Department for Business, Energy & Industrial Strategy

Improving home energy performance through lenders

Consultation stage impact assessment

Title: Consultation Stage Impact Assessment improving home energy performance through lenders **IA No:** **RPC Reference No:** **Lead department or agency:** Department for Business, Energy and Industrial Strategy **Other departments or agencies:** N/A	**Impact Assessment (IA)**
	Date: 14/10/20
	Stage: Development/Options
	Source of intervention: Domestic
	Type of measure: Primary legislation
	Contact for enquiries:

Summary: Intervention and Options	**RPC Opinion:**

Cost of Preferred (or more likely) Option (in 2018 prices)			
Total Net Present Social Value	**Business Net Present Value**	**Net cost to business per year**	**Business Impact Target Status** Qualifying provision
£1,644m	-£436m	£17m	85

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

The housing sector has several market failures which lead to under-investment in energy performance improvements. While home-owners (or their tenants) benefit from bill savings, warmer homes, and other benefits from purchasing energy performance improving products for their home, the positive externalities such as reduced greenhouse gas emissions of such decisions are rarely taken into account. Owner-occupied and privately rented homes are generally less energy efficient than social housing, and the majority needs to be improved to help deliver the UK's emission reduction targets. Currently, mortgage lenders have limited incentives to help homeowners improve their properties' energy performance, reinforcing the mortgagors' lack of incentive to act. While a few lenders have launched 'green' products, there are no significant market signals pushing all lenders to improve the energy performance of their portfolios.

What are the policy objectives and the intended effects?

The policy intends to drive cost-effective energy performance improvements in privately-owned homes that are mortgaged which would not have occurred otherwise. These energy performance improvements will lead to lower carbon emissions, improved air quality and energy bill savings for their occupants. There are also expected to be macroeconomic benefits associated with reduced energy bills leading to greater discretionary spending, and reduced default rates for improved mortgaged properties.

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

Option 0) Do minimum. No specific regulations, but potential for voluntary disclosure and voluntary targets. Voluntary disclosure and targets is assumed to have a negligible additional impact. This scenario is assumed to have the same impact as the do nothing counterfactual (action may be taken but at a low rate by lenders).

Option 1 [Preferred]) Mandatory disclosure of average energy performance of mortgage portfolio and introduction of a voluntary target on lenders, with scope to introduce a mandatory target of an average of EPC C by 2030, should insufficient action be undertaken.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 2028

Does implementation go beyond minimum EU requirements?	N/A			
Is this measure likely to impact on international trade and investment?	No			
Are any of these organisations in scope?	**Micro** Yes	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO₂ equivalent change in greenhouse gas emissions over Carbon Budget 5? (Million tonnes CO₂ equivalent)		**Traded:** -1.2	**Non-traded:** -6.5	

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

Signed by the responsible SELECT SIGNATORY: _____ Date: _____

Summary: Analysis & Evidence

Policy Option 1

Description: Voluntary Targets for Lenders with a mandatory backstop to achieve an average of EPC C on their portfolio by 2030

FULL ECONOMIC ASSESSMENT

Price Base Year 2018	PV Base Year 2021	Time Period Years 54	Net Benefit (Present Value (PV)) (£m)		
			Low: -5,026	High: 10,271	Best: 1,644

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	176	1	532	18,595
High	54	1	278	10,085
Best Estimate	102	1	395	14,008

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

Key monetised costs (present values) include: The cost to consumers of installing measures (£10,760m) the operating and hidden costs of the installed measures (£1,422m), the opportunity costs (£1,372m) the cost to lenders in identification of EPC scores and system costs (£437m) and the government's administrative costs (£18m). The central average capital cost per improved property is £3,084, with an expected average total spend of £3,700).

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

None Identified

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	-		634	13,569
High	-		941	20,356
Best Estimate	-		719	15,652

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

The key monetised benefits include: energy cost savings (£7,758m), greenhouse gas emissions savings (Traded, £316m and Non-Traded, £4,980m), improvements to air quality (£666m) and comfort taking (£1,932m) – having a more comfortable warmer home as a result of additional disposable income from reduced energy bills.

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

The key non-monetised benefits include: Wider Economic Benefits - these include but are not limited to health benefits associated with warmer homes and reduced use of the National Health Service; GDP increases from increased energy performance products; productivity gains and increased spending due to lower energy bills.

Key assumptions/sensitivities/risks	Discount rate	3.5%

The key assumptions are: Lenders will be forward looking and try to undertake enough improvements so that the government will not introduce a mandatory target. A wide set of scenarios are illustrated for voluntary targets take-up. The analysis assumes consistency in market conditions (e.g. a stable interest rate, number of mortgages being taken out remain relatively constant). As a pre-consultation IA, lender behaviour is assumed, and the market is analysed as a single entity instead of analysing individual lenders within it.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: 17	**Benefits:** 0	**Net:** 17	
			85

Contents

1 - Overview and Rationale

1.1 - Introduction

1. In June 2019, the UK became the first major economy to pass a net-zero emissions target into law. The target requires the UK to bring all greenhouse gas emissions to net-zero by 2050. In addition, the UK has stretching interim emission reduction targets, Carbon Budgets, which require a 57% reduction in emissions from across the UK economy by 2032.

2. To meet the net zero target, there is a need to largely eliminate emissions from the housing stock by 2050 and have made significant progress towards that goal over the coming decade to meet our Carbon Budgets. To date, greenhouse gas (GHG) emissions from homes have reduced by 15% compared to 1990 levels. However, they are still responsible for 15% of all UK GHG emissions, or around 20% if electricity consumption is included[1].

3. In the Clean Growth Strategy (CGS), published in 2017, the government set an aspiration to upgrade as many homes as possible to Energy Performance Certificate (EPC) Band C by 2035, where cost-effective, practical and affordable. The government estimates this will require mobilising up to £65bn of capital investment to achieve this goal.

4. The government's Green Finance Strategy[2], published in July 2019, set out the intention to act to build the market for green finance products to support home energy performance improvements. It included a commitment to consult on the merits of setting requirements for lenders to help households they lend to improve the energy performance of homes. In 2018, the Bank of England identified the energy performance of homes as one of the major climate 'transition risks' for banks[3]. It was found that mortgages on energy efficient properties were 18.4% less likely to be in arrears than mortgages on energy-inefficient properties.

1.2 - Problem under consideration

5. Owner-occupied and privately rented homes account for 83%[4] of homes in England and 84%[5] of homes in Wales. In England the average energy performance of Owner-occupied and private rented properties was a SAP score of 62 in 2018[6].

6. There are a number of barriers to the improvement of the energy performance of these homes including: low awareness; high upfront cost/few finance offers; low perception of the wider value of energy performance; lack of certainty in savings; lack of long-term signals from government; and energy performance not being perceived as adding to the value of properties.

7. Currently, mortgage lenders have limited incentive to help homeowners improve their properties' energy performance, reinforcing mortgagors' lack of incentive to act. Some lenders have launched 'green' products or made commitments to improve the energy performance of their portfolio. However, there are no significant market signals pushing all lenders to improve the energy performance of their portfolios.

1.3 - Policy Background and Objectives

8. Mortgage lenders could play a key role in driving the home energy performance improvements required to meet the Carbon Budgets and net zero target. They are uniquely placed to influence mortgagors at critical trigger points, such as home purchase, renovation, or re-mortgage - raising awareness of poor energy performance and creating a market for green mortgages and loan products. The existing relationships mortgage lenders have with their customers, often supported by a strong regional focus, provide a platform for lenders to develop green products that will encourage action from mortgagors, by removing financial barriers and help to unlock the value of improved energy performance.

9. Of the near 15 million owner-occupied households in England, 46%[7] are owned with a mortgage, equating to 7 million homes. In Wales, approximately 40% of the 1 million owner-occupied households

are owned with a mortgage. In addition, over half (55%[8]) of landlords in England have a Buy-to-Let mortgage (representing 61%[9] of tenancies or 2.9 million properties).

10. However, there has been limited mortgage product innovation over recent years. This is also the case for green product development, which has been inhibited by several barriers and the presence of market failures. These include: contested evidence on the relationship between energy performance and its impact on property valuation; lenders' poor internal information on the energy performance of lending portfolios and default rates; households' high discount rates of future energy savings; an immature capital market in green lending, and risk aversion to launching untested products. However, the government has announced a green lending demonstrator fund[10]. The fund will enable multiple lenders to offer green lending products on a small scale. The outcome of which will be interpreted by government and this consultation process.

11. The government believes that regulation on mortgage lenders is an appropriate option to address some of the barriers to action and to stimulate the market for green finance. Key to this is transparency over the energy performance of properties in lender portfolios, and this consultation includes a proposal for mandatory disclosure of energy performance data.

12. However, it is unclear whether disclosure alone will drive action. While disclosure will encourage transparency of energy performance data relating to mortgaged homes and may generate some competition between lenders, it is expected to have a limited impact alone. Therefore, the government is consulting on the introduction of voluntary targets on lenders to improve the energy performance of their portfolios, with the option to regulate for a mandatory target, should lenders make insufficient progress.

13. In this consultation, the voluntary target for lender portfolios is to aim for an average of EPC C (cost-based metric) by 2030. There are options for this to go further by using a dual metric (which could use the Environmental Impact Rating (EIR) which is carbon based). In order to keep lenders on track for a mandatory target, the government would introduce a penalty regime that would kick in should lenders fall below their targets. More information on the penalty regime can be found in Annex D.

14. The policies set out in the consultation apply only to England and Wales, as energy performance is a devolved matter in Scotland and Northern Ireland. The scope covers all FCA-authorised lenders carrying out mortgage lending in England and Wales.

1.4 - Rationale for Intervention

15. Ambitious action to improve the energy performance of homes is a vital pillar of achieving the UK's ambitious emission reduction targets. However, there are a range of market failures and barriers to energy performance improvements, which lead to under-investment in energy performance in the housing stock and provide a rationale for government intervention. These include:

- Externalities: the cost people pay for energy (and thus living in an inefficient house) does not reflect the true cost to society from the damage of carbon emissions, other greenhouse gases or air quality. The gains of improved energy performance and the positive externalities are often not reflected including to the individual such as health benefits of a warmer home and society benefits such as job creation and GDP benefits.

- Incomplete or asymmetric information: homeowners may not have a good understanding of the benefits of improved energy performance.

- Equity considerations: whereby lower income households can be 'locked in' to energy inefficient homes without the means to either make upgrades themselves or move to a more efficient home.

- Uncertain returns to investment: as households have limited certainty over their length of ownership of a property, investment returns from lower energy consumption may not be realised.

16. There is no single 'silver bullet' policy which will address all the barriers and deliver the scale of change required. To this end, government is developing a complementary package of measures, including those set out in this consultation, that will respond to these barriers and pilot new approaches.

2 - Policy Proposals

2.1 - Policy Proposals

17. There are two options that the analysis considers:

   - Option 0) Do minimum, voluntary disclosure and voluntary targets are brought in with no regulation or stimulus from government to incentivise action, leaving lenders to undertake improvements voluntarily.

   - Option 1) Mandatory disclosure and a voluntary improvement target with the introduction of a mandatory target later on in the policy period, of an average portfolio SAP score of 69 (the minimum score for EPC C), should the lenders not be driving enough improvements in the market.

2.2 - Option 0: Do minimum (alternatives to regulation)

18. Option 0 – Do minimum would not see regulation added in this area. Alternatives to regulation are:

   - *Voluntary disclosure:* lenders could be encouraged to disclose energy performance information on a voluntary basis. Lenders may choose to disclose this information through existing financial reporting obligations, making it available on their websites as well as GOV.UK.
   - This would allow lenders to overcome administrative and systems barriers to move towards a complete understanding of the EPC coverage of their portfolios, and to develop their data collection systems if future regulation compelled lenders to undertake mandatory disclosure.
   - *Voluntary target setting*: to test the market for green finance products and to capitalise on the information provided through disclosures, the government could encourage the uptake of voluntary target setting without any scope for introducing a mandatory target. Voluntary improvement targets could be set with input from government, but views are sought in the consultation on how lenders might approach voluntary targets, as well as the level of uptake government might expect.

19. It is believed that a voluntary targets scheme alone would not drive a significant amount of improvements in the market. When considering the impacts of a policy proposal, the analysis looks at the additionality that the proposal would bring to the market. Some of the "big six"[11] lenders have committed to, through different channels, improve the energy performance of their portfolios. Any impacts that a purely voluntary scheme may have would need to be on top of these already existing commitments. The government does not believe that there would be enough extra improvements in the mortgaged stock, for the stock to be on track to reach Clean Growth Strategy ambitions.

20. Under voluntary targets alone a subset of forward-thinking lenders may improve their stock. The government believes this subset of lenders would be in the minority without future mandatory targets in legislation. This is due to the majority of lenders who recognise a lack of incentives in the market for them to act, which could potentially damage their competitiveness in the short-run, as well as a lack of incentives for their borrowers to take out loans for energy performance improvements. These missing incentives are discussed in section 1.4 "rationale for intervention".

21. By undertaking improvements to their stock under a purely voluntary scheme (with no mandatory backstop), lenders would be increasing the risk of losing borrowers due to decreased competitiveness. The mortgage market is very competitive and if a lender were to undertake voluntary action, they would increase the cost of borrowing with them and would see their competitiveness decrease.

22. It is not believed that voluntary disclosure or voluntary targets would achieve the level of change (on a level playing field) required to meet policy objectives. One reason for this is the difficulty in incentivising lenders to act voluntarily. While it is possible that lenders deliver some energy performance improvements, there is currently little evidence on which to base an appraisal of this option. In Section 3, the do-nothing option is assumed to achieve no delivery, costs, or benefits, however the preferred option's impacts are reduced by 5% to account for potential deadweight relative to Option 0.

2.4 - Option 1: Mandatory disclosure of portfolio energy performance data, plus voluntary improvement target of a portfolio average of EPC C by 2030 with a potential introduction of a mandatory improvement target

23. The preferred option is for lenders to be required to annually disclose key statistics relating to the average energy efficiency of properties within their portfolio (from the outset of the policy in 2021) and to voluntarily set themselves a target of a portfolio average of EPC C by 2030. Reaching that goal, would be aligned with the wider context of the UK's statutory requirement to achieve net zero carbon emissions by 2050. We expect that the credible threat of future mandatory targets will lead to some voluntary action. See Section 3.2.1 for a detailed explanation of the potential drivers of voluntary, early action.

24. It is proposed that lenders disclose the following aggregated EPC information relating to properties in England and Wales on an annual basis: the current percentage of properties in each EPC band (A to G); the current average (mean) Energy Efficiency Rating (EER) and Environmental Impact Rating (EIR) score of the portfolio; the percentage of the portfolio with a valid EPC; the gross value of mortgage lending over the reporting period by EPC band; and the gross value of mortgage lending for energy performance improvement works over the reporting period by EPC band. There are over 19m domestic EPC records for homes in England and Wales[12]. Any properties added to the lender portfolio must either have an EPC rating already or mortgagors must undertake a new assessment.

25. In order to disclose EPC information on their mortgage portfolios, lenders would be required to collect the EPC data on their existing mortgage stock. This information could be obtained either from their existing database systems or via the bulk download facility on the Ministry of Housing, Communities and Local Government's (MHCLG's) EPC Open Data website.

26. This proposal is based on recommendations made by the Green Finance Taskforce and response to the Government's Call for Evidence on Building a Market for Energy Efficiency (BMEE). The proposed scope of disclosure would be all FCA-registered mortgage lenders carrying out mortgage lending in England and Wales. There are around 340 regulated mortgage lenders and administrators who are required to submit information to the Financial Conduct Authority. This information would be reported annually, aligned with existing financial reporting obligations and it is proposed that it is made available on lenders' websites as well as GOV.UK.

27. It is believed that the potential introduction of regulation, should the lenders fail to drive action, is the incentive that will be required to see an improvement across the market. As well as this, the penalty that could be levied on the lenders if they fail to meet the mandatory target would be seen as a large risk by the lenders and the best way for them to mitigate this risk is to avoid a mandatory phase altogether and act early and quickly during a voluntary phase.

28. It is possible that some lenders attempt to "free-ride" on the progress made by other lenders. However, the largest 6 lenders account for roughly 70% of the mortgage market. Therefore, it is likely that inaction of a small number of the largest lenders would lead to the early introduction of mandatory targets. It may be more likely that smaller lenders are able to effectively free-ride, however this would lead to significantly greater risk to those companies if mandatory targets were to be introduced. Additionally, the reporting of lenders' individual statistics would be required annually from the outset of the policy in 2021, which would limit lenders' ability to free-ride as their own performance would be visible to the regulator.

29. There is a large degree of uncertainty around individual lenders' strategic response to this policy; it is possible that each of the largest lenders will align with the others, either with all engaging in early action or delaying until mandatory targets are introduced. By contrast, certain lenders may seek to gain a first-mover advantage by positioning themselves as a green lender, despite others potentially delaying action, and making early progress in order to mitigate risks and costs of meeting the mandatory target.

30. With lenders knowing that under-delivering would lead to a mandatory phase coming into the market during the 2020s, it is expected that a greater proportion of them would act than under Option 0) Do minimum. This is due to the increased competitiveness that lenders could receive if they had less to

do under a mandatory phase as well as decreased risk of paying a penalty. Figure 6: Mortgages Affected Per Year in Section 4.1 shows how, when more improvements are undertaken in a voluntary phase, the rate at which mandatory improvements would need to be rolled out decreases.

31. The mandatory target that has been modelled, should voluntary targets not drive enough action, would be for lenders to achieve a portfolio average of EPC C by 2030. This falls in line with the UK government's Clean Growth Strategy to get as many homes as possible to EPC C by 2035 where practical, cost-effective and affordable.

3 - Analysis and Impacts

32. This section outlines the context of the market under a no policy scenario before explaining some of the policy details for the alternative scenarios.

33. The government is currently consulting on tightening regulations on landlords owning properties in the private rented sector (PRS)[13]. Apart from contextual information, analysis in this impact assessment has excluded landlords with mortgaged properties as much of the improvement in energy performance will be prompted by the PRS regulations. If adopted, it is expected that both policies would complement one another, with the lenders making finance for improvements in the PRS more readily available. The policies considered in this proposal could lead to cheaper lending to higher energy efficiency rated properties, which could lead to landlords increasing their properties to a higher standard than the proposed Minimum Energy Efficiency Standard (MEES) EPC C requirement.

3.1 - The Market Now

34. Analysis for this IA using the English Housing Survey suggests 47% of the owner-occupied housing is mortgaged. This is 7 million households across England[14] and an estimated further c500,000 across Wales[15]. In 2017/18, there were 4.5 million private rented households in England; the English National Landlord Survey indicates 61%[16] of these properties are owned with a mortgage.

35. It is estimated[17] that 71% of owner-occupied homes are below EPC C, so considerable action is needed to improve these homes to meet the target of as many homes as possible to EPC C by 2035[18]. Reaching a stock average of EPC C is progress towards this target although may not result in a majority of houses being EPC A-C.

