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Reviewing the Co-Benefits of Energy Efficiency in an Irish Context

Marion Jammet

Abstract

Energy efficiency solutions constitute an important element of the framework necessary to reduce greenhouse gas emissions and to meet the goals of the Paris Climate Agreement. In recent years, major policy initiatives, such as the European Green Deal and the Irish Climate Action Plans, have introduced ambitious measures to upgrade the levels of energy efficiency in the building stock. Beyond the decarbonisation benefits that arise from energy efficiency measures, there are also considerable environmental, health, social, and economic benefits, which are rarely measured and are often overlooked.

This paper provides an analysis of the wide range of direct and indirect co-benefits of energy efficiency upgrades in the residential and non-residential building sectors, with a particular focus on the Irish context. It concludes by examining the next steps that should be taken to support quality energy efficiency upgrades at scale.

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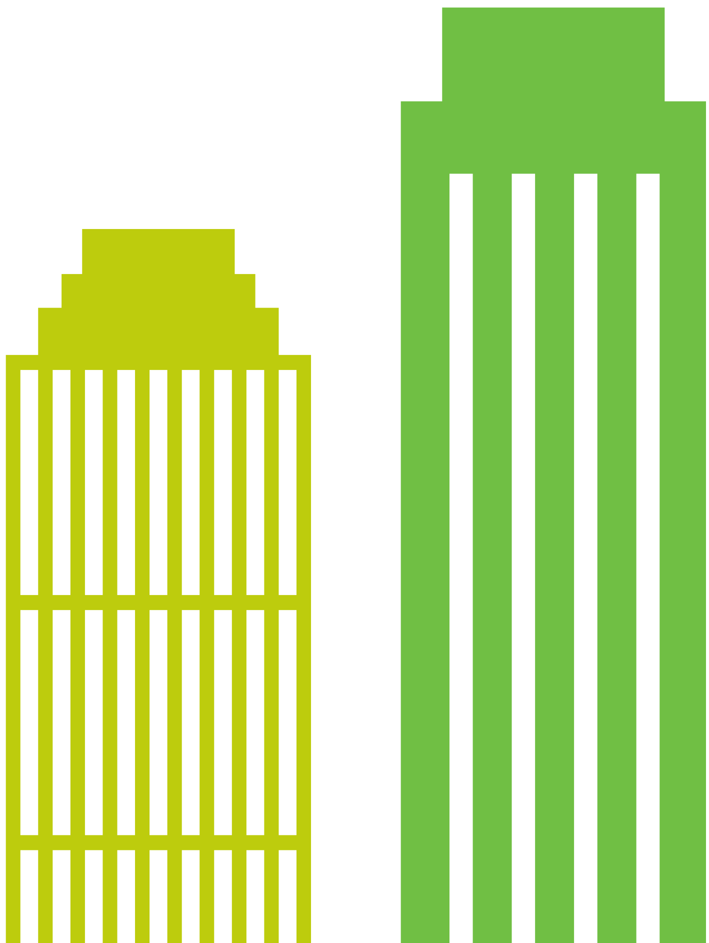


Executive Summary

The introduction of ambitious climate targets at the national and European levels, and recent concerns regarding the security of the energy supply, have led to a renewed interest in energy efficiency, with energy efficiency now being presented as the "first fuel"[1] and the most cost-effective way of tackling climate change.

Although policymakers have typically been focused on the decarbonisation benefits of energy efficiency measures, the more efficient use of energy in buildings can bring a myriad of other environmental, social, and economic benefits.

Understanding these factors and how they interact with one another in an Irish context is important to ensure that any analysis of energy renovation projects and programmes is comprehensive, unbiased, and supports sound policymaking. Such a holistic approach can also help households and businesses by supporting them to better gauge the benefits of investing in energy efficiency.

Beyond the decarbonisation benefits that arise from the introduction of energy efficiency measures, there can also be considerable environmental, health, social, and economic benefits, which are rarely measured and are often overlooked.

This paper highlights how the environmental benefits of energy efficiency are not limited to a reduction in greenhouse gas emissions and can also include a reduction in resources used and pollution emitted. While increasing the depth and rate of energy renovation will contribute to a reduction in carbon emissions associated with the operation of buildings, renovating vacant and under-used buildings in our village, town and city centres to a high-quality standard would also contribute to a reduction in transport and embodied carbon emissions[2], while addressing major sources of air pollution.

In terms of social co-benefits, this paper highlights that high quality energy renovations can mitigate health issues such as cold- and heat-related stress, allergies, asthma, as well as pulmonary and respiratory risks, while reducing the number of households at risk of fuel poverty.

Economic co-benefits mainly result from energy demand reduction and investment. Energy efficiency measures reduce exposure to energy price fluctuations and higher energy prices. They can also significantly lower the subsidy burden emanating from the state, by reducing pressure on public health and social welfare budgets. Furthermore, improved indoor air quality post-renovation can lead to greater cognitive ability and

1. According to the IEA, energy efficiency represents more than 40% of the emissions abatement needed by 2040, see IEA (2021).

2. These are the emissions associated with the production and transportation of construction materials, construction processes, and the maintenance, repair, and disposal of buildings and infrastructure.

productivity, with positive impacts for schools and businesses. Finally, delivering energy renovation at scale can also support job creation and local employment – many of these jobs being in labour-intensive industries and inherently non-transferable in nature.

