Healthy Homes Barometer 2022

Sustainable buildings for a resilient society

7th edition

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We need an ambitious legislative framework to meet climate neutrality by 2050 but also to change the way we look at buildings today – moving beyond energy performance, to climate, environment and health.

David Briggs
CEO, the VELUX Group

Healthy Homes Barometer 2022
7th edition

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Brian Motherway
Head of Energy Efficiency
International Energy Agency

Foreword

I am delighted to see the release of the latest Healthy Homes Barometer. It provides fresh and important insight into how to improve the quality and sustainability of Europe's housing stock, which directly enhances the quality of citizens' lives.

This latest instalment comes at a vital time. Today, more than ever, we are aware of the many dimensions of energy policy, which must address challenges including energy affordability, security and resilience – and, of course, the climate imperative.

The Barometer also reminds us how important the quality of our homes is to the quality of our lives. It highlights that one in three Europeans is exposed to an indoor climate hazard, such as damp or excess cold. At the same time, a rising number of people in Europe are living in energy poverty and face financial difficulties to heat their homes in winter.

Buildings are responsible for almost 40% of European energy demand. Over the last 10 years, their energy consumption has fallen by 14%, in large part due to improving efficiency. These gains have lowered bills for consumers, reduced CO_2 emissions and provided a wide range of other benefits.

With nations representing over 80% of global CO_2 emissions having pledged to bring emissions to net zero by 2050 or soon thereafter, there is an urgent need to turn the bold pledges made before and at the COP26 Climate Change Conference in Glasgow into policy actions. Today, not only are we not on track to meet these targets, but energy-related emissions are still rising. To reach net zero by 2050, further policy efforts and increased investments in energy efficiency need to be front-loaded. For all these reasons, the IEA always describes energy efficiency as the "first fuel".

We see some signs of a growing understanding of efficiency's importance. Around two-thirds of public clean energy recovery spending announced since the start of the Covid-19 crisis is efficiency-related. Buildings are a major focus of this, especially in Europe. The IEA's recently published 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas reminds us that there is major potential for faster action on efficiency, which would yield many positive effects for households, businesses and the environment.

I am convinced that energy efficiency is a key pillar for all clean energy transitions and applaud the Healthy Homes Barometer in helping quantify and increase awareness of its multiple benefits.

David Briggs
CEO, The VELUX Group

Our buildings are key to our **health and a resilient society**

Since our first Healthy Homes Barometer in 2015, our ambition has been to work with accredited research partners to examine how the European building stock can benefit people, society and the planet. This year, as we shake off the shrouds of Covid-19, we need to consider what we have learnt from living in isolation for many months.

Key learnings from experiences in juggling home, work and school, often under one roof, have made us more aware of the role buildings play in our overall health and mental well-being. This role is truly important for our lives and one that also has great economic value even if it is not measured in GDP.

This seventh edition of the Barometer shows that fifty million European households live in energy poverty and one in three Europeans are affected by at least one indoor climate hazard, such as damp and mould, darkness, cold or excess noise. Isolations during Covid-19 have only accentuated the negative impact of such living conditions. And for the first time, we used economic measurements to assess the impact of indoor climate hazards on life satisfaction and well-being – something economists and policymakers have only recently started measuring.

The results underline the need to improve Europe's building stock. The good news is that we have a lifeline available for healthier buildings in Europe. Not only have EU Member States earmarked vast sums for renovations in their national recovery plans, but the EU is also revising its legislation on buildings this year with the Fit for 55 Package. We need an ambitious legislative framework to meet climate neutrality by 2050 but also to change the way we look at buildings today – moving beyond energy performance, to climate, environment and health.

Against the backdrop of hard learned lessons from the lockdowns, the latest IPCC report conclusions on climate change, increasing energy prices and the Russian invasion of Ukraine, it has never been more timely to improve our aging buildings, which consume 40% of Europe's energy.

There is an urgent need for sustainable and affordable buildings for people to thrive at work, at school and at home.

> **It has never been more timely to improve our aging buildings, which consume 40% of Europe's energy.**

Covid-19 has laid bare the stark housing inequalities that exist in Europe and revealed the urgency of providing sustainable, healthy and affordable housing where all citizens can thrive

Why buildings have moved up the **political agenda**

Healthy homes and workplaces are the cornerstone of sustainable, resilient communities.

Since 2015, the Healthy Homes Barometer has worked with accredited research partners to investigate the state of Europe's housing stock. Previous editions have focused on the suburbs and urban areas, and the impact of housing on our most vulnerable citizens – children. This year, the Healthy Homes Barometer shines the spotlight on the buildings where we live and work and the need for renovation.

It's impossible to consider Europe's buildings at the current time without bringing in Covid-19. Since spring 2020, lockdowns caused by the pandemic have forced millions of Europeans to work, learn and live in the four walls of their homes. Overnight the home has been transformed into many people's workplaces and classrooms. For some Europeans, this has renewed their appreciation of their home. For others living in damp, dark, cold or noisy housing, the home has become an extra challenge on the pile of problems caused by the pandemic.

These very different experiences show that as we learn to live with the pandemic, the role of buildings for living and working is changing. Covid-19 has laid bare the stark housing inequalities that exist in Europe and revealed the urgency of providing sustainable, healthy and affordable housing where all citizens can thrive. This is important for health, well-being and life satisfaction – not just during a lockdown.

