Title: Final stage Impact Assessment ECO4 **IA No:** BEIS049(F)-21-EEL **RPC Reference No: RPC-BEIS-5086(2).** **Lead department or agency:** Department for Business, Energy and Industrial Strategy. **Other departments or agencies:** None	**Impact Assessment (IA)** **Date: 1 April 2022** **Stage:** Final **Source of intervention:** Domestic **Type of measure:** Secondary legislation **Contact for enquiries:** beisECOteam@beis.gov.uk

Summary: Intervention and Options

RPC Opinion: GREEN

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
£810m	-£3.8bn	£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 and to deliver on 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)

The Government's final position is:

- To focus support on owner occupied EPC D-G homes, but with support to both private rented properties and social housing for certain measures.
- Set minimum requirements to improve EPC D and E homes to at least EPC C and EPC F and G homes to at least EPC D
- Increase the proportion of the scheme that suppliers can deliver with Local Authorities (Flexible Eligibility), or Scottish and Welsh Governments, to 50% of obligation
- Overall target of £224.3 million in notional annual bill savings to be achieved by March 2026.
- Band E, F and G sub obligation of £155.9 million in notional annual bill savings between April 2022 to March 2026, this is broadly equivalent to 150,000 private tenure homes.
- Set a solid wall minimum at 90,000 solid walls being insulated over the April 2022 to March 2026 period.
- Limit the repair and replacement of broken efficient heating systems to 5,000 per year each (up to 40,000 measures in total over the four years).

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:** -0.57	**Non-traded:** -14.51	

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 minister Martin Callanan Date: 1 April 2022

Summary: Analysis & Evidence — Final Government Position

Description: Extend ECO for 4 years from April 2022 to March 2026. Focus of scheme to owner occupiers in the least energy efficient homes (Band D, E, F and G). Increase the proportion of the scheme that suppliers can deliver with Local Authorities (Flexible Eligibility), or Scottish and Welsh Governments, 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: 810**

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				**4,360**

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

The largest societal costs are installation costs (PV, £2400m), scheme administration (PV, £360m), PAS costs (PV, £410m) and the search costs in finding eligible households (PV, £140m). 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 reinstallations costs for measures (PV, £970m), hidden costs associated with installations (PV, £110m) and opex costs (PV,£14m). There are also avoided costs for households from replacement boilers (PV, £50m),

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				**5,170**

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

Households that have energy efficiency measures installed are the main affected group. They are expected to benefit from energy savings (PV £1,890m), and increased comfort from warmer homes (PV, £510m). Society will also benefit from improved air quality (PV £230m) and reduced traded (PV £120m) and non-traded (PV £2,420m) greenhouse gas emissions.

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

The UK may benefit from lower energy imports, and lower costs of meeting peak energy demand, and health benefits associated with warmer homes.

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 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: 870	**Benefits:**	**Net: 870**	**3,490**

Evidence Base

1. Overview and problem under consideration

1. This final stage Impact Assessment (IA) accompanies the Government's response on 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 – the important of this is highlighted by the current spike in gas prices, lower energy demand would help protect low income households from such spikes in future; 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 government rebates – such as Warm Home Discount that directly affect household energy costs.

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 objective 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. However, given the inability of households to pay for improvement themselves, 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 performance standard for domestic private rented properties. In September 2020, the Government launched a consultation on policy proposals for getting as many PRS homes to FPEER Band C by 2030 as possible. Given landlords are expected to have a responsibility to upgrade homes, ECO support will be provided to private tenants, where the home is upgraded with a high-cost measure, either SWI, first time central heating, renewable or district heating. For social housing, the Heat and Building Strategy announced a further £800m into the social housing decarbonisation fund over financial years 2022/23 to 24/25[9]

9. The residential sector is responsible for a significant share of the UK's greenhouse gas emissions (around 15%)[10], and primary energy consumption (around 32%)[11]. Tackling the poor energy efficiency of the housing stock is therefore important in meeting the Government's legally binding carbon targets.

10. 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].

[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

[9] https://www.gov.uk/government/publications/heat-and-buildings-strategy

[10] BEIS Final UK greenhouse gas emissions, 2019, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/972606/final-greenhouse-gas-emissions-tables-2019.xlsx

[11] BEIS Energy Consumption in the UK, 2021 https://www.gov.uk/government/statistics/energy-consumption-in-the-uk-2021 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_

- **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 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 (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

11. 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:

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

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

[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.

Equity Considerations

12. 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. 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

13. The objectives for 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 many 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 and private rented accommodation, aligned with other Government energy efficiency policies**. ECO4 will support tenants living in EPC E, F and G private rented homes where high-cost measures are required. Tenants living in EPC E, F and G social housing will also be eligible for specific measures and EPC D social

18 Households in England are in fuel poverty if they live in a property with a fuel poverty 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.
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.

housing properties will be eligible for innovation measures. ECO4 will be available across England, Scotland, and Wales. In England, the Home Upgrade Grant will be the primary support for upgrades to energy inefficient off-gas grid homes. Measures delivered under ECO4 to meet the minimum requirements are not expected to be blended using HUG or other government funding and ECO4 funding. However, other measures funded under other schemes would be allowed within a home, if installed before or after ECO4.

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

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. Over half of homes treated received a boiler measure and heating controls[24], whereas only around a third of homes have received wall insulation measures. Insulation measures are more beneficial over the long-term and are more cost effective at making progress in tackling fuel poverty.

17. ECO4 aims to focus more on fabric first multiple measure delivery which will incentivise greater investment to ensure homes are improved to a minimum level and will impose an EPC E-G minimum requirement – this will drive more insulation measures such as wall insulation.

18. ECO3 uses a measure-specific scoring approach which does not factor in the starting SAP band of the property (i.e., the deemed scores for measure are the same regardless of if the property isa EPC G or EPC C properties). This 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 introducing a revised scoring methodology for scores to be based on the difference in the average annual bill expenditure between the starting and finishing SAP rating of the home, with further regard to floor area. This will work alongside the minimum improvement requirements and E-G minimum to ensure a focus on the least energy efficient properties. 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

Policy Option 0 – the 'Do Nothing' Option

19. 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

[23] BEIS Household Energy Efficiency Statistics October 2021 – Table T2.8https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1026822/Headline_HEE_tables_21_OCTOBER_2021.xlsx

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

to credit, meaning they would not generally be expected to install measures, other than replacing broken boilers, in the absence of Government intervention.

20. 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 5.3).

Policy Option 1 - Final Government position

21. The final Government position is to continue ECO for an additional 4 years to March 2026 and increase the level of spend to £1bn per year as announced in the 2021 fuel poverty strategy - Sustainable warmth: protecting vulnerable households in England[25].

22. At consultation stage, the Government 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 through ECO4 Flex.

23. The final position is that support will be limited to EPC D, E, F and G homes, with Minimum Requirements (MRs) imposed necessitating that EPC F and G homes reach EPC D and EPC D and E homes reach EPC C.

24. Social housing E-G rated properties will be eligible for insulation measures, first-time central heating (FTCH), renewable heating, district heating systems and innovation measures, with EPC D rated properties eligible for innovation measures only. EPC E-G PRS properties will also be eligible where the package includes either solid wall insulation, first-time central heating, a renewable heating system or district heating. All social housing and PRS properties will be required to meet the relevant ECO4 minimum improvement requirements.

25. There will be a separate requirement to deliver notional annual bill savings to EPC E-G private tenure homes, equivalent to upgrading 150,000 homes. There will also be a requirement to install 90,000 solid wall insulation measures.

26. Flexible eligibility will be expanded, to allow up to 50% of the obligation to be met via that route.

Rationale for the Government's final position

27. The Government has decided to continue to deliver ECO4 through regulation, as opposed to alternative delivery mechanisms, as ECO provides a tried and tested method of delivery, with an established framework and supply chain in place. Delivering through energy suppliers, who can then pass this cost onto customers (both gas and electricity), means there is an incentive for suppliers to deliver their obligation as cost effectively as possible to remain competitive.

28. As set out in the recent Heat and Buildings Strategy[26], in future Government want to reduce electricity costs and will publish a Fairness and Affordability Call for Evidence to set out options for how to shift or rebalance energy levies (such as the Renewables Obligation and Feed-in-Tariffs) and obligations (such as the ECO) away from electricity to gas over this decade to help rebalance electricity and gas prices and to support green choices, with a view to taking decisions in 2022.

[25] https://www.gov.uk/government/publications/sustainable-warmth-protecting-vulnerable-households-in-england

[26] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1036226/E02666137_CP_388_Heat_and_Buildings_Accessible.pdf

29. Government will not make any changes to how ECO4 is funded, given that options to address price distortions need to be considered more broadly. Furthermore, more evidence is needed to assess the impact such a change could have on low-income households.

Eligibility

30. Focusing ECO4 on EPC D-G homes will help to meet fuel poverty commitments. The inclusion of EPC band Ds alongside an EPC E-G minimum, balances the need to incentivise the retrofit of the least energy efficient homes with the deliverability of the scheme. Most consultation respondents agreed with this approach, 81% of respondents agreed with targeting D-G homes and 67% of respondents agreed with having a minimum number of private tenure E-G homes upgraded.

31. Government has decided to remove eligibility for non-means tested benefits (including Disability Living Allowance and Personal Independence Payment[27]) as consulted. It is recognised that some respondents felt strongly about this change - 45% of respondents disagreed with proposals to remove non-means tested benefits. However, this change will be positive in targeting those on lowest incomes and most likely to be in fuel poverty. Households in receipt of both means tested benefits and disability benefits will continue to be eligible under ECO4. Government is satisfied that those on the lowest incomes and with conditions which make them vulnerable to cold who receive disability benefits will still be supported through ECO4. Government recognises that some low-income households not in receipt of means tested benefits, could be vulnerable to the effects of living in a cold home. These households could be supported under an expanded and reformed ECO4 Flex.

32. Table 1 shows the estimated eligible pool figures used for the analysis included in this IA. Across owner-occupied properties there are 3 million eligible properties in total, 1.15 million eligible through benefits and 1.9 million assumed to be eligible for ECO4 Flex[28]. This total owner-occupied eligible pool has a fuel poverty hit rate of 27%.

33. Government has elected not to extend support for PRS EPC D properties, given that it is likely most landlords would be able to upgrade these properties to an EPC C more cheaply outside of ECO. Furthermore, Government has decided to proceed with the proposal that PRS properties receiving ECO support must have at least one high-cost measure in the package of measures. This ensures support is focused on the tenancies needing the most support. This results in 430,000 PRS[29] homes eligible for ECO4 – however given restrictions on packages supported by ECO4 means delivery to PRS homes is expected to be limited.

34. Government has decided to continue to allow EPC E-G social housing properties support for specific measures (an eligible pool of around 230,000 properties), with EPC D social housing properties restricted to innovation measures only (innovation measures are not modelled). As outlined in the consultation and recent Heat and Buildings Strategy, Government continues to believe that the availability of separate funding streams across England, Scotland and Wales will adequately support this tenure type. Notably, £800 million of funding for the Social Housing Decarbonisation Fund was announced in the 2021 Autumn Budget and Spending Review[30].

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[27] Full list provided in table 6 of the consultation document.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1010366/eco4-consultation.pdf

[28] ECO4 Flex eligible pool estimates have been deflated by 50% to proxy LA engagement in the scheme – this is an uncertain assumption and is tested within the sensitivity section of this IA.