Figure 1: EPC Breakdown of Owner Occupiers
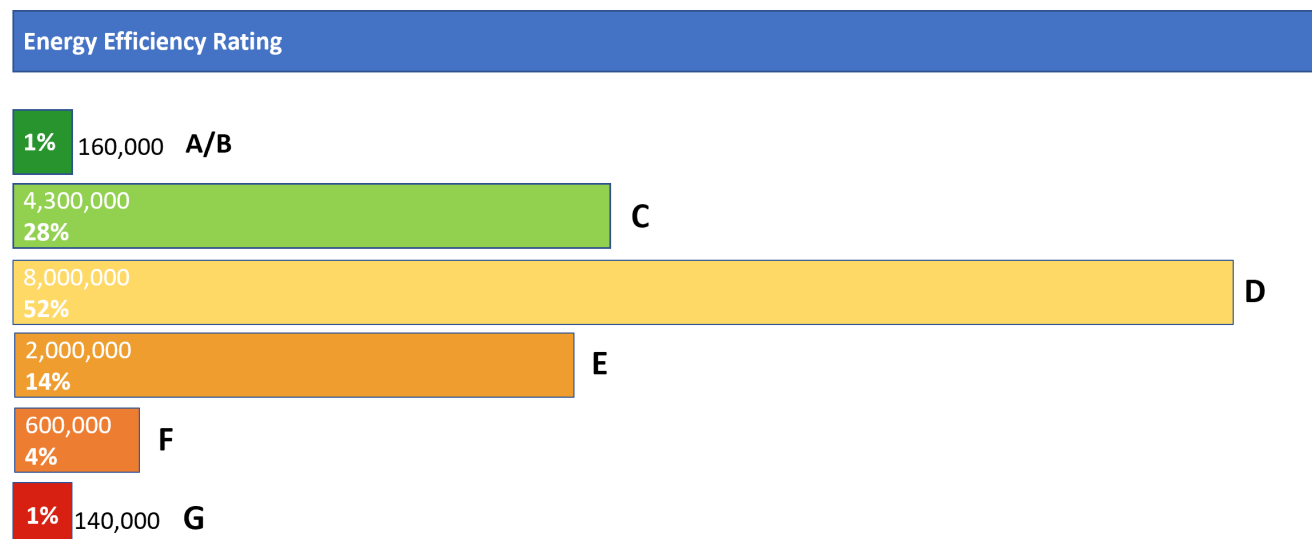
36. The UK mortgage market is dominated by the high street retail banks and a number of large building societies. The 'big six'[19] high street lenders accounted for just over 70% of all mortgage lending in 2018.

37. The profile of mortgagors in the UK has shifted in recent years. First-time buyers now account for 50% of mortgages for home purchase, their highest share of housing sales since 2007[20]. In 2008 first time buyers represented just 38% of mortgages for home purchase. Mortgaged buy-to-let borrowers account for 6% of all housing sales, a decline from 9% in 2013. Some of these national shifts mask vast regional differences.

38. First time buyers may be more likely to be at lenders' affordability limit before additional borrowing from this policy. For example, additional borrowing for efficiency measures would increase the loan-to-value ratio of the mortgage, potentially beyond the lender's threshold. Those who would be within the affordability threshold, but additional borrowing for efficiency measures pushes them beyond the threshold, would be exempt. This consultation seeks information on those who would breach this threshold due to the policy intervention.

39. The impact of the consultation options was assessed against a 'Do Nothing' counterfactual. In this counterfactual, no other government policies are running alongside these policies other than Products Standards/ Part L Building Regulations, which drive up efficiency of lighting and boiler replacements. Apart from the proposed tightening of PRS regulations, as noted above, no allowance has been made in the analysis for the possible crossovers with other policies active or in design.

40. In this instance there is no requirement on lenders to disclose their portfolio's energy performance or set a target to improve it. Some lenders are considering green finance and energy performance, but the counterfactual assumes this would not encourage large-scale changes to privately owned homes.

41. In modelling the upgrade of the housing stock in the National Household Model (NHM[21]), there is a counterfactual scenario of installations. It is assumed that low energy lighting, oil combi and gas combi boilers are all installed throughout the policy period in eligible homes. The costs and benefits presented represent the additional costs and benefits net of the counterfactual scenario.

3.2 - Policy option modelled

42. This section outlines the key policy option and how it has been modelled.

43. The policy option modelled is a voluntary scheme with a mandatory backstop. This voluntary scheme is introduced in April 2021 framed in the wider context of the government's Clean Growth Strategy ambition of achieving all homes to EPC C by 2035 where practical, cost effective and affordable. Government encourages lenders to sign up voluntarily to an average SAP 69 target by 2030. This is the same target as would become mandatory if the mandatory backstop was introduced.

44. For the purpose of this appraisal, assumptions are made about lenders' behaviour in response to signalling about the potential for future mandatory targets. The consultation seeks views on the willingness of lenders to undertake voluntary action.

45. Under the central policy scenario, across the years 2021-2024, lenders are expected to undertake some improvements to their portfolio, due to the threat of mandatory targets and penalties for under-performance. Some activity is deemed to be likely, as lenders may aim to reduce the likelihood that mandatory targets are introduced, to avoid potential cost increase due to demand-pull inflation associated with delayed action (leading to greater required action in later years), or to reduce the risk of under-achievement, and incurring penalties, if mandatory targets are introduced, e.g. by achieving a first-mover advantage. However, lenders' voluntary actions are assumed be lesser than would be required to reach an average portfolio SAP score of 69 by 2030. In the central case, we assume the voluntary delivery profile would achieve 50% of the required improvement, by 2030. The Government is seeking information on whether lenders are likely to commit to voluntary targets as part of this consultation

46. Due to this underperformance, the government introduces regulations which require lenders to improve their portfolios to an average of SAP 69 by 2030. As a result, it is assumed that lenders increase their delivery in order to meet the target, and avoid the penalty, by the 2030 deadline. This SAP score trajectory is illustrated in Figure 2 - Lenders SAP score trajectory under central scenario.

Figure 2 - Lenders SAP score trajectory under central scenario
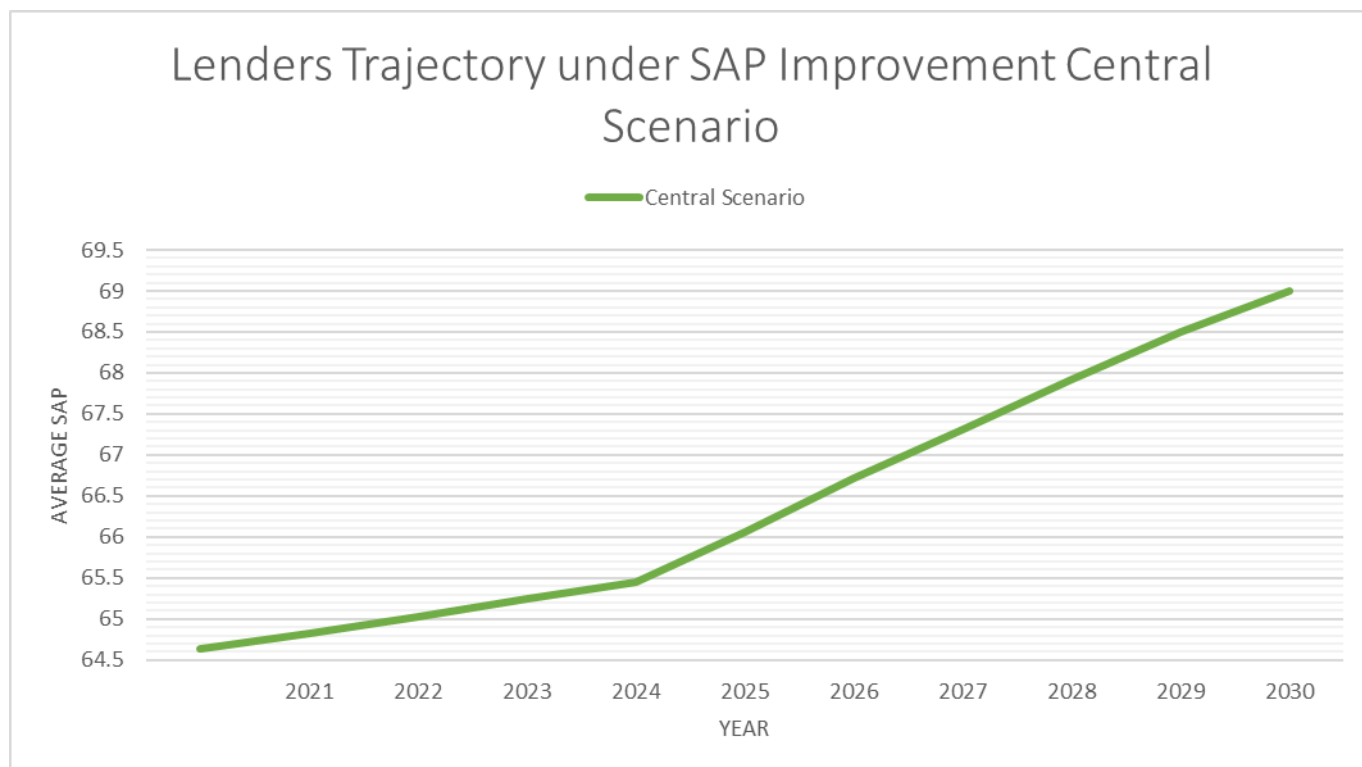
47. This is one possible scenario, the government may review the progress at an earlier date based on progress towards the target.

3.2.1 - Modelling a voluntary lender target with a mandatory backstop

48. The main aim of this policy is to make progress towards the government's net zero climate goals. Consistent with this is the Clean Growth Strategy goal of making all homes EPC C by 2035 where practical, cost effective and affordable. The targets considered in this consultation are also consistent with proposals for the private rented sector (currently under consultation). Each lender has a portfolio of homes and will have an average EPC of their stock. This average EPC will vary lender by lender depending on the type of homes they lend against. By starting with a voluntary target, each lender is able to map their own path, dependent on the state of its portfolio. This enables competitiveness in the market to be maintained, especially for lenders with less energy efficient portfolios. This path (in aggregate across lenders) must be consistent with the end goal of an average of EPC C by 2030, otherwise mandatory targets will be introduced. Lenders could and might go further than this, by setting their own ambitious goals.

49. Lenders can increase their portfolio score by lending to higher SAP scoring properties or incentivise low scoring properties to upgrade. Homes which would be tipped over a lender's affordability threshold are exempt from being offered mortgages conditional on additional borrowing. However, these homes may still be offered additional borrowing. The current proposal, however, is that they would nonetheless count towards the lender's portfolio average score.

50. As there would be the potential introduction of a mandatory target, The Government would ask lenders to set a voluntary target. The Government would encourage this to be set to at least an average portfolio score of SAP 69 with progress spread over the period, rather than delayed action. The policy proposal suggests that the mandatory target would be set at a level of an average portfolio rating of EPC C by 2030, if there is insufficient progress from the outset of the policy. The analysis assumes the voluntary targets set by lenders would be consistent with achieving 50% of this target.

51. Lenders would be expected to act under a voluntary phase for several reasons:

   - The less action undertaken under a voluntary phase by a lender, the more they will have to do over a shorter period of time, should a mandatory phase be introduced. It also increases the potential penalty that a lender could face if the increased rate of action is not feasible.

14

- Spreading improvements over a longer period is also likely to mitigate the potential for demand-pull inflation, caused by a large increase in demand, and relatively inelastic supply, towards the deadline. If several large lenders delayed action, there would likely be greater demand-pull inflation, and therefore greater costs of installations and risk of penalties.

- The cost to lenders of upgrading homes will be cheaper if upgrades are spread over time. By spreading action over more mortgage trigger points, lenders can be more selective in picking the cost-effective homes to upgrade. Homes can be selected with high SAP score increases per household. This reduces lender costs as there are fixed costs per home upgraded to incentivise the household owner.

- Starting early will build a market on which to start any mandatory targets. Introducing ambitious voluntary targets early enables systems, business decisions, demonstration projects and marketing strategies to begin. These initial actions will enable a scaling up of operations when targets become more stringent.

- The introduction of mandatory targets may be reviewed annually and therefore inaction in any given year may contribute to the introduction, which will lessen any perceived advantage to avoiding action and its related cost during the voluntary period.

- It is an opportunity to pick up high SAP 'green' customers who will be valuable in meeting improvement targets and reducing the overall risk of their portfolio (based on research by the Bank of England).

52. A voluntary period is beneficial to the policy as it provides a flexible element to targets. The voluntary period reduces any transitional impact of government regulation. It could also allow lenders to underperform against the target should there be an acceptable reason for doing so. For example, if a housing crisis impacts re-mortgages, or new schemes take time to ramp up in demand.

53. The average EPC for homes within lenders' portfolios is not known. This is partly due to lenders not all having a complete picture of EPCs (knowledge of this is not currently a requirement) and partly because of commercial sensitivity. Due to this, for modelling purposes the policy is not analysed at the individual lenders level, but the average EPC of the whole stock as if one lender had the whole market. This is explained further in Annex A and is an area the consultation will explore.

3.2.2 - Lender behaviour and the route to action

54. Current evidence in the market suggest that lenders have an appetite for improving energy performance and green lending. This is evidenced by the Royal Bank of Scotland (RBS) setting themselves a target of 50% of their homes to EPC C by 2030[22], Nationwide earmarking £1bn for green loans[23], and Lloyds Banking Group pledging to cut carbon by more than 50% in the next decade to help finance a green future[24].

55. The analysis in the central scenario assumes that lenders undertake improvements to their portfolio at a "50% rate" between 2021 and 2024. This "50% rate" means lenders only achieve 50% of the yearly SAP score improvements required to be on the government's recommended trajectory (SAP 69 by 2030). Our analysis subsequently assumes that on review of their progress in 2024, the government believes that this progress is not a high enough improvement rate. The government then introduces a mandatory target to achieve an average SAP score of 69 by 2030.

To reach the target, the lender will have to create an improvement in the homes they lend against. There are multiple ways they could do this, for example:

- Advertising the benefits of improving energy performance when offering loans.

- Offering more attractive products to those who improve the energy performance of their homes.

- Offering conditional mortgages whereby homeowners would have to improve their home in order to access finance.

- Lending more to better performing properties, whose inclusion raises the portfolio average score.

56. Lenders may hope that a voluntary target of an average of EPC C can be met using the less intrusive ways such as advertising the benefits of improving energy performance when offering loans, as this will allow them to improve without losing their competitiveness.

57. However, if this is not driving enough uptake, then the chance that they will now be mandated to reach the target will increase. Therefore, the analysis expects the lenders would offer a wider range of products in due course.

58. For proportionality, the modelling makes the assumption that lenders meet the target by any of these methods and does not make a distinction of how or what products might be on offer.

59. The counterfactual of this scenario is that there is no disclosure or targets regulation in place and that lenders do not take action. The mortgage stock improves in line with the counterfactual outlined in Table 17: Summary of Modelling Assumptions in the Analysis.

60. In the scenario where voluntary uptake was so high as to not require a mandatory period, it could be claimed that the mandatory phase would not offer any additional benefits. However, it is believed that a voluntary only scheme without the possibility of mandatory action would not be enough to see action taken. As such it is assumed that action taken during the voluntary period is additional as it is conditional on the expectation of mandatory targets being enforced.

61. The counterfactual does not include the Green Homes Grant policy[25]. There may be overlap between the Green Homes Grant and the lenders policy, however, the impact is not currently known. The Green Homes Grant will be included in the counterfactual in the pre-implementation IA when evaluation data is available to estimate the level of delivery and the impact on required delivery under this policy.

3.2.3 - Penalties for Inaction

62. Under any mandatory phase, whereby it became a legal requirement for lenders to reach an average of EPC C by 2030, the government would bring in penalties, should the lender underperform.

63. While the policy is not designed to penalise lenders or consumers, there is a recognition that in order for change to occur, a penalty would be applied to a lender should they fail to meet their target.

64. In Annex D a single example penalty has been illustrated. This penalty is for illustration only as the central analysis scenario assumes that lenders meet any mandatory targets. The penalty example is one potential design, this consultation seeks views on this and possible alternatives.

65. The penalty example is significant enough in cost to prompt action by lenders. Given this potential cost, lenders will ensure they meet their targets and no penalty is paid by any lender in the analysed scenarios.

3.3 - Results of Policies

3.3.1 – The do-nothing option (Option 0)

66. Under the do-nothing option there is not expected to be significant delivery of energy efficiency improvements. Although some lenders have recently signalled their intention to improve the energy efficiency of their portfolio and/or developing finance products for "green" investments, without sufficiently strong incentives there is not expected to be significant delivery.

67. Additionally, although there may be some consumer demand for these green finance products, historic data suggests there is little private investment in absence of government intervention. Furthermore, as stated in paragraph 21, the mortgage market is highly competitive. This high level of competition may undermine the voluntary action signalled by certain lenders, as this may lead to greater costs and less competitive interest rates. This suggests that without incentives which apply across the whole market,

competitive forces and low levels of consumer demand may prevent significant progress, despite the signalled intentions of some lenders.

68. As a result, there is assumed to be no significant delivery and the NPV and emissions savings of this option are assumed to be 0. However, it is possible that there are some improvements made to the stock in scope of this policy, either as a result of lenders' commitments or private activity. This is discussed in greater detail in Section 3.3.5.

3.3.2 – The preferred option (Option 1)

69. The following sections set out the expected impact of the preferred option. First, the impact on the housing market is considered, before an assessment of the expected EPC trajectory and the presentation of the quantified impacts. Finally, the steps taken to control for optimism bias and assess/control for the level of additionality/deadweight are set out.

3.3.3.1 - Impacts on the Housing Market

70. The government's Clean Growth Strategy aims to make "as many homes as possible to be EPC Band C by 2035 where practical, cost-effective and affordable"[26]. Under the central scenario, there is a voluntary phase from 2021-2024 and then a mandatory target is implemented up until 2030. Of the estimated ~4.5m mortgaged households below EPC C, ~2.8m mortgaged households get upgraded, of which ~1.5m households are upgraded to C or above.

71. Each year, a proportion of owner occupier households take out a new mortgage or re-mortgage the property. Of these, only a subset are eligible for the policy. The eligible stock in scope shown in Figure 3 is determined by the following set of assumptions:

    - Consumers who cannot afford to borrow additional funds will be exempt from the scope of a lender's improvement target based on an affordability criteria. In this scenario fuel poor households are assumed exempt from the eligible stock. Fuel poor households are exempt from the scope of upgrades but included in the portfolio average score. In this scenario only fuel poor households are exempted as an estimate of those who may not be in scope of the affordability criteria. This simplifying assumption is due to lack of data on affordability criteria and consumers. This consultation seeks views on the affordability criteria and proportion of consumers likely to be unable to afford additional borrowing.

    - 40% of mortgages are refinanced every 2 years, 50% every 5 years and 10% do not refinance during the policy period[27].

    - Once the household has been improved once due to the policy, it is exempt from doing so again. This is so that homeowners are not made by lenders to improve their homes several times, spending more than the £10,000 expected spend in the process.

    - Homes which switch providers are in scope if they have not previously upgraded through the policy (the consultation seeks views on how to make sure the in/out of scope factor is as simple as possible).

72. Lenders then choose which of the "stock in scope" to upgrade ("households upgraded"). The selected homes in the modelling are those which are more cost effective to upgrade, given the measure costs and fixed costs for each home. This is shown in Figure 3: Stock in Scope vs Households Upgraded as "Households upgraded".