Time to invest in our future

With Europe standing on the cusp of a Renovation Wave that will tackle the climate crisis by decarbonising our building stock, policymakers have an opportunity to invest in sustainable buildings. In their recent Energy Efficiency First Principle (EE1) Guidelines, the European Commission has already identified energy efficiency[1] in our buildings as one of the key solutions across sectors that will help achieve climate neutrality. Furthermore, the guidelines also recognised human health as one of the most important co-benefits of energy efficiency. With the right focus, sustainable, resilient and energy-efficient buildings can improve the health and well-being of citizens throughout Europe.

This year's Healthy Homes Barometer aims to contribute to this important discussion with data on indoor climate, its impact on health and life satisfaction and the economic benefits of investing in healthy buildings.

1 European Commission, September 2021, Recommendation and guidelines on Energy Efficiency First: from principles to practice.

Contents

01

The urgency of healthy, sustainable and resilient buildings exposed

With one out of three Europeans* affected by an indoor climate hazard, such as damp and mould, noise, cold or dark, the state of buildings throughout Europe can no longer be ignored.

* EU countries, UK, Norway and Switzerland

What is a **healthy, sustainable home or workplace**?

In this report, we define healthy and sustainable homes and workplaces as buildings that respect resources, optimise energy and water use, provide a healthy indoor climate and minimise climate and environmental impact.

Light and bright

Being exposed to enough daylight means you are almost twice as likely to feel energised, which also has a positive effect on your general health, improves your sleeping and reduces your risk of infections.

Cool, quiet and ideal for sleep

A cool quiet bedroom that promotes a good night's sleep contributes to overall good health and feeling energised.

Comfortable temperatures

Comfortable indoor temperatures – neither too hot, nor too cold – make you less likely to suffer from nose, throat and other upper respiratory infections.

Fresh air and ventilation

Airing out your home makes you feel more energised and also reduces the transmission of virus droplets.

The right level of humidity

Mould in your home makes you more likely to suffer from throat and other upper respiratory infections.

Comfortable sound

Excessive noise can impact your physical and mental health and lead to issues, such as sleep problems.

Nature

Creating a connection between indoor and outdoor areas improves the perception of a good indoor climate and gives a sense of improved well-being.

Why improving housing is so urgent

One in three Europeans are exposed to an indoor climate hazard

50%

Europeans who do not have enough savings to maintain their usual standard of living beyond three months[2]

15%

Europeans who live in deprived housing circumstances[3]

9%

The housing cost overburden rate for the overall EU population and rising[4]

50 million

European households are living in energy poverty, many of them unable to heat their homes in winter.[5] This figure is likely to increase in line with the current hike in energy prices.

2 Eurofound, 2020, "Living, working and Covid-19" **3** WHO Europe 2019, "Healthy, prosperous lives for all: the European Health Equity Status Report" **4** Eurostat, 2022: Housing cost overburden rate. **5** FEANTSA press release, 16 July 2021, Fit for 55 package: a unique opportunity to achieve climate goals while tackling energy poverty and unfit housing

02

The state of buildings in Europe

Indoor climate hazards, such as damp and mould, excessive noise, cold or lack of daylight, are an all-too-common problem for Europeans. In fact, almost one in three Europeans consider themselves to be negatively affected by poor indoor climate and exposed to at least one of these hazards.

Indoor climate hazards are common throughout Europe
Percentage of population of EU+27 countries affected by one or more indoor climate hazards

1 in 3 Europeans are exposed to an **indoor climate hazard**

Across the countries covered in this study, nearly 163 million people (or the equivalent of the population of Germany, Spain and the UK) are exposed to at least one of the four indoor climate hazards.

Lack of daylight

5% of all Europeans consider their home too dark.

There is considerable variation throughout Europe in daylight conditions. Countries in the colder north and sunnier south are affected by a lack of daylight in homes. This can have a direct effect on mood, well-being, cognition, alertness, performance and sleep.

Health effects: Depression, Sleeping problems, Poor vision

29 million
consider their home too dark.

Excess cold

7% of Europeans are unable to keep their home adequately warm.

According to the World Health Organisation, low indoor household temperatures are the combined result of poor thermal insulation, inadequate or inefficient heating systems, the social and economic status of the household, and the cost of energy.[6]

Health effects: Respiratory diseases, Cardiovascular disease

34 million
are unable to keep their home adequately warm.

Excessive noise

18% are exposed to noise from neighbours or the street.

The more urbanised a country is, the more the population suffers from excessive noise. In the EU, including Switzerland, UK and Norway, 21% of people living in cities considered their households to be affected by noise from neighbours or the street. The figure for those living in towns and suburbs was 14% and fell to 9% for people living in rural areas. Road traffic noise is the most common source of noise pollution.

Health effects: Cardiovascular disease, Immunosuppressive disease, Gastrointestinal disorders, Sleeping problems

92 million
are exposed to noise pollution.

Damp and mould

13% of Europeans live in dwellings with damp or leaks in the walls or roof. One in six houses is likely to be affected.

