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The correlation between energy efficiency and health

Expert area: EA15 Consumer information and Partnerships, EA16 Energy Poverty, EA2 Energy Efficiency Targets

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CA EED Expert Study Group

The correlation between energy efficiency and health

Summary

This report provides a comprehensive examination of the health implications of energy poverty and poor housing conditions. The work is based on an analysis of approximately 50 documents that vary from scientific research to project studies and policy plans, primarily from North-West Europe and the United Kingdom.

The first chapters dive into the impacts of energy poverty on physical and mental health. The most often reported impacts on physical health are respiratory and cardiovascular problems, higher blood pressure and lower strength. In addition, research highlights the association between poor housing conditions, such as cold and damp homes, and mental health problems, including stress, depression, and anxiety. The report also discusses the indirect effects of energy inefficient houses, such as dietary patterns and excess mortality.

The next section addresses the impacts of renovations and energy efficiency interventions on resident health. These interventions show convincing positive effects, including improved mental health and a reduced need for healthcare, which also lowers cumulative health costs. This sections includes various case studies and best practices that show the long term health benefits and additional societal benefits of energy efficiency interventions.

Finally, the report touches on the quantified health costs associated with poor housing conditions and the payback potential of renovation measures. It discusses direct and indirect costs of poor housing, including healthcare bills, loss of earnings, stress, and long-term consequences. The section cites various studies that quantify health costs, with data showing higher healthcare costs for those living in poorly performing houses.

The report suggests that the long-term indirect and socio-economic savings, which are challenging to quantify, could be up to ten times greater than the direct health cost savings. It emphasizes the importance of incorporating health considerations into Member States' Climate Action Plans and renovation strategies. The availability of comprehensive health data and the impacts of energy efficiency upgrades should be integral to assessing programs with multiple benefits.

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Introduction

Imagine being cold from the moment you wake up until you go back to sleep, knowing that if you turn up the heating you are setting yourself up for future problems. Maybe you won't be able to pay your energy bill next month. Or maybe you will have to choose between paying your energy bill and other expenses, like your healthcare costs, which have been accumulating since the start of the winter. Your life has become an endless trade-off between short term liveability and long-term financial wellbeing.

Energy poverty has become a major topic for most Member States over the last few years, as a result of the steep rise in energy costs, inflation and low energy performance of buildings. It is a subject that needs to be tackled in order to realise a just energy transition for all Europeans. There is a sharp rise in attention and obligation to reduce energy poverty in the 2023 updates of both the EED and EPBD. The EED contains the European standard definition on energy poverty, which is described as:

> "a household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances, in the relevant national context, existing national social policy and other relevant national policies, caused by a combination of factors, including at least non-affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes." (Directive 2023/1791).

This definition underlines that energy poverty is not merely a financial issue. Living in dwellings that can't maintain or reach adequate indoor temperatures has health implications for residents. The fact that citizens spend the majority of their time indoors makes these health implications all the more relevant. It is believed that health related problems can be both cause and consequence of energy poverty. On the one hand, living with an (chronic) illness or disability can limit people's disposable income, which leaves them at a greater risk of energy poverty. On the other hand, the effects of living in energy poverty can cause health problems, or exacerbate existing ones.

Energy efficiency measures often have long pay-back times if only the benefits of energy savings are considered. However, when taking additional benefits into account, such as reduced health costs, these measures become much more appealing for policy makers and investors (see chapter 4). Another benefit of establishing the correlation between energy efficiency and health would be that the awareness the benefits of a healthier home, can be used as a trigger to involve the energy poor in energy efficiency. By consequence health could be used as a stepping stone to prioritise and promote energy savings.

In 2023, various Member States (Belgium -Flanders-, the Netherlands, Ireland, Italy and Greece) set up an Expert Study Group in order to establish an overview of research done on the relation between health and energy poverty, and the health benefits of alleviating energy poverty through energy efficiency measures. This ties in with article 24 of the EED, that calls upon MS to prioritise appropriate measures to empower and protect vulnerable customers and alleviating energy poverty.

The aim of this report is to inform other Member States about negative health consequences of energy poverty and to encourage them to consider the health benefits/larger societal benefits when making policy decisions and starting initiatives to alleviate energy poverty.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101048703.