[29] Homes in Multiple Occupation or those in bedsits are generally excluded from ECO measures, except for private tenure HMOs. These can be upgraded if at least 1 in 5 households is eligible, and where SAP assessments cannot be undertaken on individual rooms of a property. The eligible pool has not been adjusted for HMOs or bedsits.

[30] https://www.gov.uk/government/publications/autumn -budget-and-spending-review-2021-documents/autumn-budget-and-spending-review-2021-html

Table 1: ECO4 Eligible pool estimates used for modelling[31]

	Owner occupier on benefits	Owner occupier via ECO4 Flex	Social Housing	PRS
D	880,000	1,390,000		
E	200,000	350,000	180,000	350,000
F	50,000	120,000	40,000	60,000
G	20,000	40,000	<5,000	10,000
Total	**1,150,000**	**1,900,000**	**230,000**	**430,000**
FP Hit rate[32]	**44%**	**17%**	**50%**	**71%**

EPC E, F and G minimum

35. Government will set a sub obligation broadly equivalent to 150,000 private tenure EPC band E, F and G homes being upgraded under ECO4, so that greater progress is made in meeting fuel poverty targets and the least energy efficient homes requiring greater investment are not left behind.

36. This is considered proportionate to the estimated pool of eligible private tenure homes of 3.5 million, with approximately 1.2 million of these being E, F and G properties.

Solid wall minimum requirement

37. Improving the energy efficiency of solid walled homes is a significant challenge for the nation's housing stock, but essential to meeting our statutory emissions reduction goals and to delivering the ambition of the Heat and Building Strategy. Ongoing support through ECO will help sustain the solid wall insulation supply chain, helping ensure the Government meets both objectives.

38. Setting a SWI minimum would also help ensure that delivery to harder-to-treat homes is more evenly distributed across all suppliers by, for example, preventing a smaller supplier from purely targeting the lower cost cavity wall homes to meet their obligation.

39. We recognise that the majority of uninsulated solid walled homes are EPC band E, F or G, and expect that SWI will be delivered to meet the proposed MRs for these homes. However, without a SWMR, the supply chain could, in some circumstances, choose to install a combination of other measures to reach the MR rather than SWI, which is more effective at alleviating fuel poverty over the longer term.

40. Therefore, to provide the SWI industry with delivery certainty, and to ensure consumers are receiving the most effective measures at reducing fuel poverty, we intend to continue to set a SWMR for ECO4 and remove the option to meet this through SWAM. We intend to increase this target to 90,000 SWI measures over the four years.

Scoring

41. Government intends to implement the overarching final project scoring approach as consulted on. It will continue to be based on the difference in average annual bill expenditure between the starting SAP rating and finishing SAP rating of a property, with separate scores depending on floor area using four floor area groups. Final project scores have been updated to account for the latest eligible pool figures, with the eligible pool used to calculate the average floor area within each floor area group. For example, the median floor area of the ECO4 eligible

[31] Modelled figures based on English Household Survey data adjusted for latest ECO3 delivery, and modelled PRS to E regulations.

[32] FP rates based on matching NHM eligible pool data with LILEE flags produced within BEIS fuel poverty statistics.

properties in the 73m²≤TFA<98m² segment is 83.6m², this is a very small change from the 83.5 m² used previously. These average floor areas for each of the four floor area groups are then fed into the rearranged SAP formula used by Ofgem to calculate final project scores – more detail on the approach is provided within the Ofgem scoring consultation[33]. Partial project score are not modelled for the purposes of this IA – given the focus is on the final projects and obligation target.

42. Modelling conducted on the scores produced by Ofgem has shown a less favourable distribution by floor area. Of treated homes, the largest homes were significantly overrepresented, and the smallest underrepresented, versus their respective distribution in the housing stock. The introduction of uplifts of 20% and 10% on the smallest and second smallest floor areas groups, respectively, will further reduce the risk of the smallest properties not getting sufficient support in ECO4.

43. Some of those opposed to the framework highlighted concerns that SAP, being focussed on bill savings, would not capture the carbon-saving benefit brought about by heat pumps. However, additional support for heat pumps, such as a heat pump uplift, would significantly raise the risk of bill increases rather than bill savings in some households, which would be contrary to the main objective of the scheme.

Boilers

44. Government has decided to exclude the installation of all new and replacement oil and LPG heating systems, including hybrids using these fuels, in ECO4 in line with our goal to decarbonise off-gas homes. This is aligned with our proposal – on which we are currently consulting – to end the installation of fossil fuel heating systems in homes and non-domestic buildings off the gas grid, in England, from 2026[34]. Bioliquids will also not be permitted in ECO4.

45. To balance the Government's decarbonisation goals with our fuel poverty objectives, Government has decided to allow the repair of efficient and inefficient broken oil and LPG heating systems, subject to the Broken Heating Repair Cap, only where none of the off-gas hierarchy heating measures[35] are reasonable or practical to install. This will prolong the life of the heating system and ensure homes have heating, whilst improving the insulation of the home, which has proven long term benefits for fuel poor households. Both efficient and inefficient broken oil and LPG heating systems will be eligible for repair, and there will be no requirement for the heating system to be economic to repair since oil and LPG heating system replacements will not be permitted.

4. Targets for Obligated Suppliers

46. The final Government position is:

- **An overall target of £224.3 million in notional annual bill savings to be achieved by March 2026.** This compares to £8.253 billion of notional lifetime bill savings under ECO3. The difference is driven by the move to annual bill savings as opposed to lifetime bill savings. The reason for this change is deemed scores under for ECO4 are awarded based

[33] https://www.ofgem.gov.uk/publications/energy-company-obligation-eco4-consultation-scoring-methodology-part-1

[34] Phasing out the installation of fossil fuel heating in homes off the gas grid, BEIS, (October 2021), https://www.gov.uk/government/consultations/phasing-out-fossil-fuel-heating-in-homes-off-the-gas-grid

[35] See question 51 within the Government response for detail on the off-gas hierarchy

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[36]. £224.3 million is higher than the £94 million target within the consultation IA – this is partly driven by the increase in homes treated and higher EFG minimum, as well as consultation stage modelling applying a deflator to scores for EPC D homes to further incentivise E, F and Gs. Modelling has since been refined to allow the EFG minimum to be fully modelled without the need for deflators[37].

- **A band E, F and G sub obligation of £155.9 million in notional annual bill savings** between April 2022 to March 2026, this is equivalent to around 150,000 private tenure homes.
- **A solid wall minimum broadly equivalent to 90,000** solid walls being insulated from April 2022 to March 2026
- Limit the repair and replacement of broken efficient heating systems to 5,000 repairs and 5,000 replacements per year (up to 40,000 measures in total over the four years).

5. Analytical approach

47. This section of the IA outlines the way that the policy options have been appraised. The aim of the analysis is to:
    - Estimate the uptake of energy efficiency measures within domestic dwellings during ECO4;
    - Assess the impact of the policy, in terms of energy saved, the carbon abatement, improvement in air quality, and health impacts;
    - Estimate the distributional impact of the policy, including the costs to energy suppliers and bill payers; and
    - Estimate progress against fuel poverty targets.

48. The impacts have been appraised according to Green Book and supplementary guidance and are presented in discounted real 2021 prices, against a counterfactual of ECO ending in March 2022 (i.e., option 0, no action after ECO3 ends).

49. The policy estimates have been 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 homes in the country. To estimate impacts for

[36] More detail on the approach and options considered for scoring is provided within the ECO4 consultation document. As well as Ofgem's consultation https://www.ofgem.gov.uk/publications/energy-company-obligation-eco4-consultation-scoring-methodology-part-1

[37] See footnote 31 in consultation IA.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1003740/eco4-consultation-stage-impact-assessment.pdf

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[38].

50. The policy has 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 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'.

51. There is a degree 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 relative to eligible pool, 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 over 100 times those when gas usage is reduced[39]. To limit the impact of this, multiple model runs are conducted, and the average taken across them, however, modelling should still be considered in the context of this large variability in costs and benefits which will make results uncertain.

52. The NHM does not account for the location of homes relative to one another this means modelling does not cover homes permitted under 'in-fill' where a purpose-built block of flats or homes on the same street include mixed tenure occupants. Delivery through in-fill 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

53. The policy is appraised over the period 2022 to 2068, 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. 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) to ensure that all 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 HMT Green Book Guidance.

54. 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 Improvements to evidence base

55. The key improvements to the evidence base since the consultation stage IA are outlined in Table 2 below. Most of the refinements to assumptions have resulted in lower level of

[38] Ratio of 1.167
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/householdprojectionsforengland
[39] 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://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

economic rent – leading to a higher estimate of homes able to be treated and increased targets. More detail can be found in Annex B.

Table 2 – Key improvements to the evidence base since the consultation

Area of change	Description of change	Reason for change
ECO3 stock alignment	Modelling has been updated to include the latest statistics for delivery under ECO3.	This means the starting position of the housing stock is more accurate. Modelling previously overestimated the delivery of certain measures under ECO3 – this update means there is more technical potential in the model for ECO4.
E, F and G minimum separate market price	In the consultation IA only two market prices were modelled across LA/Supplier Flex and the main scheme. Modelling now treats delivery of the E, F and G minimum requirement separately – meaning a separate market price is calculated.	This change is more reflective of what has been observed under ECO3 – where different sub-obligations attract different market prices[40]. This change segments delivery into three different groups – which reduces the opportunity for eco nomic rent to accrue. A reduction in economic rent means more funding is available to treat more properties. Further detail is provided in Annex B.
Biannual market pricing period	The consultation IA modelled annual market pricing – therefore it assumed that price for achieving bill savings was set annually at the marginal price (or highest cost). Modelling now assumes prices are set every six months.	Change was driven by stakeholder feedback that on average most ECO contracts last around 6 months. This results in lower economic rent due to a shorter period in which rent can accrue. Further detail is provided in Annex B.
Findability	The assumed proportion of the untreated eligible pool that can be found by suppliers each year. The consultation IA applied both measure findability (ranging from 10%-16% depending on measure) and household findability (flat 25%) to eligible pool. Modelling now only applies a flat household findability rate of 20%. This proportion is applied to the 'unfound' eligible pool each year. The model then selects the most cost-effective properties to treat from this found pool.	Based on internal analysis and engagement with stakeholders it was concluded that applying both measure and household findability was overly restrictive and leading to unrealistically high levels of economic rent and modelled market prices. Given the uncertainty around findability assumptions, a simpler approach has been chosen which is easier to interpret. 20% was chosen as a reasonable estimate of the proportion of the market suppliers are feasibly able to identify per year. This change results in more properties to choose from and means more cost-effective properties can be chosen – reducing the capex per home and the number of homes able to be treated.
PAS costs - Cover all the costs involved in complying with the PAS framework[41]	At consultation stage a cost of £500 per house was assumed for PAS related costs. This has now been updated to £950 per house. This is applied	Also based on consultation feedback– PAS related costs such as retrofit coordinator, designer and assessor costs were found to be higher than expected.

[40] Illustrated within Table 6.4 of BEIS ECO3 delivery statistics [ADD LINK]

[41] PAS provides a framework of standards on how to conduct effective energy retrofits of existing buildings. PAS 2035 covers how to assess dwellings for retrofit, identify improvement options, design and specify Energy Efficiency Measures (EEM) and monitor retrofit projects.