To increase the depth and rate of high-quality energy renovations, and to ensure that these co-benefits materialise, several actions are recommended in this paper.

First, the co-benefits of energy renovation must be better assessed and promoted, and a more holistic approach to it should be taken to reach carbon neutrality, while avoiding unintended consequences and thus helping to support a just transition. Capturing better quality data on the co-benefits of energy renovation is a first step to increasing the appetite for it, but it is clearly not sufficient by itself.

Retrofitting half a million homes to a building energy rating (BER) B2 by 2030 in Ireland requires something of a wartime effort. Recent increases in funding for energy renovation are part of the solution, but publicly funded retrofit programmes must deliver real carbon savings, improve indoor air quality, and support a just transition. This in turn requires making high-quality energy renovation easier to undertake (e.g., through the introduction of a register of renovation advisors, and “retrofit roadmaps”), as well as actions to attract more people to the industry and to encourage upskilling.

Given that the embodied carbon emissions of a deep residential retrofit are typically about a quarter of that of a new build, and given that transport is Ireland’s second highest source of carbon emissions, better connecting energy efficiency grants and support for the reuse of vacant and under-used properties must be a priority. Reducing embodied carbon emissions associated with energy renovation through a greater use of re-used and biobased materials must also be part of the discussion.

Finally, further actions are needed to engender a just transition. In particular, the definition of energy poverty and funding programmes to tackle this issue should be reviewed. While the existing supports for people living in fuel poverty mainly seek to target households living in income poverty, this assistance does not necessarily reach all households who experience energy poverty. In particular, and although challenging in the current housing crisis, there is a need to focus more on private rental accommodation and the split incentive that exists between tenants and landlords.

Introduction

The latest reports of the Intergovernmental Panel on Climate Change (IPCC, 2023) and of the World Meteorological Organisation (WMO, 2022) are unequivocal regarding the need to urgently, and comprehensively, reduce greenhouse gas emissions and limit global warming to below two degrees Celsius. The increased incidence of extreme weather events in recent years, such as the extensive flooding in Pakistan, drought in the Horn of Africa, once-in-a-generation hurricanes in the US, and a notably hot and dry summer throughout much of Europe in 2022, which fuelled wildfires, reduced crop yields, and impacted electricity generation, viscerally highlight the need to address the climate crisis meaningfully and urgently.

While often overlooked in energy policy discussions, it is clear now that energy efficiency is the “first fuel” (UNECE, 2022) and the most cost-effective way of tackling climate change. Energy efficiency can be defined as the level of energy consumption needed to provide a given service, and typically refers to an improvement in this relationship, using technological and/or behavioural changes (Ryan, 2012). The concerns regarding the security of the energy supply in winter 2022-2023 as the EU continues to divest from Russian energy imports, and given energy price inflation[3], have also led to a renewed focus on the benefits of energy efficiency measures.

This paper examines the co-benefits of energy efficiency measures at both the state level, and the level of the end user. In turn, the paper addresses the range of environmental, health, social, and economic benefits that can arise when energy efficiency measures are effectively implemented in the built environment[4].

Sustained energy demand reduction will be critical for European states to meet the 2050 net zero target, as set out in the European Green Deal, without relying on expensive and, as of 2022, unproven carbon dioxide removal technologies (Barrett, 2022). Mainstream energy modelling also often ignores demand-side mitigation options, but recent examinations of this topic show that reduced energy consumption can facilitate steep decarbonisation pathways, even in the context of a less rapid energy system transformation (Gaur, 2022). The implementation of effective energy efficiency measures in the Irish building stock can contribute to a reduction in the overall demand for energy while accelerating the decarbonisation process.

In recent years, at both the national and EU levels, several policy measures have been introduced that seek to improve energy efficiency in buildings. For instance, under the

3. In Ireland, domestic consumers are paying, on average, 80% more for electricity and gas in November 2022 compared to November 2021 (DECC, 2022).

4. The author decided to focus on energy efficiency in the built environment as the renovation rate remains low in Ireland. Furthermore, while emissions associated with the energy used to heat, cool, and light buildings account for 23% of Ireland’s Greenhouse Gas Emissions, where building takes place also impacts our transport emissions and how we build and renovate impacts our industrial emissions from the production of construction materials. Thus, focusing on buildings allows us to tackle emissions associated with the built environment, but also emissions associated with the transport and manufacturing sectors.

Climate Action Plan 2021, Ireland set a target of retrofitting 500,000 homes to a BER of B2/cost-optimal and of installing 400,000 heat pumps in existing homes to replace older, less efficient heating systems by 2030 (DECC, Climate Action Plan - 2021, 2021). Meanwhile, as part of the European Green Deal, the European Commission launched the '*Renovation Wave for Europe*', which set out the objective to double the annual energy renovation rate of residential and non-residential buildings by 2030 and to renovate a total of 35 million building units by the end of this decade (European Commission, 2020)[5].

Although policymakers have typically been focused on the decarbonisation benefits of energy efficiency measures, more efficient energy use in buildings can also bring a myriad of social and economic benefits. Understanding these factors and how they interact with one another is important to ensure the analysis of energy renovation projects and programmes is comprehensive, unbiased, and supports sound policymaking.

