

A GREEN STIMULUS FOR HOUSING

THE MACROECONOMIC IMPACTS OF A UK WHOLE HOUSE RETROFIT PROGRAMME

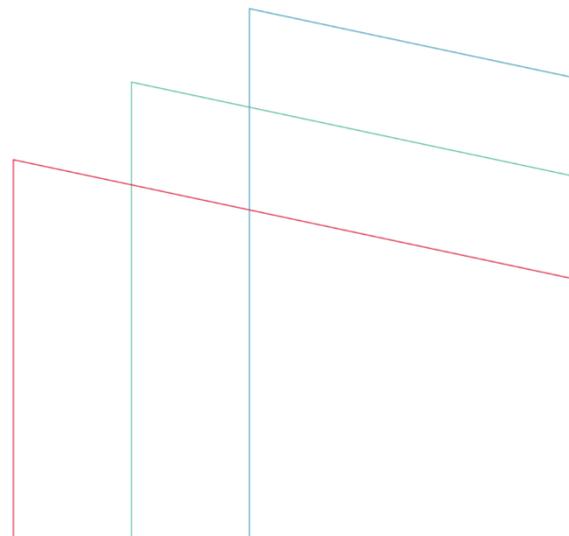
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SUMMARY

Worldwide, millions of people have contracted Covid-19 and more than 500,000 have died. Tens of millions more have lost their jobs, and much of the global economy is at a standstill. While the full shape of the recession remains to be seen, it is clear that the virus and the lockdowns introduced by governments are having a profound effect on economies worldwide. As we move past the peak and into the later stages of the crisis, governments must turn their attention to how to bring the economy off ice. The choices we make about this process will have impacts on the shape of our economy for years to come, and calls to 'build back better' are gathering momentum.

A GREEN STIMULUS FOR HOUSING

This report makes the case that the nature of the recession predicted over the coming years necessitates fiscal stimulus measures to restart and redirect the UK economy. At the same time, the UK's climate change targets necessitate the 'retrofit' of millions of homes in the coming years, involving multiple, integrated building fabric measures, new heating systems and controls, and the widespread adoption of rooftop solar.

Several organisations and groups across the political spectrum have called for an economic stimulus of building retrofits, including Policy Exchange, McKinsey, Confederation of British Industry, Local Government Association, the Green Finance Institute and most recently the Energy Efficiency Infrastructure Group. This report adds to that growing list, but we go further and model a radical scenario where around 9m UK homes receive whole-house retrofit measures over the remaining course of this parliament, saving around 15% of total domestic energy demand. This is not only necessary but is also feasible. Through our bottom-up assessment of jobs and comprehensive policy proposals, we add the 'how' to the growing calls for housing retrofit to be a key part of a green recovery.

Our modelling shows that such a scheme would produce massive benefits to the wider economy, including:

- 117,811 new direct jobs in year one, rising to a peak of 382,885, in year four. This is an average of 294,527 new jobs between 2020-2023/24, a 22% increase in total construction employment and a 162% increase in the renovation, maintenance and improvement sector. This rises to an average of 515,157 when factoring in indirect jobs.

- These measures would increase economic activity significantly. Our modelling shows that the level of annual GDP is expected to be 1.58% (or £36.34 billion in 2020 prices) higher in 2023/24, compared with the level of economic activity otherwise expected for that year. Average annual energy bill savings of £418 for each home retrofitted.
- Emissions savings of approximately 19.23MtCO₂/year by 2023/24, or 21% of 2019 emissions from the UK's homes. This is a cumulative 40.9 MtCO₂ by 2023/24, meaning this policy proposal alone could surpass the UK's fourth carbon budget targets.

The government's manifesto commitment of spending £9.2bn over the course of the parliament on energy efficiency can bring some of the aforementioned benefits but risks falling short of comprehensively dealing with the multiple crises of jobs, climate and public health. Delivering these aims will also require an unprecedented and comprehensive suite of regulations, funding instruments and policy initiatives over the next four years. We propose a four-year government-led programme that:

- Creates and funds a **National Retrofit Taskforce** with the primary aim of achieving an average Energy Performance Certificate (EPC) rating of C for all homes by 2030, beginning with this four-year programme.
- Provides additional **public capital investment** of an average of **£8.66bn** per year for four years from 2020-2024, much of it supporting low-income households through grants – while also unlocking a cumulative total of around £71.95bn of **private capital investment** in that timeframe.
- Introduces tax changes in the form of a fiscally neutral, **variable Stamp Duty Land Tax** for more efficient homes, and equalises the **VAT** treatment for all retrofitting works at 5%, provided the whole property is brought above certain EPC thresholds. In addition, the package includes green mortgages, public backed zero-interest loans and a boiler scrappage scheme, as incentives for 'able to pay' homeowners and landlords.
- Strengthens **Building regulations**, including new mandatory energy efficiency works for 'consequential improvements', and support new **business models, standards, supply chains and skills** necessary to provide 'whole-house retrofits' for 8.69m UK homes.
- Supports a long-term **Area-Based Delivery** approach, with local authorities playing a core role in tackling fuel poverty, creating demand and growing local supply chains.

1. INTRODUCTION

Worldwide, the health and economic consequences of coronavirus are still unfolding. Hundreds of thousands of people have died, tens of millions more have lost their jobs, and much of the global economy is at a standstill. While the full shape of the recession remains to be seen, it is clear that the virus and the lockdowns introduced by governments are having a profound effect on our economies. Early estimates suggest that the UK economy will contract by 35% in spring 2020,¹ unemployment is expected to rise to 10%,² frontline services are witnessing a rise in homelessness,³ and our social safety net is increasingly overwhelmed, with almost half a million new applications to universal credit (UC) in the first fortnight of the lockdown.⁴

The UK government has a number of economic recovery tools at their disposal, so it has some important decisions to make. The shape of the economy that emerges after is not predetermined. This crisis will require us to fundamentally change, reshape and reimagine our economy, who it serves, and what its purpose is. Far from going back to business as usual, we can redesign the economy around the things we value most. In 2020, we cannot afford to recover from the recession in a way that doesn't set us on a path towards ambitious climate goals, reduce inequality, and create a more inclusive and resilient society than we had before.

Like other recessions, this one has seen a fall in CO₂ emissions, with the International Energy Agency (IEA) predicting an 8% drop in emissions this year.⁵ Emissions also fell sharply during the 2008 global financial crisis, but they quickly resurged on a wave of carbon-intensive stimulus spending, as governments moved to restart their economies.⁶ The government must learn from history and pursue a post-coronavirus stimulus spending package that accelerates climate action instead.

Whilst the UK has partially decarbonised many areas of its economy, emissions from buildings remain stubbornly high. Recent policy failures and the withdrawal of zero-carbon home standards mean that very little progress has been made in recent years. In this report we make the case that investing in a programme of housing retrofit as a green recovery measure would meet the dual aims of generating economic growth and hundreds of thousands of new jobs, while decarbonising existing homes, which produce 20% of the UK's CO₂ emissions and use 35% of its energy. Thus, these proposals represent a 'New Deal' scale re-employment and economic stimulus – echoing the public works programme of the pre-war Roosevelt administration and the UK's post-war reconstruction and social housing programme. The decarbonisation of homes and

heat is an unavoidable part of our net-zero aspirations, and we must begin now to stand any chance of success.

