

Rt Hon Jeremy Hunt MP
Chancellor of the Exchequer
11 Horse Guards Road
London, SW1A 2HQ
Sent by email

Climate Change Committee
1 Victoria Street,
Westminster, London,
SW1H 0ET
w theccc.org.uk

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Reducing energy demand in buildings in response to the energy price crisis

Dear Jeremy,

Belated congratulations on your recent appointment! We look forward to working with you as the UK delivers Net Zero.

The Government has committed extraordinary sums to support households and businesses this winter through the Energy Price Guarantee (EPG) and other schemes; potentially up to £66 billion by April 2023.¹ These interventions have protected consumers from spiralling energy prices, but they also link the public finances directly to the country's energy consumption.

Even with Government support, households and businesses can expect to pay on average £1,300 more on their annual energy bills this winter than they did last year. It is a reminder of the UK's exposure to short-term fluctuations in the prices for fossil fuels, set on international markets (Figure A.1). Decarbonising the UK's economy and conserving energy can alleviate these risks and shield households, businesses and the Exchequer from future price shocks.

Our recent record on reducing emissions from buildings is particularly poor. Heating UK buildings contributed more than a fifth of the UK's greenhouse gas emissions in 2021. Building emissions have stagnated over the past decade, in large part due to under-investment in energy efficiency. A decade ago 2.3 million energy efficiency measures were installed annually through Government-backed schemes. In 2021, fewer than 100,000 were installed. Reducing energy demand in UK buildings is now the biggest gap in current Government energy policy.

Informing the public about ways to reduce energy demand in buildings and reducing public buildings energy demand

Regrettably, it is too late to introduce new policies to achieve widespread improvements to the fabric of buildings for this winter. But there are many small changes which can still make a meaningful contribution to reducing energy

¹ The Energy Price Guarantee (£31 bn), the Energy Bill Relief Scheme (£29 bn), the Energy Bills Support Scheme (£4.8bn) and the Household Support Fund (£1.5bn – not all of which goes towards energy bill support).

demand. Many of these can be done by homeowners and businesses at no or low cost without professional help (Table A.1).

The cost of living is a top public concern, but support for Net Zero also remains strong (Figure A.3). People want to reduce their bills and to tackle climate change, but often don't know what to do. The Energy Security Strategy recognised that the Government can provide trusted information on this issue. The launch of a new online energy advice service is a positive step, as is the Help for Households campaign, but more can be done as we enter winter:

- **Enhancing the Government's energy advice service.** The service should provide advice on simple energy saving measures, not just the complex home retrofits currently on offer. This service should also be broadened beyond homeowners to target all households and business owners. The service should provide consumers with reliable information about the potential for cost savings and emissions reductions they can realise by making short- and long-term changes to both the fabric of their buildings and the specific ways they use energy within them, on the basis of up-to-date energy prices.
- **Increasing the content and reach of the Help for Households campaign to say more about energy saving.** The energy reduction content should cover more options than the three currently listed, which are not applicable to all households. It can also make the link between these actions and climate change and highlight the range of other benefits available to households, including increased home comfort. Importantly, this should be expanded to be a wide-reaching public awareness campaign, which should also raise public awareness of the energy advice service.

The benefits to households and the Exchequer of better information and advice are likely to be significant (Table A.1). Individual households could save several hundred pounds from a winter energy bill of £2,500, while the Exchequer could save hundreds of millions of pounds from the £31 billion EPG.

Making energy efficiency a core part of the Government's exit strategy from expensive energy bill subsidies

With higher prevailing energy prices, investments in energy efficiency measures are recouped faster through savings on energy bills, even as inflation increases some construction costs.

The next two years should be a period for a concerted push to improve rates of loft and cavity wall insulation, draught-proofing and installing modern tools to manage energy use (such as smart thermostats, thermostatic radiator controls and smart meters).

The Government's efforts are best targeted on measures that provide good value-for-money, low upfront costs or maximise other benefits. It should also ensure the wind down of the EPG does not reintroduce price distortions between gas and electricity:

- **High value-for-money.** Cavity wall (particularly in easy-to-treat homes) and loft insulation are good value for money for many homes. For most households these measures typically cost £500-700 and the investments can be recouped through bill savings in 5 to 18 years. Our Net Zero scenarios assume between 250,000 and 440,000 households having their cavity walls insulated in 2023 and 2024 alone and over 1.6 million further installations by 2030. Similarly, we assume 780,000 to 1.4 million lofts to be

insulated in 2023 and 2024, and at least a further 5.5 million loft insulations by 2030.

- **Low upfront cost.** Hot water tank insulation offers the best value for money of all measures in our analysis, and the upfront costs are low (less than £100, even where a professional fitter is needed). Similarly, draught proofing for windows, doors and letterboxes is a cheap DIY measure from which most households can benefit. These measures can reduce gas demand by around 5-8% in a typical home.
- **Maximise other benefits.** The payback periods for solid wall insulation are lengthy even under sustained high gas prices. But there is a strong case for investing in these improvements where absolute reductions in energy bills and improvements to thermal comfort are required. This also supports the transition to low-carbon heating in these properties. Insulating fuel-poor homes helps to reduce poverty and improve the health outcomes of occupants. Our scenarios see between 310,000 and 1.1 million homes receive solid wall insulation (either internally or externally) in 2023 and 2024, with all those in fuel poverty eventually receiving solid wall insulation by 2030.
- **Encouraging low-carbon heat.** The introduction of the EPG has temporarily removed legacy policy costs from electricity prices. Energy prices after the wind down of the EPG should incentivise electrification and enable the benefits of access to low-cost renewable energy and the efficiency of heat pumps compared with gas boilers. This means permanently moving legacy policy costs from electricity bills and onto the Exchequer.

Households will continue to accrue the benefits of these improvements for years to come, including through lower bills, greater thermal comfort and better health outcomes. The Institute of Health Equity estimates that the NHS spends at least £2.5 billion each year treating illnesses derived from people's living conditions, a high proportion of which are directly linked to living in cold and damp homes.

Leading by example

Government can lead by example by investing in the energy efficiency of the public estate, demonstrating national and local government efforts to reduce energy demand. Beyond the real savings that energy efficiency improvements to the public sector estate offer Government, there is an opportunity to demonstrate leadership. The Government should not expect households and businesses to change their approach and invest in efficiency measures if it does not also take similar steps.

Paying for it

A combination of public funding and Government action is required to facilitate access to and reduce the cost of capital:

- **Shifting some public funding from bill subsidies to energy efficiency.** Government would recoup some of the money spent through the EPG through reduced energy demand in the near term. And the benefits will continue to accrue to the economy longer-term through sustained lower energy bills. This approach represents a shift away from subsidising operating costs towards capital investment – boosting construction and providing benefits to jobs and growth. This should involve expanding funding pots for policies to decarbonise homes with proven delivery

mechanisms (e.g. Local Authority Delivery scheme, Energy Company Obligation), increasing funding for public buildings and considering a grant scheme to support decarbonisation of commercial buildings.

- **Facilitating access to private finance.** Our updated analysis suggests that over 60% of households can achieve levels of energy efficiency that are compatible with Net Zero for less than £1,100.² However, during a period of high energy bills, increasing mortgage payments and wider inflation, many households and businesses have fewer resources to invest – even where this will save money in the longer run. Rising interest rates will narrow access to finance and may make people warier of taking on new debt. The Government should take an active role in facilitating access to finance for households and businesses. The Annex to this letter sets out options for doing this.

