

HOME TRUTHS

How climate change is impacting UK homes

THE CLIMATE COALITION



THE CLIMATE COALITION

This report marks the launch of The Climate Coalition's annual Show The Love campaign. Throughout February, people from all walks of life will join the UK's biggest conversation about climate change, and use their voices to show the love for everything they want to protect from the climate crisis, and the solutions we must grasp to save them.

The Climate Coalition is the UK's largest group of people dedicated to action on climate change and limiting its impact on everything we love in the UK and around the world, including the world's poorest countries. The coalition is made up of over 140 organisations with a combined supporter base of 22 million, including WWF, National Trust, RSPB, Christian Aid, CAFOD, The Women's Institute, and Oxfam. Together we want a future where the UK no longer contributes to climate change within a generation.

Find out more at theclimatecoalition.org

PRIESTLEY INTERNATIONAL CENTRE FOR CLIMATE

The Priestley International Centre for Climate brings together world leading expertise from across disciplines to deliver research that underpins robust and timely climate solutions. Based at the University of Leeds, the Priestley Centre aims to provide international solutions to the global challenge of climate change through new interdisciplinary research partnerships that better link our physical, technological, economic, and social understanding of climate change with strategies for mitigation and adaptation.

Find out more at climate.leeds.ac.uk

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FOREWORD

– GEORGE CLARKE – ARCHITECT,
TV PRESENTER, CAMPAIGNER, AND FOUNDER
OF AMAZING PRODUCTIONS

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There is no question that living in a low-carbon home is better for our health, the planet and our energy bills.

”

At this time of year, the cost of heating our homes is a strain on millions of households. Homes across the country are leaking energy from poor insulation and design, further and unnecessarily adding to the bills of low-income households and dragging them into fuel poverty.

The UK has some of the oldest housing stock in Western Europe and also amongst its least energy efficient.

It's unacceptable that as many as 40% of renters are experiencing problems with poor insulation or excess cold in their homes this winter, according to Shelter. And it's tragic that the UK saw 17,000 deaths due to cold housing conditions in the winter of 2018.¹

Together, we could change this.

The technologies to solve this problem and save us money and reduce our climate footprint already exist. We could save half of the energy used in our homes with a mix of energy efficiency improvements and renewable heat technologies.

A push towards low- and zero-carbon homes would also create new skilled jobs and careers in housing design, construction and retrofitting.

With the right Government support, we could make this happen.

In Nottingham, more than one hundred homes are being retrofitted through the inspiring “Energiesprong” (energy leap) initiative. Residents there will soon be able to look forward to newly improved and comfortable homes and lower, climate-friendly energy bills.

It will require a transformation on a scale not seen before, but one that is absolutely necessary if we want to cut the contribution housing makes to our overall climate emissions.

If we get this right, we will all be able to live comfortably and affordably in our homes.



FOREWORD

“

As this report shows so graphically, the consequences of climate change such as increased flood risk are already having devastating effects on people and businesses.

Adapting to the inevitable changes in our climate is vital, and we are taking robust action to improve the resilience of our people, economy and environment, including by investing £2.6 billion over six years to better protect our communities from flooding and erosion.

Tackling climate change and the impact on our environment is both a national and international priority. The UK is already leading the way by delivering on our world-leading target of net zero greenhouse gas emissions by 2050. We will ask our partners to match the UK's ambition at this year's COP26 talks in Glasgow.

– REBECCA POW MP, MINISTER FOR FLOODING, DEPARTMENT FOR ENVIRONMENT FOOD AND RURAL AFFAIRS

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This call to action should be taken seriously - we know our planet is in crisis, and it is high time for decisive action.

Only through ambitious sustainable housing and planning goals will we be able to build the warm and energy efficient homes that are needed to tackle the housing and climate crisis.

We now need the Government to act, with the introduction of binding targets to roll out renewable energy and low-carbon transport, to increase proper funding of environmental protection and to reintroduce the zero-carbon homes policy so that we can move to a greener economy.

– ANDREW GWYNNE MP, SHADOW MINISTER FOR HOUSING, COMMUNITIES AND LOCAL GOVERNMENT

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“

As we have been seeing with some of the extreme weather in the UK over the past few years, and as this important report reminds us, the climate emergency means we are faced with rising sea levels and more frequent and intense flooding.

We must act now to adapt to these challenges. The Environment Agency's draft Flood and Coastal Erosion Risk Management Strategy sets out how we must continue investing in our flood and coastal defences whilst also ensuring that our homes, businesses and infrastructure are resilient to the increasing risks that climate change will bring.

However, alongside adapting to its impacts, everyone in society - government, businesses, and individuals - must do everything they can to tackle the root causes of climate change. Hosting COP26 in Glasgow gives us the opportunity to form global coalitions to do just that.

– EMMA HOWARD BOYD, CHAIR OF THE ENVIRONMENT AGENCY AND UK COMMISSIONER TO THE GLOBAL COMMISSION ON ADAPTATION

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SUMMARY

Households across the UK are facing winters of heightened flood risk because of the climate crisis.

The UK is seeing an increased chance of wetter winters and more frequent and intense weather extremes, due to climate change. In two recent studies, researchers found the likelihood of extreme rainfall happening in the UK had increased by approximately 40% because of climate change.^{2,3}

Around 1.8 million people are living in areas with **significant** risk of flooding.⁴

Major floods have caused devastating damage to UK households over recent years:

- The past dozen years (2007-19) has seen a major flood event nearly every year with almost 100,000 properties damaged in England, according to data provided to The Climate Coalition by the Environment Agency.⁵
- Coastal, surface or river flooding is causing more than £1 billion worth of damage a year in the UK.⁶
- The Association of British Insurers (ABI) said more than £360 million was paid out as a result of storm, flood and burst pipe damage following the so-called Beast from the East in 2018. Most recently, the floods in Yorkshire and the Midlands in November 2019 led to more than 2,250 insurance claims for flood damage from homeowners with at least £45 million expected to be paid out to cover damaged homes and possessions.⁷

- One of the worst affected places during the November 2019 floods was Bentley, in South Yorkshire, where more than 400 homes were damaged. Previous flooding in the town in 2007 had left residents priced out of home insurance by high premiums and a £7,500 excess in one case. It has also made it difficult for residents to sell or move home.

Alisa Dolgova, Manager of Prudential Regulation, and a climate change specialist at the ABI, said: "If we see a greater increase in the extreme weather events that we've had over the past decade then that will inevitably be reflected in insurance costs."

In addition to flooding, climate change has brought increased risks of extreme heat to homeowners.

- The heatwave experienced in the UK last summer was made ten times more likely - and between 1.5°C and 3°C warmer - because of climate change, according to climate scientists.⁸
- The summer heatwaves of 2019 resulted in almost 900 excess deaths, according to Public Health England.⁹
- Subsidence claims⁹ jumped during the extended heatwave of the summer of 2018, with £115 million paid out for damaged homes in the second half of the year and more than 17,000 claims, according to the ABI.

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This is a deprived area with a large number of vulnerable people. There are people with COPD (chronic obstructive pulmonary disease) who've been left with no choice but to live in homes with damp up the walls. For a lot of families and individuals here £100 a month premiums are just not affordable. We had one family who were going to put their house on the market to move somewhere bigger, but they're not going to be able to sell their house now in this area.

– CATHERINE BERRY, COMMUNITY VOLUNTEER IN BENTLEY HELPING WITH THE FLOOD CLEAN-UP

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Flooding causing more than
 **£1 BILLION**
 worth of damage a year
 in the UK.

Nearly
 **100,000**
 properties flooded in England in the
 past 12 years.

Almost
 **1.8 MILLION**
 people in the UK live in an area
 with significant risk of flooding.



What needs to happen?

The Government's climate advisors say that existing homes in the UK are inadequately prepared for the challenges of climate change, including flooding, and that emission reductions from housing have stalled.¹¹

To minimise future floods and extreme weather linked to climate change, The Climate Coalition is calling on the UK Government to take measures to achieve its net zero target, ending the UK's domestic contribution to climate change by getting as close to zero greenhouse gas emissions as soon as possible.

Action is needed for rapid and deep emissions cuts across the entire economy and our homes contribute one-fifth of UK emissions.¹² To cut emissions from homes, a net zero target is needed for new-builds, while retrofitting and improvements must be made to the existing housing stock.

