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Two Decades of Housing Retrofit Policies in England: Beyond the Stern Review

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Abstract

The Net Zero debate is getting more contested as 25% of the UK emissions are directly attributable to the built environment, and 80% of it is expected to come from the existing building stock. Hence, decarbonising the existing building stock is significant, as the domestic housing sector dominates. There is a strong connection between the UK government policies and the progression of housing retrofit. However, limited studies have reviewed this interdependency. The Stern Review validated the importance of early action on climate change two decades ago. Ever since the UK adopted a strong climate change agenda when developing policies. This study aimed to analyse the housing retrofit policy actions over the last two decades and their influence on improving the performance of the housing stock. The study is limited to analysing policy actions relevant to England, which maintains the largest residential housing stock in the UK, with 26 million homes compared with Scotland's 2.5 million, Wales's 1.5 million and Northern Ireland's 0.8 million, while keeping the narrative in the UK context. The detailed policy review, along with political party manifesto analysis, was undertaken as the main data collection strategy. The data was analysed chronologically to explain the patterns and underline narratives. Findings reveal that the existing retrofit policies are not always in favour of the broader sustainability requirements of the country. Governments have changed their direction quite often and focused on short-term priorities for long-term gains. There is a critical need for robust, consistent and transparent policies (interconnected with other policies) as a long-term strategy for achieving sustainable goals.



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1. Introduction

The interest in retrofitting houses emerged in the UK during the 1970s oil crisis, when the residents started to shift from coal to natural gas heating [1]. British Standards Institution defines ‘retrofit’ as the process of updating existing buildings with new or

modified parts or equipment, particularly those aimed at improving energy efficiency and sustainability [2]. In general, retrofitting can be considered as an overall enhancement of the performance of a built asset. The UK houses were mainly heated through coal and town gas (Derived from coal) during the 20th century [3]. Having explored natural gas deposits in the North Sea in 1965, the gradual shift into gas heating was continued until 1977 [4]. Most of the old British houses were designed to be heated by coal, with generous purge ventilation to support open fireplaces [5]. When the coal heating systems were converted to natural gas, the UK houses benefited from reduced energy bills [6].

Currently, 90% of the houses in the UK are heated by fossil fuels. This includes natural gas at 86% and petroleum oil at 4%. Further, firewood, district heating, biomass, electricity and other sources fill the balance [7]. As far as electrical heating is concerned, heat pumps play a crucial role in sustainable space heating and hot water provision. Further, a heat pump is a key driver in the government's decarbonisation strategy [8]. Despite this importance, the official statistics of heat pump installations show a number below 370,000 as of April 2026 [9], compared with the total housing stock in the UK exceeding 30 million [10]. One of the key reasons for this slow progress can be attributed to the requirement for building fabric retrofit to make a house suitable for heat pump installation. Technically, the energy efficiency of an average EPC "D" rated terraced house is reported at 231 kWh/m²/yr [11], and this should be brought down to below 90 kWh/m²/yr to make it suitable for heat pump installation for government grants [12]. This upgrade is expensive and will not be affordable for many UK homeowners.

In the context of retrofit, a heating system upgrade is significant. Alternatively, other sources such as Hydrogen, district heating, infrared heating or biomass seem popular [13]. Regardless of the heating method, fabric energy efficiency is considered the top priority under the "Fabric First" approach [2]. Accordingly, insulation measures, ventilation, airtightness, building services, renewables and smart controls are some of the other building fabric upgrades required. There are some "low-hanging fruit" retrofit measures, which are cheaper but highly beneficial. For example, loft and cavity wall insulation [14]. Most of the retrofit measures are not cost-effective [15]. For example, Mechanical Ventilation with Heat Recovery (MVHR) systems or heat pump systems can cost a fortune for an average UK homeowner [16]. Government grants have been available to ease this financial burden to a certain extent. The Government policies are designed not just to provide financial incentives, but also to cover a broader spectrum, directly or indirectly related to housing retrofit [17].

Since the origin of government policies for housing retrofit dates back to the oil crisis in the 1970s, the policies were changed to encourage people to install energy-efficiency measures for their houses [18]. Subsequent to the energy crisis in 1973, which increased fuel prices fivefold, the Housing Act of 1974 was introduced to build new social houses and upgrade existing houses [19]. The Home Insulation Scheme was introduced in 1978, mainly for loft insulation and draught-proofing measures in low-income households [20]. Apart from that, several grant programs were offered to support housing retrofit, such as the Home Energy Efficiency Scheme of 1991 [21]. A remarkable interest in housing retrofit as well as energy efficiency in new housing was observed after the Stern Review in 2006 [22]. One of the significant outcomes of the Stern Review was the introduction of the Climate Change Act 2008 [23]. In line with this interest in sustainability, several sustainable initiatives and grant schemes were reviewed. For example, code for sustainable homes, changes to building regulations or the Carbon Emission Reduction Targets (CERT) retrofit scheme. However, the government's housing retrofit policies were criticised by several parties in the past. For example, the failed Green Deal was questioned for its success due to incorrect assumptions about homeowner behaviour, even before it was introduced [24].

There are both positive and negative outcomes of policy actions related to housing retrofit. The retrofit grants, such as Warm Homes or Boiler Upgrade Grant, directly help homeowners to reduce the cost of retrofit and to take them out of fuel poverty, which is commendable [25,26]. However, this may discourage homeowners who are not eligible for these grants. According to the rebound effect, when homeowners are paying less for heating, they may spend the savings on something else, which is not sustainable [27]. Also, the clarity of government policies is neither consistent nor stable [28], and prioritised on short-term, popular topics rather than being more strategic and long-term in focus [29].

The policies regarding housing retrofit remain the same in other countries, which can be slightly better or worse than those in England. For example, the Republic of Ireland [30] and Scandinavian countries. Especially Denmark, Sweden and Norway [31] demonstrate a high level of ambition and progress, but the policy support is not sufficient or does not perfectly align to promote housing retrofit [32–34]. Having considered the evolution and current demands for housing retrofit, the existing policies are less effective in promoting efficient housing retrofit in the UK. Housing retrofit policies are observed to be not aligned to make satisfactory progress in retrofitting the 30 million UK housing stock by 2050 [17].

There are some significant studies conducted about retrofit policies; however, they do not appropriately reflect the recent developments [35,36]. Bergman and Foxon (2020) and Alabid et al. (2022) have conducted valuable studies on retrofit policies [28,34], however, these studies were conducted for different purposes and did not examine the evolution of retrofit policies.