This green stimulus for housing will require massive investment in the nation's housing stock, an extensive training and capacity-building programme and a renewed role for businesses, government, local authorities and civil society. As well as delivering 21% saving in CO₂ emissions from homes over the course of the current parliament, this project will deliver 500,000+ jobs, a £25.60bn net benefit to the exchequer and improved standards of living, health and wellbeing for millions of households in Britain. This will require a step-change in how housing is built and how home 'retrofit' is regulated, funded and delivered. In this report we set out proposals which would begin this transition for existing homes, recognising that this momentum would need to continue throughout the 2020s and 2030s to meet the UK's climate change goals.

1.1 WHY A GREEN STIMULUS?

As outlined by the New Economics Foundation (NEF) in January 2020, before the coronavirus pandemic hit, the UK was already heading for a recession. The uncertainty around Brexit and the potential shock leaving the EU would create in our economy, and the general passage of time since the last recession meant that risk was accumulating.⁷

Fast forward less than three months to March, when, as the coronavirus pandemic swept across the world, most governments were undertaking measures that essentially put their economies on ice. Following these lockdown measures in the UK, monthly gross domestic product (GDP) fell by 5.8% in March, and then 20.4% in April, both the biggest monthly falls on record.⁸ This contributed to the economy shrinking by 2% in the first quarter of the year, prompting a number of concerning economic forecasts for the year ahead. In May, the Office for Budget Responsibility estimated that GDP could fall by 13% in 2020.⁹ In June, the Organisation for Economic Co-operation and Development (OECD) estimated that the UK economy is likely to face the deepest downturn among advanced nations, projecting the economy will contract by 11.5% in 2020 if the world avoids a second wave of coronavirus, and 14% if there is a second wave.¹⁰ At this stage, a 'V-shaped' recovery, where the economy recovers quickly and strongly following a sharp decline, is looking unlikely, with the OECD predicting that GDP levels will remain more than 5% below the level projected before the crisis by the end of 2021 in the single-wave scenario. The Bank of England has warned the UK is set to enter its worst recession in 300 years.¹¹

Monetary policy, traditionally regarded by orthodox economists as the primary tool in a government's recession-fighting toolbox, is largely exhausted in the UK. Both interest

rates and quantitative easing are reaching their ‘effective lower bounds’, a point beyond which further reductions have little or no positive effect on spending in the economy. When the government’s temporary furlough scheme ends, the only economic stabiliser left will be the widely criticised universal credit (UC), which is already overwhelmed. Unemployment is expected to reach levels not seen since the 2008 financial crisis, and there were almost half a million new UC applications in less than two weeks at the end of March, 10 times higher than the normal number.¹²

The limited scope of monetary policy and the weakened state of the UK’s fiscal stabilisers (our welfare system) means that discretionary fiscal policy has a far larger role to play in combatting this recession. But any injection of spending into the economy at this stage will have profound implications for the direction of the UK economy in years to come. There is growing consensus that the fiscal stimulus measures pursued by the government must be green, putting the UK on a pathway to our Paris agreement goals and net-zero targets whilst driving economic recovery and building social resilience.

1.2 THE CASE FOR HOUSING RETROFITS

The case for housing retrofits was already clear before coronavirus. In the UK, energy used in homes constitutes around a fifth of totalⁱ CO₂ emissions.ⁱⁱ ¹³ The Climate Change Act’s 80% carbon reduction targets for homes imply at least a 24% reduction in directⁱⁱⁱ CO₂e from 1990 levels by 2030, with near-zero emissions needed by 2050.¹⁴ Recent commitments to net-zero carbon in 2050 will necessitate an even more ambitious strategy – as set out in this document.¹⁵

While the UK has made progress in decarbonising electricity emissions, reductions from buildings and heat have plateaued since 2012, and actually increased on a temperature-adjusted basis in 2016 and 2017.¹⁶ This is due to an old and inefficient building stock, and the continued use of fossil fuel heating from gas and oil boilers.¹⁷ The current housing stock will remain a major energy consumer in 2050, with 80-85% of today’s homes likely still standing.¹⁸ What is more, with the scrapping of the Zero Carbon Homes targets in 2015, new homes built in 2020 will need to be retrofitted to meet our climate change objectives – a shocking state of affairs.¹⁹

Calls for the government to pursue a housing retrofit programme have only intensified in response to the current pandemic and recession. Recent papers by Cameron

ⁱ This includes both direct emissions from fuels used for heating and hot water as well as indirect emissions from lighting and appliances

ⁱⁱ Hereafter referred to as carbon dioxide equivalents (CO₂e)

ⁱⁱⁱ Direct emissions exclude emissions from the generation of electricity supplied through the grid

Hepburn, Joseph Stiglitz and Nicholas Stern,²⁰ the UK's Committee on Climate Change,²¹ the Energy Efficiency Infrastructure Group,²² and the Energy Transitions Commission²³ all include retrofitting as one of their key recommendations for a government-funded programme that will create jobs and kick-start a green recovery, helping us to 'build back better'. This renewed case is clear:

- **Retrofitting UK housing will create jobs in all regions of the UK, and in sectors hit hardest by the recession.** Studies of the macroeconomic impacts add further evidence for the benefits of energy-efficient improvements to homes. Cambridge Econometrics estimate that raising every home in the UK to EPC level C would sustain at least 108,000 new jobs annually between 2020-2030.²⁴ Construction has been one of the hardest hit sectors in this crisis, with 41% of staff furloughed in April 2020, second only to the hospitality industry.²⁵ Macroeconomic modelling by Leeds University suggests that ~£183bn capital investment in energy efficiency in buildings would lead to an additional cumulative increase in UK GDP of 1.27%, and in wages of 0.56% over the ten years to 2030.²⁶ Multiple studies show that the multiplier effect of home energy efficiency is significantly higher than other forms of investment such as road, rail or electricity generation infrastructure, with economic benefits likely to be felt in every community.^{27 28 29}
- **Energy cost savings for households reduce inequality and boost consumer spending on local goods and services.** One in ten UK households are in fuel poverty,^{iv} a product of income inequality, the poor condition of the housing stock, and rising energy prices - with the private rented sector (PRS) containing the highest proportion of fuel poor households (21.3%).^{30 31 32} Many households in fuel poverty are forced to choose between heating and other essential expenditures such as travel, clothing or even food.³³ This often leads to under-heating in winter, creating serious health problems particularly for young children and the elderly.³⁴
- **Retrofitting homes will result in savings to the National Health Service (NHS).** It is estimated that of the 31,100 excess winter deaths in England and Wales in 2012/13, 30-50% were due to cold indoor temperatures.³⁵ Improved winter warmth and lowered relative humidity have proven benefits for cardiovascular, respiratory, and mental health.³⁶ Indeed for every £1 spent on

^{iv} The definition of fuel poverty in the UK is where fuel costs are above average (the national median level), and these fuel costs leave a residual income that is below the UK's official poverty line. DECC (2013) Fuel Poverty: a Framework for Future Action (Issue July). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211180/FuelPovFramework.pdf

retrofitting fuel-poor homes, an estimated £0.42 is saved in NHS spending.³⁷ It has been estimated that spending £10bn to improve all of the 'poor' housing in England would save the NHS £1.4bn per annum and would pay for itself in just over seven years – and then accrue further benefits.³⁸

Consequently, a widespread home energy 'retrofit' program is likely to be one of the most effective forms of green stimulus, having wider benefits for income inequality, public health and climate change.

