



**LEFT OUT
IN THE COLD
THE HIDDEN
HEALTH COSTS
OF COLD HOMES**

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UCL Institute of Health Equity
University College London
1-19 Torrington Place
London
WC1E 6BT

<https://www.instituteofhealthequity.org>



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Report writing team

Angela Donkin and Michael Marmot

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FOREWORD

In the UK today one third of all households, 9.6 million, can't afford a decent standard of living and are in poorly insulated homes. The resultant fuel poverty is a major contributor to the poor state of health of the country. The tragedy is that this problem should be entirely remediable.

Conceptually, fuel poverty is simple. It has three components: the price of fuel, the quality of housing and poverty. Whatever the aims of privatisation of energy in the UK, it is not delivering lower costs to the consumer. Fuel costs in the UK are 30% higher than the European Union average. Small energy companies have faced a torrid time, but large energy companies continue to make large profits.

Our housing stock is among the least energy efficient in Europe. There was welcome investment in energy efficiency of households in England from 2011-2013 resulting from government action. But in 2013 such investment fell off a cliff – there was a 90% reduction in installations in loft, cavity and solid wall insulation. The investment was not resumed.

Poverty should be a national scandal. The fact that it appears not to be is, in its way, more scandalous. At the severe end is destitution, the Joseph Rowntree Foundation (JRF), in its 2023 report, defined destitution as doing without 2 or more of 6 essentials: housing, heating, light, food, appropriate clothing, and toiletries. In 2022, 3.8 million people were in a state of destitution, including 1 million children. The figure for children was 2.9 times higher than five years previously. JRF also calculates a minimum income standard which is close to the median income of £33,000. It implies that half the population are struggling financially.

In our 2010 Review, *Fair Society Healthy Lives*, we had six domains of recommendations: early childhood, education, work and employment, minimum income for healthy living, living environments, healthier lifestyles. Often, I am asked to recommend one as a priority. The present report illustrates why they are all inter-related. Cold homes have influence on children's health, development and education. Poorly paid work contributes to poverty in general and fuel poverty, in particular. Poverty for those not working results from benefit payments insufficient to meet the cost of essentials. The quality of housing and environment is key to health and health equity. The high cost of housing contributes to poverty. Fuel poverty leads to impossible choices between healthy eating and a warm environment.

We have recently added two more to our six domains: tackle discrimination, racism and their consequences; pursue environmental sustainability and health equity together. Both of these are highly relevant to the current report. There is a high level of fuel poverty among some minoritised ethnic groups. Improving the thermal property of housing will aid in efforts achieve net zero greenhouse gas emissions.

What starts, then, as a concern with cold homes quickly becomes a much more general concern with the social determinants of health inequalities.

That said, this specific problem, can be addressed by spending £7.4 billion a year for a decade to retrofit our housing stock to bring it up to acceptable standards of energy efficiency.

In *Fair Society Healthy Lives*, we laid out the concept of proportionate universalism – universalist policies with effort proportionate to need. The widespread nature of insufficient incomes – half of the population below the minimum income standard – calls for universalist policies to address the three causes of fuel poverty. The particular problems of people in destitution argues for effort proportionate to need.

We work from the basic premise that good health should be a priority for all policies. The actions we recommend in this report are important steps to creating a fairer more sustainable society with greater health equity and protection of our environment. Government and prospective governments, please take note.

Michael Marmot

Professor Sir Michael Marmot CH

Director UCL Institute of Health Equity

EXECUTIVE SUMMARY

In 2011 the Institute of Health Equity (IHE) was commissioned by Friends of the Earth to review and publish the evidence on cold homes and health and to make recommendations as to what needs to be done¹. This report, commissioned again by Friends of the Earth, reviews the evidence and progress since that original report. The evidence base is now stronger and since 2011 both the World Health Association (WHO) and English Government have recommended that, for health, homes are kept at a minimum of 18°C^{2,3}. We have also seen an increase in the proportion of properties insulated to Energy Performance Certificate (EPC) C or higher (energy efficient) from 15 per cent in 2011 to 47 per cent in 2021⁴.

However, while encouraging, these actions are not enough. Just over half of all households are living in energy-inefficient housing. This, together with excessive costs of fuel and increasing poverty, means that more of the population are at risk from the poor health and mortality associated with cold homes than when we published our first report more than a decade ago.

The UK has unacceptably high numbers of households living in cold homes

Using the government measure of fuel poverty in 2011, between 2011 and 2022 the numbers in fuel poverty, in England, doubled and were projected to increase further in 2023 so that 12 million households would have spent more than 10 percent of income on fuel after housing costs. 8.83 million households would have spent more than 10% of income on fuel before housing costs⁵.

The official government estimate for 2023, using the government's *new* measure of fuel poverty, suggests that 3.53 million households in England would have both a low income (below 60 per cent of median income) and inefficient housing (below EPC band C)⁶. However, several surveys suggest that this may underestimate the true extent of fuel poverty. For example, in 2022 13 million households in the UK, out of the 28 million (46%), were not putting on heating in cold spells⁷.

We estimate that 9.6 million households in the UK, 34%, are at risk of living in a cold home, on a low income and unable to pay anything to help insulate their home. This estimate, based on English Housing Survey (EHS) data, is the number of households living in energy-inefficient homes with incomes below the JRF minimum income standard.

Cold homes and fuel poverty have a large negative impact on health and other social outcomes

As noted in 2011, cold homes have direct negative impacts on the health of both children and adults. Cold homes increase blood pressure, which can increase the risk of a heart attack. In addition, cold air restricts the airways, suppresses immune response and exacerbates damp and mould, which in turn increase the risk of developing winter infections, and respiratory problems.

Arthritis, grip strength and sickle cell anaemia can all be made worse by living in cold conditions and a reduction in dexterity leads to an increased risk of falls in the home.

In 2022 we reported that children's lung function and brain development can be negatively impacted by living in a cold home, resulting in impaired cognitive development⁸. In addition, 28 per cent of young people are likely to be at risk of multiple mental health symptoms due to living in a cold home, compared to four per cent of children living in adequate warmth⁹.

The evidence has strengthened on the negative impacts of cold homes on mental health. Becoming unable to heat a home doubles the risk of adults developing new mental health conditions and triples the risk of these getting more severe if people already had mild mental health conditions, even after controlling for other socio-economic variables¹⁰.

Recent data on winter mortality suggests that those who are living with Dementia and Alzheimer's disease have a high risk of mortality in the winter¹¹. This may be because they forget to put heating on or wear appropriate clothing and NICE should review their 'who is at risk' guidelines in light of this evidence.

Having to spend more on heating to stay warm has wider implications for health. Households living in poverty and in cold homes have choices to make regarding what they spend their money on: for instance, prioritising heating places households at greater risk of malnutrition. Poverty and accompanying stress levels are associated with an increased risk of disease and a shorter life span.

Living in a cold home can have other social consequences, such as increased social isolation and loneliness¹² and lower school attainment. UK children miss more school days due to disease burden from damp than any EU member state, with rates over 80 per cent higher than the EU average. As well as missing days in school, it is much more difficult for children to do homework and study in a cold home where households crowd into one or two heated rooms¹³. This negatively impacts GCSE results¹⁴.

While not specific to cold homes, it is worth noting that lack of action on climate change is having an additional negative impact on the mental health of adolescents. In 2022, 70 per cent of children between the ages of 12 and 18 were experiencing what is now known as eco-anxiety¹⁵. Another multi-country study found that across 10 countries including the UK, more than 45 per cent of respondents said their feelings about climate change negatively affected their daily life and functioning¹⁶.

On all causes of cold homes, the UK is behind European counterparts

Action to increase incomes, insulate homes and reduce fuel prices could all help to reduce the health risk from cold homes. However, Government policies have left Britain in the cold.

The proportion of properties insulated to Energy Performance Certificate (EPC) C or higher (energy efficient) increased from 15 per cent in 2011 to 47 per cent in 2021. However the majority of that work was in 2011-2013. There has been a 90 per cent reduction in installations in loft, cavity and solid wall insulation since 2013, and rates have not recovered¹⁷. **Our housing stock is one of the least energy efficient in Europe**¹⁸.

The price of fuel in the UK is 30 per cent higher than the EU average¹⁹.

Incomes in the UK have flatlined since 2007 and income growth has been lower than in Europe. Low-income households are now around 27 per cent poorer than their French and German counterparts, taking home £4,300 per annum less than their French equivalents²⁰. Given stagnant wage growth, calculating poverty as 60 per cent of median income disguises the real numbers in hardship. Median income is approximately the same as the JRF minimum income standard – a minimum income for a decent standard of living. This could be considered a poverty threshold, with half the population below it.

In addition to these pressures, **the cost of housing is higher than the European average**, and this is placing more pressure on already stretched budgets. In 2020, half of the lowest earners and almost one in four (23 per cent) of all those who rent privately in the UK had to spend 40 per cent or more of their salary on housing²¹, meaning they were overburdened by housing costs; only Colombia scored worse. Since then, rents have increased substantially, up 56 per cent since October 2019²². For those who can consider buying, the cost of buying a two bedroomed flat is 36 per cent higher than the European average²³.

Government promises to ‘level up’ appear disingenuous. Income inequality is worse now in the UK than in any other large European country - the rich have got richer and the poor poorer²⁴.

Priority groups for action

Action is needed on two fronts. Homes need to be insulated and incomes need to be sufficient. For example, those who live in social housing are more likely to live in a cold home despite improvements to this housing stock over the last decade and this is because they still cannot afford the heating²⁵.

A study found that between 2019 and 2021 one in five of those who are out of work due to a health condition live in a cold home²⁶. This group is at most risk of worsening health outcomes and mortality. Given that 2.5 million are off work due to ill health in the UK, then at least half a million will be living in cold homes that are very likely to make their condition worse and make returning to productive work harder. NICE guidelines state that people at risk from the negative impacts of living in a cold home should be discharged to a warm home.

A current government scheme called ECO4 flex provides local authorities and devolved administrations with the ability to refer those with existing health conditions at risk of living in a cold home for insulation measures to be fitted²⁷. However, the scheme aims to help just 450,000 households, of which half can be referred by local authorities and will therefore be insufficient, given that children and older people with health conditions must also be in warm homes²⁸.

Households in arrears with housing payments must be another priority group, as they are highly likely to be living in cold homes. Those eligible for universal credit should be next – 90 per cent of households on Universal Credit last year were going without basic essentials and will struggle to heat their homes adequately²⁹. People of colour are more likely to be living in damp housing and be in fuel poverty and so action to address damp and incomes is needed for this group.

Following that, a wider scheme to support all those in energy-inefficient homes who are below the minimum income standard will be needed, starting with those households with members over 65 years of age and with children.

Regional mortality data on excess winter deaths could be used to help target at-risk areas earlier. This data shows, for instance, that homes in the North West, South West and Wales are more likely to be too cold and that excess winter deaths are higher in areas with high levels of deprivation³⁰. Action to improve incomes is needed to tackle deprivation. In addition, the regional statistics suggest that area by area, street by street action may be an efficient way to deliver improvements, enabling economies of scale.

This public health crisis caused by cold homes is costing society billions per year

The End Fuel Poverty Coalition has estimated that 4,950 excess winter deaths in the UK were caused by cold homes last winter³¹. This is the most tragic consequence of living in a cold home. However, the wider impacts on health, society and the climate are highly significant, widespread and warrant more focus. Evidence suggests that cold homes are costing billions per year, for example through increased costs to the NHS; higher caring costs; bigger bills; lost productivity and larger carbon emissions.

The Building Research Establishment Group (BRE) has calculated that the very worst housing in England – approximately 720,000 homes with a Category One hazard of excess cold (typically insulated to bands F or G) cost the NHS £0.5 billion per year in first-year treatment costs alone. It estimates an average cost of £6,635 per household to remedy, meaning that improving these homes would pay back within nine years, in NHS savings alone³².

Other work by the same group estimated the total societal cost of the 720,000 Category One cold hazard homes to be £15.26 billion in 2016, suggesting that the cost of insulating these homes would be recovered in less than six months. Societal costs include care costs, loss of economic potential and potential mental health costs. However, given new evidence on the direct impact of cold homes on mental health, it would be useful to have these explicitly costed in future BRE calculations because the mental health addition utilised by BRE in this calculation will be an underestimate³³.

The BRE estimate of £15 billion in societal costs of cold homes per year for England is also likely to be a considerable underestimate because it only applies to the very worst homes and needs updating in line with inflation. The Housing Health and Safety Rating System (HHSRS) was created in 2004 and at that time Category F and G homes were identified as being Category One cold hazard homes because the prohibitive cost of heating them (insufficient heating systems and insulation) would mean that many households would be unable to heat them to a sufficient standard³⁴. However, currently eight million households in England are in energy-inefficient housing and below the JRF minimum income standard, and will be struggling to heat their home effectively. It is evident that the cost to society has the potential to be significantly higher than £15 billion and higher again when extrapolated to the 9.6 million homes across the UK.

Future analyses should also factor in carbon emission cost which is not included in the above costs. Using data from the latest English Housing Survey (EHS) and a recent financial estimate of the impact of carbon

emissions from the United States Environmental Protection Agency (USEPA) it is possible to put a price on the failure to insulate homes to an adequate standard (EPC band C). Bringing all properties with low-incomes in the UK – those below the Joseph Rowntree Foundation's Minimum Income Standard (MIS) – up to EPC band C would avoid £2.9 billion a year in avoided climate impacts^{1,35}.

If we add £2.9 billion to £15 billion then the available analyses suggests that uninsulated homes are costing society at least £17.9 billion a year, however the BRE figures are just for F and G homes. The joint combination of energy-inefficient homes (lower than EPC band C) and low incomes will be costing tens of billions more, given the current cost-of-living crisis and the level of mental health harm identified. Further work to update cost-benefit analyses is warranted.

It makes moral, health and economic sense to bring forward investment needed to insulate homes to reach net zero targets

The Climate Change Committee has recommended that homes are insulated to EPC band C to reduce household carbon emissions to meet legally binding domestic carbon reduction targets and the UK's international commitments³⁶.

The evidence demonstrates that to minimise ill health from poorly insulated homes, homes need to be insulated up to EPC band D for warmth if consumers can afford current heating bills³⁷. For those that cannot, then homes need to be insulated to EPC band C to enable them to afford to heat to an acceptable standard. It is important to note that insulation must be fitted with adequate ventilation to help to avoid damp, poor internal air quality and over-heating.

Using English Housing Survey data on the cost of retrofit we have also calculated the cost of retrofitting all low-income homes (below MIS) in England at £62.2 billion (£74.5 billion for the UK). The English Housing Survey estimates the average cost of bringing homes EPC E or lower to EPC C at £13,931, and the average cost of EPC D to EPC C homes at £6221³⁸. Spread over a ten-year period, this equates to an expenditure of £6.2 to £7.4 billion per year.

Overall, this means that a one-off 10-year programme of investment in housing insulation of £60 billion, as the Labour Party originally suggested in its' Green Prosperity Plan, would more than pay for itself through avoided health costs and climate costs, savings that will continue to accumulate over decades. Further there are likely to be economic benefits from such a large programme in terms of jobs in manufacturing and installation. The current government has recently pledged £6 billion for the three-year period from 2025



to 2028, equating to £2 billion a year to retrofit the public estate, schools, hospitals, and social housing; while welcome, this level of investment is insufficient.

Genuine action to increase disposable incomes is needed

People need to be able to afford to heat their homes, eat and maintain a healthy standard of living. 90 per cent of those on Universal Credit last year could not afford essentials and this crisis is deepening. For example, the numbers having to reduce meals, skip meals or go hungry was up from 5.7 million low-income households in May 2023, to 5.9 million in October 2023³⁹. A study published in 2020 found that rates of stunted growth were increasing, with British five-year-olds shorter than the five-year-old populations of our European neighbours, with significant height inequalities between poor and wealthy areas within this country⁴⁰.