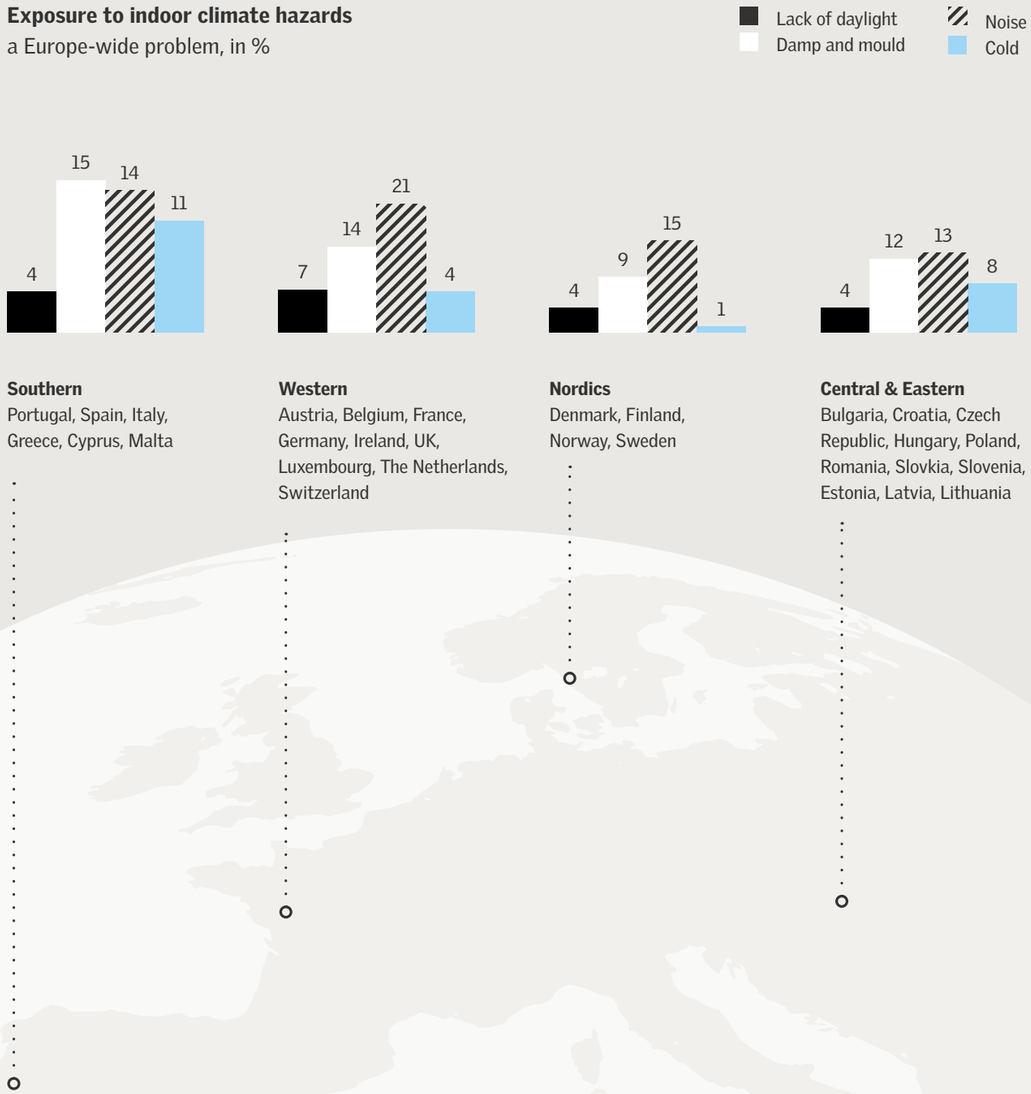
Damp and mould are more likely to be found in buildings that are overcrowded, lacking in appropriate heating and with poor ventilation[7]. Climate also plays a role and countries that experience larger amounts of annual rainfall have been found to have a greater risk of damp and mould.[8]

Health effects: Asthma, Respiratory conditions

69 million
live in housing with leaking roof, damp walls, floors or foundation or rot in window frames or the floor.

People exposed to all four indoor climate hazards are almost four times more likely to report poor health compared to people living in healthy homes.

Exposure to indoor climate hazards
a Europe-wide problem, in %



6 WHO Europe, 2011, "Environmental burden of disease associated with inadequate housing" 7 WHO Europe, 2009, "Dampness and Mould: WHO Guidelines for Indoor Air Quality" 8 Norbäck, D. et al., 2016, 'Building dampness and mould in European homes in relation to climate, building characteristics and socio-economic status: The European Community Respiratory Health Survey ECRHS II', Indoor Air, 27: 921 – 932. P. 926

The effects of **heat and light** in the workplace

Staying warm and healthy
When it comes to temperature, there are regional differences in minimum indoor temperatures but the World Health Organisation (WHO) suggests a minimum indoor temperature of 18 degrees Celsius. In addition to the health risks that come from working in colder indoor temperatures, working in the cold is also linked to increased transmission of Covid-19 and other airborne viruses as the virus survives longer in lower temperatures[9].

Get ready for heat
As the effects of global warming and climate-related heatwaves become more intense, excess heat is starting to become a bigger problem for everyone – especially children and the elderly. To counter this, sales of air conditioners are expected to double over the next 20 years[10]. While this can make indoor temperatures more comfortable and prevent the occupational heat strain that affects workers working in warmer temperatures, the irony is that it exacerbates the overall problem by increasing global warming and its negative consequences for the climate[11].

Faced with this need for thermal comfort in cold and warm periods, healthy buildings need to be designed to retain heat in colder months and be cooled during heatwaves. At the same time, improved thermal control and energy efficiency measures should not be introduced at the expense of indoor air quality as this can lead to new issues such as mould[12]. Smart buildings with digital energy saving infrastructure can be part of the solution to improve both energy efficiency and well-being.