Recognising that, when examining the benefits of energy efficiency, it is not enough to solely look at the energy savings achieved but rather at the outcomes in terms of environmental, social, and economic consequences, this paper seeks to explore the many benefits of energy efficiency in Ireland, focusing primarily on both residential and non-residential buildings.

This holistic approach also helps households and businesses by supporting them in gauging the benefits of investing in energy efficiency, as just conserving energy is not always the primary motivation of such an approach. SEAI's Behavioural insights report (SEAI, 2017) shows that, in the residential sector, consumers do not make purchasing decisions based purely on attendant or potential cost and energy savings. The majority of consumers also consider the impact of energy efficiency investment on their level of comfort, with many citing comfort as their main driver for taking action. According to the Velux Healthy Homes Barometer 2016, the three main factors driving energy efficiency upgrades in privately owned homes in Europe were: to save money on energy bills, to improve the health and comfort of the family[6], and to add value to the property (Velux, 2016). In the non-residential sector, improving comfort, health and wellbeing, and increasing productivity, alongside a perception of autonomy, as well as a desire for staff retention/recruitment and avoidance of 'stranded assets' for investment purposes, are also among the main factors that are cited. Increasingly, maintaining healthy buildings is becoming a part of corporate branding and how a company seeks to engage with the public, particularly in the hospitality and retail sectors (IGBC, 2022).

Although increasing, the depth and rate of energy renovation remains low in Ireland. Between 2012 and 2016, the deep energy renovation rate was 0.1% (European Commission, 2019)[7].

5. To support this ambition, a key piece of European buildings policy, the Energy Performance of Buildings Directive (EPBD) is currently being reviewed.

6. Almost three out of four Europeans would renovate their home if it increased the comfort of the family. This is rated equally highly as saving money.

7. Energy Renovation refers to works that improve the energy efficiency of a building. Energy renovation works typically improve the building envelope and/or technical building system, such as heating, cooling, ventilation, hot water, and lighting. Deep retrofitting is an extensive package of building energy efficiency improvements that have a high upfront cost but can lead to significant energy savings. Examples include external insulation and installation of heat pumps.

In 2022, this rate had increased to approximately 0.72% in the residential sector[8] but remains far below official targets[9]. Clearly, a better understanding of the non-energy benefits of undertaking such renovations could contribute to an acceleration of these activities in Ireland.

In the same way that energy efficiency policies must be tailored to a specific domestic context, the type and scope of the possible multiple benefits that can realistically be achieved in a given country from undertaking energy renovation activities at scale must be assessed in that specific context, taking into account factors such as geography, available energy resources, and demographics.

Overview of the multiple benefits of energy efficiency in Ireland

Environmental impacts

Environmental impacts of energy efficiency can be both direct and indirect in nature and relate primarily to a reduction in greenhouse gas (GHG) emissions, resources used, and pollution.

Reduction in greenhouse gas emissions

Despite Ireland's ambitious targets to reduce greenhouse gas emissions by 51% by 2030, relative to 2018 levels (Government of Ireland, 2021), emissions in this country continue to rise (Daly, 2022).

In Ireland, the construction industry and the built environment account for 37% of national emissions, which is equivalent to total emissions resulting from agriculture. This is made up of around 23% operational emissions associated with energy used to heat, cool, and light buildings. A further 14% of emissions are accounted for by embodied carbon emissions from the production and transportation of construction materials, construction processes, and the maintenance, repair, and disposal of buildings and infrastructure (Kinnane, 2022). Assuming a rapid decarbonisation of the electricity grid takes place as envisaged in the Government's Climate Action Plan, as well as the implementation of Nearly Zero Energy Building (NZEB) and Zero Emission Buildings (ZEB) standards by 2030 (European Commission, 2021)[10], Ireland's ambitious National Retrofit Plan should lead to an overall decrease in operational emissions by 2030, provided new builds and renovations perform as per design (Kinnane, 2022)[11]. Depending on the scale of retrofits and how many vacant or underused buildings can be brought back into use, the impact on GHG emissions could

8. According to SEAI, 8,481 privately homes were retrofitted to a BER B2 in 2022, and 4,438 received a fully funded retrofit as part of the free upgrade scheme for low-income households. 2,300 social housing homes were also retrofitted last year. A total of 2,124,590 permanent dwellings were counted in Ireland during Census 2022 (CSO, 2022).

9. The annual energy renovation rate will need to reach 2.35% in residential buildings by 2030 (DECC, 2022), 3.33% in tertiary buildings and 10% in public buildings (DECC, 2020).

10. The proposed revisions of the Energy Performance of Buildings (EPBD) and of the Energy Efficiency Directive include even more ambitious policies to decarbonise the built environment.

11. Often homes with lower BER grades do not consume as much energy as would be expected due to occupants being unable to afford to maintain adequate internal temperatures. Initial energy efficiency measures often are realised in increases in comfort rather than exclusively in energy savings. For reference, this rebound effect is estimated to be in the range of 10% to 30% in the UK (Sorrell, 2007).

be even greater than forecast. In Ireland, the 2022 census identified 166,000 permanently vacant properties in the state, and some 29,317 vacant commercial properties were identified in 2021 (GeoDirectory, 2021), with very extensive vacant spaces located above retail premises and commercial properties in Irish town and village centres[12].

