1	Option 2	Option 3	Option 4 (Preferred Option)	Option 5
	EFG / No D / Flex 50%	EFG / Low D / Flex 50%	EFG / Any D / Flex 50%	EFG / Any D / Min+SH / Flex 50%	EFG / Any D / Min+SH / Flex 25%
Traded	0.09	0.08	0.08	0.14	0.10
Non Traded	0.89	1.16	1.26	1.26	0.94
Total	0.98	1.24	1.34	1.40	1.04

Table 11: Estimated greenhouse gas savings over Carbon Budgets 5 and 6, and over the lifetime of the preferred option (MtCO2e)

	CB5 (2028 – 2032)	CB6	Total
Traded	0.14	0.08	0.62
Non Traded	1.26	1.29	11.48
Total	1.40	1.36	12.10

7.6 Impact on Energy Bills

77. 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 prices. This means that suppliers have an incentive to deliver their obligation as cost effectively as possible, and thus minimise the cost pass-through.

78. 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 estimated average cost of ECO4 on an annual household dual fuel bill is estimated to be the equivalent of around £36 per year (compared to no ECO scheme). However, for those households treated under ECO4, the policy could deliver an average gross saving on their annual dual fuel bill of around £300.

79. After the ECO4 ends (and assuming no continuation of the policy after that period), the bill savings for measures installed under the scheme continue to be realised, but the bill pass

through falls to zero. 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, which is often several decades after the scheme has ended.

7.7 Non-Monetised Impacts

80. There will be some small costs to BEIS and the administrator (Ofgem), which have not been monetised in this IA.

81. There are a significant number of benefits that have not been monetised, due to the limited scope in modelling the scheme, which focusses on setting the obligation size for energy suppliers. Also, the flexibility designed into the scheme, allowing suppliers to decide on the amount of flexible eligibility and innovative measures they deliver, will vary the range of benefits the policy delivers. These non-monetised benefits include:

- **Benefits of Flexible Eligibility:** Local Authorities' ability to access Flexible Eligibility funds could better enable the scheme to be targeted at areas that benefit from these measures the most. Suppliers delivering through Local Authorities may benefit from reduced search costs and economies of scale, for example, if suppliers are able to treat multiple neighbouring homes with solid wall at the same time. There could also be reduced compliance costs to suppliers using Flexible Eligibility as they do not need to check eligibility with the Department of Work and Pensions, helping to reduce bureaucracy.

- **Health impacts**: although not included in the NPV, there are likely to be additional health benefits associated with improving the energy efficiency (and warmth) of a home. BEIS continue to work to develop a system to accurately calculate and monetise these benefits.

- **Community impacts**: improving the well-being of vulnerable households will improve the communities of those amongst which they live. Also, measures such as solid wall insulation, often has the effect of giving areas a 'face lift', increasing further the wellbeing of those living there.

- **Wider Economic benefits**: the scheme will continue to support the energy efficiency supply chain and, in tandem with its impact on innovation, promote growth in jobs in the sector.

- **Lower energy imports:** reducing the amount of energy inputs required from overseas, reducing the country's reliance on imports and improving security of supply.

- **Lower costs of meeting peak energy demand**: increasing energy efficiency reduces the amount of peak energy demand, particularly from electrically heated homes. This reduces the amount of capacity that needs to be constructed in the grid.

- **Increase in innovation (10% of the obligation can be delivered through innovation):** the scheme is focussed on increasing business activity, particularly in areas with large potential for growth through innovation, delivering potential cost reductions in the future.

7.8 Summary

82. The sections above show how the preferred option (Option 4) does not result in the highest NPV but strikes a balance between focusing support on the worst properties first, whilst ensuring as many homes are upgraded as possible. Upgrading the worst homes first will help toward fuel poverty targets, but also reduce the risk of homes not currently in fuel poverty becoming fuel poor in future. A focus on more E, F and G homes upgraded within ECO4 also reduces the burden for future schemes and helps the UK meet net zero ambitions with as homes as possible upgraded to EPC Band C by 2035 where practical, cost-effective and affordable.

83. The benefits delivered under this scheme are focused on low-income homes and are intended to address market failures which mean upgrades delivered by ECO4 are unlikely to have happened in the absence of policy intervention, highlighting the additionality of the scheme.

8. Direct costs and benefits to business calculations

84. Businesses that will face a direct regulatory impact because of ECO4 are large domestic energy suppliers with more than 150,000 customer accounts and that supply more than 300GWh of electricity and 700GWh of gas per year

85. The supply chain will also be affected by the obligation, as energy suppliers will contract with third parties to deliver installation and heating measures to allow them to meet their ECO targets. However, in line with Better Regulation Executive guidance, these changes are indirect and so its impacts are not captured in the EANDCB.

8.1 Equivalent Annualised Net Direct Cost to Business (EANDCB)

Direct costs

86. The costs suppliers incur are expected to be passed on from suppliers to customers through energy bills, so these costs are treated as direct for EANDCB purposes, consistent with their treatment in past ECO IAs[49].

87. All key direct costs for the purposes of calculating the EANDCB have been monetised. These broadly fall into two categories – supplier delivery costs and supplier administration costs, totalling £1bn per year (undiscounted figures).

88. Direct costs determined to be direct costs include:

- Installation costs
- Economic rent that suppliers pay to households or installers
- Administration Costs
- PAS costs
- Search costs

[49] The 2012 ECO IA can be found here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42984/5533-final-stage-impact-assessment-for-the-green-deal-a.pdf , while the 2014 ECO IA can be found here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/373650/ECO_IA_with_SoS_e-sigf_v2.pdf

89. Section 6.2 outlines that the level of the market clearing subsidy is assumed to be the last (or marginal) household installing a measure, which results in economic rent. The distribution of economic rent is unknown, but two scenarios have been included to illustrate the potential range of impacts. Scenario 1 shows costs to business if all economic rent accrues to households. Scenario 2 estimates the costs on businesses if all economic rent accrues to the supply chain. In Scenario 2 the costs on business are therefore neutral overall, but with the supply chain benefiting and suppliers facing increased costs (which they pass onto customers).

Direct Benefits

90. Assuming suppliers do not accrue any economic rent, means there are no direct benefits to obligated parties in complying with the regulations. In Scenario 2, installers may benefit from profits achieved by selling notional bill savings to suppliers.

91. There may also be some benefits to businesses contracted to deliver installation and heating measures. However, in line with the Better Regulation Executive guidance[50], these changes are indirect and so its impacts are not captured in the EANDCB.

EANDCB Position and Business Impact Target Status

92. The EANDCB for the preferred option is estimated to be between £80 million and £150 million in 2019 prices depending on assumptions around economic rent.

Table 12: EANDCB and Business Impact Target - 2021 prices

	Present Value - 2021 prices				
	Option 1	Option 2	Option 3	Option 4 (Preferred Option)	Option 5
	EFG / No D / Flex 50%	EFG / Low D / Flex 50%	EFG / Any D / Flex 50%	EFG / Any D / Min+SH / Flex 50%	EFG / Any D / Min+SH / Flex 25%
Installation costs	1,110	1,400	1,470	1,620	1,340
Economic rent	760	1,510	1,940	1,720	2,090
Supplier administration costs	360	360	360	360	360
PAS costs – retrofit assessor costs	50	90	150	140	110
Search costs	60	80	110	110	90
Total direct costs scenario 1	**2,340**	**3,450**	**4,030**	**3,960**	**3,980**
Total direct costs scenario 2	**1,580**	**1,930**	**2,090**	**2,230**	**1,890**
2019 prices - 2020 present values					
EANDCB scenario 1	**90**	**130**	**150**	**150**	**150**
EANDCB scenario 2	**60**	**70**	**80**	**80**	**70**
BIT Score scenario 1	**440**	**650**	**750**	**730**	**740**
BIT Score scenario 2	**290**	**360**	**390**	**410**	**350**

[50] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/916918/better-regulation-guidance.pdf

9. Risks and assumptions

93. The impacts of ECO4 on suppliers and households is uncertain due to a range of factors. Sensitivities around the preferred option have been conducted around key assumptions, holding all other factors constant, to determine the impact of certain assumptions on the cost to suppliers of meeting their targets. Assumptions tested include;

- **Capital cost of measures** – the analysis in this IA draws on the most up to date evidence available on capital costs, but these may change in future, for example because of innovation or changes in demand. Sensitivity tests have been conducted to show the impact of high and low capital costs using a ± 30% range.
- **Search costs –** search costs are also uncertain given the smaller eligible pool under ECO4 and the move to a package approach. Sensitivity tests have also been conducted to show the impact of high and low search costs using a ± 30% range.
- **Admin costs to suppliers** – at this stage it is hard to estimate the admin costs which suppliers will face. Given the changes under ECO4 they are expected to increase relative to ECO3 but by how much is uncertain. Results have been tested against a range of £55m to £140m – these figures have been identified as viable high and low estimates based on discussions with suppliers[51].
- **Carbon prices –** the value placed on changes in greenhouse gas (GHG) emissions is currently under review, now the UK has increased its domestic and international ambitions. Therefore, current central carbon values are likely to undervalue GHG emissions, though the scale of undervaluation is still unclear. The potential impact of placing a higher value on GHG emissions has been illustrated by using the existing high carbon values series[52].
- **Optimisation approach** – modelling assumes measures are installed in order of cost effectiveness (descending SAP points per £ spent on capital costs). This assumes installers choose to install measures in a near-optimal cost-effective way. It is however difficult to predict how installers will behave, results have therefore been tested using an alternative approach where the cheapest measures are installed first.
- **Findability of properties –** it is difficult to predict how easily suppliers will be able to identify eligible properties suitable for retrofit. Table 13 sets out the central and alternative rates used to test sensitivity around findability assumptions. The first test reduces eligible pool findability rates by 50% whilst maintaining measure specific rates and the second doubles the measure specific rates. More information on these rates is provided in Annex A – Modelling approach.