Methodology

In the first phase of the ESG, the members decided on a couple of main research questions:

1. What are health related consequences of energy poverty and/or living in energy inefficient houses, and to what extent can they be quantified?
2. How can Energy Efficiency schemes help to alleviate health issues linked to energy poverty and which actors could be involved in such approaches?
3. Next to the direct benefits of increased health, what other secondary benefits can be reached and how can MS's use them as arguments for new approaches in the fight against energy poverty and in improving energy efficiency in housing?
4. What are the direct links to the EU-directives and the possible strategies and actions on the MS-level?

To answer the first three research questions, the members of the group collected approximately 50 works through web search, amongst which scientific research reports, practical research, project reports and reviews or thematic guidelines. The majority of these references has been published in the North-West of Europe and the UK. A number of these studies focus purely on renovations and health consequences thereof, instead of energy poverty and health. We included these studies because dwellings that lead to high energy expenditure and are in need of (deep) renovations are an important element of energy poverty. Based on desk research and a quick scan of the materials, the ESG distinguished three topics that represent the main content of the materials. These are (1) health-related consequences of energy poverty and energy poor dwellings, (2) the health impacts of renovations and energy efficiency schemes, and (3) the health costs of energy poverty and energy poor dwellings. Each topic in turn has been categorised according to the most important findings. We linked the categories to related materials in an overview and presented all the content on this category. For example, the category respiratory diseases under the topic health-related consequences of energy poverty and energy poor dwellings links to summarised content of various reports that discuss this relationship. It is important to note that the categories are not mutually exclusive. With this practical approach we managed to assess the collected insights and use them as a knowledge base to realise this report.

Main topic	Health-related consequences of energy poverty and energy poor dwellings	Health impacts of renovations and energy efficiency schemes	Health costs of energy poverty and energy poor dwellings
Health conditions	General information health conditions	Health impacts energy efficiency	
	Mental health and social life	Mental health and social life	
	Respiratory diseases	Respiratory diseases	
	Cardiovascular diseases	Cardiovascular diseases	
	Dementia/arthritis/lower strength	Dementia/arthritis/lower strength	
	Excess deaths	Excess deaths	
	Cognitive performance	Cognitive performance	
	Self-perceived	Self-perceived	
		Unintended consequences	
Target groups	Children/young people	Children/young people	Children/young people
	Babies	Babies	Babies
	Pensioners	Pensioners	Pensioners
	Chronically ill	Chronically ill	Chronically ill
Cooperation with health sector	Identification of cases		
	Integrated schemes		
Health-related costs EP			Cold, damp and dangerous dwellings
			Cost-effects / pay-back of measures
			Mortality costs

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Results

Impacts of energy poor housing/energy poverty on health

The analysis showed a variety of physical and mental health issues resulting from poor housing conditions. For both follows a description of the main findings and the possible impacts of energy efficiency interventions.

Physical health

Respiratory problems

Problems associated with poor housing conditions, such as dampness, mould problems, cold temperatures and indoor air pollution can cause respiratory health problems (Ballesteros-Arjona et al. 2022) (Andrieux at al. 2020). Houses with damp or mould could even cause a 30-50% increase in respiratory issues, which particularly effects children (Watson et al. 2019). These problems include a higher risk for respiratory infections, asthma and Chronic Obstructive Pulmonary Disease (COPD). For the elderly these conditions can be life threatening and even result in death (Ballesteros-Arjona et al. 2022) (Lee et al. 2022) (van Maurik et al. 2021).

The risk for respiratory problems is higher during winter and increases when the indoor temperature goes below 16°C (van Maurik et al. 2021) (Jamie-Lee & Garlick 2018). Studies have found that visits to general practitioners for respiratory tract infections increased by up to 19% for every 1° C drop in mean outdoor temperature below 5°C (Lee et al. 2022). In addition, hospital admissions for COPD are four times more likely to happen during the winter (Jamie-Lee & Garlick 2018).

In New-Zealand an experimental study analysed the different impacts of a heating intervention between a control group and experimental group of children with asthma aged 6-12 years. The heating intervention consisted of the installation of a more efficient heater of at least 6 kW before the winter of 2006 in houses where the previous heating was an open fire, plug-in electric heater or fuelled gas heater. Compared with the control group, children in households receiving the intervention experienced on average 21% fewer days of absence after allowing for the effects of other factors. The efficient heating system resulted in lower levels of air humidity and reduced exposure to mould and dust mite allergens (Free et al. 2009).