As far as the political landscape is concerned, most of these policies emerged with the election manifestos of the political parties. The promises and deliveries of the political parties and how these policies evolved have contributed to a substantial research gap related to housing retrofit policies. The key research question guiding the study is: How can past retrofit policy actions in England inform lessons for future retrofit policies? Hence, this paper aims to review the housing retrofit policy actions that are adopted in England, along with the introduction of the Stern Review (2006) and its influence towards the sustainability goals.

2. Materials and Methods

The paper adopted a critical review of policy documents and manifestos of English political parties, along with a detailed literature review in relation to housing retrofit in England. The appropriate policy documents were reviewed since the Stern Review [22] (The Economics of Climate Change, published in 2006), which has offered a clear direction to overcome the worst effects of climate change, where sustainable housing retrofit is also encouraged.

A detailed literature search was conducted using the official gov.uk website and Scopus (the largest bibliographic database) with the keywords: energy efficiency, housing retrofit policies, sustainability, net zero, climate change, United Kingdom for the period of 2005–2025. Scopus identified only 10 publications relevant to housing retrofit policy during the selected period, all of which were included in the analysis. Relevant policy actions were qualitatively selected, conforming to the inclusion criteria. A further Google search was carried out to find any complementary policy actions, such as a high court ruling over the UK government's net zero plan.

A desk study was used to map data against the timeline, policy, political landscape and the key recommendations. An underlying narrative was also exposed along with each policy, which was supported through the literature review. Table 1 shows the inclusion and exclusion criteria of the study.

Table 1. Inclusion and exclusion criteria of the study selection.

Criterion	Inclusion Range	Exclusion Range
Period	From 2005 to 2025	Anytime outside this period
Context	England (at least applicable to England)	Not relevant to England
Policies	Any enforced or proposed action	Rumours or unofficial news
Political parties in government	Labour party, Conservative party, Liberal Democrats (Coalition with Conservative Party)	All other political parties
Application	Should be relevant to housing	Policies or actions not relevant to housing at all
Owner	Government, delegated authority or political party	Any individual, group or institution without direct involvement in the policy actions

It has been noted that the past two decades of actions after the Stern Review are strongly relevant to understanding the policy landscape in England. There are some regional policy actions in constituent countries of the United Kingdom; England, Wales, Scotland and Northern Ireland and other devolved governments. Focusing on all of them could make the analysis overly exhaustive. In this scenario, the policy actions applicable to England were considered. Also, three political parties in the government were included in the manifesto analysis according to their representation in the general elections. All the inclusions should be relevant to housing.

In terms of the analytical framework, the authors reviewed the existing policy analysis frameworks, such as the OECD-DAC method and the UK Government RAS (Regulatory Impact Assessment) method. However, they were not found to be directly aligned with the research aim. The analysis is not just about primary government policies, but also related policy actions and circumstances. Accordingly, a custom analytical framework was developed focusing on purpose, jurisdiction, type of action and measured outcome. The following results section presents a brief description of the highlights, while a detailed list is given in the Supplementary Materials with references.

3. Results

The following section explains the year-by-year analysis of housing retrofit policy actions in England. For clarity, the authors summarised appropriate policies in Figure 1, followed by a further detailed analysis. The analysis starts with the year 2006, along with the Stern Review.

3.1. 2006—*The Stern Review: Being Sustainable Is Cheaper*

Although the impact of climate change was creating a critical scientific discussion, the previous assessments were not rigorous enough to develop and support the government's strategies in the long run. Hence, the government recommended a formal scientific assessment of the economic impact of climate change. As a result, "The Economics of Climate Change" (Stern Review) was published in 2006 [22]. The Stern Review highlighted the need for energy efficiency in the building sector, recognising the built environment as a key emitter of greenhouse gas emissions. It also pointed out that it is cheaper to invest in energy efficiency than to absorb emissions. The report concluded that acting on climate change now is cheaper than remedying the effects. Ideally, this is 1% of the GDP now (revised to 2% later) to prevent 20% future GDP losses.

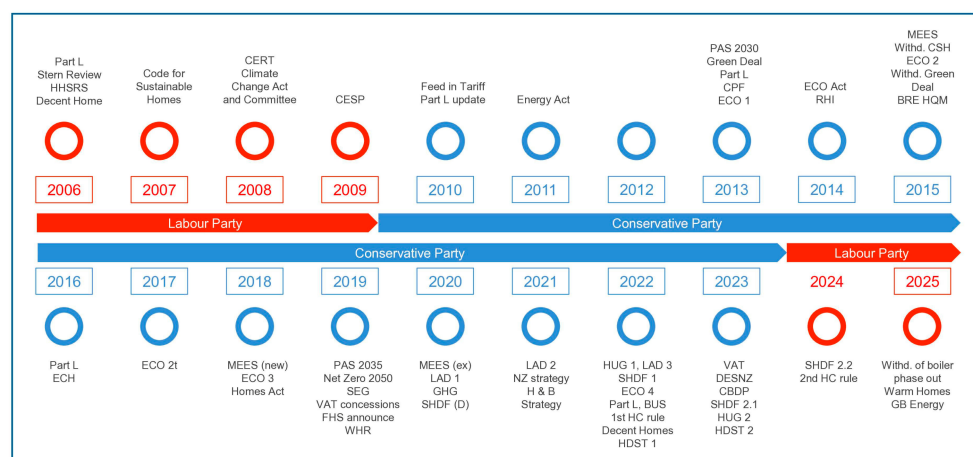


Figure 1. Evolution of housing retrofit policies in England.

In the same year, but a few months prior to the release of the Stern Review, the Building Regulation (Part L-Conservation of Fuel and Power) was updated with higher energy efficiency requirements [37] to support the EU (EPBD) Energy Performance of Buildings Directive [38]. Also, the Housing Health and Safety Rating System (HHSRS) was introduced, which identified 29 types of potential hazards in rental houses [39]. The Decent Homes Standards in 2006 also proposed the minimum standards for social housing by 2010 [40]. Those initiatives and revisions directly influenced the demand for housing retrofits.