Dr Neil Jennings from the Grantham Institute - Climate Change and the Environment at Imperial College London says: "there are so many benefits that will come if we get the living and home bit right. People will associate climate action with something that brings them homes they can afford to heat and not ones that make them ill."



More than **400** homes were damaged in Bentley during the November 2019 floods.



Action is needed across the entire economy but our homes represent **20%** of emissions.

Year	Flood event	Properties flooded (approximate numbers)
2007	Nationwide (Summer)	55,000
2008	Morpeth, Northumberland (Sep)	1,250
2009	Cumbria (Nov)	1,500
2010	Cornwall (Nov)	250
2012	Nationwide (Mar - Dec)	7,900
2013/14	Nationwide / East Coast (Dec - May)	11,000
2015/16	North of England (Dec - Jan)	17,000
2018	South East/Midlands - Thunderstorms (May)	600+
2019	East / Midlands / South East (June)	400
2019	Yorkshire (Nov)	1,100

Figure 1: Environment Agency estimates for the number of properties (homes and businesses) flooded during significant flood events in England since summer 2007.

The climate science

– DR JENNY ARMSTRONG & DR BEN RABB,
PRIESTLEY INTERNATIONAL CENTRE FOR CLIMATE,
UNIVERSITY OF LEEDS

Flooding

The record-breaking heatwave in July 2019 coincided with extremely heavy rainfall in the UK. Cheshire received more than twice the average rainfall for the month and intense rainfall led to flooding across large parts of northern England. The autumn of 2019 was also very wet in many parts of the country, with regional rainfall records broken for South Yorkshire, Nottinghamshire and Lincolnshire.¹³ This is in keeping with ongoing UK rainfall trends, where over the last decade both summers and winters have been 12-13% wetter than the long-term average.¹⁴

By running climate models with and without the greenhouse gases already emitted by humans, scientists have found evidence to link recent floods to anthropogenic climate change – notably the widespread floods of 2000/01, the 2014 southern England winter floods and the 2015/16 north England and south Scotland floods were all made more likely due to climate change.^{15, 16, 17, 18, 19}

1.8 million people in the UK are currently living in areas at significant risk of flooding from rivers, the sea and surface water. This number is rising all the time and, if the current rate of warming continues, is estimated to increase by over 40% to 2.6 million in as little as 20 years.^{20, 21} These figures are based on the UK Climate Projections released in 2009 (UKCP09), and have been recently supported by the Met Office’s UK climate projections which show in general an increased chance of warmer, wetter winters and hotter, drier summers, in addition to more frequent and intense weather extremes.²²

UKCP18 includes some important scientific advances which suggest that the increase in flood risk has been previously underestimated. Climate models have now been developed which operate at a resolution and time step similar to that of weather forecasts (hourly at 2.2 km horizontal resolution), allowing important fine

scale meteorological features to be captured, such as thunderstorm clouds and mountains. These ‘local’ projections suggest summers will see more heavy rainfall caused by convective thunderstorms than previously thought. This will increase the risk of heavy rain leading to surface water flooding across the UK, affecting communities often away from flood plains.²³ The Environment Agency estimates that, in England alone, an average annual investment of £1 billion will be necessary up to 2065 to manage increasing flood risks from all sources.²⁴ (£800m was spent in 2018/19²⁵).

Over the last decade both summers and winters have been

12-13%
wetter than the long-term average.



Sea level rise, coastal flooding and erosion

The seas around the UK have risen on average by around 17 cm since the early 1900s. The Environment Agency estimates that 1,800 km of the UK's coastline is eroding - a quarter of it at more than 10 cm per year, and in some places the erosion is more than 2 m per year.²⁶

Future increases in flood and coastal erosion risk will be primarily driven by mean sea level rise rather than changes in wave height and storm surges.²⁷

The south of the country has seen a more rapid rise and, if emissions continue at the current rate (a high emissions scenario), the resulting increase in global warming will mean London is likely to experience between 0.53 m and 1.15 m sea level rise by the end of the century. This is around 0.25 m greater than estimated in UKCP09 (due to increased contribution from melting land ice), and will result in an increase in the frequency and magnitude of flooding and coastal erosion (and saltwater intrusion) around the UK coastline.²⁸

+17cm

The seas around the UK have risen on average by around 17 cm since the early 1900s.



Heat and drought

The UK Met Office has described 2019 as 'a year of extremes', with records for both the hottest summer and warmest winter day both broken.²⁹ A series of three heatwaves during the summer led to an estimated 892 additional deaths.³⁰ These events came just one year after the joint hottest summer season on record - a hot spell that resulted in 863 additional deaths,³¹ which was made 30 times more likely due to man-made greenhouse gas emissions.^{32,33} There was also a surge in costly household insurance subsidence claims as a result of the hot, dry conditions.³⁴ The increased demand for water during the 2018 hot summer, combined with previously low rainfall, also led some areas of the UK to enter drought. By the end of 2018, Yorkshire Water had applied for drought permits in response to low reservoir levels.³⁵ The same region was struggling with flooding a few months later.

All areas of the UK have warmed over the last century and will continue to do so - with the south warming more rapidly than the north.³⁶ If greenhouse gas emissions continue at their current rate, hot spells like the summer of 2018 will become normal by 2050, occurring on average every other year.³⁷ By the 2070s a hot summer's day could be between 3.7 °C and 6.8 °C warmer than present.³⁸

Around 20% of homes in England already experience overheating even during relatively cool summers.³⁹ In addition, the proportion of green space in England, which can provide a local cooling effect, has dropped from 63% to 55% between 2011 and 2016, exacerbating the Urban Heat Island Effect.⁴⁰ Energy demand to cool buildings is projected to increase, possibly exceeding £1 billion per annum by 2050, during which time the number of heat-related deaths in the UK could increase by around 250% compared to today.⁴¹

Water availability is also a growing problem in the UK - with between 27 and 52 million people living in areas with water supply problems by 2050.⁴² The average daily water consumption per person is already currently higher than many other European countries (around 140 litres per person per day).⁴³

How housing contributes to our climate emissions

There are currently 29 million households in the UK and the government is committed to build another 1.5 million new homes by 2022. Homes are responsible for a large proportion of the UK's greenhouse gas emissions, exacerbating the impacts of climate change on their occupants. For example, heating and hot water in UK homes makes up 25% of total energy use and 15% of greenhouse gas emissions. A further 4% of greenhouse gas emissions are the result of electricity used in the home for appliances and lighting.⁴⁴

New homes are becoming more energy efficient - the average day to day emissions for homes built post 2018 is 19.1 kg CO₂ / m² whilst those built prior to 2018 typically emit around 54.2kg CO₂ / m².⁴⁵ Retrofitting old homes to improve energy efficiency is therefore a

priority. In particular, pre-1919 housing stock has been identified as having significant potential for reduced emissions through retrofit; however, there are major barriers due to lack of funding.⁴⁶

+1.5 m

There are currently 29 million households in the UK and the government is committed to build another 1.5 million new homes by 2022.



YORK, 2018. CREDIT: NORTHALLERTONMAN

How climate change is already affecting the UK's weather

– DR FRIEDERIKE OTTO, ACTING DIRECTOR OF THE UNIVERSITY OF OXFORD'S ENVIRONMENTAL CHANGE INSTITUTE

While climate change policies, politics and public debate often focus on global mean temperature, the changing likelihood and intensity of extreme weather events is one of the most visible ways by which climate change manifests itself and affects people.

Global warming – measured as global mean temperature – is currently at approximately 1°C above pre-industrial levels.⁴⁷ This directly affects weather events by increasing the likelihood and intensity of heatwaves, decreasing that of cold waves and, on average, leading to more extreme precipitation since warmer air can hold more water vapour. The increased concentration of greenhouse gases in the atmosphere also alters atmospheric circulation – where and how weather systems develop and move.

Taken together, these two effects determine how climate change affects a local area. Crucially, they can either work in the same direction or against one another.