A research group from the Netherlands conducted a regression analysis on the relationship between health and the energy transition with data from the National Health Survey. They found a significant association between heating with gas and self-reported asthma, or medication use for people up to 50 years old. After correcting for age, sex and migration background, this group has 4% more chance to use asthma or COPD medication when heating with gas compared to district. Furthermore, the research found that people living in a dwelling with an Energy Performance Certificate label A or B use less medication against asthma or COPD than those in dwellings with label C. These effects are also stronger with persons up to 50 years old (Geijtenbeek et al. 2022).

Cardiovascular problems

As in the case of respiratory issues, cold seasons are the riskiest period to develop cardiovascular problems. For example, deaths resulting from cardiovascular diseases in England were 22.9% higher than average in winter months. Cold temperature can raise people's blood pressure, which can cause strokes or hearth attacks (Lee et al. 2022). A Scottish study estimated that 9% of cases of high blood pressure in Scotland could be prevented by maintaining indoor temperature above 18°C (Shiue & Shiue 2014). On the potential effect of excessive heat on cardiovascular problems, no specific evidence was found but further research could be relevant.

A quasi-experimental cohort study from New-Zealand on a large-scale retrofit programme found that people of 65 years and older with a history of a cardiovascular-related hospitalisation showed a 32.7% lower mortality risk after their home was insulated than the people who didn't receive these measures (Preval et al 2017).

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Dementia, Alzheimer's and lower strength and dexterity

Decreasing body temperature is also associated with a build-up of markers for dementia and Alzheimer's in the brain (van Maurik et al. 2021). In addition, cold homes have been associated with lower strength and dexterity and exacerbated symptoms of arthritis (Lee et al. 2022). A Greek survey study concluded that approximately 22% of the respondents who reported health problems such as arthritic and rheumatic diseases also reported that they could not adequately heat their home (Papada & Kaliampakos 2016).

Mortality

In extreme cases the increase of health problems, especially respiratory and cardiovascular problems, can lead to an excess of deaths in the winter for people who have poor housing conditions (van Maurik et al. 2021). For each 1°C drop in outdoor temperature below 19°C, there is a 2.8% increase in mortality for those who live in the coldest 10% of homes while there is a 0.9% increase for those in the warmest 10%. Those living in the coldest 25% of homes are 20% more likely to die in the winter than those living in the warmest 25%. When the outdoor temperature falls, deaths from coronary thrombosis will peak after 3 days, and deaths from respiratory illness will peak after 12 days (Jamie-Leigh & Garlick 2018).

In contrast to what we would expect, countries with milder climates do not have less excess winter deaths. The reason is that some warmer countries have poor domestic thermal efficiency (Marmot Review Team 2011). Besides cold homes, people in badly insulated houses are on average more exposed to (extreme) heat, which also leads to an increase in the number of deaths (van Maurik et al. 2021).

A quantitative study based on national surveys in Greece found a positive correlation of the mortality rate with the percentage of households unable to keep their home adequately warm. For the period 2003-2014 when the "inability to keep home adequately warm" index in Greece ranged between 12 and 32.9%, it was estimated that 270-740 deaths per month in the winter period or 1080-2962 (or 1 to 2,7% of) deaths per year could be attributed to fuel poverty. Consequently, the economic crisis in Greece (2011-2014) increased the number of deaths attributed to fuel poverty by 75% or 1035 deaths annually (Atsalis 2016).

The impact of renovations on physical health

A meta-analysis of 36 studies concluded that on average household energy efficiency interventions led to a small but significant improvement in the health of residents. Only a few studies reported detrimental effects. For example, the renovation materials or lower ventilation rates could result in indoor air pollution. People with low incomes saw greater positive outcomes for their health and well-being as a result from energy efficiency interventions (Maidment et al 2014).

A longitudinal study from the UK investigated tenant healthcare utilisation associated with upgrading 8558 council houses to a national quality standard. Homes received multiple internal and external improvements and were analysed using repeated measures of healthcare use. They focused on residents aged 60 years and over. The residents living in improved homes showed up to 39% less hospital admissions compared with those living in homes that were not upgraded. These reduced admissions were mainly associated with electrical systems, and to a lower degree to windows and doors, wall insulation and garden paths (Rodgers et al. 2018).