Figure 3: Stock in Scope vs Households Upgraded
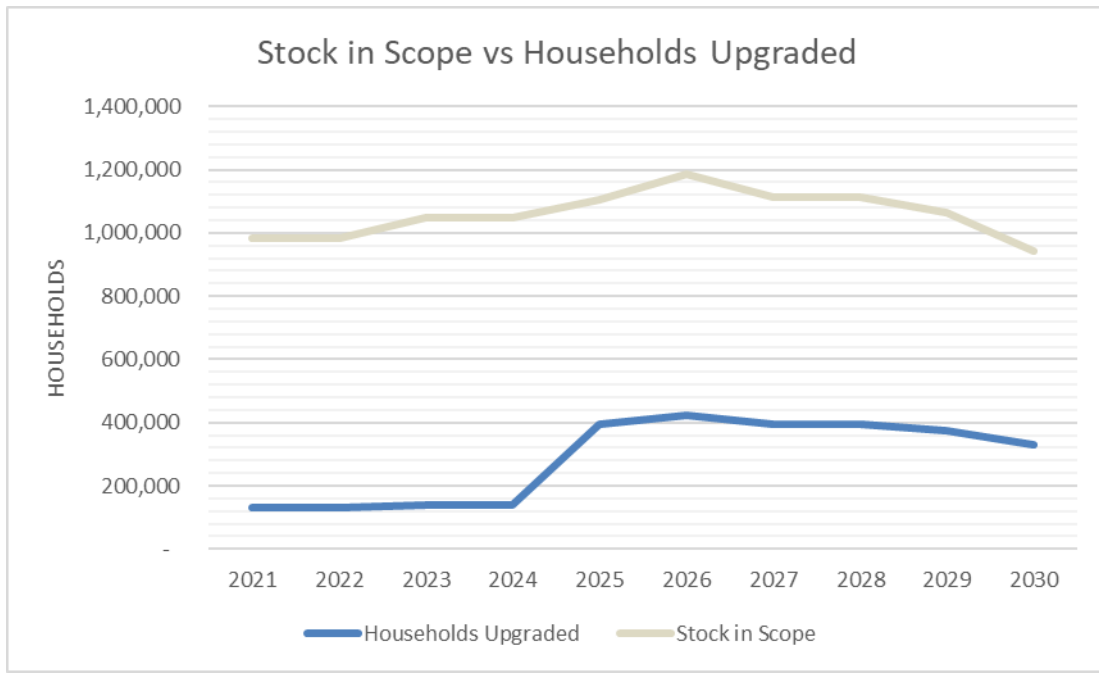
73. The stock in scope is formulated using the above assumptions, data from the Bank of England on the number of new/re-mortgages per year and data from UK Finance on the number of first-time buyers per year. This is explained in greater detail in Annex A3.2, with an explanation of how year by year the scope is calculated, including equations and qualitative explanations.

74. In the central scenario analysed, around 2.8m mortgaged households get upgraded by 2030. Households, depending on their starting SAP and technical potential, spend differing amounts of money on measures. Figure 4 shows the spread of these costs across the households that are upgraded.

Figure 4: Cost Distribution
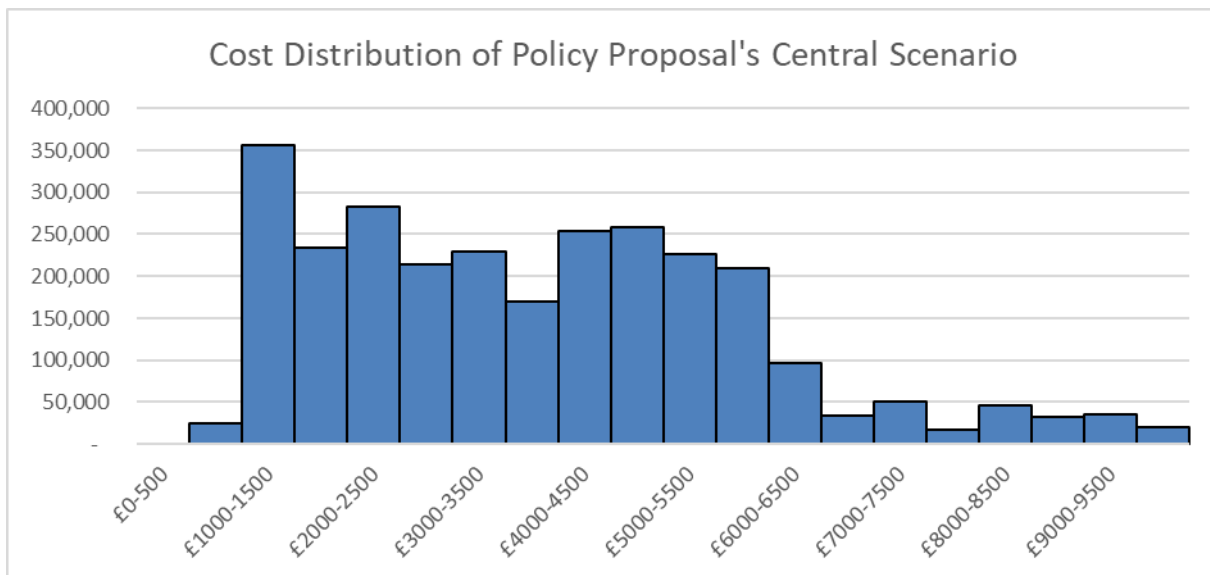
75. Figure 4 shows that around 90% of households that install measures are doing so for less than £6,000, with average spend around £3,700. The analysis indicates that although the maximum spend for the policy is £10,000, the vast majority of households will not spend up to that level, lowering the impact of the policy for these consumers.

3.3.3.2 - The central scenario

The key assumptions of the central scenario are as follows:

- During the voluntary phase, lenders are under-achieving, making 50% of the required progress to be on track for the 2030 SAP 69 target (50% below interpolated target).

- Government introduces a mandatory scheme in 2025.

- Central capital costs, based on research[1] by Cambridge Architectural Research for insulation measures and research[2] by Delta EE for heating measures.

- Central other costs e.g. EPC costs[3] and hassle costs[4].

- Central environmental valuation inputs provided in the Green Book supplementary guidance[5].

- Trustmark costs (ensures qualified installer of measures). These are based on central estimates presented in the updated ECO3 impact assessment[6].

76. To model the central scenario, the required household measures to reach SAP 69 are apportioned based on the trajectory assumed. In this case 50% below the interpolated target during the voluntary stage before the mandatory stage. The mandatory stage is a linear interpolation from the 2025 average SAP score to SAP 69 in 2030, see Figure 5: Central Scenario SAP Score Trajectory.

77. Figure 6: Mortgages Affected Per Year shows the number of homes per year that would be affected under the analysis' central scenario. The results of the economic appraisal (below) are based on this trajectory. This is one scenario rather than a prediction of lender's collective action.

78. The scenario shows that under voluntary targets (2021-2024) the number of upgrades is far less than under the mandatory period (2025-2030). In 2025 there is an increase in upgrades however this decreases over time as the eligible stock decreases. The eligible stock decreases due to homes being upgraded previously by the policy. Government may also act sooner or later to introduce mandatory targets than this scenario. A 50% assumption has been chosen as the central scenario as the introduction of a voluntary target is less likely to lead to 100% take-up. It is also argued that there would be some action with the anticipation of mandatory targets in future years. Subsequently, the analysis considers a large range of uncertainties and more information on how the 50% was chosen has been shown in section 3.2.

1

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/656866/BEIS_Update_of_Domestic_Cost_Assumptions_031017.pdf

2 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/913508/cost-of-installing-heating-measures-in-domestic-properties.pdf

3 https://hoa.org.uk/advice/guides-for-homeowners/i-am-selling/how-much-does-an-epc-cost/

4

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

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

6

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/822619/ECO3_Improving_Consumer_Protection_Consultation_Impact_Assessment.pdf

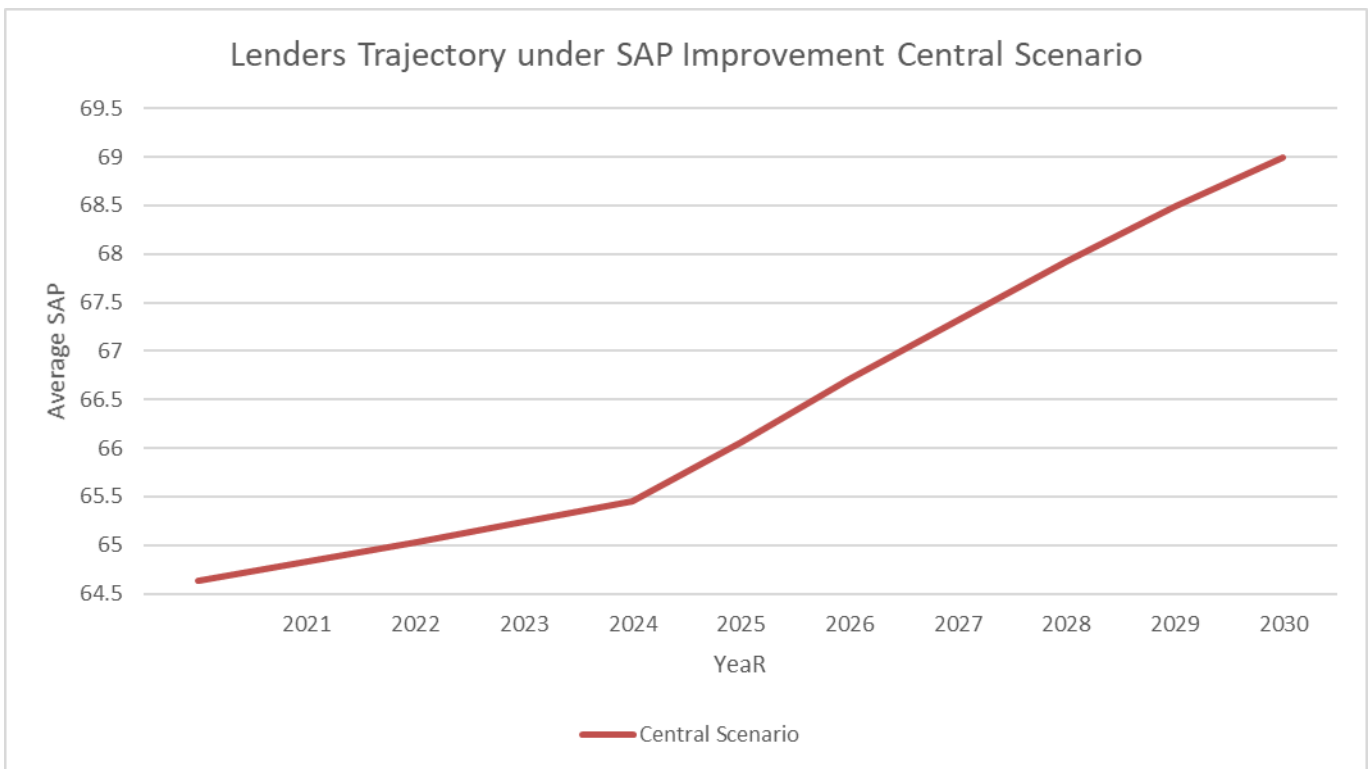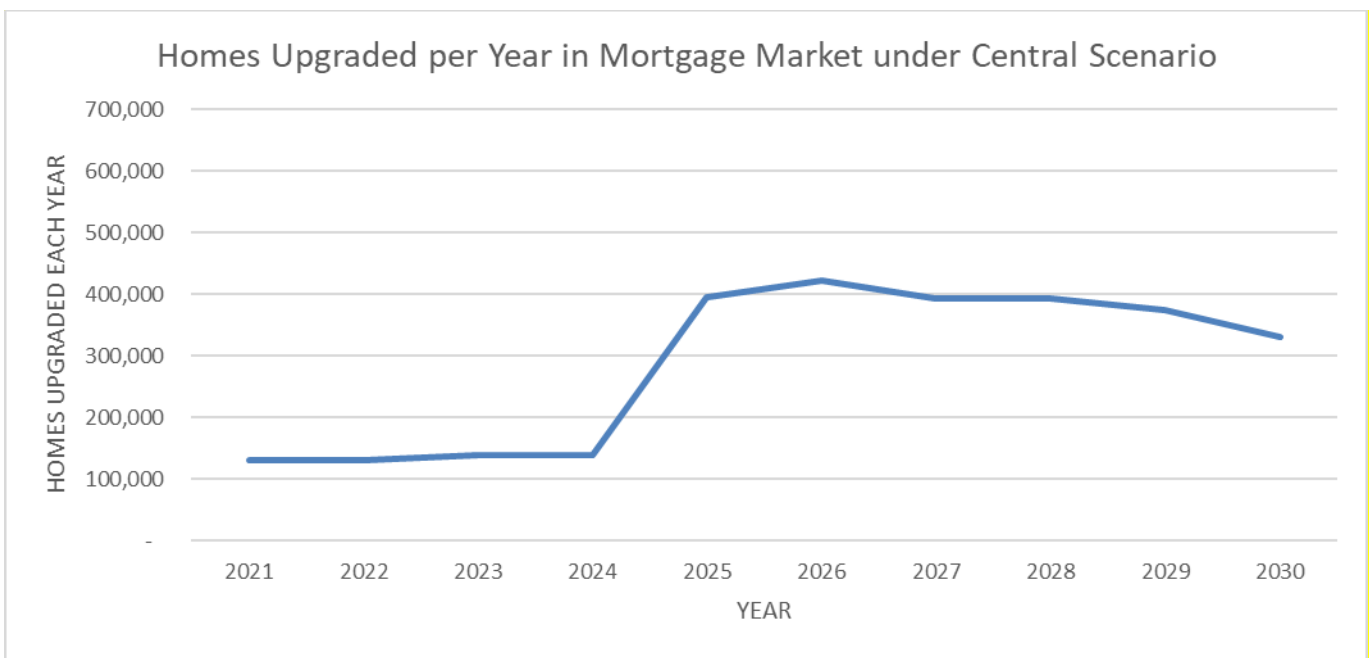*Figure 5: Central Scenario SAP Score Trajectory*

Lenders Trajectory under SAP Improvement Central Scenario

Figure 6: Mortgages Affected Per Year

Homes Upgraded per Year in Mortgage Market under Central Scenario

3.3.3.3 - Summary Tables

79. Table 1: Costs & Benefits summarises the main quantifiable costs and benefits of the policy. It has been monetised and discounted in line with HM Treasury's Green Book and supplementary guidance on valuing energy use and greenhouse gas emissions. The impacts have been modelled using BEIS's National Household Model, details of which can be found in Annex A, alongside the key assumptions and overall modelling approach.
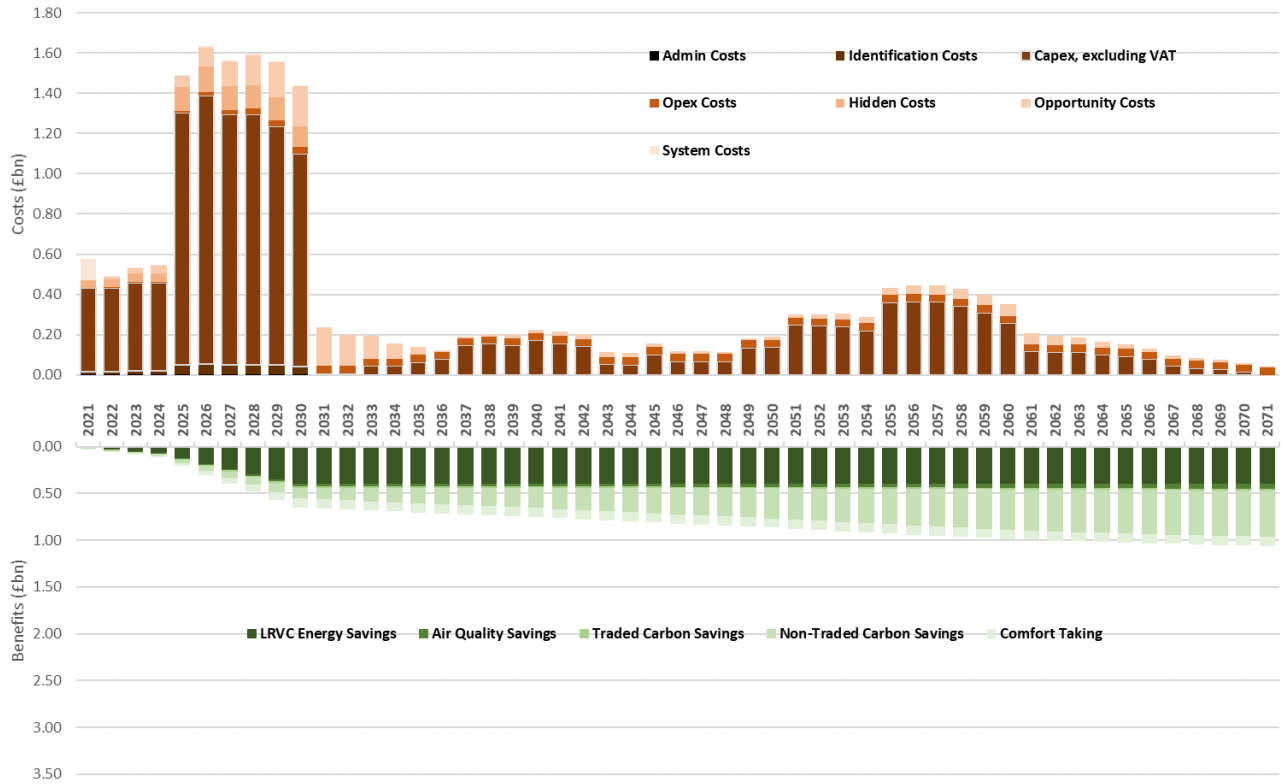
Table 1: Costs & Benefits

Type of Cost or Benefit	Value (£bn)
Government Costs	
Administrative Costs	0.02
Lender Costs	
Identification Costs	0.30
System Costs	0.14
Consumer Costs	
Capital Expenditure	9.52
PAS Costs	1.24
Operating Expenditure	0.71
Hidden Costs	0.71
Opportunity Costs	1.37
Total Costs (A)	**14.01**
LRVC Energy Savings[28]	7.76
Air Quality Savings	0.66
Traded Carbon Savings	0.320
Non-Traded Carbon Savings	4.98
Comfort Taking	1.93
Total Benefits (B)	**15.65**
Net Present Value (B − A)	**1.64**
Benefit:Cost Ratio (B / A)	**1.12**

80. The figures presented above are cumulative figures, discounted, from the start of the policy in 2021 to the end of the appraisal period in 2072, 42 years after the installations in the final policy year. This appraisal period is applied because this is the expected functional lifetime of the longest-life measures: cavity wall, floor, and loft insulation, of which we expect 0.8m, 1.2m, and 1.0m installations, respectively. A full table of delivery volume by measure type can be found in Table 18 in the annex. These benefits are unlikely to accrue to the paying householder if they sell the property.

81. Table 1 shows that capital costs, the costs of installing the improvements themselves, constitute roughly three quarters of the total expected cost. There is no assumption that the measure costs could be subsidised by lenders. There are other significant costs, such as anticipated costs of compliance with PAS2035 retrofit standards, and the opportunity costs associated with foregone investment opportunities. Together, these costs make up more than 85% of the expected policy costs.