For example, in the UK we have recently seen heavy rainfall in winter. This is an example of global warming and changes to atmospheric circulation having an additive effect. **The warming itself has increased the likelihood of extreme rainfall, and we also get more low pressure systems from the Atlantic, making extreme rain, like we've seen in 2014 in the South⁴⁸ and in 2015 in Cumbria,⁴⁹ about 40% more likely.**

However, the two ways by which climate change affects weather can also go in opposite directions. This is what we seem to be seeing in the summer, where we expect more intense rainfall because of the warming, but, at least in the only attribution study that exists so far, the overall effect is insignificant.⁵⁰

An Attribution Study sets out to calculate how impactful anthropogenic climate change is on current weather and was developed in the early 2000s.

The fact that these two key effects (warming and atmospheric circulation changes) interact very differently from region to region, season to season and event to event means that we cannot attribute an individual extreme weather event to climate change without doing a dedicated scientific analysis that takes the local meteorology into account. It is now possible to do these so-called attribution studies increasingly faster and better.

The underlying concept is simple: scientists assess possible weather in the world we live in today with the current level of greenhouse gases, and compare the result to possible weather in a hypothetical world with pre-industrial levels of greenhouse gases. The difference between both assessments of possible weather gives the influence of climate change. Doing this in practice, however, is not always straightforward as it requires simulations of climate models that are very good at representing different types of weather.

For heatwaves, droughts, larger-scale rainfall and flooding, attribution studies have been possible for at least half a decade. For other events like hail storms and wind storms the science is still developing.

While we therefore do not know all the effects of climate change today, we do know the role of climate change in some of the UK's most damaging heavy rainfall and flood events as described above.

40% more likely may not sound like much, but it renders a flood that was a 'once in a 100 years' event a once in 70 years event. Or, what would previously happen less than once in 20 years would now be more likely to happen every 14 years and thus potentially make a house uninsurable or policies extremely expensive.

Finally, heatwaves are the events we see in the UK where climate change is a real gamechanger. In the summer of 2019, the record-breaking heatwave was 2°C hotter than it would have been without human-induced climate change. We can now expect to see this kind of summer every few years.⁵¹ This will also have consequences for homeowners, builders and insurers as current building stock is not adapted to these extreme temperatures.

Moving forward, an understanding of the local effects of climate change on extreme weather will help builders, insurers, homeowners and policymakers plan accordingly and ensure the right adaptation policies and regulations are in place.



How climate science has brought home the reality of climate change to UK residents

– CLARE NASIR, METEOROLOGIST AND TV WEATHER BROADCASTER, THE MET OFFICE

For years, impact projections due to a warming Earth were a risk for future generations, and not so much for the here and now. So success in highlighting fresh research and focusing on areas of risk was at best patchy.

The other communication problem that cast haze into the climate change conversation has been the question posed every time the weather turned extreme and people's lives were threatened, "is this down to climate change?"

The standard answer being, "it is difficult to link one extreme weather event directly to climate change".

The science of climate change is based on long term trends, and there was a glaring gap between linking decadal temperature patterns and short-term spikes in rainfall or temperature, with years of data necessary to make sound correlations.

Within the past 10 years, circumstances have conspired to solve this problem. Firstly, we have witnessed significant hikes in global temperature. Secondly, climate models have become ever more sophisticated,

allowing for a stronger and far more confident language in climate reports. Both of these factors are set against an alarming rate of extreme weather events – here in the UK, and globally.

Yet, climate scientists were still incredibly cautious. Until, perhaps, the summer of 2018.

The heatwave across Britain and Europe in 2018 was preceded by six months of headline making weather, red warnings for snow – the Beast from the East, a hot Easter, a prolonged dry spring, then an intense heat that began in April, peaked again in May before much of Europe became a summer hothouse from June.

Whilst there is always something to celebrate during the early days of warmth in this country it wasn't long before everyone was suffering and that question reared its head time and time again... "Is this climate change?"

This time though, from a small corner of the Met Office Hadley Centre came the answer "Yes."





The Met Office revealed that due to anthropogenic emissions, the summer of 2018 – joint hottest on record for the UK – was 30 times more likely to happen because of human produced carbon emissions.

This form of analysis, known as an attribution study, sets out to calculate how impactful anthropogenic climate change is on current weather and was developed in the early 2000s.

In essence, climate models are retrospectively run to replicate a weather event with varying levels of greenhouse gases. From there, conclusions can be drawn on how much human impact is contributing to the extreme weather.

In the last five years, the number of these particular studies published from climate institutions worldwide has increased markedly. For example, in 2012 there were eight, these included three on heat, two on drought, one on rainfall and two on ice. By 2018 the number published was 58.

The majority of these attribution studies conclude, to a varying degree, that human induced climate change contributed significantly to extreme weather.

During the heatwave of July 2019, climate scientists executed some swift attribution calculations in a matter of days, and this transformed the communication of climate change into something far more tangible and current. For me this was a revelation, I was able to report with conviction and confidence that the extreme temperatures

recorded across the UK during this hot spell were five times more likely because of the influence of increased greenhouse gases. It brought a new reality to those who were still living and breathing that oppressive heat.

Climate change was no longer an abstract concept of concern for the future – it had arrived in the now. Such a small detail makes the vast subject of climate change personal. Uncomfortably personal.

Messaging climate change in the clearest way is imperative. This is not just for policymakers. Earth's response is playing out before our eyes, it's harrowing to watch, and even worse to experience.

Flooding and heat stress are two key components that will become far more commonplace here in the comfortable climates of the mid-latitudes. Whilst we all know no one on the planet is immune to the effects of Amazonian deforestation and devastating wildfires.

Everyone has a stake in what's happening, and this sense of urgency, voiced by climate scientists decades ago – is now top of the public agenda.

The risk to our homes: the impacts of a climate crisis

The most significant early impacts of climate change for the UK are increases in the frequency and severity of extreme weather – heatwaves and flooding, and possibly storms and drought, all of which pose a major risk to homeowners.⁵²

Around 1.8 million people are exposed to significant flood risk today.⁵³ If we don't reduce climate emissions then that figure will rise to 3.5 million under 4°C climate change projections.⁵⁴ Around 90,000 homes are also projected to be built in high flood risk areas over the next five years.⁵⁵

“The rush to build is leading to ridiculous short-termism like building on flood risk land. If you are looking to live in a home for 20 to 30 years you should know it is safe from climate risk,” said Paula Higgins, chief executive of the HomeOwners Alliance.

In November 2019, a month's worth of rain fell in a single day in some parts of South Yorkshire leading to severe flooding around Sheffield and Doncaster. Around 1,800 homes and businesses were badly affected by flooding, while in Doncaster, the worst affected area, just under 1,000 properties were flooded.⁵⁶ In the previous month, parts of Yorkshire, Lincolnshire, Norfolk and the East Midlands had registered in excess of 170% of their average monthly rainfall in October.⁵⁷

Insurance payouts to people hit by the November 2019 floods in Yorkshire and the Midlands are expected to reach £110 million. The average household flood claim is likely to be around £31,000, with £45 million expected to be paid out for damaged homes and possessions, according to the Association of British Insurers (ABI).⁵⁸ The ABI said it had received more than 2,250 claims from flooded properties.

The Environment Agency says that one in six homes are now at risk of flooding, which is currently leading to more than £1 billion of insured losses a year to UK residents.⁵⁹ However, most people are not yet aware of the elevated flood risk UK homeowners now face. Six out of ten people surveyed by YouGov said they had never looked into the flood risk of their home.⁶⁰

A separate survey conducted for the Association of British Insurers (ABI) found homebuyers were more likely to have looked into the ease of parking in the area (33%) than checked whether their house could be at risk from flooding (28%).

Residents in Bentley, South Yorkshire, where more than 400 homes were damaged during the November 2019 floods, have said they have been priced out of home insurance by high premiums and a £7,500 excess in one case. Across the UK, insurance premiums are reported to have risen by 25% over the past three years due to the impacts of repeated extreme and unpredictable weather made more likely by climate change, although there has also been a rise in the government tax on insurance policies in that period.⁶¹

“We are all vulnerable to flooding. You don’t have to live near a river to be at risk,” said Alisa Dolgova, Manager of Prudential Regulation, and a climate change specialist at the Association of British Insurers (ABI). “If housing continues being built in flood risk areas we’ll see insurance costs rise.”

