Schneider Electric White Paper

# Building homes of the future



Life Is On Schneider Electric



> We see homes evolving from smart to smart and sustainable."

Schneider Electric is a company with a purpose firmly rooted in sustainability. That's what's shaping our vision of the home of tomorrow. We see homes evolving from smart to smart and sustainable, where technologies are interconnected to not only provide greater comfort, but also reduce the environmental impact.

To progress the evolution of homes, we need to address four main challenges: sustainability, resilience, efficiency, and personalisation.

First, we need to equip homes to become more sustainable and reduce their impact on the planet. The second challenge, resilience, covers two aspects: safety from electrical faults and the continuity of power supply, even in severe weather conditions.

The third challenge is efficiency. Electricity consumption is increasing as we spend more time at home and add loads like EV charging. Thankfully, there are huge opportunities to use energy smarter and limit the increase in use and costs.

Finally, there's personalisation. Home is no longer just where we live, but also where we play, work, and study. This means we need better personalised, modular spaces that flexibly adjust to different activities.

At Schneider, we fully recognise these four challenges and are actively working to address them. Through Wiser, our platform for smart and sustainable homes, we are linking digital with electric to allow homeowners to take better control of their homes, their carbon footprint, and their wallet.

As a Home Builder, you have a great capacity to advocate for the sustainable transformation of homes and support the global fight against the climate change. Let's go on this journey together and make it happen.

**YiFu Qi**
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# Where do we stand?



# Climate crisis

Greta Thunberg's thought-provoking words started a row on social media about climate change and the greenhouse effect. Climate Change and Global Warming are the most pressing issues in the world, which need immediate attention and each of us contributing to bring about a change. What we need to understand is, climate change will not be saved by a single action. We all have a role to play in creating a cleaner future.



Recently NASA has observed increases in the amount of carbon dioxide and some other greenhouse gases in our atmosphere. Carbon dioxide ($CO_2$) is a greenhouse gas which traps heat in the atmosphere and makes the planet warmer.

Scientists have calculated that 350 ppm (parts per million) is a safe level of $CO_2$ in the atmosphere,[1] yet we have already reached 410 ppm,[2] and this has contributed to the global temperature rising by 0.89 °C.[3]

The increase in global temperature has led to significant climate change activity. For example, throughout 2019, Greenland lost a million tons of ice sheet per minute[4]. Further, in 2020 alone, we saw:

A **heatwave** in Antarctica in which the temperature rose to 20 °C.[5]

One of the worst **bushfire seasons** ever recorded in Australia.[6]

**Wildfires** in California that filled the sky **with dense polluting smoke**.[7]

Warm ocean temperatures helped fuel a record Atlantic hurricane season in 2021, as well as rapidly intensifying tropical cyclones in the Indian ocean and Asia Pacific.

About 40% of the global population lives within 100 km of the coast and sea level rise is increasing vulnerability to hazards like storm surge.

As global warming continues, global average sea level rise persists at a rate of 3.3 mm (0.13 inches) per year. Again, that's similar to adding roughly 2.5x the water in Lake Erie (Lake Erie is the fourth-largest lake of the five Great Lakes in North America and the eleventh largest globally) to the ocean every year, or around 25x that amount per decade.

Japan just recorded its earliest cherry blossom bloom in 1,200 years. The famous pink cherry blossoms of Kyoto reached full bloom this year on March 26, 2021, the earliest date in the 12 centuries since records began. Japanese University Scientists claim that this is a symptom of the larger climate crisis.

And this is just the tip of the iceberg. According to Amos Tai, associate professor of Earth System Science at the Chinese University of Hong Kong, early bloom of cherry blossoms is the beginning of a worldwide phenomenon that could destabilise natural systems and countries' economies. There are two sources of increased heat, which is the main factor making the flowers bloom earlier: urbanisation and climate change. With increased urbanisation, cities tend to get warmer than the surrounding rural areas, in what is called the heat island effect. But a bigger reason is climate change, which has caused rising temperatures across the region and the world.

With January 2020 going in the record books as the warmest January in 141 years, and statistical analysis done by NOAA scientists predicting 2020 to be one of the five warmest years on record, the researchers believe there will be more local extinctions across the globe. And with summer heat waves potentially becoming more dangerous in the coming decades, the possibility for loss of life will likely only grow from here.

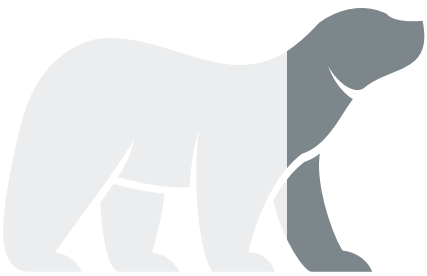


> “Japan just recorded its earliest cherry blossom bloom in 1,200 years.”



**68%**

loss of mammal, fish, bird, reptile, and amphibian populations between 1970-2016.