3.2. 2007—*Net Zero Homes*

The Code for Sustainable Homes 2007 (CSH) [41] was one of the key catalysts after the Stern review, which aimed at introducing national standards for assessing the sustainability of new builds. The standard was based on the key recommendations of the Energy White Paper [42], Sustainable Communities Plan-2003 [43] and EU directives on the energy performance of buildings [38]. This was also a preparation for the proposed Climate Change Act [23], and the code was voluntary [41]. Even though the CSH was not directly focused on the housing retrofit, its principles of holistic sustainability (energy, CO₂ emissions, water, materials, waste, and health and well-being) are clearly aligned with the retrofit agenda.

3.3. 2008—*An Act for Climate Change*

The Climate Change Act 2008 was introduced to make climate change actions a law in the UK. The UK became the first country in the world to make climate action a law, legally binding the government to achieve greenhouse gas emission reductions. Initially, this was set to achieve an 80% emission reduction by 2050, compared with the 1990 levels [23]. The Climate Change Committee was established to advise the parliament on achieving these emission reductions under a feasible action plan [44]. The government was required to provide five-year carbon budgets to achieve emission reductions over time. Carbon Emissions Reduction Target (CERT), a grant scheme for housing retrofit, was introduced in April 2008 to deliver energy efficiency measures for residential buildings under a piecemeal approach. The energy companies were obliged to achieve an overall target of 293 MtCO₂ by December 2012. The scheme achieved 296.9 MtCO₂ savings by the deadline [45].

3.4. 2009—*Involving Energy Companies in the Retrofit Process*

A three-year housing retrofit grant scheme, ‘Community Energy Savings Programme (CESP)’, was introduced. The scheme was funded by both energy companies and generators. Both parties are obliged to achieve lifetime carbon savings (i.e., 9.625 MtCO₂) by installing energy efficiency measures in houses. The scheme ended in December 2012, and an overall

16.31 MtCO₂ emissions savings were achieved. Unlike the CERT scheme, this scheme was delivered with a whole-house and area-based approach with the help of local authorities.

3.5. 2010—*Renewable Energy*

The ‘Feed-in Tariff (FiT)’ scheme was introduced to encourage the uptake of small-scale renewable energy and low-carbon electricity generation technologies such as solar photovoltaic, wind, hydro and micro-CHP (Combined Heat and Power). The recipients were offered a payment for electricity generated, even if they consumed or exported it. The FiT scheme played a crucial role in boosting the adoption of solar Photovoltaic (PV) in UK homes. It made the installation of solar PVs financially affordable, encouraging many homeowners to retrofit their houses. The approach positively contributed to the decarbonisation of the electricity supply from the domestic sector. The scheme has been closed to new applicants since April 2019 and replaced with the Smart Export Guarantee (SEG) scheme [46]. Apart from this, there were amendments to Part L to increase the insulation requirements with a focus on a fabric-first approach [37]. A coalition government (Conservative & Liberal Democrats) came into power. The flagship Green Deal retrofit scheme was given initial attention.

3.6. 2011—*An Energy Act Focused on Energy Efficiency*

The Energy Act of 2011 was introduced as a successor to the Energy Act 2004. This legislation laid the legal framework for the Green Deal retrofit scheme, Minimum Energy Efficiency Standards (MEES) and Energy Company Obligation (ECO) retrofit scheme. Compared with the previous Energy Act in 2004, which focused on nuclear, renewables and energy infrastructure, the revised act focused on energy efficiency, energy security and housing retrofit [47].

3.7. 2013—*The Green Deal*

The Green Deal housing retrofit initiative was launched with the expectation of retrofitting 14 million houses by 2020. The scheme used a “Pay As You Save” model in which the expected energy savings should be equal to or higher than the cost of the retrofit [48]. In support of this scheme, the PAS 2030 specification was introduced to ensure the installation and competency standards of installers [49]. The Energy Company Obligation (ECO) grant scheme was first announced to replace the CERT and CESP retrofit schemes. The ECO retrofit grant scheme focused on vulnerable and low-income households and was funded by energy companies. The scheme had three elements: ‘Affordable warmth’ focused on low-income and vulnerable households, which is also called the Home Heating Cost Reduction Obligation (HHCRO). HHCRO achieved £5.16 billion in lifetime energy bill savings. ‘Carbon Emission Reduction Obligation’ (CERO) is aimed at wall insulation measures. Suppliers achieved 18.33 MtCO₂ under the CERO element. ‘Carbon Saving Community Obligation’ (CSCO) targeted rural areas. Suppliers achieved 9.87 MtCO₂ under CSCO, including 1.79 MtCO₂ under the rural sub-obligation [50].

The UK introduced the Carbon Price Floor (CPF) in April 2013 in line with the EU Emissions Trading System (EU ETS). This is a carbon tax imposed on fossil fuel-based generators of electricity. The generators are required to pay a tax for carbon emissions during electricity generation. The purpose of the tax was to encourage generators to move to low-carbon alternatives [51]. This tax has increased the electricity prices significantly, deterring homeowners from shifting to heat pumps from fossil fuel heating.

3.8. 2014—*Endorsement of Energy Company Obligation*

The Electricity and Gas (Energy Company Obligation) Order 2014 was passed in December. The Energy Company Obligation started in January 2013 under the provisions

of the Energy Act 2011. This new Act was to clarify the delivery of the grant and communicate some amendments [52]. Another important policy action is the introduction of the Renewable Heat Incentive (RHI) Scheme. The domestic RHI scheme was applicable to residential buildings. This gave an annual cash incentive to the installers of low-carbon heating methods (Such as heat pumps) for seven consecutive years. This usually reimburses the cost of installation partly [53]. It played a major role in housing retrofit by incentivising homeowners to switch away from fossil fuel heating systems.

3.9. 2015—No More Green Deal nor Mandatory Net Zero Houses

Under the provisions of the Energy Act 2011, Minimum Energy Efficiency Standards (MEES) were introduced under the Energy Efficiency (Private Rented Sector) regulations. The houses were required to have a minimum energy performance level according to the EPC rating system before they could be legally rented out [54]. The Code for Sustainable Homes (Introduced in 2007) was scheduled to be made mandatory in 2016, requiring all new houses to be net zero. However, the government abolished this to promote new housing construction, which was the priority at that time [41]. Further, technological, design, enforceability and financial challenges hindered the implementation of this code. The voluntary standard of Home Quality Mark by Building Research Establishment (BRE) replaced the Code for Sustainable Homes [55]. Also, the Green Deal was discontinued due to low homeowner interest. It was only able to retrofit just above 14,000 houses, despite the target of 14 million [56]. In between these incidents, the Energy Company Obligation's 2nd phase started in April 2015 and ended in March 2017.