For residents in Bentley, insurance is already unaffordable, said Catherine Berry, a community volunteer in Bentley helping with the flood cleanup. Selling and moving home is not an option for homeowners in the area either, with November’s floods the second major flooding the town has suffered in a little more than a decade.

Shannon Roberts, from the South Yorkshire Community Foundation, said people in Bentley felt like a forgotten community.

“There was one lady who still had pools of water under her floorboards a month later. She had a dehumidifier on, costing her £15 a day to run. She doesn’t have spare income to cover the cost. A lot of people can’t comprehend what has happened.”

Research from the University of Oxford on residents impacted by flooding found many suffered symptoms of depression, anxiety and post-traumatic stress disorder (PTSD) more than one year after flooding.⁶²

People living in properties located within the UK’s most deprived communities face a higher flood risk, according to research by The Joseph Rowntree Foundation, with Government flood risk management not taking account of social vulnerability and the ability of homeowners to adapt and cope.⁶³

“You see it all over the world, climate change hits the poorest hardest as they’re the ones who can’t afford insurance, can’t move or can’t absorb the impact and shock of a climate event,” said Berry.

“

The biggest issue in the private rented sector is mould and damp. Our survey work has found 50% of all properties have had a problem with both in the past five years. It can be because of people’s energy costs being too high, homes not ventilating properly or built poorly where the only way to ventilate is to open the windows and turn up the heating. But if you can’t afford the energy bills, you can’t do this.

The blame is often shifted to tenants who are told they are not heating their homes properly, but they can’t afford to. There is also a well-documented problem of overheating in new housing. Tenants who complain are told in no uncertain terms to go away and risk losing their home. It is vulnerable households that suffer the effects worse and are less able to adapt. Those who can will move out and the rest will be left behind.

Most renters have told us that they were unlikely to request energy efficiency improvements from their landlords, despite government regulations which stipulate that landlords cannot unreasonably refuse to carry these out.

– JOHN BIBBY, POLICY MANAGER AT SHELTER

”



MALTON, YORKSHIRE. CREDIT: STEVE ALLEN

“

I remember it well as I fell asleep on my sofa and my arm had fallen down to my side and straight into freezing cold water that had engulfed my living room. My tortoise was actually floating on top of the water and I remember thinking this is an awful dream. My daughter was eight months pregnant with my first grandchild and obviously the health implications for them both were enormous as she was living with me then. My house is actually on a corner and is built in a basin-like area of Barking so there is every likelihood something like this could happen again. We have had flooding before but never to this extent.

– CLARE SULLIVAN, A FLOOD VICTIM LIVING IN EAST LONDON.

”

Sea level rise and coastal flooding

Seaside towns and villages falling prey to erosion, flooding and rising sea levels are periodically a focus of national media. The plight of the Norfolk village of Happisburgh⁶⁴, the Welsh village of Fairbourne⁶⁵ or the Cornish seaside town of Looe⁶⁶, for example, have become widely publicised. The Environment Agency expects Looe to flood 14 times in 2019 and 60 times a year in 2050, according to reports.⁶⁷

If coastal defences are not sufficiently sustained then an additional 310,000 properties could be exposed to coastal flooding compared to homes exposed at present.⁶⁸

“ One of the big concerns with flooding is the much more intense rainfall events. We understand flooding on the Thames, Trent, Humber and other major ones, but we seem to be getting floods popping up all over the place. These intense pluvial events could pop up anywhere. It does not take a huge amount to overwhelm our drainage systems.

– PROFESSOR ROBERT NICHOLLS,
DIRECTOR OF THE TYNDALL CENTRE

“ There is such a pressure on housing that there is the need to build on flood plains. If you're building homes on a flood plain you need to build defences to protect those homes. For existing buildings and infrastructure there is a lot of pressure to build defences for existing towns, but the grant-aid from central Government requires it to be cost-beneficial. The Government wants to defend where there is a high cost-benefit from doing that. The smaller communities will be the ones that are stuck. They are faced with hard challenges today, which will worsen in the future. ”

– DR SALLY BROWN,
FLOOD EXPERT AT BOURNEMOUTH UNIVERSITY

“ There are different types of flood risk facing homeowners: river flooding, coastal flooding, groundwater flooding from saturated grounds and pluvial events from sudden and intense water events that overwhelm drainage systems. The flood damage in Doncaster in November 2019, for example, was from several days of rainfall hitting homes on the flood plain. These intense storms are becoming more likely with climate change. But sudden intense rainfall after weeks of dry weather is difficult to forecast.

– DR ALISTAIR FORD,
TYNDALL CENTRE FOR CLIMATE CHANGE RESEARCH

Heatwaves

High temperatures in homes are known to cause real problems for household occupants. These range from discomfort and mild health effects, to serious health effects.⁶⁷ The summer heatwaves of 2019 resulted in almost 900 excess deaths, according to Public Health England.⁷⁰

Older people are particularly vulnerable and fatalities increase from cardiac and respiratory disease during heatwaves. **Excess deaths in nursing homes increased by 42% in some parts of the UK during the 2003 heatwave.**⁶⁹ The number of elderly (over age 75) has increased by 0.8 million to 4.1 million over the last 20 years.⁷²

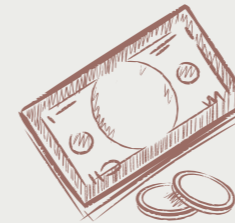
For homeowners there is also the added risk of subsidence. Homes built on clay are particularly susceptible to subsidence during long, dry summers because trees and shrubs suck all the available moisture from the soil, causing buildings to shift on their foundations.

Subsidence claims jumped during the extended heatwave of the summer of 2018, with £115 million paid out for damaged homes in the second half of the year and more than 17,000 claims, according to the ABI.

Insurers identified around 200 postcodes that are most susceptible to subsidence claims, mostly where homes are built on clay. They all lie to the south-east of a line drawn across from the Humber down to the Severn.⁷³

There is also a risk from lower temperatures, with extreme cold weather events expected to lead to 40,000 additional deaths.⁷² A 2019 survey of private tenants conducted by YouGov on behalf of Shelter found more than 40% of renters had experienced problems with

poor insulation or excess cold in their privately rented homes, in the last five years. Also, one in six private renters said they had cut back on heating their home to keep up with rental payments over the past year.



Subsidence claims jumped during the extended heatwave of the summer of 2018, with £115m paid out for damaged homes in the second half of the year and more than 17,000 claims, according to the ABI.

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Our baby Elin was born late June so the hot summer really affected her. It was so hard to keep her cool, she had to just wear vests all summer long. I found it hard as a new parent to figure out if she was too hot all the time and keeping the house cool was a real problem.

– YOUNG MOTHER LIZZIE LEWIS, SWANSEA, WALES

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It's so hard in the summer to stay cool, I am 70 years old and this summer was the worst heatwave I've ever experienced. I often can't leave the house during the heatwave as my breathing gets so bad, but trying to keep the house cool is extremely difficult.

— LUCY O'CONNELL, 70, LONDON

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BUDE, CORNWALL, DURING THE JULY 2019 HEATWAVE.
CREDIT: TRAVELLIGHT*



Insects in the home: moths, mosquitoes, invasive ants, termites, and different types of house and sand flies are all expected to see an increase in population due to climate change.⁷⁵



National Trust: Ham House in Richmond, London



Ham House in Richmond is exhibiting the tell-tale signs of climate stress, with heatwaves affecting the house itself, people who visit the property and, the volunteers and staff on site. Last summer the house had to close to the public for the first time when internal temperatures reached around 40C. This is not only unsafe for staff and volunteers but is also detrimental for the building's fabric and the treasures within. For example, the high heat is causing valuable paintings to blister. There may also be long-term impacts of this high temperature and lower atmospheric relative humidity on the natural fabric such as

the timber within the building. As a result, the property has had to change its summer working hours in the garden with staff and volunteers now coming in earlier at 07:00 when the temperatures are more comfortable. Ham House's problems are also partly caused by the London heat island effect, whereby temperatures are relatively higher in the capital compared with surrounding rural areas due to anthropogenic heat sources and urban heat sources. This is something affecting the millions of houses in the London and south east area as they will all be feeling the impacts of climate change in a similar way.

A view from Bentley after the floods in November 2019, from Catherine Berry, a community volunteer in Bentley.