82. Of the £15.65bn of modelled benefits, roughly half of them are attributed to long-run variable cost savings, and a further third are attributed to non-traded greenhouse gas emissions savings, both of which being caused by reduced energy demand resulting from the installation of energy efficiency measures. Comfort taking and air quality benefits make up an additional 16.6% of the benefits.

Figure 7: Annual Costs & Benefits

83. Figure 7: Annual Costs & Benefits shows the scale of the initial cost of installing measures under the policy period (2021-2030) as well as the increase in installations needed under a mandatory scheme (2025-2030). Throughout this period, capital costs make up the majority of the costs. From 2031 onwards the costs are lower in magnitude. These costs represent post-policy operating costs, opportunity costs of the investment and any re-installations that would need to incur at the end of an installations lifetime. Social benefits accrue throughout the years, increasing once the mandatory scheme begins. From 2031 onwards, the benefits outweigh the costs in each and every year, showing the long-term effectiveness and beneficial nature of the proposal.

84. In order to reach the UK's net zero greenhouse emissions by 2050, the Government has 5-yearly Carbon Budgets that it aims to meet in order to stay on a trajectory towards net zero by 2050. Table 2 shows the contribution this policy, in isolation, could have in meeting the Government's Carbon Budgets 4 (2023-2027) and Carbon Budget 5 (2028-2032) emissions reduction targets.

Table 2: Carbon Savings

Greenhouse Gas Emissions (MtCO2e)	Average EER C – 10K
CB4 Traded	0.71
CB4 Non-Traded	2.45
CB5 Traded	1.16
CB5 Non-Traded	6.50

3.3.4 - Adjustments for Optimism Bias

85. There is widespread evidence that economic appraisals are often prone to optimism bias about expected costs, benefits, and deliverability. The figures above have been adjusted to account for potential additional sources of optimism bias around key social impacts.

86. Where available, robust evidence from academic research and policy evaluations has been used in order to adjust for optimism bias. The energy savings associated with energy efficiency improvements have been downwardly adjusted to account for the in-use performance of the various measures expected to be delivered through the policy[7]. These factors are based on analysis of the National Energy Efficiency Data-Framework (NEED). This results in a downward adjustment to the energy savings per measure of up to 33%. Additionally, environmental benefits such as Carbon Budget savings and air quality benefits are adjusted using a "comfort taking" factor of 15%, which is based on evidence[8] relating to households' expected behaviour following energy efficiency improvements.

87. Where robust evidence is not available, 5% adjustments have been made in order to mitigate the potential optimism bias in key assumptions. This factor has been applied to administrative costs (government and lender), capital costs, costs of compliance with PAS 2035, Opex costs, and the hassle costs associated with the installation of measures. Additionally, several cost scenarios are presented in Section 4.1. These cost adjustments are *additional* to the optimism bias adjustments made to the central scenario.

88. Opportunity costs of the households' foregone savings have not been adjusted, as the assumed real interest rate (3%) is considerably greater than readily available rates on 5-year bonds. As a result, this assumption is already deemed to be relatively pessimistic.

89. It is important to note, however, that some policy benefits may be significantly under-valued. Primarily, the carbon values applied to traded and non-traded emissions savings are based on the UK Government's commitment to reducing net carbon emissions by 80% by 2050. In 2019, the UK Government expanded this commitment to net carbon neutrality buy 2050. This will require significantly greater investment, and as a result, the value associated with emissions savings should be greater. Therefore, there is likely significant pessimism bias regarding the valuation of the policy's emissions savings.

3.3.5 - Additionality

90. As discussed in Section 3.3.1, there is assumed to be no delivery under the do-nothing option. This is because historic data suggests little private investment is expected without some form of intervention and that competitive forces may prevent progress by individual lenders in absence of market-wide incentives.

91. Some lenders have, however, signalled that they intend to earmark funds for energy efficiency improvements, or improve the energy efficiency of their portfolios. If these signals culminate in actual improvements to the mortgage stock, the additionality of this policy will be less than 100%. In order to more accurately reflect the direct impacts of the policy proposal, a 5% downward adjustment is made to reflect improvements which may occur in the counterfactual.

92. This policy targets a section of the housing stock which has been largely unaffected by previous, confirmed policies, in recent years. Low-income owner occupiers are targeted by fuel poverty policies such as the Energy Company Obligation as well as the Green Homes Grant, however these households are likely to be exempt from the lenders obligation as these households are likely to be close to lenders' affordability threshold, if they have a mortgage. Owner occupiers are included in the

---

[7] In-use factors were calculated for scoring of the Energy Company Obligation and are published by Ofgem here.

[8] Sanders, C., Phillipson, M., 2006. Review of Differences between Measured and Theoretical Energy Savings for Insulation Measures, Centre for Research on Indoor Climate and Health. Glasgow Caledonian University

able-to-pay element of the Green Homes Grant Voucher Scheme, however the level of delivery under that policy is currently unclear. Additional analysis will be undertaken in order to account for the potential overlap with existing, confirmed policies, once delivery data becomes available.

4 - Wider Analysis

4.1 - Sensitivity Analysis of CBA

93. In modelling the central scenario there are several uncertain factors which could impact results. The key uncertainties are:

- Average SAP improvement rate. This is the voluntary action relative to the SAP 69 2030 target.
- Capital costs
- Other costs
- Energy prices
- Carbon values (including carbon prices for traded emissions)

94. This section models these uncertainties to give an indication of result sensitivity.

4.1.1 - Average SAP Improvement Rate

95. The rate at which lenders will improve the average SAP score of their portfolio is uncertain. The central scenario used for the main CBA results shows one possible outcome. In order to model the risk and uncertainty that surrounds this parameter, three separate scenarios have been analysed.

- **Low Improvement Rate:** The analysis models a voluntary phase from 2021-2024 in which lenders improve their stock at a low rate. This rate of progress leads them to be on a track to get their average SAP score 25% of the way to an average of SAP C by 2030. Due to this, the government brings in a mandatory target from 2025[29]. This mandatory period would require large-scale substantial action.

- **Central Improvement Rate:** The analysis models improvement at a rate that leads lenders to be on a track to get their average SAP score 50% of the way to an average of SAP C by 2030. Due to this, the government brings in a mandatory target from 2025[30]. This mandatory period would require medium-scale substantial action.

- **High Improvement Rate:** The analysis models improvement at a rate that leads lenders to be on a track to get their average SAP score 75% of the way to an average of SAP C by 2030. Due to this, the government brings in a mandatory target from 2025. This mandatory period would require action but at a lower rate than other scenarios for those who made good progress in the voluntary period.

96. Having lower or higher rates of improvement under a voluntary phase alters the trajectory with which lenders must improve should a mandatory target need to be introduced in order to achieve the average of SAP 69 by 2030.

97. Under these scenarios, for lenders who have taken action during the voluntary period when other lenders have not, it would be beneficial for the mandatory phase to come in, so that a level playing field occurs and those who have not acted have to take action more quickly to the reach the same final target standard.

Figure 8: Lenders Trajectory Under SAP Improvement Sensitivities
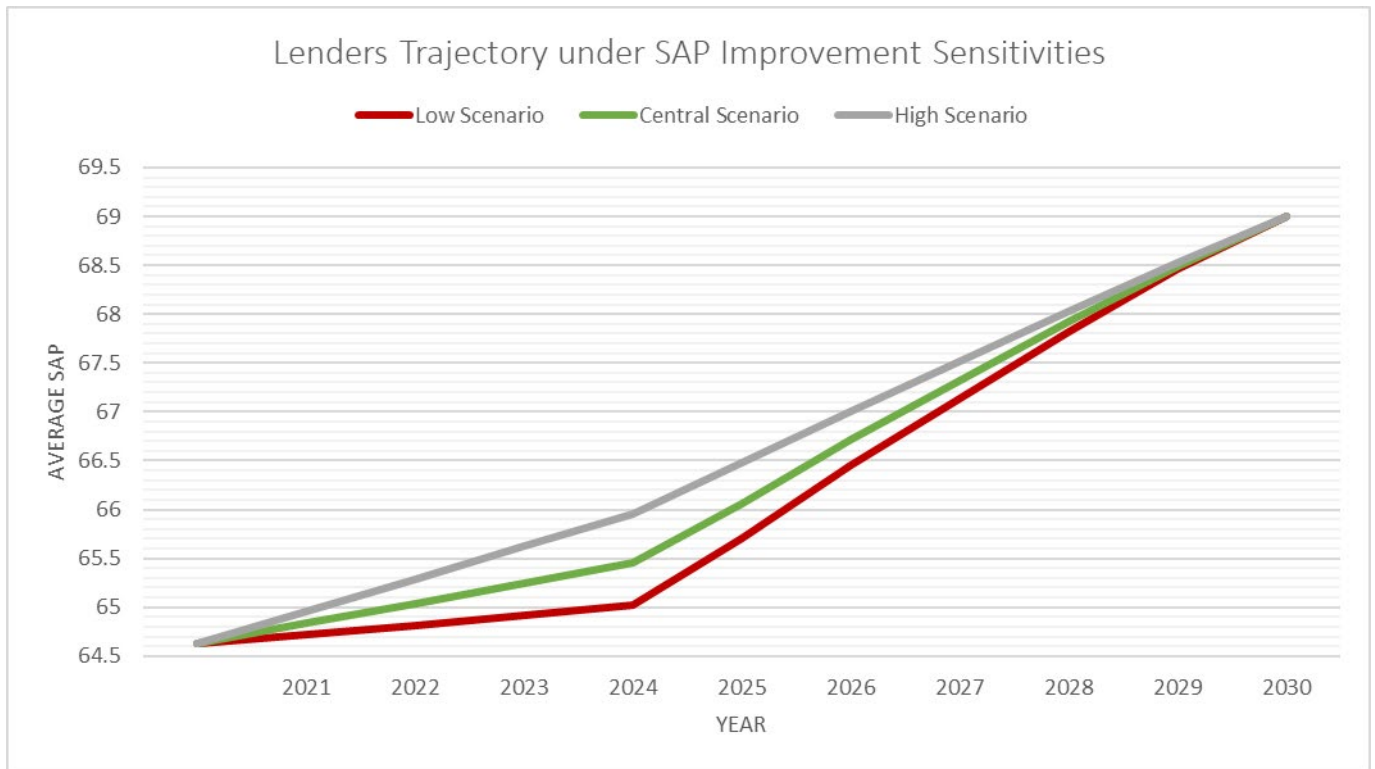
98. Figure 8: Lender Trajectories Under SAP Improvement Sensitivities shows how much steeper the trajectory is for lenders under a mandatory phase given a lower improvement rate in the voluntary phase. Modelling results of these trajectories are presented in Table 3, Table 4 & Table 5.

Table 3:SAP Improvement Sensitivity: Key Metrics

Type of Cost or Benefit (£bn)	25% Improvement Rate	50% Improvement Rate	75% Improvement Rate
Total Costs	13.73	14.01	14.33
Total Benefits	15.40	15.65	15.95
Net Present Value	**1.67**	**1.64**	**1.61**

Table 4: SAP Improvement Sensitivity: Mortgage Stock Affected

Percentage of Eligible Mortgages Borrowing to Invest in Energy Performance Improvements	25% Improvement Rate	50% Improvement Rate	75% Improvement Rate
Voluntary Phase (2021-2024)	6%	13%	22%
Mandatory Phase (2025-2030)	38%	35%	33%

99. Table 3 shows that as under all three sensitivities, by 2030, an average of SAP 69 is achieved, the difference in NPV is negligible, although a higher voluntary improvement rate leads to a marginal decrease in the NPV. This negative relationship between voluntary action and social value is due to the way in which discounting for social time preference affects the present value of costs and benefits[9], and the effect of the rate of voluntary take-up on the time-distribution of costs and benefits. Figure 9 shows the distribution of social costs and benefits, and the social time preference discount rate, over time.

---

[9] Per HMT's Green Book guidance on economic valuation, a social time preference discount rate of 3.5% is applied up to 30 years, and a rate of 3% applied thereafter.

100. As a result of this discount rate, the later costs are incurred, the lower their present value. Because the modelling assumes that lenders meet the obligation under each take-up scenario, and environmental benefits accrue over a long period, there is very little difference in the present value of benefits achieved under each option. However, as shown in Figure 9, high voluntary uptake leads to significantly greater costs being incurred in the earliest years of the policy, when the effect of the discount rate is lowest. As a result, the present value of these costs is greater, despite that the total undiscounted costs are the same. The interaction between the distribution of costs over time interacting with the effect of the social time preference discount rate is the cause of this negative relationship between early action and expected NPV.

101. This may seem to suggest that delaying action will have greater social value, however this obscures several potential drawbacks to delaying action, which are not included in the NPV. Low action in the voluntary phase results in a higher level of required action in the mandatory phase to meet the target. A sharp increase in demand for energy efficiency improvements towards the end of the policy could lead to greater costs through demand-pull inflation. The modelling does not account for the additional costs that delayed action at a faster improvement rate imposes. To model this would require more evidence on the costs faced by lenders. The consultation seeks views on these costs.

102. Furthermore, assuming no change in the refinancing and first-time buyer rate, this would require them to improve a greater proportion of new borrowers over these years, as shown in Table 4. This may lead to a greater risk of under achievement and financial penalty. As above, these potential costs are not included in the NPV.

Figure 9: Distribution of social costs and benefits, and the impact of discounting
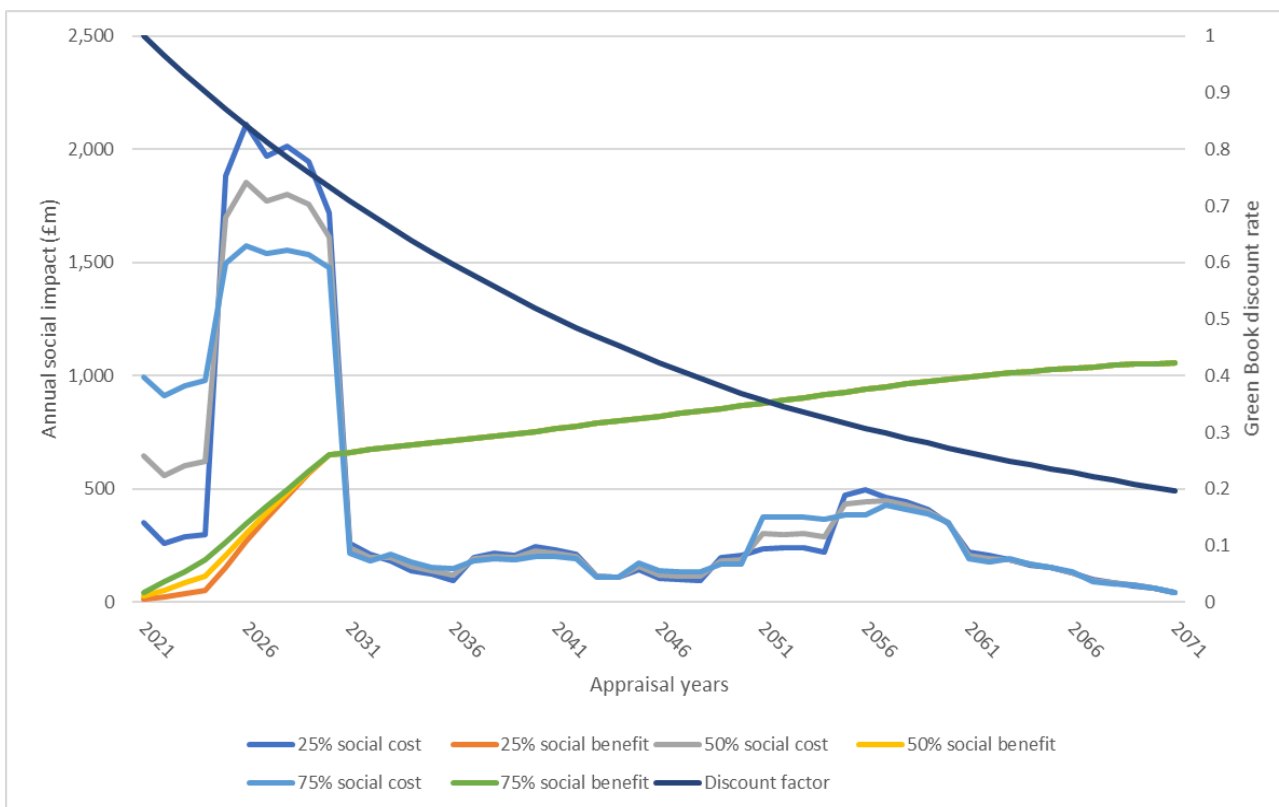
103. Table 4 shows one of the more important metrics for this sensitivity is the percentage of eligible mortgagors that will need to borrow to undertake improvements. The higher the percentage, the more difficult it will be for lenders to encourage enough borrowers to undertake improvements. This may require lenders to only accept homes which upgrade or have a high starting SAP score in these scenarios.

104. Under the 25% low scenario, lenders must encourage 38% of their eligible borrowers to undertake improvements under a mandatory phase. This is a tougher task than the 33% needed under a 75% high scenario.

105. Due to the differing levels of improvement rate across the early years of the policy (2021-2024), the effects on Carbon Budgets 4 & 5 range across the scenarios (see Table 5).

Table 5: SAP Improvement Sensitivity - Carbon Savings

Greenhouse Gas Emissions Savings (MtCO2e)	25% Improvement Rate	50% Improvement Rate	75% Improvement Rate
CB4 Traded	0.55	0.71	0.88
CB4 Non-Traded	1.95	2.45	3.03
CB5 Traded	1.15	1.16	1.17
CB5 Non-Traded	6.46	6.50	6.55

106. Table 5 shows that the lower the improvement rate under a voluntary phase, the less impact the policy will have on Carbon Budget 4 as fewer improvements will be undertaken between 2021-2024. However, due to the subsequent rate of improvement under a mandatory phase, the carbon savings quickly accrue and the difference between the CB5 figures is small.

4.1.2 - Capital Costs

107. The ease with which lenders will be able to get borrowers to improve their homes, the number of homes they will have to improve and the measures they will need to install are all dependent on the cost of the measures.

108. As costs of measures are subject to uncertainty, a sensitivity of +/- 30% is applied to all measures installed in order to show a possible range of costs.

109. Two pieces of evidence can be cited for the +/- 30% cost sensitivity used: 1) A 2017 BEIS report "What does it cost to retrofit homes"[31], cites low, central and high figures for all measures, the 30% sensitivity captures the variation in costs shown in this report. 2) Green Book appraisal guidance states that for construction work on standard buildings, there is often an optimism bias of 24%. Including a capital cost sensitivity range of +/- 30%, accounts for this optimism bias.

110. Table 6 shows the impact of changing these cost sensitivities relative to the central scenario.

Table 6: Capital Cost Sensitivities - Key Metrics

Capital Cost Sensitivities	Low Cost Assumptions	Central Cost Assumptions	High Cost Assumptions
Percentage of Mortgage Stock Treated	39%	40%	43%
Average Capital Cost per Home (not discounted, £2018)	£2,240	£3,084	£3,806
Total Costs (£bn)	10.49	14.01	17.82
Total Benefits (£bn)	15.76	15.65	15.83
Net Present Value (£bn)	**5.27**	**1.64**	**-1.99**

111. The high cost assumption sees the highest average capital cost per home as well as the highest total cost, which is to be expected. It results in the lowest NPV due to the significant increase in costs with only a minimal increase in benefits, which is due to a slightly different measure mix and amount of homes. The number of homes treated increases as the model installs fewer measures under the same assumed maximum spend per property of £10,000. The higher number of homes that need to be treated and the more expensive it is for borrowers, the harder it becomes for lenders to comply with

the target, making the high cost assumption the most difficult to undertake. The opposite is true for the low-cost assumption.