There is room for the UK social protection system to be more generous with more progressive taxation, however given constrained government budgets, better targeting of limited tax revenue may also be warranted.

In 2021/22, 64 per cent of working age households in the UK in poverty had a person in the household in work⁴¹, up from 52.9 per cent in 2009/10. This is a worrying trend, but worse is the rise in households in poverty where both adults work. In 2019/20 18.8 per cent of children and working-age adults in poverty lived in families where all adults were working and at least one adult was working full time, up from 12.6 per cent in 2009/10.

Support to help people work full time, paying at least the living wage, and better profit sharing in companies should be explored to reduce poverty among staff and supply chains. The resulting reduction in the number of workers needing top-up payments could help to better fund those in need of government support with more generous payments.

Better targeting of winter fuel payments to those on low incomes could redirect more than £2 billion a year towards insulation and greater support for those most in need, albeit that some additional costs would be associated with the administration costs of means-testing this scheme.

Increasing incomes, without insulating homes or moving to carbon-neutral power sources, will increase carbon emissions as people will be able to afford to heat their homes. Insulation and a movement towards carbon-neutral fuels are necessary steps to take to mitigate against this.

Fuel and property prices need to move closer to the European average

The cost-of-living crisis and rising poverty is placing additional strain on households which is damaging health. A focus on reducing the cost of fuel and housing is needed to help incomes stretch further.

The cost of fuel in the UK is 30% higher than the EU average. Standing charges cost consumers just around 80 pence per day if they pay by direct debit and £1 per day if they pay by prepayment meter^{42,43}. These are not progressive taxes and have a disproportionate impact on low-income households in energy-inefficient homes. A more progressive levy applied to income tax would be beneficial for low-income consumers. With a shift to electric heating over coming decades, we need to reduce the cost of electricity through building renewable energy sources more quickly. In addition, consumers pay for the most expensive unit of power to generate, rather than the average. A review of this pricing strategy is needed to bring fuel prices down.

The cost of housing is too high. Half of low-income households are spending more than 40 per cent of their income on housing and are therefore overburdened by housing costs according to the OECD. For those who can afford to buy, property prices are 36% higher than in Europe.

RECOMMENDATIONS

1

- The Government should commit at least £62.2 billion (England) to £74.5 billion (UK) to a 10-year retrofit programme targeted to those on low incomes in energy-inefficient housing. This will save tens of billions of pounds a year through improvements in productivity, health, climate and other costs. This programme should be strategically planned, including giving councils a clear role in targeting insulation programmes street by street in the areas most in need, and include setting higher standards for privately rented homes, with necessary fiscal incentives to ensure costs do not result in higher rents.

If this scale of spending is rejected, as appears to be the case, by both main political parties, then the government must publish how it will use other levers to insulate all 9.6 low-income homes to EPC C level as fast as possible and at least within a decade, and ensure that the reductions in carbon emissions from homes are sufficient to meet the international and domestic 2030 carbon reduction goals alongside the other carbon reduction measures it will need to deploy.

2

- Local authorities and devolved administrations to utilise the powers they now have to socially prescribe insulation with adequate ventilation through the ECO4 flex scheme for those living in energy inefficient homes with low incomes and with existing health conditions such as heart disease or asthma. Government to increase the scope of scheme to deal with demand to cover all those living in energy inefficient homes with a household income below the JRF minimum income standard and a health condition beyond the 225,000 planned maximum.

3

- Government and business leaders to do more to tackle poverty and ensure households can afford a healthy life, including through ensuring the National Minimum Wage and National Living Wage are sufficient, and by more equitable redistribution of profits within companies to reduce in-work poverty.

4

- The Government to support the JRF and Trussel Trust campaign to raise Universal Credit to ensure that it covers the basic essentials and continues to do so, with at least an annual review.

5

- Government to work with energy companies to bring UK fuel prices down to the EU average or below to ensure those on lower incomes can afford to heat their homes. For example, to revisit non progressive standing charges and pricing strategies that mean consumers pay for the highest cost of fuel to generate rather than the average cost of fuel. Government to pay for improvements to energy generation through more progressive taxes.

6

- Government to bring in schemes to increase the supply of affordable good quality, sustainable housing, including through reform to the private housing market and through increased investment in building social housing.

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INTRODUCTION

In 2011, the Institute of Health Equity (IHE) was commissioned by Friends of the Earth to review and publish the evidence on cold homes and health and to make recommendations as to what needs to be done¹. This report reviews the evidence and progress since that original report.

1. THE IMPACT OF COLD HOMES ON HEALTH AND MORTALITY

As documented in our 2011 report², and others more recently³, living in a cold home can contribute to a range of negative health outcomes^{4,5,6}, including poor respiratory, and cardiovascular health^{7,8}, mental illness (e.g. depression and anxiety), loneliness, social isolation^{9,10} and a greater prevalence of falls¹¹. Cold homes affect the physical and mental health of children and adults.

Given the strength of the evidence, the UK government recommends that people should maintain the temperature of rooms that they spend a significant amount of time in at 18°C or more¹². The World Health Organization also reviewed the evidence and, in 2018, made a similar recommendation on indoor temperature, with an additional recommendation that in climate zones with a cold season, such as the UK, efficient and safe thermal insulation should be installed in new housing and retrofitted in old housing¹³.

This chapter summarises the latest evidence.

1.1 CIRCULATORY DISEASES

At temperatures lower than 12°C, blood vessels narrow, causing higher blood pressure and more viscous blood, which can lead to increased risk of blood clots, strokes, and heart attacks¹⁴. Reviews have also identified impacts of cold indoor temperatures on other biomarkers for cardiovascular disease, including increased electrocardiogram abnormalities¹⁵ and higher blood platelet count¹⁶. Having a respiratory infection in the winter, such as a cold or flu, together with the circulatory effects, can further exacerbate the risk.

Someone's physical health can also affect their ability to maintain thermal comfort in a cold home. A study on overweight adults illustrated an increased response to cold environments, indicating a "propensity toward developing hypertension", as well as a "preclinical marker for those at risk for cardiovascular disease"¹⁷.

Currently, 7.6 million people in the UK are living with heart or circulatory disease, and 65 per cent of these are over the age of 65¹⁸.

There is evidence that interventions that increase indoor temperatures can lower blood pressure^{19,20,21}. For example, a study based in four blocks of flats in the Easthall area of Easterhouse in Glasgow found lower blood pressure among the residents following energy efficiency housing improvements in their blocks²². Shiue and colleagues calculated that 9 per cent of hypertension (high blood pressure) in the Scottish population could be prevented if homes were heated at above 18°C²³.

1.2 RESPIRATORY DISEASES

Cold air can cause airways to narrow, and this can increase mucus, making breathing harder. Cold, dry air can cause irritation, worsening symptoms of wheezing, coughing and breathlessness, and weakens the immune system making it harder to fight respiratory infections like colds, flu and Covid-19²⁴. Cold temperatures also warrant more time spent indoors, increasing the likelihood of transmitting respiratory infections and diseases to others in close proximity.

Not being able to heat a home adequately also increases the risk that homes will have damp and mould. Inhaling mould spores can cause allergic type reactions, the development or worsening of asthma, respiratory infections, coughs, wheezing and shortness of breath. The death of two-year-old Awaab Ishak in 2020 was found to be a direct result of black mould in the flat he lived in in Rochdale and serves as a stark reminder of the impact of damp and mould on health²⁵.

Surveys of the general population suggest that approximately 12.7 million people in the UK (approximately one in five) have a history of asthma, Chronic Obstructive Pulmonary Disease (COPD) or another long-standing respiratory illness²⁶.

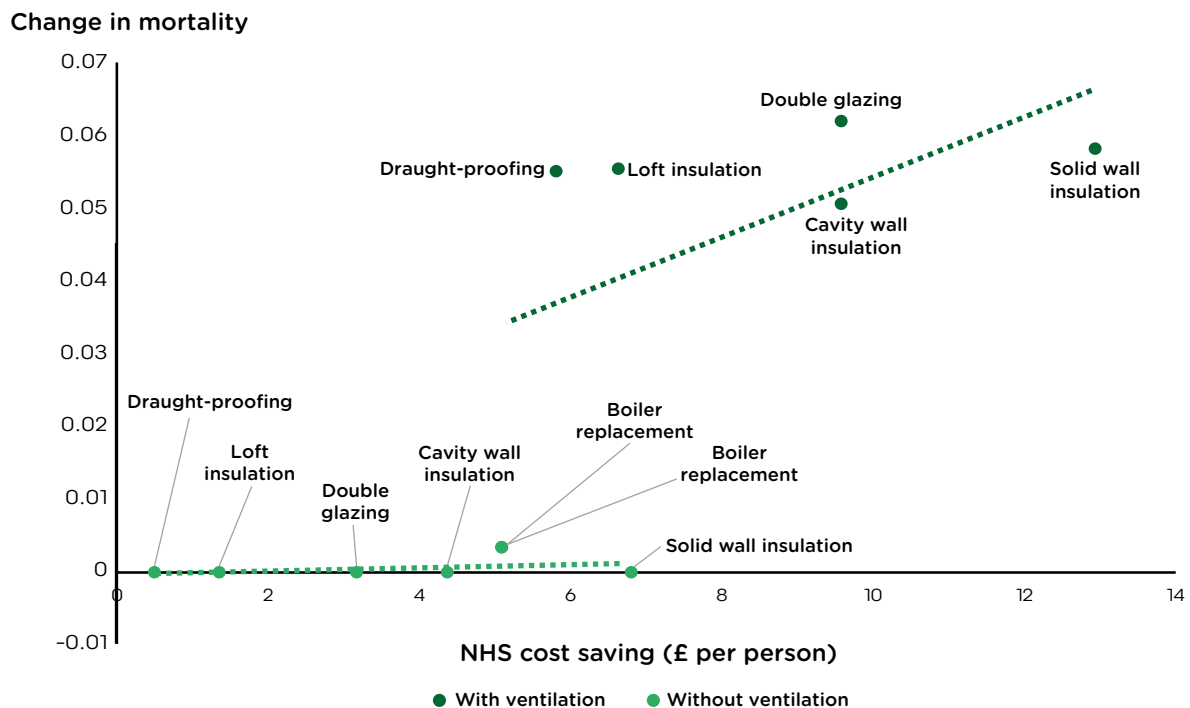
Some studies have found a positive impact of increased indoor temperatures on those with respiratory conditions. For example, a cohort study from China, including adults with COPD, reported reduced respiratory problems, with an Odds Ratio (OR) of 0.95 for developing severe symptoms with every one degree drop in indoor temperature below 18.2°C regardless of indoor humidity levels²⁷. This finding is consistent with other findings that have shown increased risk at lower temperatures^{28,29,30,31}.

Cold temperatures are associated with reduced resistance to respiratory infections and increased circulation of viruses that can cause upper and lower respiratory tract infections, including bronchiolitis, in children³². The damp and mould often associated with cold homes contribute to developing asthma and acute asthma attacks³³. Damp and mould may contribute to

approximately 10–15 per cent of new cases of childhood asthma across Europe³⁴. Asthma and its effects are further worsened by a proliferation of house dust mites as people keep windows closed to contain heat and thus reduce ventilation^{35,36}. An English longitudinal study from 2001–2005 showed that rates of respiratory illness were over twice as high in children who had lived in cold, damp homes in the previous three years compared with those who had not³⁷.

A comprehensive review of housing interventions to improve energy efficiency used multicriteria decision analysis to compare interventions³⁸. Specifically, the authors considered: mortality gain (QALYs); morbidity gain (QALYs); NHS costs (£); space heating (kWh) and impact on inequalities in health. The authors used this information to rate interventions on a scale from zero (not effective) to one (effective). They found that the health benefits of housing interventions and the savings to the NHS are much higher if associated with adequate ventilation compared to without as demonstrated by Figure 1.

Figure 1: Change in mortality and NHS cost savings (£ per person) due to various housing interventions, with and without ventilation, in households eligible for intervention, England, 2018



Source: NIHR³⁹

1.3 MENTAL HEALTH CONDITIONS

Since 2011 the evidence base on the mental health impacts of cold homes has strengthened. Individuals living in cold homes experience increased financial stress and worry; financial burden, combined with thermal discomfort, can lead to mental health issues such as anxiety and depression⁴⁰. A study utilising longitudinal data from the UK has shown that over a 10-year period, becoming unable to keep the home adequately warm was associated with statistically significant increases in the odds of reporting severe mental distress, even after controlling for variables such as income⁴¹. Low income was associated with an increased risk of severe mental distress, but over and

above that cold had a direct negative impact as well. For those with good mental health in the first wave of the survey, becoming unable to keep the home adequately warm doubled the likelihood of developing severe mental distress at a later time point. For those with borderline mental health in the first wave of the survey, becoming unable to keep the home adequately warm tripled the likelihood of developing severe mental health issues, relative to those who remained living in warm homes⁴².

The Government also recognise the increased risk of mental health problems⁴³. Harker and Shelter (2006)⁴⁴ reported that 28 per cent of young people are likely to be at risk of multiple mental health symptoms due to living in a cold home, compared to four per cent of children living in adequate warmth.

Interventions to reduce fuel poverty have been shown to have a positive impact on mental health and wellbeing outcomes. A mixed-methods approach to explore the health and wellbeing impacts of a fuel poverty programme in East Sussex that took place between October 2016 and March 2018 found self-rated health and wellbeing were significantly higher post-installation⁴⁵. Interviewees described clear examples of the positive impacts on physical health and wellbeing such as fewer chest infections, reduced pain, feeling less anxious and depressed, and generally feeling happier and more relaxed.

According to a survey conducted in 2014, 1 in 4 people in England experience a mental health problem of some kind each year^{46,47}.

1.4. GRIP STRENGTH AND ARTHRITIS

There are certain health impacts of living in a cold home which can disproportionately affect elderly populations and exacerbate conditions associated with ageing. For example, chronic conditions such as rheumatoid arthritis have been shown to be negatively impacted by prolonged exposure to suboptimal temperatures⁴⁸. In addition, grip strength and muscle strength can be weakened in cold temperatures. The physical performance of older adults is reduced in cold environments as described in one study in the UK and another in Spain, which both found lower extremity performance was significantly inhibited by inadequate heating in the home⁴⁹. This can lead to balance problems⁵⁰ and increased falls risk⁵¹. This is important when considering the future of a rapidly ageing population and the subsequently increasing burden on the UK's healthcare system. Recognising that "maintaining older adults in their homes is a matter of promoting personal autonomy and social justice, as well as an issue of sustainable healthcare"⁵².

1.5. OTHER CONDITIONS

Research has also demonstrated the relationship between epigenetic changes and response to prolonged cold temperatures. Epigenetics is the study of how behaviours and environment can cause changes that affect the way our genes work. The 2022 report from the Institute of Health Equity on Fuel Poverty and Cold Homes recognised that a person's DNA can be affected by the conditions in which they live⁵³. It is plausible that inadequate housing conditions will influence changes to genes, including those that trigger metabolic issues associated with chronic ailments like obesity and diabetes⁵⁴. Insecure or insufficient housing quality has been shown to be related to stress, mental health problems and adverse epigenetic changes throughout one's life course. Findings suggest that epigenetics may play an important role in establishing the linkages

between the wide range of biological systems and health outcomes that are shaped by socioeconomic status⁵⁵.