Rising flood water devastated Bentley, a suburb of Doncaster, in November 2019, with more than 400 homes affected, according to volunteers from the South Yorkshire Community Foundation.

People were exhausted after the flooding and did not know what to do. They were told it was a 1 in 100 years flood risk so they didn't think it would happen again after the floods in 2007.

The biggest immediate need was for cleaning equipment as they wanted to get back into their homes to live in them again where they could. They were worried about looting and their homes being broken into if they left them, even where they had been flooded.

Bentley is a poor area - within the 15% most deprived areas of the country - so with a flood event it's affecting people already in poverty. We've had families who have not been able to cope with the unexpected loss of a fridge of food.

More than half of the homes in this area are not insured. People here have been quoted £100 a month for insurance premiums with an excess of £7,500. For a lot of families and individuals here £100 a month premium is just not affordable.

There are people living in rented or social housing, with landlords who are responsible for repairing fixings but not replacing belongings. Some people also have

landlords who are not fixing properties and leaving their tenants to live in damp and unsafe conditions. The tenants are scared of being made homeless and often don't understand their legal rights or have the money to go to solicitors. It's horrible.

We've got vulnerable and elderly people living with dehumidifiers and living without floorboards. We have people here who don't know how they're going to cope. It's really affected people's mental health. There are people with COPD (chronic obstructive pulmonary disease) who've been left with no choice but to live in homes with damp up the walls.

A lot of people have stayed in their homes even if flooded as it's really difficult for them to move out, whether mentally or because of jobs or their kids' school being local. They're sitting there watching the damp rising up the wall.

We had one family who were going to put their house on the market to move somewhere bigger, but they're not going to be able to sell their house now in this area. You see it all over the world, climate change hits the poorest hardest as they're the ones who can't afford insurance, can't move or can't absorb the impact and shock of a climate event.

Monty Don OBE

– THE UK'S LEADING GARDEN WRITER AND BROADCASTER



"This winter has been one of the wettest I can recall, and one of the warmest. Despite the sodden soil and flooded fields, the garden is sprouting as though it were the beginning of March, not mid January. But it is not unusual, not the exception that proves the rule like the exceptionally cold winters of 1963 or 2010. Wet and warm is becoming the new normal and every gardener in the land is experiencing it directly. In fact gardeners are the front line of climate change. We cannot help but observe daily the changes in the timing of flowering, the appearance or lack of pollinators, the nesting of birds and the proliferation of many fungal problems that warmer, wetter weather is causing.

My own garden has flooded half a dozen times this winter and the fields that surround us are completely under water as I write this. Twice this winter we have been unable to leave our home for days at a time because the roads were too flooded to pass, and because the ground is now saturated it does not take exceptional rain to renew the floods. This is not a disaster for us - the garden recovers, we adapt, and the house is dry. But as we have all seen, many have not been so lucky and to have your home flooded is a traumatic and deeply disturbing experience.

Nevertheless every indication is that **as a result of the changing climate this is likely to become more prevalent for more people.** On the one hand of course we have to manage flood control but without acting to reduce the acceleration of climate change that is too little too late. As gardeners, we are exploring many ways of reducing emissions, recycling, planting and being proactive - as well as reacting to the warm, wet weather with our planting and horticultural management.

Good gardening means dealing intelligently and creatively with what you cannot change such as your soil, situation or weather whilst using knowledge, skill and inventiveness to change that which you can control. If we approach the overwhelming problems of climate change with the modest, but intimately connected skills of gardeners then perhaps we can not only diminish its effect but also create beauty and opportunity from it too."

Monty Don O.B.E. is the UK's leading garden writer and broadcaster. He has been making television programmes for over twenty years on a range of topics, spanning travel, craft, outdoor living and, principally, gardening. He has been lead presenter of the BBC Gardeners' World since 2003 and since 2011 the programme has come from his own garden, Longmeadow, in Herefordshire.



Saving our homes: what can we do?

Heating and hot water for UK homes make up 15% of the UK's total greenhouse gas emissions (GHG). A further 4% of GHG emissions are the result of electricity used in the home for appliances and lighting.⁷⁶

15% 
Heating and hot water

The homes we live in should be low- or zero-carbon, resilient to weather-related impacts and affordable to run. But in reality, that is not the case today.

The UK Government can prevent an ever-increasing number of homes being put at risk of flooding and heatwaves by taking measures to deliver on its net zero target, ending the UK's contribution to climate change by getting as close to zero greenhouse gas emissions as soon as possible.

Our homes account for one-fifth of the UK's greenhouse gas emissions, but there are enormous opportunities to reduce emissions from homes with a net zero target on new builds, and retrofitting the existing housing stock through improvements to insulation and non-fossil fuel energy sources.

The UK Government is working towards low-carbon heat⁷⁷ (i.e. ground or air source heat pumps) in every home by 2050, yet fewer than 500,000 homes (out of 29 million in total) currently have some form of low-carbon heating.⁷⁸

Low or zero-carbon homes would deliver multiple benefits, including thousands of new skilled jobs and career opportunities, reduced energy costs and emissions, healthier homes and environments and water savings - all of which would be of particular benefit to the wellbeing of vulnerable groups such as the elderly and those living with chronic illnesses.⁷⁹

The housing industry supports the shift to reduce housing's contribution to climate change. In an interview for this report, John Perry, policy adviser at the Chartered Institute of Housing and Christoph Sinn, external affairs manager at housing association Orbit, said:

"we should be aiming to build to zero-carbon from 2025 to future proof our housing stock. To achieve this we have to start planning now, including upskilling the workforce, mainstreaming the use of modern methods of construction, and ensuring buildings perform to the required standards". The UK Government is currently committing to low-carbon standards from 2025.⁸⁰

The Government's climate change advisors argue the costs of a nationwide switch to low-carbon heating in existing homes are manageable and would fall when there is a concerted effort to act.^{81,82}

Tackling energy use also has the ability to significantly reduce the pressure on household outgoings, including for vulnerable and low-income households. One half of the energy currently used in UK housing could be saved by investing in a mix of current technologies encompassing improved energy efficiency, heat pumps and heat networks. While investment in more efficient heating, insulation, controls, lighting and appliances alone could save households £270 a year.⁸³ Households can also already easily switch to renewable energy tariffs.

"There are so many benefits that will come if we get the living and home bit right. People will associate climate action with something that brings them homes they can afford to heat and not ones that make them ill," Dr Neil Jennings, Grantham Institute - Climate Change and the Environment at Imperial College London.

Protecting against flooding

While we need to urgently reduce our climate emissions to avoid ever-increasing flood risk to our homes, there are also other necessary steps for mitigating flood risk. Improvements to flood defences, stricter controls on the building of homes in flood risk areas and sustainable drainage systems have all been identified as necessary to tackle the increased risk of flooding faced by UK homes. We need to increase the use of natural flood management, such as changing the way land is managed so soil can absorb more water. Green space and infrastructure, including trees in urban areas can help reduce the risk of surface water flooding and cool cities during heatwaves.⁸⁴ However, the total proportion of urban greenspace in England declined between 2001 and 2018 from 63% to 55% of urban areas.⁸⁵



2001

2018

Proportion of urban greenspace in England

How we can decarbonise our homes

– DR JENNY ARMSTRONG & DR BEN RABB, PRIESTLEY INTERNATIONAL CENTRE FOR CLIMATE AND YORKSHIRE INTEGRATED CATCHMENT SOLUTIONS PROGRAMME (ICASP), UNIVERSITY OF LEEDS

Actions that lower the UK's greenhouse gas emissions and improve the resilience of households to the impacts of climate change offer a dual benefit. For example, some approaches to managing whole catchments can both reduce flooding and mitigate the causes of climate change that increase the likelihood of flooding.⁸⁶

One way this is being achieved is by taking action to manage fluvial and coastal flood and coastal erosion risk by protecting, restoring and emulating the natural regulating function of catchments, rivers, floodplains and coasts - something known as Working With Natural Processes (WWNP).⁸⁷ WWNP methods have multiple benefits, including reducing peak river flows whilst improving water quality and biodiversity. Many WWNP techniques remove carbon from the atmosphere whilst increasing resilience to climate change impacts such as flooding. For example, a restored wetland can sequester 2,700kg carbon per hectare per year⁸⁸ and act as a buffer along the coastline to reduce erosion and the impact of flooding.