112. Further analysis relating to the capital cost sensitivities, including the measure mix, is presented in Annex C1.

4.1.3 - Other Costs

113. Although ~75% of the costs analysed are the capital costs, other costs involved in the CBA also come with a range of uncertainty, especially administrative costs for government & lenders. Table 7 shows the total policy costs with a range of +/- 30% applied to non-capital costs.

Table 7: Other Costs Sensitivities

Other Costs Sensitivities	Low Cost Assumptions	Central Cost Assumptions	High Cost Assumptions
Total Costs (£bn)	13.26	14.01	14.98
Total Benefits (£bn)	15.65	15.65	15.65
Net Present Value (£bn)	**2.39**	**1.64**	**0.67**

4.1.4 - Energy Prices

114. As can be seen in the results shown in section 3.3, long-run variable cost of energy supply (LRVC) savings account for around 50% of the benefits accrued across the policy. These monetised energy savings are underpinned by the central energy prices provided by tables in the Green Book supplementary guidance on valuing energy and greenhouse gas emissions[32]. Table 8 shows the sensitivity of the analysis to the 'Low' and 'High' figures provided for energy prices. Table 8 shows that by taking the "Low" and "High" published values for energy prices, the NPV can range from £0.54bn-£3.90bn, further showing the sensitivity of these results.

Table 8: Energy Price Sensitivities

Energy Price Sensitivities	Low Energy Prices	Central Energy Prices	High Energy Prices
Total Costs (£bn)	14.01	14.01	14.01
Total Benefits (£bn)	13.63	15.65	17.00
Net Present Value (£bn)	**-0.37**	**1.64**	**2.99**

115. These energy costs and benefits fall on mortgage customers and exclude the transfer cost element of retail energy prices.

4.1.5 - Carbon Values

116. The value placed on changes in greenhouse gas (GHG) emissions is currently under review, now the UK has increased its domestic and international ambitions. Accordingly, current central carbon values are likely to undervalue GHG emissions, though the scale of undervaluation is still unclear. The potential impact of placing a higher value on GHG emissions can be illustrated by using the existing high carbon values series, in addition to the prescribed central values. The Government is planning to review the carbon values during 2020. Table 9: Carbon Price Sensitivities shows the effect that having high carbon values has on the analysis, more than doubling the NPV.

Table 9: Carbon Price Sensitivities

Carbon Price Sensitivities	Central Carbon Prices	High Carbon Prices
Total Costs (£bn)	14.01	14.01

Total Benefits (£bn)	15.65	18.43
Net Present Value (£bn)	**1.64**	**4.43**

4.1.6 - Combined Sensitivities

117. Table 10 compares the NPV under the central scenario against two scenarios which total in the lowest and highest NPVs based on the analysis shown in sections 4.1.1 - Average SAP Improvement Rate – 4.1.5 - Carbon . The low and high scenarios are as follows:
   - Low Scenario – 25% improvement rate under the voluntary phase, high capital costs, high other costs, low energy prices, central carbon prices and Trustmark[33]. Trustmark is the Government Endorsed Quality Scheme covering work a consumer chooses to have carried out in or around their home and is estimated to cost £500 per home.
   - Central Scenario – 50% improvement rate under the voluntary phase, central capital costs, central other costs, central energy prices, central carbon prices and Trustmark.
   - High Scenario – 75% improvement rate under the voluntary phase, low capital costs, low other costs, high energy prices, high carbon prices and Trustmark.

Table 10: Combined Sensitivities

Combined Sensitivities	Low	Central	High
Total Costs (£bn)	18.60	14.01	10.01
Total Benefits (£bn)	13.57	15.65	20.36
Net Present Value (£bn)	**-5.03**	**1.64**	**10.27**

118. Combining all the sensitivities together leads to the overall NPV figures presented in Table 10: Combined Sensitivities. This shows the extremes of the sensitivity and uncertainty of the analysis with a range of -£5.0bn - £10.3bn for the NPV.

4.2 - Additional "Best Case" Scenario for Voluntary Take-up

119. On top of the proposals analysed in Sections 3 & 4, a best case scenario is presented below, which shows a higher than expected uptake during voluntary targets and therefore a path that would not lead to the introduction of a mandatory phase. would not lead to the introduction of a mandatory phase.

   - Best Case Scenario: The analysis has a higher improvement rate (set at 100%) than the 'high' scenario in section 4.1.1 - Average SAP Improvement Rate. All other factors such as capital costs, carbon prices etc are set at the central value. The improvement rate represents a scenario above the high estimate. Lenders from the early years of the policy are on track to achieve a target of an average of SAP 69 (EPC C) by 2030 and so no mandatory phase is introduced. In 2030, they achieve an average portfolio score of SAP 69 (EPC C).

120. The threshold at which no mandatory phase would be introduced is not set out in this IA and will be decided pre-implementation based on knowledge gained during the consultation. This threshold may be set at a level where a single large lender who does not act could trigger mandatory targets. This scenario has been set out to show a different pathway that lenders may take compared to those outlined in sections 3 & 4.

Figure 10: Lenders Trajectory Under Case Studies

Lenders Trajectory in Case Study
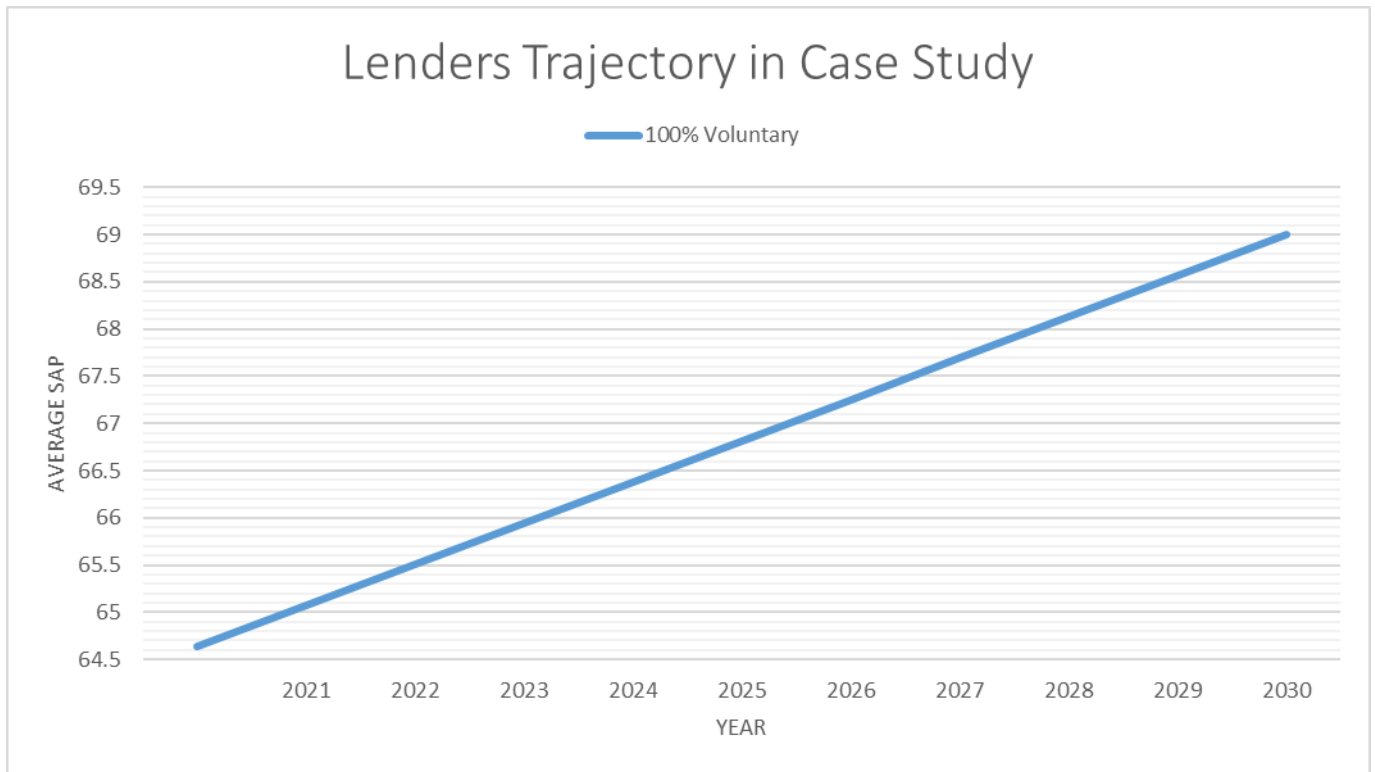
121. Figure 10 shows the trajectory of lenders under the hypothetical case study. The blue line shows how in a scenario where 100% of the improvement to an average of SAP 69 is met. As there is no introduction of a mandatory target at any stage, the analysis does not experience the same upwards kink in improvements as seen in Figure 11.

Figure 11: Lender Trajectories Under SAP Improvement Sensitivities

Lenders Trajectory under SAP Improvement Sensitivities
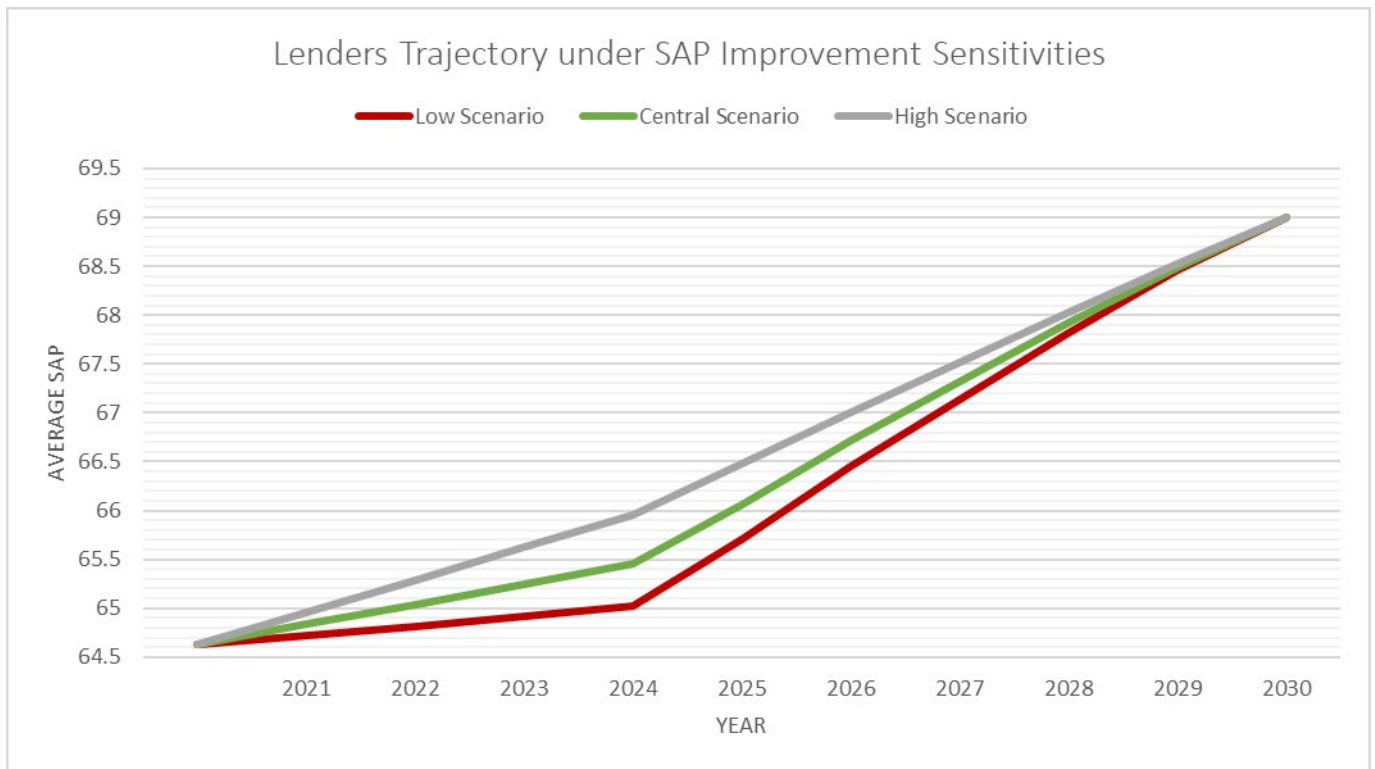
4.2.1 - Results of Best Case Scenario

122. The three sensitivities shown so far in the impact assessment all make the assumption that due to the level of improvement seen in the market, the Government introduces a mandatory target in 2025. However, the introduction of a mandatory target is not necessary in all scenarios and will only be brought in should the government believe the improvements in the market are not at a high enough rate.

123. The following analysis shows a scenario in which lenders, in all years, are achieving improvements at a rate which puts them on track for an average SAP improvement which would equate to getting 100% respectively of the way from their starting SAP to SAP 69. At this point, a mandatory phase is not introduced.

124. In this analysis, the threshold at which mandatory targets would be introduced along with the year that they would be introduced in, is a hypothetical scenario and should not be seen as official cut off points. Table 11 shows the results of this scenario.

Table 11: Case Study Key Metrics

Type of Cost or Benefit (£bn)	Case Study
Government Costs	
Administrative Costs	0.02
Lender Costs	
Identification Costs	0.31
System Costs	0.155
Consumer Costs	
Capital Expenditure	10.07
PAS Costs	1.30
Operating Expenditure	0.75
Hidden Costs	0.74
Opportunity Costs	1.45
Total Costs (A)	**14.81**
LRVC Energy Savings[34]	8.20
Air Quality Savings	0.69
Traded Carbon Savings	0.34
Non-Traded Carbon Savings	5.10
Comfort Taking	2.04
Total Benefits (B)	**16.37**
Net Present Value (B – A)	**1.57**
Benefit: Cost Ratio (B / A)	**1.11**

Table 12: Case Study Mortgages Affected

Mortgages Affected	Case Study
Total Number of Homes Upgraded	2.8m
Percentage of Eligible Mortgages Borrowing to Invest in Energy Performance Improvements (2021-2030)	40%

125. Table 11 shows that the 100% scenario results in the best NPV when compared against the main improvement sensitivities in Section 4.1.1. This scenario achieves the same number of homes

upgraded as the improvement sensitivities but more evenly spread out, reducing delivery risk in the later years as well as nullifying the requirement for a mandatory phase.

126. The rate at which lenders improve their portfolio will have an impact on the level of greenhouse gas emissions savings that can be expected across the relevant carbon budgets.

Table 13: Case Study Greenhouse Gas Emissions Savings

Greenhouse Gas Emissions (MtCO2e)	Case Study
CB4 Traded	1.13
CB4 Non-Traded	3.82
CB5 Traded	1.21
CB5 Non-Traded	6.71

127. Table 13 shows that under this scenario, improvements are on track to reach an average of SAP 69 by 2030, and the highest level of carbon savings are achieved across all Carbon Budget periods.

4.2 - Wider Economic Benefits including Health Benefits and House Prices

128. The method for valuing health benefits from measures that improve energy performance is not currently incorporated in the Green Book's methodology, so these have not been added to the net present value in the cost benefit analysis. The analysis has, however, given quantitative and qualitative evidence below for the likely scale of impact.

129. Living at low temperatures poses a risk to health, with a range of negative morbidity and mortality impacts associated with exposure to the cold. The Marmot Review Team report on cold homes and health[35], in addition to the Hills Fuel Poverty Review[36], set out the strong body of evidence linking low temperatures to these poor health outcomes. Making energy performance improvements in homes can improve the health of the occupants, for example by reducing their risk of cardiovascular and respiratory diseases from warmer internal temperatures.

130. BEIS has monetised the health benefits associated with making these energy performance improvements using BEIS's Health Impacts of Domestic Energy Efficiency Measures (HIDEEM) model (more details on this model can be found in Annex C). HIDEEM simulates the change in relative risk of a range of cold-related morbidity and mortality risks for people living in homes receiving energy performance improvements. The changes in relative risk are then converted into Quality Adjusted Life Years (QALYs) and monetised in accordance with Department of Health guidance on health valuation.

131. There are potential overlaps with the comfort taking benefits included in the net present values used in this analysis. Therefore, it does not currently include the monetised health impacts in the cost-benefit analysis. At present it is not possible to quantify robustly the potential savings to health provision services (such as the NHS) from improving the energy performance of homes, although they are expected to be significant.

132. Table 14 shows these health calculations.

Table 14: Health Benefits by Measure

Measure	Health benefits (£m)
Loft Insulation	71
Floor Insulation	99
Cavity Wall Insulation	200
External Wall Insulation	44
Total	**414**

133. Another wider benefit of energy improvement policy is the uplift in house prices that can be associated with the uplift in the EPC ratings of the households which have received the installations. A 2017 hedonic pricing study has shown for every 1% increase in SAP score, there is a 0.09% increase in house value.[37]

134. By applying this to our analysis, the aggregate increase in the value of the housing market can be estimated around £15bn.

135. Although it is clear that properties that have a greater energy efficiency rating have a higher property value, it is not so clear that increasing the energy efficiency rating of a property directly leads to an increase in the value in and of itself.

136. Other wider economic benefits that have not been monetised due to additionality considerations and the absence of a Green Book compliant methodology for valuing them. This includes the employment impact from the installed measures supply chain (including those involved in assessing, installing and manufacturing measures), and the consequent potential impact on the country's GDP.

4.3 - Fuel Poverty

137. Fuel Poverty is defined as being both low income (below median) and having high fuel costs (above median).

138. For modelling purposes fuel poor households have been exempt from upgrades as a proxy for the affordability threshold. The analysis therefore predicts the effect on fuel poverty to be minimal. However, a qualitative assessment of how this policy could impact this sector of the housing stock has been undertaken, in order to show any potential effects the policy may have. Exemptions are not yet determined and are being considered in the consultation.

139. Due to the nature of the proposal, households will need to take out loans with their lender in order to fund the energy performance upgrades, which in turn increases their housing costs. There is the potential that this extra housing cost incurred may move homes into fuel poverty, should the cost be great enough to make the household into low income and the home improvement not great enough to move the Fuel Poverty Energy Efficiency Rating (FPEER) to C or above.

140. Fuel poor households may be more likely to be exempt based on the affordability threshold, however they will have the option to borrow additional funds if they wish to do so and the lender is willing. Therefore, there is potential for homes to improve their FPEER rating and remove themselves from fuel poverty.

141. Government welcomes views in the consultation process on the fuel poverty impacts of the policy. The government intends that lenders will not lend to those homes who may be pushed into fuel poverty should they take out additional borrowing. The policy would eventually be evaluated for impact on fuel poor households. Therefore, the analysis assumes negligible changes in the number of fuel poor households.

142. Further information on the current state of fuel poverty can be found in Annex C.

4.4 - Equity Weighting

143. In addition to the NPV presented in Table 1, it is also 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.

144. Equity weighting considers that mortgagors have an above median after housing cost income whilst non-homeowners have a lower than median after housing cost income. Given mortgagors have higher income, their equity weighted costs and benefits are reduced. The equity weighting is based on all mortgagors rather than those who specifically are upgraded. However new costs and benefits are included – retail energy profits and VAT as these transfers are equity weighted.