2. PROPOSAL: A GREEN STIMULUS FOR HOUSING

This report makes the case for a massive government backed ~£85bn program of capital investment in home retrofit over the next four years. This program would put the UK on track for its 2050 net-zero carbon targets through the adoption of lowcarbon heat technologies and eventually ensure the vast majority of homes are EPC C or above by 2030. As we will show, this plan is fundamental for creating hundreds of thousands of jobs, growth and prosperity in response to the Covid downturn, and will deliver further huge benefits for the climate, public health and inequality.

2.1 WHOLE-HOUSE RETROFIT

Retrofit involves introducing (retrofitting) new materials, products and equipment into an existing building with the aim of reducing energy use. However, the historically piecemeal approach incentivised by government policies has often created damaging unintended consequences in homes.^{39 40 41 42} Often insulation is installed without consideration of moisture and ventilation, and heating systems are installed without consideration of insulation or heat emitters – leading to higher bills.⁴³ The central pillar of our green stimulus for housing must therefore be a ‘whole house’ approach to retrofit, which combines improvements, from fabric to ventilation to microgeneration, to optimise the performance of the building as a whole. While these might still be implemented in stages, this approach differs to the current status quo by promoting the interaction of multiple measures at the earliest stages.⁴⁴

A recent report by the Department for Business, Energy and Industrial Strategy (BEIS) Select Committee outlines how the current government’s longer term plan to address emissions from existing buildings is “woefully inadequate” for the net-zero emissions goal.⁴⁵ They argue the sheer scale of the task will now necessitate millions of multiple measures to be installed at once, in a move towards whole-house retrofits.⁴⁶ Moreover, given the timescales, we do not have time to go back to homes a third or further time – a whole-house approach is more efficient.

2.2 MODELLED SCENARIO TO 2024

The UK residential decarbonisation agenda has been plagued by a lack of leadership and ambition for over a decade. Ineffective policies such as the Green Deal have caused the Committee on Climate Change (CCC) to revise down their ‘cost effective’ mitigation

scenarios for buildings for the fourth and fifth carbon budgets running to 2032.⁴⁷ Previous studies have quantified the potential savings to meet and exceed carbon budget targets, including a study by Cambridge Econometrics which modelled the impact of bringing all homes in the UK to EPC C by 2035.^{48 49 50}

However, the impending economic impact of Covid-19 combined with the UK's new net-zero commitments provides a strong case for going further in the near term. Many 'cost effective' scenarios only factor the microeconomic costs and benefits and have pushed broader macroeconomic impacts to the periphery; while most were conceived when the UK was targeting only an 80% reduction in 2050 emissions. We therefore argue that the macroeconomic benefits of retrofit and the increased urgency of the Covid-19 crisis justify a plan which is at least a third more ambitious than Cambridge Econometrics'. This strategy also sees a significantly expanded role for low-carbon heat and renewable microgeneration – reflecting the importance of heat electrification and solar photovoltaic (PV) for the wider jobs and decarbonisation agenda.

To understand the impact of these proposals on energy demand and CO₂ emissions, housing stock analysis specialists Parity Projects undertook a Carbon Reduction Options for Housing Managers (CROHM) model assessment. This modelling is based on data from the English Housing Survey (EHS) data for 2016. The EHS was conducted for 12,292 properties in England but scaling figures were provided to allow for extrapolation to the whole of the UK, providing a dataset of 27,227,700 properties.

The CROHM whole-house retrofit strategy includes targets for the three key types of measure. These targets are consistent with a 2050 net-zero trajectory that would see the vast majority of homes meet EPC C or better by 2030, an additional widespread adoption of heat pumps,^v other low-carbon heat sources and PV panels. Based on the analysis from the CROHM strategy, our near term 2023/24 targets for each type of measure are:

- **10% (~38TWh) reduction^{vi} in heat demand** through energy efficiency improvements
- **87-fold increase^{vii} in low-carbon heat** with around 10% of homes heated by heat pumps

^v Current EPC methodologies do not see an improvement in EPC score from heat pumps, as the EPC metrics are based on running costs only, however, evidence is emerging which shows smart and flexible operation of heat pumps can lead to significant bill savings. (Rosenow, J., & Lowes, R. (2020). Heating without the hot air: Principles for smart heat electrification Regulatory Assistance Project (RAP)®)

^{vi} Based on BEIS 2018 data. BEIS, Energy Consumption In The UK, Department for Business, Energy and Industrial Strategy, 2018. Retrieved from: <https://www.gov.uk/government/statistics/energy-consumption-in-the-uk>

^{vii} Current number of low carbon heat systems assumed to be 78,791 Source: <https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-april-2020>

- 135% increase^{viii} in microgeneration from renewables (7.4GW, mostly rooftop PV)

2.2.1 Energy demand reduction

To meet the 10% demand reduction target, the CROHM model adopts a range of energy efficiency measures as shown in Figure 1. The model selects available measures on the basis of their cost effectiveness, until it meets a specific energy target or budget. As shown by the figure, the largest share of savings comes from continued adoption of efficient boilers and hot water systems, with the remaining 49% coming from energy efficiency measures to the building fabric.

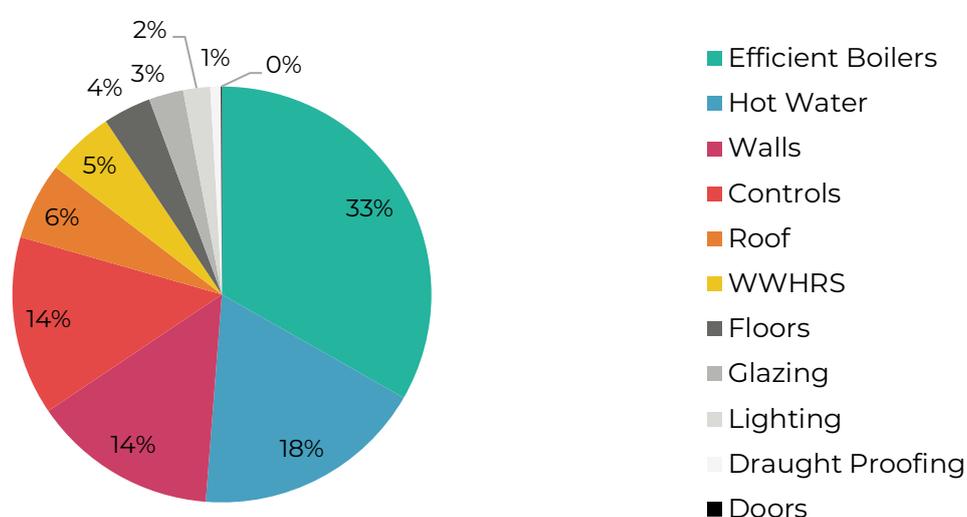


Figure 1 Percentage contribution from energy demand reduction measures

2.2.2 Low-carbon heat

Our proposed green stimulus package also includes a major heat decarbonisation program. Progress in decarbonising heat has been very slow to-date and therefore is starting from a very low baseline of around 79,000 homes.^{ix} Over the four years of our scenario we model the adoption of 2.6m heat pumps, or an average of around a 665,000 a year to 2024. This would represent approximately one third of all the heating systems replaced in this period and an 87-fold increase in low-carbon heat from today. An additional 3.8TWh of heat demand is assumed to come from other low-carbon heat sources such as solar thermal systems, biomass boilers and hydrogen boilers.