Mental Health

Research shows that energy poverty and mental health problems, such as stress, depression and anxiety go hand in hand. In one study, 47% of people reported becoming anxious or depressed because of living in cold homes (Thomson 2013). In another survey, 29% of the respondents reported feeling more stressed due to the energy crisis (Dienst Gezondheid en Jeugd Zuid-Holland 2023). A third study found that mothers with new-borns who were living in cold and damp homes reported higher levels of postnatal depression (Ballesteros-Arjona 2022). Deprivation in general is challenging, especially for new-borns and very young children. Up to 10% of a person's DNA can be affected by the conditions in which they live as a child. Epigenetic changes can occur when children are exposed to

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consequences of cold, damp housing such as mould and disrupted sleep (van Maurik et al. 2021).

Direct consequences

Since affected households will by definition also experience other types of deprivation, it is hard to specifically attribute these problems to energy poverty. Nevertheless, a 2022 statistical study from the Central Bureau for Statistics in the Netherlands found associations between energy poverty indicators such as difficulties in paying energy bills, the use of secondary heating equipment or a high energy quote (energy expenditure as a percentage of income) with higher levels of stress. They found that households with a high energy quote experienced up to 14% higher levels of stress (Geijtenbeek et al. 2022). This correlation can be explained by the fact that high energy costs reduce available resources for transport, socialising and meeting with family and access to essential services, which are all important social determinants of health (van Maurik 2021).

Indirect consequences

Simultaneously, mental health problems are also caused by indirect consequences of living in inadequate housing. A remarkable example of this is shown in a review study by Thomson et al. (2013). The majority of studies they reviewed, concluded that health improvements as a result of energy efficiency interventions were mostly attributable to increased usable living space for families. The main cause of mental health problems was overcrowding as a result of only heating and living in a limited number of rooms. An increase in usable space and privacy led to improved relationships within the home and a decrease of missed education or work. Another example is the relationship between insulation and the use of sleep medication. Badly insulated homes provide less protection against environmental noise, often causing sleep and cognitive disorders in exposed households (Andrieux et al. 2020). Insulation, and in particular the insulation of the exterior walls has been proven to limit environmental noise (Geijtenbeek 2022).

The impact of renovations

Intervention studies have repeatedly shown associated improvements in mental health following energy efficiency and advice interventions. These are often related to the alleviation of financial stress and worry, increases in perceived value for money of heating systems, increased control over heating systems and heating management, reduced social isolation and generally feeling warmer and happier at home (Jamie-Leigh & Garlick 2018). In some cases, there was no association with gains in self-reported health, but there was one with satisfaction with household warmth and better social functioning (Ballesteros-Arjona 2022).

Given these findings, improved houses can help to avoid stress and can contribute to a better overall well-being of individuals and as a consequence of society.

Health costs and payback analysis of measures

As described in the previous section, housing inadequacies such as mould, dampness, cold or structural damage may increase the probability of a series of hazards for health. Despite a well-established knowledge base on the health impact of poor housing, literature on the quantification of the monetary effects is still under development. More research, including longitudinal studies, and a detailed analysis of energy consumption habits and more granular healthcare data is needed. However, within the long tradition of research on fuel and energy poverty, a substantial number of case studies provide good insights into the costs of these health hazards:

- direct costs: healthcare bills for individuals and society;
- indirect costs: loss of earnings potential and career prospects, stress, days off work, long-term future consequences such as poor labour market outcomes for children growing up in poor housing and missing school for long periods due to ill-health related to poor housing (Eurofound 2016).

In what follows, only the healthcare costs are taken into account as direct costs.

A 2023 NL-study based on healthcare bills of 5,8 million households, found evidence of a 5**% increase of healthcare costs in low-income households living in worst-performing houses** (EPC labels F and G), compared to high-performing houses (labels A and B). The extra cost increased to 8% for

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households under consuming energy by turning the heating down or off. Within this group, for children up to 18 years old the average cost for medicine increased by 24% and even by 40% for hospital cost of compared to the same age group living in similar houses (van Maurik et al. 2021).

Taking into account **direct costs of morbidity** caused by poor housing, data shows that the annual burden for the National Healthcare System (NHS) in the United Kingdom **has increased over the last decade**. Already in 2011, the annual cost was reported to be consistently exceeding GBP 1 billion/year (0.04% of the GDP) (Marmot Review Team 2012). The Institute of Health Equity estimated it in 2019 as high as GBP 2.5 billion/year (0.09% of the GDP) (Watson et al. 2019). The analysis includes a variety of diseases, mainly affecting respiratory and circulatory system, as well as mental health consequences.