Table 15: Equity Weighted Costs and Benefits

Type of Cost or Benefit	Value (£bn)
Non-Equity Weighted	
Total Costs	14.01
Total Benefits	15.65
Benefit:Cost Ratio	1.12
Net Present Value (NPV)	**1.64**

Equity Weighted	
Total Costs	13.87
Total Benefits	18.37
Benefit:Cost Ratio	1.32
Net Present Value (NPV)	**4.49**

145. The analysis shows that the application of equity weights leads to a significantly greater NPV than when equity weights are not applied. The key driver of this is the reduction of most policy costs. This is because mortgagors, who bear the large majority of costs, tend to have greater-than-average income. By contrast, most of the policy's benefits are external (for instance, LRVC, air quality, and emissions benefits), and are therefore not equity weighted. As a result, policy benefits rise relative to costs, and the equity weighted NPV exceeds the unweighted NPV.

4.5 - Equivalent Annual Net Direct Cost to Business [EANDCB]

146. The proposed policies will result in increased costs on mortgage lenders as they will be required to incentivise customers to take out extra loans on their mortgage to upgrade or attract high SAP score customers. The lender will face costs providing these incentivising levers (although may be able to transfer these costs across the wider business (for example other profit-making parts of the business).

147. The direct costs to business in the analysis are:

- **Identification Costs** - The cost to lenders of identifying their missing EPCs and obtaining new EPCs for those households that have upgraded

- **Administration Costs** - The cost to lenders of creating new products to incentivise customers, collecting data from their customers on when they have upgraded, setting up new systems and employing new staff in order to comply with the regulations

- **Compliance Costs** - The cost to lenders of reporting to the government in order to prove compliance

148. The analysis assumes transition costs for the lenders in the first year of the policy through the setting up of new systems and the employment of new staff in order to have the capability to report back to the government to prove compliance.

149. On-going costs throughout the policy period for the lender are considered in the analysis as the cost of obtaining EPCs for those homes on their portfolio that do not currently have them as well as upgrading the EPCs for those homes that have installed a measure. They also incur the added on-going cost of reporting back to the government yearly in order to prove compliance.

150. Costs assumed in these calculations are explained in more detail in Annex A. The consultation process is looking to gather more evidence from respondents on costs likely to be incurred from these policies.

151. Using the Department for Business, Energy & Industrial Strategy's Impact Assessment Calculator, the provisional Equivalent Annualised Net Direct Cost to Business (EANDCB) of the central policy option is set out in Table 16. As well as this, the Business Net Present Value and Business Target Score are also listed to reflect the impact on business.

Table 16: Equivalent Annual Net Direct Cost to Business (EANDCB)

Central scenario costs and benefits	Value (£m 2018 Prices)
Total Net Present Social Value	1,644
Business Net Present Value	-436
Net Direct Cost to Business Per Year	17
Score Against the Business Impact Test	85

152. There are potential benefits to business from the presented policy options that have not been quantified. These include reduced risk of default on better energy performing homes due to lower energy bills and increased security of assets for lenders.

4.6 - SaMBA: Small and Micro Business Assessment

153. Small and micro lenders are classified as those who have less than 50 staff and therefore are expected to have fewer mortgages in their portfolio, so may have less ability to spread improvements across a customer base and may be less able to target specific properties that have the most ability to improve.

154. Due to data limitations, the impact on Small and Micro Businesses has not been analysed in this IA, however a qualitative look at the market can be given. The 'big six' high street lenders accounted for just over 70% of all mortgage lending in 2018[38] and the top 50 lenders hold 95% of the market share[39]. A disproportionate impact could occur if one or more small lenders had more inefficient properties than average and their individual target was therefore much harder to achieve.

155. The consultation asks about data surrounding Small and Micro Businesses and how to mitigate against a disproportionate impact. Following on from the consultation, the policy will be designed to incorporate these mitigation factors.

4.7 - Equality

156. As part of the wider impacts of this policy, the analysis has broadly looked at the effect of the proposals on those who share protected characteristics. Those characteristics that have been considered in this Impact Assessment are: Disability, Ethnicity, Religion, Gender and Age.

157. Due to data limitations, these are the only five characteristics that have been analysed at this time. The consultation seeks to gather further information on the 5 characteristics already assessed plus those characteristics not assessed. The consultation also seeks views on how to promote equality among the full set of protected characteristics under the equality act.

158. Data used for the following analysis under section 4.7 has been taken from the English Housing Survey (EHS) 2016-17 dataset. For reference throughout this section on the EPC breakdown of the whole mortgaged stock, please refer to Figure 1 in section 3.1.

159. The survey is filled out by the household reference person (HRP) i.e. a designated head of the household and therefore the equality questions refer to the answer that person gave. It does not look at all the owners of the home.

160. For the following categories, conclusions are made purely on the EPC breakdown of the different sub-sectors. The government is aware that other factors will play a part in the proportional impact of this policy, however, due to data limitations, these are not considered in the current analysis.

4.7.1 - Disability

161. An estimated 23% of the mortgage stock contains a household member that is disabled or long-term ill. Figure 12 shows the EPC breakdown for those households which contain a disabled or long-term ill member.
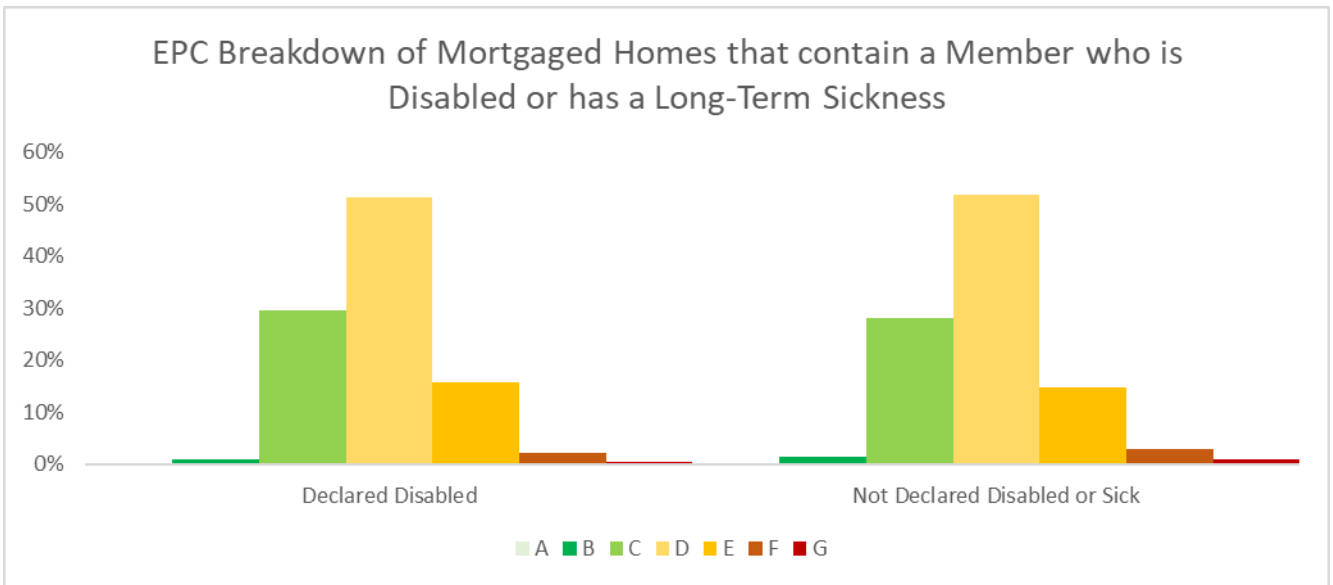
162. As shown above, the EPC breakdown for this protected characteristic is in line with that of the entire stock and therefore the analysis can conclude that they will not be disproportionately affected based on their starting EPC.

4.7.2 - Ethnicity

163. An estimated 91% of mortgaged household reference persons (HRP) identified as white and therefore those of other ethnicities are a protected characteristic and are classified as the minority in this analysis. Figure 13 shows the EPC breakdown of ethnic minorities compared against the breakdown of those HRP that identify as white.

Figure 13: Ethnicity EPC Breakdown
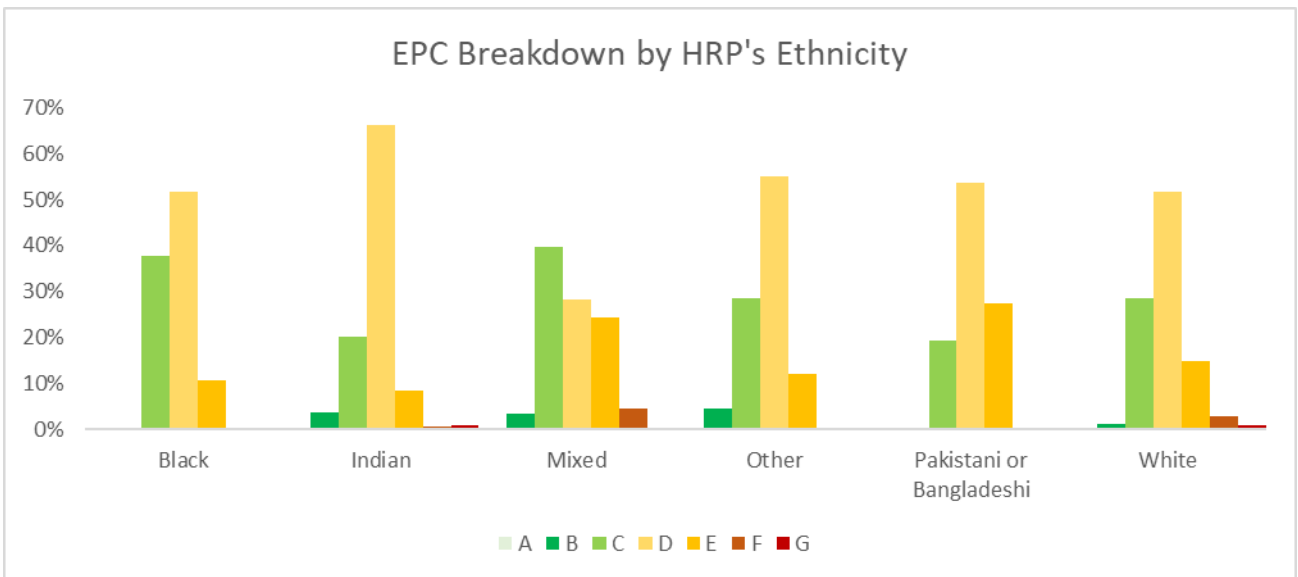
164. The breakdown by EPC for ethnic minorities is broadly similar in distribution to that of households where the HRP is white and to the mortgage stock as a whole. The consultation seeks feedback as to any potential equality impacts of this.

4.7.3 - Religious Belief

165. Around 30% of mortgaged households stated they have a religious belief, with the other 70% stating that they had no religious belief or that the question didn't apply to them. Figure 14 shows how the energy efficiency bands of those homes differs.

Figure 14: Religious Belief EPC Breakdown
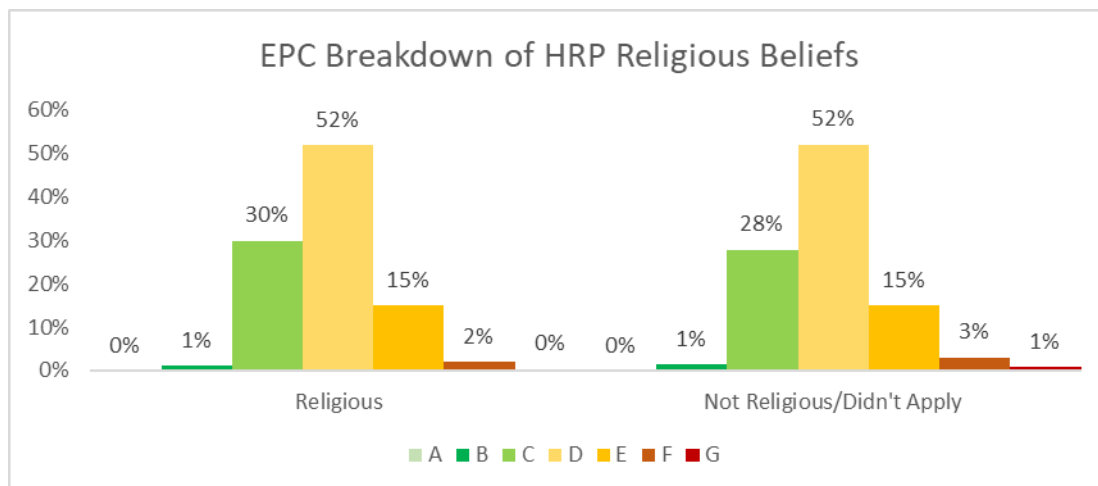
166. The analysis shows that the EPC rating of the home bears no correlation to the household's religious belief. When comparing the above figure to Figure 1: EPC Breakdown of Owner Occupiers it can be concluded that this protected characteristic is not disproportionally affected.

4.7.4 - Gender

167. Around two-thirds of the HRP's for mortgaged households identified as male, with the other third identifying as female. For this analysis, due to data limitations, these are the only two genders considered. The HRP is the designated head of the household and is the member that fills out the EHS for the household. The EPC breakdown between the genders is presented in Figure 15.

EPC Breakdown of HRP by Gender
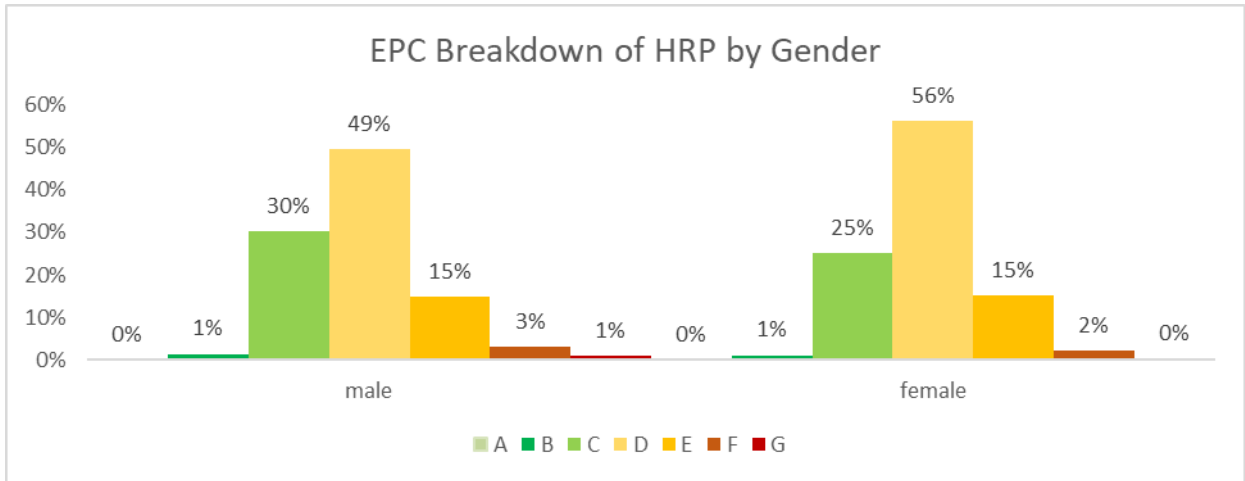
168. As shown by the above figure, the split of EPC's between the genders is relatively even and in line with that of the entire mortgaged stock and therefore the analysis concludes that neither gender will be disproportionally affected by the proposal.

4.7.5 - Age

169. The analysis considers the spread of EPCs across the age ranges and whether or not any particular range will be disproportionally affected by the proposals put forward in the consultation. Figure 16 shows this breakdown.

Figure 16: Age EPC Breakdown

EPC Breakdown by Age Group
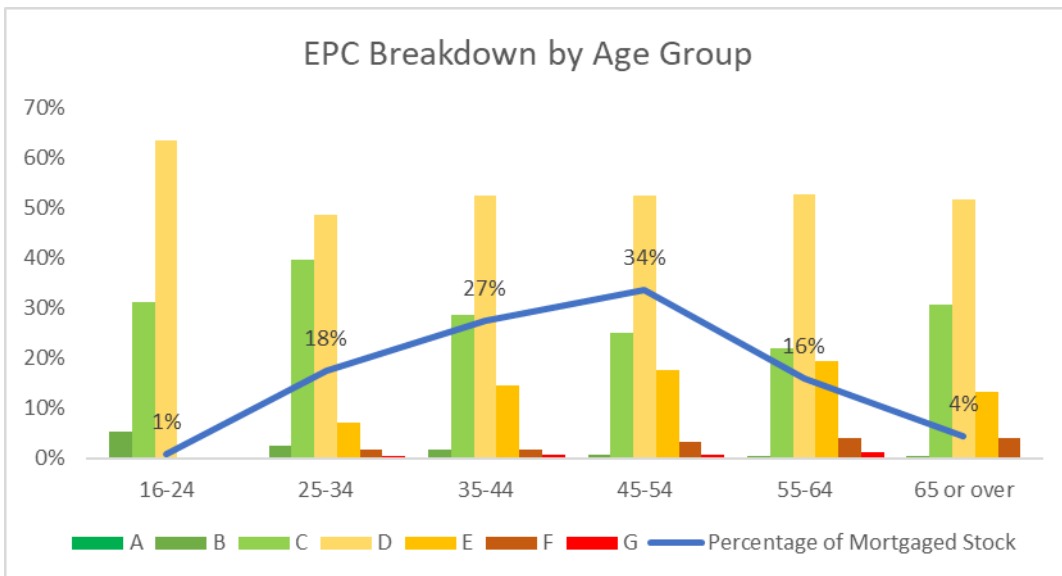
170. The figure shows that 16-24 year olds and 65+ age groups represent far smaller proportions of the mortgaged stock than other categories. These two groups will be less affected by the policy than other ages. All age ranges have around 60-70% of their households below an EPC C. The consultation seeks views on equality impacts by age groups.

4.8 - Risks and Uncertainties

171. In addition to the risks and uncertainties mentioned throughout this impact assessment, it is worth noting as a pre-consultation impact assessment, many of the uncertainties form part of the consultation to allow lenders and other stakeholders to offer evidence to support/change the assumptions listed for pre-implementation.

172. The analysis uses stable interest rates for proportionality. Interest rates can vary and change, sometimes unpredictably and the effects of this policy could be very different under high interest rates.

173. Aspects of the impacts on the housing market have not been taken into account in this analysis. These include consumers who are already on the affordability threshold and the impact that increased mortgage costs would have on them. The consultation is seeking evidence on this.

174. There is a lack of clarity around how borrowers will react if variable rate mortgages become more attractive in the wake of this policy. The analysis assumes that the proportion of the mortgage stock on variable rate mortgages is constant. If this were to change to become more dynamic, this would affect the number of mortgages in scope of this policy that come to market each year and therefore the rate at which the policy could be implemented.

175. Risks around pushing households into unsustainable debt has not been accounted for in the modelling. However, the consultation is seeking evidence on this to design a policy that avoids this risk.

176. Exemptions are currently modelled for fuel poor households as a proxy for those that may be on the edge of affordability and therefore would not be eligible to take out an extra loan on top of their mortgage. They are exempt from taking out additional borrowing but are still included in the portfolio average scores. Exemption adjustments to the eligible stock will be considered further at pre-implementation stage.