Research has also indicated a relationship between cold and windy weather and the increased likelihood of a pain crisis among people with sickle cell disease⁵⁶. Though this relationship may vary by geography, it is important to recognise the pain inflicted on people living in cold homes with chronic diseases that are difficult to manage.

Finally, recent studies have indicated that cold homes are related to sleep problems in older adults which can have a negative impact on brain performance, mood and physical health^{57,58}.

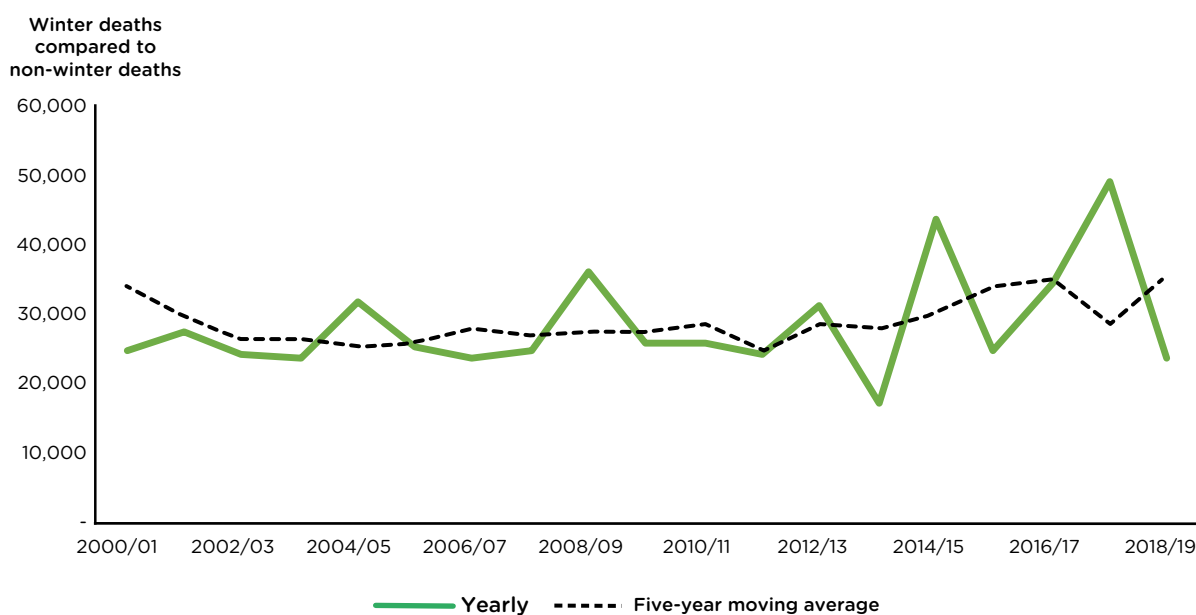
1.6. DIRECT IMPACT ON MORTALITY

Mortality related to cold weather conditions has been calculated in the UK for many years using the 'excess winter deaths' statistic. The number of excess winter deaths (EWD) is a statistical measure of the increase in mortality during winter months (December to March) compared with non-winter months (the preceding August to November and the following April to July).

In 2011, The Institute of Health Equity documented the excess winter deaths that had been occurring in the previous 10 years. The following graph illustrates that period but brings it up to 2019. As can be seen by the graph, there has been a slight increase in the winter mortality five year moving average since our first report in 2011. Figures are available post 2019, but the trend is best viewed to pre COVID-19 given that the period between 2020 and 2022 was exceptional. Between 2020 and 2022 there were an unprecedented number of deaths due to COVID-19, and in addition, an unprecedented high number of summer deaths linked to the July 2022 heatwave when temperatures in England surpassed 40°C for the first time. It is also worth noting that for the 20/21 winter period, after COVID-19, dementia and Alzheimer's disease contributed to the next highest level of additional winter mortality, then respiratory, and circulatory diseases⁵⁹. People with dementia or Alzheimer's disease may not remember to wear warm clothes or even put the heating on and can have difficulty communicating what they need to stay warm. While higher levels of social isolation over this period may have contributed to this statistic, this finding does suggest that this group is an at-risk group.

In 2011 we estimated that 21.5 per cent of excess winter mortality was because of cold homes. The figures for the winter of 22/23 had not been released by the ONS at the time of writing this report. However, the End Fuel Poverty Coalition has estimated that 4,950 excess winter deaths in the UK were caused by cold homes last winter⁶⁰.

Figure 2: Winter deaths compared to non-winter deaths, England and Wales, 2000/01 to 2018/19



Source: Office of National Statistics⁶¹

As illustrated in Table 1, data up to 2013 illustrates that the UK had one of the worst rates of excess winter deaths in Europe, coming sixth from bottom – worse than colder countries such as Norway and Sweden⁶².

Table 1: Excess winter death indices in descending order: 30 European countries (1980 - 2013)

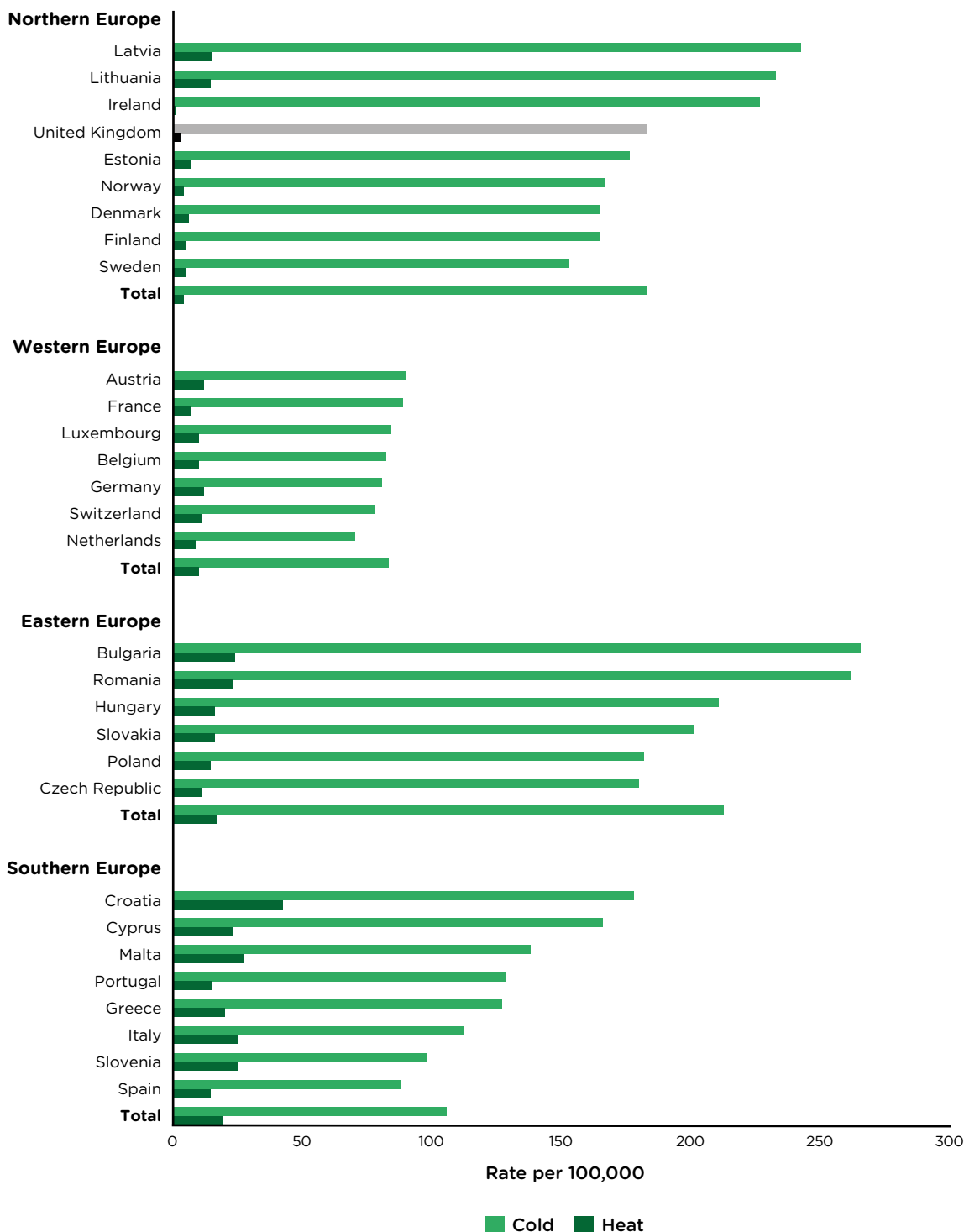
Country	EWDi	Country	EWDi
Malta	29.4	Slovenia	13.2
Portugal	28.0	Hungary	12.3
Cyprus	23.6	Denmark	12.2
Spain	20.6	Norway	12.1
Ireland	19.7	The Netherlands	11.8
UK	18.6	Germany	11.7
Greece	17.9	Poland	11.7
Bulgaria	17.8	Latvia	11.5
Romania	17.5	Lithuania	11.5
Italy	16.0	Luxembourg	11.2
Switzerland	14.2	Estonia	10.9
France	13.8	Czech Republic	10.8
Belgium	13.6	Finland	9.5
Sweden	13.3	Iceland	8.4
Austria	13.2	Slovakia	8.2

Source: Liddell et al⁶³

The following diagram is from a recent study published in the Lancet and it takes data from European cities up to 2020⁶⁴. Those living in cities in England and Wales have a higher risk of mortality from cold than those living in cities of Norway, Denmark, Finland and Sweden. In terms of Northern European countries, only Latvia, Lithuania and Ireland fared worse in terms of mortality linked to cold temperatures. However, in

Table 1, Latvia, Lithuania and Ireland fare better. This may be related to relatively low levels of insulation in cities in these regions or particularly cold winters/hot summers, with high mortality since 2013 and warrants further investigation. While the death rates illustrated in the table are not standardised, these areas still had high levels of excess winter deaths after standardisation.

Figure 3: Deaths attributable to either heat or cold (aged 20+), raw death rates per 100,000 person-years, European countries by region, 2000-20



Source: The Lancet Planetary Health⁶⁵



2. INDIRECT IMPACTS ON HEALTH AND MORTALITY

2.1 INCREASED POVERTY

High fuel costs and energy-inefficient homes contribute to increased poverty levels. Poverty damages health and reduces life expectancy in more ways than through not being able to heat a home.

According to the Office for National Statistics, in 2018 to 2020, males living in the most deprived areas of England were living 9.7 years fewer than males living in the least deprived areas, with the gap at 7.9 years for females. Both sexes have seen statistically significant increases in the inequality in life expectancy at birth since 2015 to 2017⁶⁶. In addition, those living in the most deprived areas had many more years in ill health. At birth, the most deprived females had 19.6 fewer healthy life years than their least deprived counterparts; for males it was almost 19 years fewer. At age 65, the least deprived women enjoyed 7.8 more healthy life years than the most deprived women and for men it was 7.5 years more⁶⁷.

The latest research from the Joseph Rowntree Foundation found that 90 per cent of all low-income households on Universal Credit went without basic essentials in the six months leading up to October 2023 because they could not afford them, up from 84% in May 2023⁶⁸. Specifically, this means they went without one or more of the following:

- Shelter (they have slept rough for one or more nights)
- Food (they have had fewer than two meals a day for two or more days)
- Heating their home (they have been unable to heat their home for five or more days)
- Lighting their home (they have been unable to light their home for five or more days)
- Clothing and footwear (appropriate for weather)
- Basic toiletries (such as soap, shampoo, toothpaste and a toothbrush).



43% could not afford to heat their home and 77% were food insecure.

Numbers of people experiencing food insecurity and therefore having to reduce meals, skip meals or go hungry, were up from 5.7 million low-income households in May 2023, to 5.9 million in October 2023⁶⁹. That poverty is getting worse and deepening is also evidenced by the fact that the number of households where children are experiencing food insecurity has nearly doubled in the past year. In January 2023, 21.6% of households with children reported that their children had directly experienced food insecurity in the past month, affecting an estimated 3.7 million children. This is compared with 11.6% in January 2022⁷⁰.

Around 2 million households had switched their fridge or freezer off in the six months leading to October 2023 to save money during the cost-of-living crisis, despite medical advice explicitly warning against doing so because of the risk of infection to food. Just under one million (46 per cent) had done so for the first time, indicating a deepening crisis.

Not having enough money for food has been linked to an increase in both obesity levels and rates of malnutrition. Healthy nutritious food is nearly three times more expensive than obesogenic, unhealthy, food. According to the Food Foundation, healthier foods cost an average of £8.51 per 1,000 calories against just £3.25 per 1,000 calories for unhealthy foods⁷¹. There is a strong association between deprivation and obesity in children. In 2021/22, the prevalence of obesity in children in the most deprived areas was more than double the value in the least deprived areas. This is true both for children in Reception and in Year 6, and there is evidence that inequalities in childhood obesity are widening⁷². In addition, there is increased evidence of stunted growth, with British five-year-olds are now up to 7cm shorter than children of the same age in Europe⁷³.

The impact of the accumulated stress associated with deprivation can also increase the levels of several potentially harmful biomarkers in the body. 'Allostatic load' refers to the cumulative burden of chronic stress and life events and can be measured by a combination of biomarkers. A systematic review of the impact of increased allostatic load on health found that it was associated with a higher risk of a variety of health conditions, including an increase in cardiovascular disease, lower bone density, poor sleep quality, poor diet and being overweight, chronic fatigue syndrome and poor self-rated health⁷⁴. The same study associated this with increased frailty, a decline in cognitive and physical functioning and a worsening of visual acuity in older adults. Better housing conditions and satisfaction with the home appeared to reduce allostatic load⁷⁵.

The impact of the accumulated stress associated with deprivation can also have a negative impact on parental mental health and the ability to maintain a positive nurturing environment for children, increasing the risk of Adverse Childhood Experiences and poor attachment in the early years. This leads to long term impacts on behaviour, and children's mental and physical health⁷⁶.

What fuel-poor households decide to cut back on can have varying impacts. For example, if a decision is made to prioritise food and fuel, then internet access might not be affordable. Given that many public services, including financial or social advice services and remote access health care appointments, rely on access to technology and good-quality internet, fuel-poor households who are digitally excluded can struggle to access support resources⁷⁷. Poverty conditions also increase the risk of living in an overcrowded house⁷⁸, or worse, experiencing homelessness. Overcrowding increases the risk of injury, respiratory disease and spread of infections, and has a negative effect on mental health and interpersonal relationships⁷⁹.

Action to make homes more affordable to heat, such as insulation, will help to decrease the impact of poverty on health outcomes.

2.2. INDIRECT IMPACTS THROUGH REDUCTIONS IN EMISSIONS

There is strong evidence to support that deep rapid cuts to greenhouse gas emissions/CO₂ are needed to limit global temperature increase to less than 2°C by the end of the century, and that this will be best achieved through both reducing the demand for energy (i.e. through insulation/energy-efficient transport) and transitioning the energy supply to green alternatives⁸⁰.

Climate change exposes millions of people to acute food insecurity, reduced water security and risks from flooding and storms. In 2021, more frequent heatwaves and droughts were responsible for 127 million more people experiencing moderate to severe food insecurity in 122 countries, compared to the annual numbers seen between 1981 and 2010⁸¹. In Europe, there has been an increase in malaria-carrying mosquitos, tick-borne diseases, and Vibrio bacteria-suitable coastal waters in Europe⁸².

3. COLD HOMES AND IMPACT ON OTHER OUTCOMES

3.1 SOCIAL ISOLATION

Living in a cold home has been associated with social isolation and loneliness⁸³. People who are unable to heat their homes often adopt coping mechanisms that limit socialising – for example, not inviting friends over and going to bed early to keep warm⁸⁴. In response to survey questions, one study noted that 17% of those on low incomes in a cold home would not invite friends over to visit⁸⁵.