Another highly referenced source is the periodic enquiry "Cost of Poor Housing" provided by the renowned independent building research group BRE Garrett et al. 2021). In 2021 treatment of people affected by poor housing costed the NHS some GBP 1.4 billion/year. For many health hazards ongoing treatment leads to structural costs lasting (far) beyond the first year. In addition, there will be the **indirect 'societal costs'**, which in some cases may continue for a lifetime. When these societal costs are included, it was estimated that the full cost to society of leaving people living in poor housing is some GPB 18.5 billion/year or over 10 times more. The total cost for remedial works is close to GBP 10 billion of which 60% is needed for mitigating excess cold. **Payback time would be 7-8 years for the health costs, and less than one year if full costs are considered**.

In Wales the health cost of energy poverty amounted to GBP 95 million per year in 2019 (Watson et al. 2019). The estimate refers to the cost of the first-year treatment. Encompassing long-term consequences would lead the overall societal cost to GBP 1 billion or 10 times more. Funding the removal of hazards in the home would cost GBP 584 million offering a **payback period of 6 years where immediate health savings are considered, or just over 6 months where societal savings are included.**

A central heating intervention in Cornwall saw a reduction in the number of school days missed due to asthma (a drop from 9.3 out of 100 days to 2.1 days) and reductions in the number of nocturnal coughing incidences (Jamie-Leigh & Garlick 2018).

The EU-agency Eurofound, commissioned by the European Parliament, examined in 2016 the cost of inaction on inadequate housing in all the EU Member States (Eurofound 2016). Based on a detailed methodology for the quantification and cost-benefit analysis of economic and social costs of poor housing, the annual social and economic cost of inadequate housing was calculated at EUR 194 billion. Examples of costs included in the assessment are: higher costs for heating, health service costs, loss of asset value, social isolation, loss of earnings potential. Mitigation interventions require approximately a EUR 295 billion investment with payback time 18 months if all measures would be carried out at once**. For every €3 invested, €2 would pay back in one year.** The true impact of housing inadequacies tends to be evident only in the longer term, the study suggests, as do the real healthcare savings of investment in good quality housing to healthcare, economy and society. If initiatives are spread out over longer periods of time and renovations lead to savings such as lower energy and healthcare bills, engaged residents may be willing to contribute to them financially. The report states **that investments in heating and insulation provide the greatest economic and social benefits.**

The next figure shows how a Social Return on Investment cost-benefit analysis can be made taking into account the total appreciation of costs of non-action and benefits of policy intervention.

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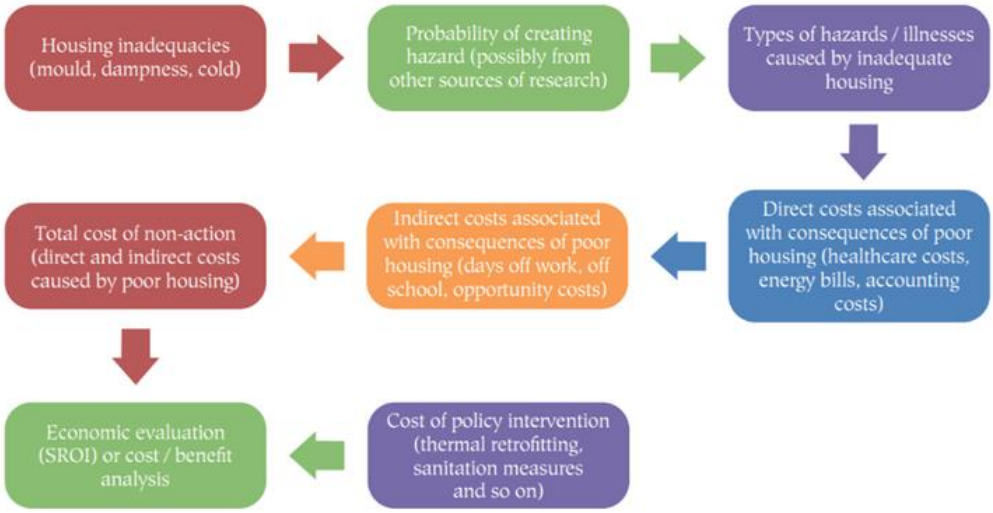

Source: Eurofound (elaborated in-house in 2014).