Area of change	Description of change	Reason for change
	regardless of measures received – therefore assuming all ECO4 homes are Path B homes[42]	
External Solid Wall Insulation (EWI) Capex	The average costs of EWI within the consultation IA was £8,500. This has increased to £14,700 – this includes costs associated with enabling work as well PAS related additional costs such as additional ventilation.	Based on consultation feedback a review was undertaken of EWI capex assumptions to ensure modelling better reflected all costs involved with EWI.
PRS and SH	Modelling now includes PRS properties. The measures social housing properties are eligible for have also been updated	Changes reflect greater clarity around final policy design.
Updated carbon values	Carbon prices have increased since consultation stage which has meant an increase in monetised benefits from a reduction in both traded and non-traded carbon. This has resulted in a higher NPV relative to consultation stage.	Since consultation there has been an update of HMT's green book carbon prices[43] which are used in policy appraisal and evaluation. This update has been made to reflect the latest evidence, targets, and wider context.

5.3 Counterfactual

56. Low income 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.

57. 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[44]) 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 for their business-as-usual activities.

58. 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.

59. Some energy efficiency improvements will be required in future under other Government heat and building policies, this could mean some ECO4 benefits may not be purely additional but

PAS2035:2019 is designed to work alongside the updated PAS 2030:2019 (previously PAS2030:2017) standards which sets out how the installation of specific EEMs should be carried out in existing domestic buildings. PAS2035 and updated PAS2030 was introduced under ECO3 with all measures delivered after 31st December 2020 required to comply with PAS2035:2019 and delivered by an installer certified to PAS 2030:2019.

[42] For more details on PAS see the ECO3 Improving Consumer Protection IA. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/822619/ECO3_Improving_Consumer_Protection_Consultation_Impact_Assessment.pdf

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

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

instead be bringing forward improvements which would otherwise need to happen in the absence of ECO4. However, the overlap with planned policies is expected to be small. ECO4 is expected to complement energy efficiency schemes such as Local Authority Delivery, the Home Upgrade Grant, and the Social Housing Decarbonisation Fund. There may be some overlap with proposed amendments to the PRS Regulations, which would require PRS properties to be at least EPC Band C by 2028. However, ECO4 will support only retrofits in PRS properties rated EPC E-G, which represent just one-quarter of the D-G properties that would need to be improved under the proposed PRS Regulations[45]. Further, the measures installed under ECO4 will be high-cost measures that landlords would be unlikely to choose to comply with a new EPC C standard, e.g., external wall insulation – a £10,000 cost cap on improvements is proposed for landlords who need to achieve EPC C. ECO4 may cause the short-term displacement of lower-cost measure installations in the PRS, though to achieve net zero by 2050, these measures will likely still need to be installed in the longer term.

60. There is also only minimal overlap expected with the Boiler Upgrade Scheme which will run from 2022 to 2025 and provide upfront capital grants to households when switching to a heat pump, given ECO4 recipients are not expected to be able to finance energy efficiency improvement measures in the absence of Government intervention (even at reduced rates). The Heat and Building Strategy provides more detail on the different domestic energy efficiency policies[46].

61. The Government is also considering ways to kick start the green finance market and have consulted on introducing mandatory disclosure requirements for mortgage lenders on the energy performance of homes on which they lend, and on setting voluntary improvement targets to be met by 2030. As these policies develop, any overlaps with existing Government policy will be assessed.

6. Categories of Costs and Benefits

6.1 Summary of costs and benefits

62. 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 3 below summarises the key costs and benefits included in this IA, followed by a description of each component.

Table 3– 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

[45] https://www.gov.uk/government/statistics/english-housing-survey-2019-to-2020-headline-report. Section 2: housing stock tables Fig 2.11

[46] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1032119/heat-buildings-strategy.pdf

Group	Costs	Benefits
	Supplier administration costs	Comfort taking (the benefit of warmer home)[47]
	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

6.2 Excess subsidies ('Economic Rent')

63. 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.

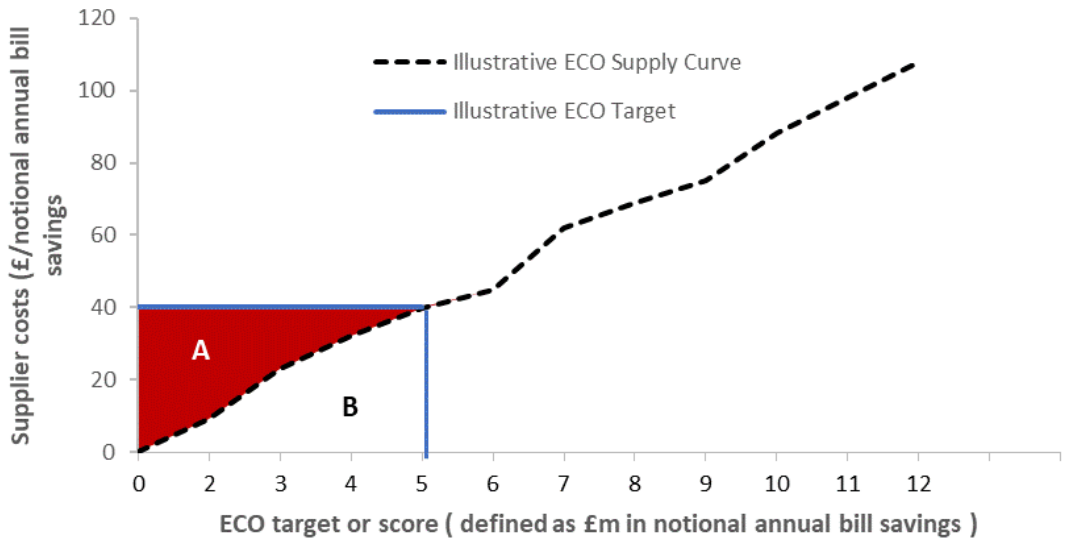
64. The modelling assumes households, local authorities or devolved administrations do not need to contribute toward the installation of measures. As observed under previous ECO schemes, installers are expected to sell notional annual bill savings to suppliers. Installers are then expected to seek out the most cost-effective properties, looking to achieve these annual bill savings for the lowest price.

65. 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 1 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

[47] 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.

targets, suppliers can promote and install the most cost-effective measures and can target the most amenable households.

Figure 1: Illustrative ECO Supply Curve



66. As the level of the target increases, suppliers must move up the supply curve, and consequently treat less cost-effective homes; these act to increase the market clearing subsidy that suppliers must pay to meet their obligation.

67. Economic rent could accrue to businesses. 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 1) and installers would make no additional profit. However, if installers charge suppliers at the marginal price for bill savings (horizontal blue line in Figure 1 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.

68. 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 1), 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.

69. The consultation IA provided two alternative scenarios for the distribution of economic rent, the first assuming all economic rent accrues to households and the second assuming it accrues to businesses (via suppliers). This IA uses the second of these scenarios as the central case, as this has been identified as the most likely outcome based on anecdotal evidence from stakeholders. This assumption does not affect the non-equity weighted NPVs (as it is reflected as a transfer between economic agents) but will affect the equity weighted NPV which weights economic rent differently depending on who pays or benefits.

70. 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)

71. The overall monetised costs and benefits of the policy options to society, net of the counterfactual and discounted, are shown in Table 4.

72. The NPV for the scheme has increased since consultation stage and is now £810 million, the majority of this change is driven by the increase in carbon values used to monetise carbon savings which have been updated by HMT to better reflect the latest evidence, targets and wider context.

73. There has also been a significant reduction in economic rent down from £1.7 billion in the consultation IA to £490 million in this IA (not equity weighted). This reduction has been offset slightly by increases in PAS costs, which are now £410 million compared to £140 million at consultation stage. However, the net result means more of the ECO4 funding is estimated to be spent on installations – with installation costs increasing from £1.6 billion to £2.4 billion. The increase in capex spent on installations means more homes can be treated resulting in higher energy savings.

74. The installation costs of the energy efficiency measure, 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. These costs along with supplier admin costs, PAS costs, search costs and economic rent are initially paid by suppliers but are expected to be recouped from consumers through higher bills. 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. This is an uncertain assumption and households may not choose to reinstall measures after their useful life.

75. Admin cost estimates have remained unchanged since consultation stage. More detail on costs and benefits is provided in 'Annex A – Modelling approach'

Table 4: Aggregate costs and benefits of ECO4, 2022 – 2067 (£m, 2021 prices)

Description of costs and benefits – present value of final government position	NPV	Equity weighted NPV
Installation costs	2,400	3,560
Reinstallation costs - paid by households at end of useful lifetime	970	1,840
Natural boiler replacement costs - household costs avoided	-50	-110
Hidden costs – hassle costs for household associated with installations	110	110
Supplier administration costs	360	530
PAS costs – retrofit assessor costs	410	600
Search costs	140	210
Operational costs of running measure	14	20
Value of economic rent *(assumed to be paid by the suppliers) [not included in NPV]*		720
Total Costs (excluding rent)	**4,360**	**7,490**
Value of energy saved	1,890	1,890
Value of air quality improvements	230	230
Value of change in traded carbon savings	120	120
Value of change in non-traded carbon savings	2,420	2,420
Value of comfort taking	510	900
Extra utility from lower bills in low-income households [not included in NPV]		2,220
Value of economic rent *(assumed to accrue to supply chain)* [not included in NPV]		490
VAT benefit to society [not included in NPV]		60
Total Benefits	**5,170**	**8,320**
Overall Net Present Value	**810**	**830**

Equity weighted NPV

76. 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 equity weighted figures in the table above show the costs and benefits of the scheme with equity weights applied based on who is paying or benefiting. This reflects the distributional impacts of the scheme, consistent with the Green Book guidance[48] (see 'Annex A – Modelling approach for more information on the equity weights).

77. The equity weighting tends to increase both the costs and benefits of the policy outlined in Table 4, 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

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

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.

78. Economic rent is assumed to be paid by suppliers but accrue to installers, this means the cost of economic rent is weighted by the bill payer weight (as suppliers are assumed to pass on the costs to bill payers). The benefits of economic rent accrue to businesses, so are unweighted. Despite the costs of economic rent being weighted more highly than benefits, the higher weights applied to comfort taking and the extra utility of lower bills for low-income households mean the equity weighted NPV is very slightly higher than the main NPV.

ECO3 Interim delivery

79. To avoid a gap between schemes, a three month 'ECO3 interim delivery', will allow suppliers to deliver measures according to ECO3 rules between 1st April 2022 – 30th June 2022. Any measures installed during this period could be delivered under ECO3 rules (with replacement or repair of oil and LPG fuelled heating systems and demonstration actions are excluded). Other measures that are not solid wall insulation delivered in solid walled homes will not count towards the Solid Wall Minimum Requirement. Throughout this period installers and suppliers will also have the option to deliver early to ECO4 scheme rules and be awarded ECO4 deemed scores. Which route suppliers choose to deliver under in this period or how much they will choose to deliver is unknown.

80. Three months' worth of ECO4 equates to 6% of the total ECO4 period. If delivery was assumed to be evenly distributed across months this could equate to £240 million in terms of supplier spend. If suppliers were to maximise delivery under ECO3 rules in this period, this £240 million could be spent on ECO3 measures and awarded ECO3 deemed scores. A supplier's ECO4 obligation would then be reduced to account for this delivery based on the carry-over methodology set out in the Government response. Based on latest ECO3 statistics, between the 1st April 2021 and 30th June 2021, £933 million of ECO3 deemed lifetime bill savings were delivered at a cost of £250 million to suppliers. However, delivery may be lower at the start of ECO4, as previous ECO schemes have shown limited uptake in the first few months – for example, only £151 million of deemed lifetime bill savings were delivered in the first three months of ECO3.