Better light, better work
Alongside temperature and air quality, daylight has been shown to positively impact the working environment and even improve performance in line with the amount of daylight[13 14 15]. What's more, it also creates a more pleasant and enjoyable working environment, which has been shown to considerably reduce absenteeism[16].

15%
Better access to daylight can reduce absenteeism in the workplace by 15%[16].

2 billion tonnes of CO_2
If the rest of the world used the same amount of air conditioning as the US, air conditioning would use about 13% of all electricity needed globally and produce two billion tonnes of CO_2 annually[11].

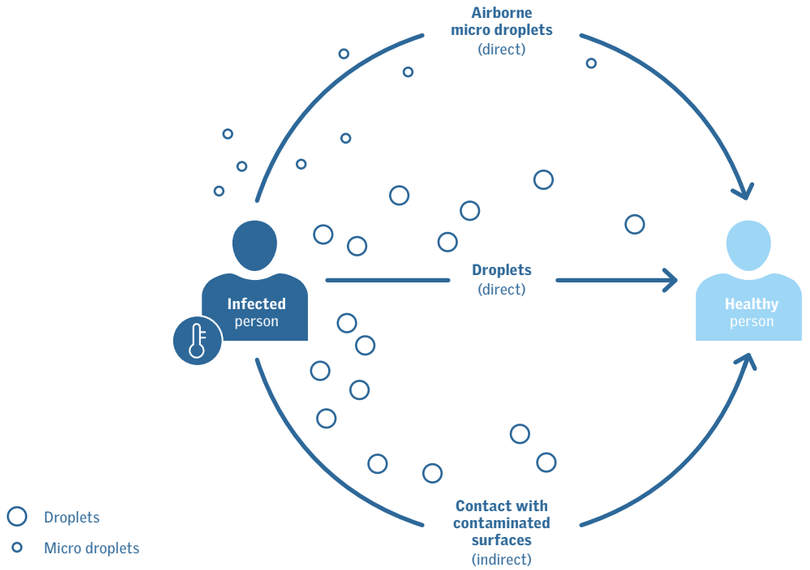
9 P. Dabisch et al, 2020, "The influence of temperature, humidity, and simulated sunlight on the infectivity of SARS-CoV-2 in aerosols" **10** L. Wenz et al, 2017, Proceedings of the National Academy of Sciences, "North–south polarization of European electricity consumption under future warming" **11** Stephen Buranyi, "The air conditioning trap: how cold air is heating the world", the Guardian website. **12** Ortiz et al, 2020, Energy and Buildings Volume 221, "Indoor environmental quality related risk factors with energy-efficient retrofitting of housing: A literature review" **13** H. Juslén, 2007, Helsinki University of Technology, "Lighting , Productivity and Preferred Illuminances - Field Studies in the Industrial Environment" **14** AT Kearney, 2015, LightingEurope, ZVEI, "Quantified benefits of Human Centric Lighting" **15** P. R. Mills, et al., 2007, Journal of Circadian Rhythms Volume 5, "The effect of high correlated colour temperature office lighting on employee well-being and work performance" **16** Mujan, I. et al., 2019, Journal of Cleaner Production, "Influence of indoor environmental quality on human health and productivity - A review", 217, pp. 646-57

03

How buildings can safeguard health

As we look to the future, we can use our learnings to date to make buildings more resilient to airborne virus transmissions.

Understanding different transmission routes



What we know about virus transmission

Today we know that the principal mode by which people are infected with SARS-CoV-2 (the virus that causes Covid-19) is through exposure to respiratory droplets that carry the infectious virus. These small aerosol droplets can be passed from an infected person's mouth when that person speaks, coughs, sings or breathes heavily[17]. In unventilated and crowded indoor spaces, this leads to a higher risk of virus transmission.

At the start of the pandemic there was considerable focus on transmission of the virus from infected surfaces. Today we know that this presents significantly less risk than airborne virus transmission[17].

Ventilation makes a difference

Although research into the spread of Covid-19 is still in its early stages, initial findings are confirming what health authorities have been telling us about the importance of ventilation. A small US study of infected students in a college dormitory showed that opening a window could halve the amount of virus particles in a room[18]. With the average person inhaling 15,000 litres of air each day[19], spending time in busy and inadequately ventilated spaces has become a very real health risk during the pandemic[20].

17 Centers for Disease Control and Prevention, 2020, Science Brief: SARS-Cov-2 and Surface (Fomite) Transmission for Indoor Community Environments **18** P. Horve et al., 2021, Research Square, "Longitudinal Analysis of Built Environment and Aerosol Contamination Associated with Isolated COVID-19 Positive Individuals" **19** VELUX 2008, "The Indoor Generation Survey", pdf **20** WHO, 2021, "Roadmap to improve and ensure good indoor ventilation in the context of COVID-19"

Is it safe to be together indoors?

Although SARS-CoV-2 can be spread efficiently through the air, there are a number of ways to make indoor spaces safer.

Ventilation matters

Natural ventilation in the form of opening windows to let in fresh air continues to be a simple, cost-effective and easily understood way to mitigate the risk of contamination. By introducing fresh outdoor air into an indoor space, the pathogens in the air are diluted and the air is rapidly refreshed. This is why the WHO[21] and health authorities in a range of countries including the UK, Japan and Germany are encouraging people to open windows and air out regularly. At the same time, opening a window allows UV rays from daylight into the room, which can help deactivate viruses.