Research has shown that interventions aimed at improving energy efficiency and insulation in homes can have positive effects on wellbeing and quality of life. Specifically, they can reduce financial stress, improve thermal comfort and improve social interactions within the home⁸⁶.

Social isolation is a separate risk factor for poor health, with one report noting that loneliness was as great a risk factor to ill health as smoking⁸⁷.



3.2 LOWER SCHOOL ATTAINMENT

There is a clear relationship between socioeconomic status and children's absenteeism from school. For example, a recent study based on longitudinal data in Scotland found increases in sickness absence by level of deprivation and for those in socially rented housing⁸⁸.

Energy-inefficient, cold homes are more prone to damp and mould, and it is estimated that 1.7 million school days are missed across Europe due to illnesses associated with damp and mould⁸⁹. UK children miss more school days due to disease burden from damp than any EU member state, with rates over 80 per cent higher than the EU average. As well as missing days in school, it is much more difficult for children to do homework and study in a cold home where households crowd into one or two heated rooms⁹⁰.

According to a rapid evidence assessment conducted by the Education Endowment Foundation (EEF), there is a positive correlation between school attendance and educational outcomes in the UK⁹¹. The research found that students with the highest attendance throughout their time in school achieve the best GCSE and A-level results. Pupils from low-income households see a larger negative effect from each day of absence⁹².

The negative impacts may not be limited to just attendance – research has shown that children living in cold homes have worse outcomes, including lower school attainment, increased truancy, and higher rates of bullying⁹³.

These negative social outcomes can have long-term effects on their wellbeing and prospects, reducing productivity and increasing the risk of needing social protection.

4. WHO IS MOST AT RISK?

4.1 AT-RISK GROUPS AS SET OUT BY THE NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE (NICE) GUIDANCE

Given that much of the health information has been reported before, there are guidelines to help local areas to implement and monitor their progress towards preventing deaths and illness associated with cold homes, as recommended by both the Cold Weather Plan for England⁹⁴ and NICE⁹⁵ Guideline 6: Preventing excess winter deaths and illness associated with cold homes. It is aimed at public health teams, housing professionals and others who have a role at a local level in reducing harm due to cold homes. PHE and NICE guidelines set out the groups of people that they consider to be vulnerable to the cold. People may be considered vulnerable because of a medical condition, such as heart disease; a disability that, for instance, stops people moving around to keep warm, or makes them more likely to develop chest infections; or personal circumstances, such as being unable to afford to keep warm enough. The guidelines state that the following groups are vulnerable:

- people with cardiovascular conditions
- people with respiratory conditions (in particular, chronic obstructive pulmonary disease (COPD) and childhood asthma)
- people with mental health conditions
- people with disabilities
- older people (65 and older)
- young children (under 5)
- pregnant women
- people on a low income
- people who have attended hospital due to a fall
- people who move in and out of homelessness
- people with addictions
- recent immigrants and asylum seekers

The NICE guidelines come with 12 recommendations; one of which is to discharge those who have been in a health or care setting to a warm home. This provides a lever for health professionals to identify and prioritise this group, although it must be noted that a year after this guidance was published, just 8 out of 314 local authorities had anything official on their website regarding the delivery of this guidance. This is not to say however that action was not taking place, most areas were working actively on tackling fuel poverty⁹⁶.

It would be useful to update this evaluation, especially given other schemes, such as the warm home ‘prescription’ initiative which provides vouchers for heating⁹⁷, and the ECO4 flex scheme through which local authorities can refer those with existing conditions to have their homes insulated.

The ECO4 flex scheme should be utilised for those in need however it is estimated that scheme will improve just 450,000 homes, of which half can be referred by local authorities or the NHS, which is insufficient⁹⁸. Later in this document we estimate that 9.6 million households in the UK households may be at risk of living in a cold home and that one in five people off work with an existing health condition are living in a cold home. Given 2.5 million off work due to ill health and also children and older people at risk we would estimate that this scheme should be extended to insulate the homes of many more people, and further work to estimate demand accurately is required.

4.2. ADDITIONAL VULNERABILITY NOT SET OUT IN NICE GUIDANCE

The evidence presented above suggests that children and young people are at risk of harm from cold homes, particularly through the impacts on mental health and educational outcomes. This could be considered another risk factor, although we recognise that the risk is to young people who are living in a low-income household and so they may already be identified through the low-income criteria. We would however add those with dementia or Alzheimer’s disease to this list given the high winter mortality index associated with these conditions.

Region and area level deprivation

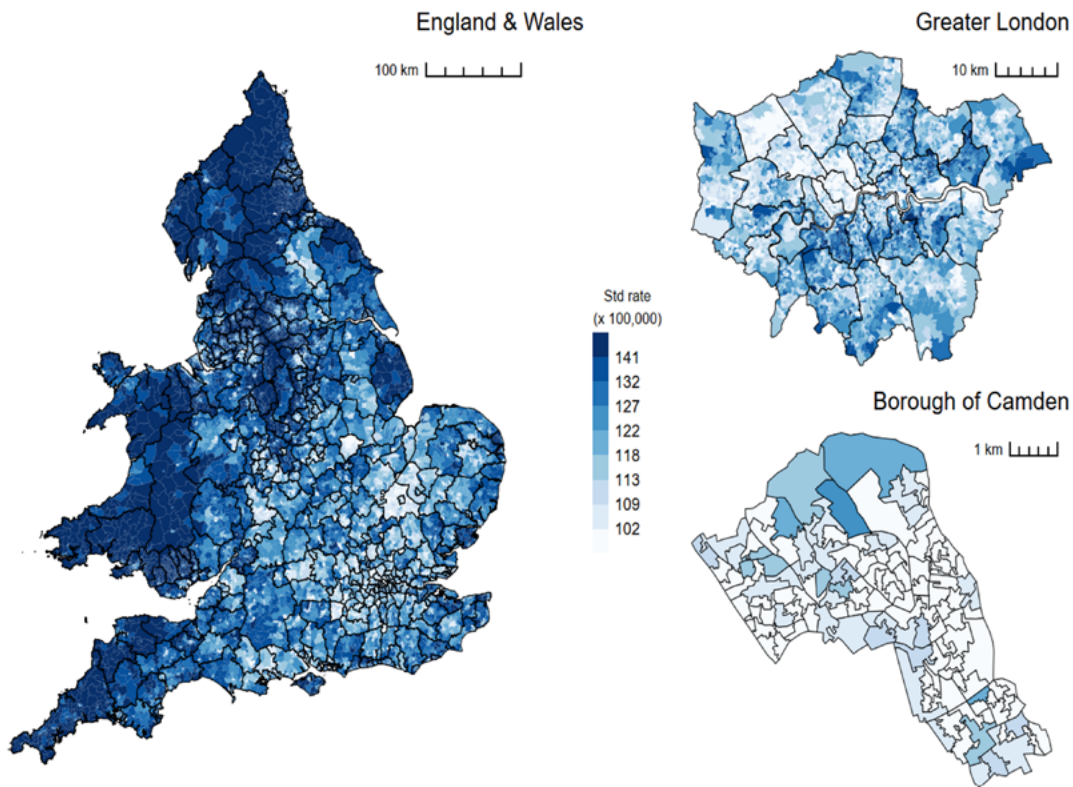
Since the publication of our last report for Friends of the Earth in 2011, a comprehensive review of the relationship between temperature and mortality was published in 2022 by Gasparrini and colleagues and looked at data on all-cause mortality and air temperature in England and Wales, at Lower Super Output Level between 2000 and 2019. On average, there were 791 excess deaths attributable to heat and 60,573 attributable to cold, corresponding to standardised excess mortality rates of 1.57 deaths per 100,000 person-years for heat and 122.34 deaths per 100,000 person-years for cold.

The risks increased with age but were highly heterogeneous geographically, indicating that other factors associated with regions could be linked to greater deaths. Figure 4 illustrates those areas with higher cold-related mortality. The work by Gasparrini

supports a link between deprivation and mortality from cold homes, finding that the most deprived areas have the highest mortality (140 deaths per 100,000 person years) compared to those in the lowest quintile (109 deaths per 100,000 person years); people in more deprived areas have a 28 per cent increased risk of dying from cold⁹⁹. Targeting support to poorer areas with programmes to reduce cold homes is therefore

justified. However, the level of variation that can be seen in small geographical areas is important as highlighted by the map of Camden. In this London borough, some of the of the wealthiest areas (Highgate and Hampstead) have higher winter mortality. The variation, as seen in Camden, highlights the need for local authority staff to fully understand risk in their areas.

Figure 4: Winter deaths compared to non-winter deaths, England and Wales, 2000/01 to 2018/19



Source: *The Lancet Planetary Health*¹⁰⁰

Race

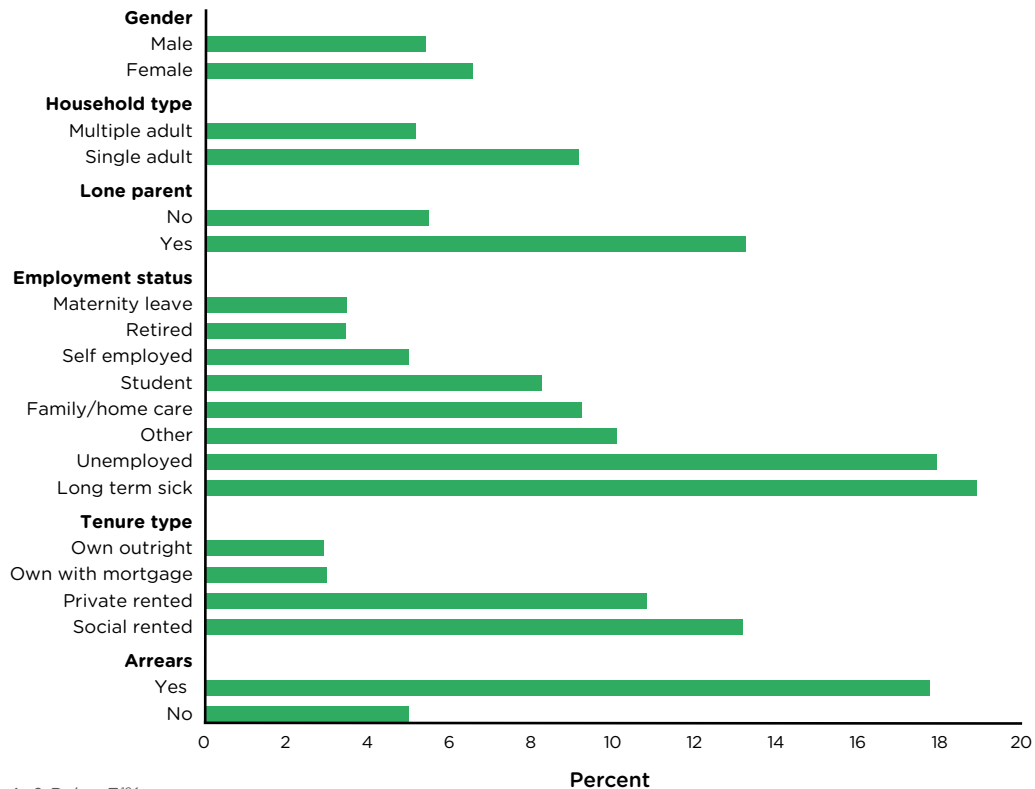
English Housing Survey data published in October 2020 shows that disproportionate numbers of people from specific ethnic minority groups live in damp housing when compared with their white British counterparts. Mixed white and Black Caribbean (13 per cent), Bangladeshi (10 per cent), Black African (9 per cent) and Pakistani (8 per cent) households were all much more likely to have damp problems than white British households (3 per cent)¹⁰¹

In addition, those in ethnic minorities have almost double the risk of living in fuel poverty compared to white households. Using the government statistic of less than 60% median income and in a home with an EPC rating less than C, 20.3% of ethnic minority households were in fuel poverty compared to 12.4% of white households¹⁰².

4.3 WHO LIVES IN COLD HOMES

Clair and Baker have recently published evidence from the UK Household Longitudinal Study (Understanding Society)¹⁰³. The survey tracks 40,000 households and the data presented below was collected between January 2019 and December 2021. With the current cost of living crisis, the numbers are likely to be much higher, but the increased risk in certain groups is likely to be the same.

Figure 5: Living in cold homes by characteristic, per cent, United Kingdom, 2019-21



Source: Clair A. & Baker E.¹⁰⁴

Figure 5 describes the household composition and circumstances of those living in a cold home. The fact that nearly one in five (19%) of the working age population who are off work for health reasons, live in a cold home, is of concern. We know that having an existing health condition is a risk factor for worsening morbidity and mortality, but this clearly impacts the productivity of the workforce as well.

A high percentage of those living in cold homes are in housing arrears (18 per cent). The issue of being in arrears was also noted in a different research study that found, in a sample of older men in the UK, that manual social class, being in arrears, difficulties making ends meet and not being married, were each associated ($P < .05$) with each of the four measures of cold homes¹ (adjusted odds ratios ranged from 1.61 to 4.68). Social isolation, poor respiratory health and grip strength were also associated with reports of cold homes. Those who reported the presence of at least three cold home measures had increased mortality (adjusted hazard ratios 2.85 [95 per cent confidence interval, 1.11–7.30, $P = .029$])¹⁰⁵.

4.4. PRIORITY GROUPS FOR ACTION

If we consider both who is at greatest risk of ill health and who is most likely to live in cold homes, action to

address the cold homes of those with existing health conditions and disabilities should be a priority.

While all those on low incomes will be at risk, there are many in arrears with housing payments that are at risk. Action to prevent arrears and increase incomes is needed for this group and the wider group on Universal Credit. Action to improve damp housing and reduce fuel poverty for households of colour is also needed.

Following that, a wider scheme to support all those in energy-inefficient homes who are below the minimum income standard will be needed, starting with those households with members over 65 years of age, or with children. Where roll-out of a national scheme needs to be phased, action to address all areas with high mortality rates from cold homes as identified in the map above, for example homes in the Northwest, Southwest and Wales and areas with high levels of deprivation, should be tackled earlier.

In sum, there should be two complementary approaches: protecting groups at high risk from cold-related morbidity and mortality; and reducing the population burden of cold-related ill-health. The first implies focussing on priority groups; the population strategy implies improving conditions for the much larger group of the population with smaller risk of ill-health from cold homes.

¹(1) having difficulties in meeting the heating/fuel costs; (2) staying in bed longer to stay warm during the previous winter; (3) unable to keep the living room comfortably warm during the cold winter weather, and (4) turning the heating off even when cold because of worries about the costs during the previous winter.

5. CURRENT HOUSING AND ECONOMIC CONTEXT

5.1 NUMBERS AT RISK OF LIVING IN A COLD HOME

Energy Performance Certificates (EPCs) provide an energy rating of a building from A to G, where A is very efficient, and G is the least efficient. The better the rating, the more energy efficient the building is, and the lower the fuel bills are likely to be. The energy performance of the building is shown as a carbon dioxide (CO₂) based index¹⁰⁶.

Record numbers of the population will have found it difficult to heat their homes this year.

Estimates for 2023 utilising the Government's measure of fuel poverty, suggest that 3.53 million households in England have both a low income (below 60 per cent of median income) and energy-inefficient housing (below EPC band C)¹⁰⁷.

However this is likely to be a gross underestimate. Utilising the same government methodology as in 2011, then fuel poverty doubled between 2011 and 2022, and was estimated to increase further in 2023, with

12 million households needing to spend more than 10 percent of income on fuel after housing costs, and 8.83 million before housing costs^{108,109}.