Table 13: Sensitivity tests conducted on findability assumptions

Sensitivity category	Sensitivity detail	Central	Half household findability	Double measure findability
Household findability – percentage of the eligible pool that can be found each year and the remaining technical potential that	Eligible pool findability	25%	13%	25%
	Cavity Wall Insulation	12%	12%	24%
	Loft Insulation	16%	16%	32%
	Solid Wall Insulation	11%	11%	22%

[51] More information is provided in Annex A – Modelling approach

[52] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

suppliers can identify within that pool each year	Underfloor	10%	10%	20%

94. Table 14 below shows the impact on supplier spend per unit of score and NPV under the various sensitivity tests described above.

Table 14: Change in supplier £ per score relative to preferred option under central assumptions

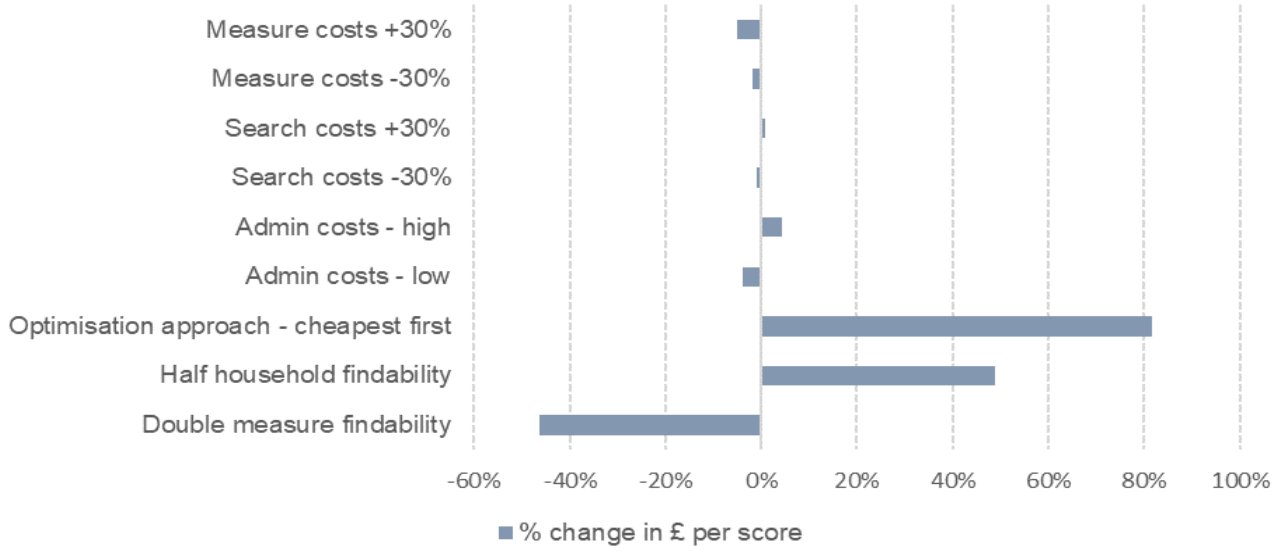
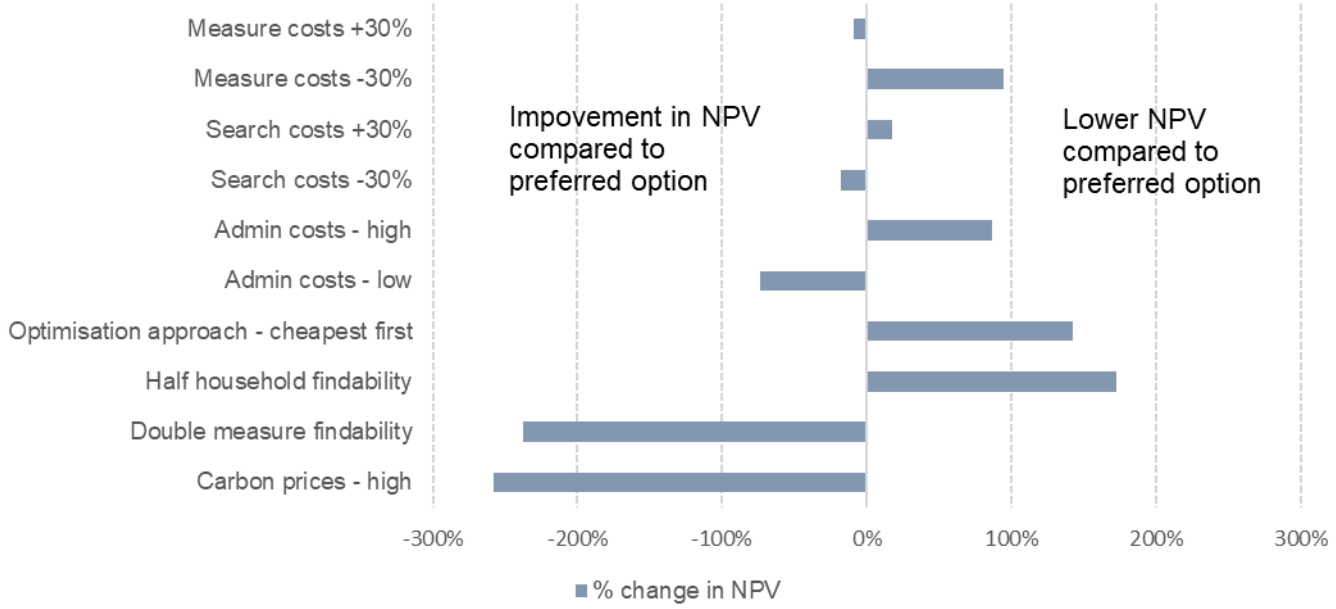


Table 15: Change in NPV relative to preferred option under central assumptions



95. Table 14 shows the price paid per score achieved under the preferred option is not hugely sensitive to assumptions around capex, search costs or supplier administrative costs, with prices remaining within +/- 5% of results under central assumptions. The costs paid by suppliers are much more sensitive to assumptions around the order in which measures are installed (the optimisation approach). This suggests if installers were to install the cheapest measures first, as opposed to the most cost effective, costs could be 80% higher. This approach is expected to be a less likely scenario, installers and suppliers have a clear incentive to deliver the most amount of score for the lowest cost and this behaviour has been observed in previous iterations of ECO. There is also a large amount of sensitivity in results

(both in terms of score costs and NPV), to assumptions around findability. These assumptions are highly uncertain with more work needed to refine.

96. Table 15 shows the percentage change in NPV for the preferred option when assumptions are varied. As the NPV for the preferred option is negative, sensitivity tests which result in a negative percentage change show an improvement in NPV, whereas a positive percentage change is a worsening in NPV. The analysis shows that the NPV for the preferred options is much more sensitive than score cost to varying assumptions, this highlights the issue with volatility around costs and benefits.

97. When using the existing high Green Book carbon values, which may be more likely to reflect the future carbon prices, the NPV for the scheme is positive.

98. There are other modelling risks which could affect results, which have not been tested:

- **Measure mix** – 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. Modelling assumes recipients accept all measures identified as cost effective in getting them to the minimum requirement. If households refuse certain measures, installers could choose to fit less cost-effective measures to meet the minimum requirement or search for another property altogether. If a consumer agrees to a project but then, for example, after one measure is installed, they abort the project, we intend to allow a supplier to receive partial project scores for the measures that have been installed where they don't meet the minimum requirement. If this were to happen on a large scale this could impact the costs involved in ECO4 and the number of properties treated[53]. Additionally, not all measures that can be delivered under ECO4 are included in the modelling for this IA. This may mean suppliers face greater choice in upgrading homes, altering the measure mix chosen and potentially meaning homes can be upgraded for cheaper cost.