Another valuable source of EU-data is the COMBI project (2015-2018) (Thema et al. 2018). COMBI applied socio-economic models to estimate the energy poverty-related public health impacts of building refurbishments in 2030. An annual EUR 23.5 billion investment in residential refurbishments would reduce, among other benefits, premature deaths due to particulate matter with 10,805 units per year. Depending on the policy scenario, differentiated by the level of priority given to vulnerable population in building refurbishment initiatives, 3.000 to 24.000 premature deaths and up to 22.300 unhealthy life years can be avoided due to indoor cold. The associated economic value of avoided annual health damage in 2030 ranges from EUR 323 million to EUR 2.5 billion for premature mortality due to indoor cold and 338 million EUR to of 2.9 billion EUR due to asthma morbidity from indoor dampness.

Conclusion

Given the many factors relating to energy poverty through the research papers presented, assessment of impact based only on energy savings payback is limited and does not include the multi-faceted multiple benefits. Although the used sources vary in scope and approach, their findings have general things in common:

- Health impacts linked to poor housing generate substantial costs: for every euro in direct health costs up to 10 euro in indirect costs occur.
- Although energy efficiency measures may not always be cost-effective when energy savings is the only payback metric, if the savings to the health service are also included, then the measures become much more appealing.
- Even more: when both health costs and ‘societal cost’ are included, EE investments generate a pay-back time between 6 and 18 months, with structural and long-lasting savings.

More research on this topic should be stimulated, preferably on the EU-level.

Among the reviewed contributions, the methodology used by the BRE Group and the COMBI project are of particular interest for potential further development, adaptation and replication in different contexts.

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Best practices

Most, if not all Member States have implemented multiple measures for renovating buildings in light of the EU energy and climate goals. Alleviating energy poverty has increasingly become an important objective when developing new policies on this topic. The health benefits that can be realised with such measures are perhaps recognized to a certain degree, but it has not been the main cause for developing new policy schemes for building renovations in most Member States. Notably however, there are some Member States that have developed a policy or implemented certain measures on building retrofits for energy poor households that have a very clear connection with health and well-being.

In the following subchapters a few interesting examples of these measures are highlighted. These best practices are based on examples collected by the Energy Poverty Advisory Hub in the EPAH Atlas, filtered on the topic of health (https://energy-poverty.ec.europa.eu/discover/epah-atlas_en) and the examples collected from the studies as mentioned in the methodology section.

Energy Poverty Action Plan (Ireland)

People at risk of energy poverty need access to different combinations of available measures to meet their individual needs and circumstances. Recognising this, Ireland has developed an Energy Poverty Action Plan by key stakeholders. The plan includes actions within 4 main response areas, Meeting the Cost of Energy, Energy Efficiency and Retrofit, Research and Evidence and Governance and Communication. Two programmes initiated from Ireland's action plan have a distinct focus on the relation with energy poverty, bad housing conditions and health, the 'Warmth & Wellbeing Pilot Programme' and the 'Healthy Homes Ireland'.

The Warmth and Wellbeing pilot

Following the successful study with over 1,300 upgrades homes through the Warmth & Wellbeing pilot, a report is now being prepared by the London School of Hygiene and Tropical Medicine, and due for publication in 2024. Early insights from the Warmth and Wellbeing scheme point to the specific health and wellbeing improvements, particularly for older people, that can be attained through retrofitting. This can combat the health-related consequences of living in a cold, damp home which has been shown to be linked to excess winter mortality, to increased rates of respiratory diseases and to poorer states of mental health and wellbeing.

Furthermore, children growing up in energy poor households may be especially vulnerable to negative health effects arising from living in cold environments. The pilot has shown an increase in winter indoor temperatures in retrofitted homes, a reduced decline in indoor temperature when it is very cold and a reduced diurnal variation. A survey done during this study has shown self-reported improved well-being scores on multiple dimensions (e.g. mobility, self-care, pain, anxiety, and depression). Health care through the reduced usage of GP, Emergency Departments, and hospital services has also emerged as one of the early insights. Modelled outcomes show a lower mortality (especially cardiorespiratory) and a reduced volume of prescribed drugs.

The Warmth & Wellbeing pilot is an inspiring example of a policy scheme in which (positive) health consequences are an integral part of the program. From the start, the scheme aimed to have a positive health impact on energy poor households, which is shown by the study done on health effects after renovation and the reduced social costs it inevitably accomplished. It shows that longer-term home energy upgrades are a key part of the longer-term solution to alleviating energy poverty, improving wellbeing, and simultaneously reducing the amount of energy we use in our national housing stock and our reliance on fossil fuels to heat our homes.