3.10. 2016—Each Home Counts Review (Bonfield Review)

The Building Regulations Part L was amended to better align with the EU Energy Performance of Buildings Directive (EPBD) and to clarify compliance. There were no major enhancements to energy efficiency requirements [37]. Upon the failure of the Green Deal, the UK government sought an investigation into the problems of retrofitting houses in 2015 from the Building Research Establishment (BRE). As a result, the report 'Each Home Counts' (Bonfield Review) was published in 2016 with 27 recommendations to improve the quality of residential retrofit [57]. This was a pivotal point in housing retrofit in the UK.

3.11. 2017—Energy Company Obligation Continues

The extension of the ECO 2 (Energy Company Obligation) scheme until September 2018 is notable. The scheme had two obligations. One is the Carbon Emission Reduction Obligation (CERO) through installing insulation, connecting to district heating systems and installing secondary insulation measures. The second is the Home Heating Cost Reduction Obligation (HHCRO) through insulation and replacement of boilers for fuel-poor houses. This is also called the "Affordable Warmth" scheme. The obligations under these schemes were 19.7 MtCO₂ emission reduction for CERO and £6.46 billion lifetime energy bill savings for HHCRO [58].

3.12. 2018—Retrofit Schemes Continue

There was nothing new that happened this year, but a continuation of the schemes. As conveyed by the Energy Act 2011, Minimum Energy Efficiency Standards (MEES) came into effect for new tenancies from April 2018. In general, landlords could not let a house with an EPC F or G rating (subject to some exceptions). As the ECO 2t ended in September 2018, the ECO 3 came into effect from December and ran up to March 2022 [59]. A new act called the Homes (Fitness for Human Habitation) Act 2018 was published to strengthen the protection of social and private tenants by introducing an implied term "fitness for human

habitation” into contracts. This improved the power of the tenants to go to court directly without depending on the local authority to carry out HHSRS checks on the property [60].

3.13. 2019—Zero Emissions by 2050

Upon the recommendations of the Each Home Counts report (2016), Publicly Available Specification (PAS) 2035:2019 was introduced to improve the quality of the housing retrofit process. PAS 2030 was also updated in line with the introduction of PAS 2035 [61]. Importantly, the UK government amended the Climate Change Act 2008 to achieve net zero emissions by 2050. Earlier, the UK government was legally bound to achieve 80% of emission reductions by 2050 compared to 1990 levels [23]. As the Feed-in Tariff (FiT) incentive for small-scale renewable electricity generation came to an end in March (for new clients), the Smart Export Guarantee (SEG) scheme was introduced in June. Unlike the FiT, SEG only paid for exports at variable rates, not for generation [62].

There were Value Added Tax (VAT) concessions for new builds, but not for retrofitting houses. This discouraged homeowners from retrofitting their houses, and the retrofits were relatively more expensive than new builds. Considering this mismatch, the government introduced a reduced rate of 5% VAT on the installation of selected energy-saving materials/equipment in residential buildings. This ended in March 2022 for Great Britain & March 2023 for Northern Ireland [63]. Focusing on the net zero 2050 climate goals, the government announced that they expect to enforce the Future Homes Standard in 2025 and changes to Part L and Part F of the building regulations to support that. The objective of this move is to make all the newly built houses future-ready from 2025 onwards [64]. Another retrofit drive in June was the Whole House Retrofit (WHR) innovation competition. This was a pilot project in London to achieve higher energy efficiencies at a lower cost and aim for retrofit at scale. The project was allocated £7.7 million for 470 properties originally, which were later reduced to 74 properties. It was required to achieve 30–50 kWh/m²/yr energy efficiency for the retrofitted houses [65].

3.14. 2020—Another Failure: Green Homes Grant

The Minimum Energy Efficiency Standards (MEES) were introduced by the Energy Act 2011, in effect for new tenancies from April 2018. This was further tightened to include existing tenancies from April 2020. This means all private rented houses should have at least an EPC E rating [54]. As a measure to stimulate economic recovery and contribute to climate change, the government introduced the Green Homes Grant in July with a six-month delivery period. This allowed eligible households to receive funding up to £5000 or £10,000 for retrofitting their houses [66]. Although the government had allocated £1.5 billion for this scheme, only £314 million (£50 million for administrative expenses) had been spent as of February 2021 due to poor delivery and efficiency of the scheme. Approximately 47,500 houses were retrofitted compared to the 600,000 target [67]. As a part of this scheme, the Green Homes Grant Skills Training Scheme allocated £6.9 million for skills training under PAS and MCS qualifications [68].

The Local Authority Delivery (LAD) Scheme was introduced in September to retrofit poor-performing and fuel-poor houses. LAD 1A was delivered by local authorities with a budget of £200 million. The scheme retrofitted 18,500 houses [69]. The Social Housing Decarbonisation Fund Demonstration SHDF (D) pilot project was launched in September and allocated £62 million for undertaking 20 projects. Six projects were withdrawn later. 1143 properties have been retrofitted so far under this scheme [65]. This pilot project also focused on deep energy retrofit and retrofit at scale in line with the Whole House Retrofit

(WHR) pilot project. None of these projects could achieve the retrofit-at-scale objective, although they achieved deep retrofit objectives.

3.15. 2021—Publication of Government Strategies to Net Zero by 2050

Local Authority Delivery Scheme Phase 2 (LAD 2) was launched to retrofit more vulnerable houses. It ran up to December 2021, and 22,500 houses were retrofitted. LAD 1B and LAD 2 had a budget of £300 million allocated (the total budget for LAD 1 & 2 was £500 million) [69]. Another important policy action in 2021 was the launch of a net-zero strategy in response to the government's 2019 obligation to achieve net zero by 2050. The main document was the "Net Zero Strategy: Build Back Greener" [70], and there was a further document, "Heat and Building Strategy" [7], to highlight the strategy related to buildings. Apart from these two strategies, there were several other net-zero-related government strategies published from time to time. However, they were disregarded in this paper as they deviate from the focus (i.e., housing retrofit). The heat and buildings strategy outlined the government's expectation to phase out gas boilers from 2035 and the tightening of Minimum Energy Efficiency Standards (from EPC E to C) from 2025 for new tenancies and from 2030 for all tenancies [7].