- **Eligible homes** – modelling is focused on owner occupied (D, E, F and G) and social housing (E, F and G) properties. Modelling does not cover homes permitted under 'in-fill' where a block of flats includes mixed tenure occupants nor does it include PRS properties that may qualify where aligned with the proposed cost cap for landlords. The modelling is unable to account for location of properties (needed for in-fill modelling) or the decision of landlords under PRS regulations and so as a result, delivery to these tenures has not been modelled. This means the eligible pool may be slightly larger than modelled and could result in more properties treated, though the impacts are not expected to be large.

- **Exemptions** – modelling assumes all household suitable for measures receive them. It does not account for circumstances in which a home cannot meet the minimum requirement, for example due to it being a listed building. Under these circumstances an exemption may be awarded, this could mean the modelling overestimates the number of properties upgraded to the minimum requirement.

- **Flexible Eligibility** – we have assumed that 50% of LAs engage with Flexible Eligibility, this is based on ECO3 delivery[54]. The estimated eligible pool for Flexible Eligibility has

[53] Some of this may be captured within findability rates.
[54] Based on around 50% of LAs delivered over 50 measure each

therefore been reduced by 50%. This is a rough approximation as LAs will be of differing sizes.

99. Further detail on modelling approach and assumptions is included within 'Annex A – Modelling approach'.

10. Impact on small and micro businesses

100. Under the current ECO scheme suppliers become obligated when they reach over 150,000 customer accounts and have a supply volume above 300GWh of electricity and 700GWh of gas per year. There is also a supplier allowance set at 300GWh for electricity and 700GWh for gas, all energy suppliers are entitled to the same supplier allowance, after which their obligations would be calculated on a per unit of supply basis. This is intended to protect smaller suppliers by reducing the size of the obligation for suppliers when they first become obligated and reducing any disincentive to expand.

101. The Government is proposing keeping the customer account and energy supply thresholds unchanged but reducing the supplier allowance by 50%. This would reduce the supplier allowance to 150GWh for electricity and 350GWh for gas per year.

102. Government is committed to eventually removing supplier thresholds, making all suppliers obligated to overcome any market distortion between obligated and non-obligated suppliers. The Energy White Paper[55] set out the intent to remove thresholds, and to do so by enabling small suppliers to participate in ECO without incurring disproportionate costs, for example through a buy-out mechanism. A buy-out mechanism, however, would require new powers under primary legislation, which will not be in place before the start of ECO4. Therefore, the reduction in supplier allowance is the first step toward removing market distortion, without imposing new burdens on small suppliers not already obligated before a buy-out mechanism is available.

103. Based on data to December 2020, an estimated 99% of customers are with obligated suppliers[56]. As supplier thresholds are proposed to remain unchanged, proposals are not expected to increase the number of obligated suppliers or affect any small or micro businesses. Analysis done for a previous BEIS Impact Assessment[57] suggests that the average headcount (in March 2017) for suppliers with 150,000 – 200,000 customer accounts (in December 2017) for which data was available was roughly 120. Available information online on the size of supplier's workforces suggests it is still reasonable to assume no small or micro businesses will be obligated under ECO4.

104. Reducing the supplier allowance, will change the way the obligation is distributed between suppliers. A reduction in supplier allowance will result in an increase in share of obligation for smaller obligated suppliers and a reduction for larger obligated suppliers than if the current supplier allowance were retained. All suppliers will have more of their supply volumes used to calculate obligation share, however for smaller suppliers this increase represents a much larger proportion than for larger suppliers. Table 16 is intended to illustrate this point using a simplified example in which there are only gas supply thresholds, this shows a significant increase in obligation share for small suppliers relative to large when the supplier allowance is reduced.

[55] https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future (page 35).

[56] Data held by Ofgem and collected under ECO3 requirements – correct as of 31st December 2020

[57] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/716463/Warm_Home_Discount_FS_IA_Signed.pdf

Table 16: Illustrative example of a change supplier allowance on different suppliers

Illustrative suppliers (all with 150k+ customers)	Gas supply GWh	Allowance set at 700 GWh		Allowance set at 350 GWh	
		Supply volume obligated on	Share of obligation	Supply volume obligated on	Share of obligation
Supplier 1	10,000	9,300	99.8%	9,650	96.3%
Supplier 2	720	20	0.2%	370	3.7%

105. Some small and micro businesses in the supply chain may also be indirectly affected by the increased level of supplier demand for their services because of the ECO extension to March 2026[58]. This is expected to have a positive impact on these companies' gross profits compared to a counterfactual of not continuing the scheme. However, on the grounds of proportionality, BEIS has not attempted to calculate the impact on gross or net profits as a result of ECO4.

11. Equalities Impacts

106. This section provides an analysis of how different groups of people will be affected by the policy, in line with the government's guidance on the Equality Duty. This guidance suggests the distributional impact of policies should be evaluated with regards to their impact on social groups with protected characteristics including age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief and sex.

107. The government has considered whether any of the above groups might be adversely or positively impacted by this policy in different ways. Equity analysis of ECO4 by protected characteristic is presented below but limited to those characteristics captured the English Housing Survey used within NHM modelling, this is matched with the fuel poverty dataset to provide more information on household characteristics. The government will explore ways to utilise more information in the future to analyse equalities impacts. Estimates for the overall population of households and owner occupier households used in tables below are taking from the English Housing Survey 2019-20[59].

Age

108. ECO4 recipients under the preferred option are expected to be older than the overall population. The age profile of recipients is more like that of English owner occupiers which is the tenure the policy is focused on. As a result, ECO4 is expected to disproportionately benefit older individuals.

Table 17: ECO4 recipients by age (England only)

Age band	Preferred option	Overall population	Owner occupiers
16-24	1%	3%	1%
25-34	7%	14%	9%
35-44	19%	17%	14%

[58] This occurs because a higher demand for energy efficiency measures under ECO will push up the market price. This may cause the installer to take on more work and/ or may increase the margins they receive on their existing work

[59] https://www.gov.uk/government/statistics/english-housing-survey-2019-to-2020-headline-report

45-54	23%	20%	20%
55-64	18%	17%	20%
65 or over	33%	29%	36%

Disability

109. Around 40% of recipients within the preferred option have a member of their household with a long-term illness or disability. This suggests ECO4 recipients are more likely to be disabled than the general population. However, compared to the fuel poor population the policy underrepresents those with long-term illness or disability.

Table 18: ECO4 recipients with a member of the household has a long-term illness or disability (England only)

Member of the household has a long-term illness or disability?	Preferred option	Overall population of households in England	Fuel poor households[60]
No	59%	66%	54%
Yes	41%	34%	46%

110. The Government is proposing to exclude certain non means tested benefits such as disability and carers allowance benefits to help better focus ECO4 eligibility on low income households. Households who only claim disability benefits, may still qualify for ECO4 under Flexible Eligibility if they earn below £31,000 or are referred via one of the alternative routes (such as NHM referrals).

111. The Government recognises removing disability benefits will disadvantage higher-income disability benefit recipients who do not claim means-tested benefits, as they will no longer be eligible for ECO. However, the 2017 English Housing Survey indicates that around 60% of disability benefit recipients also receive a means-tested benefit. An estimated 400,000 owner occupier households in band D, E, F and G homes are in receipt of disability benefits, with no other means tested benefits.

112. Additionally, fuel poverty rates among households receiving both a disability benefit and a means-tested benefit (27%) are much higher than households only receiving a disability benefit (10%). Therefore, including disability benefits as qualifying benefits alone is likely to worsen the fuel poverty and low income targeting of the scheme. The estimated fuel poverty hit rate of recipients under ECO4 is 29%[61] which is the same as underestimated ECO3[62].

Race

113. Table 19 suggests ECO4 recipients are less likely to come from ethnic minority households. Of the different ethnic minorities, Indian, and Pakistani or Bangladeshi minority groups are slightly overrepresented under the preferred option, with Black and other minority groups underrepresented compared to the general population.

[60] Based on BEIS Fuel Poverty Statistics 2019 data: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966471/Fuel_poverty_detailed_tables_2019_data_LILEE.xlsx

[61] Estimate for England only

[62] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749638/ECO_3_Final_Stage_IA__Final.pdf

114. The race profile of the preferred option is more in line with that of all owner occupiers. This suggests the race profile of ECO4 recipients reflects the lower proportion of ethnic minorities who are owner occupiers compared to the general population.

Table 19: ECO4 recipients by race (England Only)

Ethnic minority	Preferred option	Overall population	Owner occupiers
white	89%	87%	90%
black	2%	4%	2%
Indian	3%	3%	3%
Pakistani or Bangladeshi	3%	2%	2%
other	2%	4%	3%
all ethnic minority	11%	13%	10%

Marriage and civil partnership

115. The table below shows ECO4 recipients are less likely to be couples than the overall population of households. If relationship status is used as a proxy for marriage or civil partnership, this suggests the policy may underrepresent these groups. However, the proportion of ECO4 households who are couples is more closely aligned to the characteristics of fuel poor households – of which 47% are couples and 41% are single[63].