Furthermore, advances in smart airing solutions, such as sensor-controlled window opening, enable efficient airing out by automatically opening and closing the window when needed to maintain a healthy indoor climate.

Alongside natural ventilation, mechanical ventilation systems, such as heating, ventilation and air conditioning units, are also effective in creating a constant hygienic air flow rate. However, mechanical ventilation should be carefully assessed to ensure that airflow remains optimal and meets the required standards for the number of people who will be using the space. In many cases, upgrading the existing mechanical ventilation system to deliver recommended additional air flow rates to reduce the spread of infectious diseases can be an expensive solution compared to the simple solution of opening a window, which can have the same effect.

21 WHO, 2021, "Roadmap to improve and ensure good indoor ventilation in the context of COVID-19"
22 REHVA website, COVID-19 Guidance Directory

Creating a safer indoor space

Any type of human interaction indoors will always carry a risk of airborne virus transmission. However, combining natural and mechanical ventilation is an effective solution to reduce contamination. The diagram shows how to minimise the airborne spread of any contamination[22].

04

Why indoor climate matters for life satisfaction

It is well known that the state of buildings and their indoor climates can affect our physical health. However, recent research shows that indoor climates also affect our mental well-being.

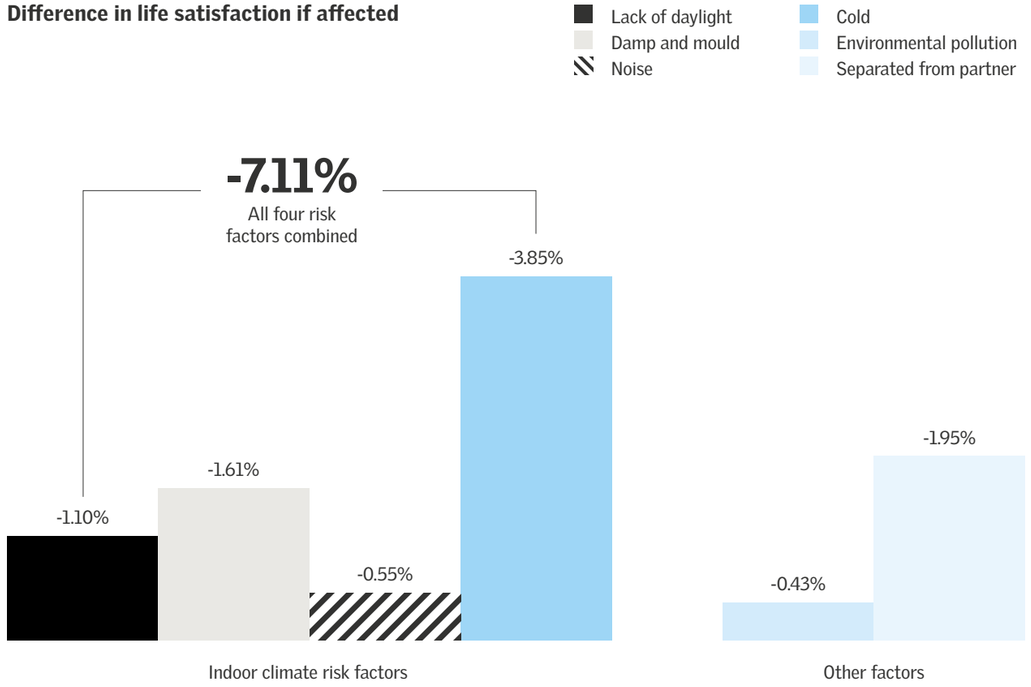
Home is not always **the sanctuary** we might think

The Well-being Valuation Analysis (WVA)
Measuring life satisfaction lost from building deficiencies can be done using a new but recognised method – Well-being Valuation Analysis (WVA). This lets us assess the impact of an indoor climate hazard, such as damp and mould, on a person's overall well-being. It combines two measurements: the subjective assessment of well-being and an economic measurement of the impact the indoor climate hazard has on a person's well-being.

For governments and policymakers, this type of assessment now allows them to measure the value of a building renovation intervention in a more holistic way. They are now able to consider mental health alongside the more tangible benefits, such as energy savings and climate neutrality. In fact, human health and well-being have been highlighted by the European Commission as among the most important co-benefits of energy efficiency[23].

23 European Commission, 2021, "Commission Recommendation on Energy Efficiency First: from principles to practice"

Difference in life satisfaction if affected



Putting a value on well-being
The first step of the analysis is to estimate the association between exposure to an indoor climate hazard and income and life satisfaction. In the second step, the so-called "compensating income variation" is used to estimate the necessary income required to compensate for the loss of life satisfaction caused by exposure to the indoor climate hazard (economic regression analysis). If the result is negative, the indoor climate hazard is shown to reduce life satisfaction and well-being.

As the data shows, a lack of heating has almost twice the impact on perceived well-being and life satisfaction as being separated from a partner. With 34 million Europeans unable to keep their homes warm, the potential impact on their well-being is significant.