Making it happen

There are practical barriers to delivery which must also be overcome:

- **Gaps in public advice and information.** The Government should continue to enhance the energy advice service over the long term. This should include directing people towards obtaining better information about their properties, providing bespoke support on more complex retrofits and links to national and local Government schemes which can offset costs and help with installations.
- **A lack of long-term policy stability.** One of the failings of the Green Homes Grant was a lack of long-term certainty about the scheme. Construction firms will not invest to develop expertise and build up their workforce based on funding streams that may not exist in a few years' time. The Government needs to signal its funding intentions beyond spending review periods and indicate what will replace public funding once it is phased out, to provide the necessary certainty.
- **Shortages of skills and supply chain constraints.** There currently aren't enough skilled workers to retrofit millions of homes each year. New programmes are needed to support retraining and new entrants into the construction industry in general as well as into specialised occupations. There are also wider issues which may constrain supply chain growth, such as access to capital, manufacturing and import capacity, and the administrative capacity of businesses.
- **Higher standards for low-emission and climate-resilient homes.** The Government should take forward its proposals to introduce minimum efficiency standards for the private rented sector (both residential and commercial) and social housing. In light of the urgency of the current situation, Government should also consider bringing forward the Future Homes and Buildings Standards, planned for 2025. The technology exists to deliver high levels of thermal efficiency (staying warm in winter while cool in summer) in both existing and new homes, while being moisture-safe and with excellent indoor air quality. Achieving this requires a holistic approach in design, build and retrofit, which is currently not being driven effectively by existing policy.

² This originally formed part of our Sixth Carbon Budget analysis but has been updated to account for recent increases in costs of materials and labour.

- **Closing the performance gap.** Much of the Government's approach relies on Energy Performance Certificates, which require reform to ensure they can provide households with better information about their energy use and drive decarbonisation. None of these approaches – either for new or existing standards – will work unless they are backed up by effective enforcement regimes to ensure that standards are met.

Preparing for low-carbon heat

These actions will set the groundwork for a ramp up in low-carbon heat in the mid-2020s and continue the UK's ambitious but necessary trajectory towards Net Zero. The Government should set the policy framework now to bring down the upfront and running costs of low-carbon heating technologies. This includes: finalising the market-based mechanism for heat pumps, permanently removing costs of historical policies from electricity bills and reforming the electricity market to weaken the link between gas and electricity prices.

Collectively, these actions can protect the UK's fiscal health in the near term while building longer-term energy security and permanently reducing UK emissions. The accompanying Annex sets out the analysis that informed the figures in this letter.

I would welcome an early opportunity to discuss these matters further.

Yours,



Lord Deben
Chair of the Climate Change Committee

Cc: Rt Hon Grant Shapps MP, Secretary of State for Business, Energy and Industrial Strategy; Rt Hon Michael Gove MP, Secretary of State for Levelling up, Housing and Communities

Annex: Reducing energy demand in buildings

This annex sets out the analysis that informed the recommendations set out in the Climate Change Committee's letter to the Chancellor of the Exchequer and Secretary of State for Business, Energy and Industrial Strategy on 9th November 2022, making the case for reducing energy demand in response to the energy price crisis.

It is divided into five sections:

- (a) Energy prices
- (b) Public attitudes
- (c) The immediate opportunity: cost-free or low-cost energy efficiency measures
- (d) Beyond winter 2022/23: Medium-term energy efficiency measures
- (e) Policy options to finance energy efficiency upgrades

(a) Energy prices

Energy prices are extremely volatile and have reached all-time highs. Record fossil gas prices have been set multiple times this year, hitting a peak of 19.4 p/kWh, nearly 10 times the 2018-2021 average (Figure A.1).¹

The Energy Price Guarantee means that the Government covers the additional costs of all residential gas usage when the retail price rises above 10.3 p/kWh. This approximately equates to a wholesale price of 7.6 p/kWh, well above the pre-crisis average of 2 p/kWh.* There have been 117 days when the gas spot price has been above this nominal threshold so far in 2022.²

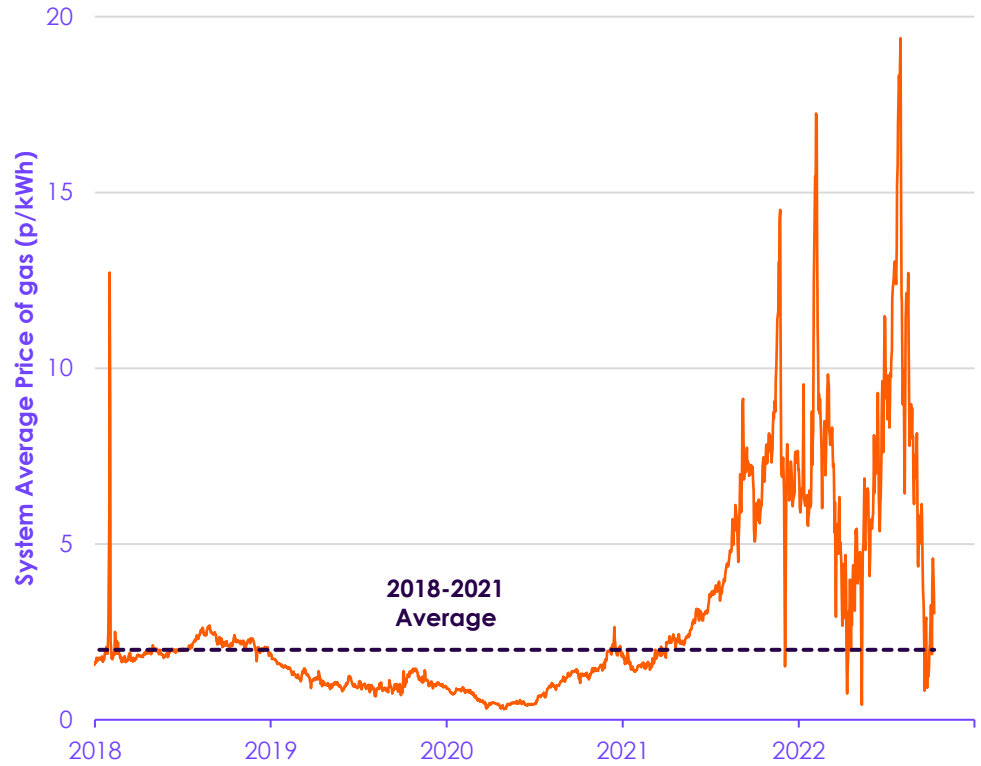
The spot price of gas has recently fallen (after peaking in August). However, the exact point where support from the Energy Price Guarantee kicks in will depend on the nature of forward contracts signed by energy suppliers and their hedging arrangements. Many suppliers will already be locked into contracts at higher prices through the coldest months of the year. As such, the spot price is not a good indicator of whether or not the Government has to provide fiscal cover. What the price history does show is the unprecedented scale of recent price spikes, which may continue as long as the Russian invasion of Ukraine continues. It also illustrates that even prior to recent spikes gas prices have been historically volatile.