In addition to operational carbon savings, replacing some of the 300,000 homes that need to be built by 2030 under the Government's housing plan (Government of Ireland, 2021) by retrofitting properties that are currently lying vacant and bringing them back into use as homes would lead to significant savings in both embodied carbon (Kinnane, 2022) and transport emissions. The embodied emissions of a deep retrofit in the residential sector account for an average of just one quarter of the emissions associated with new builds in Ireland (Kinnane, 2022). The quantity and type of materials used[13] in renovations or new builds can also contribute to a reduction in embodied emissions.

Transport is Ireland's second highest and fastest growing source of carbon emissions[14]. With respect to planning, increasing urban density would facilitate a more effective use of both existing and any new transport infrastructure[15]. Beyond direct operational carbon savings, retrofitting homes located in villages, towns, and city centres, would contribute to a reduction in transport emissions, and would support the Government's Climate Action Plan, including the commitment made in 2023 to reduce total vehicle kilometres by 20%[16].

Achieving these objectives requires the measurement of the 'whole life carbon impact' of projects[17]. Smaller towns could also be used to experiment with ways to bring these properties back into use, for instance, through an expansion of the Collaborative Town Centre Health Check (CTCHC) programme.

Better use of scarce resources

Reducing energy consumption and emissions through energy efficiency measures also plays a role in reducing waste and the associated pollution of land and water, thereby contributing to efforts to combat the destruction of natural habitats while limiting the negative impact on biodiversity. For instance, the renovation of buildings can lead to the reduction, reuse, and recycling of waste compared to the replacement of existing buildings by new ones (Ferreira, 2017). Renovating vacant and under-utilised spaces

12. Collaborative Town Centre Health Check Programme (CTCHC) land use surveys (Step 2 of a 15 - Step assessment process) highlight that the ground floor commercial vacancy rate in towns in Ireland is 18- 45% - the normal target at the European level is 5%. The upper floors in towns are at c. 80% - both these levels are disproportionately high in a European context.

13. Published EPDs (environmental product declarations) show that bio-based materials generally have lower embodied carbon to produce than alternatives such as steel and concrete (CINARK, 2022; IGBC, 2023).

14. The transport sector in Ireland has been the fastest growing source of GHG emissions over the past three decades, showing a 112% increase between 1990 and 2021 (DECC, 2022).

15. Stephan & Crawford have shown that embodied energy of building materials and the energy used in transportation accounts for about half the life-cycle energy of a typical suburban house in Australia (Stephan, 2014). Data on this topic are currently being developed for Ireland as part of the SEAI funded RE-CUGI project.

16. This is also fully aligned with the recently published OECD's "Redesigning Ireland's Transport for Net Zero Towards Systems that Work for People and the Planet" (OECD, 2022).

17. A number of European countries and regions have already regulated or are about to regulate for 'Whole Life Carbon', these include Denmark, Finland, France, the Netherlands and the City of London.

in village, town, and city centres would also address some of the environmental issues associated with sprawl[18]. This is important as urban land expansion in Ireland is among the highest in Europe and has been characterised by the existence of scattered, remote urban structures in many places (Ahrens, 2019)[19].

Furthermore, lowering energy demand through the introduction of energy efficiency measures can reduce pressure on scarce natural resources, reducing the need to explore increasingly challenging contexts for resource extraction, such as in ultra-deep offshore areas and in the Arctic (IEA, 2019). For instance, a recent UNEP report highlights how the extraction of non-renewable marine resources such as oil & gas and seabed mineral deposits in particular, pose a significant risk to the ocean (UN Environment Programme Finance Initiative, 2022). Similarly, in an Irish context, transitioning away from burning peat should support the restoration of peatland ecosystems with positive impacts on carbon sequestration and biodiversity.

Pollution

Notably, energy use and the consumption of certain chemicals contribute to air and water quality. As outlined below, poor air quality is a major but underappreciated cause of significant ill-health and mortality in Ireland (Quintyne, 2020). Major sources of air pollution in Ireland include domestic burning of fossil fuels, energy generation, and diesel vehicle emissions (EPA, 2020).

Very low-energy buildings in northwestern Europe were found to deliver a reduction of 9% in the emissions of particulate matter and 6.3% for sulphur dioxide (Korsholm, 2012). As such, by reducing the rates at which solid fuels are burned as well as the amount of pollution emitted by power plants, improved energy efficiency can play an important role in reducing the concentration of outdoor air pollutants and can lower the incidence of respiratory and cardiovascular diseases in the population.

Social impacts

The COVID-19 pandemic has emphasised the need to maximise ventilation opportunities and to improve the energy efficiency of buildings in a holistic manner so as to, "improve our living standards by making our buildings more comfortable, healthier, safer, and less costly to heat" (DECC, Climate Action Plan - 2021, 2021). Beyond climate targets, improving energy efficiency in our built environment can indeed have significant positive impacts for public health and wellbeing, and is key to addressing fuel poverty.

Health & Wellbeing

Europeans spend 90% of their time indoors – two-thirds of this time being spent inside homes (Velux, 2020). Thus, the buildings where people live and work can significantly impact health and wellbeing.

18. See European Environment Agency (2016) and McKinney (2006).

19. Based on the density recommendations included in the National Planning Framework and current patterns of development, it is estimated that a land surface equivalent to a third of County Dublin will need to be urbanised by 2030 to deliver the new homes planned in the Ireland 2040 plan as part of the National Planning Framework.