Table 20: ECO4 recipients by relationship status (England Only)

Relationship status	Preferred option	Overall population
Couple	53%	66%
Single	41%	33%
Other multi-person households	6%	2%

Sex, gender reassignment, religion or belief, and pregnancy and maternity

116. The English Housing Survey and therefore modelling is unable to provide estimates for these protected characteristics. However, there is no evidence to think people with these characteristics are more or less likely to benefit from, or lose out because of, this policy.

Income

117. Table 21 shows that ECO4 recipients are more likely to be in the lower income deciles, with around 63% of recipients in the lowest five deciles.

Table 21: ECO4 recipients by equivalised after household cost income decile (England only)

Equivalised income decile	Preferred option

[63] Based on BEIS Fuel Poverty Statistics 2019 data: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966471/Fuel_poverty_detailed_tables_2019_data_LILEE.xlsx

1st decile (lowest)	9%
2nd decile	13%
3rd decile	13%
4th decile	16%
5th decile	12%
6th decile	13%
7th decile	10%
8th decile	6%
9th decile	6%
10th decile (highest)	2%

12. Further modelling results

118. This section summarises further information about households receiving support under ECO4. 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.

Table 22: Estimated recipients by whether on gas grid[64]

Connected to gas grid	Preferred option	Owner occupied - England only
Not connected to gas grid	13%	11%
Connected to gas grid	87%	89%

Table 23: Estimated uptake of measures by dwelling type[65]

Dwelling type	Preferred option	Owner occupied - England only
end terrace	14%	11%
mid terrace	20%	16%
semi-detached house	32%	30%
detached house	17%	25%
bungalow	9%	9%
flat	9%	9%

Table 24: Estimated uptake of measures by rurality, preferred option

Rural status	Preferred option	Owner occupied - England only[66]

[64] Owner occupied data on gas grid connections for England taken from EHS 2018 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/898461/DA2203_Parking_and_mains_gas_-_households.xlsx

[65] Owner Occupied data on dwelling type for England taken from EHS 2019-20 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945377/2019-20_EHS_Headline_Report_Section_2_Stock_Annex_Tables.xlsx

[66] Owner Occupied data on rurality for England taken from EHS 2019-20. Rural defined as rural residential, village centre and rural. This includes villages, town and fridge and hamlets and isolated dwellings. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945377/2019-20_EHS_Headline_Report_Section_2_Stock_Annex_Tables.xlsx

Rural	21%	20%
Not rural	79%	80%

119. The table below provides an illustration of the measure mix modelled within the NHM. For example, modelling suggests that band E properties require on average around 2.5 measures each, with the vast majority (92%) getting either solid or cavity wall insulation and one or two smaller measures. Smaller measures are predominantly heating controls and/or floor insulation or loft insulation.

Table 25: Estimated measure mix across starting EPC band

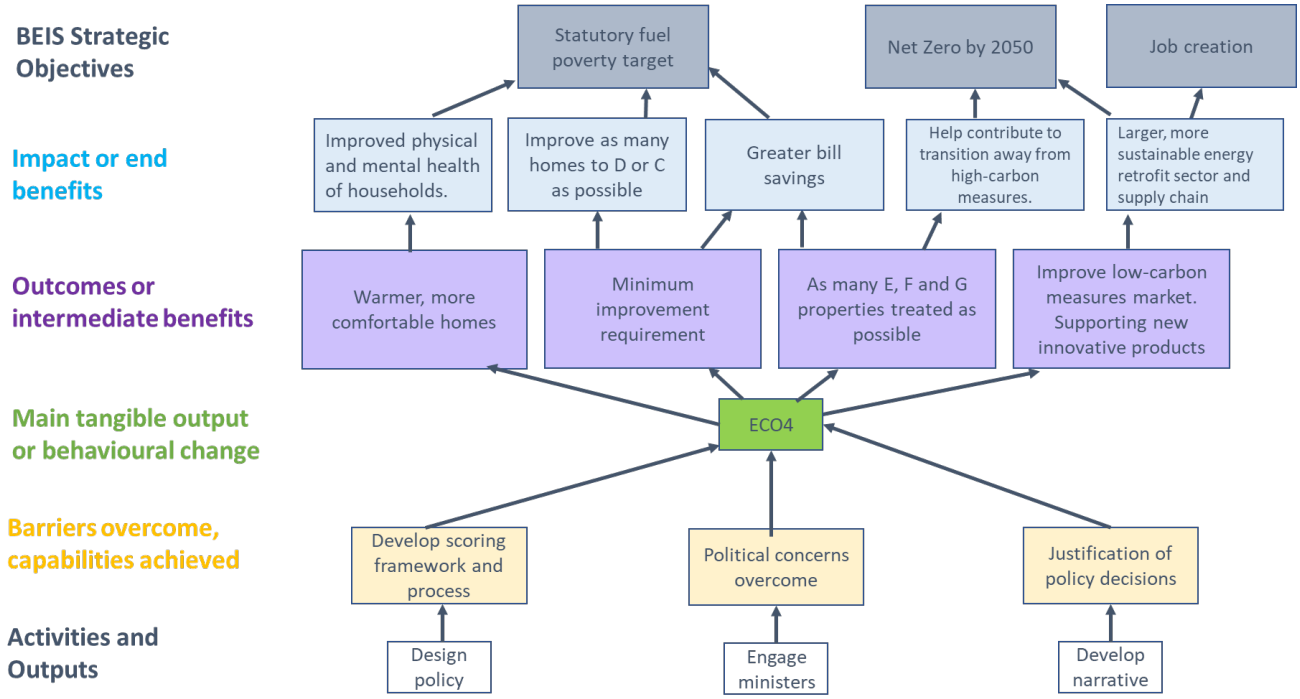
Measure mix	D	E	F	G
External wall insulation	17%	73%	55%	52%
Filled Cavity wall insulation	45%	20%	18%	25%
Loft insulation	30%	19%	19%	20%
Floor insulation	23%	18%	25%	21%
Heat pump	1%	15%	22%	62%
Heating controls	50%	57%	41%	22%
HWT insulation + thermostat	3%	10%	22%	22%
Draught-proofing	4%	13%	11%	3%
First time gas central heating	1%	6%	27%	25%
Solar Photovoltaic	0%	3%	2%	0%
Broken heating systems repair/replacements	5%	16%	5%	0%
Measures per home	1.8	2.5	2.5	2.5

13. Monitoring and Evaluation

Theory of change

120. Shows the strategic objective for ECO4 and how the anticipated outcomes and impacts of the policy are expect to feed into this.

Figure 3: Theory of change map for the proposed ECO4



121. Monitoring of participation and work covered by the ECO4 will be undertaken by the scheme administrator (Ofgem), as with its predecessor ECO3. This will continue until the scheme concludes (which is expected to be no earlier than 2026). Alongside this there will be an ongoing evaluation assessing beneficiary experiences and outcomes conducted by external researchers, and designed, commissioned and managed by BEIS's Buildings Evaluation Team. This evaluation will use a combination of representative surveying and purposively sampled interviews with participating households to understand what has happened during the scheme and the extent of both positive and negative outcomes for this population and priority subgroups. Subject to further scoping work, there may also be a quantitative impact evaluation after scheme delivery has been completed, and additional research with non-household stakeholders involved in delivery (such as Ofgem, Energy Companies, installers and suppliers).

122. It is anticipated that there are minimal external factors that may impact on the success of the proposed monitoring and assessment work, but core assumptions include:

- The continued financial stability of suppliers of secondary data (primarily TrustMark), and dedicated resource for their collection and processing of required data to assess compliance and fraud;
- The continued regular supply of this data to BEIS, for use in monitoring and evaluation (such as survey sampling) under existing Data Sharing Agreements.
- COVID-19 impacts to stakeholders and contractors are not severe enough to substantially prevent or compromise delivery.

123. The assessment will include work to understand external factors and the extent to which they have impacted on scheme delivery.

124. The full evaluation is expected to use a primarily survey-based approach with a sample of ECO4-participating households, supplemented with targeted qualitative work, and combined with (optional) quasi-experimental analysis to assess whether the original scheme objectives

have been met. The evaluation will also include early insight into implementation and the response by scheme participants and other stakeholders (including Ofgem, Energy Companies, installers and suppliers) to inform the development of the scheme. The evaluation will be delivered in three waves across the scheme's lifetime. Interim reports from each wave will provide the flexibility to incorporate changes to the aims and questions of the evaluation. A preliminary evaluation plan linked to the programme's Theory of Change is presented in **Annex D**.