The total HM Treasury outlay under the Energy Price Guarantee is a function of the gas price and the nationwide demand for residential energy. We expect that the days of highest demand in the UK will also typically be the days when the gas price is highest. The Government does not have the means to substantially influence the gas wholesale price.³ As such, the primary way HM Treasury can manage the fiscal outlay is by taking action to reduce the amount of energy used nationally.

* The equivalent value for businesses is less clear. The gas unit cost cap under the Energy Bill Relief Scheme for non-residential consumers is 7.5p/kWh.

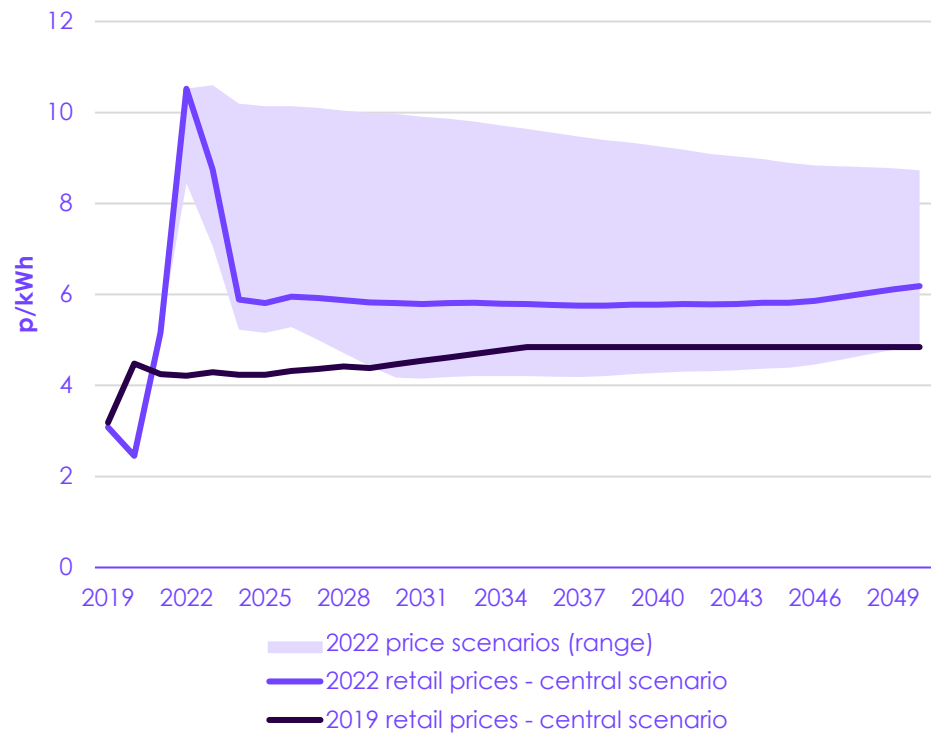
Forecasting fossil fuel prices is extremely difficult. However, the Office for Budget Responsibility's assessment from July 2022 anticipates prices persisting at levels three to four times the 2018-2021 average until at least 2027.⁴ For our updated analysis on payback periods of energy efficiency measures, which is set out in section (c), we have used the range of prices shown in Figure A.2. These are based on medium-term OBR forecasts from July 2022 out to 2026, and CCC analysis and sensitivities informed by Aurora Energy Research forecasts beyond 2026.

Figure A.1 System average price of fossil gas



Source: National Grid (2022) Gas Prevailing View

Figure A.2 Fossil gas retail price scenarios



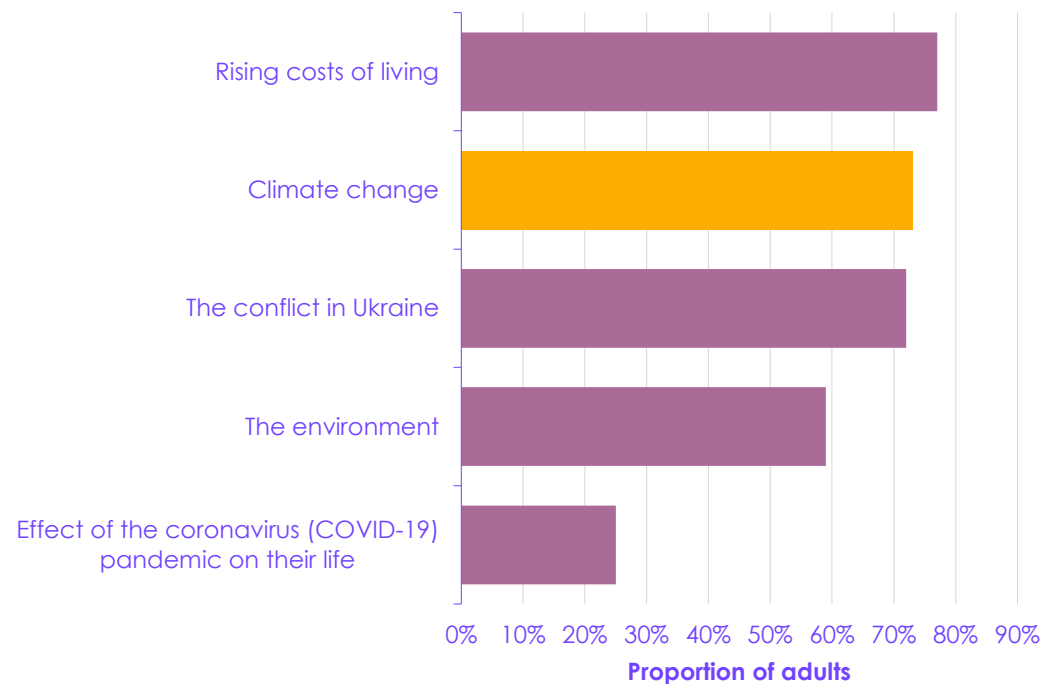
Source: CCC analysis based on OBR (2022) *Fiscal risks and sustainability*; CCC (2020) *The Sixth Carbon Budget*, Aurora Research (2022) *Great Britain Power and Renewables Market Forecast*
 Notes: Refers to retail prices. The 2019 scenario refers to the scenario used by the CCC in our 2020 Sixth Carbon Budget advice. The 2022 scenarios are updates based on CCC analysis of external estimates.

(b) Public attitudes

While the cost of living is a top public concern, support for Net Zero remains strong, as demonstrated below (Figure A.3). Households are engaging more with, and cutting back on, their energy use because of high energy prices:

- In October 2022, nearly three-quarters of adults in the UK stated that they were worried about climate change, with only the cost of living listed as a concern by more people. The environment was also listed as a concern by nearly 60% of respondents.⁵
- A year ago, less than 20% of households stated that they were considering making energy efficiency improvements to their homes. The main reasons given for not intending to make changes was the belief that these measures were either expensive or offered low value for money (or both).⁶ By October this year nearly a quarter of households said that they were actually making energy efficiency improvements to their homes (as opposed to merely considering it).⁷ This suggests that current prices have shifted some people's views on the value for money of energy efficiency measures and driven some real action.
- Households recognise that reducing their energy consumption and improving the efficiency of their homes and appliances also helps to tackle climate change.⁸ The Citizen's Panel the CCC recently collaborated on with Lancaster University highlighted how owner-occupiers are enthusiastic to act on Net Zero and reduce their home energy use.⁹

Figure A.3 Public concerns in October 2022



Source: ONS (2022) *Public opinions and social trends, Great Britain: 29 September to 9 October 2022*.