Environmental events are responsible for 68% loss of mammal, fish, bird, reptile, and amphibian populations between 1970-2016.[8] What's more, as there is a time lag of 50-years between $CO_2$ emissions and their effect on pollution and temperature levels, the global changes we are seeing now are just the start of the problems we are going to face in the future.[9]

Burning fossil fuels like coal and oil is one of the main causes of $CO_2$ levels rising.[10] Fossil fuels contain carbon that has been extracted from the atmosphere by plants through photosynthesis (capturing $CO_2$ and turning it into sugars) over millions of years. By burning them, we return the carbon to the atmosphere too quickly for the nature system to keep up with, throwing the biosphere out of balance.

# Step up and save the word

## The Paris Climate Agreement

The Paris Agreement is a landmark international accord adopted by almost every country in 2015 to combat climate change and its negative consequences. The agreement seeks to significantly reduce global greenhouse gas emissions in order to restrict the rise in global temperature to 2 degrees Celsius above preindustrial levels in this century, while looking for ways to keep the rise to 1.5 degrees Celsius.

All major emitting countries have agreed to reduce their climate emissions and strengthen their commitment over time as a part of the agreement. The pact establishes a mechanism for consistent monitoring, reporting, and ratcheting up of countries' individual and collective climate targets, as well as a roadmap for developed countries to assist developing countries in their climate mitigation and adaptation efforts.

The Paris Agreement formally came in to effect on November 4, 2016. The Agreement has been signed by 190 countries as of January 2021.

## But is this enough?

Since the first climate talks in the 1990s, officials have debated which countries—developed or developing—are more responsible for climate change and, as a result, should reduce their emissions.

Developing countries contend that, over time, developed countries have released more greenhouse gases. They argue that since they were able to expand their economies without constraint, these developed countries should now shoulder a greater share of the burden.

Indeed, the United States has released the most carbon dioxide over the course of history, closely followed by the European Union. China and India, along with the United States, are now among the world's largest annual emitters. Developed countries have proposed that they must act sooner rather than later to combat climate change.

Most analysts believe that these countries' commitments are insufficiently optimistic and will not be implemented fast enough to keep global warming below 1.5°C or even 2°C.

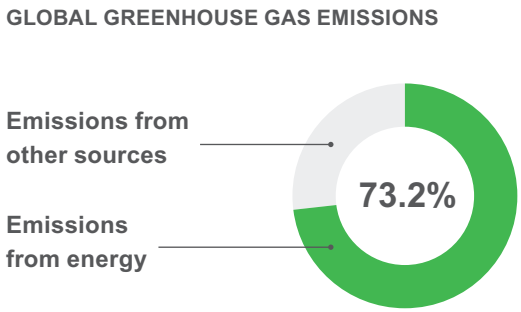


# Energy use in the home

## Focus: The United Kingdom

In 1970, only 30% of UK houses had gas central heating; by 2005, this has risen to a whopping 95%. Despite the huge advances in all areas of technology since 2005, the number of households using gas heating has remained relatively constant, with 85% of households still using gas heating in 2019.[11]

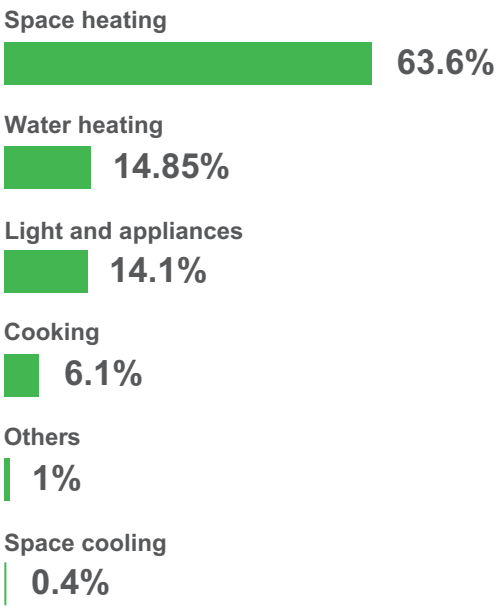
Research on global greenhouse gas emissions by sector from 2016 indicated that 73.2% of the global greenhouse gas emissions were from energy (electricity, heat, and transport).




Heat accounts for half of the global energy consumption. In fact:

- Data from 2016 showed energy use in buildings make up 17.5% of global greenhouse gas emissions, with **10.9% coming from residential buildings** from the generation of electricity for lighting appliances, cooking, and heating at home.[12]
- According to the U.S. Energy Information Administration, buildings in use (both residential and commercial) account for 40% of energy usage in the United States.[13]
- As of 2019, modern renewables are only supplying 11% of the energy for heating, and so fossil fuels continue to dominate and heat use still has a large environmental impact, contributing 40% of global $CO_2$ emissions.[14]
- A 2019 survey carried out in the UK by the Department for Business Energy and Industrial Strategy (BEIS) found that 85% of respondents use gas central heating, whereas only 5% use electric. In fact, half of respondents had never even heard of renewable heat.[15]
- In 2020, 47% of heat consumption in buildings was for space and water heating. [16]

Whilst data from 2018[17] suggests that the distribution of energy consumption within EU households was the following:



In order to limit the global temperature rise to 1.5 °C (as set out in the Paris Climate Agreement), by 2030 we will need to improve all of this by 30%. And, whilst we are seeing a yearly improvement of 1.5% for the building sector's energy intensity, the global built environment floor area grows faster, at a rate of around 2.3% each year. If we keep this going, by 2050 the carbon emissions from buildings will double.[19] In an attempt to combat this, the UK Government have called for low carbon heating solutions to be placed in all new homes built after 2025.[20]

> "If we keep this going, by 2050 the carbon emissions from buildings will double."