125. The evaluation will be supported by a range of data:
    - The scheme data collected by Ofgem and held by BEIS will contribute key information needed for the evaluation, including the addresses of participating households, their delivery status and all measures installed by date.
    - The proposed evaluation design will collect more detailed data from a sample of households through surveys, including their fuel poverty status, their installation experience and their usage and benefits from the installed measures.
    - In order to assess the scheme impacts there may need to be additional survey data collected from non-participating households, in order to support understanding of the counterfactual.
    - Depending on the methodology chosen to assess scheme impacts, either scheme or household data may need to be linked to existing National Energy Efficiency Data-Framework (NEED), Energy Performance Certificate (EPC) or Energy Follow Up Survey (EFUS) datasets. This could be required to establish a counterfactual population, or to capture quantitative impacts.
    - The proposed evaluation design will also collect limited qualitative data on installation experience, usage and benefits from a small number of households. Subject to the scoping review, qualitative data may also be collected from non-domestic stakeholders.

Further detail, including a high-level timeline and research questions, is provided in the evaluation plan in Annex G.

Uses of evaluation findings

126. Evaluation findings will be shared with the ECO policy team in the first instance, to support decisions about any 'in-flight' changes to be made to the scheme.

127. Models and methodologies will be shared as part of the evaluation outputs and will be disseminated across the analytical teams in the Energy Transformation group.

128. All raw data sets will be shared with BEIS to support further analysis, as well as being uploaded to the UK Data Archive where appropriate. The contracted evaluator will be required to provide anonymised datasets to support this. All planned research reports will be published.

14. Justice Impacts

129. There will not be a significant impact on the legal system or the volume of cases going through the courts, as BEIS is not making significant changes to the enforcement regime. The justice system would become involved were someone to seek to challenge an Ofgem enforcement action for a breach of the obligation or potentially where Ofgem sought a court order

Annexes

Annex A – Modelling approach

1. This annex sets out the modelling approach used in this impact assessment, the detail of the costs and benefits analysed in the cost-benefit analysis, and any other key assumptions made.

1. Background to the National Household Model (NHM)

2. The NHM was used to model suppliers' possible actions under the proposed ECO4 regulations. The NHM is a discrete event simulation model that allows us to install various measures in different houses and estimate the impact. For example, all uninsulated lofts could be insulated, and the associated costs and energy savings assessed. The model is based on the English Housing Survey (EHS), an annual survey of thousands of households in England which, when taken together, represent all the different types of house in the country. The NHM is based on 2013-14 EHS data, within the NHM this data is adjusted to try and reflect the latest position we have data for by accounting for measures installed in line with National Statistics[67].

3. The NHM models energy-related behaviour for domestic dwellings using a SAP-based energy calculation. SAP tends to overestimate energy consumption, and therefore potential energy savings, in less efficient homes. Part of this overestimation stems from occupants of less efficient homes rarely heating them to the same level as assumed under SAP. To account for this, the SAP-based energy savings estimates are aligned with the real-life energy savings of different measures using in-use factors.

4. The NHM model is based on data from the EHS. To estimate impacts for Great Britain as a whole, outputs have been scaled up based on the ratio of the number of households in England to Great Britain (1.167), calculated from official statistics[68]

2. Overview of modelling approach

5. The policy was modelled by selecting properties meeting the eligibility criteria and 'found' by suppliers. Then installing measures to meet the required level of SAP improvement in descending order of cost effectiveness (score per £ spent) each year until the yearly or total targets are met, with more homes being 'found' each year to increase the pool from which homes are chosen by the model.

6. Suppliers do not have perfect knowledge of the housing stock and household. Thus to limit the knowledge of the model, findability rates are modelled. This restricts the eligible pool to certain percentages being 'found' each year to reflect this limit on supplier's knowledge.

7. Cost effectiveness is calculated by simulating installing combinations of measures in all homes (that have been 'found' and meet the eligibility criteria) and calculating the cost of the package and bill saving score achieved, this provides the score/£ or cost-effectiveness rating. Yearly targets are set each year, but in the final year only the total target is used, ensuring over- or

[67] Household Energy Efficiency Statistics (including technical potential update), available at: https://www.gov.uk/government/collections/household-energy-efficiency-national-statistics

[68] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland

under-spending/achieving is minimised. These targets are based on score achieved when spending £1bn each year (increasing in line with inflation), under a given scenario.

8. Before the ECO4 scenario starts, stock updates and other policy scenarios which pre-date ECO4 happen. A counterfactual runs alongside, breaking and replacing boilers. A counterfactual scenario involves running the whole model without the ECO4 scenario happening and is used to compare the impact of ECO4 versus a business-as-usual baseline.

3. Counterfactual

9. Households are assumed to replace their boilers once they break, with or without policy intervention, which we refer to as 'natural replacements'. 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.

10. As in previous ECO IAs, BEIS assumes that suppliers or their installers are able to deliver boilers at 75% of the cost that householders would face if replacing the boiler themselves.

11. 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 subsidised boilers under ECO. We do not include the cost of VAT in regular cost benefit analysis calculations as it represents a societal transfer rather than a societal cost. However, we do include transfers in equity-weighted cost benefit analyses as 'who pays' then becomes a consideration.

12. The NHM assumes a proportion of heating systems break each year, with the percentage varying based on boiler age, system, and fuel type. These assumptions are based on analysis of the EHS across multiple years, looking at the proportion of owner-occupied homes with broken heating systems by age and boiler type. This results in around 1-2% of boilers or storage heaters breaking each year. The assumption that all household replace broken boilers may underestimate the total benefits of the scheme, given there is anecdotal evidence of fuel poor households being unable to afford a replacement boiler and living without heating and hot water[69].

4. Covid impact on the eligible pool

13. Households are eligible for ECO4 if they are in receipt of certain means tested benefits[70]. The EHS data which feeds into the NHM is used to identify households on eligible benefits within the NHM. The EHS data can also be used to apply ECO specific income caps on child tax credit. However, further work was needed to reflect the impact covid-19 had on the number of households on Universal Credit (UC) which would not be reflected in the EHS data.

14. Published data from DWP[71] shows a rise in the number of households on UC, from 2.70 million in March 2020 to 4.38 million in June 2020. This represents a possible large increase to the

[69] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/322901/Warm_Front_Evaluation_Report.pdf

[70] See ECO4 consultation document for full list

[71] https://stat-xplore.dwp.gov.uk/webapi/jsf/login.xhtml - via 'Households on universal credit' and 'Table 1 – Month by Family Type'

eligible pool that would need to be reflected in the modelling, whilst still using the EHS data. From the EHS data a sampling frame was created of households not already on UC, but who would be eligible if not for their income. This is to reflect that the increase in households on UC was driven by people losing their jobs due to covid-19 and applying for and receiving UC.

15. Working with DWP, BEIS was able to build a picture of the additional UC applicants and demographic characteristics of those households. A process known as raking, or iterative proportional fitting (IPF), was used to generate sampling probability weights for EHS households. IPF is used to adjust weights to a known population total and distribution. In this context, the aim was to weight EHS data to match the number of and demographic distribution of households receiving UC because of covid-19. The IPF generated weights provide the probability of that household being selected from the sample as a new UC recipient and thus eligible for ECO4. This allows those selected as new UC recipients to be as reflective as possible of the population they represent whilst also reflecting the limited knowledge of the makeup of this population.

16. It is also expected that over time these households will come off UC as they once again find employment. Discussions with DWP on what this drop off rate could possibly look like was incorporated into the modelling.

5. Findability

17. It is expected that suppliers will first try and identify homes eligible for at least one of the four insulation measures (solid wall insulation, cavity wall insulation, loft insulation and floor insulation). As the supply chain does not have perfect sight of the entire market, it is assumed that suppliers can only target a random proportion of the remaining technical potential, with this proportion varying by measure. The NHM therefore applies findability rates per insulation measure, shown in Table 26. Once a home has been "found" for one of these measures then all other measures needed to meet the minimum requirement can then also be installed.

18. This approach accounts for the difficulty in finding technical potential but does not account for difficulty in finding ECO4 eligible homes i.e. homes on benefits or eligible through LA flex. To account for this an overall eligible findability rate is applied to the eligible pool in the NHM before measure findability rates are applied. This rate assumes suppliers are only able to find a random 25% of the ECO4 eligible homes each year. This rate is highly uncertain and further work needed to improve the evidence based around ease with which interested properties can be found.

Table 26: Assumed findability rates per year during ECO4

Measure	Central
Cavity Wall Insulation	12%
Loft Insulation	16%
Solid Wall Insulation	11%
Underfloor	10%

19. The majority of the findability rates are based on calibration to the rates of delivery observed in the market, and are unchanged from the ECO3 IA.