81. 6% of the ECO4 NPV roughly equates to a benefit of £48 million, this benefit could be replaced with the benefits of delivery under ECO3 rules, which are expected to be different to those under ECO4 rules, although the scale of this impact is unknown. ECO3 delivery rules are likely to mean more homes could be upgraded in this period, but with potentially higher starting EPCs (as ECO3 is not limited to D-G properties), and with no minimum improvement requirement, meaning potentially fewer measures delivered per home. This means the carbon and bill saving per homes is likely to be lower, but with more homes benefiting – impacts are still expected to be positive.

82. The above NPV and analysis provided in later sections of this IA does not factor in delivery under ECO3 rules within this period. It therefore assumes overall ECO4 delivery is unaffected by this period. This approach is deemed proportionate given three months only represents a small proportion (6%) of the total of ECO4 and it is unknown how the benefits of ECO3 delivery will compare to ECO4 or which rules suppliers will choose to deliver under. Additionally, the total EFG minimum sub-obligation will remain unchanged (with no carry-over possible). Therefore, suppliers will still need to achieve this level of delivery (which is expected to make up 75% of all spending) through ECO4 rules further limiting the impact of additional ECO3 delivery over this period.

7.1 Annual costs to suppliers

83. The 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 4. 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.

84. Table 5 below, shows suppliers' costs during ECO4, and how these compare to the expected annual supplier costs under current scheme[49].

85. Ofgem have legal powers to take enforcement action if a supplier is non-compliant against their obligations. However based on past schemes compliance rates have been high.

Table 5: 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**

86. 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 to a minimum energy efficiency improvements approach.

7.2 Measure uptake

87. Table 6 below shows modelled gross energy efficiency measure uptake during ECO4.

Table 6: Modelled uptake of energy efficiency measures (GB) between April 2022 – March 2026. Central scenario[50]

	Final government position
Floor insulation	25,000
Filled Cavity wall insulation	165,000
Loft insulation (including room in roof)	105,000
External wall insulation	90,000
Broken heating systems repair/replacements	45,000
Heat Pumps	60,000
Heating controls	225,000
Draught-proofing	30,000
Solar Photovoltaic	15,000
HWT insulation and/or thermostat	35,000
Total measures	**800,000**

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

[50] Results taken from an average of 28 runs

7.3 Homes Treated

88. The estimated number of homes treated under ECO4 is shown Table 7 below.

Table 7: Estimated number of homes treated and insulated under ECO4[51] - central scenario[52]

	Final government position
Number of homes treated (GB)	450,000
EPC D homes treated (GB)	300,000
EPC E homes treated (GB)	60,000
EPC F/G homes treated (GB)	90,000
Number of EFG homes treated (GB)	155,000
Homes getting CWI or SWI (GB)	255,000
Fuel Poor Homes treated (England Only)	125,000
Social housing homes treated (GB)	5,000
PRS homes treated (GB)	45,000

7.4 Fuel Poverty Impact

89. Table 7 shows 125,000 fuel poor homes are expected to be treated in England which equates to 32% of recipients in England being fuel poor. Table 8 shows progress towards the fuel poverty target and milestones, alongside the latest fuel poverty statistics for England (2021)[53], to demonstrate the contribution ECO4 is expected to make to fuel poverty targets. This is measured using the LILEE measure of fuel poverty.

90. The table shows that by the end of ECO4, 100,000 fuel poor properties are expected to be upgraded to Band C (thus FPEER C) and therefore no longer be in fuel poverty. Around 25,000 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.

91. 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 8: Estimated impact of ECO4 on fuel poverty (England Only), 2026[54]

Fuel poor households	Latest Fuel Poverty Statistics (2021)	Final government position (end 2026)[55]	
		Upgraded to Band C	Upgraded to Band D
Band D	2,496,000	65,000	-
Band E	522,000	20,000	-
Band F/G	158,000	15,000	25,000

[51] Figures rounded to nearest 5,000

[52] Results taken from an average of 28 runs

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

[54] Modelled figures rounded to nearest 5,000 so may not sum to totals in table 7.

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

Total	**3,176,000**	**100,000**	**25,000**

7.5 Carbon Savings

92. Table 9 shows the estimated traded and non-traded carbon savings under the final government position 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).

Table 9: Estimated greenhouse gas savings over Carbon Budgets 5 and 6, and over the lifetime of the final government position (GB) (MtCO2e)

	CB5 (2028 – 2032)	CB6	Total Lifetime
Traded	0.17	0.06	0.57
Non Traded	1.62	1.63	14.51
Total	1.79	1.69	15.08

7.6 Impact on Energy Bills

93. 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.

94. 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. In November 2021, Ofgem consulted on how they plan to determine the Energy Company Obligation (ECO) cost allowance in the default tariff cap ('cap') from cap period eight (April 2022 – September 2022) onwards[56]. The estimated average cost of ECO4 on an annual household dual fuel bill is estimated to be the equivalent of around £37 per year for a dual fuel customer (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 £290.

95. After 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

[56] https://www.ofgem.gov.uk/sites/default/files/2021-11/Price%20Cap%E2%80%AF%E2%80%93%E2%80%AFConsultation%20on%20Energy%20Company%20Obligation%20scheme%20allowance%20methodology%20in%20the%20default%20tariff%20cap.pdf

96. There will be some small costs to BEIS and the administrator (Ofgem), which is expected to be covered within business-as-usual spending and has not been monetised in this IA.

97. 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 ECO4 Flex:** 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.
- **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[57,58]. 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, are often seen to improve the appearance of an area, increasing further the wellbeing of those living there.
- **Wider Economic benefits**: the scheme will continue to support the energy efficiency supply chain and, support 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 provided 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. Over 6,000 innovation measures have been installed across the whole of ECO3 so far.
- **Competition impacts –** an eligible household can benefit from ECO4 regardless of if they are supplied energy by an obligated supplier or not. Suppliers can pass the costs of delivering their obligation on to their customers. This cost pass through means that suppliers should 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. However, the current gas spike may continue to affect customer incentives to switch supplier over the course of ECO4 – the future competition impacts remain unclear for ECO4 and will depend on when the current gas spike subsides and the composition of the market after that point. The 2019 energy retail market consultation[59], raised concerns about size-based ECO obligation thresholds. It was highlighted that thresholds which exempt smaller suppliers may lead to an uneven playing field for suppliers, disrupt

[57] 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

[58] 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

[59] https://www.gov.uk/government/consultations/flexible-and-responsive-energy-retail-markets

important price signals and incentivise some suppliers to set their prices in a way that means they recover these policy costs disproportionately from default tariff customers. This was identified as potentially exacerbating the issue of excess prices for unengaged customers (loyalty penalty). Government is committed to eventually reducing to a very low level or removing supplier thresholds, making all suppliers obligated to overcome any market distortion between obligated and non-obligated suppliers. This is discussed further in Section 10.

8. Direct costs and benefits to business calculations

98. 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

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

8.1 Equivalent Annualised Net Direct Cost to Business (EANDCB)

Direct costs

100. 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[60].

101. 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).

102. Direct costs determined to be direct costs include:

- Installation costs
- Economic rent that suppliers are assumed to pay to installers
- Administration Costs
- PAS costs
- Search costs

Direct Benefits

[60] 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

103. Assuming installers are the main recipients of economic rent, they benefit from excess profits achieved by selling notional bill savings to suppliers. However, these benefits are the result of resource used to comply with regulations and are therefore excluded from the EANDCB in line with RPC guidance[61].

104. There may also be some benefits to businesses contracted to deliver installation and heating measures. However, these would also fall under resource used to comply with regulations.

EANDCB Position and Business Impact Target Status

105. The EANDCB for the final government position is estimated to be £ 872 million in 2019 prices.

Table 10: EANDCB and Business Impact Target

Present Value - 2021 prices (£m)	Final government position
Installation costs	2400
Economic rent	490
Supplier administration costs	360
PAS costs – retrofit assessor costs	410
Search costs	140
Total direct costs	3,800
2019 prices - 2020 present values	
EANDCB (£1bn supplier spend over 4 years)	872
BIT Score	3,490

9. Risks and assumptions

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

- **Capital cost of EWI measures** – EWI is the most expensive measure modelled under ECO4 and 20% of homes are modelled as receiving it. Cost estimates have been updated since consultation IA to account for recent increases in costs related to PAS requirements and general cost inflation – however there is still uncertainty around costs suppliers will face. Two alternative scenarios have therefore been tested to show the impact on results of a change in EWI costs. First a 20% increase to fixed and variable costs is modelled (average cost of £16,600), this range has been based on the range observed across estimates provided by suppliers. The second, is a cost sensitivity based on observed costs from the Green Homes Grant Voucher (GHGV) scheme which generally resulted in lower total costs. This results in an average cost of around £11,300.
- **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

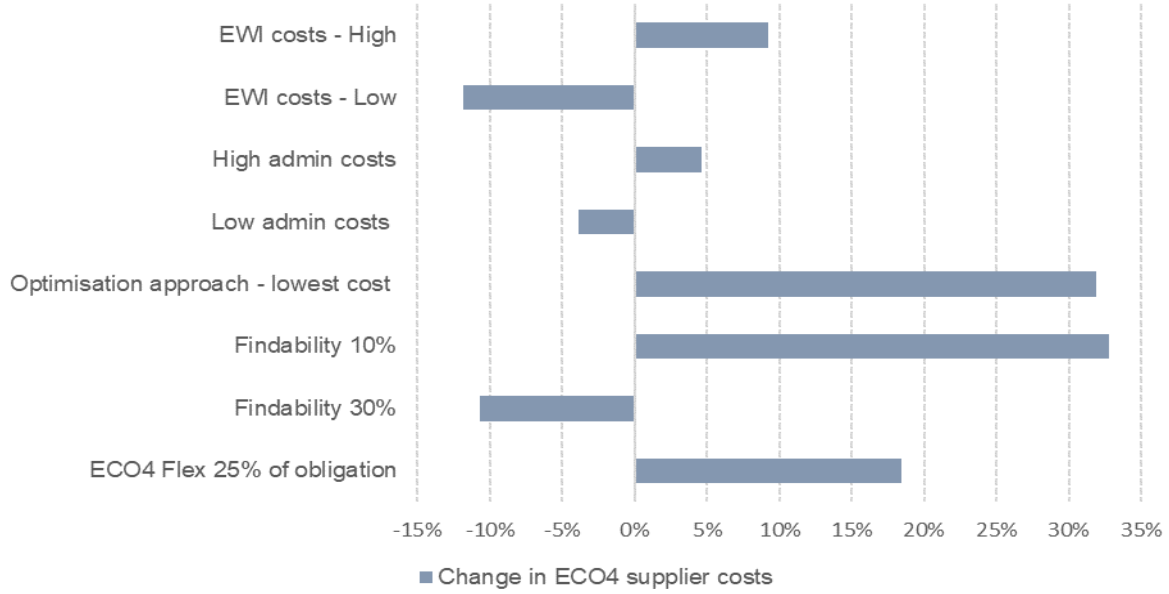
[61] https://www.gov.uk/government/publications/rpc-case-histories-other-bit-methodology-issues-march-2019

relative to ECO3 but by how much is uncertain. Results have been tested against a range of £55 million to £140 million per year – these figures have been identified as viable high and low estimates based on discussions with suppliers[62].