Notes: Data correspond to respondents who said they were either 'somewhat worried' or 'very worried' when asked the questions: "How worried or unworried are you about the impact of climate change?", "In the past two weeks, how worried or unworried have you been about rising costs of living?", "In the past two weeks, how worried or unworried have you been about the environment?", "In the past two weeks, how worried or unworried have you been about the conflict in Ukraine?" and "How worried or unworried are you about the effect that the coronavirus (COVID-19) pandemic is having on your life right now?".

(c) The immediate opportunity: cost-free or low-cost energy efficiency measures

Table A.1 sets out potential annual bill savings to households from a range of cost-free and low-cost* energy efficiency measures. It also sets out the number of households that could adopt them, their typical energy savings, and the savings that HM Treasury could realise through reduced demand for gas price support under the Energy Price Guarantee.

These measures would deliver many other benefits which we have not quantified here, including supporting residents' health, greater comfort and increased energy security. Many of these co-benefits can also reduce HM Treasury expenditure, for example living in a home which is less cold and damp will reduce demand for health and social care services associated with poor living conditions.^{10,11,12}

Government has an important role in highlighting these opportunities and encouraging action to take them. Many of these are cost-free, but the potential savings the Treasury could accrue even with relatively low adoption are substantial:

- A campaign encouraging households to reduce the flow temperatures for their condensing boiler from 75°C to 60°C (without reducing the indoor

* 'Low-cost' measures typically cost a household less than £150 to install, although this will depend on the size, age, and condition of individual homes.

temperature) would only need 10% adoption by eligible households to save the Treasury nearly £28 million in 2023 alone. Other simple measures with potential for high savings include closing curtains at night (£7-34 million saved) and reducing heating by five hours a week (£4-22 million saved).

- A public awareness campaign to incentivise energy demand reductions has reportedly been considered by the Government and could cost as little as £15 million.¹³ By comparison the Government spent nearly £540 million on the public information campaigns relating to coronavirus (March 2020 to June 2022).¹⁴

In practise, the specific measures that individual households can or will adopt depends on the nature of each home and the circumstances of its inhabitants. Households will pick and choose the measures that suit them best – in many cases a package of measures may offer the best results. There is no single package of measures for all homes, but some examples are shown in Table A.2.

Table A.1

Potential annual savings to households and HM Treasury of cost-free or low-cost energy efficiency measures

Measure	Household impacts and assumptions			Potential savings to HM Treasury by level of household uptake ¹		
	Typical cost	Potential number of households ²	Typical bill saving (per household) ²	10% uptake	20% uptake	50% uptake
Adjust radiator valves in less-used rooms to 3°C cooler than living room	no cost	3.5m	£135	£26m	£51m	£128m
Adjust radiator valves in less-used rooms to 1.5°C cooler than living room	no cost	21.5m	£68	£79m	£159m	£397m
Reduce boiler flow temperature from 75°C to 55°C ³	no cost	7.7m	£55	£25m	£50m	£125m
Reduce boiler flow temperature from 75°C to 60°C ³	no cost	10.8m	£43	£28m	£55m	£138m
Reduce daily hot water temperature from 52°C to 42°C ³	no cost	16.3m	£26	£25m	£49m	£123m
Reduce hot water cylinder temperature from 70°C to 60°C ³	no cost	7.0m	£26	£9m	£17m	£42m
Reduce heating by five hours per week	no cost	5.2m	£16	£4m	£9m	£22m
Closing curtains at night	no cost	13.6m	£10	£7m	£14m	£34m
Install a smart thermostat	<£300	16.9m	£64	£64m	£129m	£322m
Install window film on all windows	<£300	24.5m	£43	£51m	£103m	£257m
Loft insulation to 300mm – homes with 0-50mm	£480-800	1.3m	£291	£17m	£33m	£83m
Loft insulation to 300mm – homes with 50-200mm	£480-800	12.2m	£54	£32m	£64m	£160m

Source: Nesta and Cambridge Architectural Research (2022), *Free and low-cost energy-saving actions to bring down bills, improve energy security and help the planet*; CCC (2020) *Sixth Carbon Budget*; DLUHC (2022) *English Housing Survey 2020-21: technical report*

Notes: Bill savings from measures cannot necessarily be aggregated up and may not be applicable to the same house type. **(1)** Corresponds to the share of households that actually adopt a measure as a proportion of all households **using gas or electricity for heating** who could do so. **(2)** Covers all households with gas, oil, or electric heating, even though HMT will only recoup benefits from homes making savings on gas or electricity bills. Many homes may be able to adopt more than one measure – this analysis assumes there are 28.2m dwellings in the UK **(3)** Some measures only apply to homes with either a condensing boiler or a system boiler and hot water tank. Based on average household gas consumption of 11,730 kWh/year, from the Nesta/CAR analysis. Household savings estimates based on a gas unit price of 10.3 p/kWh (level of the Energy Price Guarantee).

Table A.2

Examples of packages of efficiency measures which households could adopt at low or no cost

Package	Potential annual gas bill savings per household	Households who could benefit (upper bound)	Household requirements
Reduce heating by five hours per week Close curtains at night Install a smart thermostat Increase loft insulation from 50-100mm to 300mm	£100 to £210	4.2 million	
Reduce boiler flow temperature to 55°C Reduce indoor temperature to 18°C Close curtains at night Turn off boiler pre-heat facility Reduce heat from radiators in less-used rooms by 1.5°C	£90 to £320	6.4 million	Condensing boiler
Reduce water cylinder temperature to 60°C Close curtains at night Reduce heat from radiators in less-used rooms by 1.5°C	£10 to £180	6 million	System boiler
Reduce boiler flow temperature to 60°C Add foil behind radiators (solid or unfilled cavity walls) Add window film to all windows Close curtains at night	£60 to £140	10 million	

Source: Nesta and Cambridge Architectural Research (2022). [Free and low-cost energy-saving actions to bring down bills, improve energy security and help the planet.](#)

Notes: Bill savings from packages of measures cannot necessarily be aggregated up and may not be applicable to the same house type. Only savings from reducing gas demand are shown in this table.

(d) Beyond winter 2022/23: Medium-term energy efficiency measures

Energy efficiency measures can be a sound investment for individual households, the public sector and businesses, and the economy as a whole.

The economic case for energy efficiency

Fossil fuel prices have been historically volatile. Energy efficiency offers an ongoing shield to households from future price shocks. Figure A.4 shows payback periods for a range of energy efficiency measures under three energy price assumptions: the central energy prices used in the CCC's 2020 Sixth Carbon Budget analysis (based on fossil fuel price scenarios from BEIS' 2020 Energy and emissions projections) and two up-to-date scenarios (one where high gas prices are sustained and one where they return to previous levels – see Figure A.2).