6. Detailed modelling approach

20. There are four main steps to modelling the impact of ECO4: deriving the 2022 housing stock; modelling the counterfactual (installations expected to happen anyway); modelling the policy; and calculating the net impact of the policy.

    a. Modelling the counterfactual in order to derive the modelled stock of eligible properties for the beginning of 2022:
        - The NHM starts with the housing stock from the 2013-14 EHS.
        - Within the NHM the 2013-14 data is then adjusted to account for latest data. This is done by installing measures in line with installations from National Statistics[72] for years where this information is available.
        - The stock is also updated for policy changes which will happen before 2022. The previous Private Rented Sector EPC E regulations are modelled in 2020, installing measures up to a £3,500 cost cap in EPC F and G properties. ECO3 installations are modelled from 2019 to 2022, using an ECO3 scenario built into the NHM.
        - A fixed proportion of boilers and storage heaters are broken and replaced each year, depending on boiler age and type. This results in around 1% broken each year.
    b. Modelling the counterfactual from 2022:
        - This starts from the derived model stock of eligible ECO4 properties at the end of 2021.
        - As with the modelled stock derivation, boiler and storage heater replacement continues each year.
        - No other counterfactual installations are assumed.
    c. Modelling the scenario from 2022:
        - On top of the counterfactual outlined above, ECO4 delivery is modelled from 2022 to 2026.
        - Each year, findability rates are applied to the remaining technical potential pool. ECO4 eligible properties which are "found" then have measures installed, with homes being chosen in descending order of bill saving (score) per £, until the property has reached the ECO4 required SAP increase (or better if cost effective).
        - The model then moves on to the next home until the cost/score target for that year has been reached, or no more dwellings remain. The final year, replaces the yearly target with the total target to minimise over- or under-spend
        - Measures can be split into 2 parts – cost-effective fabric measures, which need to be installed first, followed by the rest of the measures, which can be installed once at least one cost-effective fabric measures have been installed. This is to reflect a 'fabric first' principle. Not following a fabric first principle may result in a different installed measure mix and associated costs and benefits.
    d. Once both a counterfactual and scenario model scenarios have been produced, the net impact of the policy can be calculated by subtracting the counterfactual from the scenario. This accounts for bringing forward of boiler replacements that would have happened if the policy had not been implemented.

21. The output from the model allows the changes which have occurred as a result of the policy to be examined by comparing the stock before and after the policy measure installations. Changes over the entire policy appraisal period, net of the counterfactual, are assessed to calculate the net present value of the policy.

[72] Household Energy Efficiency Statistics (including technical potential update), available at: https://www.gov.uk/government/collections/household-energy-efficiency-national-statistics

7. Costs included in the cost-benefit analysis

22. **Installation costs**. This is the largest individual cost of ECO4. When installations come to the end of their life, it is expected that replacement will be made by households. It is assumed that installation costs are incurred again at that stage and these costs are included in the NPV.

23. With the exception of Solar PV, no reduction in real costs of installations is modelled over time. In reality, technological improvements and increased competition may lower the costs of installing energy efficiency measures and therefore lower the costs of the policy. Similarly, no costs are assumed to 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.

24. **Operational costs**. Covers the annual cost of running heating measures, and includes servicing and maintenance costs, but not the fuel costs

25. **Hidden costs**. These include the time taken by householders to liaise with the installer, prepare the property for installation and any oversight. These costs are estimated to be small in the majority of cases.

26. **PAS costs.** Cover all the costs involved in complying with the PAS 2035 framework, including lodgement fees (£8+VAT) and the costs of using a retrofit co-ordinator (including design assessment, overheating assessment, air tightness test and monitoring and evaluation costs). This is assumed to cost £500 per households – further detail of these cost assumptions can be found within the ECO3: Improving consumer protection IA[73]. PAS costs are assumed to be part of the suppliers/installers costs and so result in less of the total spend to be used on measures themselves.

27. **Administrative Costs:** In delivering their ECO4 obligation, suppliers will incur administrative costs (additional to those faced from PAS 2035 requirements). These will vary by supplier, depending on their setup[74], but include items such as the cost of running IT databases, staff time 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.

28. There are several reasons administrative costs are likely to rise under ECO4, including changes to the scoring mechanism, the move towards a package approach and a larger obligation than under ECO3. Within discussions with suppliers, it was suggested ECO4 administrative costs could be closest to those seen under ECO1 or ECO2. Under ECO1 and ECO2, as reported by suppliers, administration costs were around £80 and £85m[75] per annum (in real 2015 price) respectively. £94m per year (£85m in 2015 inflated to 2021 prices) has therefore been modelled as the central estimate for administrative costs under ECO4. A high and a low estimate have also been included within the sensitivity section, the high of £140m was suggested by one supplier as a potential high scenario. The low estimate of £55m has been use based on the current administrative costs seen under ECO3[76] multiplied up by the increase in obligation under ECO4 relative to ECO3[77].

[73] See Table 3 : https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/842280/ECO3_Improving_Consumer_Protection_Final_Stage_Impact_Assessment.pdf

[74] For example, some suppliers may have their own installation arms, which may reduce the administration costs the supplier directly incurs.

[75] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/586266/ECO_Transition_Final_Stage_IA__For_Publication_.pdf

[76] Average annual costs of £35m across the whole of ECO3, using delivery costs reported to the end of September 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/964213/Headline_HEE_tables_25_FEB_2021_FINAL.xlsx

[77] 1.56 – 1 billion divided by 640m

29. **Search Costs:** Where suppliers are obligated to deliver measures to households, 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.

30. **Natural Boiler Replacement Cost Savings (Negative Costs):** households are assumed to replace their boilers once they break, with or without policy intervention. Boiler replacements made by households, rather than through policy intervention, is referred to 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.

31. The avoided costs of households replacing boilers themselves is counted as a negative cost (i.e. a saving), and the cost of replacing boilers through ECO4 as a positive cost.

8. Benefits included in the cost-benefit analysis

32. **Energy savings benefits**. 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). These benefits have been monetised in accordance with Green Book supplementary guidance on valuing energy use and GHG emissions[78].

33. **Air quality improvements and reductions in greenhouse gas emissions benefits**. The reduction in the amount of energy used improves air quality and reduces traded and non-traded greenhouse gas emissions. Reductions in greenhouse gas emissions help meet the UK's legally binding emission reduction targets, while improvements in air quality reduce adverse health impacts, and other long-term environmental impacts. These benefits have been calculated in accordance with Green Book supplementary guidance.

34. **Comfort taking benefits**. Energy performance improvement measures reduce the amount of fuel required to deliver a given level of energy service, meaning that some households will heat their homes to a higher temperature, for a longer period, or heat more rooms in their homes. This is valued at retail energy prices (in the Green Book supplementary guidance) which act as a proxy for the willingness of consumers to pay for the additional comfort.

9. Cost and benefits included in the distributional analysis

35. 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 Table 3.

[78] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

36. **Supplier delivery costs (economic rents).** The presence of the market barriers and failures (discussed in section 6.2) mean that suppliers must subsidise the installation of energy efficiency measures to induce eligible households to install measures. This 'excess subsidy' is referred to as 'economic rent', and can potentially accrue to the household, the installer, or the energy supplier.[79] Economic rent is modelled by assuming Economic rent is modelled by assuming the price of a unit of 'score' (or notional bill saving achieved) is set using the marginal price observed in a year. This implies the price is set based on the highest £/score observed each year and the difference between this price and the actual installation costs is the economic rent.

37. **Consumer bill impacts**. 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.

38. **VAT paid on measures.** Installation paid for by households will incur VAT which is a transfer between the household and society. As a result of the avoided costs from natural boiler replacements households will avoid paying VAT on boiler replacements which will represent a benefit to the households and a cost to society. Households will need to pay VAT on the costs of reinstallations further down the line, this will be a cost to households but benefit to society.

39. **Value to society of lower energy bills in low-income households.** Energy bill savings are a private benefit in that 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.[80]

10. Key input assumptions

Scoring framework

40. The scoring methodology used for this IA is based on the difference in annual fuel expenditure between the starting SAP rating of the property (pre-retrofit) and the finishing SAP rating of that property (post retrofit). This change in fuel expenditure has been taken from the EHS average across multiple years (2016-2018), and across four floor area groups. The floor area groupings used are less than 73 square metres, 73 to less than 98, 98 to less than 200 and 200 square metres or over.

41. Decisions around the final scoring framework will sit with Ofgem, who will be required to publish the full scoring methodology once finalised.

[79] 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.

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

Capital costs

42. Table 27 presents the cost of the different measures (excluding heating) which may be applied to properties[81]. Since the ECO3 impact assessment, this cost data has been combined with an assessment of the average area treated for different property types to produce cost models that scale the cost of particular measures to the property. This allows for a much more granular representation of measure cost, which is useful when assessing policies with cost caps or payback period thresholds. Note that these cost models were fitted to the underlying data and therefore may appear different to cost models built up from the individual components of an installation.

43. For Solar PV installations, capital costs are calculated as a function of roof area based on data from Renewable Energy Consumer Code (RECC)[82].