It is estimated that UK peatland stores 2300 Mt (megatonnes) of carbon⁸⁹ but 80% are damaged, through drainage and extraction.⁹⁰ The preservation of peatlands is highly relevant in the context of climate change mitigation targets. Importantly, restoring peatland offers a significant opportunity to sequester additional carbon whilst decreasing surface water runoff, reducing flood risk and improving water quality.

Tree planting can also reduce flood risk by decreasing run-off.⁹¹ Oak forest at peak growth can sequester up to 15 tonnes of CO₂ per hectare per year, with a net long-term average of around 7 tonnes of CO₂ per hectare per year. Once established, woodland can go on accumulating carbon for centuries.⁹²

In the urban environment, Green and Blue Infrastructure (GBI) provides opportunities to develop climate resilient urban areas and reduce emissions whilst also delivering multiple societal, ecological and economic benefits.⁹³

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There will need to be a Government programme to retrofit our homes. Better insulation protects you from high temperatures outside and reduces energy use. It's a co-benefit. Climate change is a cumulative problem so the longer we leave it the harder it gets. For adaptation we can reduce risk upstream to stop water shooting down the river system and we can also adapt our urban areas to create flood ponds and reduce flood water.

– DR ALISTAIR FORD, TYNDALL CENTRE FOR CLIMATE CHANGE RESEARCH

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Energy efficiency

Energy Performance Certificates were introduced by the government in 2007 to show the efficiency of buildings: A is the highest and G the lowest. Less than 2% of homes in England and Scotland have an A or B rating⁹⁴. Existing dwellings are currently, on average, rated D for their energy performance, compared to B for new builds.⁹⁵

Analysis from the property company Bidwells has shown properties rated D-G on their energy performance certificates in England had the potential to save £6 billion a year by improving to just a C standard.⁹⁶

The UK has some of the oldest housing stock in Europe, with 20% built more than 100 years ago and more than 50% built more than 50 years ago.⁹⁷ Our homes are also amongst the least energy efficient in western Europe, with a collapse in the numbers of homes being insulated since 2012, as well as rising fuel prices.

Fuel poverty as a result of energy-inefficient housing affects around 2.4 million households, according to the charity Shelter, with more than 17,000 deaths due to cold housing conditions in the winter of 2018.⁹⁸ Heat and cold induced deaths related to extreme temperatures are often attributed to cardiovascular and respiratory causes which are linked to poor thermal efficiency, high levels of damp in housing, and high rates of fuel poverty.⁹⁹

“If we want to mitigate against climate change then we have to address energy efficiency seriously. The standards are still a long way behind the net zero target set by the Government. We need standards to ensure we use heat much more efficiently and better insulate our homes,” said Alistair Ford, a researcher at the Tyndall Centre for Climate Change Research.

Public awareness of the energy efficiency and the GHG reductions and cost savings they could make is still low. Less than one quarter of residents said the Energy Performance Certificate had influenced their choice to buy or rent a dwelling, according to the most recent Government-run English Housing Survey. While just one in four households reported changing their electricity or gas tariff in the past year.¹⁰⁰

More than 50% of people polled were not aware of the energy efficiency rating of their current home when they moved in. Residents in the UK also expect increasingly higher household internal temperatures. “We need to change social norms and make it desirable to put a jumper on rather than turning up the thermostat,” said Coleridge.

“

A lot of people don't have the knowledge and confidence to do these things [energy efficiency improvements to their homes]. A lot of the [energy efficiency] standards are reliant on enforcement but if you complain about damp or cold or heat [to a landlord] you could get thrown out of your home. People need confidence so it has to be down to the Government to retrofit homes street by street. People need to be empowered and we need leadership from both the Government and industry.

– PAULA HIGGINS FROM THE HOMEOWNERS ALLIANCE

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Retrofitting

A lot of the focus is on new build standards, but the UK has a major challenge in the retro-fitting of its existing housing stock. Three-quarters of the homes we will be living in, in 2050, have already been built, depending on future build and demolition rates. Retrofitting existing homes can include: cavity wall or solid wall insulation; floor and loft insulation; improved glazing (all of which reduce the 'fabric heat loss' of a building); and draught proofing (which reduces the 'ventilation heat loss' of a building).¹⁰¹

Dr Kate Simpson from the Dyson School of Design Engineering at Imperial College London.

"The fact that they're old is not necessarily a problem. Energy performance is important but we should also consider the embedded carbon and social value of old buildings to avoid unnecessary demolition. We need to improve decision-making for each property, considering retrofit options through more rigorous data-driven tools which go beyond operational energy use and consider factors such as embodied carbon, indoor

environment and potential risks including moisture and structure impacts, considered in parallel with local area priorities and householder perspectives. Monitoring the impact of measures following retrofit can evaluate the measured success and householder satisfaction levels from retrofit.¹⁰² This could feed into future decision-making. To deliver, we need urgent upskilling of the construction industry,¹⁰³ relevant to local housing stocks and demographics, linked to upcoming opportunities for building professionals. It is a big challenge, but we need to do it and we need investment now."

The next ten to fifteen years are crucial, according to the Government's climate advisors, if we want to meet our greenhouse gas emissions reduction objectives.¹⁰⁴ However, many homeowners are unaware of the need for heating in our homes to be changed to low-carbon, and if they are aware are unprepared for the financial or disruption costs associated. For example, only 160,000 homes have installed heat pumps. In 2018, gas met nearly two-thirds of total domestic energy demand.

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Parliament has declared a climate emergency yet our building regulations are out of kilter with achieving that goal. New buildings regulations will not achieve net zero and there are very few regulations about existing buildings. We have a large and ageing housing stock, including millions of Edwardian and Victorian housing, of which three-quarters will still be standing in 2050. We need a transformational shift in retrofitting existing buildings. The Energy Saving Trust says we need to retrofit 600,000 homes a year. We're retrofitting in the hundreds at the moment. The technologies we need are all tried, tested and proven in practice. We just need a massive injection of money and skills.

– **TIM COLERIDGE, ARCHITECT AND SENIOR LECTURER AT THE CENTRE FOR ALTERNATIVE TECHNOLOGY, WALES.**

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ENERGIESPRONG PROJECT IN NOTTINGHAM.
IMAGE: ENERGIESPRONG

IN THE SPOTLIGHT

Energiesprong

In 2019, Nottingham became the first council to pioneer the “Energiesprong” (energy leap) initiative, which has radically upgraded the energy efficiency of thousands of homes in the Netherlands. More than 150 homes in Sneinton in Nottingham will receive new wall cladding, windows and solar panels by the end of the year. A second project is taking place in Maldon, Essex. The initiative provides guaranteed energy bill savings to offset the upfront costs and retrofits are done quickly to reduce disruption to households.¹⁰⁵ “It’s just like you are in a different house, it’s totally different!” Ken Bennent, who lives in one of the completed homes, told the BBC.



CARBON CO-OP, MANCHESTER.
IMAGE: CARBON CO-OP

IN THE SPOTLIGHT

The Carbon Co-op, Manchester

The Carbon Co-op in Manchester supports and encourages people to retrofit their homes and help reduce their climate footprint. It has been training contractors for members to use to retrofit their homes as part of its People Powered Retrofit campaign. It has also run Green Open Homes events for people to visit homes that have been retrofitted to see what is possible and learn how other residents have gone about making home improvements.



IMAGE: SSASSYPROPERTY.COM

IN THE SPOTLIGHT

Net zero energy use

Ssassy Property is developing a 25-home site in Oxfordshire that will be net zero-energy in use i.e. each home will be designed to generate as much energy across the year as it uses. PV panels produce electricity onsite, air source heat pumps use energy from the air to heat the homes, triple glazed windows allow light in but minimise heat loss and mechanical ventilation and heat recovery avoids heat being lost through ventilation. The homes will also be constructed using a proportion of timber, hemp and natural fibre insulation to help lock up carbon.