^{viii} Current capacity is assumed to be 5.2GW Source: <https://www.gov.uk/government/statistics/solar-photovoltaics-deployment>

^{ix} Current number of low carbon heat systems assumed to be 78,791. ONS (2020) RHI monthly deployment data: April 2020. Retrieved from: <https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-april-2020>

2.2.3 Microgeneration

Our proposals further commit to a massive expansion of rooftop solar PV to over 3.8m available roofs. This would amount to an additional 7.4GW (8.3TWh) of PV in the total electricity mix, assuming an average array size of 2.5kW. We assume contributions from other sources such as micro-wind to be negligible.

These combined measures would result in around a 15% domestic energy demand saving by 2023/24 shown in Table 1. As shown, many homes would receive demand-reducing energy efficiency measures, low-carbon heat and PV panels. These measures would cumulatively move the average UK home 5 Standard Assessment Procedure (SAP) points from an EPC D to an EPC C in under five years, despite treating less than one third of homes.

Table 1 Cumulative impacts of home retrofit scenario on domestic energy use to 2023/24

	Baseline	Optimise d demand reduction	+ Heat pump	+ Other low carbon heat	+ Micro- generation (PV)**	Total
Count of properties affected	-	8,689,091	2,619,801	4,212,009	3,815,607	8,999,191*
Average UK EPC rating (SAP score)	D 64.4	D (67.2)	D (67.5)	D (67.7)	C (69.3)	C (69.3)
TWh Savings (Including in use factors)	-	38.15	17.69	3.75	8.27	67.85
Savings as % of domestic demand	-	10%	4.4%	1%	7%**	15%

*This is the total count including overlapping measures

**This % figure is based on domestic electricity demand

2.3 DEPLOYMENT RATES

Parity Projects' model also provided deployment rates in terms of number of homes retrofitted each year to 2024. Current retrofit rates are unclear, with a lack of available data. However, we assume no more than 500,000 energy retrofits are being delivered either voluntarily or under government schemes such as the Energy Company Obligation scheme (currently only treating around 100,000 homes a year).⁵¹

Starting from this low baseline, our scenario assumes an initially slow ramping up of measures in 2020 before a rapid uptake through 2021-2024. This scenario leads to a peak of ~3m retrofitted homes a year in 2023 – broadly equivalent to the current UK renovation rate of around 10%.⁵² This would require deployment commensurate with what was originally conceived under the Green Deal.⁵³ Annual solar PV installs would need to re-establish growth rates seen during the previous boom period of 2014-15,⁵⁴ while low carbon heat installs would need to increase exponentially; although the latter would partially supplant the annual 1.7m boiler replacements. These deployment figures – although an order of magnitude larger than current activity – have some precedent in historic renovation, renewable energy and heating market activity. These trends are summarised in Figure 2.

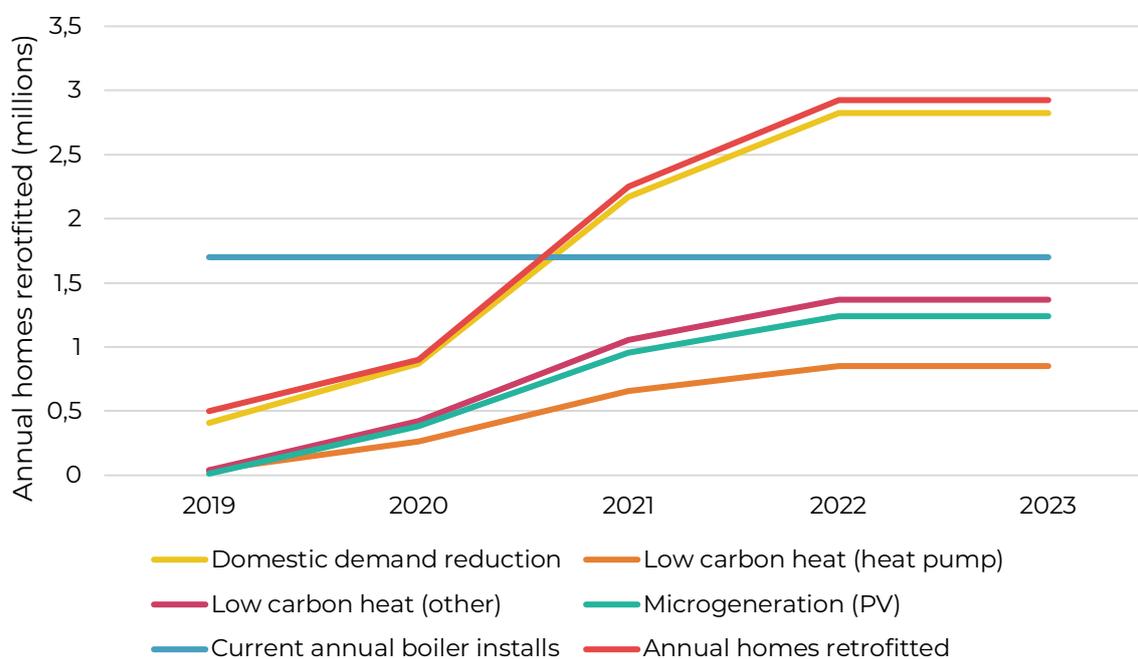


Figure 2 Annual rate of deployment across key retrofit measures proposed to 2023

2.4 IMPACTS

2.4.1 Jobs

The UK currently lacks sufficient capacity for the scale of programmes needed to put us on a path towards net-zero carbon. The existing renovation maintenance and improvement (RMI) sector represents 12.09% of the UK construction industry.⁵⁵ 2008 was a high point for the industry with 242,779 employed, although more recent figures for 2017 are a more modest 160,255. It is this existing market that would need to be expanded to deliver the retrofit aspirations of this report. Data on home improvement

rates is patchy, although Hiscox insurers state that renovation rates increased from 3% in 2013 to 15% in 2017.⁵⁶

Using employment data from Retrofitworks' area-based initiatives, we undertook a detailed bottom-up analysis of required construction workers based on our scenario.^x Many existing contractors will be involved in delivering retrofit, however, an army of hundreds of thousands of new tradespeople additional to those in the existing RMI sector will be needed. Following discussions with industry experts during the consultation for this report, a period of three to four years was thought to be required to train up the supply chain to full capacity.

The construction industry has been one of the hardest hit in the current crisis, with 41% staff furloughed in April 2020, second only to the hospitality industry.⁵⁷ Based on our deployment scenario, we see an initial 103,549 new tradespeople employed in year one, peaking at 336,533, in year four. This compares favourably to annual construction job increases of 145,200 (1999), 152,900 (2003) and 107,800 (2010) in previous years.⁵⁸ In addition, we assume a significant role for specialist Retrofit Coordinators, with an average of 35,655 employed throughout the period. These trends are summarised in Figure 3, showing the existing RMI industry and the gradual ramp up of jobs over the period. This would sustain an average of 294,527 annual construction jobs between 2020-2024, a 22% increase in total construction employment and a 162% increase in the RMI sector.