According to Velux's latest healthy homes barometer, 24% of the Irish population is exposed to an indoor climate hazard, such as damp or excess cold (Velux, Healthy Homes Barometer, 2022). Living in a home that is too cold in winter is the most damaging building deficiency from a health perspective[20]. A 2014 study focusing on the island of Ireland shows a cumulative mortality increase of 6.4% in relation to every 1°C drop in daily maximum temperature, with similar increases recorded for cardiovascular disease and stroke, and disproportionately higher recorded rates of respiratory illnesses (Zeka, 2014).

The positive effects of housing warmth on respiratory health and wellbeing among both children and adults are a consistent finding in research. Insulation, air sealing, and heating upgrades can mitigate health issues such as heat- and cold-related stress, allergies, asthma, pulmonary and respiratory risks (Wilson, 2017), as well as cardiovascular diseases, arthritis, and rheumatism. This is highly relevant in Ireland as the country had the second highest rate of asthma hospital discharge in Europe in 2016, and as fine particulate matter from the burning of solid fuel such as coal, peat, and wood is responsible for an estimated 1,300 premature deaths per year across Ireland (EPA, 2020). This can be related to both damp, cold houses, as well as to high levels of air pollution in villages, towns, and cities. Notably, and unsurprisingly, improving thermal comfort by installing insulation and through the use of better heating systems can also drive significant and consistent mental health improvements (Liddell, 2010).

Improvements in the pulmonary and cardiovascular health of the population can in turn reduce pressure on GP practices and rates of absence from school and work (HSE, 2021), thus contributing to healthcare cost savings for both households and the state. Initial findings from the Warmth & Wellbeing scheme run by the Sustainable Energy Authority of Ireland (SEAI) have found that retrofitting the homes of people with chronic respiratory disease reduces their usage of GP service, hospital emergency departments, and other hospital services while also reducing the volume of drugs that are prescribed[21]. A study on the costs and benefits of renovating 7.4 million energy-inefficient dwellings (class F-G) by 2025 in France[22] estimates that an energy efficiency programme delivered at scale could result in €758 million in annual savings for the healthcare system. The same study reports that direct medical costs linked to poor housing amount to some €930 million in France per year while indirect costs, including from absenteeism at work and school and associated productivity losses, amount to up to €20 billion per year - almost 22 times more than direct costs (Renovons, 2017).

To improve public health, energy efficiency improvements must be introduced alongside ventilation upgrades to ensure that measures, such as draught proofing, do not hinder air flow, and to mitigate the risk of any negative impacts on these factors that could be

20. People living in a home that is too cold in winter are twice as likely to report poor health, while those living in a damp home are 1.8 times more likely to report poor health (Velux, 2018).

21. The "Warmth and Wellbeing" pilot scheme was launched in 2016. The scheme aims to improve health and wellbeing outcomes and social inclusion through home energy efficiency retrofitting thus making homes warmer and more energy efficient.

22. Through at least two "substantial actions" to improve energy efficiency.

created by inadvertently locking in toxins and damp[23]. Delivering high-quality energy renovation must, hence, be at the heart of all retrofit programmes.

Coggins et al (2022) find an increase in indoor air pollutants in Irish homes following deep retrofitting. The authors of this study propose greater compliance with the ventilation requirements of retrofits and the promotion and use of low-emitting construction materials (Coggins, 2022). While mechanical ventilation involves increased energy use which can impact the BER certification of homes, the issues identified in this study relate to the improper handover, inadequate cleaning, and maintenance of operational systems being in keeping or not with the relevant requirements as set down in legislation. Improvements across these fronts will not impact the BER awarded to homes.

Finally, when it comes to energy efficiency in buildings, the individual characteristics of those who receive energy efficiency interventions clearly influences the extent and nature of any health outcomes that can be expected. In fact, it is estimated that those in the lowest 20% on the household income scale are nearly 25% more likely to live in homes with deficiencies such as leaky roofs or inadequate heating (Velux, 2019). In 2016, around 46% of occupied private households in Ireland without central heating were occupied by one person, and 13.7% of households headed by someone aged 65 or over relied on burning coal or peat for heating. Furthermore, approximately 20% of rented dwellings in Ireland have a BER of F or G, compared to the overall housing stock where only 15% of properties have a BER of F or G (DCCAE, 2016). The proportion of households using peat central heating also varies markedly across the country, with the highest proportions in Offaly (38%), Roscommon (27%), and Galway County (23%) (CSO, 2016).

Energy poverty alleviation

Energy poverty is a multidimensional phenomenon, and can arise from a combination of factors including: low income, relatively high expenditure of income on energy, and the poor energy efficiency of dwellings (European Union, 2019). In Ireland, it is quantified through “the expenditure method of measuring energy poverty”, whereby, if a household spends more than 10% of total income on energy, it is considered to be in energy poverty (DECC, Energy Poverty Action Plan - 2022, 2022).

Recent statistics show a significant increase in the number of households at risk of fuel poverty in Ireland, with almost a quarter of the population in 2022 (ESRI, 2022), and with many households struggling to heat their homes in winter 2022/2023.