# Health and well-being

There are two ways of looking at this. On the one hand, health and well-being are affected by the natural world and, in this case specifically, the impact of climate change. And on the other, health and well-being are affected by our built environments — in this case specifically, our homes. So, there's not much escaping it, and ignoring both of these facts will only cause more issues.

## The impact of climate change on human health and well-being

The field of ecopsychology looks at people's psychological relationships with nature and how this affects health and well-being. With the seemingly insurmountable challenges and issues that we face, it is no surprise that the effects of climate change are causing harm to our mental health. Suggested solutions are to take action and also to connect with nature to reduce feelings of powerlessness and the anxiety that comes with it.[21]



Many of us are experiencing eco-anxiety, something that the American Psychiatric Association (APA) has described as a "chronic fear of environmental doom."[22] A 2020 survey by Global Action Plan found that one in three teachers is noticing high climate anxiety in students, and 77% of students report feeling



anxious about climate change.[23] Whilst a cross-generational study of 913 Americans and Australians found that 93% feel concerned for the environment, with plastic pollution (40.1%), biodiversity loss (39.1%), and climate change (38%) seen as the three most pressing issues. What's more, 77% of respondents reported a desire to learn more about living sustainably, although 79% believe it is up to governments to take the lead.[24]

And what about our physical health? Well, the EU Environment Agency estimates that 13% of deaths in the EU are linked to some form of pollution. [25] The World Health Organization estimates that currently 4.2 million people worldwide die prematurely from outdoor air pollution every year. [26] and that nine out of ten people breathe highly polluted air.[27] What's more, new research has found a connection between COVID-19 deaths and air pollution.[28]

## The impact of the built environment on human health and well-being

As a result of urban living, we now spend around 90% of our time indoors — be that in our homes, our cars, public transport, workplaces, cafes, bars, restaurants, or gyms.[29] When you look at the research, it's easy to understand that the spaces and things that we surround ourselves with can have a deep impact on our physical and psychological health and well-being. For instance:

- There are 7 million premature deaths annually worldwide due to air pollution,[30] and indoor air pollution can be 100 times higher than outdoors.[31]

- 93% of 16–64-year-olds in the UK have smart technology,[32] and spending too much time in front of screens can disrupt our circadian rhythms; many of us are out of sync with our bodies sleep patterns, which can have physiological, cognitive, and overall health consequences.[33] In fact, a huge 67% of UK adults suffer from disrupted sleep.[34]

- Many household activities can bring air pollutants into the home. For example, carbon monoxide from the combustion of fuels such as gas or wood; fine particulate matter from things like candles, cooking, fireplaces; damp and mold from poor ventilation; and VOCs (volatile organic compounds) are emitted from many materials in the home. These can all have serious health consequences.

- Looking at damp and mold, which is often the result of poor heating and ventilation, research suggests that at least 20% of buildings in European countries, Canada, and the United States have signs of dampness, and 21% of U.S. asthma cases can be attributed to damp and mold in the home.[36]

- Findings show that up to 25% of heat is lost through the roof, 10% through windows, 15% through the front door, 35% through uninsulated walls, and 15% is lost through the ground.[37]