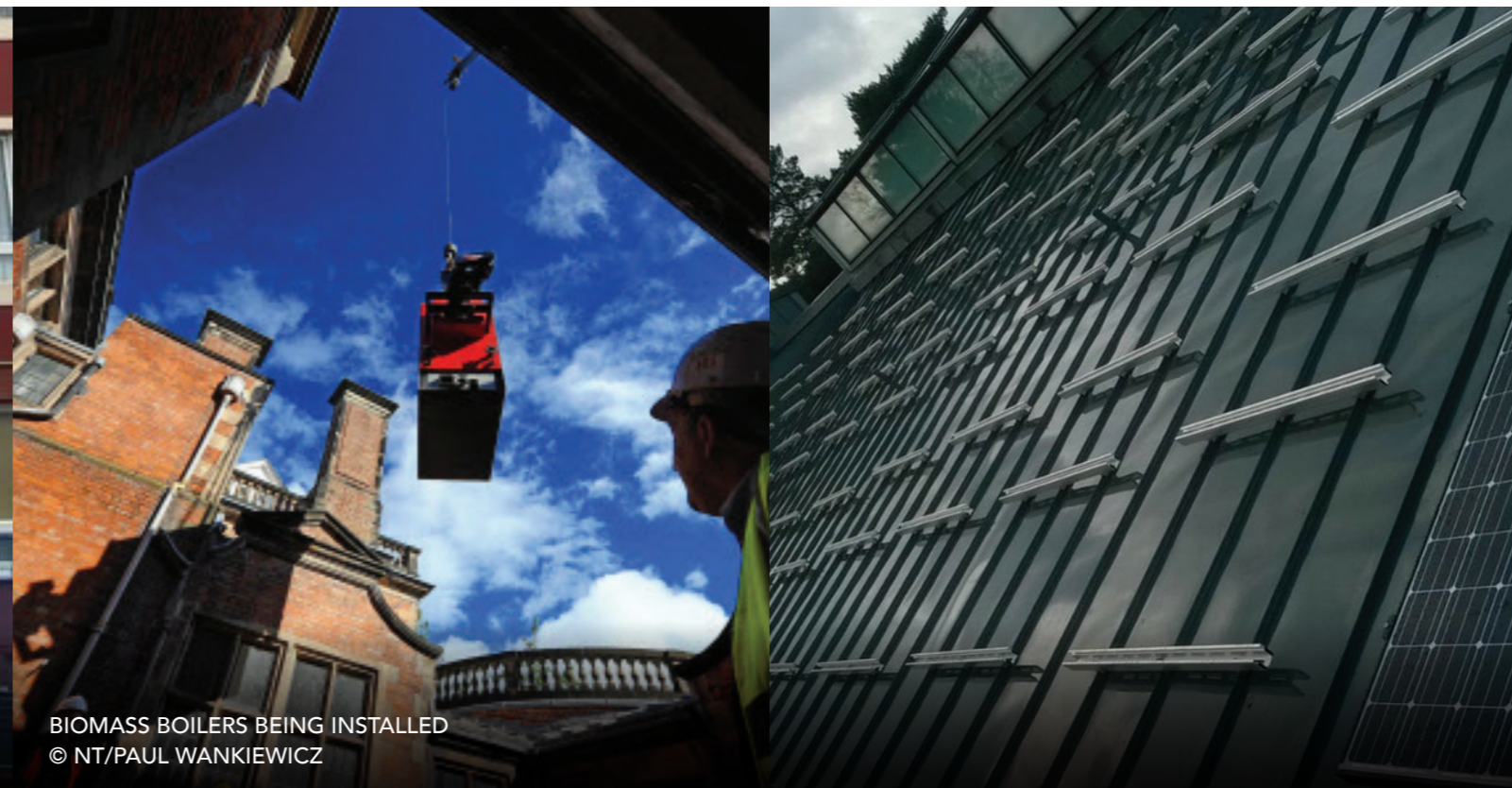
IMAGE: KENSA

IN THE SPOTLIGHT

Croydon heat pump pilot

Croydon Council launched a heat pump pilot last year to improve air quality and help residents save £300 a year on heating bills and cut climate emissions. A council-owned 10-storey block of 44 flats in New Addington in Croydon, south London, will have the existing electric storage heaters replaced with ground source heat pumps. The temperature of the ground beneath our homes is warmer than the outside temperature in winter enabling heat to be brought up to more cheaply heat homes.

The retrofit will be completed in spring this year. The £700,000 heating system is reported to have been funded through the council's housing budget and via energy credits from energy regulator Ofgem. "Many Croydon tenants find paying their winter fuel bills a struggle, so this pilot scheme and wider refurbishment will make a real difference by ensuring their homes are warmer, more energy-efficient and cheaper to run," said Councillor Alison Butler.¹⁰⁴

BIOMASS BOILERS BEING INSTALLED
© NT/PAUL WANKIEWICZ

IN THE SPOTLIGHT

Historic homes going green

The National Trust has a number of historic homes that it has retrofitted with renewables to make them climate friendly, as well as holiday homes that can be rented by the public. The Old Rectory on the iconic Gower coast has an air source heat pump and smart control systems that have reduced energy consumption and tackled damp issues. At Sutton Hoo, solar PV has been installed on a visitor centre and a biomass boiler in a house. They are also installing electric car charging points at 100 National Trust holiday homes by the end of the year.

Net positive housing

In 2019, the UK became the first major economy in the world to set in law a target to cut its greenhouse gas emissions to net zero by 2050, compared with the previous target of at least an 80% reduction from 1990 levels.

Household emissions will have to fall fast to achieve the net zero target.¹⁰⁷ Around 20% of the UK homes that will exist in 2050 have yet to be built and, in reality, these new homes will need to aim higher and become net positive to make up for deficits elsewhere in society. The UK's existing housing won't achieve carbon neutrality - even with extensive retrofit.¹⁰⁸

At present, too many new homes only meet the bare minimum of standards. Since 2015, it has been claimed, owners of new-build homes in England have collectively

paid more than £58 million in additional energy costs because of a failure of the UK to introduce a Zero Carbon Homes Policy.¹⁰⁹ That policy would have required new-build homes not to result in the net release of any carbon dioxide into the atmosphere during day-to-day running through a combination of reduced energy demand, low-carbon energy like heat pumps and abatement measures, such as planting trees to offset emissions.

Given the costs of retrofiting, the Government has been told that much more needs to be done to ensure all homes meet the highest possible standards.¹¹⁰

Net positive housing could be achieved through a change in energy use and construction materials. There are already thousands of buildings in-use across the UK

and Europe constructed to very low-energy standards, such as the PassivHaus approach.⁹ The Government's climate advisors have argued that including passive cooling measures in buildings at the design stage is more cost-effective than retrofit.¹¹¹

A PassivHaus social housing project in Norwich consisting of 105 terraced homes won the Stirling Prize for architecture last year, providing residents with low-cost heating bills and low-carbon living.¹¹² Energy costs are around 70% cheaper than the average home.¹¹³ While a 50-home development of flats and homes on Leyton Road in East London is reported to be the first to use a large-scale communal air source heat pump feeding an ambient temperature heat network and individual heat pumps, together with solar photovoltaic panels to provide a predicted 57% reduction in carbon emissions on site.¹¹⁴



PassivHaus' energy costs are around **70%** cheaper than the average home.



DENBY DALE PASSIVHAUS.
IMAGE: GREEN BUILDING STORE

IN THE SPOTLIGHT

Passivhaus buildings

Passivhaus buildings are so well insulated, airtight, carefully designed, and constructed that they do not require a conventional heating system, says Tim Coleridge, architect and senior lecturer at the Centre for Alternative Technology, Wales. Warming the incoming air a little during the cooler months is sufficient to keep these homes, flats, offices, care-homes and other buildings warm and comfortable with extremely good indoor air quality.

Tim Coleridge, architect and senior lecturer at the Centre for Alternative Technology, Wales, said, "there is a lot of discourse on net zero, but the built environment needs to go beyond that and make a positive contribution to reducing net greenhouse gas emissions and improve biodiversity. A new building can't just make the site the same as when you found it. It is possible for buildings with very good insulation, solar PV and energy saving alternatives to gas boilers such as heat pumps to end up

producing more energy than they consume and contribute to society's deficit. This is not science fiction. Very low-energy standards are already tried and tested, we now need to get on and roll them out at large scale."