Energy poverty has long-term debilitating effects for individuals and society. Europeans who live in energy poverty are almost three times more likely to live in damp, unhealthy buildings compared to those not living in energy poverty (Velux, Healthy Homes Barometer, 2018). As above, living in a cold, damp home has major impacts on health,

23. In Europe (EU27), an annual burden of 2.1 million DALYs (Disability-adjusted life years), dominated by cardiovascular diseases, lung cancer and various respiratory diseases and symptoms, has been attributed to exposure to indoor air pollution (Asikainen, 2016).

including through increased susceptibility to respiratory and cardiovascular diseases, excess winter mortality, and mental stress (DECC, Energy Poverty Action Plan - 2022, 2022). The use of inappropriate forms of energy for heating can also increase the risk of accidents, fires, and carbon monoxide poisoning, while poor indoor air quality and dampness increases susceptibility to asthma and allergies.

Energy efficiency upgrades also produce financial dividends for households and landlords, who can benefit from direct energy savings, reduced maintenance costs in buildings, and lower long-term risks through climate regulations and carbon taxes, which can be expected to only increase in the years ahead. Beyond a reduction in fuel bills, energy efficiency measures can also reduce exposure to energy price fluctuations. Energy efficiency is the surest source of energy supply that exists (Lehr, 2012) and offers security against disruption including by lowering the potential economic losses caused by price volatility and high energy prices.

Energy efficient retrofits of low-income housing offer a more enduring solution to fuel poverty than energy tariff subsidies or fuel payments because they address the root cause of fuel poverty rather than the symptoms (DECC, Energy Poverty Action Plan - 2022, 2022). Furthermore, energy efficient retrofits satisfy a just transition consideration.

Across Europe, recent hikes in fossil fuel prices have prompted governments to increase spending to shield consumers from the direct impact of rising prices (European Commission, 2023). Under Budget 2023, announced in September 2022, the Irish Government introduced a package of once-off measures worth €2.5bn to support customers through the 2022/23 winter. In contrast, the Government's total annual retrofit budget for 2022 was only €329m (DECC, 2022). Although actions to protect the fuel poor from the direct impact of rising prices are needed in the near term[24], focusing on deep energy retrofitting measures is key to tackling the root causes of energy poverty. Nevertheless, targeted compensation to address fuel poverty at the household level can be challenging[25]. While the existing supports for people living in fuel poverty in Ireland mainly seek to target households living in relative income poverty, this assistance does not necessarily reach all households who experience energy poverty. For instance, many larger urban families who live in rented or mortgaged dwellings may not be considered to be in income poverty but may still experience fuel poverty due to the difficulties people face when it comes to paying bills, and such households might not be covered by existing schemes (Pillai, 2022; European Commission, 2022). Specific actions are also needed to increase knowledge and understanding of what supports are available and how they can be accessed among energy-poor households.

Economic benefits

It is estimated that energy efficiency measures could help GDP grow by an extra 1% (Ryan, 2012). This would be driven in large part by two main factors: energy demand reduction

24. See ESRI's analysis of Budget 2023 which shows that once-off measures announced in the Budget would insulate most households from rising prices this winter (Doolan, 2023).

25. The European Commission estimates that only one third of expenditure to assist in meeting energy costs across the EU has been targeted at the financially vulnerable (European Commission, Citizens Energy Forum, 2022).

and investment, leading among other things to the creation of employment. This section covers the estimated co-benefits of energy efficiency from an economic point of view, starting from the macro-level, before moving to the micro-level.

Public budget

Energy cost reductions accruing to the public sector from the introduction of energy efficiency measures are straightforward to estimate, but there are many other co-benefits, such as savings to healthcare and social welfare budgets, which also contribute to long-term savings which should also be considered.

As previously highlighted, state subsidies are paid out for both energy production and consumption, with significant increases in recent months in order to tackle the energy price crisis following Russia's invasion of Ukraine in 2022. Reducing energy demand and supply through the introduction of efficiency measures can also significantly lower the state's subsidy burden, by reducing pressure on public health and social welfare budgets[26]. For example, the Catalonia Institute of Energy Research estimates that renovating 1.5 million dwellings considered to be at risk of energy poverty would save the public administration €370 per household per year – composed of €150 in savings per household in health services costs, and €220 in labour costs, leading to a total annual saving of €555 million to the public sector (Ortiz, 2016).

Finally, as Ireland's Government spending constitutes between 10% and 12% of the country's GDP, public procurement of energy efficiency technologies can also be used to drive the wider market for energy efficient goods and services, and innovation. Taken together, these effects can offset any lost revenues from a fall in the volume of energy excise duty and carbon taxes that are collected (IEA, 2014).

Delivering energy renovation at scale can also clearly support job creation, thus reducing spending on unemployment and other social welfare programmes, as is discussed in the next section.

Job creation

Supporting and creating jobs is a further key benefit of investing in energy renovation. Increased demand for energy efficiency services and technologies have proven to create a large number of skilled jobs, many within the communities where energy renovation takes place (Burr, 2012). In the EU, for every €1 million invested in energy renovation of buildings, an average of 18 jobs are created (Renovate Europe Campaign, 2020).

Job creation from this part of the energy transition can come from both direct (e.g. energy renovation installers) and indirect (e.g., jobs in the manufacturing of insulation products) employment opportunities in the near term. Many of these jobs are in labour-intensive industries such as construction, engineering, maintenance, and contracting services – many of which are inherently local and non-transferable in nature (C40 Knowledge Hub, 2023) (BPIE, 2021).