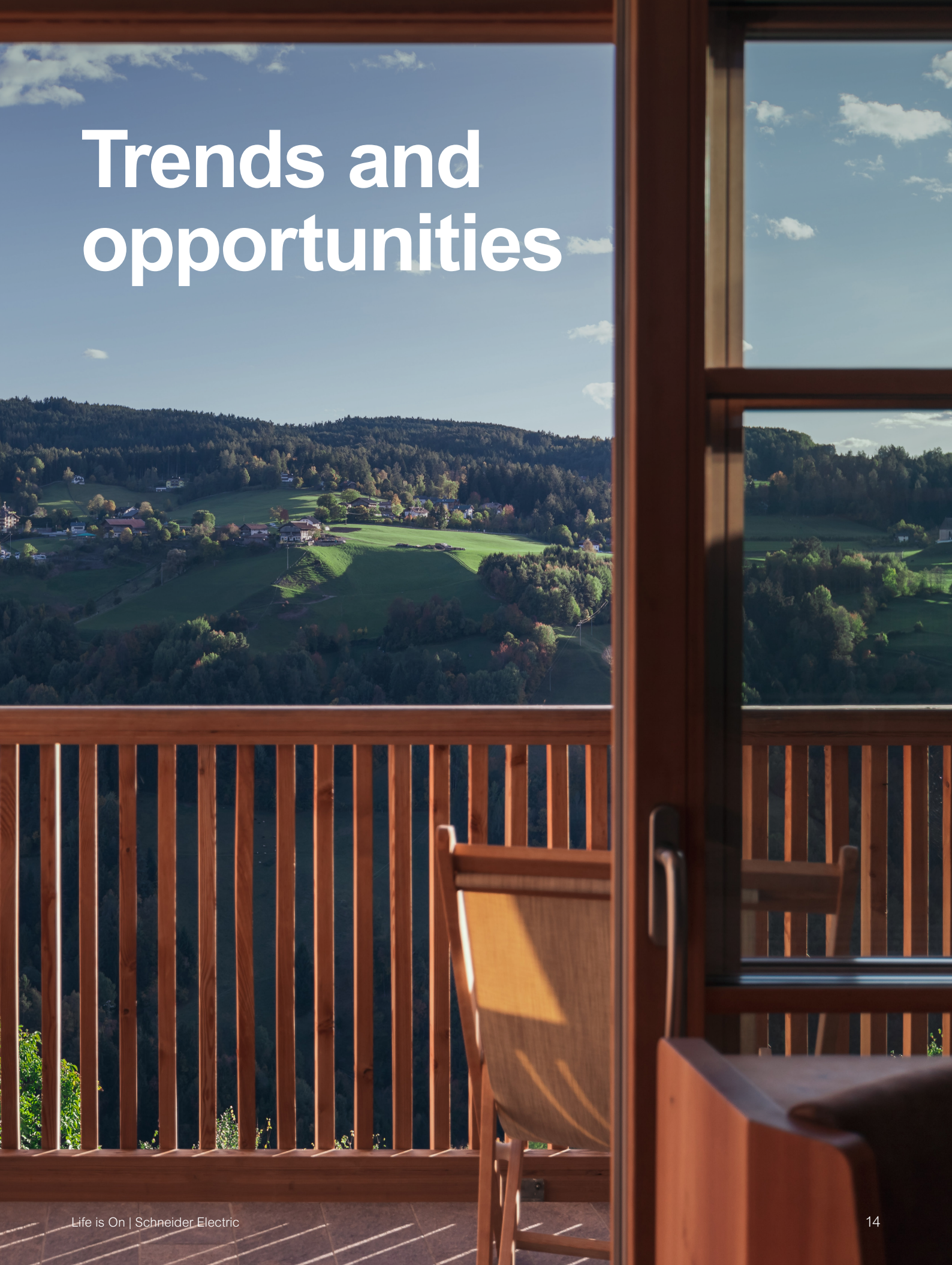
- Excess winter deaths are almost three times higher in the coldest quarter of UK housing, and other health implications of a cold home include increased cardiovascular and respiratory diseases, such as pneumonia; children are more than twice as likely to suffer from these issues in cold homes compared to children in warm homes.[38]

In terms of energy consumption at home, if we make even relatively simple sustainable home improvements such as insulation, we can create more energy efficient, controllable homes that can help both the planet and our physical and psychological well-being. So, looking to our homes is paramount, as clearly there is room for improvement. It is here that we as individuals can make a difference, and future-proofing our homes is more important now than ever, so that we can live well in spaces we are spending much more of our time.

Because of the increasing reliance on our homes, energy consumption at home is increasing, yet many don't pay much attention to this. In fact, in the UK, whilst 74% of people are aware of Energy Performance Certificates and EPC ratings — a measure of how energy efficient a home is — only 3% make changes to their homes following EPC guidance.[39] If an EPC isn't motivating people, then we must highlight how energy efficiency in the home is linked to health and well-being, in recognition that this will be a more powerful route to inspire change.



# Trends and opportunities



# Trends in home energy use

Since the COVID-19 outbreak, people have been spending more time at home, increasing domestic energy consumption. For example, in the US in 2020, whilst nationally the consumption of power dipped by 4% between April and June, household energy use increased by 8% — the highest energy usage for the last decade.[40] This trend, however long it lasts, makes home energy consumption a **leverage point***; the cumulative effect of small changes in energy use in every house, in every neighborhood, in every village, town, or city, in every country, would be enormous.

Our homes offer us an opportunity to be more sustainable: they are where we can all make a difference — by being in control of where our energy comes from, how much we use, when we use it, and even generating our own — to combat the primary source of greenhouse gas emissions (energy).[41]



In systems thinking, ***leverage points** are the places where small changes can have the biggest impact.

> “Our homes offer us an opportunity to be more sustainable: they are where we can all make a difference.”