Other estimates suggest even higher numbers will be struggling to heat their homes. Bradshaw and Keung estimated that 15 million households (over half of households in the UK) spent more than 10 per cent of their income on fuel in 2023¹¹⁰. Other surveys support this level of risk.

In a Consumer's Association survey, nearly half of those surveyed in the UK (46 per cent) did not turn their heating on when it was cold over the winter of 2022, equating to an estimated 13 million households nationwide¹¹¹. More recently, an October 2023 survey by the Office for National Statistics found that half (50 per cent) of adults in Great Britain are using less fuel such as gas or electricity in their homes because "they cannot afford it given the rising cost of living"¹¹². However, it is possible that some of these households are reducing heating because of costs and environmental considerations but managing to keep their homes warm.

The Government estimate of poverty is much lower than the level set by the Joseph Rowntree Foundation (JRF) as a minimum income standard¹¹³. The Minimum Income Standard for the UK (MIS) illustrates how much money people need so that they can buy things that



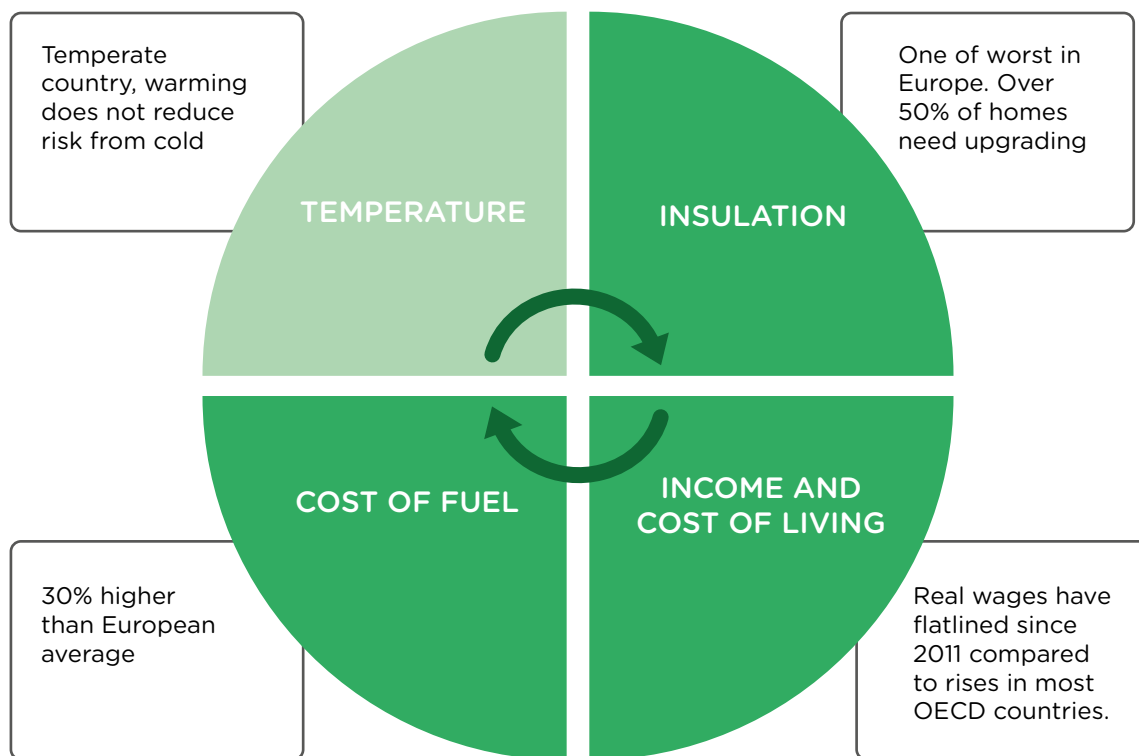
members of the public think that everyone in the UK should be able to afford. As such, it is a measure of the decency of income. A single person would need to earn £29,541 to reach the MIS. On that basis, £9.6 million households in the UK (8 million households in England) are both on a low income, defined as being below the JRF MIS, and in energy inefficient housing (Blew EPC Band C). (See Annex 1 for information on how we calculated these figures).

5.2 CAUSES OF COLD HOMES

This section briefly addresses the main causes of cold homes and sets out the level of risk that households are currently facing in relation to them. Specifically, this section addresses:

- The outside temperature
- The level of insulation in the UK housing stock
- Fuel prices and fuel poverty
- Income, poverty and the cost of living

Figure 6: An imperfect storm: Causes of numbers living in cold homes



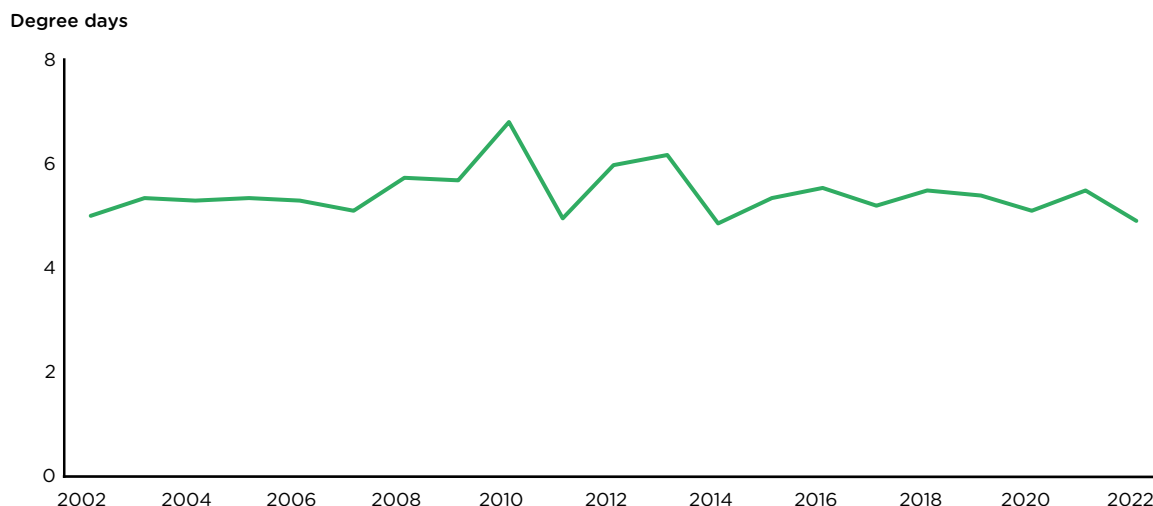
5.2.1 Temperature

The Met Office has noted that the mean winter temperature in the UK is getting slightly warmer and there has been a downward trend in days below 2°C. On the other end of the scale, there has been an increase in very hot days, with the 40°C heat barrier broken in the July 2022 heatwave, which brought with it over 4,000 deaths.

However, if we look at the amount of heat needed to heat homes to a minimum of 18°C, as recommended by the UK Government and the WHO, then as Figure 7 demonstrates, the amount of heat needed in the UK has not changed significantly in the UK since 2002¹⁴.

In short, while average temperatures do seem to be increasing, there is no evidence to suggest that this is impacting significantly on the extent to which we need to heat our homes. Climate change is an ever-evolving science - while projections for the UK currently indicate wetter and milder winters, climate change is also associated with erratic and extreme weather patterns. This is a reality that must be prepared for.

Figure 7: Average heating degree days in a month², Great Britain, 2002-22



Source: Department for Energy Security and Net Zero¹⁵

5.2.2 Number of homes not sufficiently insulated

Poor housing quality, insulation and ventilation damage health and wellbeing. Insulating a home helps to regulate the indoor temperature, reduces carbon emissions and can reduce energy bills, thereby alleviating fuel poverty. Insulation is an energy demand-reducing action recommended by the Intergovernmental Panel on Climate Change.

The Climate Change Committee also recommends insulating to EPC band C to reduce emissions. In the UK, more than half of homes are not insulated to EPC band C or above and as such are insufficiently insulated to support reductions in emissions.

What level of improvement in insulation is needed?

Substantial changes in the energy-efficiency characteristics of a dwelling are needed to achieve a noticeable improvement in indoor temperatures. Researchers have found a plateau effect beyond which no further increase in temperature occurs from just insulation alone, which begins at energy-efficiency levels close to the average for the English stock (band D)¹⁷. However, while insulation alone cannot further improve temperature, spending money on heating can, and the heating costs associated with heating EPC band D homes are higher than heating costs for EPC band C homes. Improvements in energy efficiency from

band D to band C positively impact health, mainly by enabling consumers to be able to afford to heat their homes and by reducing fuel poverty.

Average bills by EPC rating in January 2024 are estimated to be: £2,272 for an EPC band E-rated home; £2,038 for a D-rated home; and £1,759 for a C-rated home, although clearly these figures will vary according to the size of the property¹⁸. Another survey notes that homes with an EPC rating of band F are likely to have a gas bill almost £1,000 higher than a home rated C. These are significant savings¹⁹.

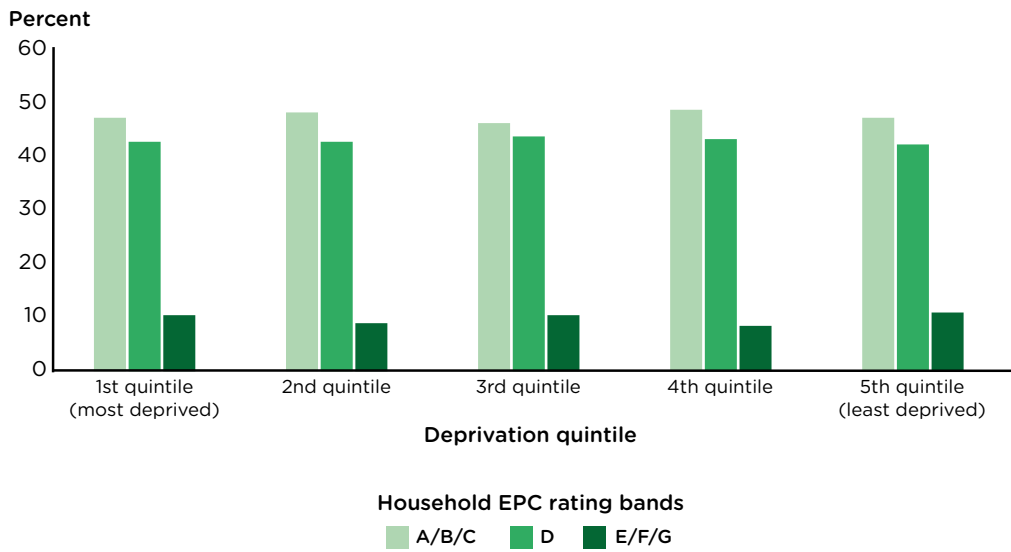
Energy efficiency of homes by income group and tenure

Figure 8 illustrates that there is not much difference by income decile in terms of who lives in energy-efficient homes with action to improve energy efficiency needed across society. Figure 9 illustrates that there are fewer people living in social housing in homes insulated below D however. This is because the Government has been running schemes for a number of years to help improve the insulation of these homes. The evidence below suggests that while action to improve social housing should continue, the greatest numbers of energy inefficient homes are owner occupied or privately rented and improving these homes needs to be the focus.

²Heating degree days: It is important to note that the numbers do not mean the number of days each month that heating is needed, but it also considers the difference between the base temperature and the minimum temperature needed in a home, which is 18 degrees Celsius. If the outside temperature was 2 degrees below the base temperature for 2 days, there would be a total of 4 heating degree days over that period (2 degrees * 2 days = 4 degree days). This actually means that the data is more useful, comparable and comprehensive, but it is harder to describe!¹⁶

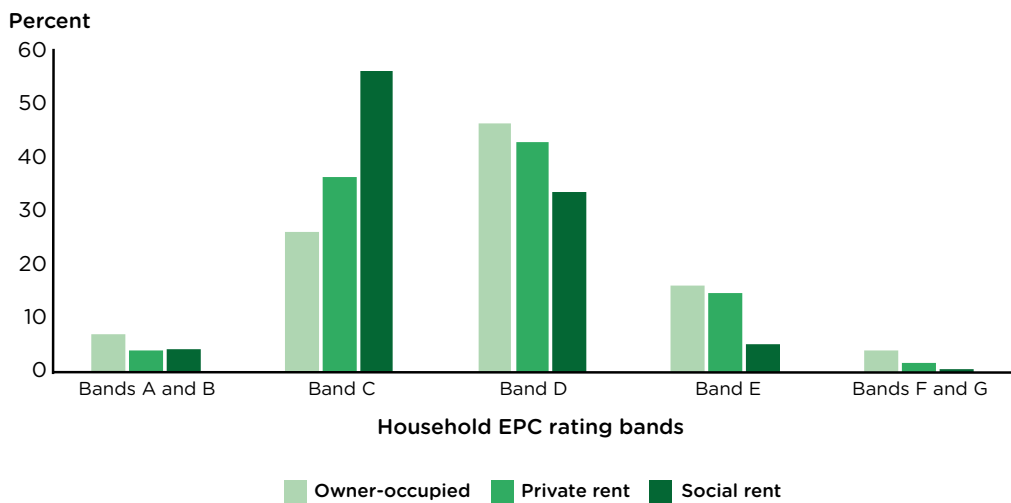


Figure 8: The energy performance of homes by deprivation quintiles, England, 2021/22



Source: Department for Levelling Up, Housing and Communities²⁰

Figure 9: Tenure type by EPC rating bands, per cent, England, 2022/23



Source: ONS²¹

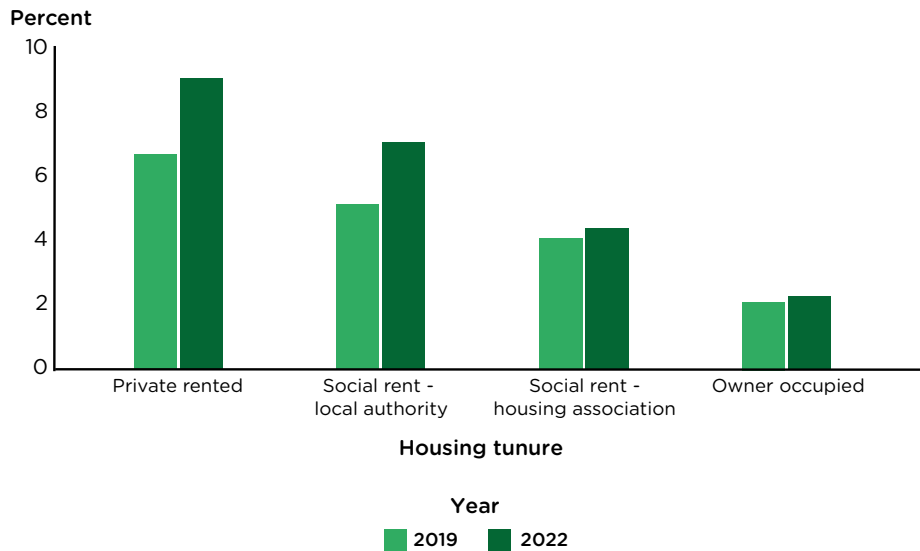
Since April 2020, private landlords can no longer let homes that are below EPC band E, but just recently legislation that would have required them to insulate to EPC C has been dropped. It should be noted that landlords will not directly benefit from improved warmth, health, and reduced fuel bills. Recent higher mortgage rates, tax changes and regulations regarding insulation and fire safety have made it less profitable for landlords to buy houses and offer them for rent. Landlords have been moving out of the sector, resulting in a shortage of supply and rent increases that have further exacerbated the cost of living.