- **Optimisation approach** – modelling assumes measures at a household level 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 and willing to have measures installed. Assumptions around how much of the eligible pool can be found each year have large impacts on results. A 30% scenario and a 10% scenario have been tested to illustrate the sensitivity of results to this assumption.
- **ECO4 Flex -** it is currently assumed that suppliers use their full allocation and 50% of the obligation is met through Flexible Eligibility. However, if this route is not fully utilised there would be a smaller pool of properties available for retrofit. The figures below shows the impact on results if only 25% of the obligation is met via Flexible Eligibility.

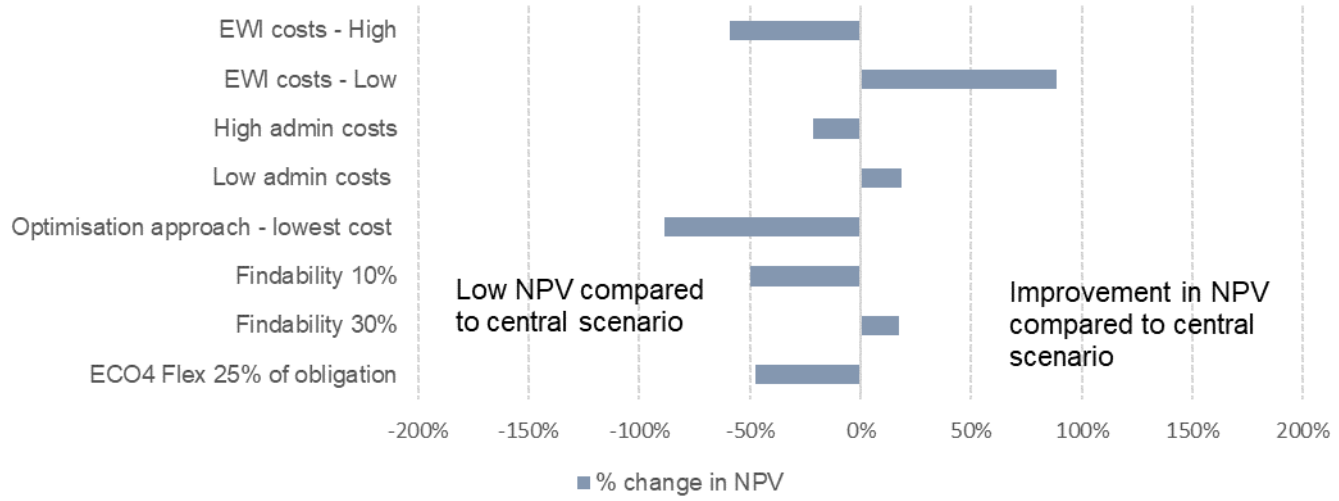
107. Figure 2 and 3 below show the impact on supplier spend per unit of score and NPV under the various sensitivity tests described above.

Figure 2: Change in supplier £ per score relative to preferred option under central assumptions



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

Figure 3: Change in NPV relative to preferred option under central assumptions



108. Figure 2 shows supplier costs are most sensitive to findability rates, if the number of properties suppliers can find (and are willing to have measures installed) each year was halved to only 10% of the unfound eligible pool, the costs faced by suppliers in meeting their obligation could increase by over 30%. This results in an 50% lower NPV. Conversely, if suppliers were able to find double the number of properties, modelling suggests they could see a 10% reduction in costs – and a higher NPV. Despite improvements since consultation stage, there is still considerable uncertainty around findability rates. However, the central scenario is seen as a relatively conservative assumption, as assuming 20% of unfound properties are found each year results in only around 60% of the total eligible pool found over the course of the scheme.

109. Supplier costs are also sensitive to the optimisation approach used in the modelling – if suppliers were to install measures in lowest cost order instead of lowest cost per unit of score, the cost to meeting their obligations could increase by over 30%, with a 90% reduction in NPV. 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.

110. The NPV of the scheme and supplier costs are also highly sensitive to the assumed EWI price, if prices resembled higher estimates provided by suppliers this could reduce the NPV by over 50%, increasing supplier costs by almost 10%. However, if costs were reduced and closer to those observed under GHGV, suppliers could see a reduction in costs of over 10%, with the scheme NPV increasing by almost 90%. There is uncertainty around the true costs of EWI and how theses might change over ECO4. EWI costs might be expected to be higher than observed under GHGV, due to the new PAS requirements. However, modelling assumes that the entire SWI minimum is met through EWI which is higher cost than internal solid wall insulation – this may mean costs faced by suppliers for meeting the SWI minimum requirement are lower.

111. Overall, the sensitivity testing showed the scheme's NPV is more sensitive than supplier costs to the changes in assumptions. However, in all scenarios tests the NPV of the scheme remained positive.

112. 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 this were to happen on a large scale this could impact the costs involved in ECO4 and the number of properties treated[63]. 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. For example, internal solid wall insulation is not included, but made up nearly 60% of SWI delivery under ECO3[64] . This measure is cheaper than external solid wall and therefore could provide a cheaper route for suppliers to meet their SWI minimum.

- **Eligible homes** – Modelling does not cover homes permitted under 'in-fill' for example where a block of flats or street includes mixed tenure occupants, as the modelling is unable to account for location of properties (needed for in-fill modelling). 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. However, given Government will cap the percentage of retrofits treated by each supplier that can be subject to exemptions at 5%, the impact of this is not expected to be large.
- **SAP10 –** throughout the course of ECO4, SAP2012 will be updated to SAP10. SAP is the used to assess the energy and environmental performance of dwellings. It will therefore be used by installers to determine the end EPC rating of a property and the measures needed to get there. The current modelling relies on SAP2012 to determine measures needed and improvement in energy bills and EPC band (and therefore the resulting score). If the deemed scores and obligation target remain unchanged but installers move to SAP10 this may alter incentives on which homes to treat and measures to use.

- There are several changes under SAP10 which it has not been possible to test at this stage and therefore full sensitivity testing has not been included. However, one of the largest changes (and most relevant for ECO4) is to fuel prices, with the price of electricity rising significantly. These new fuel price assumptions have been tested (whilst keeping all other SAP2012 assumptions constant) to give a sense of potential impact on suppliers a change in SAP methodology could have if scores and obligation remained unchanged. Initial analysis suggests a small increase (<1%) in supplier costs under this test – however this does not factor in all changes under SAP10. Results showed SAP10 fuel costs are likely to make electrically heated homes more favourable to treat (as great savings can be achieved in these homes given the increase in price). Government will consider further the impacts this might have on the scheme and should it be found that an update to scores is worthwhile, will consult on a potential score update.

[63] Some of this may be captured within findability rates – which limit the eligible 'found' and willing to have measures each year to 20% of the unfound population.

[64] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1035286/Headline_HEE_tables_25_November_2021.xlsx

- **Supply chain risks** - ECO4 will run alongside several other Government energy efficiency schemes and there may be risks associated with local supply chains being overstretched. However, ECO4 is an established policy with a strong supply chain in place, therefore this risk is expected to be smaller for ECO. There are also risks for the supply chain associated with a gap in delivery between ECO3 and ECO4 – to mitigate these risks an ECO3 interim delivery will be put in place to support the supply chain during this gap.

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

10. Impact on small and micro businesses

114. 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.

115. 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.

116. Government is committed to eventually reducing thresholds to a very low level or removing all together and making all suppliers obligated to overcome any market distortion between obligated and non-obligated suppliers. The Energy White Paper[65] 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.

117. Government has decided not to introduce a buy-out mechanism as proposed in the consultation, though it will seek to introduce an alternative delivery approach, primarily for smaller suppliers. This will provide a low cost, more flexible delivery option . This would not involve energy suppliers paying a levy, rather, it would allow them to deliver measures to help fuel poor households in a simpler way. The Government plans to legislate for the powers to create this new mechanism when Parliamentary time allows. Government will consult on the details of that mechanism and that will include a judgement about the market situation at the time – in light of the current gas price spike. A reduction in supplier allowance is therefore the first step toward removing market distortion, without imposing new burdens on small suppliers not already obligated before an alternative delivery approach is available.

118. Based on Ofgem data collected for the final phase of ECO3, at 31st December 2020, an estimated 99% of customers are with obligated suppliers[66]. 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

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

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

Impact Assessment[67] 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.This is expected to still hold given the recent changes in the market, and 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.

119. 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 11 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.

Table 11: 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%

120. As this change will not place new obligations on currently unobligated suppliers, we do not expect suppliers to face additional set-up costs – however a larger share of the obligation will mean increased delivery costs for smaller suppliers (although may also create opportunities for economics of scale in delivery).

121. 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[68]. 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

122. 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.

123. 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

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

[68] 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

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 taken from the English Housing Survey 2019-20[69].

Age

124. ECO4 recipients 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 12: ECO4 recipients by age (England only)[70]

Age band	Preferred option	Overall population	Owner occupiers
16-24	2%	3%	1%
25-34	7%	14%	9%
35-44	16%	17%	14%
45-54	19%	20%	20%
55-64	19%	17%	20%
65 or over	37%	29%	36%

Disability

125. Around 46% of recipients 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 but aligns with fuel poor households.

Table 13: ECO4 recipients with a member of the household has a long-term illness or disability (England only)[71]

Member of the household has a long-term illness or disability?	Preferred option	Overall population	Fuel poor households[72]
No	54%	66%	54%
Yes	46%	34%	46%

Race

126. Table 14 suggests ECO4 recipients are less likely to come from ethnic minority households.

127. The race profile of ECO4 is more in line with that of all owner occupiers, but still underrepresents black and Pakistani/Bangladeshi minority groups. This suggests the race

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

[70] Data taken from EHS 2019-20: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945376/2019-20_EHS_Headline_Report_Section_1_Households_Annex_Tables_.xlsx

[71] Data on overall population taken from EHS 2019-20: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945376/2019-20_EHS_Headline_Report_Section_1_Households_Annex_Tables_.xlsx

[72] 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

profile of ECO4 recipients only in part reflects the lower proportion of ethnic minorities who are owner occupiers compared to the general population.

Table 14: ECO4 recipients by race (England Only)[73]

Ethnicity	Preferred option	Overall population	Owner occupiers
White	92%	87%	90%
Black	1%	4%	2%
Indian	3%	3%	3%
Pakistani or Bangladeshi	1%	2%	2%
Other	3%	4%	3%
All Ethnic Minority	8%	13%	10%

Marriage and civil partnership

128. 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[74].

Table 15: ECO4 recipients by relationship status (England Only)[75]

Relationship status	Preferred option	Overall population	Owner occupiers
Couple	51%	57%	66%
Single	44%	38%	31%
Other multi-person households	6%	5%	3%

Sex and household structure

129. The EHS provides data on the reported sex of household reference period (HRP). The HRP is the designated head of the household and is the member that fills out the EHS for the household. 60% of the HRP's for ECO4 households reported their sex as male, with the remaining 40% reporting female. Based on 17-18 EHS data[76], 58% of HRPs in the general population reported their sex as male – the latest EHS data is not available, but this suggests ECO4 may slightly overrepresent male HRPs. Reporting sex of HRP may skew results towards males.