We are increasingly turning away from high carbon sources of energy such as gas, to low carbon sources such as electricity. It is forecast that we will see an “accelerated transition to low-carbon energy”, “pragmatic investment in carbon capture solutions”, and “the advancement and application of low-carbon technologies.”[42]

In fact, the fossil fuel industry has struggled during the COVID-19 crisis — due to reduced demand from transport and other sectors — yet renewable energy has experienced record growth. It was estimated that:

- By 2025 renewables will become the largest source of electricity generation worldwide as predicted by the International Energy Agency (IEA).[43]
- Global solar thermal consumption to heat water will be 20% higher in 2025 than it was in 2020.[44]

What's more, the International Energy Agency (IEA) reports that in response to the COVID-19 crisis, governments (excluding the EU) have been investing in energy-related stimulus packages worth $220 billion — half of which focus on clean energy technologies, particularly increasing the energy efficiency of buildings.[45] Whilst in the UK, the government's Green Home Grant vouchers offer up to £10,000 toward installing energy efficient home improvements such as insulating, reducing energy use, installing low-carbon heating or lowering the amount of $CO_2$ the home produces.[46]

Government grants and conscious consumers are creating a shift toward greater home energy resilience e.g., the use of solar panels and other renewable technology, smart systems, and systems that enable households to store the energy they capture. What's more, as electric vehicles such as cars, bikes, and scooters gain popularity, this energy resilience means our homes can become the power stations to charge them up, without the worry of energy cost or environmental impact.




*__Internet of things__ — devices such as sensors, smartphones and wearable technology are connected via a network that enables them to communicate with each other.[47]

Additionally, advances in smart technology are giving households the opportunity to better understand and control the energy used in the home, enabling us to become conscious energy consumers. This is from smart thermostats that enable remote home temperature control, to smart home systems in which all electrical devices are connected in an **Internet of Things.***[48]

Domestic systems can track the energy use of each appliance and times of energy consumption, so households can understand where they can reduce their energy waste and make savings, such as charging an electric vehicle overnight to take advantage of off-peak tariffs.

## Wiser energy use, lower bills

Engineered for smart and sustainable homes, Wiser connected home solutions support more efficient energy use through smart automation.

### Lighting control

With Wiser, homeowners can set an Away Moment for when nobody's home to automatically turn off all lights. The use of presence detecting sensors for less frequented areas of the house, like storage or basement, helps make sure no light is turned on and forgotten.

### Heating control

Wiser can lower the heating when no one's around and warm up the house before the owners' arrival. The system is also able to detect if a window is open and adjust the heating to prevent energy loss.

### Shutter control

Automated Wiser schedules can also be set for shutters. They can be lowered on a cold day to prevent heat loss or brought up on a sunny day to warm up the house. In the summer, closing the shutters can help keep interiors cooler and optimize air conditioning.

### Appliance control

Remote control of home appliances via an app means homeowners don't have to wonder if they turned them off. They can do it from anywhere to both save energy and gain peace of mind.

### Energy management

Through the Wiser Energy module added to the electrical panel, homeowners get detailed insights into their energy consumption. They can track energy usage patterns throughout the day, see which devices consume the most energy, and make informed decisions when choosing their tariffs. When integrated with the solar installation, Wiser allows tracking both generation and consumption. The system also detects electrical installation issues and sends immediate notifications via the app.




Not only is having this kind of control over energy use good for the environment and household expenses, it is also good for our well-being: it can reduce financial stress and create more comfortable environments for all occupants, whilst also giving a sense of control over our environments. This is more important than you might think, as the desire for control is innate in human beings, and anything that undermines it can be harmful to our well-being[49]

# Growth of the well-being economy

It's not just conscious consumerism that is on the rise, so is wellness consumerism:

- Data from 2018 showed the global wellness economy to be valued at $4.5 trillion, including the spa industry, wellness tourism, and wellness real estate.
- Between 2015 and 2017, this rose 6.4% each year, which is almost twice the annual global economic growth (3.6%).
- In terms of global economic output, the wellness industry makes up 5.3%.[50]

In the UK, 25% of the population suffer from some form of sleep disorder,[51] whilst almost 12 million Brits get by on less than 6 hours of sleep a night.[52]

In 2020, the first research into the mental well-being economy found that it is worth $121 billion, with the **senses, spaces, and sleep market accounting for $49.5 billion**.[53] The effect of the built environment on human well-being is also recognized in many building standards such as LEED, Greenstar, and DGNB; whilst the WELL building standard[54], which launched in 2013, was to focus exclusively on the health and well-being of building occupants.

The impact of the built environment on physical and psychological well-being is recognized by people in both the well-being and the buildings industry. We have seen a huge rise in interest in biophilic design,[55] which taps into our human evolutionary connection to nature to design



built environments that support well-being. Our approach to biophilic design takes into account how our environments affect us, as experienced through our senses (touch, taste, hearing, smell, sight, balance, and position of the body). We each have different thresholds for sensory stimuli in our environments and can be over or under stimulated if we don't get the sensory levels right for us individually, and this can cause physical and cognitive discomfort.[56]

Our thermal and visual comfort are extremely important for our well-being and having better control over lighting and heating in the home can reduce stress caused by our environments, improve sleep, focus, and thermal comfort, whilst reducing illness due to poor air quality and eye strain. The COVID-19 pandemic has made us all think about our health and well-being as an absolute priority and looking after our health has become more essential and desirable than ever before.