3.16. 2022—More Grants to Retrofit Houses

This year marked the launch of more housing retrofit grants. These are HUG 1 (Home Upgrade Grant), LAD 3 (Local Authority Delivery), SHDF Wave 1 (Social Housing Decarbonisation Fund), BUS (Boiler Upgrade Scheme) and ECO 4 (Energy Company Obligation). HUG 1 was for low-income households in off-gas-grid houses. A £150 million budget was allocated, and the scheme was set to be delivered through local authorities [71]. The LAD Phase 3 was also for low-income households, but this is for households with mains gas. A budget of £200 million was allocated to LAD 3 [71]. Both HUG 1 and LAD 3 were under the "Sustainable Warmth" program. SHDF wave 1 awarded £179 million to 69 projects and ran up to March 2023. This scheme retrofitted around 20,000 social houses [25].

The Boiler Upgrade Scheme (BUS) was another important milestone regarding housing retrofit policies. This grant was launched in May to financially support the replacement of a fossil-fuel or electric (not a heat pump) boiler. The scheme will run up to December 2027 [26]. The scheme initially granted £5000 for upgrading a boiler, which later increased to £7500. Since the launch of this scheme, it has supported 51,109 boiler upgrades totalling £343 million in government expenditure [72]. The aim of this grant is to promote heat pump installation to reach the government's 2028 target of an annual 600,000 heat pump installations, as outlined by the Heat and Buildings strategy in 2021 [7]. BUS replaced the earlier domestic Renewable Heat Incentive (RHI), which helped partially reimburse the cost of installing low-carbon heating systems [53].

ECO 4 was launched in July and ended in March 2026. The Great British Insulation Scheme (GBIS) is a complementary insulation grant scheme under the ECO 4, which focuses only on insulation measures [73]. Meanwhile, the high court ruled that the government's net zero strategy was not adequate and ordered it to present a revised strategy [74]. The government launched a consultation to evaluate introducing the Decent Homes standard to privately rented houses. The private rented sector was considered to be worse, with 20% or 4.4 million houses being below the standard quality [75]. The first phase of the Home Decarbonisation Skills Training (HDST) programme allocated £9.2 million for training retrofit professionals [76].

3.17. 2023—Birth of the Department for Energy Security and Net Zero

The Department for Energy Security and Net Zero (DESNZ) was established in February by splitting the former Department for Business, Energy and Industrial Strategy (BEIS) into three: DESNZ, the Department for Business and Trade (DBT) and the Department for Science, Innovation and Technology (DSIT). The key objectives of DESNZ are identified as energy security, transition to net zero, energy efficiency, energy affordability and regulatory oversight [77]. Two of the key reasons for the DESNZ are identified as the energy security risk due to the Russian invasion of Ukraine and the highlighted need to have a robust strategy for net zero by 2050. In response to the high court ruling in July 2022, the UK government published the Carbon Budget Delivery Plan (CBDP) in March 2023. This report has revised its strategy with more stringent and clearer measures to achieve net zero in 2050 [78]. However, the claimants of the previous case again filed a case at the High Court, challenging that the CBDP is still inadequate.

There were two other housing retrofit grant schemes launched this year. SHDF wave 2.1 awarded £778 million to 107 projects and ran up to March 2025 [25]. HUG Phase 2 was launched in April 2023 and ran up to March 2025. A budget of £700 million was allocated for this grant [79]. As a continuation of the reduced rate VAT for retrofit in 2019, installation of energy-saving materials and heating equipment was made zero-rated or reduced-rated up to April 2027 [63]. The second phase of the Home Decarbonisation Skills Training (HDST) programme allocated £8.85 million in funding for training retrofit professionals [80].

3.18. 2024—Net Zero Strategy Is Still Inadequate

Social Housing Decarbonisation Fund (SHDF) wave 2.2 awarded £75 million for 42 projects and continued up to March 2026 [25]. In May 2024, the High Court ruled on the government's revised net zero strategy: the Carbon Budget Delivery Plan. The UK government needed to come up with a revised strategy by 29 October 2025 [74]. The claimants argued that the new plan (CBDP) has uncertain and vague proposals to tackle climate change, relying on high-risk and unproven technologies.

3.19. 2025—Promises and Deliveries

The Warm Homes Grant schemes for private and social houses came into effect, replacing HUG and SHDF, with the expectation of retrofitting five million houses. Unlike the HUG, the Warm Homes grant is open to both on-gas and off-gas houses with more relaxed eligibility criteria. The government allocated £500 million for this grant [81]. The Labour government allocated £1.29 billion for this fund across 144 projects, and the scheme will continue until 2028 [82]. Another important policy action is the establishment of the Great British Energy Company. The purpose was to strengthen the UK's energy security, reduce energy bills, take control of the market and speed up the transition to clean energy [83]. The government also announced the allocation of funds under the Warm Homes Skills Programme for training in retrofit skills. The first phase is allocated up to £8 million, and the second phase is allocated up to £9.283 million [84]. Further, as a response to the high court judgement, the government presented their revised net zero strategy: Carbon Budget and Growth Delivery Plan [85].

4. Discussion

4.1. Political Landscape of the Two Decades

Having identified several policies in relation to housing retrofit (after the Stern Review), it was important to analyse how the political parties in power (political movement) supported those policies. Therefore, the party manifestos were also reviewed during the

key milestones of the last two decades. Table 2 summarises the key information of each political party in power since 2005.

Table 2. General election details in the UK [86,87].

Year	Date	Controlling Party	Prime Minister/s	Tenure
2005	5 May 2005	Labour Party	Tony Blair	May 1997–June 2007
2010	6 May 2010	Conservative Party (coalition with Liberal Democrats)	Gordon Brown David Cameron	June 2007–May 2010 May 2010–May 2015
2015	7 May 2015	Conservative Party (majority government)	David Cameron	May 2015–July 2016
2017	8 June 2017	Conservative Party (minority government with Democratic Unionist Party)	Theresa May Theresa May	July 2016–June 2017 June 2017–July 2019
2019	12 December 2019	Conservative Party (majority government)	Boris Johnson Boris Johnson	July 2019–Dec 2019 Dec 2019–Sep 2022
2024	4 July 2024	Labour Party (majority government)	Liz Truss Rishi Sunak Keir Starmer	Sep 2022–Oct 2022 Oct 2022–July 2024 July 2024 Onwards

4.1.1. Labour Party in Power (2005 to 2010)

The 2005 general election re-elected the Labour Party, and Tony Blair continued as the Prime Minister of the UK. The Labour Party manifesto has addressed climate change, better houses and energy efficiency in homes and businesses. There was limited attention on housing retrofit. The Conservative Party manifesto emphasised their commitment to energy efficiency in their climate change policy [88]. David Cameron, the Conservative Party's candidate, used the tagline "Vote Blue, Go Green" to highlight the party's commitment to sustainability. One of the key reasons for this enthusiasm can be signposted as the enforcement of the Kyoto Protocol in 2005 [89]. Despite that, none of the manifestos has presented any facts or quantitative evidence.