26. E.g., under Budget 2023, the Irish Government introduced a package of once off measures worth €2.5bn to support customers with increases in energy prices through the 2022/23 winter.

Although the construction industry in Ireland is currently facing labour shortages, 1.5 million homes must be retrofitted across the country by 2050 in order for Ireland to meet its net zero commitments. This is an opportunity for policymakers to address the cycles of "boom & bust" that have been typical in the Irish construction sector for decades, while also providing local and sustainable jobs, as well as the many co-benefits outlined in this paper. In the near term, achieving this objective would require action to attract more people to the industry, as well as to precipitate the upskilling of building professionals and construction workers in areas including carbon literacy, energy efficiency, and circularity (IGBC, 2022), and by supporting project aggregation to transition to more standardised energy renovations[27].

Businesses

Research shows that improved indoor air quality and temperature control can lead to greater cognitive ability and productivity. In particular, good indoor air quality can increase people's productivity by up to 10% (Olesen, n.d.). This is important in office environments where personnel costs, including salaries and benefits, typically account for 90% of a business' operating costs (WGBC, 2016). Hence, relatively small variations in worker productivity can have a disproportionate overall impact on a company's performance as well as on costs. As before, improved energy efficiency can also affect absenteeism, turnover, job satisfaction, health, and overall well-being.

A BPIE study from 2018 highlights how holistic, people-centric renovations, that guarantee adequate ventilation levels, air temperature, daylight and acoustics of a typical office space can result in a 12% increase in employee productivity, which could add approximately €500 billion to the economy each year (BPIE, 2018).

Studies have also shown that well-designed and well-executed energy renovation work within hospitals can reduce the average patient stay by approximately 11%. Energy efficiency improvements also have a concomitant positive impact on educational outcomes. For instance, improving indoor environmental quality can lead to learning performance improvement of between 3 and 8% (BPIE, 2018)

Finally, energy efficiency measures can reduce exposure to energy price fluctuations and higher energy prices. Indeed, energy efficiency is the surest source of energy supply that exists (Lehr, 2012). For building owners, it can also improve rentability and reduce long-term liabilities posed by future climate risks, which could come in the form of new carbon taxes and potential new building regulations.

Taken together, all of these benefits contribute to improving organisations' overall competitiveness.

27. An example of the same is the EnergieSprong programme currently operating in the Netherlands, France and the UK. EnergieSprong delivers whole house retrofits to net zero energy levels via off-site manufactured building envelopes, see: https://energiesprong.org/this-dutch-construction-innovation-shows-its-possible-to-quickly-retrofit-every-building/

Energy providers and infrastructures benefits

As discussed above, reduced energy demand through the introduction of efficiency measures can be important in reducing the cost of generating energy, the need for investments in additional energy generation capacity, and the operation and maintenance costs of energy infrastructure. Typically, these three benefits add up to around 80% of total energy provider benefits (IEA, 2014). It can also help utilities and energy providers to improve system reliability, enhance capacity adequacy, better manage peak demand, optimise the utilisation of generation and network assets, and dampen price volatility in wholesale energy markets.

For utilities and energy providers, offering energy efficiency services to customers can improve customer relations, and can present new avenues of business for energy providers, in addition to unit sales of energy. Energy efficiency programmes targeting low-income customers have been shown to reduce customer default by 25% or more (Skumatz, 2011).

Furthermore, energy efficiency measures have the potential to lower GHG emissions, and the related costs borne by energy providers as emitters, such as through carbon taxes, emissions trading schemes (ETS), and other costs associated with environmental regulation.

Conclusion

Decarbonising all aspects of the built environment across its whole life cycle is critical in order for Ireland to reach its national climate targets. However, the impacts of energy efficiency improvements are not simply limited to energy and carbon savings. As highlighted in this paper, investing in high-quality energy renovation at scale can produce a myriad of social and economic benefits, and can present important opportunities to innovate and reskill. These co-benefits must be better assessed, and a more holistic approach to energy renovation should be taken to reach carbon neutrality, while avoiding unintended consequences and supporting a just transition[28].