Net positive homes also need to re-think what materials they use in construction, the production of which leads to climate emissions. There are growing arguments in favour of building with natural and bio-based materials such as wood, enabling

carbon sequestration and the 'locking up' of carbon within the structure of the building.¹¹⁵ Murray Grove, a nine storey residential housing block in Hackney, London, was the first tall urban housing project to be constructed entirely from prefabricated solid timber, from the load bearing walls and floor slabs to the stair and lift cores.¹¹⁶ A second, larger, housing development was completed by the same architects in 2017.¹¹⁷



SOLCER HOUSE.
IMAGE: THE WELSH SCHOOL OF ARCHITECTURE

IN THE SPOTLIGHT

The net positive house, Cardiff

The SOLCER House project based at Cardiff University was the UK's first purpose-built home capable of exporting more energy to the national grid than it uses. The house was built with high levels of thermal insulation, low-carbon cement and low-emissivity double glazed aluminium clad timber frame windows and doors. The south facing roof comprises glazed solar photovoltaic panels, fully integrated into the design of the building, allowing the roof space below to be naturally lit. This

has been designed to reduce the cost of bolting on solar panels to a standard roof. The house's energy systems combine solar generation and battery storage to power both its combined heating, ventilation, hot water system and its electrical power systems which includes appliances, LED lighting and a heat pump.¹¹⁸ In December 2019, Neath Port Talbot council in Wales also approved the development of 35 homes that are capable of generating more energy than they use.¹¹⁹



SOLCER HOUSE.
IMAGE: THE WELSH SCHOOL OF ARCHITECTURE

IN THE SPOTLIGHT

The PassivHaus

The Denby Dale Passivhaus was the first UK Passivhaus to be built with cavity wall construction and one of the first certified Passivhaus homes in the UK. It is 20 times more airtight than a standard built home, with a ventilation system that provides constant fresh air while retaining heat inside the house. It uses 90% less energy to heat than the average older uninsulated and leaky home, and heating costs are around £120 a year.¹²⁰



IMAGE: BEDZED: TOM CHANCE

IN THE SPOTLIGHT

BedZED: the pioneering zero-carbon community

BedZED in south London was one of the UK's first large-scale examples of low-carbon living with the 100-home development completed back in 2002, developed by Peabody Trust in partnership with Bioregional and ZEDfactory architects. The typical two-person household saves £1,000 a year on energy, water and car bills compared to the London average thanks to energy efficient homes, solar panels, a biomass boiler, an onsite car club, secure cycle parking and excellent public transport links.¹²¹



IMAGE: BIOREGIONAL

IN THE SPOTLIGHT

One Brighton: Low-carbon and affordable homes

This 172 apartment site, completed in 2010, included 54 affordable new homes and was the UK's first car-free private development (nine disabled parking spaces and five for car-club vehicles are provided). Developed by Crest Nicholson and Bioregional Quintain, it is heated via a biomass boiler and green energy provider, and aims to cut emissions by 89% compared to the typical UK home.¹²²

Conclusion: call to action

This report clearly sets out the impacts that our increasingly changing climate is having on UK homes. The Met Office described 2019 as 'a year of extremes'¹²³ and the effects of more frequent and extreme weather events, linked to climate change, put millions of people at risk in the UK alone.

Data from the Priestley International Centre for Climate shows that these impacts will only increase in severity, in line with climate projections, if all countries do not curb their emissions and get on track to reaching net zero emissions as soon as they possibly can.

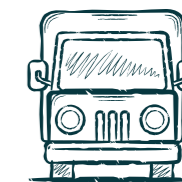
The good news is that the solutions to end our contribution to climate change are at our fingertips.

The UK Government has set a legally binding target to reach net zero greenhouse gas emissions by 2050, in line with the Paris Agreement, and as advised by the Committee on Climate Change. However, we are not currently on track to reaching that target, and urgently need policies and resourcing from all departments put in place. The next decade is a crucial window for action and implementation. The policies needed to deliver net zero also present enormous opportunities to rejuvenate communities across the country with world-class zero carbon infrastructure, nature-abundant landscapes, cleaner air, and thriving low-carbon industries.

The UK must ensure it is on track to deliver its domestic net zero target as quickly as possible; alongside tangible commitments to support the countries in the Global South who are least responsible for climate change to transition and adapt. As a starting point, we must immediately implement all policy recommendations from the Committee on Climate Change's 2019 Progress Report,¹²⁴ strengthened as necessary to reflect net zero ambition, and include new, ambitious policies for the aviation and shipping sectors without delay.

This means:

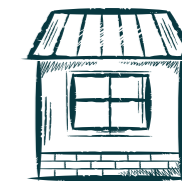
2030 phaseout of new petrol and diesel **cars and vans**



Boosting **public transport** and active travel nationwide



Putting **homes** on track to net zero and tackle fuel poverty



At least tripling **renewable generation** by 2030



Restoring and revitalising our **natural landscapes** and supporting rural communities



The above policies underpinned by an ambitious spending programme to an equivalent of at least **5% of government spending** per year.



Each day we are seeing the impacts of climate change on the people and places we love— from our favourite sports, to what's on our plates, to the homes we live in. A net zero country, fit for the future, is within reach; now we need the policies and investment that get us there as soon as possible.

Show The Love

Show The Love is the UK's biggest conversation about climate change, and an annual celebration of everything that we love and want to protect from its worst effects. Every February since 2015, organisations, institutions, and millions of people have harnessed the power of green hearts to show they care about climate change and its impacts on the things we care about. Every single one of us can be part of this movement.

The Show The Love campaign aims to get people talking about how the things we love are affected by climate change – and the actions we can take to protect them. Start by having conversations about the findings in this report. Talk about your own experiences of being affected by increasingly extreme weather. Talk about what



you care about and how it will be affected by climate change. Help make climate change a part of the national conversation. A cleaner, greener, future is within reach - together we need to grasp the solutions and get our climate back in balance.

Show The Love 2020 will build on the momentum of the last five years, and encourage everybody to take actions to tackle the climate crisis. Green hearts will kick off conversations about the things we love and the future we want for our children. From Womens Institutes' crafters to Premier League football clubs, from pubs to primary school playgrounds – we can all show that we care, and we can all use our voices to call for change.

¹ NEA and E3G (2019) '17,000 people in the UK died last winter due to cold housing' Available at: <http://www.nea.org.uk/wp-content/uploads/2019/02/Joint-NEA-E3G-PR-FPAD-150219.pdf>

² Schaller, N., Kay, A., Lamb, R. et al. (2016) 'Human influence on climate in the 2014 southern England winter floods and their impacts' Nature Climate Change 6, 627–634 Available at: <https://doi.org/10.1038/nclimate2927>

³ Otto, F.E.L et al (2016) 'Climate change increases the probability of heavy rains in Northern England/Southern Scotland like those of storm Desmond—a real-time event attribution revisited' Available at: <https://doi.org/10.1088/1748-9326/aa9663>

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⁵ According to Environment Agency data provided to The Climate Coalition for this report

⁶ Sayers, P. and Penning-Rowsell, E. (2015) 'Climate Change Risk Assessment 2017: Projections of future flood risk in the UK' Available at: https://www.researchgate.net/profile/Paul_Sayers/publication/306017661_Climate_Change_Risk_Assessment_2017_Projections_of_future_flood_risk_in_the_UK/links/57aae82f08ae3765c3b6e47f.pdf

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⁹ Public Health England (2019). 'PHE heatwave mortality monitoring: Summer 2019' Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/841320/PHE_heatwave_report_2019.pdf

¹⁰ ABI (2018). 'Subsidence claims quadruple to highest level in more than a decade ABI' Available at: <https://www.abi.org.uk/news/news-articles/2018/subsidence-claims-quadruple-to-highest-level-in-more-than-a-decade/> - £115m is the total figure. £64m for Q3 and £51m for Q4. This is what ABI told the authors of this report by email.

¹¹ UK Committee on Climate Change (2019) 'UK housing: Fit for the future?' Available at: <https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf>

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²¹ Quote from original report: "The population living in such areas is projected to rise to 2.6 million by the 2050s under a 2°C scenario and 3.3 million under a 4°C scenario, assuming low population growth and a continuation of current levels of adaptation".

²² Met Office (2019) 'UK Climate Projections: Headline Findings Version 2' Available at: <https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp-headline-findings-v2.pdf>

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