The EPC report was also introduced in 2007, supporting the EU directive regarding building energy performance [90]. Another key policy action was the Climate Change Act 2008 [23]. Inspired by the Stern Review 2006 [22], the government confidently introduced the act with the ambition of achieving an 80% emission reduction by 2050 from 1990 levels. This can be a strong leap forward from the 2005 Labour Manifesto, where they stated a 60% reduction of emissions by 2050 [91]. The Carbon Emissions Reduction Target (CERT) [45] and the Community Energy Saving Programme (CESP) [45] were the only housing retrofit programmes observed during the period from 2005 to 2010. The Stern Review had a significant influence on these grants. In general, the Labour government policies have focused on sustainable development, and they have made efforts to improve the housing conditions to a considerable extent. During their tenure, the national carbon emissions related to residential buildings have dropped [92]. Further, there is progress in insulation measures thanks to the retrofit grants such as CERT and CESP. This is justified with the Stern Review, Climate Change Act, introducing EPC, retrofit drives CERT & CESP, as well as the Code for Sustainable Homes.

4.1.2. Conservative Party in Power (2010 to 2024)

2010 General Election: The Conservative Party came into power in 2010, making David Cameron the Prime Minister. The political landscape of the European Union may have influenced the energy efficiency policies in the UK a lot during this period. One example is the launch of "Energy Roadmap 2050" by the European Union [93]. The Energy Act of 2011 can be considered the most important policy instrument in this period with regard to housing retrofit in the UK. The act introduced the Energy Company Obligation (ECO) retrofit scheme. It introduced the Minimum Energy Efficiency Standards (MEES), which

influenced private landlords to retrofit their properties to a higher energy performance level. The act also introduced the Green Deal housing retrofit scheme with the aim of retrofitting 14 million houses [47], but only managed to complete 10,000 houses [56] as of 2015 due to low interest from homeowners. The Green Deal is considered a combination of the promises from both the Conservatives and Labour parties according to their 2010 general election manifestos [94,95]. Although the Green Deal failed and was discontinued in 2015, the lessons learned from this scheme influenced the measures taken to ensure the quality of housing retrofit [96,97].

PAS 2030 specification was introduced to ensure the quality and competencies of the installers [49]. Due to the poor quality of the installation work done by incompetent installers, the industry has already lost its faith in retrofitting [97,98]. It is reported that some companies were set up to get government funding by installing these measures, without ensuring the quality of the work and post-retrofit guarantees. They disappeared after obtaining payments. The introduction of the PAS 2030 specification ensured these problems would not repeat [99].

The Paris Agreement [100] influences the UK government to go for net zero by 2050 [23]. The European Union published their Heating and Cooling strategy in 2016 [101], recognising the need for an immediate decarbonisation of buildings to achieve sustainable goals. The European Green Deal was launched in 2019 to address challenges to net zero by 2050, including strategies for energy efficiency in buildings [102].

2015 General Election: Looking at the 2015 election manifestos, the Conservative Party has not given much attention to housing retrofit (only an idea of one million home insulation), but attention was paid to energy security and energy supply [103]. The Labour Party manifesto had ignored energy efficiency in existing houses, but claimed the need for new houses [104]. It is important to learn why no major political parties have raised the failed Green Deal in their manifestos. They have stated how they will support new house construction, which was the predominant issue at that time. However, the Liberal Democrats' party manifesto has taken energy efficiency seriously. They have elaborated on rebranding the "Green Deal" and set minimum energy efficiency targets for both owner-occupiers and landlords. They have proposed a new "Heating and Energy Efficiency Act" in their manifesto [105].

The Each Home Counts report was published in 2016 with 27 recommendations [57]. The report was considered to be an eye-opener for housing retrofit. Since 2016, 26 out of 27 recommendations have been adopted as of 2025. Although there are criticisms about the insufficiency of these implementations, it is considered that the report has made a positive change to drive housing retrofit in the UK [97]. The only recommendation which has not been attended to yet is the establishment of a consumer information hub for homeowners (Recommendation 7). There are research proposals for such information hubs developed under one-stop shop models [106,107].

As far as the 2019 general election is concerned, the Conservative Party manifesto aimed at investing £9.2 billion in energy efficiency improvements in homes, schools and hospitals [108]. The Labour Party promised to retrofit all the UK houses to the highest energy-efficiency standards by 2030 [109]. "Warm Homes for All" was a policy proposed by the Labour Party for the 2019 election. They promised £60 billion for ten years for energy efficiency improvements of the houses [110]. The Liberal Democrats presented a more ambitious manifesto with regard to housing retrofit. They mentioned that they will retrofit all the low-income houses for free, and other houses will receive incentives to subsidise the retrofit cost. This would reduce fuel poverty by 2025, reduce VAT for retrofit and promote street-to-street retrofits. £6 billion annual investment in retrofit had been proposed during the subsequent five years for these activities [111]. The term "Retrofit" appeared on election

manifestos this year (Labour Party and Liberal Democrats Party) for the first time in history. This was an important milestone since the term retrofit is politically recognised.

When the 2013 Green Deal was introduced, it was assumed that the problem was with the installers and PAS 2030 was introduced to ensure the quality assurance of the installers. Each Home Counts report pointed out that there are problems beyond the competency levels of the installers, which need to be addressed holistically [57]. One of the answers to these problems is PAS 2035:2019. This is about the project management of the housing retrofit process, focusing on risk management and quality assurance. The revision to the Climate Change Act 2008 to achieve net zero by 2050 was a key policy action during this period [23]. Most of the policy actions related to housing retrofit taken during the next five years can be considered related to this legislation.