Table 27: Non-heating central capital cost assumptions used in the modelling (2021 real prices)

Measure Description	Fixed cost (£)	Unit cost	Units for unit cost
Loft insulation	160	5.2	£ / m^2 treated
Low cost cavity wall insulation	270	3.2	£ / m^2 treated
High cost cavity wall insulation	1700	30	£ / m^2 treated
Solid wall insulation (external)	4100	36.3	£ / m^2 treated
Double/secondary glazing	1130	146.1	£ / m^2 treated
Floor insulation	0	20.4	£ / m^2 treated
Draught proofing	40	1	£ / m treated
Hot water cylinder insulation (tank)	30		
Cylinder (hot water tank) thermostat	60		
Appliance thermostat	60		
Room thermostat	90		
Zone controls	730		

44. Table 28 shows the capex per kWh system for gas boilers, off gas grid boilers, and air and ground source heat pumps, along with associated fixed costs depending on if the measures are installed as first-time central heating (FTCH), the property type and/or number of bedrooms, or if replacing oil boilers. Table 29 shows the electric storage heater (ESH) capex costs depending on the number of bedrooms in the dwelling. The capital cost used in the model varies according to capacity and was derived from an internal study completed at the start of 2018, which involved interviews with installers, manufacturers, and other industry association input on the costs of heat generation measures and controls.

[81] Based on figures produced here: https://www.gov.uk/government/publications/domestic-cost-assumptions-what-does-it-cost-to-retrofit-homes

[82] For more information, see: https://www.recc.org.uk/

Table 28: Central capital cost assumptions for heating measures (2021 real prices)[83]

Size (kw)	Mains gas boiler	Off gas grid gas boiler	GSHP	ASHP
5				£3,135
6				£3,543
7				£3,904
8			£6,903	£4,246
12			£8,090	£5,479
15	£1,050	£1,440		
16			£9,054	£6,566
18	£1,050			
20			£9,879	£7,555
21		£1,440		
22		£1,570		
24	£1,050			£8,473
26		£1,570		
27		£1,930		
30	£1,150			
35	N/A	£1,930		
35		£1,930		
36		£2,260		
40	£1,530			
45	£1,720	£2,260		
50	£1,910	£2,510		
55	£2,100	£2,760		
60	£2,290	£3,010		
65	£2,480	£3,260		
70	£2,670	£3,510		
With central heating				
<=4 bedrooms or is a flat	£730	£1,630	£11,550	£4,250
> 4 bedrooms	£3,780	£3,780	£17,600	£9,150
First time central heating				
<=4 bedrooms or is a flat	£2,130	£3,030	£14,550	£7,250
> 4 bedrooms	£4,680	£5,980	£21,100	£12,650
Oil tank removal		£2,000	£1,000	£1,000

[83] Missing values show no estimate exists for a system of that size

Table 29: Central capital cost assumptions for electronic storage heaters (2021 real prices)

Size (kw)	ESH
0	£ 2,690
1	£ 2,690
2	£ 3,480
3	£ 5,291
4	£ 7,733
5	£ 9,710
6	£ 11,020
7	£ 12,330
8	£ 13,854
9	£ 15,452
10	£ 17,020
11	£ 18,722
Fixed costs	£ 1,557

Operational costs

45. Operating costs relate to the annual maintenance of Solar Photovoltaic (Solar PV) . Drawing on assumptions used for the most recent ECO3 IA and Feed-in Tariff Impact Assessments (for central heating and solar PV respectively), cost assumptions of £24 per kW of installed capacity for solar PV are used.

Hidden costs of installations

46. The hidden costs of installing measures are drawn from an ECOFYS report[84] tailored to the characteristics of the whole ECO eligible stock. 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. Hidden costs are shown in Table 30.

Lifetime of measures

47. The lifetime of measures used in the ECO modelling are shown in Table 30.

In-use factors

48. In-use factors scale the SAP energy savings so that they better represent the observed savings of particular measures. In-use factors from Ofgem have been used where available[85]. The in-use factors for other technologies have been taken from this study[86]. These in-use factors are shown in Table 30

[84] 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

[85] https://www.ofgem.gov.uk/system/files/docs/2018/01/eco2t_measures_table_-_jan_2018_-_v1.2.pdf

[86] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48407/5505-how-the-green-deal-will-reflect-the-insitu-perfor.pdf

Table 30: Hidden costs and measure lifetimes assumed (2021 prices)

Energy performance improvement measure	Estimated hidden cost to owner/occupiers (£)	Lifetime (years)	In use factor
Loft insulation	135	42	0.65
Cavity Wall Insulation	95	42	0.65
Solid Wall Insulation (external)	220	36	0.67
Floor insulation	165	42	0.85
Draught-proofing	55	10	0.85
First Time Central Heating	110	0	-
Storage heater	20	20	0.9
Boilers	20	12	0.75
Air source heat pump	190	15	0.75
Heating Controls	50	12	0.5
Hot Water Cylinder Insulation	5	10	0.85
Hot Water Thermostat	50	12	0.9
Ground source heat pump	240	20	0.9
Solar PV	155	25	1

Administrative cost assumptions

49. 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 eligible households. The supplier admin costs assumed are set out in Section 7.

50. In addition to the supplier admin costs, we also include the search costs involved in finding eligible households and also estimate separately the cost of guarantees that accompany replacement boiler installations:

- **Insurance backed guarantees:** The cost of this guarantee is assumed to be £15 per boiler.

- **Search costs:** Where suppliers are obligated to deliver measures to households eligible for ECO support, they incur costs of not only identifying suitable properties but also in searching for eligible households and verifying they are 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.

51. The assumed search costs underpinning this IA are shown in Table 31 below. The updated cost assumptions are derived from the supply chain survey and stakeholder feedback. All search costs are per successful install (for example, if 2 eligible households needed to be found per successful install than the costs of finding both households is presented below).

Table 31: Assumed Search Costs (2021 prices)[87]

Measure	Homes on the gas grid (£)	Homes off the gas grid (£)
Cavity Wall Insulation	260	430
Loft Insulation	190	430
Floor insulation	290	430
Solid Wall Insulation	290	430
Central Heating	150	670
Broken Replacement Boilers	150	670
Working Replacement Boilers	150	670
Ground Source Heat Pump	260	430
Air Source Heat Pump	260	430
Storage Heater	300	670
Storage Heater Upgrade	300	670
Heating Controls	0	0
Solar PV	260	430

11. Additional modelling assumptions

Solar PV

52. The ECO4 model includes Solar PV panels in the selection of measures which can be applied to homes as part of the policy. With this type of measure, however, factors such as roof coverage, efficiency, and total energy produced and/or sold back to the National Grid have to be considered to accurately reflect the impact this measure's inclusion may have on SAP ratings and greenhouse gas emission savings. Considerable research, testing and collaboration with BEIS engineers and scientists has been undertaken, and assumptions on efficiency and proportion of generation exported are consistent with those used in modelling for Feed-in Tariffs. This results in the following assumptions being included in the model;

- the proportion of roof area that can be covered by Solar PV per household is assumed to be 30%,
- Solar PV systems are assumed to continue to fall in price at a rate of 1.3% each year, based on projections by Parsons Brinckerhoff.[88]
- 50% of the energy produced by the panels is assumed to be used by the household with the other 50% being exported back to the grid,
- the efficiency of any Solar PV installation is taken to be 12%,

Equity Weighting

53. In line with the Green Book[89], we apply equity-weights to our cost-benefit analysis to value the distributional impact of the main policy options. Equity weighting accounts for the

[87] Source: BEIS Supply Chain Survey.
[88] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/456187/DECC_Small-Scale_Generation_Costs_Update_FINAL.PDF
[89] https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

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.

54. The equity weights used are shown in Table 32 below. 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. This year has been used to match data used for the NHM.

Table 32: *Equity Weights using After Housing Cost Equivalised Income*

Decile	Equity Weight
1	5.21
2	2.42
3	1.74
4	1.37
5	1.11
6	0.91
7	0.73
8	0.59
9	0.45
10	0.27

55. Using the equity weights, an additional £1 for *any* household in the lowest income decile group would be valued at £5.2, whereas an additional £1 to *any* household in the highest income decile group would be valued at £0.27.

56. Table 33 provides a summary of where equity-weights are applied in the cost-benefit analysis.

Table 33: Description of the application of the equity weights to the different costs and benefits

Cost/ Benefit Category	NPV (not weighted)	Equity-weighted NPV
Installation Costs	This covers just the capital cost of measures installed.	This is weighted according to the distribution of gas and electricity bill payers across the income scale
Reinstallation costs + VAT	This covers the costs of reinstalling measures when required – this is based on their average useful lifetime. Households will also pay VAT on their installations however this is a transfer between recipients and society so is excluded from the standard NPV.	Recipients pay for these costs so they are weighted according to the income distribution of the households receiving ECO4 measures. VAT is included as low income households are paying and society benefiting – with different weights.