Whilst the immediacy of the pandemic has both unfortunately, and understandably, put the climate crisis on the back burner for many, it has highlighted how important our homes are. We need them to be multifunctioning, comfortable, and healthy environments where we can sleep, eat, work, exercise, study, and support our relationships with family and friends (be that in-person or remotely).

The growth in interest in both physical and mental well-being is a chance for architects and designers to shine a light on how our environments, particularly our homes, affect us. This is an opportunity to engage clients in sustainability through something close to them — their health and well-being — and demonstrate how their home can support it. For example, insulation doesn't seem like an exciting home improvement, but when clients are made more aware of how much it can reduce wasted energy, and realise the benefit of this on the environment, their thermal comfort and, in turn, their well-being, it becomes a more appealing investment.



# Sustainable Living



## Focus: Urbanisation & Construction Sector

Cities account for just 3% of the earth's land surface, but they account for more than 70% of all carbon emissions. We need to design and build our infrastructure, our cities, and our economy in such a way so that they are resilient to the effects of the changing climate. We can only decarbonize our habitat through collaboration between government, the private sector, and local communities, each playing their part.

It is estimated that 80% of the buildings that will exist in 2050 have already been built and are standing today. Existing buildings are responsible for approximately 40% of EU energy consumption and 36% of the greenhouse gas emissions, meaning they are the single largest energy consumer in Europe. As part of its Paris commitments, the UK government pledged last year to reduce greenhouse gas emissions by more than two-thirds (68%) from 1990 levels by 2030.

Similarly, in the United States, buildings and their construction together account for 36% of global energy use and 39% of energy-related carbon dioxide emissions annually, according to the United Nations Environment Program.

According to UN Environment, to meet the goals of the Paris Climate Agreement, the built environment's energy intensity – a measure of how much energy buildings use – will have to improve by 30% by 2030. Globally, the building sector's energy intensity improves by about 1.5% per year; but the number of buildings is increasing, and global floor area increases by about 2.3% per year, which offsets some of those energy intensity improvements. If no action is taken at a large scale, carbon emissions from buildings are expected to double by 2050.

As per the World Resources Institute (WRI), all buildings must be net zero carbon by 2050 to meet the goals of the Paris Agreement. Not even 1% of buildings are considered net zero carbon today.

According to WRI, the first and easiest step in addressing emissions is to reduce consumption through energy efficient design. The next steps would be replacing fossil fuels with on-site carbon-free renewable energy, and off-site renewables. This is a taller order, as it means addressing our energy infrastructure. The final, and least preferred option is purchasing carbon offsets.

There is a pressing need for homebuilders to create sustainable housing. Sustainability is a game changer and an absolute necessity which will transform the construction industry – especially housing. Building and investing in sustainability not only contributes to preserving the environment in which it is built, but homeowners can enjoy energy savings. These savings range from 50% to 70% in the life cycle of a net zero home, with up to 40% less water consumption and a reduction in maintenance costs of between 7% and 8%.

With climate change awareness on the rise, people are very keen to invest in sustainable housing. Putting building construction on the path to zero net energy use is the most cost effective and immediately available strategy for lowering greenhouse gas emissions in the built environment. A green building may be a brand-new construction, or one that has been retrofitted with new mechanical systems, heating, ventilation, and lighting. It is difficult to achieve net zero energy use by retrofitting, and so the onus is on architects and building industry professionals to educate their clients about building sustainable homes from scratch.



# Advantages of Sustainable Housing



### Reduced Environmental Footprint

Your environmental impact is significantly reduced when you build homes that are built to last. From the outset of construction, green homes have sustainable benefits. Building techniques reduce waste and recycle products, allowing for more productive use. Sustainable homes minimise emissions that contribute to climate change because they are designed with the goal of reducing energy use.

### Economically viable

Operating costs of sustainable homes can be minimised as a result of construction methods that ensure effective use of water and electricity. Sustainable materials and methods are being used in construction projects all over the world, which would save money on utility costs in the future. In addition, most home builders recognise that that sustainable buildings have a higher perceived build quality by customers, are more in line with their values and ethos and will create significant financial savings throughout their occupation. As a result, you save both money and time.

### Energy Efficient

Green home construction prioritises energy conservation. Solar panels, high efficiency insulation, enclosed attics, low-emissivity windows, advanced framing methods, and energy-efficient heat pumps are only a few of the features. As a homeowner, the expenses are lowered as your heating and cooling needs are reduced.

### Increased Property Value

More and more investors and Home Developers across the world are betting on sustainability by introducing sustainable construction methods and materials, selecting sustainable-recognized suppliers and promoting Net Zero Homes and Sustainable Building Certifications as standards for their developments.

### Enhances Quality of Life

More natural light and improved climate protection are features of sustainable buildings and homes, which help to raise morale, improve health, and improve life quality.