The UK government's expectation is to retrofit all the homes up to EPC "C" where possible, install an electric heat pump and decarbonise the energy supply. The rest of the properties (ideally hard-to-treat older properties) are to be considered with alternative heating methods, such as Hydrogen [7]. This is in line with the Climate Change Committee's recommendation for a balanced pathway in their 2019 report, "The UK's path to net zero" [112].

The UK government's net zero strategy (by the conservative party) was challenged at the High Court twice, and the government lost the case both times [74]. The main argument was that the strategies were vague and based on unrealistic assumptions. Critics argued that the government policies have changed direction suddenly, focused on short-term solutions without a strategic vision and relying on future innovations which are not yet practical [17].

In summary, there were positive and negative policy actions observed during the 14 years of Conservative government. Each Home Counts report, PAS 2030, 2035, Net Zero 2050 and retrofit grants can be considered as positive moves. However, the processes were complex, and the directions were changed from time to time. The Green Deal and Green Homes Grant were critical failures. Code for Sustainable Homes, MEES and Gas boiler phase-out were withdrawn, pushing net zero potential for years further.

4.1.3. Labour Party in Power (2024 Onwards)

Looking at the election manifestos for the 2024 general election, the Conservative Party promised £6 billion for three years for energy efficiency measures in approximately one million houses [113]. In response to this, the Labour Party promised a total of £13.2 billion over the next five years [114]. One of the key observations in these two manifestos was to emphasise that nobody is forced to have these energy efficiency upgrades, such as replacing the gas boiler with a heat pump. The Liberal Democrats' 2024 [115] election manifesto has reduced their radical energy efficiency proposals for the residential sector from their 2019 manifesto to the 2024 one. While they have reinstated that they will have a ten-year emergency retrofit strategy, which is free to low-income households, nothing new was observed [115]. The Reform UK party's manifesto has totally rejected the net zero goal and renewable energy uptake. Their way of tackling fuel poverty has focused on the North Sea gas deposits, coal and nuclear energy with the removal of environmental taxes from fossil fuel prices [116]. The Green Party's 2024 manifesto supports a local-authority-led retrofit programme to insulate homes, improve energy efficiency, reduce fuel poverty, and expand low-carbon heating [117]. The term "retrofit" has been missed in all these manifestos despite both the Liberal Democrats and Labour Party having used it in their 2019 manifestos.

The Labour government was re-elected in 2024. It can be argued that the political priority at this time was energy security, but not energy efficiency. The withdrawal of the

mandatory gas boiler phase-out was announced by the Conservative government and validated by the Labour government. This was not favourable news for most environmentalists. The retrofit industry was making plans, and technology was feasible without depending on heavy innovations [118]. The establishment of the Great British Energy Company was a positive move to take control of the energy markets [83]. The current price disparity between electricity and gas is a key barrier to promoting low-carbon alternatives. If the government could take control and make the relevant policy decisions, residents would be motivated to go for heat pumps, focusing on attractive cost savings. Currently, the cost of electricity is four times higher than that of gas [119]. Usually, a heat pump can generate 3–4 times more energy than it consumes [8]. However, there can be a number of reasons which will not make a heat pump reduce energy bills without a deep retrofit. Based on the results of the SHDF demonstrator/WHR evaluations [65] and the CCC recommendations [112], it is unlikely that the government will focus on deep retrofit at scale strategies in the near future.

4.2. Evolution of Housing Retrofit Grants

An important aspect related to the retrofit policy is the financial support (grants) for retrofitting houses. In general, there are a number of housing retrofit grants for the post COVID-19 period. The Climate Change Committee has estimated £256 billion to decarbonise the housing stock under its balanced pathway in 2019 [112]. Figure 2 shows the delivery periods/timelines of the grants, but not the value of each grant.

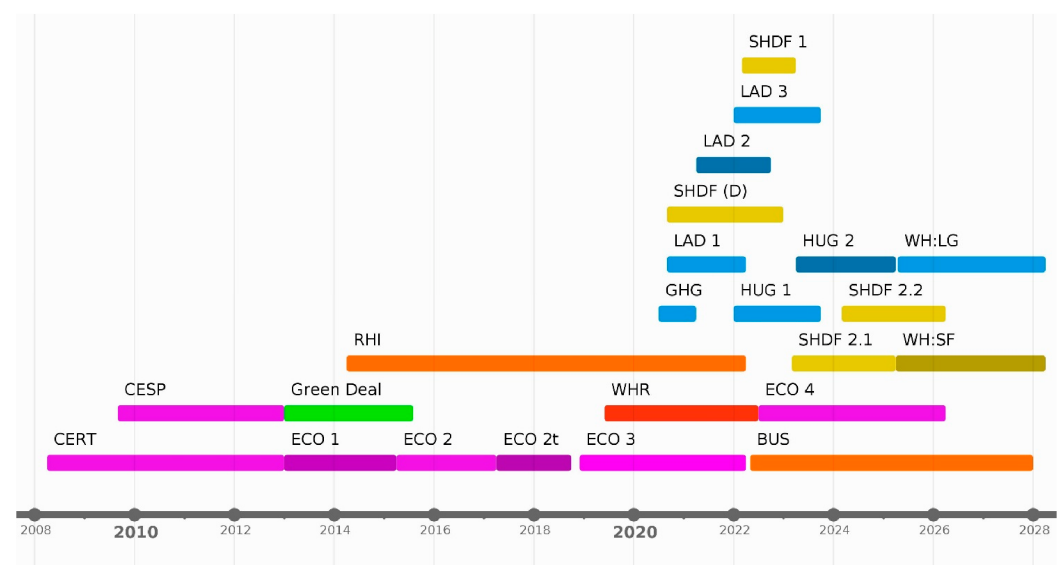


Figure 2. Timeline of housing retrofit grants.

The Labour Party manifesto 2024 promised a total investment of £13.2 billion for energy efficiency [114]. However, critics argue that this is far below the originally promised £60 billion for ten years of capital allocation by the Labour Party in the 2019 election promise “Warm Homes for All” [110]. This was not found in their 2019 election manifesto [109], and it is argued that this promise is just to gain attention. According to the UK Government, these measures are delivered through various grants and schemes such as Warm Homes or the Boiler Upgrade Scheme. The current Labour government has allocated £1.79 billion for the warm homes scheme against their promised £2.6 billion for the initial year [25,81]. Figure 3 shows a visual presentation of the progress of residential emissions reduction and the performance of retrofit measures during the past two decades.