177. The analysis assumes households are perfectly rational agents who have a willingness to upgrade their homes in the most cost-effective way. This means on a household level, the installed measures are optimised to provide the highest SAP score increase feasible under the relevant cost cap. The most cost-effective homes are then selected taking account of the fixed cost to upgrade each home. The fixed cost assumption means that only households where the [(measure cost + fixed cost)/sap score] increase is greatest. The measure optimisation and partial household optimisation leads to some optimism bias in the figures presented which has not been accounted for.

5 - Evaluation

Policy aims

178. The policy has been designed with a set of overarching aims and expectations of how they can be achieved:

- The aims of the policy include reducing greenhouse gas emissions and providing wider benefits which outweigh the societal cost. For example, energy savings and air quality.

- The way in which these aims will be met is through increasing the SAP scores of mortgaged properties. Higher SAP scores are associated with lower energy bills and lower emissions.

- The policy introduces a target SAP score for lenders to achieve across their lending portfolio.

- Based on this target, lenders are expected to introduce new green lending products.

- These products will increase green mortgage uptake from consumers by increasing awareness and offering the right incentive structure.

179. If these aims are met, they should be measurable in terms of the policies impact. Key performance indicators, including indicative targets, could include:

- The proportion of the market offering green lending products. It is expected (weighted by market share) that the majority of lenders will offer a green lending product. This is defined as a product which incentivises SAP score improvements in homes.

- The quantity (£) of lending for efficiency improvements; From our central scenario 40% of homes to be upgraded with an average spend of around £3,700 (including VAT and PAS compliance costs). The policy should achieve this level of upgrade spend minus any spend by other policies or homeowners. This counterfactual spend can be estimated based on the disclosure of average SAP score of the lenders portfolio each year.

- The number of SAP points improved across the mortgaged stock by lenders. By 2030 the mortgaged stock average SAP score is expected to be over 69.

- Carbon savings MtCO2e. Carbon savings over CB5 are expected to be at least 6MtCO2e (non-traded).

180. These targets have been set based on the central scenario results and are subject to change as the policy develops through consultation.

Monitoring and evaluation

181. Monitoring and evaluation activities will be conducted in order to meet a) the requirement for a statutory Post Implementation Review (PIR), first due in 2028, and b) to assess the longer-term impact of the policy through to 2030. To support the development of a robust monitoring and evaluation plan a theory of change will be developed at the pre-implementation impact assessment stage. This theory of change will confirm the impacts of interest, key actors involved, and the assumptions underpinning the policy. This theory of change will be used to finalise the KPIs listed above. An illustrative Theory of Change assessment is presented below. It is noteworthy that this assessment is subject to change as policy details continue to develop.

Outcome	Evidence	Method	Baseline/Comparator
Increased green mortgage lending for consumers			
Increased quantity of funding for	a) Quantity of funding of green improvements	a) Disclosure results will provide quantity of funding by mortgage provider	English housing survey additional lending for efficiency improvements

			estimate before policy introduced
Improvement in mortgaged properties' energy efficiency rating			
Increased SAP score	a) Measure of average lenders portfolio SAP score	a) Disclosure results will provide average mortgage SAP score by mortgage provider at policy end	a) Disclosure results will provide average mortgage SAP score by mortgage provider at policy start
How effectively has the scheme delivered energy, carbon and bills savings?			
Delivery of measures which are expected to deliver energy, carbon and cost savings for households	a) Predicted energy reduction from installations (annual kWh per house) b) Predicted carbon savings from installations (annual CO_2 per house) c) Predicted bills savings from installations (annual £ per house) d) Predicted improvement in EPC from installations (% reaching EPC C)	a) Compare installations against PAS2035 pre-assessment outputs	Comparisons can be drawn to savings achieved under other domestic energy efficiency policies, most prominently ECO (similar target audience and measures).
Delivery of energy, carbon and bills savings for households	a) Achieved energy reduction from installations (annual kWh per house) b) Achieved carbon savings from installations (annual CO_2 per house) c) Achieved bills savings from installations (annual £ per house) d) Achieved improvement in EPC from installations (e.g. change in portfolio average EPC; total portfolio SAP point change)	a) Assumed savings from PAS2035 provides a post-installation assessment b) Real world savings from NEED	PAS2035 can be compared to the pre-installation assessment to assess if installations delivered as planned. NEED allows for assessment of whether the PAS2035 assumed savings are achieved. NEED allows for comparison to a counterfactual group to assess the additionality of the savings.
How effectively has the implementation of the PAS2035 process lead to consumers being involved in decision making, with appropriate packages of measures being installed to a satisfactory quality?			
Quality of installations improved	a) Proportion of households reporting faults after installation of measures	a) Household surveys b) Trustmark audits	Household self-reported instance of faults can be compared to ECO surveys

Installation of appropriate measures	a) Installations aligned with PAS assessment recommendation	a) Comparison of interventions against PAS recommendations b) Household survey	Comparisons can be drawn to consumer activity in previous years, to activity of exempt group, to households' self-reported intentions in absence of finance.
How effectively has the scheme driven consumer demand for installation of energy efficiency measures been achieved?			
Increased consumer demand	a) General public awareness and willingness to install key EE measures b) Proportion of engaged households willing to proceed with installations	a) BEIS public attitudes tracker (PAT) b) Household survey	a) Previous PAT surveys b) Track change over time within the project
Consumers engaged in installation process and have positive experience – involvement in process/decision making, satisfaction	a) Extent to which applicants feel involved in decision making process b) Satisfaction with installation and process	a) Household survey b) Comparison of interventions against EPC/PAS recommendations	Comparisons can be drawn to existing ECO household surveys (similar measures)

182. At the final impact evaluation stage, a set of evaluation questions will be developed. These are likely to includes questions such as:

- To what extent have the policy aims been achieved? The above indicators can be tested based on the information provided through disclosure requirements and National Household modelling of carbon savings.

- How is the policy being implemented in practice? Including consideration of how lenders, consumers and other stakeholders are reacting to the policy and barriers to delivery of the objectives.

- Are the policy objectives achieved? Including energy performance improvements being made to the housing stock and delivery of greenhouse gas emission savings.

- What (intended and unintended) impact has the policy had on relevant stakeholders and markets? Including additional burdens and benefits to lenders, consumers and wider housing market stakeholder, and the impact on the housing market itself (including sales volumes and property prices)

- Are the impacts evenly distributed across society? Including consideration of impacts on lower income and fuel poor households.

183. The monitoring and evaluation activities expected to be put in place to answer the above questions is likely to include:

- The scheme administrator will collect ongoing monitoring data regarding activity under the policy. This will provide up to date insight into what the policy is delivering as well as supporting subsequent analysis to support the evaluation.

- Existing external datasets will likely be the primary source of impact data. Data from the EPC register and the English Housing Survey can be used to assess the extent to which the housing stock has become more energy efficient, while property market data from Land Registry can be used to assess impacts on the housing market.

- Qualitative primary research is likely to be commissioned to provide a detailed understanding of how the policy is impacting key stakeholders including lenders and consumers. This research could also collect data regarding costs incurred by different stakeholders.

184. At the final stage impact assessment, the budget for monitoring and evaluation activities will be reviewed and included into the government administrative budget.

Annex A - Modelling

A1 - Modelling approach

1. Lenders currently do not need to disclose their portfolio energy efficiency rating and each lender will have a different portfolio of homes. As these portfolios are not known, and therefore it cannot be estimated the start point and related target for each, the market as a whole is analysed, as well as the average starting point and therefore the amount of homes that would need to be improved to reach the target.

2. This average market approach gives an average SAP point of 64.5. The modelling is based on a target of reaching SAP band 69 by 2030, a required improvement of 4.5 SAP points. The average calculated is on an unweighted basis whereby each house's SAP score is valued as a weight of 1 in the calculation of the average SAP score.

3. If the lending market fails to keep up with this trajectory, a mandatory improvement target will be introduced. Underperforming lenders will then fall into the penalty regime (Annex C). Penalty charges are not calculated in the modelled scenarios as it is assumed that lenders meet the mandatory targets set. The hypothetical example in Annex C assumes a penalty being implemented on a year on year basis based on progress against a linear trajectory towards the target. Alternative penalty systems may be considered based on the outcome of consultation responses.

4. In our modelling an assumed maximum spend of £10,000 per property is applied. This represents the maximum amount one household is expected to borrow in order to achieve the overall improvement target. Even if a household has not achieved all its technical potential, if it has spent up to this assumed maximum spend it will be exempt from there on in. It is exempt from further upgrades but is still included in the lenders' portfolio average score. If a household is wanting to spend more than the £10,000 then that is the household's prerogative but for modelling purposes, it is assumed that no household is expected to do this.

5. In equity weighting the outcome of the policy, two extra costs and benefits are considered: VAT and Retail profits. These are considered transfers in the non-equity weighted CBA but are in the equity weighted CBA. All costs and benefits are weighted based on the income levels of different groups of society in the weighted CBA.

6. Administrative costs: government administration costs are based on Annual Survey of Hours & Earnings Data (ASHE) and are calculated to fall in line with administrative costs that have been estimated by Ofgem for the Energy Company Obligation (ECO).

7. Lender administration costs are unknown, and the consultation will ask for evidence to update future assumptions. In the modelling it has been assumed that lender costs would be higher than government administration costs, so the analysis uses a point estimate of 2% of scheme total. Most of the lender's administrative costs will be upfront costs of setting up new systems, with smaller on-going administrative costs of needing to report their average back to government. Therefore, the analysis breaks this 2% of scheme total down to 1.5% for upfront costs and 0.5% as on-going costs. This will be reviewed for the pre-implementation stage impact assessment based on evidence received through the consultation.

8. The analysis exempts fuel poor households from upgrading their homes, however their households SAP scores are included in the average calculation. This is currently the only exemption modelled. The exemption means that the property is not eligible for upgrading to help improve the portfolio score. Building on responses given and data collected from the consultation, it is possible further exemptions will be made for the next stage IA.

9. The proposed lender voluntary measures would come into force from (at the earliest) 2021 and would continue over a policy period to 2030. Progress of lenders will be reviewed frequently by the government and, if necessary, government will introduce a mandatory phase.

10. The appraisal period is 51 years from the modelled start of the policy in 2021 up to 2071. There are 51 years between the start of the policy and 42 years after the last policy installation, which is the longest lifetime of a measure installed under the policy.

A2 - Modelling the Stock

11. The National Household Model (NHM) was used to model the installation of measures in the domestic mortgaged housing stock and their associated energy savings from such installations using a SAP-based energy calculation.

12. The model starts by calculating the average SAP score of the mortgaged stock and then installs measures in descending order of SAP point increase per £ spent until the average of the mortgaged stock is at EPC C. In-use factors are used to estimate the real-life energy savings associated with installed measures.

13. When upgrading homes there are fixed costs which apply per house. For example, the search costs of identifying willing customers or PAS 2035. The modelling accounts for this by selecting the optimal set of houses to upgrade subject to a fixed cost of £1,000[40] per house upgraded. A value of £1,000 covers PAS 2035 costs, search costs and other fixed costs the lender may face. This ensures that in scenarios the optimisation will install the most cost-effective measures where the cost is fixed cost + package of measures in that house cost

14. The NHM's initial stock contains a mortgaged stock of 7.03m homes with an average SAP score of 64.6.

A3 - Mortgage Churn

A3.1 - Mortgage Churn Data

15. The analysis needs to take into account the churn of mortgages. This is how many homes are likely to mortgage or re-mortgage during the policy period.

16. A mortgage rate will be given for either a fixed term or a variable term. For example (not based on market data), the lender may offer 5% interest rate for 2 years or the interest rate may vary based on market conditions.

17. Typically, fixed rate mortgages offer a better financing rate for borrowers for a given notional amount (particularly for those who are risk adverse). The most common fixed rate terms are for 2 and 5 years. UK Finance have released a report[41] for the number of 5-year fixed (approx. 50%) and 2-year fixed loans (approx. 40%).

18. The UK finance data also shows that 40% re-finance every 2 years, 50% re-finance every 5 years and 10% have mortgages longer than the policy period.

19. Bank of England data shows approximately 72% of existing mortgage balances are on a fixed rate while 28% are on a variable rate (usually a higher rate than fixed rates which moves with the Bank of England base rate)[42]. Approximately 8% of new mortgages are on the standard variable rate, 92% on a fixed rate.

A3.2 – Mortgage Churn: Stock in Scope Calculations

20. Each year, the same amount of mortgages and re-mortgages are assumed to occur as the base year chosen from the Bank of England date. Figure 17 shows the stock in scope each year as a result of the financing and refinancing and those households undertaking energy efficiency improvements and falling out of scope.

21. Up until 2026, the numbers coming into scope steadily increase, the shape being driven by the different mortgage terms up to five years from both new borrowers and households refinancing. Beyond then, the combination of recurring mortgagors undertaking improvements and the mandatory phase bringing greater abatement, means the stock in scope begins to turn downwards.

22. Figure 17 shows the stock in scope and how they flow into scope across the policy period. The flows have six component parts:

- The first, bottom block shows new borrowers (consisting of first-time borrowers and households moving house and borrowing on a new property) between 2021 and 2022 using two-year fixed mortgages who, in subsequent years, return to scope when they refinance.

- The next block up shows households already on two-year mortgages who refinance in 2021 and 2022 who, in subsequent years, return to scope when they refinance.

- The third block shows new borrowers (consisting first time borrowers and households moving house and borrowing on a new property) between 2021 and 2025 using five-year fixed mortgages who, in subsequent years, return to scope when they refinance.

- The fourth block shows households already on five-year mortgages who refinance in 2021 and 2025 who, in subsequent years, return to scope when they refinance.

- The fifth block added in 2023 shows households who are first time buyers (or buyers without an existing mortgage) using two-year mortgages. The difference between this and the first block being the exclusion of households getting a new mortgage but moving from an existing mortgaged property.

- The sixth and final block added in 2026 shows households who are first time buyers (or buyers without an existing mortgage) using five-year mortgages. The difference between this and the third block being the exclusion of households getting a new mortgage but moving from an existing mortgaged property.

23. The shape of Figure 17 is explained by the following underlying trends:

- After households enter lenders' scope, a proportion will improve their energy efficiency between each time they reappear. This happens more rapidly for those on two-yearly mortgages than five-yearly deals, but both drive down the stock in scope over time.

- New borrowers are added after 2022, adding to the stock in scope where it peaks in 2026.

- The mandatory regime is assumed to begin in 2025. While this does not affect the households in scope, it significantly increases the number of properties being improved. This can clearly be seen in Figure 18.
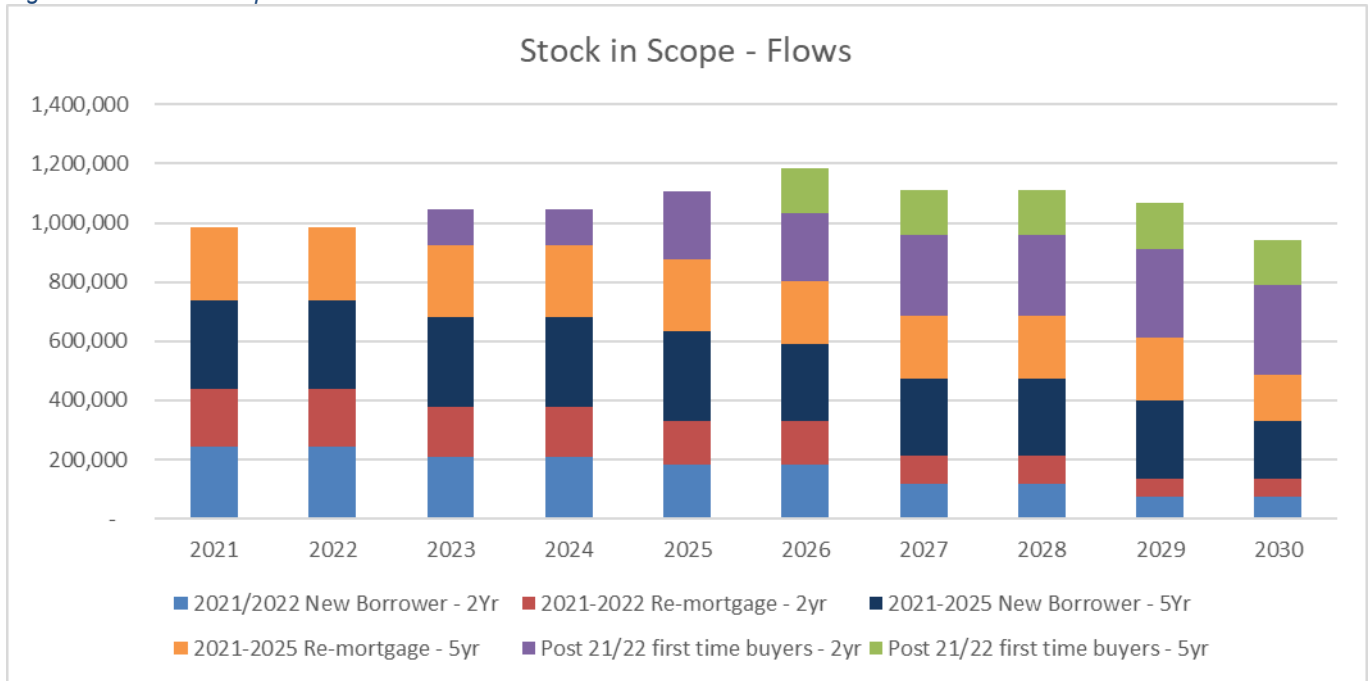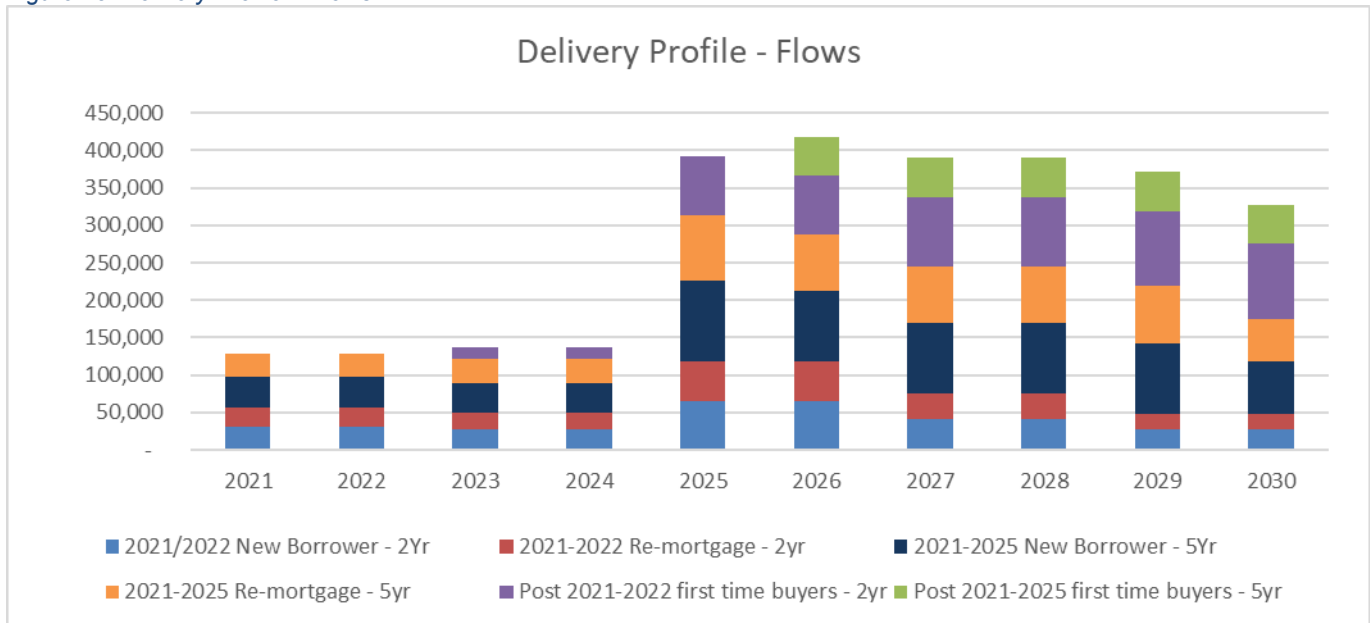
Figure 17: Stock in Scope – Flows

Figure 18: Delivery Profile – Flows

24. These above figures show broad estimates of stock in scope over time and a delivery profile of improvement. As this is a simplified approach to representing the stock and flows of households in scope within the consultation, additional information would be welcome on how to improve these estimates.