130. Around 75% of couples (with or without children) treated by ECO4 had a male HRP. Whereas lone parents, other multi-person households and single households were around 50-60% female. This may skew results toward male headed households, given Table 17 shows

[73] Data taken from EHS 2019-20: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945376/2019-20_EHS_Headline_Report_Section_1_Households_Annex_Tables_.xlsx

[74] 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

[75] Taken from EHS 2019-20: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945376/2019-20_EHS_Headline_Report_Section_1_Households_Annex_Tables_.xlsx

[76] Sex of HPR is not reported within published EHS tables – this figures have been taken from the underlying survey data itself of which 17-18 is the latest data available.

51% of households receiving ECO4 measures are estimated to be couples, compared to 44% being single (with or without children) and 6% other multi-person households.

131. This compares to 57% of the total population of households being a couple, 38% single (10% lone parents and 28% one person) and 5% being multi-person households. This suggest ECO4 is less likely to treat lone parents, although this may be driven by the lower proportion of lone parent households that are owner occupiers. ECO4 is also more likely to treat single person households.

Table 16: ECO4 recipients by sex (England Only)

	Male	Female
All households	60%	40%
Couple	75%	25%
Lone parent	37%	63%
One person	47%	53%
other multi-person households	39%	61%

Table 17: ECO4 recipients by household structure (England only)[77]

	Recipients	General population	Owner occupiers
Couple	51%	57%	66%
Lone parent	6%	10%	6%
One person	38%	28%	25%
other multi-person households	6%	5%	3%

Gender reassignment, religion or belief, and pregnancy and maternity

132. The English Housing Survey 2013-14, and therefore modelling, is unable to directly 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

133. Table 17 shows that ECO4 recipients are more likely to be in the lower income deciles, with around 64% of recipients in the lowest five deciles.

[77] Taken from EHS 2019-20: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945376/2019-20_EHS_Headline_Report_Section_1_Households_Annex_Tables_.xlsx

Table 18: ECO4 recipients by equivalised after housing cost income decile (England only)

Equivalised income decile	Preferred option
1st decile (lowest)	12%
2nd decile	14%
3rd decile	13%
4th decile	14%
5th decile	11%
6th decile	13%
7th decile	11%
8th decile	5%
9th decile	6%
10th decile (highest)	1%

12. Further modelling results

134. 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 19: Estimated recipients by whether on gas grid (England only)[78]

Connected to gas grid	Preferred option	Overall population
Not connected to gas grid	18%	12.6%
Connected to gas grid	82%	87.4%

Table 20: Estimated uptake of measures by dwelling type (England only)[79]

Dwelling type	Preferred option	Overall population	Owner occupiers
end terrace	10%	11%	11%
mid terrace	14%	18%	16%
semi-detached house	32%	25%	30%
detached house	19%	17%	25%
bungalow	12%	8%	9%
flat	12%	21%	9%

[78] Data on gas grid connections for England taken from EHS 2019: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/898461/DA2203_Parking_and_mains_gas_-_households.xlsx

[79] 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

Table 21: Estimated homes treated by rurality (England only)[80]

Rural status	Preferred option	Overall population	Owner occupiers
Rural	23%	16%	20%
Not rural	77%	84%	80%

135. The table below provides an illustration of the measure mix modelled within the NHM. For example, modelling suggests that EPC D properties only need around 1.4 measures on average whereas with EPC G properties need 3.1 on average. EPC F homes are estimated to need fewer measures than EPC E homes, but more high-cost measures such as EWI and heat pumps. It should be noted that small sample sizes may affect results for EPC F and G homes.

Table 22: Estimated measure mix across starting EPC band

Measure mix	D	E	F	G
External wall insulation		26,000	47,000	17,000
Filled Cavity wall insulation	136,000	17,000	10,000	3,000
Loft insulation	74,000	14,000	11,000	5,000
Floor insulation	4,000	8,000	7,000	7,000
Heat pump		14,000	27,000	21,000
Heating controls	160,000	38,000	19,000	8,000
HWT insulation and/or thermostat	7,000	9,000	14,000	5,000
Draught-proofing	18,000	6,000	5,000	3,000
Solar Photovoltaic		4,000	5,000	4,000
Broken heating systems repair/replacements	15,000	24,000	7,000	
Average Measures per home	1.4	2.6	2.3	3.1

136. The table below shows recipients treated by floor area of property compared to the eligible pool of owner-occupied properties.

Table 23: Estimated homes treated by floor area[81]

	Final government position	Owner occupied eligible pool
Less than 73 sqm	29%	30%
73 to 98 sqm	35%	38%
98 to 200 sqm	33%	29%
200 sqm or more	3%	2%

137. Table 24 shows the regional breakdown of English recipients based on NHM modelling. These estimates should be seen as indicative only, as modelling does not capture all factors that influence where delivery happens, such as regional differences in measure costs or regional supply chain coverage. As modelling is based on the English Household Survey estimates have not been provided for delivery in Wales and Scotland.

[80] 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

[81] Based on NHM estimates of eligible pool and homes treated.

138. Modelling suggests the North West may see a large proportion of delivery – this aligns with ECO3 delivery, where 18% of English delivery happened in this region. ECO4 modelling suggests the South East could see the most delivery, however this region has not seen a large proportion of delivery under ECO3 and this may be driven by higher costs within London and the South East.

Table 24: Estimated English homes treated by Region

	ECO4 Final government position	ECO3 Delivery (Oct18-Sept 2021)
East	10%	6%
London	9%	7%
South East	18%	9%
North East	5%	8%
North West	16%	18%
Yorkshire and the Humber	9%	14%
East Midlands	9%	12%
West Midlands	10%	15%
South West	13%	11%

13. Monitoring and Evaluation

Aims and Objectives of Monitoring and Evaluation Approach

139. The aims of ECO4 are shown in the Theory of Change, below, and reflect the longstanding aims of ECO – to tackle fuel poverty and improve the energy efficiency of inefficient homes. The main difference with ECO4 is that the scheme has a narrower focus on the least energy efficient homes and encourages multiple measures delivery to ensure homes are raised to a minimum standard. Please note that the Theory of Change remains provisional and is subject to change following review during the early phases of the evaluation.

140. The M&E approach will assess the extent to which ECO4 has been successful in meeting these aims. Specifically, the objectives are to examine whether, by 2026, ECO4:

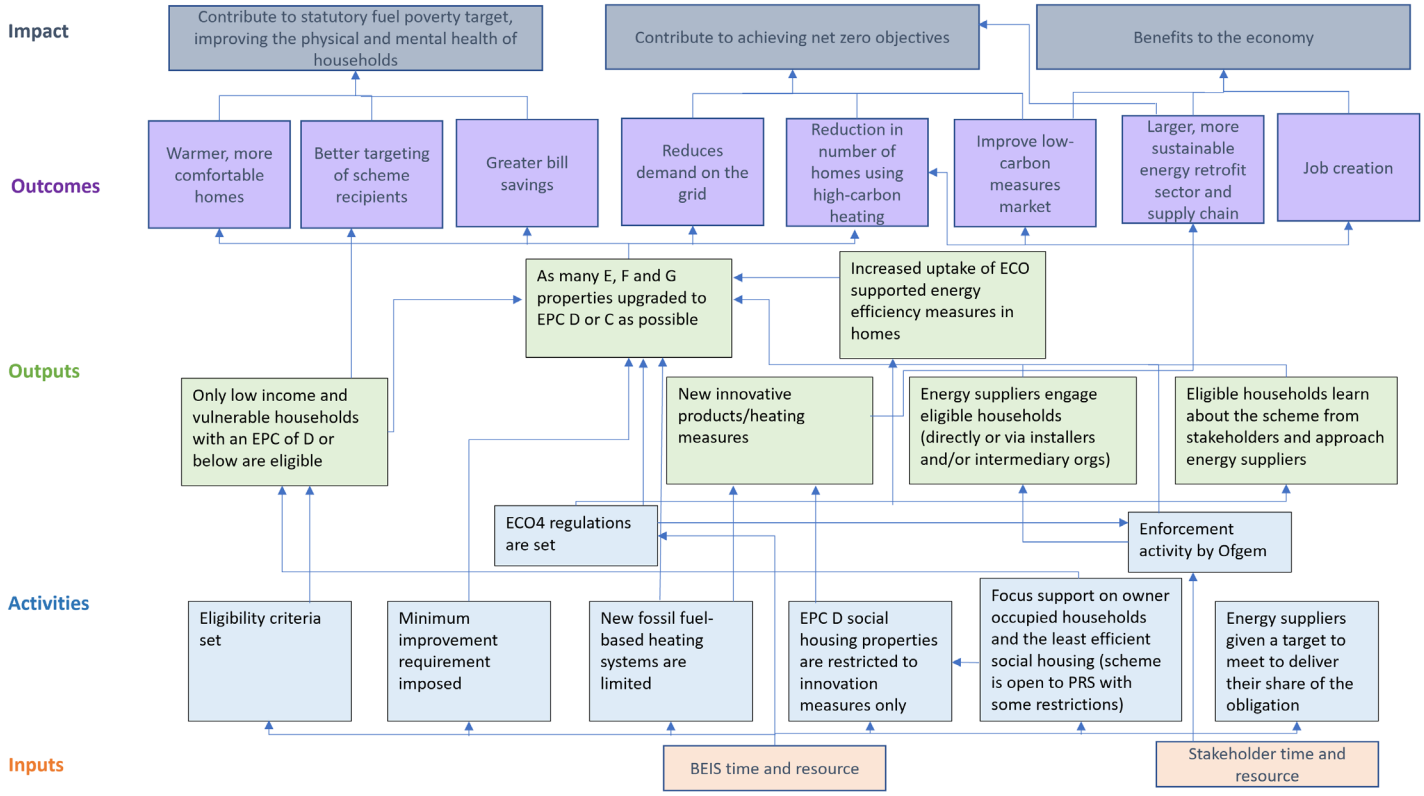
1. Targeted households at risk of fuel poverty, as measured by the Low Income, Low Energy Efficiency (LILEE) metric.
2. Tackled fuel poverty by raising the energy efficiency of fuel poor households to EPC C and reducing energy bills for fuel poor households.
3. Contributed to the UK's net zero target by increasing the energy efficiency of homes currently at EPC D or below and reducing associated carbon emissions.
4. Improved physical and mental health among fuel poor households by increasing thermal comfort.
5. Contributed to increased jobs in the energy efficiency sector by stimulating demand for installations.

Theory of change

141. Below, the provisional Theory of Change shows how we expect ECO4 to achieve these high-level objectives. It sets out the pathways to impact which result from the scheme

activities, outputs and outcomes. This Theory of Change has been reviewed and updated post-consultation, with oversight from monitoring and evaluation advisers.

Figure 51: Theory of Change map for the proposed ECO4



142. A full list of evaluation questions will be developed during the planning phase. However, some potential high-level questions, derived from the Theory of Change, include:

- Who has the ECO4 scheme reached?
- What are the outcomes of ECO4 for households?
- How has the delivery of ECO4 been experienced by households?
- How has the delivery of ECO4 been experienced by installers, suppliers and other non-household stakeholders?
- What are the longer-term impacts of ECO4?
- What immediate learning from interim reporting can be used to iterate and improve future waves of ECO4?
- What is the wider learning from the evaluation?