^x Parity Projects calculated the number and type of tradespeople required to undertake the work outlined in their Carbon Reduction Options for Housing Managers (CROHM) model, outlined in the previous section. Those numbers were then used to identify the uplift in people needed beyond those that existed in the UK based on ONS Construction Statistics Annual, Number 19, 2018 edition.

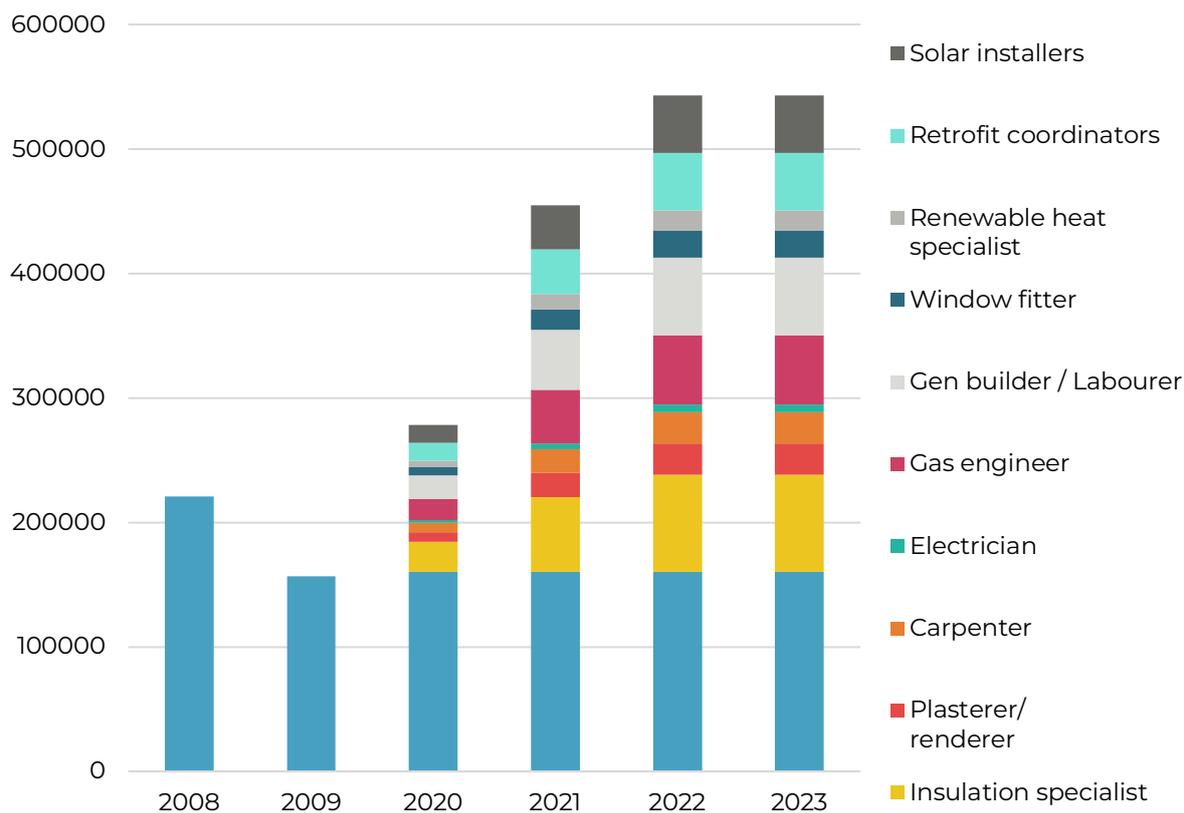


Figure 3 Direct employment impact of proposed retrofit programme

A government spending package designed to create jobs will have two phases: immediate need – where the existing workforce can be mobilised, and people made recently redundant can be supported to work in the retrofit sector – and medium-long term need, where there is adequate time to have trained new entrants to the sector.

The sweet spot for targeting training will consider priorities. Those works that can be supported with apprentices that are available quickly can start soon. Those where people being made redundant from other sectors – who are in need of deeper training – will come on stream more slowly and ramp up further down the track. The ability of the retrofit market to be this nimble whilst mobilising almost instantly makes it a standout sector for supporting an ailing economy whilst having an immediate impact on the environment.

This ability to mobilise immediately requires smart thinking about which jobs can be stimulated most effectively based on immediate customer demand. Further, it requires considering which measures have a supply chain that is ready with minimal re-training and a high confidence in quality installations. As time goes by, measures can be added

that require larger volumes of new apprentices come on-stream after their initial training.

However, our view is that all of this cannot proceed without each home having a clear plan toward net zero. Any indiscriminate installations that block the lowest cost and least hassle path to net zero make the long-term cost of implementing a national retrofit plan much higher than it is now.

In addition to direct employment in the construction industry, we also assume a significant increase in indirect jobs in the wider economy and supply chain. Following ONS assumptions for the ratio of direct vs indirect jobs in the low carbon industries we assume the energy demand, low carbon heat and solar PV scenarios produce 0.77, 1.06, 0.96 indirect jobs per direct job respectively.⁵⁹ Thus, based on the share of spending for each of these aspects of the scenario, the total number of indirect jobs created by the scenario is estimated to be an average of 220,630 per year. Taken together the direct and indirect employment impacts are therefore estimated to sustain an average of 515,157 new jobs between 2020-2024.

2.4.2 Macroeconomic impacts

Investment in dwellings leads to a positive economic impact on industries supplying the construction sector with energy efficiency products. Changes in expenditure on energy affect consumption outlays and thus revenues of consumer-facing industries and their supply chains. Based on macroeconomic modelling undertaken by the University of Leeds as part of a wider 2030 scenario, we estimate that the measures outlined in this report would increase economic activity significantly.⁶⁰ Our modelling shows that the level of annual GDP is expected to be 1.58% (or £36.34bn in 2020 prices) higher in 2023/24, compared with current forecasts for that year with no intervention.⁶¹

2.4.3 CO₂e savings

The retrofit plans set out in this report, would make a significant contribution to reducing the UK's CO₂ emissions. Parity Project's modelling indicates that a cost-optimised approach, set out in the previous section, would save approximately 19.23Mt CO₂ a year in 2023, reducing emissions from the UK's homes by around 21% from 2019 levels. Following the deployment scenario outlined in our proposal, this would represent

a cumulative 40.9 MtCO₂^{xi} by 2023/24. Adopting this policy proposal alone could surpass the UK's fourth carbon budget targets.

2.4.4 Energy bills and wider benefits

The retrofit measures outlined in the scenario for existing homes result in significant savings in energy bills for households (Table 2). Total savings amount to £3.76bn per year by 2023 or an average of £418 for each home retrofitted. Whilst some of these savings may be initially offset by loan repayments for the 'able to pay' households, these savings will provide an immediate and significant benefit to those homes who qualify for low income and fuel poverty grants.

Table 2 Impact of scenario on domestic energy bills by 2023/24 and wider benefits

	Optimise d demand reduction	Heat pump	Other low carbon heat	Microge- neration (PV)	Total
Net energy bill savings	£2.39bn	£0.18bn	£0.15bn	£1.04bn	£3.76bn
Average savings per home retrofitted	£276	£70	£36	£272	£418
Average savings per UK home	£88	£7	£5	£38	£138

Assuming the measures installed would have a minimum lifespan of 15 years, and no further measures were installed, we estimate the cumulative bill savings to be £53.17bn by 2035. Quantifying the financial value of wider societal benefits is fraught with difficulty and questionable assumptions. Acknowledging these caveats and adopting the same methodology as Cambridge Econometrics and Rosenow et al,^{62 63} we estimate undiscounted 2035 benefits for avoided CO₂e (£15.49bn), improved health (£10.89bn), comfort (£10.89bn) and air quality (£9.92bn), as seen in Figure 4. These benefits amount to a combined total of £100.43bn by 2035 while many benefits would be expected to continue post-2035.