Healthy Homes Ireland

Healthy Homes Ireland (HHI) is a forum established by VELUX and the Irish Green Building Council (IGBC) in December of 2021. Through engagement with a broad high-level group of industry practitioners and academics, it addresses health issues arising from poor quality housing. The initiative aims to ensure there is no compromise made between health and energy efficiency in new build and renovated homes and to positively influence public policy and practice by bringing together industry stakeholders to consider how to address health problems caused by existing low-quality homes.

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The HHI steering group made a series of recommendations on how to advocate for healthy homes in Ireland. Recommendations include the creation of a leadership body for healthy homes, upskilling industry, pathways for occupant empowerment, updates to building regulations and grant funding. Currently, Ireland will look how these recommendations can be used to improve existing schemes.

Green ambulance (Belgium)

In Brussels, if a medical practitioner suspects that a patient's health problems are caused by bad indoor climate, the doctor can request an intervention from the RCIB (Regional Cell for Intervention on Indoor Air Pollution).This scheme, called the Green Ambulance and initiated by the Brussel's Public Agency of Environment 20 years ago, offers a home inspection to look for the causes of these health problems. If caused by indoor air pollution, the household will receive advice on how to improve the air quality. Even though this scheme does not specifically target households in energy poverty, it can be an opportunity to reach these households and to refer them to other existing schemes for home improvements.

Examples from non-EU member states

United Kingdom

Within the United Kingdom, there are both national and devolved policies for alleviating energy poverty, with each nation having their own schemes to aid vulnerable households.

In England, the Seasonal Health Intervention Network (SHINE) is an **interesting example of a one-stop referral system.** SHINE informs the National Health Service (NHS) and third sector to help residents of Islington (a district in the northern part of London) who struggle to keep their house adequately heated. With a budget of over one million euro, the project provides **help on energy advice, benefit checks, debt advice, energy efficiency grants and referrals to health services**, such as the London Fire Brigade and the police, as well as telephone support and electricity and water discounts. The initiative focusses on groups most in need, specifically people who spend over 10% of their income on energy, older people, people who have long-term health issues such as respiratory or cardiovascular conditions, disabilities, or impairments, and families with younger children.

In Wales, the Healthy Homes, People, Lives & Community brings together energy advice and support, social prescribing, and wellbeing to improve people's health outcomes by understanding and addressing the root causes of energy poverty. The Community Workers visit vulnerable energy consumers across North Wales, identify the causes behind the issues a household is experiencing and offer a tailor-made package of interventions.

New Zealand

In New Zealand, the Healthy Homes Initiative (HHI) is a programme that was initially set up by the Ministry of Health (MoH) to combat rheumatic fever. It is targeted towards low-income families with children at risk of rheumatic fever who are living in crowded households. As part of an intervention, the HHI carries out **comprehensive housing assessment by certified Home Energy Performance (HPA) Advisors, and devise individualised action plans to help create warmer, drier and healthier homes**. HHI also help families to get the home improvements they need to create a better living environment, especially for their children, and to reduce the impacts of structural crowding (too many people living in a house) and functional crowding (too many people sleeping in the same bedroom).

The initiative covered 11 district health boards (DHBs) with a high incidence of rheumatic fever and is a collaboration between multiple key government agencies, such as Kāinga Ora – Homes and Communities, Ministry of Social Development (MSD) and the Energy Efficiency Conversation Authority (EECA) and, more recently, the Ministry of Business, Innovation and Employment (MBIE). In 2016 and 2021 the programme was further expanded to include the rest of the country as well as a wider range of vulnerable groups.

Notably, the programme was evaluated in 2022 (over a period of three years) and showed that for every 10 children referred to the HHI, there is estimated to be one fewer hospitalisation, six fewer GP visits and six fewer filled prescriptions over the following 12 months. Furthermore, the evaluation shows the **number of hospitalisations for referred households was reduced by 19.8 percent after the intervention, and that when people were hospitalised, these hospitalisations were shorter and less severe.** The report highlights that HHI is making a tangible contribution to better health and social outcomes for referred people.

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Conclusions and recommendations

This report finds a range of varied studies that clearly confirm the importance of health as an integral part of the benefits of energy efficiency improvements. In policy terms, the focus on delivering warm, dry homes and removing households from fuel poverty can deliver substantial health cost benefits and induce many others. The benefits of reducing home health hazards include:

- Direct health benefits to the health sector, occupants and visitors;
- Wellbeing and mental health benefits;
- Reduced mortality;
- Improved education outcome;
- Raise in productivity and earnings potential;
- Increased asset value of property;
- Saved costs of future retrofitting;
- Structural savings in energy and carbon emissions;
- Increased social capital;
- Local job opportunities and tax revenues.