Figure A.5 compares the value-for-money of different measures to their potential to reduce energy demand. Table A.3 shows the average upfront cost of these measures for a typical three-bed semi-detached house:

- All measures are increasingly cost-effective under higher prices. Payback periods for measures such as cavity wall insulation (in easy to treat homes) and loft insulation are relatively short, even if gas prices return to previous low levels.
- Hot water tank insulation offers the best value for money of all measures in our analysis, and the upfront costs are low (around £100), even where a professional fitter is needed.¹⁵ Similarly, draught proofing (and reduced infiltration) for windows, doors and letterboxes is a cheap DIY measure from which most households can benefit.
- In the case of some of the most expensive measures (e.g. solid wall insulation, double glazing) payback periods can be several decades long, even in a scenario where gas price highs are sustained. However, these measures can have other benefits, such as improvements to health, noise reduction and facilitating low-carbon heat.
- Our analysis for the Sixth Carbon Budgets suggests that for over 60% of households the average cost of energy efficiency improvements to their homes to align to Net Zero would be less than £1,100. The average costs for all households are higher, at over £10,900,* reflecting the extent of work needed to bring the most inefficient homes (typically the oldest homes in the stock) up to standard.
- These measures will also benefit households and businesses that rely on oil for heating. While the price of fuel oil has not increased as much as the price of gas, it is still higher than that assumed in our Sixth Carbon Budget analysis and has also been historically volatile. Efficiency measures will deliver bill savings to these households. Likewise, other measures which reduce electricity demand, such as turning lights off when not in use, replacing bulbs with LEDs, and installing more energy-efficient appliances will all help to reduce bills and emissions.

* This originally formed part of our Sixth Carbon Budget analysis but has been updated to account for recent increases in costs of materials and labour, using the ONS's 2022 Construction Output Price Indices. Figures are rounded to the nearest £100.

Table A.3

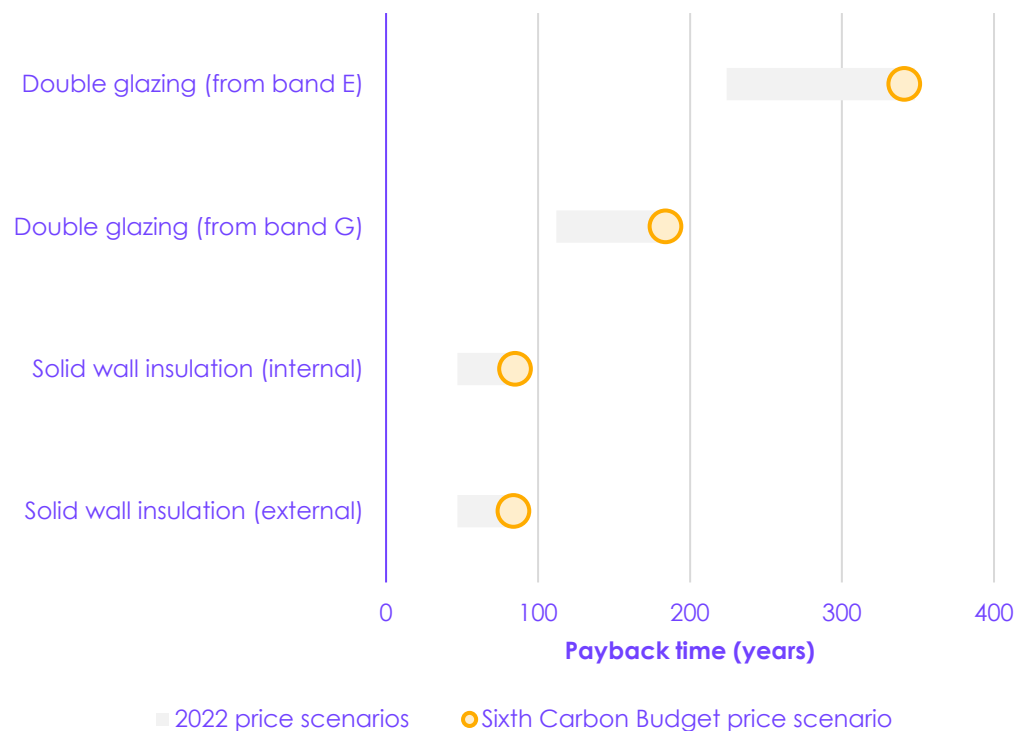
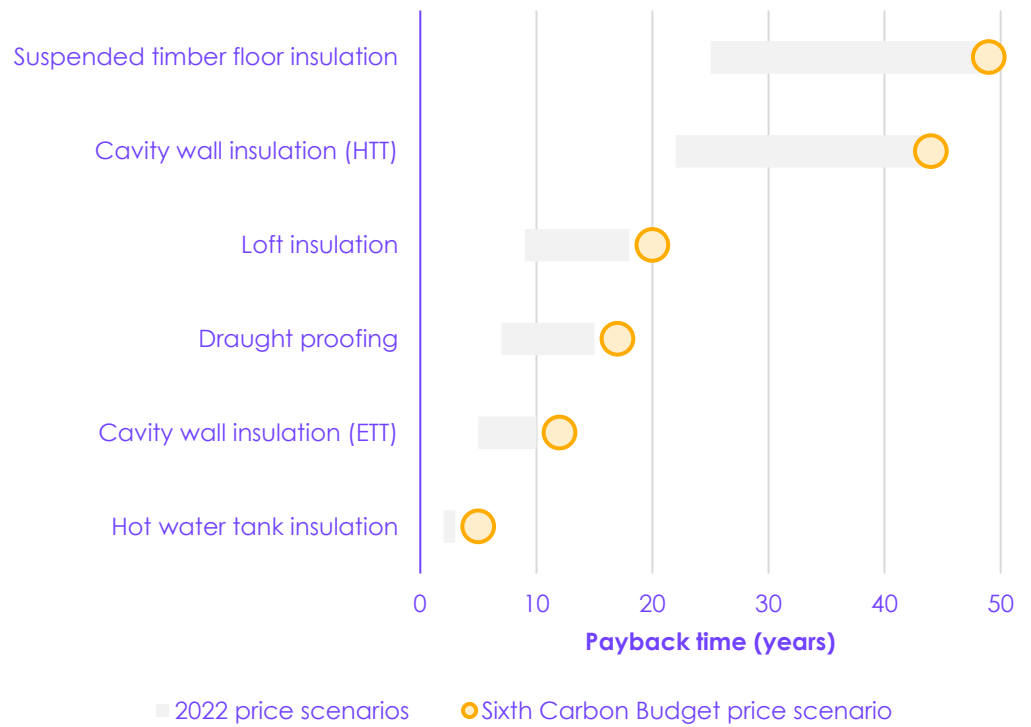
Average capital cost of energy efficiency measures for a typical three-bed semi-detached house

Measure	Typical capital cost
Hot water tank insulation	£100
Draught proofing	£300
Loft insulation	£500
Cavity wall insulation (easy to treat)	£700
Cavity wall insulation (hard to treat)	£2,700
Floor insulation (suspended timber)	£2,800
Double glazing	£6,900
Solid wall insulation (internal)	£7,950
Solid wall insulation (external)	£9,350

Source: CCC (2020) Sixth Carbon Budget; Element Energy (2020) Development of trajectories for residential heat decarbonisation to inform the sixth carbon budget; ONS (2022) Construction Output Price Indices.

Notes: Capital costs are indicative for a three bed semi-detached house. Costs have been adjusted from those used in our Sixth Carbon Budget analysis to 2022 values based on the ONS' construction cost index. Costs are rounded to the nearest £50.