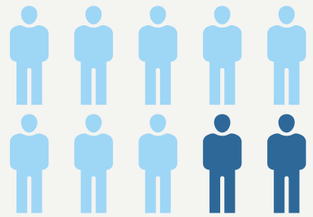
This data reveals that the costs of poor indoor climate are not just poor physical health but also poor mental well-being, including an increased risk of depression. Individuals exposed to all four indoor climate risks are almost five times more likely to report being unhappy compared to an individual exposed to no risk factors. This makes it even more urgent to prioritise renovation and investment in housing and workplaces.

Improve housing, improve health
Alongside the economic benefits in healthcare savings and productivity improvements, there are huge economic gains to be had in terms of improving well-being. For example, reducing exposure to damp and mould and rectifying the lack of daylight in residential buildings has been shown to result in well-being benefits that are felt to be the equivalent of almost €100 billion per year in EU countries. That is equivalent to the total EU Unemployment Risks in an Emergency (SURE) financial support distributed to 19 Member States in 2021 to fight the negative economic and social consequences of the COVID-19 outbreaks on their territories.

Time to put indoor climate **on the agenda**

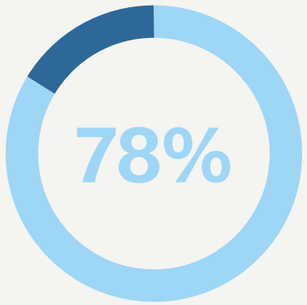
x5

People living in homes with all four indoor climate hazards are almost five times more likely to feel unhappy compared to people who live in healthy homes.



8/10

People in Europe and North America are unaware of indoor pollution[24].



Most people are aware of and concerned about outdoor pollution. Yet when it comes to indoor pollution, there is a lack of awareness. 78% of people are unaware that the air indoors is more polluted than outdoor air[24].

24 VELUX, 2018, "Indoor Generation survey", pdf

05

Decent affordable housing is more urgent than ever

An investment in housing is more than just improving living conditions. Healthy homes can also play a role in reducing inequities and illness.

Decent housing equals **health**

Recent data from the World Health Organisation shows that the policy action of investing in housing would have the greatest impact on health inequities over a period of two to four years - more so than investing directly in health[25].

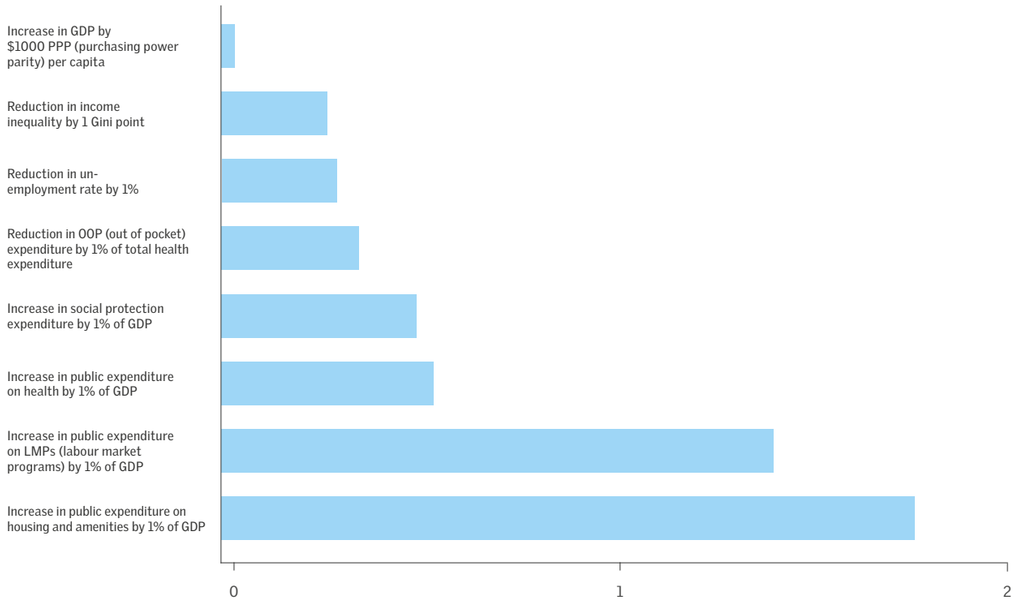
Housing is an investment in the future
In recent years, when it comes to buildings, the political focus has been on support for those suffering from energy poverty and on improving energy efficiency. With increasing energy prices, this has become an even more pressing issue.

While improving energy efficiency has been shown to lead to improvements in indoor environment, well-being and health[26 27], without sufficient ventilation it can lead to ideal conditions for mould or other pollutants[28]. This is why the European Commission guidelines on energy efficiency state the need to consider adequate ventilation to improve indoor climate when implementing energy efficiency measures[29].

25 WHO Europe 2019, "Healthy, prosperous lives for all: the European Health Equity Status Report" **26** Grey et al, 2017, SAGE journals, "Cold homes, fuel poverty and energy efficiency improvements:A longitudinal focus group approach" **27** Williams et al, 2020, Frontiers in Sustainable Cities, "Health and Climate Benefits of Heat Adaptation Strategies in Single-Family Residential Buildings" **28** Ortiz et al, 2020, Energy and Buildings Volume 221, "Indoor environmental quality related risk factors with energy-efficient retrofitting of housing: A literature review" **29** European Commission, 2021, "Recommendation and guidelines on Energy Efficiency First: from principles to practice."

Housing has the biggest impact on health inequities[25]

This study was carried out in 24 countries and compared the effect of eight different macroeconomic policies in reducing health inequities with a time lag of 2-4 years.



What is energy poverty?