^{xi} These figures are based on the assumption that the electricity grid is decarbonised to 50g/CO₂e/kWh, by 2030.

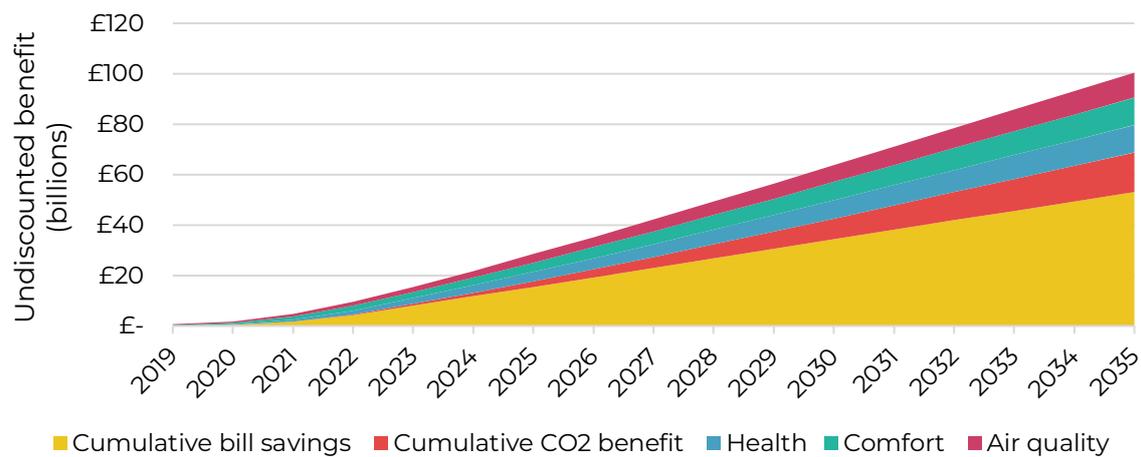


Figure 4 Cost estimates for environmental and direct economic benefits

3. COMPREHENSIVE POLICY APPROACH

Delivering these ambitious goals will mean overcoming a range of interrelated barriers which currently suppress demand for whole-house retrofits. These include a widespread lack of information, engagement and trust with households on the options for, and advantages of, retrofit, and perception that retrofit has uncertain benefits and concerns over low-quality workmanship, with limited guarantees on performance. This strategy must also reduce complexity, disruption and integrate with the timing of wider renovation decisions. Further, policies are needed to overcome the up-front capital cost of measures and split incentives, between landlords and tenants, or those looking to move.

Policy must also recognise that the primary motivation for upgrading one's home is unlikely to be energy bill savings alone. Those who do choose to retrofit also do so for greater comfort, a healthier internal environment, visual improvement, solving a problem such as a faulty boiler, or environmental concerns.⁶⁴ By emphasising these aspirational aspects and integrating with wider renovation decisions, retrofit can become something that is desired and sought out by the public. Delivering these aims will require a sophisticated and systematic approach, involving a broad range of policy instruments and initiatives as set out below.

3.1 FISCAL INCENTIVES AND FUNDING

A range of **fiscal incentives** will be needed at key 'trigger points', designed to nudge renovation decisions towards energy retrofits when moving to a new home or undertaking wider renovations. Although reduced VAT on retrofit-led renovations will have a cost to the exchequer, others, such as Stamp Duty rebates, can be made fiscally neutral.

- **Stamp Duty Rebate.** A system of variable Stamp Duty rates and rebates would see house buyers receive a discount if a property is above a given energy efficiency standard or pay a higher rate if its performance is poor, encouraging new buyers to improve the energy performance of their home in a given period. Parity Projects modelling estimates this mechanism could facilitate around 1.8m whole house retrofits between 2020-2023/24.^{xii}

^{xii} The variable rate of stamp duty assumes that new homeowners would undertake efficiency improvements commensurate with stamp duty savings based on relative EPC ratings – with higher

- **Reduced VAT on retrofit-led renovation:** Normally, renovation works on an individual's private residence are subject to VAT at 20%. However, VAT of 5% already applies on commercial residential conversion work and the installation of certain energy-saving and generating measures. In order to stimulate demand for retrofit, government could extend the reduced 5% VAT rate to cover all wider extension or renovation works under a certain cost or eligibility ceiling, provided a certain EPC rating was achieved. Contractors could therefore offer reduced quotes for wider works which include energy efficiency, driving a supply-chain led uptake. Assuming current wider renovation rates and spending, Parity Projects modelling estimates this mechanism could facilitate around 2.4m whole-house retrofits over four years.^{xiii}

We propose a **tiered funding approach**, with government-funded grants for those on low incomes and fuel poverty, zero-interest loans (especially important for the private rented sector) and means tested Green mortgages for owner occupiers. These different instruments will be funded through a mix of government spending (repurposing the coronavirus financing facility that has so far supported businesses through the current crisis to now offer zero-interest loans for green infrastructure) public bank/municipal bond finance and private sector lending. These mechanisms will need to ensure that they address the fuel poverty crisis, pervasive split incentives and fund a wider range of non-energy improvements.

- **Government grants for low-income households.** The current supplier obligation (ECO) led fuel poverty approach, should be replaced by direct government grants for whole-house retrofits, funded by general taxation. Funding grants in this way, rather than through electricity bills, removes the regressive impact from higher energy costs and reduces perverse incentives for the electrification of heat.
- **Low/zero-interest loans.** The high cost of capital for unsecured private finance and the split incentives between landlords and tenants should be addressed by new zero interest loans tied to the property not the individual. These loans

performing homes receiving a rebate, and lower performing homes paying increased stamp duty. This scenario uses the floor area and a degree of randomness to apply a market cost from 5 bands, based on actual sales figures; under £250k, £250k-£500k, £500k-£1m, £1m-£2m and over £2m. The amount of stamp duty that would be due was then calculated from the mid-way point of the cost band.

^{xiii} We recommend that government makes changes elsewhere in the tax system to fully reverse the potentially regressive distributional effects of a £1bn per year reduction in VAT for homeowners. For example, reducing allowances in capital gains tax to raise the offsetting £1bn per year from the realisation of profits from asset disposals would ensure that the tax system as a whole becomes more progressive overall, rather than less.

should be sufficient in scope and scale to fund the full range of measures necessary and adopt a sliding scale of grant to loan ratios based on means testing.

- **Green Mortgages.** The existing mortgage market should be expanded and altered to incentivise increased lending for retrofit measures as well as reduced rates of interest for highly efficient properties. These mortgages will largely be aimed at the able to pay, owner occupied sector, although will need careful integration with the schemes outlined above to ensure all households are able to access financing appropriate to their means.
- **Boiler Scrappage Scheme.** As a supplement to the fuel poverty grant scheme above, we propose that government adopts the currently proposed £4,000 Clean Heat Grant scheme to all homes but increases its scale by an order of magnitude to fund 100,000+ heat pumps in the first years of the program.⁶⁵ This cash grant would be made available to low-income homes and off-gas grid properties and would be expected to make a significant impact in the off-gas grid segment.