A balance therefore needs to be struck. Adequate incentives for landlords such as tax breaks on improvements should be investigated with the aim of improving private rentals while maintaining supply at an affordable price. However, a more comprehensive approach to increasing the affordability of housing needs to be actioned. The ‘market’ has failed to provide sufficient adequate and affordable housing and therefore reforms of the private housing market together with an increase in building social housing are warranted.

Damp homes

There has been an increase in housing with damp and mould as illustrated by Figure 10, which could be associated with a reduction in heating, as a result of fuel poverty and/or poor ventilation. Rates of damp problems are highest and increasing in the rental sector. As noted above, health improvements and savings are dependent on having both insulation and sufficient ventilation and insulation on its own is not recommended.

Figure 10: Homes with any damp problem by tenure type, per cent, England, 2019 and 2022

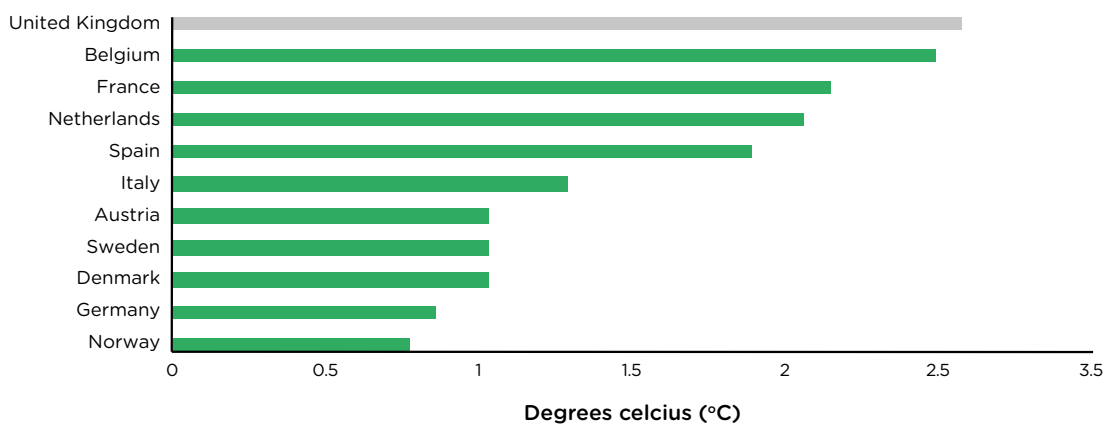


Source: Department for Levelling Up, Housing and Communities ¹²²

How do we compare to Europe

The UK's housing stock is the oldest and one of the least energy efficient in Europe. Over 52 per cent of homes in England were built before 1965 and nearly 20 per cent were built before 1919¹²³. As a result, UK homes use more energy than typical homes in other European nations. A study published in 2020 found that a UK home with an indoor temperature of 20°C and an outside temperature of 0°C lost on average 3°C after five hours, up to three times more heat than homes in Germany.

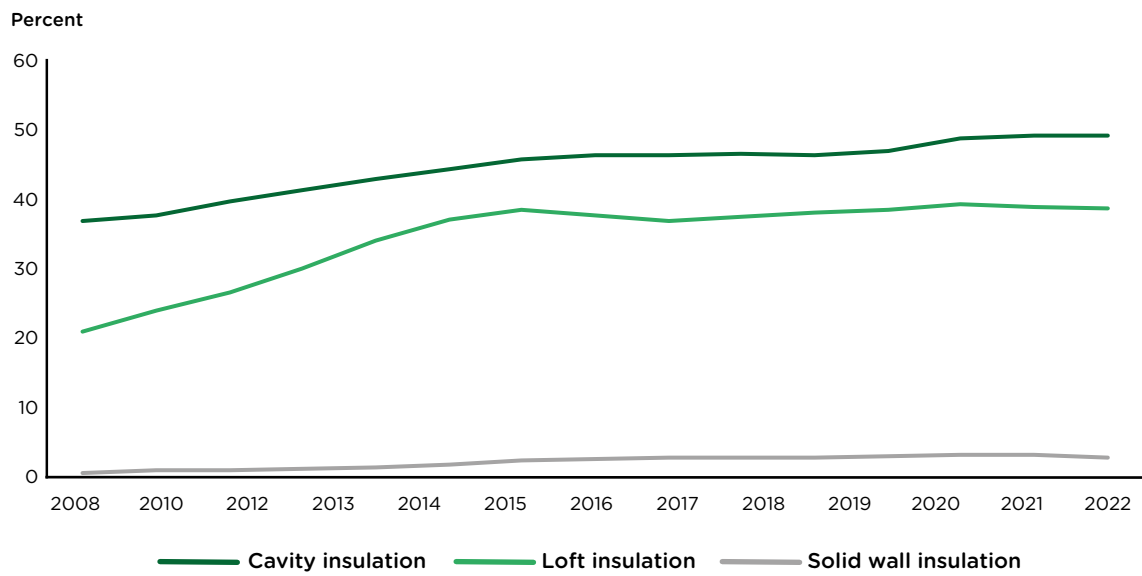
Figure 11: Home heat loss, degrees Celsius, UK and European neighbours, 2020



Source: Tado ¹²⁴

In addition, the UK's progress on insulating housing stock has stalled with a 90 per cent reduction in installations since the peak in 2012 of 2.3 million installations, as demonstrated by Figure 12.

Figure 12: Percentage of dwellings in England with different types of insulation 2008-2022



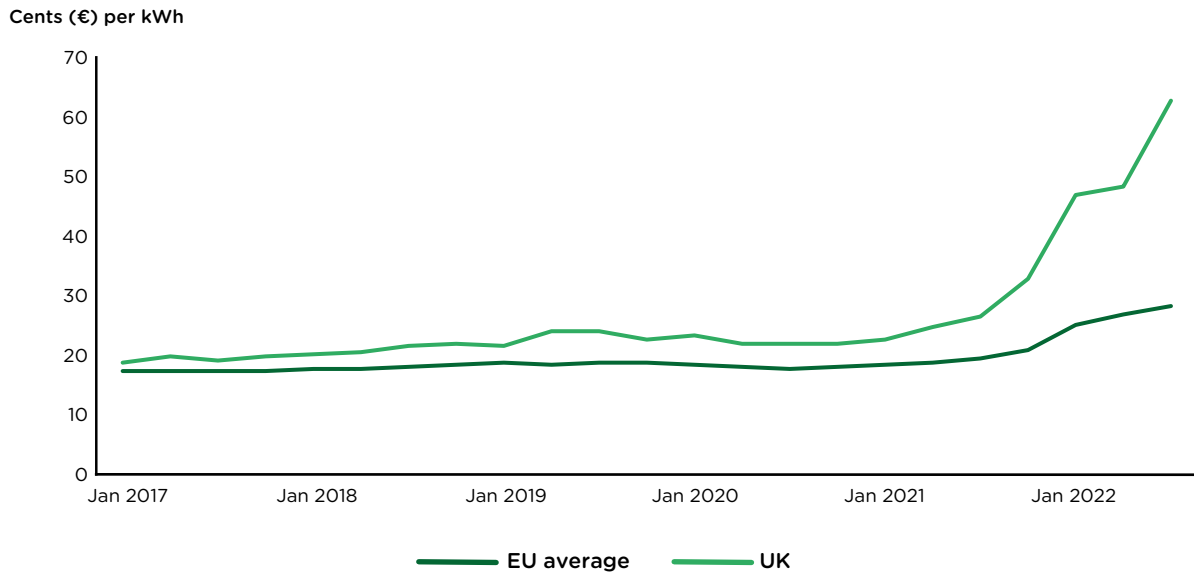
Source: Department for Levelling up, Housing and Communities 2013²⁵



5.2.3 The cost of fuel

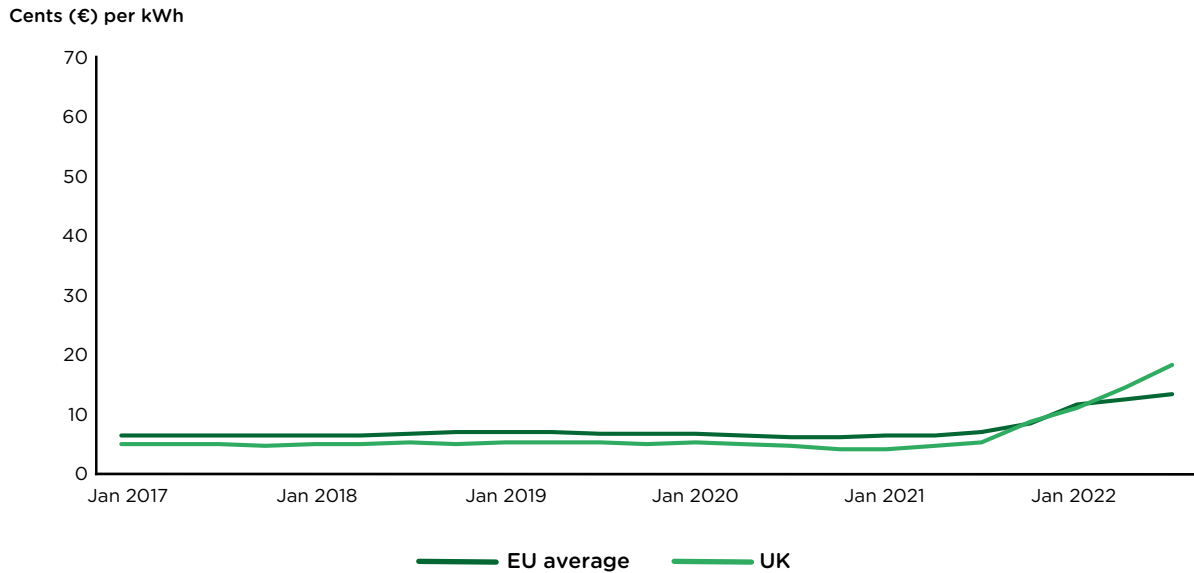
The cost of heating a home has risen much more steeply in the UK in comparison to the EU average for both electricity and gas, as illustrated by figures 13a and 13 b that chart the changes in price since 2017.

Figure 13a: Average price for electricity, cents (€) per kWh, UK and EU, January 2017 to July 2022



Source: EuroNews¹²⁶

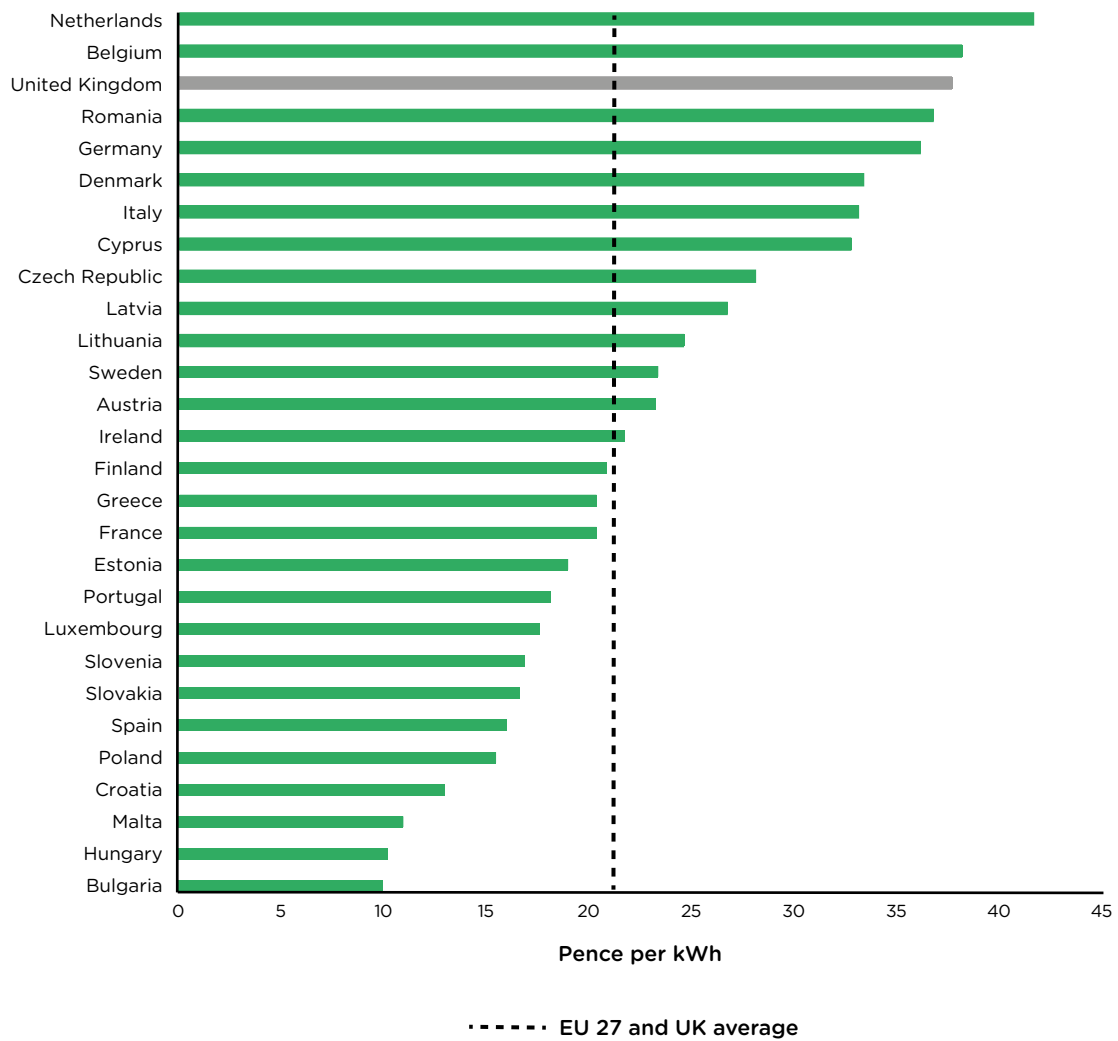
Figure 13b: Average price for gas, cents (€) per kWh, UK and EU, January 2017 to July 2022



Source: EuroNews¹²⁷

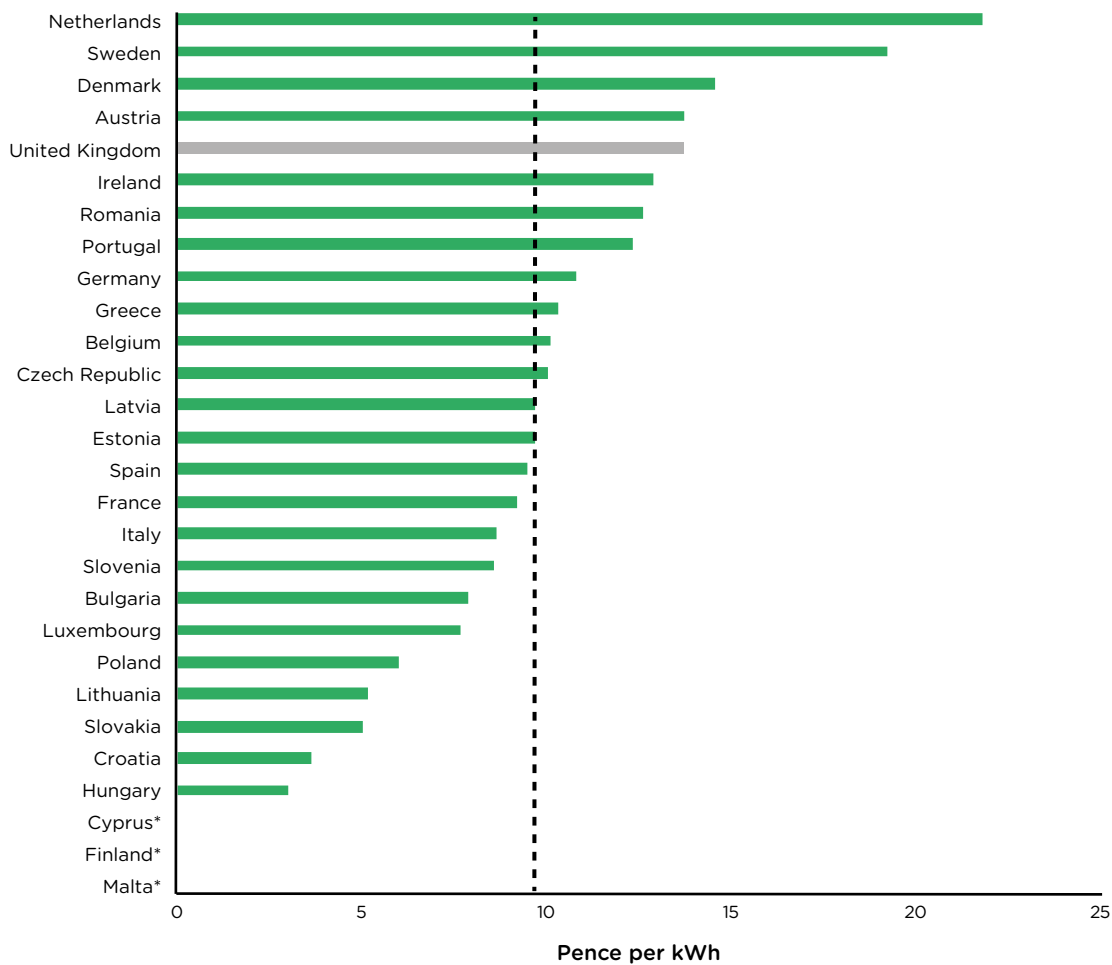
As demonstrated by Figures 14a and 14b, in the first half of 2023, including all taxes and levies, the cost of gas and electricity in the UK was approximately a third more expensive than the European average.