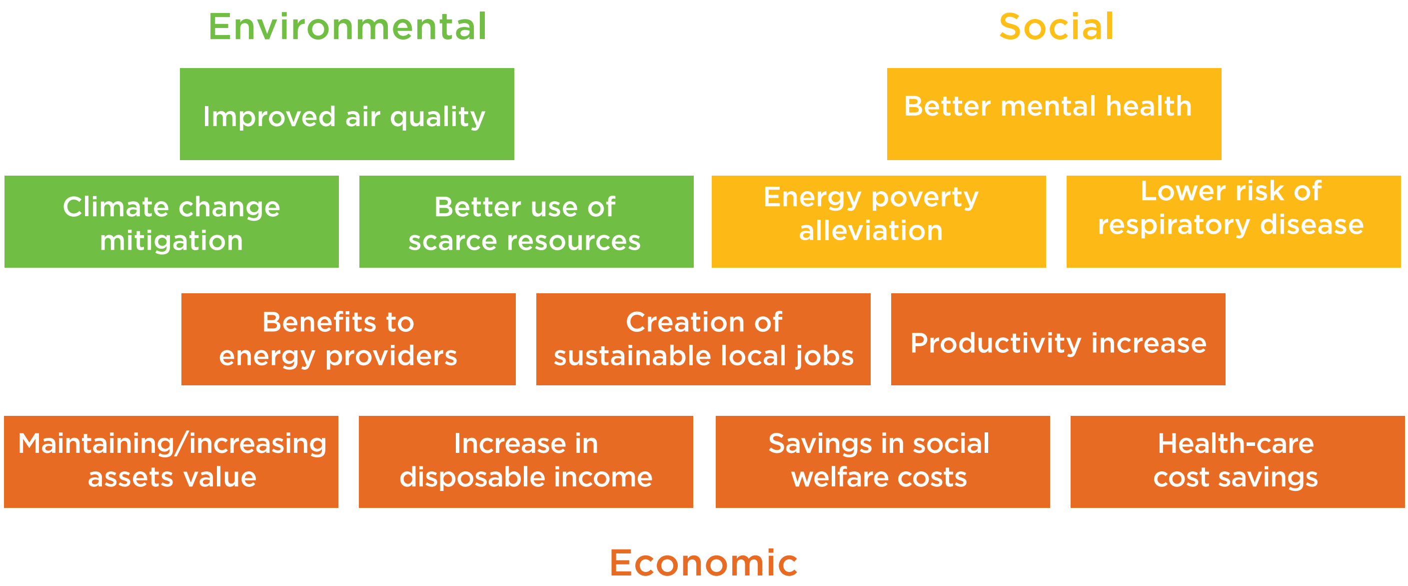
More specifically, to deliver on the renovation wave, energy efficiency must become more desirable, accessible and affordable for all.

Capturing better quality data on the co-benefits of energy renovation is a first step to increasing the appetite for the necessary changes to take place. Capturing good data can be challenging and time and labour intensive[29]. Many of the co-benefits outlined in this paper are diffuse, indirect, and difficult to monetise, but remain crucial for Ireland to meet its net zero commitments and to engender a just transition. Complex interactions exist between each co-benefit and identifying cause-and-effect can be difficult, as is so often the case when it comes to complex public policy measures at scale. Information technologies, automation, and communication networks can reduce the cost of collecting data and can improve the accuracy of findings by using larger sample sizes in any analysis.

28. In its assessment of Ireland's latest national long-term renovation strategy, the European Commission recommends "providing more specific estimates of the wider benefits, including the effect on climate resilience" as an area for potential improvement compared to best practice (European Commission, 2021).

29.Societal level (Rogers, 2017), company-project level (Schmatzberger, 2021)

Holistic Energy Efficiency Improvements



Nonetheless, additional resources will be needed to collect them at scale, and to better communicate the potential benefits to policymakers, businesses (Schmatzberger, 2021), landlords, homeowners, educators (Jammet, 2020), and citizens.

Energy renovation must also be made easier to undertake. Too often, homeowners who want to retrofit do not know what to do and where to start, and practical information can be hard to come by, especially for non-experts. The introduction of “retrofit roadmaps”, providing a clear plan for how to improve and retrofit buildings that can be implemented over time would help. The roadmaps should be developed by independent energy renovation advisors that homeowners could identify through a regulated register. This would not only improve trust in the outcomes of energy renovation, but it would also incentivise upskilling in the industry and across society. Clearly as current labour and skills shortages make the delivery of retrofit targets highly challenging, further actions are required to attract more people to the industry. To deliver and facilitate deep energy renovation at scale, businesses need to be in a position to train staff, build new business models, and guarantee long-term work opportunities for re-skilled employees.

Retrofitting half a million homes to a BER B2 certification by 2030 requires something of a wartime effort. Recent increases in funding for energy renovation is part of the solution, but publicly funded retrofit programmes must deliver real carbon savings and must support a just transition.

Given that the embodied carbon emissions of a deep residential retrofit is typically about a quarter of that of a new build, and given that transport is Ireland’s second highest source of carbon emissions, better connecting energy efficiency grants and support for the re-use of vacant and under-used properties must be a further priority for the Irish Government.

Reducing embodied carbon emissions associated with energy renovation through a greater use of re-used and biobased materials must also be part of the discussion. Given its large agricultural sector, Ireland has a strategic interest in identifying, encouraging, and developing local low-carbon biobased solutions, and in encouraging solutions drawn from the circular economy. A more widespread use of green public procurement could support the development of these industries.

Further actions are also needed to ensure a just transition. In particular, the definition of energy poverty and funding programmes to tackle this issue should be reviewed. Although challenging in the current housing crisis, there is a need to focus more attention on private rental accommodation[30] and the split incentive between tenants and landlords[31]. For the 'able to pay' market, the rate of low interest loans to be introduced would need to be truly low to support the deep energy renovation at scale that this paper seeks to promote.

30. Approximately 20% of rented dwellings have a BER of F or G, compared to the overall housing stock where 15% of properties have a BER of F or G. Over 55% of private rented dwellings have a BER of D or lower (DCCAE, 2016). This implies that people in rented properties are at a significantly higher risk of fuel poverty than people living in owner occupied or local authority homes (DECC, Long-Term Renovation Strategy, 2020).

31. This refers to the situation in which the building owner pays for energy efficiency upgrades but cannot recover savings from reduced energy use that accrue to the tenant.

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The Institute of International and European Affairs,

8 North Great Georges Street, Dublin 1, Ireland

T: +353-1-8746756 F: +353-1-8786880

E: reception@iiea.com W: www. iiea.com