A3.2 – Mortgage Churn: Assumptions and Outputs

25. There is a risk that this policy could change the proportions of borrowers on fixed and variable rates as a way of circumventing the regulations. One way to avoid any requirements for re-mortgaging would be to move on to a variable rate after a fixed term ends, for instance. Given the distribution of house prices and measures being installed, it is expected that most fixed rate borrowers will still be better off financially by remaining on a fixed rate mortgage.

26. The potential additional borrowing required from upgrading is unlikely to increase mortgage costs by more than the spread between fixed and variable rate mortgages. Therefore, the assumption used is

there will be no change in the frequency or length of refinancing. There could, however, be a move from borrowers towards longer term fixed rates to avoid the risk of higher rates from this policy, or lenders may move to shorter fixed term rates to give more flexibility to target homes.

27. These proportions have been used in this analysis to model the number of mortgage trigger points. It is assumed that consumers who would otherwise have chosen fixed rate mortgages will not switch to variable following the introduction of the policy.

28. The model calculates the mortgage churn - the number of new mortgaged homes and those that would refinance each year - based on the length of current refinancing behaviour. As the policy would lead to home improvements (in most cases greater than the number of new homes coming in each year), the supply of homes requiring improvements would decrease. As such each year fewer and fewer homes are being mortgaged/refinanced and require improvements.

29. The analysis predicts that in the market, approximately two in five homes would need to improve during the policy period, with the assumption, after 5 years of the policy being in force the only new mortgages are first time buyers.

30. While lenders are able to provide finance at any point (consumers can request loans or extensions to mortgage at any time), it is considered that lenders are most likely to suggest or mandate improvements to the home at the point of a new mortgage or re-financing (see Table 17 for new and refinanced mortgages per year). The UK Finance estimates take a snapshot of one year and have been assumed representative of future years.

A4 - Modelling Assumptions

Table 17: Summary of Modelling Assumptions in the Analysis

Category of Assumption	Value	Assumption Detail
Number of annual mortgage trigger points	1,487,227	• Bank of England statistics on the number of new mortgages (731,646), re-mortgages (582,786) and other (172,795) have been included in scope.
Fixed rate (F) vs Variable rate (V) mortgages	Balance –72% fixed, 28% variable Gross advances - 92% fixed, 8% variable.	• Bank of England data finds that for net advances 72% are fixed rate and 28% variable rate. • For Gross advances 92% are Fixed rate 8% Variable rate.
Average refinancing length for fixed mortgages	40% 2 year fixed, 50% 5 year fixed and 10% other loans.	• BEIS analysis based on UK Finance mortgage split of 40% 2 year fixed, 50% 5 year fixed and 10% other loans.[43]
Typical refinancing length for variable mortgages	>policy period	• Assume that mortgagors would not refinance again before 2030, if on the standard variable rate (Option 2, would face fee only once during policy period)
Assumed Maximum Spend	£10,000	• The maximum amount required to be spent on efficiency measures before becoming exempt from lenders requirements. • The assumed maximum spend is in 2018 prices and increases in line with CPI.
EPC breakdown of mortgage stock	A/B – 1%, C – 29%, D - 51%, E - 14%, F - 4%, G - 1%	• Due to lack of data on the EPC breakdown of the mortgage stock, it is assumed to be the same as the owner occupier stock

Appraisal Period	2021-2071	Incorporates the lifetime costs and benefits.
Policy period	2021-2030	Incorporates the period in which measures are installed
Counterfactual	NA	It is assumed that low energy lighting, oil combi and gas combi boilers are all installed throughout the policy period in eligible homes. No other policies such as ECO or private rented sector have been included.
Lenders' Administrative Costs	0.5% the capital cost each year 1.5% of total capital cost upfront	• In total, 2% of the capital cost [under the single metric, dual metric uses the same admin costs]. • This is a point estimate figure for the lender's administrative costs. The consultation document asks for evidence on the scale of these costs
Exclusions of measure suitability	NA	• For the model run there are exclusions for the installation of storage heaters and fossil fuel boilers. • There is also exemption of 25% of pre-1929 properties that have the technical potential to install external wall insulation.
Uncertainties in analysis	NA	• See section 4.8 for uncertainties in assumptions made.

A5 - Measures being undertaken

31. Using the NHM it can be predicted what measure might be undertaken to achieve the target based upon the amount of homes requiring improvements mentioned above.

32. For the model run there are exclusions for the installation of storage heaters and fossil fuel boilers and exemption of 25% of pre-1929 properties that have the technical potential to install external wall insulation. It is assumed that some pre-1929 properties will be hard to treat with solid wall insulation due to the current building condition.

33. Table 18 shows the mix of measures the analysis predicts need to be installed in order to obtain the cost and benefits that are mentioned above. This combination of measures is the mix that our modelling predicts is the most cost effective per SAP point increase.

Table 18: Measures Installed

Measures	Measures Installed (Millions)
Low Energy Lighting	1.70
Draught Proofing	0.66
Loft Insulation	1.02
Floor Insulation	1.22
Cavity Wall Insulation	0.84
External Wall Insulation	0.08
Temperature Controls	2.64
Hot Water Tank Insulation	0.63
Wet Central Heating	0.04
Low Carbon Heating	0.04
Solar Thermal	0.01
Solar PV	1.25

Annex B – Costs and Benefits

B1 - Summary Tables for Costs and Benefits

1. Table 19 shows the range of costs and benefits that have been considered.

Table 19: Costs and Benefits Analysed

Grouping	Type of Cost/Benefit	Cost Benefit Monetisation
Costs		
Government	Administrative Costs including enforcement of regulations	Monetised in Social Cost-Benefit analysis
Consumers	Capital Cost of Installing Measures.	Monetised in Social Cost-Benefit analysis
	Operating costs, excluding fuel use (e.g. maintenance of solar PV)	
	Hidden costs of installing measures, such as the time required to clear rooms or learn new systems	
	Opportunity Costs of spending money on upgrading home rather than putting in savings	
	Trustmark costs - Under our low scenario only every household that installs measures will do so through a Trustmark certified installer (PAS 2035).	
Lenders	Identification Costs for obtaining new EPCs and upgrading EPCs for their properties that have installed improvements	
	System Costs of disclosing data to the government, encouraging households to improve their homes & complying with the policy	
	Penalty Costs should lenders fail to meet targets under a mandatory phase	Not Monetised in Social Cost-Benefit analysis as this is a transfer between lenders and Government
Benefits		
Consumers	Lower Energy Costs	Private benefit, not included in social cost-benefit analysis
	Health Benefits	
	Improved thermal comfort in homes (comfort taking)	Monetised in social cost-benefit analysis (also a private benefit)
	Lower Energy Use	
	Improvements in air quality from lower fuel use	
	Reductions in greenhouse gas emission	
Society	Property value uplift as a result of making improvements	Quantified, but not included in the cost-benefit analysis because of potential double-counting with comfort-taking and due to it being a transfer.

B2 - More Detail on Costs and Benefits

2. A few of the costs listed above have added rationale that are not explained in the above table.

3. Capital cost of installing measures. This is the largest individual cost of the Regulations. When installations come to the end of their life, it is expected that replacement will be made. It is assumed that installation costs are incurred again at that stage and these costs are included in the NPV.

4. In practice, technological improvements and increased competition may lower the costs of installing other energy performance measures and therefore lower the costs of the Regulations. The analysis does not assume the costs to rise over time, as it is assumed that the supply chain can meet the additional demand for increased energy performance measures.

5. Opportunity Costs. Supplementary guidance to the Green Book on valuing energy use and greenhouse gas emissions advises that "the costs of private financing would generally be considered to be a real social cost". This is because financing costs may affect private sector allocation decisions. When capital is tied up in a specific project, alternative profitable use of such capital is ruled out and there is a foregone social benefit. Opportunity costs have been included in this impact assessment, assumed as an interest rate of 3% over 5 years.

6. System Costs. These cover all costs that the lender will face in understanding the regulations, creating green finance products for consumers and showing compliance to the government.

7. The benefits that are analysed in this cost benefit analysis are green book compliant and have economic rationale for their inclusion.

8. Energy savings benefits. The installation of increased energy performance measures reduces energy used. This has been monetised in accordance with Green Book supplementary guidance on valuing energy use and GHG emissions.

9. Air quality improvements and reductions in greenhouse gas emissions benefits. The reduction in the amount of energy that needs to be used improves air quality and reduces traded and non-traded carbon emissions. Reductions in carbon emissions help meet the UK's legally binding carbon targets, while improvements in air quality reduce adverse health impacts, and long-term environmental impacts (including climate change). These benefits have been calculated in accordance with Green Book supplementary guidance.

10. Comfort taking benefits. Increased energy performance 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 which act as a proxy for the willingness of consumers to pay for the additional comfort.

Annex C – Wider Analysis

C1 - Sensitivity Analysis

1. As well as looking at the metrics shown in Table 6: Capital Cost Sensitivities - Key Metrics, when analysing capital cost sensitivities, the analysis also looks at the different mix of measures installed, which are shown in Table 20: Measure Mix.

Table 20: Measure Mix – Capital Cost Sensitivity

	Measures Installed (Millions)		
Measure type	Low Cost Assumptions	Central Cost Assumptions	High Cost Assumptions
Low Energy Lighting	1.65	1.70	1.79
Draught Proofing	0.65	0.66	0.70
Loft Insulation	0.99	1.02	1.09
Floor Insulation	1.19	1.22	1.34
Cavity Wall Insulation	0.82	0.84	0.85
External Wall Insulation	0.13	0.08	0.02
Temperature Controls	2.54	2.64	2.82
Hot Water Tank Insulation	0.61	0.63	0.66
Wet Central Heating	0.05	0.04	0.04
Low Carbon Heating	0.05	0.04	0.04
Solar Thermal	0.01	0.01	0.00
Solar PV	1.17	1.25	1.39
Total	9.85	10.14	10.73

2. Across the three capital cost sensitivities a clear trend is apparent when looking at the respective measure mixes. As costs increase, the installations of External Wall Insultation, Wet Central Heating, Low Carbon Heating & Solar Thermal decrease as these are expensive measures which, with a 30% increase in prices, are 'priced out' of households.

3. In conjunction with this, all other measures follow a trend of increasing installations as capital costs increase. This is for two reasons:

   - The decrease in the measures previously mentioned requires an increase in other measures in order to raise the SAP score of the household. External Wall Insulation especially is a measure which delivers a relatively large SAP improvement and as these installations decrease, other measures such as Floor & Loft Insulation must increase to cover the SAP improvement gap

   - As costs increase, fewer measures can be installed in each household for under the £10,000 threshold. Therefore, for the market to still reach an average of SAP 69, a greater number of households have to be improved, leading to a greater number of measures overall.

C2 - Health Benefits

4. Over recent years BEIS has been collaborating with a team of leading experts from University College London and London School of Hygiene and Tropical Medicine to develop a model to estimate the change in occupants' health from the installation of increased energy performance measures (resulting from changes in the indoor temperature and pollutant exposure). The model that was developed is the Health Impact of Domestic Energy Efficiency Measures [HIDEEM] model.

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

C3 - Fuel Poverty

6. Under the current measure of fuel poverty[44] around 8% of owner occupiers in England are considered to be fuel poor. 85% of these fuel poor households live in homes with FPEER Bands D to G. This compares to 11% of all homes in England being considered as fuel poor [45].

7. Owner Occupier has the smallest proportion of fuel poor of all tenures; however, it has the largest absolute number, with 1.2m fuel poor homes.

8. The average fuel poverty gap of Owner-Occupied D to G EER-rated households is around £400 compared to an average of £321 across England across all EER bands. Therefore, owner-occupiers require a much larger reduction in fuel costs to move out of fuel poverty.

Annex D - Penalty Regime Example

1. The example penalty can be calculated by first taking the carbon savings foregone during the mandatory period and then imposing an increasing scale of price per tonne of carbon abatement missed.

2. Each lender would have a unique amount of CO2e emissions that they could save from the start of a mandatory phase[46], were they to reach the target of an average of EPC C by 2030. If they do not reach this target, they will have fewer carbon savings. The difference between the actual carbon savings that the lender is on a trajectory to achieve and the carbon savings that should be achieved if they were to reach the target would be used to calculate the penalty. The penalty will be based on both traded and non-traded carbon savings and based on foregone savings across a mandatory period.

3. In the analysis, the National Household Model (NHM) is used to calculate the foregone carbon savings per SAP point increase (unweighted). Alternative ways of calculating the foregone carbon savings could be used and this consultation invites stakeholder views.

4. For each SAP point below the target, a lender is fined a price per tonne of carbon (the foregone savings described above) that increases by 5%, with the base price being that of carbon in 2030 (currently £81/tCO2e).

5. The 5% increase is designed to encourage action, whereby even small improvements in the EPC average can avoid large costs. This means if a lender was seeing the possibility of a missed target, further action to avoid the penalty would still be cost-effective. This is best illustrated in Table 21.

Table 21: Hypothetical Penalty Scheme

SAP points below the target	Penalty Price per tCO2e missed (£)
0	0
1	81
2	85
3	89
4	94
5	98
6	103
7	108
8	114
9	119
10	125

6. This penalty is modelled as being calculated and applied on a yearly basis from the start of the mandatory phase, analysing the difference between the current average SAP of the lender and what the lender's average SAP should be, were they on trajectory to reach the target. The preferred option would be to use money raised from the penalty to fund energy performance improvement. The consultation seeks views on this.

1 Table 3: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2018

[2] https://www.gov.uk/government/publications/green-finance-strategy

[3] Bank of England, 'Transition in thinking: The impact of climate change on the UK banking sector', September 2018, p.28

[4] English Housing Survey 2018-19, Headline Report

5 https://statswales.gov.wales/Catalogue/Housing/Dwelling-Stock-Estimates/dwellingstockestimates-by-localauthority-tenure

[6] https://www.gov.uk/government/statistics/english-housing-survey-2018-to-2019-headline-report

[7] English Housing Survey 2018-19 Headline Report

8 English Private Landlord Survey 2017-18, figure 1.12

9 English Private Landlord Survey 2017-18, figure 1.12

[10] https://www.gov.uk/government/publications/green-home-finance-innovation-fund-competition-successful-bids/green-home-finance-innovation-fund-competition-successful-bids accessed on 07/09/2020

[11] Lloyds, Nationwide, RBS, Santander, Barclays, HSBC

[12] https://epc.opendatacommunities.org/

[13] https://www.gov.uk/government/consultations/improving-the-energy-performance-of-privately-rented-homes

14 English Housing Survey 2018-19 Headline Report

15 https://statswales.gov.wales/Catalogue/Housing/Dwelling-Stock-Estimates/dwellingstockestimates-by-localauthority-tenure 995,314 Owner Occupied households, assumption that 47% of these are mortgaged. This is the same split as in England

[16] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/775002/EPLS_main_report.pdf

[17] 40% of homes nationwide do not have an EPC certificate

18 where practical, cost-effective and affordable

[19] Lloyds, Nationwide, RBS, Santander, Barclays, HSBC

[20] https://www.independent.co.uk/news/business/news/housing-market-first-time-buyers-record-property-ladder-a9266476.html

21 The National Household Model is the department's proprietary modelling environment for policy simulations that change thermal properties and heating technologies in the domestic housing sector.

22 https://www.rbs.com/rbs/about/climate.html

23 https://www.mortgagestrategy.co.uk/news/nationwide-to-offer-green-mortgages-and-loans/

24 https://www.lloydsbankinggroup.com/Media/Press-Releases/2020-press-releases/lloyds-banking-group/lloyds-banking-group-pledges-to-cut-carbon-by-more-than-50-in-the-next-decade-to-help-finance-a-green-future/

[25] https://www.gov.uk/government/news/rishis-plan-for-jobs-will-help-britain-bounce-back

[26] https://www.gov.uk/government/publications/clean-growth-strategy/clean-growth-strategy-executive-summary

[27] https://www.ukfinance.org.uk/policy-and-guidance/reports-publications/changing-shape-uk-mortgage-market

[28] long-run variable cost of energy supply (LRVC)

[29] In such a scenario government may introduce mandatory targets at an earlier date.

[30] In such a scenario government may introduce mandatory targets at an earlier date.

31 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/656866/BEIS_Update_of_Domestic_Cost_Assumptions_031017.pdf

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

33 https://www.trustmark.org.uk/

[34] long-run variable cost of energy supply (LRVC).

35 Marmot Review Team (2011). The Health Impacts of Cold Homes and Fuel Poverty. Available at: http://www.instituteofhealthequity.org/projects/the-health-impacts-of-cold-homes-and-fuel-poverty

36 Hills (2011). Fuel Poverty: The Problem and Its Measurement. Available at: http://eprints.lse.ac.uk/39270/1/CASEreport69%28lsero%29.pdf

37 University of Cambridge (2017) – Do House Prices and Rents in the Private Rented Sector Reflect Energy Efficiency Levels?

38 UK Finance, Annual ranking of mortgage lenders by outstanding balances and gross lending, 2018 figures

[39] https://www.ukfinance.org.uk/data-and-research/data/mortgages/largest-mortgage-lenders

[40] In the NHM a fixed cost of £1,000 per house is included in the optimisation formula as a way to ensure measures are not installed without considering fixed costs per household. The optimisation formula maximises (increase in SAP points)/(cost of measures + (£1,000*number of households upgraded)). The £1,000 figure is based on PAS + search costs + disruption costs + other fixed costs. However in the CBA modelling only the £500 PAS cost is included per household. The £1,000 fixed cost is not included in the CBA.
41 https://www.ukfinance.org.uk/policy-and-guidance/reports-publications/changing-shape-uk-mortgage-market
42 Financial Conduct Authority
43 'Other loans' are considered to be those with a longer fixed term rate in which they would not refinance during the policy period and therefore do not fall within scope
44 One of the areas government is consulting on is the measure of fuel poverty: https://www.gov.uk/government/consultations/fuel-poverty-strategy-for-england
45 https://www.gov.uk/government/collections/fuel-poverty-statistics

[46] This could be based on size of properties, number of mortgages or other methods.