Adequate warmth, cooling, lighting and the energy to power appliances are essential services needed to guarantee a decent standard of living and citizens' health. Energy poverty occurs when a household suffers from a lack of adequate energy services in the home.[30]

Decent housing more urgent than ever

Even before the Covid-19 struck, the housing cost overburden rate (the percentage of the population living in households where the total housing costs represent more than 40% of disposable income[31]) was a shocking 9.4% for the overall EU population[32] and this figure is rising.

For those in a financially difficult situation, such as the 50% of Europeans who do not have enough savings to maintain their usual standard of living beyond three months, the pandemic, rising living costs and the housing boom have put an extra strain on household finances. A lack of affordable housing in Europe has compounded this fragility.

With the housing overburden rate as high as it is, perhaps it is no surprise that over 15% of Europeans live in deprived housing circumstances[33]. What's more, 50 million European households are living in energy poverty, many of them unable to heat their homes in winter[34]. Regardless of the cause of energy poverty, its consequences are serious; twice as many people have poor health when living in energy poverty[35].

Health and comfort play a large role in home improvements

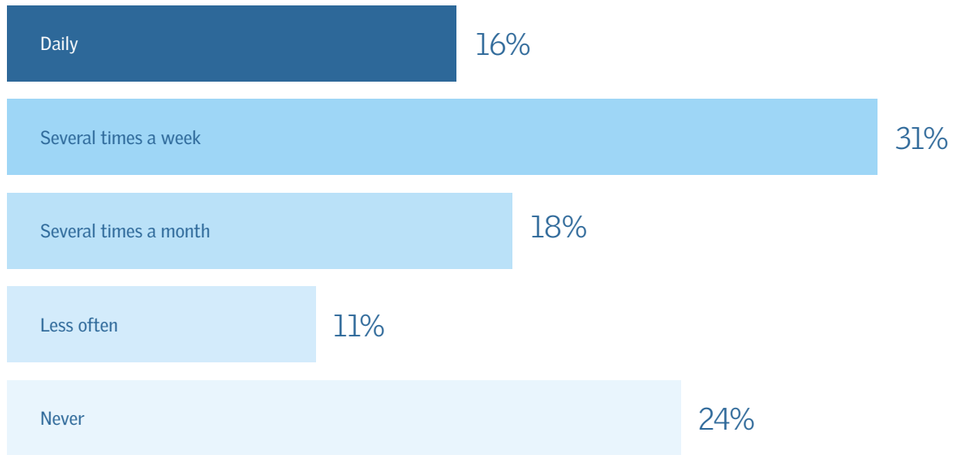
On an individual level, consumers are interested in renovating their homes for a number of reasons. For example, when it comes to energy efficiency, a Navigant study from 2019 found that although saving energy was important, cost savings and improvements to the comfort and health of consumers homes were more relevant. This supports the findings from the Healthy Homes Barometer from 2016, which showed that almost three out of four Europeans would renovate their homes if it increased family comfort.

x2

Twice as many people have poor health when living in energy poverty.[36]

Do we want to work from home[37]?

Data collected in Spring 2021



Our homes need to do more

Since early 2020, social restrictions and lockdowns to limit the spread of Covid-19 have changed our way of life. For example, the formerly unthinkable shift to online work and school became a reality for many white-collar workers and children often in a matter of days. This has changed the very nature of our homes, many of which now have to incorporate the workplace and classroom.

At the same time, employers have seen that the move to remote work has not significantly affected productivity[38], which has made them more receptive to the idea of a hybrid model of working in the office some days a week and remotely for the rest. This trend looks likely to continue and both Eurofound and OECD reports predict an increase in remote work[39].

30 European Commission Energy Poverty Advisory Hub, https://energy-poverty.ec.europa.eu/index_en **31** Eurostat Statistics explained, "Glossary: Housing cost overburden rate" **32** Eurostat, 2022, Housing cost overburden rate **33** WHO Europe 2019, "Healthy, prosperous lives for all: the European Health Equity Status Report" **34** FEANTSA press release, 16 July 2021, "Fit for 55 package: a unique opportunity to achieve climate goals while tackling energy poverty and unfit housing" **35** VELUX, Healthy Homes Barometer 2018 **36** VELUX, HealthyHomes Barometer 2018 **37** Eurofound, 2020, "Living, working and Covid-19" **38** Bartleby, The Economist 12 June 2021,"Remote workers work longer, not more efficiently" **39** S Canivenc et al., 2021, Presses des Mines, "Le travail à distance dessine-t-il le futur du travail?", The original version has been partly adapted for the present work in English. ISBN: 978-2-35671-704-7ISSN: 2495-1706

06

It's time for Europe to invest

Throughout Europe, buildings are old and too many were built at a time when energy efficiency and carbon emission reductions were not a consideration.

The many **benefits of renovation**

As climate action becomes ever more urgent, building renovation is now firmly on the political agenda with initiatives such as the Renovation Wave, the Fit for 55 legislative package and the rollout of national recovery and resilience plans.

According to a new EU report[40], if the EU does not take further ambitious and united action in the transformation of its energy system, it could cost up to 5.6% of EU GDP in 2050. Furthermore, achieving increased energy efficiency in the range of the EU target of 40% by 2030 would bring economic benefits worth €126 billion per year. It should also be remembered that this €126 billion per year does not take into account the economic benefits of reducing indoor climate risks, such as the savings on healthcare, social costs and lost productivity[41].