Learning from current evaluation

143. The current evaluation involves a three-wave household survey and follow-on qualitative interviews with households who have received measures under two phases of the scheme: ECO2t and ECO3. The research was commissioned to provide insights on the type of households who have been reached by the scheme, households' experience of getting energy

saving measures installed and the perceived impact. From this ongoing evaluation, we have identified the following key areas of interest for further exploration in ECO4:

- **Eligibility and characteristics of households:** Early findings[82] show that currently the type of household and the characteristics of the occupants reached by the scheme varies, though there are some groups which are overrepresented. For example, the number of households reached by ECO containing at least one person aged 65 or over is higher than the national estimate of all households (40%, compared with 32% nationally). Given the changes to eligibility criteria for ECO4, we will continue to explore this, with a more explicit focus on those at risk of fuel poverty.
- **Non-household stakeholders**: The current ECO evaluation does not involve research with non-household stakeholders. Yet there is evidence that installers and other non-household stakeholders can have a significant impact on the consumer experience[83]. Moreover, reaching this group would better enable us to test the causal pathways in the theory of change and examine the impacts on the energy retrofit sector. As such, speaking with companies involved in delivery would add considerable value to our evaluation.
- **Impacts of different measure**s: The current evaluation assesses consumer satisfaction with measures installed. It has found evidence of differences in experiences and impacts of the scheme depending on the type of measure households had installed, particularly between heating and insulation measures as well as between single and multiple measures[84]. As ECO4 has a requirement to have multiple measures installed, we will continue to explore the impact of this as well as differences between the types of measures installed.

Monitoring Framework

144. Monitoring of participation and work covered by the ECO4 scheme 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). The provision of scheme data by Ofgem will continue to provide a considerable amount of key monitoring data, though the exact details shared with BEIS will depend on the final evaluation methodology. Alongside the Ofgem data, we will consider the value of other data sources such as the TrustMark lodgement registry, Domestic Energy Performance Certificates (EPC) register and National Energy Efficiency Database (NEED).

145. Ofgem will be required to provide data on the following:

- Approved ECO measures by category
- Measure installation date
- Measure delivery status by company
- Installation address
- Pre- and post-installation EPC band
- Building information including floor area, property type, tenure.

[82] https://www.gov.uk/government/publications/eco-evaluation-wave-1-interim-report-2020; findings cover ECO2t and ECO3

[83] For example, whilst 75% of beneficiaries were satisfied with the experience, qualitative findings suggest that for those households who were dissatisfied, one area of dissatisfaction is household perceptions that installers had not delivered the measures they promised.

[84] Surveyed households that had received multiple measures were more likely to say that they had benefitted a fair amount or a great deal (67%) compared with those who had received a single measure (54%).

146. The monitoring data will be primarily used to understand the extent to which ECO4 successfully reached fuel poor households and subsequently reduced fuel poverty and carbon emissions. We will also use the data to draw a sample of ECO beneficiaries and installers for the evaluation.

147. Key indicators will be defined in the M&E planning stage but these are likely to include i) proportion of eligible households reached who are at risk of fuel poverty, as measured by the LILEE metric and ii) numbers of at-risk households whose homes have been upgraded to EPC C after ECO4 installations. These indicators will be monitored internally, using a combination of Ofgem data and other sources, such as the questionnaire used as part of the evaluation. During the planning stage, we will also determine whether it is reasonable to include milestones up till 2026, and what these milestones might be.

148. As households must be living in homes at EPC band D or below to be eligible for ECO4, all beneficiary households will meet the Low Energy Efficiency criterion for risk of fuel poverty. For the second criterion – income – we plan to match the Ofgem data with the evaluation questionnaire, which will gather self-reported data on household income. To generate a flag for risk of fuel poverty, we will then identify which of these households reported an after-housing costs income of 60% of the median.

149. By tracking post-installation EPC ratings for these households, we will quantify the numbers of at-risk households who are no longer at risk of fuel poverty because of the scheme. We can also use this information to estimate carbon emissions and energy bill reductions, employing a similar methodology to that used as part of a recent evaluation of the Domestic Minimum Energy Efficiency Standards regulations[85]. While we will principally rely on EPC data to identify those at risk of fuel poverty, we will explore the feasibility of estimating energy costs using building information. We can also calculate changes in SAP scores resulting from the types of ECO measures installed. Given known reliability issues with EPC data[86] this may provide a useful sensitivity test.

150. 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.

Evaluation Approach

[85] The authors of this report used SAP ratings and assumed heating behaviours to calculate estimated carbon emissions and bills reductions as a result of the EPC E minimum standards for domestic private landlords.

[86] See, for example:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/922660/EPC_Action_Plan.pdf

151. This section sets out the initial considerations for an evaluation of the ECO4 scheme.

Approach

152. The evaluation will be conducted by external researchers but will be designed, commissioned and managed by BEIS. We will draft an Invitation-to-Tender (ITT) and appoint a supplier via a competitive bidding process.

153. We plan to commission a process and outcome evaluation to look at the outcomes of the scheme and assess whether the original scheme objectives have been met. Specifically, we will assess outcomes for households (e.g. fuel poverty, energy bill reductions, thermal comfort, health and wellbeing) and non-household stakeholders (e.g. new jobs created in the sector).

154. The proposed process and outcome evaluation approach will expand on the already rich outcome-level data from ECO2t and ECO3. We will supplement this largely qualitative data with the quantitative evidence on outcomes taken from the Ofgem and other monitoring data sources to build a thorough understanding of the extent to which ECO4 reached fuel poor homes, improved energy performance and stimulated demand for green jobs. Given that we expect to build a good understanding of the outcomes and impacts of the scheme from these elements, the option of conducting an additional impact evaluation will be kept under review. The principal difference between the proposed approach and an optional impact evaluation is that while the former will provide us with evidence of outcomes, it will not use a counterfactual and it will therefore not be fully possible to explore the attribution of those impacts to the scheme. We will make a final decision as to whether a fuller impact evaluation is feasible and will add value during the ITT drafting stage (further detail in Method section below).

155. Findings from the evaluation will be used to support internal policy decisions regarding the current and potential future iterations of the ECO scheme.

Method

156. The exact nature of the evaluation will be determined during the ITT drafting stage. However, the process and outcome evaluation element is expected to include:

- Post-heating season surveys of a representative sample of participating households after ECO4 measures have been delivered. This will provide a robust quantitative measure of scheme coverage, household delivery experience, and initial outcomes. The survey will address the consumer-focussed evaluation questions.
- Follow up qualitative research with a sub-sample of the surveyed households. It is expected that this will be via interviews, which will explore the survey findings in greater depth, as well as provide detailed evidence in relation to key evaluation questions. The current evaluation of ECO2t and ECO3 had planned to use a quasi-ethnographic approach, involving researchers going into a small number of households who had received measures and conducting at-home interviews and observation. At-home interviews enhance case studies by allowing the researcher to gain contextual informational regarding the household and providing an opportunity for visual evidence (e.g. photographs and short videos) to be captured. Due to Covid-19 restrictions this has not yet taken place but is currently planned to go ahead in the final wave of qualitative research for the current evaluation in Summer 2022. We will assess whether it is appropriate to use this methodology again in the ECO4 evaluation, subject to its success

in the current evaluation, available budget and resource, and Covid-19 restrictions at the time of drafting the ITT.

- We will also gather views from a sample of non-household stakeholders. These will include installers and suppliers, and may also include managing agents, Ofgem, energy company representatives and Local Authorities. The sample for these stakeholders will be obtained via scheme data. This research may consist of depth interviews, focus groups and/or surveys. The methodology will be finalised during the ITT drafting stage. By including a sample of non-household stakeholders we will be able to address the non-consumer focused evaluations questions. ECO has historically not evaluated the experiences of this group.

157. During the planning phase, we will consider the balance of the added value of a fuller impact evaluation vs the resource and cost commitment. Initial scoping suggests that there may be challenges in identifying a suitable counterfactual, as many households at risk of fuel poverty are likely to have benefited from earlier versions of the scheme or be eligible for other government measures, making it hard to identify a comparable population. Therefore, while we will consider quasi-experimental (e.g. Difference-in-Difference) approaches, a theory-based evaluation may be more suitable . If it is decided to go ahead with a theory-based evaluation, contribution analysis or process tracing methods may be the most appropriate due to the complexity of the causal impacts of the ECO scheme. Contribution analysis is particularly useful for evaluations where the programme is well established and has a clear theory of change that can be assessed, as is the case for ECO; and process tracing can be used to establish how potential causes have influenced changes within a programme. For both methods we may look to utilise the findings from the process evaluation and possibly supplement these with additional data from sources such as further surveys, focus groups and/or administrative data.

Data sources

158. 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.
- The proposed evaluation design will also collect limited qualitative data on installation experience, usage and benefits from a small number of households. Qualitative data will also be collected from non-domestic stakeholders.

Uses of evaluation findings

159. Evaluation findings will be shared within BEIS in the first instance, to support decisions about any ‘in-flight’ changes to be made to the scheme.

160. The timings of evaluation activities and outputs will align with scheme delivery (see Table 25). BEIS will expect the research contractor to disseminate findings to the policy team to support ongoing learning and evidence-based changes to scheme delivery, where required.

161. Models and methodologies will be shared as part of the evaluation outputs and will be disseminated across analytical teams.

162. 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.

Table 25: Possible evaluation timings and methods[87]

Evaluation Component	**Timings** (to be set when ECO4 delivery timeline finalised)	**Aims**	**Possible research methods**
Evaluation scoping review stage	Ahead of drafting the invitation-to-tender (ITT) for the evaluation contract.	Ensure evaluation design remains relevant, proportionate, and informed by the best evidence available. Decide on a final evaluation specification for ITT.	Reflect on any further M&E findings from ECO2t and ECO3 evaluation. Iterate and finalise strategic-level theory of change via internal workshops. Assess available and anticipated budget.
Main consumer process and outcomes evaluation	Aligned to delivery timeline of ECO4	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	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, potentially linked to survey data.

[87] Please note that given the uncertainty around whether we will commission a fuller impact evaluation, this has not been included in this table.

		improve ongoing ECO4 delivery. Final reports provide evidence to inform design of future iterations of ECO or successor schemes.	
Non-consumer stakeholder process evaluation *(exact details subject to above review*)	Aligned to delivery timeline of ECO4	Understand how the delivery of ECO4 is experienced by non-consumer stakeholders involved in delivery – such as 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.	Research methods, such as depth interviews, focus groups and surveys will be considered

14. Justice Impacts

163. 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. The NHM is adjusted to try and reflect the latest position we have data for by accounting for measures installed in line with National Statistics[88].

3. The NHM models energy-related behaviour for domestic dwellings using a SAP-based energy calculation – based on SAP2012. 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[89]

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, a findability rate is modelled. This restricts the eligible pool to certain percentages being 'found' each year to reflect the 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

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

[89] 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. Stock update

9. Before the ECO4 scenario starts the EHS data within the NHM is updated to reflect ECO3 delivery to ensure the starting stock of households in the NHM is a representative of the current housing stock as possible. Since the Consultation IA we have improved this process using ECO3 delivery data to April 2021. Given ECO3 has not yet completed we have scaled up current delivery to meet 100% of the ECO3 target – this assumes that delivery in the final months of ECO3 follows the same distribution in terms of measures delivered as past ECO3 delivery.