Figure 14a: Domestic electricity prices for medium users, including all taxes and levies, United Kingdom and EU 27 countries, January to June 2023



Source: Department for Energy Security and Net Zero²⁸

Figure 14b: Domestic gas prices for medium users, including all taxes and levies, United Kingdom and EU 27 countries, January to June 2023



----- EU 27 and UK average

*No data available

Source: Department for Energy Security and Net Zero²⁹

Figures 13 and 14 above compare UK energy prices to several other countries to illustrate the variation between EU countries, and the rate of inflation in prices over time compared to the EU average. While a short-term goal may be to get to EU average, the figures demonstrate that it is entirely possible to also be significantly lower than that.

From January 2024, the average price of gas is 7 pence per kilowatt hour (kWh), and the average price of electricity 29 p/kWh³⁰. The cost in the UK for fuel is 30 per cent higher than the European average and this clearly increases the numbers in fuel poverty. While the price of gas is the important factor for space heating at present, the fact that electricity is so much more expensive than gas is a serious issue given a current

push to transition to using heat pumps to decarbonise power. Households could be in a position where their boiler is three times more efficient in terms of energy use, but they are paying more.

Standing charges cost consumers just around 80 pence per day if they pay by direct debit and £1 per day if they pay by prepayment meter in the UK³¹. These will impact disproportionately on low-income consumers and while the funding generated is utilised to fund some insulation schemes run by energy companies, these taxes and levies are not progressive. In addition, in the UK we are being charged for the highest unit cost of fuel, rather than the average unit cost of fuel, and this needs reforming. The UK has a large gap between the richest and poorest in energy costs as a proportion of household income³².

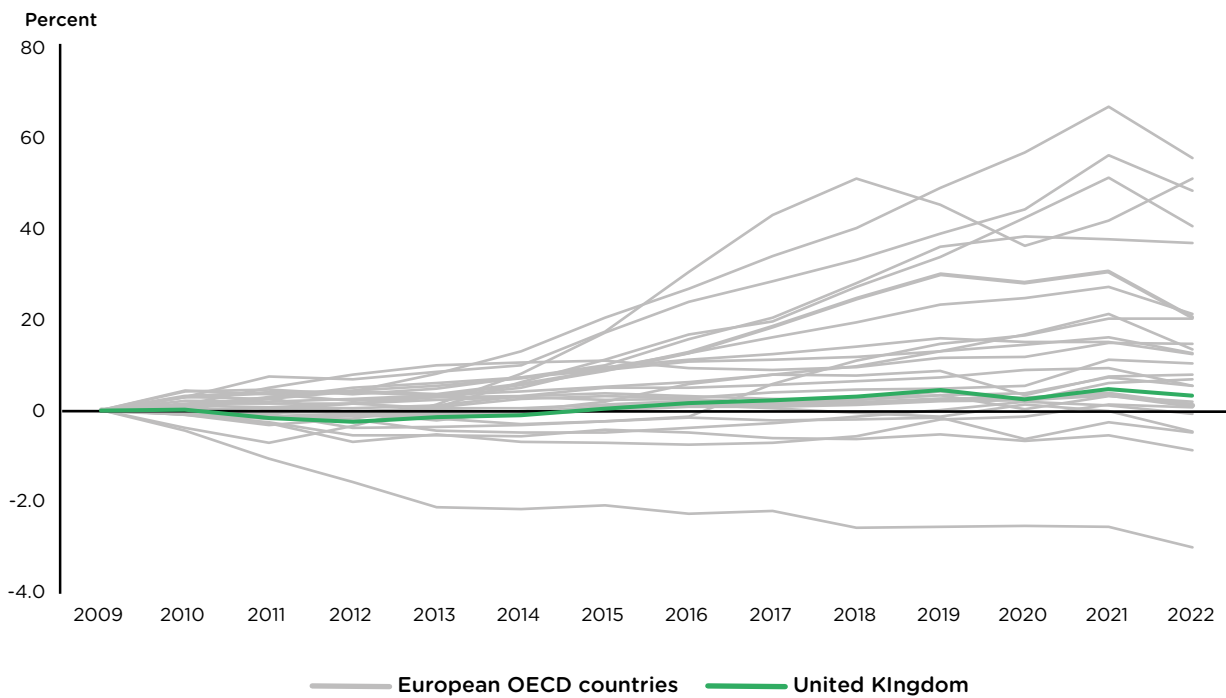
5.2.4 Income and the cost of living

In terms of GDP output, the UK is the sixth richest nation in the world, yet according to the ONS, half of UK households cannot afford to heat their homes in winter. Recent analyses by the Resolution Foundation have demonstrated that while real wages grew by 33 per cent a decade to 2007 they have flatlined since and income inequality is higher in the UK than in any other large European country¹³³. Those on middle incomes are now 20 per cent poorer than their peers in Germany and 9 per cent poorer than those in France.

Low-income households in the UK are now around 27 per cent poorer than their French and German counterparts. In monetary terms the living standards of the lowest-income households in the UK are £4,300 lower than their French equivalents, while as stated above, our energy costs are 30 per cent higher¹³⁴.

Figure 15 demonstrates that UK wages have not fared well in comparison to the majority of OECD countries and the detail of which countries are faring better or worse is found in Annex 2.

Figure 15: Change in real average annual wages since 2009, US Dollars Purchasing Power Parity at 2022 constant prices, European OECD countries, 2009-22

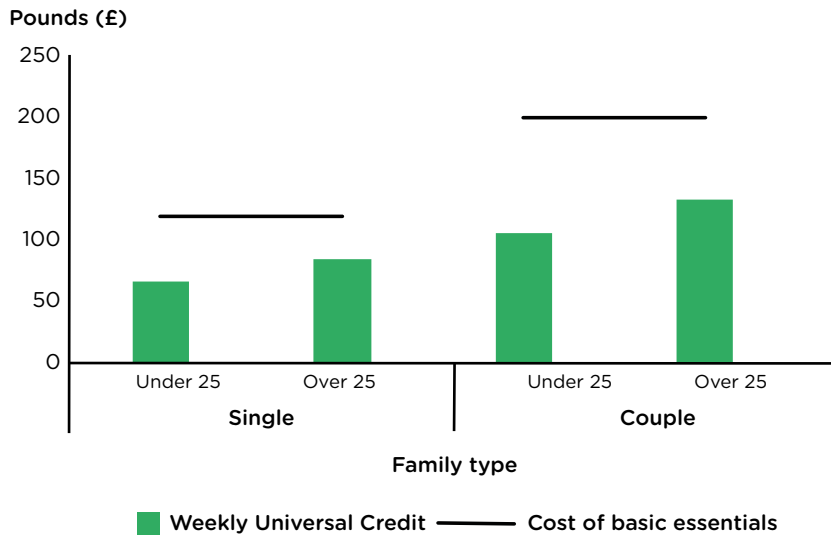


Source: OECD (ND) Average Annual Wages¹³⁵

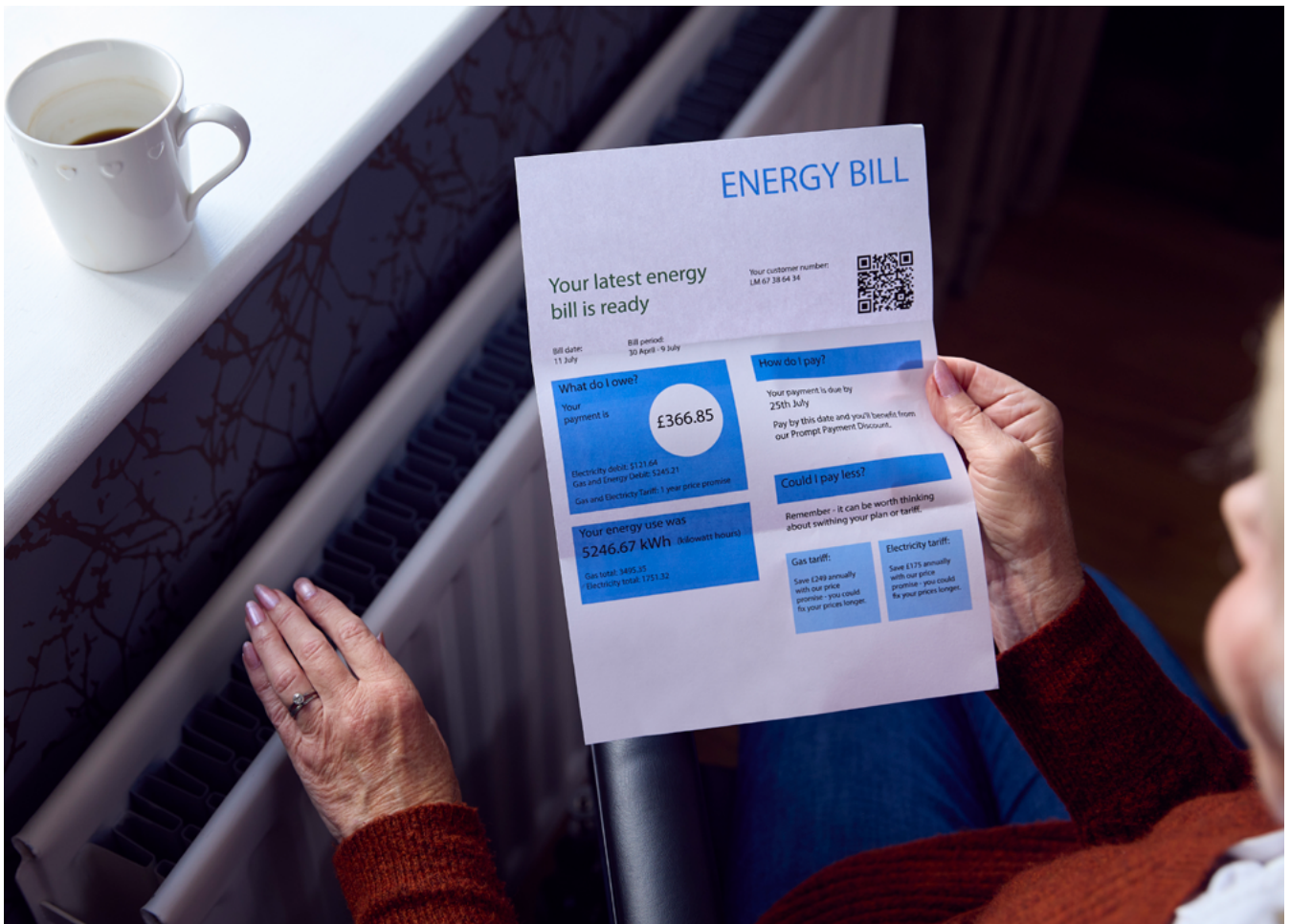
There has been a staggering increase in the numbers in work but still in poverty. Alongside wages, working age benefits have not kept up with prices for 10 out of the last 15 years. This, together with wider cuts since 2010, has reduced the incomes of the poorest fifth by just under £3,000 per annum¹³⁶. A campaign by the Joseph Rowntree Foundation launched in 2023 is ongoing to

persuade the Government to increase benefits so they do cover basic essentials¹³⁷. The gap between the cost of essentials and the level of benefits is demonstrated by Figure 16. Further analyses in October 23 found that 73 per cent of low-income households had experienced food insecurity¹³⁸.

Figure 16: Weekly universal credit by age and family type, and JRF's weekly essentials guarantee, UK, 2023/24



Source: Joseph Rowntree Foundation¹³⁹, ONS¹⁴⁰



Cost of living

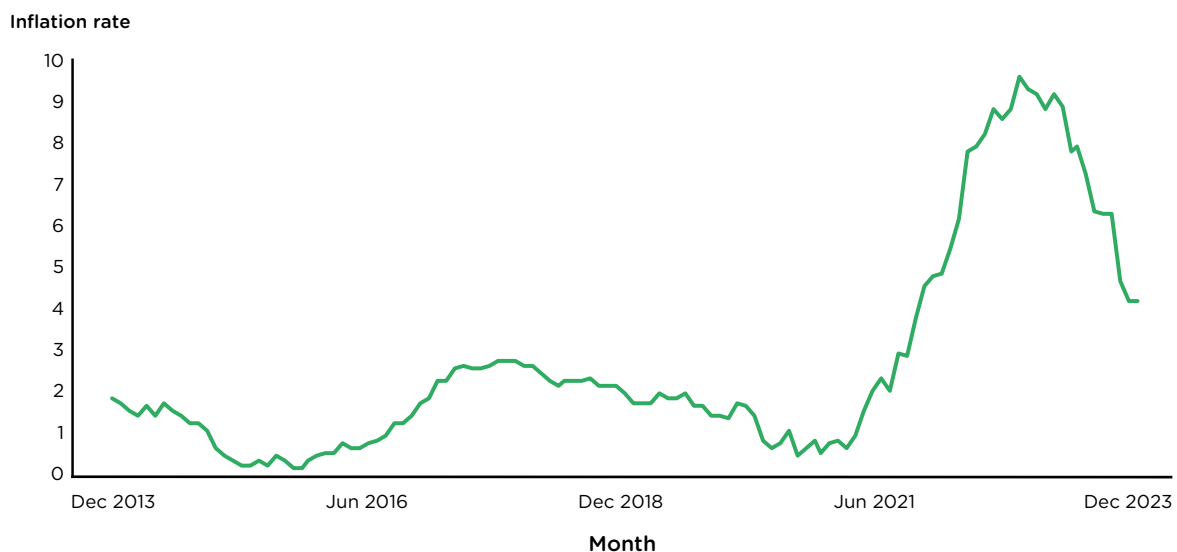
The cost of goods and services in the UK has risen sharply, along with other countries, and is still high¹⁴¹. Grocery staples such as milk and meat have seen significant price increases, along with other essentials like toilet roll and petrol¹⁴². Figure 17 illustrates a peak in inflation which has significantly increased prices and while inflation is falling, it is not negative, prices are still rising. In addition, increases to the cost of fuel and food are driving inflation and given that these represent a higher proportion of low-income household budgets than for higher income households, the inflation rate for low-income households is higher.