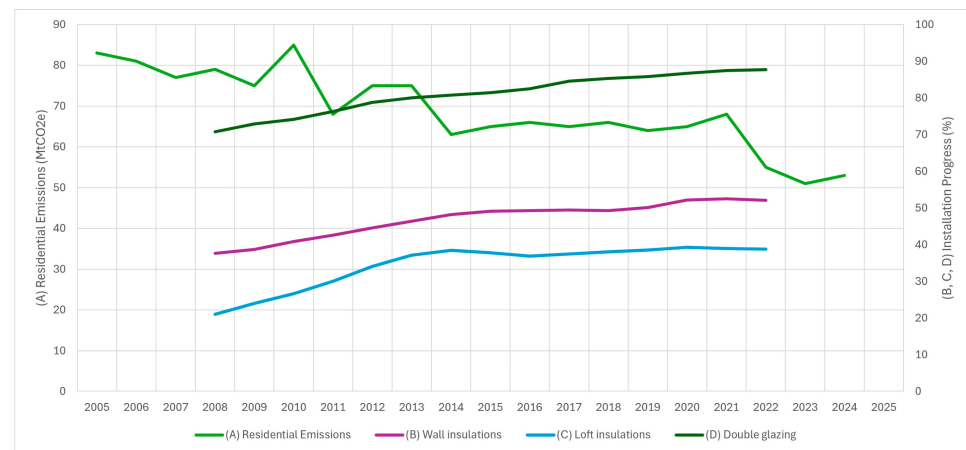


Figure 3. Progress of emissions and retrofit measures.

Figure 3 refers to existing statistics from official government publications and Statista [92,120]. Underlying figures can be obtained through the relevant sources. The retrofit measures statistics are only available for England, and they only contain measures installed through government grants. 2024 emission figure is provisional. Due to partial availability and lack of consistency, the purpose of the figure is to illustrate the trend. The UK residential emissions were reduced by around 45% during the past two decades from 83 MtCO₂e (2005) to 53 MtCO₂e (2024). However, the progress of retrofit measures has stagnated since 2014. The reduction of emissions is mainly attributed to the reduction of emissions from the energy supply [70], not because of energy efficiency.

5. Conclusions

This policy analysis focused on the housing retrofit policies along with political party manifestos and related government actions in England for the period of 2005 to 2025. According to Figure 3, the ten-year period from 2014 is the lost decade of insulation [121]. Despite that, there is a growth of housing retrofit policies oriented towards quality over quantity. One of the arguments was that the lost decade of insulation is due to the poor homeowner trust in housing retrofit, due to the negative case studies of mass insulation schemes without focusing on the unintended consequences. Thanks to the regulatory measures addressing the concerns of the Each Home Counts report [57], such as PAS 2030/PAS 2035 [2,122], the housing retrofit is observed to be moving forward towards a direction of quality and low risk.

Unfortunately, the focus of housing retrofit is on retrofit at scale, rather than deep retrofit, predominantly inspired by the Climate Change Committee's balanced pathway [112,123]. While this could address the problem of residential decarbonisation, there is a question that to what extent this strategy could answer problems such as fuel poverty and quality of life. A deep retrofit is a no-regret solution which can address decarbonisation, fuel poverty and the quality of life of the residents. The government would not proceed with such a strategy, given that the deep retrofit pilot projects had failed [65]. If the government does not aim for a deep retrofit strategy, lower electricity prices will be a must to eliminate fuel poverty. The government has recently set up the Great British Energy Company to solve the problems of energy security and energy prices, which is a timely action.

Lessons learned: Inconsistencies among the policies are considered to be a learned lesson. For example, while the retrofitting is promoted, people have to pay more VAT for retrofit over the new builds. Another lesson learned is the expected adverse effects of frequent changes in policy direction. E.g., scrap of MEES regulation and gas boiler phase out. The government should also learn lessons from the effects of short-term popular

actions over strategic actions. For example, retrofit grants such as the Green Deal or Green Homes Grant were vaguely planned and executed without a strategic focus. Retrofit policies are complex and not easily comprehensible to homeowners. There is a range of housing retrofit grants, and their criteria have changed all the time.

From the perspectives of residents, industry and resource availability, the authors recommend a strong, straightforward, strategic and holistic approach to housing retrofit with a focus on 2050. Key limitations of the study were the impracticality of conducting a cross-border analysis of policies across England, Wales, Scotland and Northern Ireland. In addition, some less impactful policies may have been excluded from the analysis. However, these limitations are unlikely to have significantly influenced the overall findings of the study.

Supplementary Materials: A summary and references of the housing retrofit policy-related events in the United Kingdom from 2005 to June 2025 can be accessed through <https://doi.org/10.6084/m9.figshare.29385098.v2>. This is a more detailed version of Figure 1.

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Abbreviations

The following abbreviations are used in this manuscript:

BRE	Building Research Establishment
BUS	Boiler Upgrade Scheme
CBDP	Carbon Budget Delivery Plan
CCC	Climate Change Committee
CEO	Chief Executive Officer
CERO	Carbon Emission Reduction Obligation
CERT	Carbon Emissions Reduction Target
CESP	Community Energy Saving Programme
CHP	Combined Heat and Power
CPF	Carbon Price Floor
CSH	Code for Sustainable Homes
DBEIS	Department for Business, Energy and Industrial Strategy
DBT	Department for Business and Trade
DESNZ	Department for Energy Security and Net Zero
DSIT	Department for Science, Innovation and Technology
ECO	Energy Company Obligation
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
EU ETS	European Union Emissions Trading System
EU	European Union

FHS	Future Homes Standard
GBIS	Great British Insulation Scheme
GDP	Gross Domestic Product
HDST	Home Decarbonisation Skills Training
HHCRO	Home Heating Cost Reduction Obligation
HHSRS	Housing Health and Safety Rating System
HQM	Home Quality Mark
HUG	Home Upgrade Grant
LAD	Local Authority Delivery
MCS	Microgeneration Certification Scheme
MEES	Minimum Energy Efficiency Standards
MtCO ₂	Million Metric Tons of Carbon Dioxide
MVHR	Mechanical Ventilation with Heat Recovery
PAS	Publicly Available Specification
RHI	Renewable Heat Incentive
SDG	Sustainable Development Goals
SEG	Smart Export Guarantee
SHDF	Social Housing Decarbonisation Fund
VAT	Value Added Tax
WHR	Whole House Retrofit

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