4. Counterfactual

10. 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.

11. 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.

12. 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[90]. 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.

13. 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[91].

[90] As VAT is only paid by consumers.

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

5. Covid impact on the eligible pool

14. Households are eligible for ECO4 if they are in receipt of certain means tested benefits[92]. 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.

15. Published data from DWP[93] 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 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.

16. 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.

17. It is also expected that over time these households will come off UC as they once again find employment. To get this level of drop we use the OBR Welfare Trend report from March 2021[94]. Using the OBR report, a yearly drop of rate is applied in the modelling, removing these new UC recipients from the eligible pool.

6. Findability

18. 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. It is therefore assumed that suppliers can only found 20% of the 'unfound' eligible pool each year. The NHM therefore applies a 10% findability rate at the start of each six-month delivery period to the 'unfound' eligible pool. Once a home has been 'found' it remains found for the remainder of the policy – with the findability rate applied to those 'unfound' properties in the next delivery period. As the 20% annual findability rate is applied to the 'unfound' pool instead of the total eligible each year the model only finds around 60% of the total eligible pool across the ECO4 period.

19. This approach has been updated since the consultation IA where two different types of findability rates were applied, first measure findability rates were applied which ranged between 10-16% depending on the measure and then a household findability rate of 25% was applied. This was deemed too restrictive and was driving unrealistic levels of economic rent.

[92] See ECO4 consultation document for full list

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

[94] https://obr.uk/wtr/welfare-trends-report-march-2021/

20. A flat household findability rate, as opposed to a combination of measure and household rates, was chosen as, given the uncertainty within these estimates, a simpler and easy to interpret approach was deemed favourable. Measure findability rates have also been removed as the modelling already captures what homes are suitable for what measures, therefore the measures which are easier to find will be driven by the random selection of households found.

21. There is significant uncertainty around the proportion of properties that can be found by suppliers. The rate of 20% has been chosen based on a judgement of what seems reasonable in discussions with stakeholders, however we explore the impact of different levels of findability on results within the sensitivity section.

22. The level of findability chosen results in around 12% of the 3.7 million eligible pool being treated throughout ECO4 – this compares to around 17% expected to be treated within the ECO3 IA[95] – suggesting the chosen level does not result in an unrealistic number of upgrades.

23. There are reasons to believe 20% is still a relatively conservative assumption, given it results in less than 60% of the total eligible pool found across the full four years.

7. Detailed modelling approach

24. 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[96] for years where this information is available.
        - The stock is 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 2018 to 2022, using actual ECO3 delivery data.
        - 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 'unfound' eligible pool. ECO4 eligible properties which are "found" then have measures installed, with

[95] 7.1m eligible homes under ECO3 with 1,195,000 homes treated https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749638/ECO_3_Final_Stage_IA__Final.pdf

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

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 starts with the SWI minimum, with packages installed to SWI eligible homes in order of cost effectiveness until the annual SWI minimum for that year has been reached (or the total SWI minimum is met in the final year).
    - The EFG minimum is then modelled, with packages installed in E, F and G homes in the order of cost effectiveness until the annual/total EFG minimum target is met, or no more dwellings remain.
    - Homes upgraded under the SWI and EFG minimum also count towards the total score target of which up to 50% can be met through LA Flex.
    - The model then moves on to the remaining LA Flex target. Packages are installed in LA Flex eligible homes in cost effectiveness order until the remaining annual/total LA Flex target is met or no more dwellings remain.
    - Packages are then installed in homes on benefits or living in social housing under the remaining annual/total score target is reached.
    - 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.

25. 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.

8. Costs included in the cost-benefit analysis

26. **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.

27. 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.

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

29. **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.

30. **PAS costs.** Cover all the costs involved in complying with the PAS 2035 framework, including lodgement fees (£30+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 £950 per household - this has been based on evidence provided by installers and has increased from £500 assumed at consultation stage. 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.

31. **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[97], 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.

32. 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[98] 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[99] multiplied up by the increase in obligation under ECO4 relative to ECO3[100].

33. **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.

34. **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.

35. 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.

9. Benefits included in the cost-benefit analysis

36. **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

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

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

[99] 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

[100] 1.56 – 1 billion divided by 640m

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[101].

37. **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.

38. **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.

10. Cost and benefits included in the distributional analysis

39. 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 NPV estimate.

40. **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 is assumed to accrue to installers in the central scenario but could potentially also accrue to the household, or the energy supplier[102]. 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 delivery period. This implies the price is set based on the highest £/score observed each period and the difference between this price and the actual installation costs is the economic rent.

41. **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.

42. **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.

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

[102] 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.

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.[103]

11. Key input assumptions

Scoring framework

43. The scoring methodology used for this IA is based on the approach outlined in the Ofgem scoring consultation. Scores have been updated slightly to better reflect the median floor area within the four floor area groups found in the eligible pool and uplifts have been applied to the two smallest of floor area groups.

Capital costs

44. Table 26 presents the cost of the different measures (excluding heating) which may be applied to properties[104]. 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.

45. For Solar PV installations capital costs have been calculated using regression analysis of solar PV installation data, provided by MCS. This model estimates the log of cost per KW capacity, which is then used to calculate the total system cost based peak system capacity, installation year and region.

Table 26: 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)	4200	124[105]	£ / m^2 treated
Floor insulation	0	37	£ / m^2 treated
Draught proofing	40	1	£ / m treated
Hot water cylinder insulation (tank)	20		
Cylinder (hot water tank) thermostat	60		
Room thermostat	90		
Zone controls	0	100	Number of bedrooms

[103] 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.

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

[105] Cost reduces to £107 when treating a bungalow as scaffolding is assumed not to be needed

46. Table 27 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 28 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.

Table 27: Central capital cost assumptions for heating measures (2021 real prices)[106]

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

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

Table 28: 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

47. Operating costs relate to the annual maintenance of 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

48. The hidden costs of installing measures are drawn from an ECOFYS report[107] 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 29.

Lifetime of measures

49. The lifetime of measures used in the ECO modelling are shown in**Table** Table 29**Table** .

In-use factors

50. 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[108]. The in-use factors for other technologies have been taken from this study[109]. These in-use factors are shown in Table 29.

[107] 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

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

[109] 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 29: 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

51. 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.

52. 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.

53. The assumed search costs underpinning this IA are shown in Table 30 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 installation then the costs of finding both households is presented below).

Table 30: Assumed Search Costs (2021 prices)[110]

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[111]	0	0
Solar PV	260	430

12. Additional modelling assumptions

Solar PV

54. 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 2.3% each year, this is based on regression analysis using MCS data
- 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

55. In line with the Green Book[112], we apply equity-weights to our cost-benefit analysis to value the distributional impact of the main policy options. Equity weighting accounts for the

[110] Source: BEIS Supply Chain Survey.

[111] Assumed to be zero as suitability for heating controls will go alongside heating system search costs.

[112] 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.

56. The equity weights used are shown in Table 31 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 31: 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

57. 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.

58. Table 32 provides a summary of where equity-weights are applied in the cost-benefit analysis.

Table 32: 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	The cost of economic rent is weighted according to the distribution of gas and electricity bill payers across the income scale

	subsidy' or economic rent is a cost that accrues to suppliers and ultimately the bill payers.	
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 installers	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 installers.	This benefit applies to businesses and therefore no weight is applied.

Annex B – Further detail on modelling improvements

1. This annex provides more detail on updates to the modelling and their impact on economic rent.

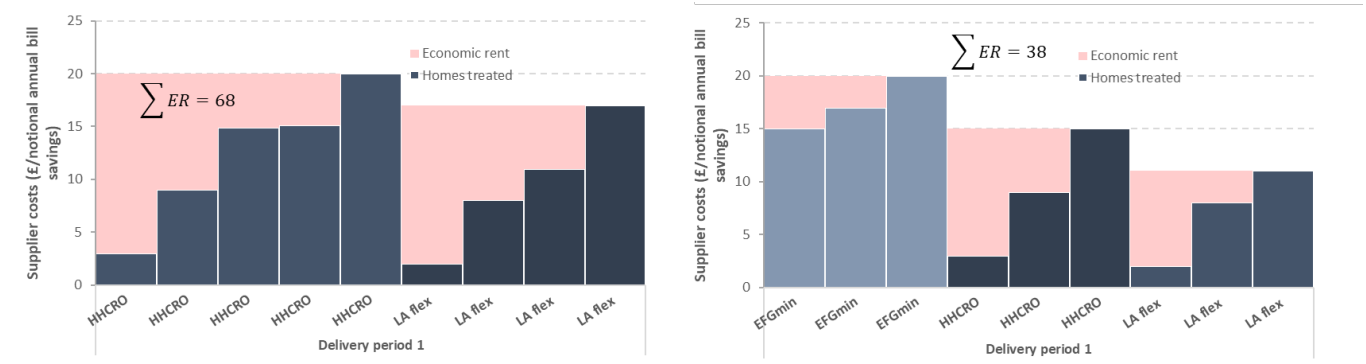
E, F and G minimum separate market price

2. Under the consultation IA the NHM modelling split delivery up into two sections; the main HHCRO requirements and delivery via local authorities and devolved administration through ECO4 flex. This meant the two parts of the scheme were assumed to have different market prices, with ECO4 flex cheaper to deliver due to the larger eligible pool. Analysis has now been refined to include a separate for the E, F and G minimum requirements.

3. There is strong evidence from previous ECO schemes of multiple market clearing prices for different sub-obligations, and it is likely that under ECO4 suppliers will pay a separate price to achieve their E, F and G minimum requirement. Breaking up delivery into three separate market clearing prices reduces the period for which economic rent can accrue and will be more reflective of how we expect real life delivery works. This reduction in the estimated economic rent is illustrated within the diagram below, the left-hand chart shows delivery when only two market clearing prices are modelled and the right-hand chart shows the introduction of a separate price for the E, F and G minimum.

4. The shaded blue bars in Figure 6 represent homes treated across a single delivery period – with the same homes treated in both charts (the different shades represent the different sub-obligations). It is assumed installers use the marginal price (highest £/notional annual bill saving) within each sub-group to set the market price charged to suppliers, with economic rent calculated as the difference between the actual price for treating a home and the market price. Introducing an additional market clear price reduces the number of homes for which economic rent can accrue. Therefore, although the same homes are treated in both charts in the left-hand diagram total economic rent is £68 compared to £38 in the right hand diagram. A reduction in the assumed level of economic rent within the scheme results in more homes treated as more funding is available.

Figure 6: Illustrative example of how economic rent reduces when more market clearing prices are introduced



Biannual market pricing period

5. Modelling previously assumed the market price for achieving notional annual bill savings was set annually, however stakeholder feedback highlighted this was an unrealistic assumption and that most pricing contracts last around six months. Increasing the delivery periods from four to eight we have halved the period in which economic rent can accrue in a similar way as illustrated within Figure 6, this change therefore also reduced the estimated level of economic rent and increase the number of homes that can be treated.

Findability rates

6. As described above findability rates have been refined to remove measure findability rates and apply a flat rate of 20%. This proportion is applied to the 'unfound' eligible pool each year. The model then selects the most cost-effective properties to treat from this found pool. This change increased the estimated number of properties that could be 'found' within the modelling, allowing the NHM to select more costs effective properties therefore reducing the average capex spend on homes as well as the economic rent. This further increased estimates of number of homes able to be treated under ECO4.