Economic rent that suppliers pay to households or the supply chain	This represents the difference between the measure installation costs and the market price for the measure, and therefore represents the excess subsidy suppliers have to pay for measures. For the purposes of this IA, we assume that any 'excess subsidy' or economic rent is a cost that accrues to suppliers and ultimately the bill payers.	The cost of economic rent is weighted according to the distribution of gas and electricity bill payers across the income scale
Administration Costs (including search costs and PAS costs)	Administration costs are virtually all 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 – these are calculated by valuing time.	No change from unweighted values, as unclear the extent to which value of time varies across recipient households.
Operational costs	These are the annual cost involved with running heating measures, and includes servicing and maintenance costs.	Recipients pay for these costs so they are weighted according to the income distribution of the households receiving ECO4 measures.
Natural boiler replacement costs (negative cost)	These are costs avoided by households as they no longer need to replace boilers they would have replaced in the absence of ECO4. Households will also pay VAT on their installations however this is a transfer between recipients and society so is excluded from the standard NPV.	Recipients avoid these costs so they are weighted according to the income distribution of the households receiving ECO4 measures. VAT is included as low income households are paying and society benefiting – with different weights.
Value of Change in carbon	Energy changes x emissions factors x carbon values	No change, not expected to be a clear difference in impact across income deciles.
Value of Change in Air Quality	Energy changes x AQ damage factors	No change, not expected to be a clear difference in impact across income deciles.
Change in energy saved	Energy changes x Long Run Variable Cost of Energy Supply	No change, not expected to be a clear difference in impact across income deciles.

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 low income households 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].
VAT benefits to society	Households will pay VAT on reinstallations and will have avoided VAT within the counterfactual – the net impact on VAT is a transfer so excluded from the main NPV.	As society benefits from increased VAT receipts we apply no weight
Value of economic rent to low Income households	This represents the difference between the measure installation costs and the market price for the measure, and therefore represents the excess subsidy suppliers have to pay for measures For the purposes of this IA, we assume that any 'excess subsidy' or economic rent accrues to households receiving measures. Any excess subsidy paid to households is monetised and included as a benefit.	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.

Annex B – Evaluation plan

1. This section sets out the initial considerations for an evaluation of the ECO4 scheme. The evaluation would aim to regularly assess the effectiveness and beneficiary experience of the scheme through a primarily representative household survey design, sense-checking and exploring these quantitative findings with follow-up depth quasi-ethnographic interviews with households. This methodology would be largely replicated (albeit iterated) from the current evaluation of ECO2t and ECO3. It also sets out (subject to a later review) the option of an impact evaluation design over the scheme's lifetime, as well as qualitative research with non-household stakeholders involved in delivery. Lessons learned from ongoing evaluation work suggest that BEIS could potentially benefit from a more complete understanding of how installers have been engaged and are being promoted. Findings would be used to support a post-implementation review of the scheme (timings will depend on the results of the consultation). The evaluation is expected to address the following high-level evaluation questions.

2. High-level evaluation questions, derived from the Theory of Change above:

    - **Who has the ECO4 scheme reached? Are these the intended household types?**
        - Property characteristics
        - Household demographics and characteristics
        - Characteristics of domestic heating usage
    - **What are the outcomes of ECO4 for households?**
        - To what extent have households benefitted from the scheme in the short term? In which contexts? e.g. health, energy bills, home temperature.
        - To what extent have households encountered problems as a result of the scheme in the short term? e.g. energy bills, damage, moisture, technical issues.
        - To what extent have households changed lifestyles and engagement with energy efficient method as a result of the scheme? In which contexts?
    - **How has the delivery of ECO4 been experienced by households?**
        - Decision and process to arrange installation of measures
        - Installation experience
    - **How has the delivery of ECO4 been experienced by those involved in delivery?** *(subject to the impact evaluation review decision)*
        - Ofgem – as administrator
        - Energy companies – as managers
        - Installers and providers
    - **What are the longer term impacts of ECO4?** *(subject to the impact evaluation review decision)*
        - Household heating usage and bills
        - Household fuel poverty status (LIHC and LILEE definitions)
        - Further separate improvements to energy efficiency of housing stock
        - Jobs supported
        - Skills market development for energy efficiency retrofits
    - **What immediate learning from interim reporting can be used to iterate and improve future waves of ECO4**?
        - From annual reports of both process and outcomes evaluations
    - **What is the wider learning from the evaluation?**

- What can we learn for any potential future iterations of ECO or successor schemes?
- What is the wider learning for energy efficiency policy in the domestic sector?

Table 34: Evaluation timings and outputs

Evaluation Component	**Timings** (to be set when ECO4 delivery timeline finalised)	**Aims**	**Main research methods**
Evaluation scoping review stage	Immediately prior to development of ECO4 final IA	Ensure evaluation design remains relevant, proportionate, and informed by the best evidence available. Decide on a final evaluation specification for M&E component of SBC management case	Analyse consultation IA findings. Reflect on any further M&E findings from ECO2t and ECO3 evaluation. Iterate and finalise strategic-level theory of change via internal workshops. Feasibility study to assess whether comparison groups can be constructed with sufficient data availability to conduct an impact evaluation Assess available and anticipated budget.
Main consumer process and outcomes evaluation	Aligned to delivery timeline of ECO4, with annual survey waves commencing 9 months after first installation measures complete.	Understand how the delivery of ECO4 is experienced by beneficiary households. Understand the immediate outcomes of ECO4, and how they differ from previous iterations. Capture medium-term insights to improve ongoing ECO4 delivery.	Annual representative survey of beneficiary households Depth interviews with households of interest, to check and expand on survey findings, and explore longer-term outcomes. Sub-group analysis of Ofgem scheme datasets, and existing related data,

		Final reports provide evidence to inform design of future iterations of ECO or successor schemes.	potentially linked to survey data.
Non-consumer stakeholder process evaluation (*subject to above review*)	Aligned to delivery timeline of ECO4, with interview waves commencing 6 months after first installation measures complete.	Understand how the delivery of ECO4 is experienced by all non-consumer stakeholders involved in delivery - installers, suppliers, energy companies, Ofgem & managing agents. Capture short-term insights to improve ongoing ECO4 delivery. Final reports provide evidence to inform delivery design of future iterations of ECO or successor schemes.	Depth or focus group interviews with installers, suppliers and managing agents, sampled from scheme data. Strategic depth interviews with purposive sample of Ofgem and energy company representatives.
Impact evaluation (*subject to above review*)	Commencing no earlier than the first survey wave, and no later than 1 year after scheme delivery concludes. Timing entirely dependent on chosen methodology.	As a results of ECO4 installations, understand: -How household heating usage and bills have changed -If household fuel poverty status has changed -If household has gone on to make further separate improvements to house's energy efficiency	Quantitative quasi-experimental design using existing Ofgem scheme data (and existing linked data if required). e.g. Difference in difference (via follow-up surveys, and subject to identification of suitable control group).

-If any additional installer or supply chain jobs have been supported by the scheme

-How the skills marketplace for domestic energy efficiency retrofits has changed

3. **Potential methodologies:** The exact nature of the main evaluation will be determined during the evaluation scoping stage. However, the key methodologies and approaches that are expected to be used across the evaluation include:
    - Post-heating season surveys of a representative sample of participating households after ECO4 measures have been delivered, to provide a robust quantitative measure of scheme coverage, household delivery experience, and initial outcomes (including for priority sub-groups). This will allow evaluators to address all consumer-focused evaluation questions other than impact.
        - Potential timings for this fieldwork are:
        - Spring 2023 (to cover installations April-autumn 2022, including early insights)
        - Spring 2025 (installations: winter 2022-autumn 2024)
        - Spring 2027 (installations: winter 2024-spring 2026).
    - Qualitative research:
        - depth interviews or focus groups with installers, suppliers and managing agents, sampled from scheme data.
        - depth interview with a purposive sample of Ofgem and energy company representatives.
        - This will allow the evaluator to address all non-consumer focused evaluation questions other than impact.
        - ECO has historically not evaluated the experiences of this group.
    - Quasi-experimental analysis (QEA) of ECO4's impacts set out in the strategic theory of change. Potentially a difference-in-difference design using the existing survey-based methodology, assuming sufficient budget can be secured. There will need to first be a feasibility study to assess whether comparison groups can be constructed with sufficient data availability to conduct a QEA. This will allow evaluators to address all impact evaluation questions.

4. **Data and Methodological considerations to date:** The proposed survey will create new data of a sample of households with ECO4 measures installed, which may be comparable to data generated by the current evaluation. The provision of scheme data by Ofgem will continue provide a considerable amount of key monitoring data, though the exact details shared with BEIS will depend on the final evaluation methodology. Key data is likely to include:
    - Approved ECO measures by category
    - Measure installation date
    - Measure delivery status by company
    - Installation address

5. **Other data sources** that are available and expected to be used in the evaluation include:
    - TrustMark lodgement registry
    - Domestic Energy Performance Certificates (EPCs)
    - Energy Follow-Up Survey (EFUS)
    - Domestic National Energy Efficiency Framework database (NEED)