3.2 LEADERSHIP AND DELIVERY

Achieving the promise of residential retrofit and tackling the multiple challenges that stand in the way will require a joined up and co-ordinated strategy. To meet net-zero ambitions and end the UK's pervasive fuel poverty issues, we propose that the government bring forward the EPC C target for all homes to 2030 and make this a legally binding minimum energy efficiency standard at the point of sale or rent.

- **National Retrofit Taskforce:** To deliver this vision, we argue the UK government should fund a National Retrofit Taskforce, with overarching statutory responsibility for the retrofit agenda and in meeting targets. We propose that the Taskforce co-ordinates the implementation of the wider Area Based Delivery strategy and engages different government departments and other key stakeholders. This cross departmental Taskforce could be modelled on an upscaling of the successful Home Energy Efficiency Programmes for Scotland (HEEPS) program, the National Infrastructure Commission and the previous Zero Carbon Hub for new homes.
- **Area Based Delivery:** There is growing consensus for an 'Area Based Delivery' model for retrofit and regeneration activity in local areas. Such a scheme would need to have multiple functions: awareness-raising initiatives to engage communities, co-ordinating the supply chain, administering government grants and finance, providing quality assurance and redress services as well as

collaborate with the pre-existing network of community actors and intermediaries. Central government would therefore need to provide significant additional funding to local authorities to fulfil this role, after a decade of austerity.

- **Building Renovation Passports:** There remains a lack of knowledge surrounding the current condition of homes, the appropriate measures that could be implemented and the order in which they should be undertaken. We therefore propose an area-based strategy to radically improve the availability and quality of home energy data through Building Renovation Passports (BRP) providing a long-term (15-20 years) step-by-step renovation roadmap for a specific building, resulting from an on-site energy audit established in dialogue with building owners/occupants. This area based update of the UK's EPC database and free BRPs to all low-income households is estimated to cost ~£146.2m annually.

3.3 BUSINESS MODELS

Integrated 'one-stop-shop' business models – where contractors provide an end to end service alongside traditional building/renovation work – will catalyse the wider refurbishment market into energy retrofits. These business models represent current best practice – commonplace in the rest of northern Europe – and will need to become the norm in the UK. We also propose innovation support for energy performance contracts and mass-produced net-zero carbon retrofits – such as the Energiesprong initiative – in the social housing sector.

- Provide £62.5m/year innovation deployment funding for new retrofit business models and supply chain innovation including net-zero energy performance retrofits
 - Mandate one-stop-shops as the core business model to deliver whole-house retrofits for the 'able to pay' as part of the Area-Based Delivery
 - Fund regional trials of energy performance contracting for Energiesprong/net-zero retrofits for social housing, although make future funding contingent on cost savings

3.4 STANDARDS, SUPPLY CHAIN AND SKILLS

Significant opportunities exist to embed retrofits within the existing RMI market, requiring new regulations and enforcement. Retrofit must also be undertaken to the highest possible standards by competent and properly trained contractors, necessitating a nationwide training program based on an increasingly professionalised industry. Avoiding another Grenfell will require a root and branch review of both retrofit

standards and Building Regulations to ensure a joined-up approach to energy efficiency, product quality, fire safety, and disability access in new and existing homes. In addition, government should support innovation in supply chains and delivery processes to realise much needed cost savings and efficiency within the industry.

- **Strengthening building regulations:** New legislation should require homeowners to carry out energy efficiency improvements to the rest of their property when undertaking 'consequential improvements' which impact building regulations. These measures would be proportionate to the cost of the original 'trigger' works and would provide a complementary 'stick' to the 'carrot' of reduced VAT on retrofit led renovation.
- **Retrofit standards and enforcement:** Government should undertake a root and branch review of building regulations, material certification and enforcement; with particular emphasis on moisture, indoor air quality, fire safety and disability accessibility implications of retrofit measures and existing dwellings. This should include mandatory compliance standards including Retrofit Co-ordinators, PAS 2035 and Building Renovation Passports for all retrofitted homes.
- **Training and education:** Addressing the huge skills gap and job requirements of this program will require a massive training program. The Construction Industry Training Board (CITB) should therefore be comprehensively reviewed and a reform programme instituted, including an increased £50m per year of public funding for new retrofit focused further education courses, academic qualifications and apprenticeships.

4. COSTING AND FUNDING SCENARIOS

4.1 SCENARIO 1: PUBLIC SECTOR FINANCE ONLY

The Parity Projects' model estimated total costs for each of the three types of measure, allocating them on the most cost-effective basis to meet the target. In Scenario 1 we assume these improvements are fully financed via government grants to low-income homes, and state-backed 0% interest loans for 'able to pay' households. Here we use Cambridge Econometrics' assumptions on the ratio between low-income and able to pay homes. We assume an initial cost of capital of 1% - reflecting the current historically low borrowing costs – with a loan term of 25 years. This interest rate would then be subsidised down to zero – similar to the mechanism that has successfully been adopted in Germany for over 15 years.⁶⁶

Floor and solid wall insulation costs are assumed to decrease by 30% by 2030 from today's rate,⁶⁷ resulting in total demand reduction costs of £49.98bn to 2023. We assume that heat pump costs decline by 37% over the period to 2030.⁶⁸ We therefore estimate that low carbon heat systems would cost an additional £26.01bn over the four-year period. Rooftop solar is estimated to reduce from £1000/kWp today to approximately £798/kWp in 2030.⁶⁹ Here 7.04GW of solar PV is estimated to cost an additional £9.23bn. Factoring the cost of capital, this scenario therefore has the lowest level of financing, at £93.56bn and would cost on average of around £9,484 for each of the 8.69m homes retrofitted.

4.2 SCENARIO 2: PRIVATE FINANCE AND GREEN MORTGAGES

In Scenario 2 and following the policy option modelling we assume that approximately £16.91bn of this total investment is funded through mortgages: triggered by the variable Stamp Duty Land Tax and 5% VAT on retrofit led renovations. Here we assume a 4% interest rate over 25 years for green mortgages, with these investments spread in the same way across both time and between funding sources.

Should the government choose not to develop a public finance mechanism for the remaining investment or subsidise the interest payments, the overall cost of the programme would be considerably higher (£124.2bn). Cambridge Econometrics' scenario assumed that unsecured loans provided through a private sector lender would carry an 8% interest rate (akin to the Green Deal) would be reduced to 5%, should the government guarantee the loans.

Therefore, assuming a 5% interest rate on these privately provided loans leads to an increase of £30.64bn in the total undiscounted cost of the program vs Scenario 1. This is due to the private banks requiring a greater return on investment and higher interest rate for this type of unsecured lending. This also leads to a considerably higher cost per household, which could negatively impact the economic viability of deeper measures such as solid wall insulation, even on the 25-year payback periods assumed in this report. This scenario has an average cost of around £13,801^{xiv} for each of the 8.69m homes.

4.3 SCENARIO 3: PUBLIC FINANCE AND GREEN MORTGAGES

In Scenario 3 (our central scenario) we therefore propose to retain but reduce the total size of the public loan scheme, to include green mortgages – alongside that the public bank/municipal bond mechanism. The total level of finance required by the program (£100.15bn) is presented in Table 3 with average cost of around £10,461 for each of the 8.69m homes retrofitted.