Another factor to consider is housing costs because these are often the largest outgoing. According to the Organisation for Economic Co-operation and Development (OECD), almost one in four (23 per cent) of all those who rent privately in the UK spend 40 per cent or more of their salary, meaning they are overburdened by housing costs¹⁴³. That is a higher

proportion of renters than any other country in Europe for which figures are available. For the poorest, things are even tougher. More than half of the lowest earners in the UK who rent privately are spending more than 40 per cent on housing costs and are therefore overburdened; only Colombia scores higher in the data. For those who can buy a home, analysis by Finder found that the average two bedroomed flat in Europe was £193,000 compared to a cost of £263,000 in the UK, so the price of homes in the UK is 36 per cent higher than the European average, although there are large regional variations¹⁴⁴.

Recently, increasing interest rates have pushed housing costs up considerably for many. In 2023-24, another 3 million households in the UK face a £3,000 a year increase in their mortgage costs by the end of the 2023-24 financial year¹⁴⁵.

Figure 17: Annual rate of inflation of the Consumer Prices Index including owner occupiers' housing costs (CPIH), UK, December 2013 to December 2023



Source: ONS¹⁴⁶

This rise in mortgage rates and the broader impact of inflation on food and transport prices has been calculated to amount to a 12 per cent decline in real incomes for a typical mortgage household between 2021-22 and 2023-24, making it more difficult to allocate money for heating¹⁴⁷. Many private renters are also likely to be severely affected by rising interest rates, which are passed on by landlords in the form of higher rents.

Many households on low incomes are eligible for help with housing costs. In 2019-20, IFS found that 38 per cent of private renters were eligible for this help.

However Local Housing Allowances (LHA) were frozen until the November 2023 budget, with the number of households whose housing costs were not fully covered by housing support has increased over the last three years. The analysis by IFS showed that just 5 per cent of properties available on Zoopla were affordable to those on low incomes¹⁴⁸. The government has now raised the LHA cap, but the impact has been to force low-income households into inferior quality housing. Since 2013 the risk of living in a home with poor energy efficiency has doubled and the risk of paying above average energy costs has nearly quadrupled¹⁴⁹.

6. THE ECONOMICS OF ACTION

In previous sections we have shown that the UK has high numbers of people living in cold homes and that living in such conditions can have a deleterious impact on both physical and mental health. Having so many people living in cold homes therefore increases the demand for the NHS and contributes to ‘winter pressure’. It also costs households more in terms of bills, reducing demand for other items and lowers current productivity through days off work and future productivity through days off school.

We document some of the costs associated with cold homes that others have found in this section. Cold homes are costing society tens of billions of pounds each year.

6.1 SAVINGS FROM ACTION TO TACKLE COLD HOMES

Category One hazard homes cost the NHS £0.5 billion in first-year treatment costs and £15 billion a year in terms of wider costs to society

The BRE group has quantified the costs and benefits associated with insulating the very worst housing, those homes with a Category One hazard. A home with an HHSRS Category One excessive cold hazard aligns roughly with an EPC rating of F or G¹⁵⁰.

The group’s latest report, based on 2019 data, sets out that the 719,324 homes with a Category One hazard of excess cold are costing the NHS £532,351,186 per year in first-year treatment costs alone. It estimates an average cost of £6,635 per household to remedy the home meaning that the cost of improving these homes would be recovered within nine years, in NHS savings alone¹⁵¹.

Other work by the same group estimated the total societal cost of Category One cold hazard homes in England to be £15.26 billion in 2016, suggesting that insulation costs would be recovered within 0.4 years. Societal costs included, for instance, care costs, loss of economic potential and potential mental health costs¹⁵².

The true savings from reducing cold homes are likely to be many times higher

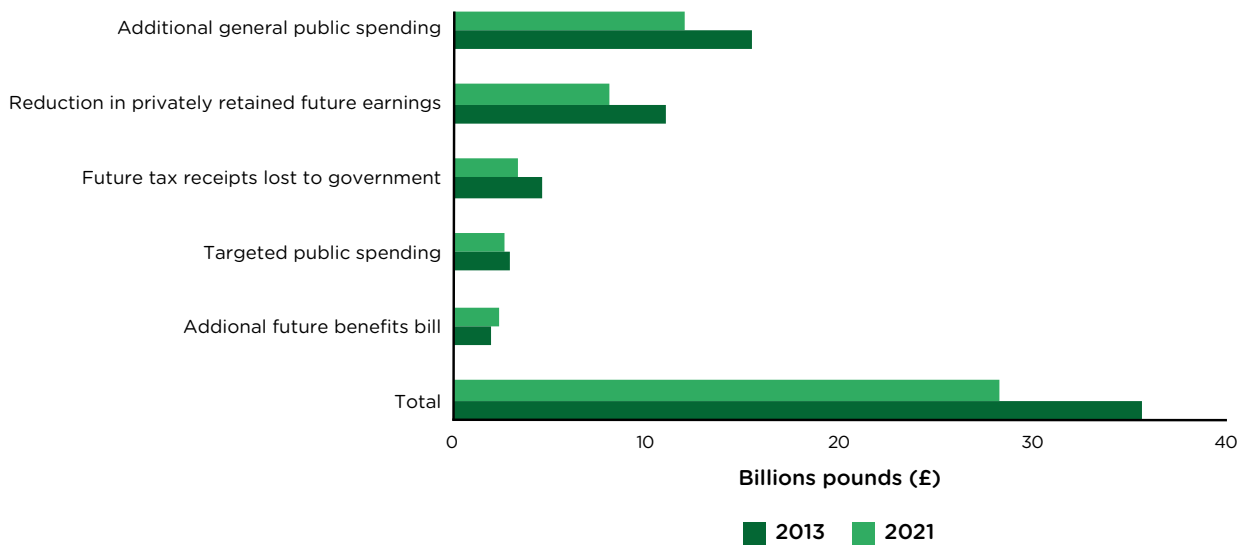
The figures above relate to just 719,324 homes in England and the societal costs are based on research that was completed eight years ago. However, with 9.6 million on low incomes in energy-inefficient housing in the UK, the actual cost to society will be much higher. Further work to update the costs and benefits based on current levels of fuel poverty and the latest research, such as on mental health impacts, is warranted and may help to provide useful data to support an invest to save strategy.

6.2 IMPROVED EDUCATION AND PRODUCTIVITY

Negative impacts on educational attainment affect children’s future life chances. Increasing numbers of families in poverty and in cold homes will be contributing to the widening attainment gap, which started before the pandemic, has been exacerbated by the pandemic, and will be further exacerbated by the cost-of-living crisis.

In 2021, the JRF published updated estimates on the costs to society of increased child poverty¹⁵³. These figures are from data before the recent increases in fuel and are likely to be an underestimate. Clearly not all these costs can be attributed just to cold homes, but action to improve insulation and reduce poverty would have a significant impact on bringing these costs down.

Figure 18: Estimated cost of child poverty, £ billion, United Kingdom, 2013 and 2021



Source: *The cost of child poverty in 2021*¹⁵⁴

6.3 POSITIVE IMPACTS FROM REDUCTIONS IN CARBON EMISSIONS

Using data from the latest English Housing Survey (EHS) and a recent financial estimate of the impact of carbon emissions from the United States Environmental Protection Agency (USEPA) it is possible to put a price on the failure to insulate homes to an adequate standard (EPC band C)¹⁵⁵. Bringing all properties with low-incomes in the UK – those below the Joseph Rowntree Foundation’s Minimum Income Standard (MIS) – up to EPC band C would avoid £2.9 billion a year in avoided climate impacts.

6.4 INSULATION COSTS

Not everyone will be able to afford to insulate their home. Our analysis indicates that 8 million households in England and 9.6 million households in the UK are below the JRF Minimum Income Standard and in energy inefficient housing. These households are struggling to make ends meet and will not be able to afford the costs of insulation on top of current commitments.

The English Housing Survey (EHS) provides data on the cost of upgrades. Using EHS estimates for the cost of upgrading from EPC band D to C and band E or below to C, we get a relatively accurate estimate of the cost of upgrading the homes of the poorest.

The cost estimates in the tables below are likely to be higher than in practice because the mix of homes below our thresholds has a greater proportion of smaller homes (e.g., flats) and a smaller proportion of bigger homes (e.g. detached) than those where household income is above the threshold. The EHS reports that detached homes are more likely to be expensive to upgrade. The first table presents the costs for England using the latest data from the EHS. The second table estimates the costs for the whole of the UK.

Table 2 Estimated costs of retrofitting the homes of those who are on low incomes and in energy inefficient housing, different definitions - England

Unable to pay by threshold in inefficient homes: EPC band D-G (per cent, number of homes in England)	Average retrofit cost of £7,529 ^[1]	Average retrofit cost D to C of £6,221 and E-G to C of £13,931 ¹	Annual carbon saving using 1.1 tCO ₂ for D to C and 4.3 tCO ₂ for E-G to D ¹ (value using social costs of carbon at \$220/£173 per tonne)
< MIS income/Below EPC band C: 34 per cent, 8.0 million households in England	£60.4 billion	£62.2 billion	14.0 MtCO ₂ (£2.42 billion)

Table 3. Estimated costs of retrofitting the homes of those who are on low incomes and in energy inefficient housing, different definitions - UK.

Estimated scale up to UK numbers (e.g. households, retrofit costs and carbon savings)

Unable to pay by threshold in inefficient homes: EPC band D-G (per cent, number of homes in England)	Average retrofit cost of £7,529 ¹	Average retrofit cost D to C of £6,221 and E-G to C of £13,931 ¹	Annual carbon saving using 1.1 tCO ₂ for D to C and 4.3 tCO ₂ for E-G to D ¹ (value using social costs of carbon at \$220/£173 per tonne)
< MIS income/Below EPC band C: 34 per cent, 9.6 million households in UK	£72.3 billion	£74.5 billion	16.8 MtCO ₂ (£2.91 billion)

^[1] Retrofit costs and carbon savings based on EHS data available here: <https://www.gov.uk/government/statistics/english-housing-survey-2021-to-2022-energy> (Chapter 4: annex tables)

Clearly these costs are high, however as stated above, the health benefits of retrofitting homes that people cannot afford to heat could be considerable, and investments made to homes will reduce cold-home-related morbidity and mortality as well as illnesses more generally exacerbated by poverty.

Those who can afford to pay for improved insulation will also need to do so, and consideration of how landlords, tenants and owner occupiers can be incentivised to insulate through cheap finance and tax incentives for instance needs to be considered.

As noted above, while tenants and homeowners will see a benefit in reduced bills and improved health, the benefits for landlords are smaller. However, we would expect that they would see some improvement in the

condition of their homes and a reduction in arrears should be seen as damp and poverty are reduced. For example, Wakefield and District Housing (WDH) is a housing association that provides homes for rent or shared ownership in the Wakefield district and across Yorkshire. By putting a range of measures in place, including meeting the decent homes standard, they were able to reduce arrears as a percentage of rental debit to 2.66 per cent with a stock of 30,943 homes which is approximately half of the industry average¹⁵⁶.

Net benefit or cost?

There are considerable advantages to improving homes, and we can be confident that any investment would pay for itself. More formal modelling might be warranted to help the government structure investment products that will help them reach these goals.

RECOMMENDATIONS

At present there is an imperfect storm of high fuel costs, high housing costs, inadequate incomes, and poorly insulated homes in the UK. This is causing harm to health, to children's outcomes, and to the housing stock itself, leading to high costs for society and more winter pressure on the NHS which is struggling to cope with demand. The recommendations in this report suggest action across several areas to rectify this.

1

- The Government should commit at least £62.2 billion (England) to £74.5 billion (UK) to a 10-year retrofit programme targeted to those on low incomes in energy-inefficient housing. This will save tens of billions of pounds a year through improvements in productivity, health, climate and other costs. This programme should be strategically planned, including giving councils a clear role in targeting insulation programmes street by street in the areas most in need, and include setting higher standards for privately rented homes, with necessary fiscal incentives to ensure costs do not result in higher rents.

If this scale of spending is rejected, as appears to be the case, by both main political parties, then the government must publish how it will use other levers to insulate all 9.6 low-income homes to EPC C level as fast as possible and at least within a decade, and ensure that the reductions in carbon emissions from homes are sufficient to meet the international and domestic 2030 carbon reduction goals alongside the other carbon reduction measures it will need to deploy.

2

- Local authorities and devolved administrations to utilise the powers they now have to socially prescribe insulation with adequate ventilation through the ECO4 flex scheme for those living in energy inefficient homes with low incomes and with existing health conditions such as heart disease or asthma. Government to increase the scope of scheme to deal with demand to cover all those living in energy inefficient homes with a household income below the JRF minimum income standard and a health condition beyond the 225,000 planned maximum.

3

- Government and business leaders to do more to tackle poverty and ensure households can afford a healthy life, including through ensuring the National Minimum Wage and National Living Wage are sufficient, and by more equitable redistribution of profits within companies to reduce in-work poverty.

4

- The Government to support the JRF and Trussel Trust campaign to raise Universal Credit to ensure that it covers the basic essentials and continues to do so, with at least an annual review.

5

- Government to work with energy companies to bring UK fuel prices down to the EU average or below to ensure those on lower incomes can afford to heat their homes. For example, to revisit non progressive standing charges and pricing strategies that mean consumers pay for the highest cost of fuel to generate rather than the average cost of fuel. Government to pay for improvements to energy generation through more progressive taxes.

6

- Government to bring in schemes to increase the supply of affordable good quality, sustainable housing, including through reform to the private housing market and through increased investment in building social housing.

ANNEX 1

Calculating the numbers at risk of living in a cold home

Income threshold type		
Minimum income standard	Single adult	£29,541
	Single parent - 1 child	£35,559
	Single parent - 2 children	£42,967
	Single parent - 3+ children	£66,496
	Non-pensioner couple	£40,646
	Non-pensioner couple - 1 child	£42,928
	Non-pensioner couple - 2 children	£49,514
	Non-pensioner couple - 3+ children	£62,068
	Single pensioner	£20,480
	Pensioner couple	£27,854
Mean national income	All households	£33,205
Median national income	All households	£28,332

A minimum income standard threshold was calculated for each case in the EHS, using information on the age and number of occupants in each household case. The EHS includes a variable on the number of dependent children in each household, which was used to identify the presence of children.

Each EHS case was assigned to one of the 10 household types listed above, based on the number of adults and whether they were of pensionable age, and the number of children. In the small number of cases where households had more than two adults (non-pensioner or pensioners) these were classed as couples.

The thresholds for each of these household types was obtained from the UK Minimum Income Calculator (<https://www.minimumincome.org.uk/>). Each case in the EHS was compared to these thresholds and categorised accordingly.

ANNEX 2

Change in real average annual wages since 2009, US Dollars Purchasing Power Parity at 2022 constant prices, European OECD countries, 2009-22

	Percent change in real average annual wages 2009-22, US Dollars ppp at 2022 constant prices
Lithuania	55.4
Iceland	50.1
Latvia	48.2
Estonia	40.5
Poland	36.7
Slovak Republic	21.1
Czechia	20.4
Hungary	20.2
Norway	14.6
Slovenia	13.3
Sweden	12.5
Germany	12.4
Luxembourg	10.2
France	7.8
Switzerland	6.8
Denmark	5.4
Finland	5.3
United Kingdom	3.1
Belgium	2
Austria	1.1
Portugal	0.6
Ireland	-0.7
Netherlands	-4.7
Italy	-5
Spain	-8.8
Greece	-30.1

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