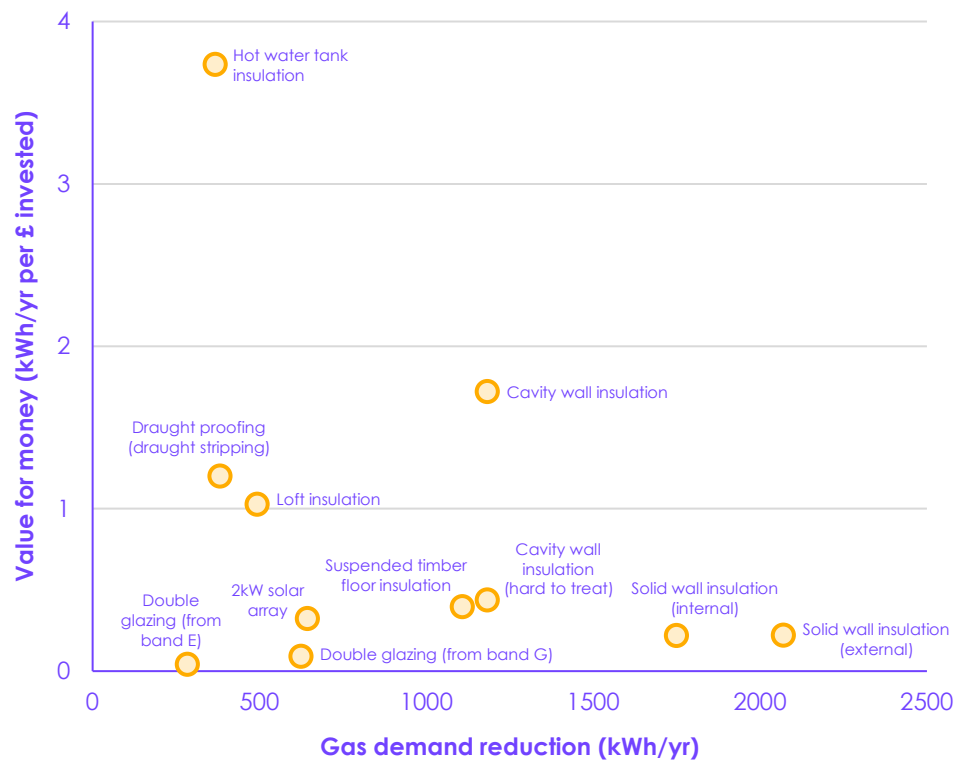
Figure A.4 Payback periods for energy efficiency



Source: CCC (2020) *Sixth Carbon Budget*; Element Energy (2020) *Development of trajectories for residential heat decarbonisation to inform the sixth carbon budget*; ONS (2022) *Construction Output Price Indices*; CCC analysis based on OBR (2022) *Fiscal risks and sustainability*; Aurora Research (2022) *Great Britain Power and Renewables Market Forecast*

Notes: ETT and HTT – Easy-to-treat and Hard-to-treat.

Figure A.5 Value for money relative to demand reduction potential



Source: CCC (2020) *Sixth Carbon Budget*; Element Energy (2020) *Development of trajectories for residential heat decarbonisation to inform the sixth carbon budget*; ONS (2022) *Construction Output Price Indices*; CCC analysis based on OBR (2022) *Fiscal risks and sustainability*; Aurora Research (2022) *Great Britain Power and Renewables Market Forecast*.

Notes: Double glazing from bands E and G refers to window energy ratings, which range from G to A++.

Economy-wide impacts

Decarbonisation will reduce our demand for fossil fuels and enhance the UK's energy security. Domestic demand for gas falls rapidly from 2022 to 2035 in both the Sixth Carbon Budget's Balanced Pathway and the Tailwinds Scenario (Figure A.8):

- If the UK's households can install energy efficiency measures in line with our Balanced Pathway (see Figure A.6) alongside low-carbon heating, then gas demand would be nearly 40 TWh (12%) lower by 2028 (compared to demand under a high-carbon baseline), and over 130 TWh lower by 2035 (42%). Energy efficiency measures* account for more than 40% of all the residential gas demand reduction in the Balanced Pathway by 2028.
- If households install measures in line with our Tailwinds scenario (see Figure A.6), gas demand would be nearly 60 TWh (18%) lower by 2028 than in the baseline, and nearly 200 TWh (61%) lower by 2035. Energy efficiency in this scenario corresponds to more than 60% of demand reduction by 2028.

* Energy efficiency measures include: cavity wall and solid wall insulation, roof and loft insulation, floor insulation, small measures such as draught proofing, reduced infiltration, low-flow shower heads, hot water tank insulation, behavioural measures (such as turning off lights), and other measures such as energy-efficient appliances and transitioning from gas to electric stoves.

Table A.4 shows the number of fabric efficiency measures installed in those scenarios in 2023, the upfront costs of those measures, gas bill savings in 2023 and cumulative gas bill savings between 2023-2035 for houses on the gas grid:

- Even though current gas prices have improved the economic case for fabric efficiency, we cannot assume that prices will stay high forever. As Table A.4 illustrates, the gas bill savings from these measures do not exceed the upfront capital investment across the economy over the period. For floor and solid wall insulation, this is also true for the average payback period of individual measures (see Figure A.4). For cavity wall insulation, this is because hard-to-treat homes are included in the analysis.
- Savings shown in Table A.4 are an underestimate of potential savings available to households. That is because savings will continue beyond 2035, and because our analysis of demand reductions following fabric efficiency upgrades in homes incorporates 'comfort taking' – a known behavioural effect whereby households tend to increase internal temperatures to increase comfort following an improvement in insulation, reducing associated demand savings.¹⁶ These increases in comfort are not quantified in our analysis, but would represent benefits to households (including to health). There is also uncertainty on the degree of comfort taking that occurs in practice – in particular, when households are faced with high gas prices, they may opt to keep temperatures lower and reduce their bills instead.
- This analysis is an estimate of installations, costs and savings only to houses on the gas grid, as it is based on reductions in gas demand. The costs of individual measures are similar for houses off the gas grid. There are equivalent opportunities to achieve bill savings over time in houses off the gas grid, linked to the prices of oil and electricity, rather than gas.
- Roll-out of measures in the Balanced Pathway is the minimum we would have expected to occur in 2023 to achieve our Net Zero commitments. However, this would represent more than a five-fold increase in deployment from 2021, when fewer than 100,000 measures were installed. The fact that capital costs are higher than immediate bill savings, coupled with tight household budgets, suggests that we are unlikely to reach even this level of take-up without an additional push from Government. Shifting some of the funding that is currently going into subsidising energy bills to fund fabric efficiency measures would improve their economic case and incentivise take-up.
- Roll-out of measures in our Tailwinds scenario is over three times higher than in the Balanced Pathway. This level of take-up would result in faster emissions reductions than in our Balanced Pathway (Figure A.7) and higher bill savings to households. While such an ambitious retrofit programme would be at the boundaries of what we deemed in 2020 to be achievable given the need to scale up skills and supply chains, a comprehensive package of Government policy support could help to achieve it.