Now that the European Union has made funds available for the Renovation Wave, there is a real opportunity to invest in European building stock and energy efficiency and improve health, well-being and productivity.

Improving indoor climate hazards pays off

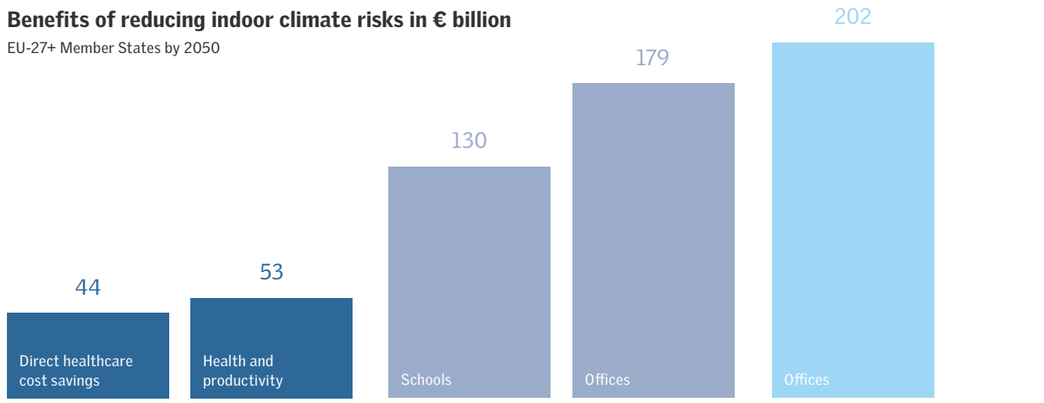
The table below shows the total annual economic benefits of improving poor indoor climates in residential and public buildings, such as schools and offices across Europe. A lack of sufficient data for economic modelling means that these figures are a conservative estimate of the potential benefits that can be achieved by reducing the four risk factors across Europe. However, based on what can be modelled at this point, it is estimated that Europe's economy could gain more than €600 billion by 2050. That is well over half of the expected investments needed for realising the European Green Deal's aim to transform the 27-country bloc from a high- to a low-carbon economy by 2050[42].

40 A. Heflich et al, 2021, Think Tank European Parliament, "EU Energy System Transformation: Cost of non-Europe."
41 Eurofund, 2016 "Inadequate housing is costing Europe €194 billion per year"
42 European Commission, 2020, "The European Green Deal Investment Plan and Just Transition Mechanism explained"

↓ Note: EU 27+ includes 27 EU Member States plus Switzerland, Norway and the United Kingdom (except for productivity improvements through increased ventilation in schools where Switzerland and Norway are excluded). Figures are in real present value Euros. Direct healthcare cost savings are related to population attributable fractions of exposure to damp and mould as well as daylight and the association with asthma and upper and lower respiratory infections and depression. Improvements in ventilation rates in European schools assumes an improvement of ventilation rates to 3 l/s, and for offices it assumes an increase of ventilation rates to 7 l/s (upper scenario in BPIE report). Productivity improvements through access to daylight in European offices are based on a scenario assuming an increase to 800 lux (highest scenario in BPIE report).

Benefits of reducing indoor climate risks in € billion

EU-27+ Member States by 2050



€608 bn

Cumulative economic benefits

07

Healthy buildings can bring about the change Europe needs

Applying sustainable renovation strategies to Europe's existing building stock can lead to benefits that include improvements in health and well-being, increased productivity levels and a reduction in climate impact.

The statistics in this report paint an alarming picture of the state of Europe's building stock. However, there is a way to change this and bring about improvements in health, productivity and well-being: investing in sustainable renovation strategies.

Now is the time to rethink how we build and focus on a more sustainable and holistic approach to renovation. Improvements to the existing building stock need to consider decarbonisation, energy savings and climate protection, alongside the health and well-being of the people who use buildings.

A window of opportunity has been opened with the EU-sponsored Renovation Wave and the political awareness is growing. With one out of three Europeans affected by an indoor climate hazard, the citizens of Europe deserve action.

Sustainable renovation benefits

- Improved productivity
- Energy savings
- Decarbonised building stock
- Greater well-being
- Improved health
- Climate protection

About the Healthy Homes Barometer 2022

The Healthy Homes Barometer is a series of pan-European reports designed to investigate the link between homes and health.

The first edition of the Healthy Homes Barometer was published in 2015 and the 2022 edition is the seventh Barometer published by the VELUX Group.

This year's Barometer is a fresh compilation of facts, research and insights. Research has primarily been conducted by RAND Europe, a not-for-profit policy research organisation, with additional insights. The analyses were conducted by RAND Europe unless otherwise stated.

The statistical and econometric analyses are predominantly based on the European Union Statistics on Income and Living Conditions (EU-SILC) data, with other data sources including WHO and Eurofound data sources, and the European Quality of Life Survey (EQLS).

To calculate the well-being impact of indoor climate hazards, the Well-being Valuation Analysis was used (WVA). This is based on econometric regression analysis using data from the EU SILC 2018 and 2013, which had special modules asking about indoor climate hazards as well as people's life satisfaction.

A multi-country computable general equilibrium (CGE) model was used to assess the economic implications of an adult's exposure to damp and mould, as well as lack of daylight.

#HealthyBuildings

Read the full RAND Europe report
https://www.rand.org/pubs/research_reports/RRA1323-1.html

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