The reason behind this is simple. Many home buyers view sustainable features as “must haves”, so green homes are sold much faster than their counterparts, and in some places, homeowners are willing to pay higher prices when extra features are added to improve their quality of life.

There is a need to build homes and places in such a way that they save money on heating and power, help people live less carbon-intensive lives, and help minimise greenhouse gas emissions that lead to global warming. Future green net zero homes will indeed stem from the clean energy transition, reducing our carbon footprint significantly.

# Net Zero Homes: The future

Over the course of a year, a Net Zero or Zero Energy home can generate as much power on-site as it consumes. As a result, any electricity the building consumes from the electrical grid can theoretically be returned.

Net Zero Homes are more than just about renewable energy sources ; they are airtight, well-insulated, and energy efficient to the point that they generate as much renewable energy as they consume in a year, leaving the inhabitants with a net zero energy bill and a carbon-free household.

To create a healthier house, a zero energy home combines innovative architecture and superior building technologies with energy efficiency and on-site solar panels. Zero-energy homes are ultra-comfortable, safe, peaceful, and environmentally friendly homes that are also affordable. It is important to use resources in a more intelligent and educated manner.

The secret to successfully constructing a sustainable green home is proper planning. In this process homebuilders are committed to sustainable construction and creating homes that value the natural environment in which they are constructed, with a strong emphasis on architecture and design. Consumers have a preference, and everything they need is included in the carefully considered specification from the start of construction, allowing them to personalise aspects of their new home without incurring extra costs.

When specifications are limited to budget constraints and sustainable features are not reaching the level expected by potential homeowners, Home Builders can also offer some upgrades during the sales phase to reach these expectations and improve home owner's quality of life.

Apart from energy efficiency and lowering the carbon footprint - improving life quality is at the heart of building a sustainable home. The buyers would receive a well-designed new home with all of the requisite functions and no need for renovation. They also get to live in an environmentally friendly home with well-thought-out materials, a comfortable indoor atmosphere, low maintenance and running costs in a sustainable, climate-smart home.

## Some of the advantages of Net Zero Homes are:

- Ultimate Energy Efficiency - Homes that are airtight, well insulated, and energy efficient, resulting in a net zero energy bill and a carbon-free house for the residents.
- Healthier & More Comfortable - Creates a healthy environment with the cleanest air, feel the most comfortable temperatures, and enjoy the quietest indoor environment which is free from allergens and toxins.
- Carbon Free and Climate Friendly - Zero-energy homes are one of the cornerstones of a low-carbon, non-fossil-fuel-dependent future.
- Save Money from Day One - A zero energy home will shield you from fluctuations in energy prices. Living in a zero-energy home is less expensive than living in a conventional home.

# The New Generation of Environment Conscious Home Owners: What do they Seek?

Homeowners today, especially the younger generation, who are first time buyers, are more committed to sustainable development goals. They care deeply about environmental sustainability and this momentum is building at scale.

There is a visible shift in consumer demand in real estate sector towards more energy efficient buildings, notably since the global lockdown which compelled people to stay indoors. The coronavirus pandemic has revealed the downsides of energy-intensive buildings. Most of the world's population lived and worked from home during this time, which has led to a new demand for green buildings and efficient energy systems.

In a survey conducted by Schneider Electric, where consumers from United States, France, Germany, and Sweden participated, 90% of consumers surveyed are willing to invest to create a more energy efficient home. The study shows that 37% of consumers have considered changing housing since the pandemic, among which 6% have already made a move towards sustainable homes/net zero homes.



The new generation is worried not just about the environment's future, but also about the viability of our cities. Due to the common pitfalls that come with living in an urban environment, such as the rising cost of living, noise and air pollution, many are looking for alternative housing solutions. As per the Schneider study, over 80% of consumers across all the 4 regions where the survey was conducted cite wellbeing as a priority for their homes, and energy efficiency and sustainability also remain important factors. Apart from these, Safety and Data privacy rank high on their preference list.

These days, most consumers are looking into smart home ideas. A smart home is one in which the appliances are connected to a smart home device that automates everyday functions and can normally be operated remotely. It helps you to have more control over your energy use by automating activities such as temperature control, lighting control, and window treatment control. 41% of the consumers surveyed expect a newly built home or apartment to be equipped with smart home products, and 25% consumers are willing to pay more for a home, condo, or rental if it comes with smart home technology.

# The Role of Home Builders



Home builders and home developers have the first-hand responsibility and decision-making power around what the home will stand for. They have to do what is right for the planet, right for society, and right for their consumers. Despite current economic challenges and the risk of a global recession as a result of the global pandemic, investment in environmentally friendly, zero-carbon buildings continues to grow, with experts believing that 'reducing a real estate portfolio's carbon footprint is one of the safest ways to contribute positively to the environment'.

The most logical step or way to meet the global climate change targets is to build Net Zero Buildings or Green Buildings. Environmentally sustainable and resource-efficient green buildings use less electricity, water, and other natural resources. As a result, less waste and greenhouse gases are produced, reducing the burden on human health and the atmosphere over the course of the building's entire lifecycle.