Table A.4

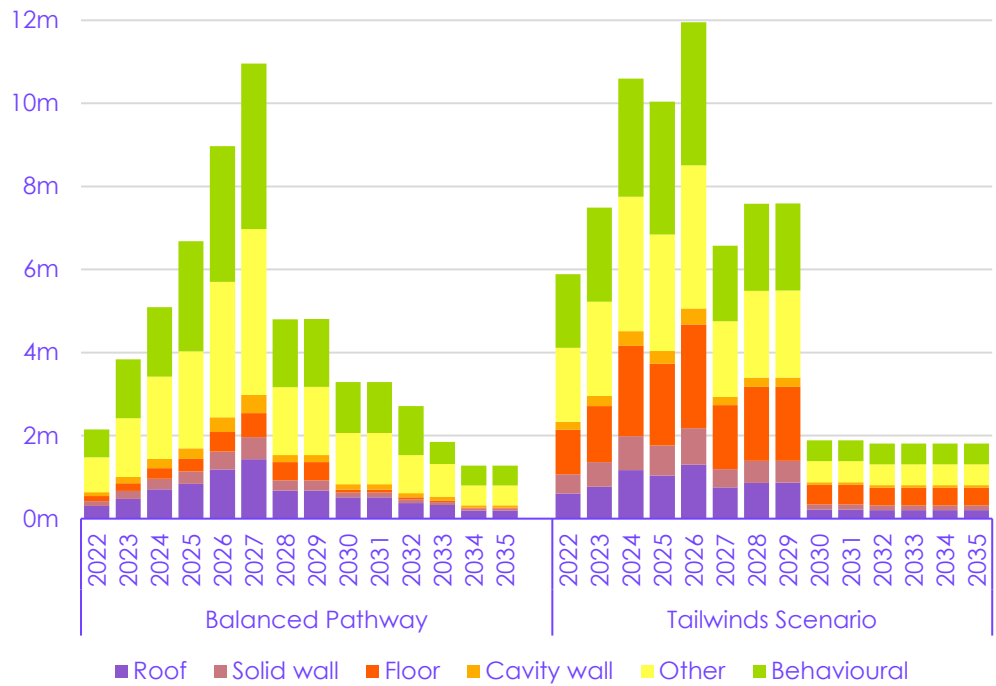
Deployment of fabric efficiency measures, capital costs and annual consumer bill savings for houses on the gas grid

Measure	Balanced Pathway				Tailwinds Scenario			
	Installations in 2023	Total capital costs	Household savings		Installations in 2023	Total capital costs	Household savings	
			2023	2023-2035			2023	2023-2035
Cavity wall insulation	80,000	£76m	£7m	£53m	166,000	£138m	£15m	£114m
Loft and roof insulation	260,000	£116m	£13m	£97m	516,000	£132m	£27m	£202m
Floor insulation	101,000	£315m	£9m	£64m	916,000	£1.9bn	£79m	£591m
Solid wall insulation	103,000	£727m	£15m	£111m	398,000	£2.3bn	£60m	£444m
Total	544,000	£1.2bn	£44m	£325m	1,996,000	£4.4bn	£236m	£1.4bn

Source: CCC analysis.

Notes: Savings are discounted using HM Treasury's social discount rate (3.5%). Cumulative savings are shown out to the Sixth Carbon Budget period, but savings will continue to accrue to households beyond this period at a similar level (albeit discounted). Savings are lower due to assumed 'comfort taking' leading to higher internal temperatures. Savings only include those from reduced gas demand and are estimated based on central 2022 price scenario shown in Figure A.2. The number of measures taken up in each scenario is rounded to the nearest thousand.

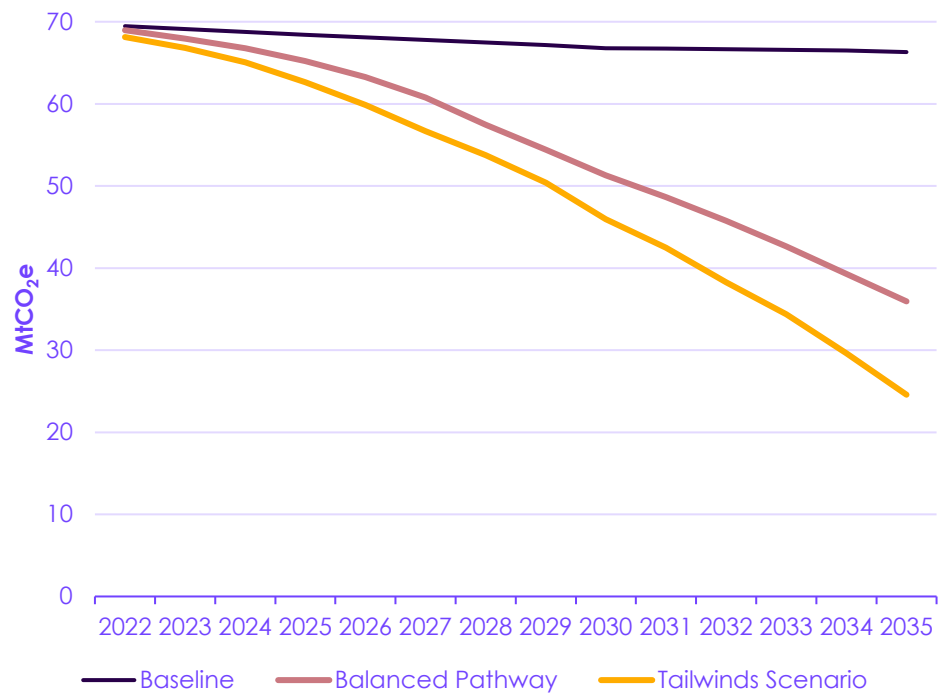
Figure A.6 Energy efficiency roll-out in the CCC's scenarios



Source: CCC (2020) Sixth Carbon Budget.