Table 3 Distribution of government grants, green mortgages, zero interest loans and interest rates

	Low income grants (£bn)	Able-to-pay scheme (£bn)	Green mortgages (£bn)	Interest buy down - able-to-pay (1%) (£bn)	Mortgage interest payments (4%) (£bn)	Total govt. investment (£bn)	Total cost (£bn)
2020	£2.22	£4.62	£1.69	£0.60	£0.88	£2.82	£10.02
2021	£5.55	£11.56	£4.23	£1.50	£2.20	£7.05	£25.04
2022	£7.21	£15.03	£5.50	£1.95	£2.86	£9.17	£32.55
2023	£7.21	£15.03	£5.50	£1.95	£2.86	£9.17	£32.55
Total	£22.19	£46.25	£16.91	£6.01	£8.79	£28.20	£100.15

^{xiv} Unlike scenarios 1 and 3, in scenario 2 we assume the interest costs of the able-to-pay scheme are borne entirely by households

4.4 POLICY COSTS

The implementation of this strategy will require significant funding for the area-based programme,^{xv} data gathering, fiscal incentives and education and training required to deliver them. We estimate the National Retrofit Taskforce to have relatively modest costs, similar to the Zero Carbon Hub of £1.6m per year. Based on data from the Retrofitworks initiative, we estimate the Area Based Delivery to cost £12m per 500,000 homes. Meeting the increased supply chain demands will require significant additional investment in training. We therefore propose that government match fund current Construction Industry Training Board (CITB) funding with an additional £50m per year.^{xvi}

We also propose that government would create an £250m innovation deployment fund, to drive new business models and cost reductions in materials, products and processes. We further assume that each home would receive a free EPC and building renovation passport for all grant funded properties, estimated to be £250 for each home that is treated. Finally, the costliest aspect of the strategy would be the 5% VAT incentive. Although the costs presented below represent the reduced income to the exchequer, the proposal set out in this report may also drive an increase in wider renovation and maintenance market, which would deliver increased tax receipts. These costs are outlined in Table 4.

Table 4 Wider policy costs of the program

Policy	2020-2024
Variable Stamp Duty	Revenue neutral
National Retrofit Taskforce	£6.4m
Supply Chain Innovation Fund	£250m
Skills and training	£200m
Local Authority Area based program	£216m
Smart EPCs & Building Renovation Passports	£584.9m
5% VAT	£5,191m
Total	£6,449m

^{xv} The costs of the energy audit and RdSAP mode are included in the Cambridge figures which we present in Tables 3-5

^{xvi} Currently industry funded at £180m/year, the CITB provide grant funding to train construction industry professionals <https://www.citb.co.uk/levy-grants-and-funding/citb-levy/about-the-citb-levy/>

4.5 IMPLICATIONS FOR GOVERNMENT BALANCE SHEET

Based on the assumptions above, the program is self-financing (Table 5). Using tax revenue multipliers from Cambridge Econometrics,⁷⁰ the increased economic growth leads to a higher intake of income tax, VAT, national insurance and corporation tax payments. By adopting the central Scenario 3, we see a large net gain in government revenue of £25.6bn (undiscounted) over the four-year life of the scheme, despite the inclusion of £6.45bn in wider policy costs. These tax benefits equate to £1.74 for every pound spent.

Table 5 Net impact on government balance sheet

Parliament	Government investment in funding schemes (undiscounted) (£bn)	Total additional policy costs (undiscounted) (£bn)	Additional govt. tax revenue* (undiscounted) (£bn)	Net impact on govt. balance sheet (undiscounted) (£bn)
2020	£2.82	£1.61	£6.03	£1.62
2021	£7.05	£1.61	£15.06	£6.43
2022	£9.17	£1.61	£19.58	£8.83
2023	£9.17	£1.61	£19.58	£8.83
Total	<u>£28.20</u>	<u>£6.45</u>	<u>£60.25</u>	<u>£25.60</u>

* Tax returns to government investment may be subject to a time lag, and therefore accrue in subsequent years

5. MAINTAINING MOMENTUM POST-2024

In this paper, we have set out a four-year retrofit programme designed to create jobs, stimulate the economy as we move through the coronavirus recession, and reduce emissions from UK housing. But the work of transforming the UK's housing stock cannot stop there. The Intergovernmental Panel on Climate Change (IPCC) now outline that 45% reductions in global emissions are needed by 2030 if warming is to be limited to 1.5°C. ⁷¹ Alongside the UK's net-zero targets, this will necessitate massive reductions in emissions from buildings, and especially homes in a little over a decade. ⁷²

The National Retrofit Taskforce must therefore also continue the work begun in 2020-23/24 with a strategy to 2030 and beyond. The foundation of this strategy must be a regulatory approach that ensures all homes are brought up to a decent standard come-what-may. This will include staged minimum EPC standards for the social, private rented and owner occupier sectors, as well as an eventual ban on new fossil fuel heating in all homes. This will also require fundamental reforms to the SAP and EPC system, so that they reflect the actual impact of retrofit measures and a building's energy performance. We suggest the following policies:

- MEES EPC C for all housing (aiming for EPC A/B) by 2030, staggered by sector
- Adopt area-based approach to fossil heat disconnection
- Prohibit new fossil-based heating in existing homes from late 2020s

6. CONCLUSION

The proposals set out in this report amount to total public investment of an average of £8.66bn per year from 2020-2024, much of it supporting low-income households through grants. The total government investment of £34.65bn can help unlock an additional cumulative total of £71.95bn private finance in this four-year period. This funding would support a National Retrofit Taskforce to deliver whole-house retrofits for 8.69m UK homes. The rate of increase and the final size of the retrofit program would be without precedent in peacetime. It would in effect see a doubling of the current renovation market in terms of people employed, creating hundreds of thousands of jobs across every region of the UK. This stimulus would be a huge boost to the construction industry, one of those hardest hit by the pandemic, with 41% staff furloughed in April 2020, second only to the hospitality industry.⁷³

At a time of significant economic uncertainty, this proposal would see a significant increase in economic activity. Our modelling shows that the level of annual GDP is expected to be 1.58% (or £36.34bn in 2020 prices) higher in 2023/24, compared with current forecasts for that year with no intervention.

While coronavirus is the immediate challenge facing the world today, climate change is perhaps the most significant challenge of the 21st century, and something that governments must now face up to as we move past the global pandemic. The four-year proposal set out here would result in a saving of approximately 19.23MtCO₂/year by 2023/24, or 21% of 2019 emissions from the UK's homes. This is a cumulative 40.9 MtCO₂ by 2023/24.

The scale of challenge for existing homes necessitates a step change in how retrofit is undertaken, funded and regulated. This will require a multi-measure whole-house approach involving the adoption of deeper measures, low carbon heat and renewable microgeneration. Delivering this will require a joined up systematic approach covering multiple sectors and policy domains.

In this document we set out how a green stimulus for housing could contribute to the UK's coronavirus recovery, climate change, poverty and the government's levelling up agenda, creating a housing stock and economy fit for the century to come. Addressing the multiple issues constraining the uptake of whole-house retrofits will not be easy but the benefits would be worthwhile even without the massive impact this will have on the UK's most intractable source of carbon emissions.

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