Research shows that the indirect savings, some of which are harder to quantify, could add up to ten times the already very substantial savings on direct health costs. Also, these benefits continue year-on-year, while the initial costs are a one-off. Therefore cost-benefit analyses should take into account the long-term savings.

In order to ensure that health is a key consideration and integral part of Member States Climate Action Plans and long-term renovation strategies, **the provision of better health data and the direct impacts of energy efficiency upgrades and shift from fossil fuels to renewable sources should form part of the assessment of programmes in the context of multiple benefits.** Great public sector data from health, wellbeing and the broader multiple benefits will greatly assist in quantifying the broader benefits and also joining the dots on public policy in this area**.**

Based on multiple government agency collaboration and coordination new measurement methodologies to more accurately monitor the various aspects of energy poverty should also play a key part in informing policy and programme delivery design. In this way, **user friendly tools for modelling the health (and multiple) benefits of energy savings measures in poor performing houses** could be a great asset for EE policy makers in their search for much-needed massive budgets to enable vulnerable households to realise energy performant and healthy homes.

Besides improving their knowledge base, that Member States can directly use in policy preparation, gaining experience with health-based EE / energy poverty schemes could be of high value to provide further evidence of the direct and indirect benefits. Projects exploring the integrated collaboration between the health sector and housing renovation schemes could include identification of the target group, development of adequate communication tools to reach out to the target group, set up referral services, provide low threshold tailored renovation interventions, measure outcomes, set up trainings for both health and renovation professionals and sharing of the costs.

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Annexes

Energy poverty in the EED

Directive (EU) 2023/1791 sets a new framework for the energy poverty. Initially, energy poverty is defined in **Article 2**, point 52.

Moreover, the application of the energy efficiency first principle should intend to combat energy poverty in the MS according to **Article 3**, while the MS shall also ensure that the regional and local authorities take actions to mitigate significant negative direct or indirect impacts of energy efficiency measures on energy poor, low-income households or vulnerable groups when designing and implementing energy efficiency measures within the context of their long-term planning tools, such as decarbonisation or sustainable energy plans, after consulting vulnerable groups which are at risk of being affected by energy poverty or are more susceptible to its effects (**Article 6**).

In Article 8, It is foreseen that the MS shall implement energy efficiency obligation schemes, alternative policy measures, or a combination of both, or programmes or measures financed under a national energy efficiency fund (**Article 30**), as a priority among, but not limited to, people affected by energy poverty. More specifically, the MS shall establish and achieve a share of the required amount of cumulative end-use energy savings among people affected by energy poverty, which will at least be equal to the proportion of households in energy poverty as assessed in their national energy and climate plans. Furthermore, the MS may require obligated parties to work with social services, regional authorities, local authorities or municipalities to promote energy efficiency improvement measures among people affected by energy poverty.

The foreseen information and awareness raising within the framework of **Article 22** should promote publicly supported energy consumption assessments and targeted advisory services and support for household consumers, in particular people affected by energy poverty. Moreover, the MS shall in cooperation with competent authorities, and, where appropriate, private stakeholders establish dedicated one-stop shops or similar mechanisms for the provision of technical, administrative and financial advice for energy efficiency with a particular focus on households affected by energy poverty. The MS shall establish appropriate conditions for market actors to provide adequate and targeted information and advice on energy efficiency to final customers, including people affected by energy poverty.

A dedicated article (**Article 24**) has been introduced for empowering and protecting vulnerable customers and alleviating energy poverty through the initiation of targeted energy efficiency measures. ember States shall establish a network of experts from various sectors or entrust an existing network, to develop strategies to support local and national decision makers in implementing energy efficiency improvement measures, technical assistance and financial tools aiming to alleviate energy poverty.

In **Article 30**, the Commission shall assist Member States in setting up financing facilities and project development assistance facilities at national, regional or local level with the aim of increasing investments in energy efficiency in different sectors and of protecting and empowering people affected by energy poverty.
Finally, a specialised method for calculating energy savings affected by energy poverty has been added in **Annex V** using standardised occupancy and thermal comfort conditions or parameters, such as parameters defined in national building regulations.

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For further information please visit **www.ca-eed.eu** or contact the CA EED Coordinator Lucinda Maclagan at **lucinda.maclagan@rvo.nl**