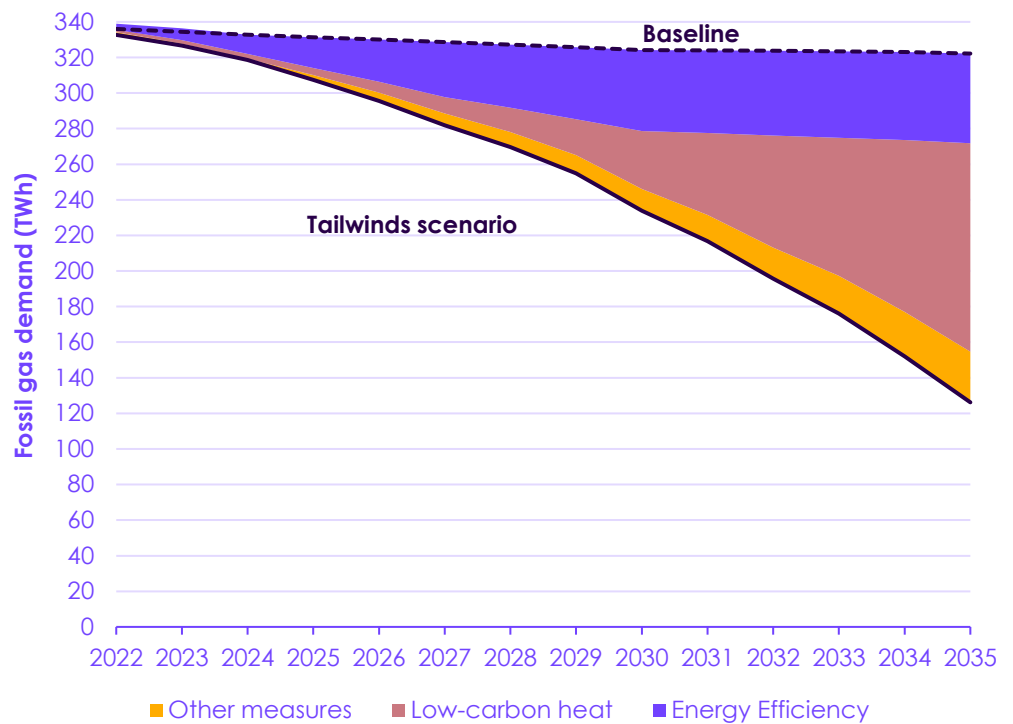
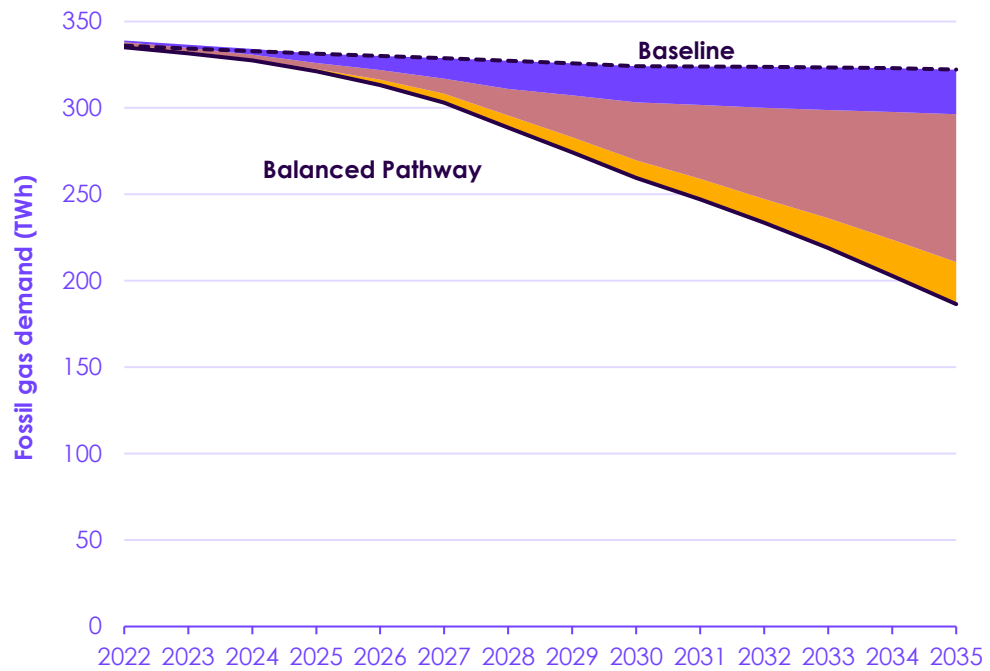
Notes: Roof includes roof and loft insulation; behavioural measures include: pre-heating, heat as a service, low-flow shower heads, and smart meters; other measures include: draught proofing and hot water tank insulation.

Figure A.7 Emissions from residential buildings in the CCC's scenarios



Source: CCC (2020) Sixth Carbon Budget

Figure A.8 Reduction in fossil gas demand in the CCC's buildings scenarios



Source: CCC (2020) *Sixth Carbon Budget*.

Notes: 'Energy Efficiency' measures include: cavity wall and solid wall insulation, roof and loft insulation, floor insulation, small measures such as draught proofing, reduced infiltration, low-flow shower heads, and hot water tank insulation, and behavioural measures. 'Other measures' include: energy-efficient appliances, transition from gas to electric stoves,

(e) Policy options to finance energy efficiency upgrades

There are several policy levers the Government could utilise to fund or finance energy efficiency upgrades for the UK's buildings. These include direct public funding and policies to open up private financing.

The Government is exploring innovative green financing solutions to decarbonise owner-occupied homes through the Green Home Finance Innovation Fund. £1.8 million in grant funding has been awarded to three organisations to pilot innovative financing solutions.¹⁷ However, there are other policies Government could implement regardless of the outcome of these trials to drive uptake of energy efficiency measures in the next year.

There are many options that have been proposed by a range of stakeholders (across industry, think tanks, NGOs), including some which have been successfully implemented in other countries. A combination of these types of policy will be needed, in particular if faster progress is to be achieved:

- **Government-backed loans:**
 - The Government has said that it would engage with the UK Infrastructure Bank (UKIB) to explore their wider role in scaling up green home retail finance. An option here would be to look to direct resources held by UKIB towards low-interest loans to improve the energy efficiency of buildings, which is being considered by UKIB and has been supported by several stakeholders, including some financial institutions.^{18,19}
 - Government could also seek to establish a new institution, similar to the KfW bank in Germany, to provide Government-backed loans for small-scale retrofits.²⁰ The long-term benefits of this move could be great and could also support the widespread adoption of low-carbon heating during the 2030s and beyond.
- **Regulatory and tax interventions:**
 - Property-linked finance is an innovative option which entails a loan linked to the property rather than property owner. When a property is sold, repayment obligations transfer to the new owners, which can help to tackle the 'payback period barrier' (where households are put off from investing in measures with long payback periods, as they may not own the property long enough to fully recoup savings).²¹ It is already available in countries including the US, where it has supported more than \$11 billion in investment into energy efficiency and resilience measures, but currently not the UK.²²
 - An adjustment to the level of Stamp Duty paid by households depending on the energy efficiency (e.g. Energy Performance Certificate (EPC) rating) of a home – where homes that are already energy efficient pay a lower rate and buyers have a set amount of time (most proposals are for two years) to improve their homes and get a stamp duty rebate. This could incentivise energy efficiency upgrades at the point of sale and boost the value of homes that are already energy efficient. Depending on the level of the adjustment offered (and whether an increase to Stamp Duty for inefficient homes is incorporated) this policy could also be revenue neutral to HM Treasury.²³

- The Government is considering introducing a requirement for mortgage lenders to disclose the energy performance information of their portfolio. Under current plans they would be expected (but not legally required) to achieve an average energy efficiency level for homes in their portfolio of at least EPC C.²⁴ Implementing this proposal as an obligation with appropriate enforcement mechanism, rather than voluntary approach, could also drive improvements to efficiency at the point of sale.
- To drive roll-out of energy efficiency in the private-rented sector Government could consider allowing landlords to claim tax rebates for improvements undertaken to their properties.²⁵ A similar policy was introduced by the UK Government in 2004 and removed in 2015,²⁶ reportedly due to low levels of take-up. Any such policy would still require Government to follow through with its plans to increase minimum EPC standards for the private rented sector.

- **Driving change through energy companies:**

- Expanding the existing Energy Company Obligation (ECO) beyond fuel-poor households is another recent proposal from representatives of the energy industry. The scheme would provide partial subsidies to owner-occupied households for fabric efficiency upgrades, which would be accessed through energy suppliers. The scheme would build on the current ECO scheme, benefiting from an existing delivery mechanism and supply chain partnerships. It would require some additional public funding to cover the partial subsidy.²⁷
- ‘Energy as a service’ business models allow consumers to pay for energy services without making upfront capital investments, generally through a subscription service. Using this model for ‘Heat as a service’ could allow consumers to choose the level of comfort or warmth they want, and energy companies or other providers could help them choose the best retrofit solution to provide that outcome.²⁸ The Citizens Panel the CCC collaborated with Lancaster University on recommended heat as a service business models to support decarbonisation in leaseholder properties.²⁹

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