For home developers, a sustainable housing approach will require careful planning from the outset to consider both the design and construction but also the ongoing occupation and use of its spaces. Let us look at some of the sustainable housing principles that home builders abide by:

## Plan & Design for Sustainability

Preparedness towards environment-friendly methods of utilising minimal non-renewable energy sources, low-operational energy and aiming for a longer lifecycle with accomplishing operational efficiency is paramount for every builder. Regulatory compliance and voluntary certifications can help home developers stay on their sustainability mission such as BREEAM, LEED, WELL standard, etc. Right from the very beginning, home builders can make sure the overall carbon footprint of homes is low by using design modelling to plan, revise and enforce changes instead of wasting resources. Using Building Information modelling (BIM) data generated during design and build over the whole project lifecycle will enable faster, safer, and less wasteful construction, and more cost-effective and sustainable operation, as well as maintenance and eventual decommissioning.

## Design for an Energy-Efficient Building

Home builders should design the house for energy efficiency; buildings should be equipped to consume less energy and generate power independently for their own consumption:

- Use naturally sourced material for better insulation during construction
- Install and integrate use of Solar power or other renewable generators
- Design for better air tightness and Ventilation as air, and moisture have a huge impact on indoor air quality and comfort
- Install solar panels and supporting electrical control systems to harness the sun's power and, as a result, optimise energy efficiency
- Enable use of solar energy storage for self-consumption which is an essential aspect for Energy Positive Building
- Include installing Home Automation, Energy Efficient Lighting, Electronics and Appliances for low energy use along with comfort.

## Construct with Low Carbon Footprint

Home builders should aim to use efficient and environmentally responsible materials and procedures to protect the environment in which a building is built, as well as the building itself.
They can achieve that by:

- Using more renewable sources of energy during the construction phase; lesser energy consumption and wastage means lower carbon footprint.
- Use of Greener construction material like bamboo, sheep's wool, cellulose, earthwool, etc.
- Use more recycled or reclaimed construction materials from other projects, such as steel furnace ash ( also known as GGBS) as a means of reducing the carbon impact of concrete.
- Use of RoHS (Restriction of Hazardous Substances) and REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) certified products.

## Waste Management

Planning ahead to keep waste to a minimum is the most effective strategy to reduce wastage. You will reduce the amount of waste you submit to landfill by using smart construction, repurposing materials, and using recycling centres. Separating waste; holding similar materials together for easier recycling or pickup; and separating non-recyclable and hazardous materials for disposal. Some of the ways to handle waste effectively include partnering with retailers and distributors who produce packaging made of recycled and recyclable materials that can be processed and handled.

## Green Building Certification

A green building certification shows a home builder's commitment to building a sustainable home. Green building certifications are used to assess and recognise buildings which meet certain green requirements. These voluntary certifications recognise and reward companies who build and operate greener buildings, thereby encouraging and incentivising them to push the boundaries on sustainability. Some of the more recognized certifications are LEED (Leadership in Energy and Environmental Design), issued by the U.S. Green Buildings Council. Energy star certification is offered by the Department of Energy and the Environmental Protection Agency, and BREEAM (the Building Research Establishment Environmental Assessment Method) is also an international program that recognises sustainable buildings and projects. It is important for home developers to review and make sure regulatory compliance and Certification Approvals are in place before finally handing over the house to its consumer. Green building certification checklists also ensure they do not miss any important parameters or steps in planning a sustainable home.

Home builders have the responsibility to inform and educate their clients on all of the available options and advantages of making their homes more sustainable and net zero. More energy efficiency means lower energy bills and a low-cost sustainable home for customers.



# The architect's and designer's roles

So, we know that people are motivated to be more sustainable and healthier, but they don't necessarily know how to go about it in their homes, and this is where the design of the home is crucial:

To overcome the barriers to action, here are nine things you can be doing for your client



**Audit for carbon emissions and projected energy efficiency** — identify opportunities for savings and efficiency measures in their homes as a baseline. For example, in the USA you could use the EPA's Household Carbon Footprint Calculator, in the UK the Carbon Independent's carbon footprint calculator, or a SAP calculation to dig deeper into your EPC rating.[57]



**Install smart control systems as part of designing multifunctioning homes** — in order to support all occupants' physical and psychological needs and activities, whilst enabling them to understand and reduce their energy use. KNX is a great example (more on this in the case studies).



**Specify materials that don't run off gas and install air filtration and continuous ventilation systems** — to safeguard your clients' interior air quality.



**Specify products and materials that are durable and repairable** — to help clients shift into the circular economy and save stress and money in the long term — **Schneider Electric** can help you specify products that are made to last.



**Recommend renewable energy sources** as a steppingstone to energy resilience. The first step might be to switch to a renewable energy supplier.

**Create energy resilience** — design or renovate homes that generate and store energy and can charge clients' electric vehicles easily.

**Stimulate a deeper connection with the wider natural environment** — bringing nature in through biophilic design[58] to promote well-being.

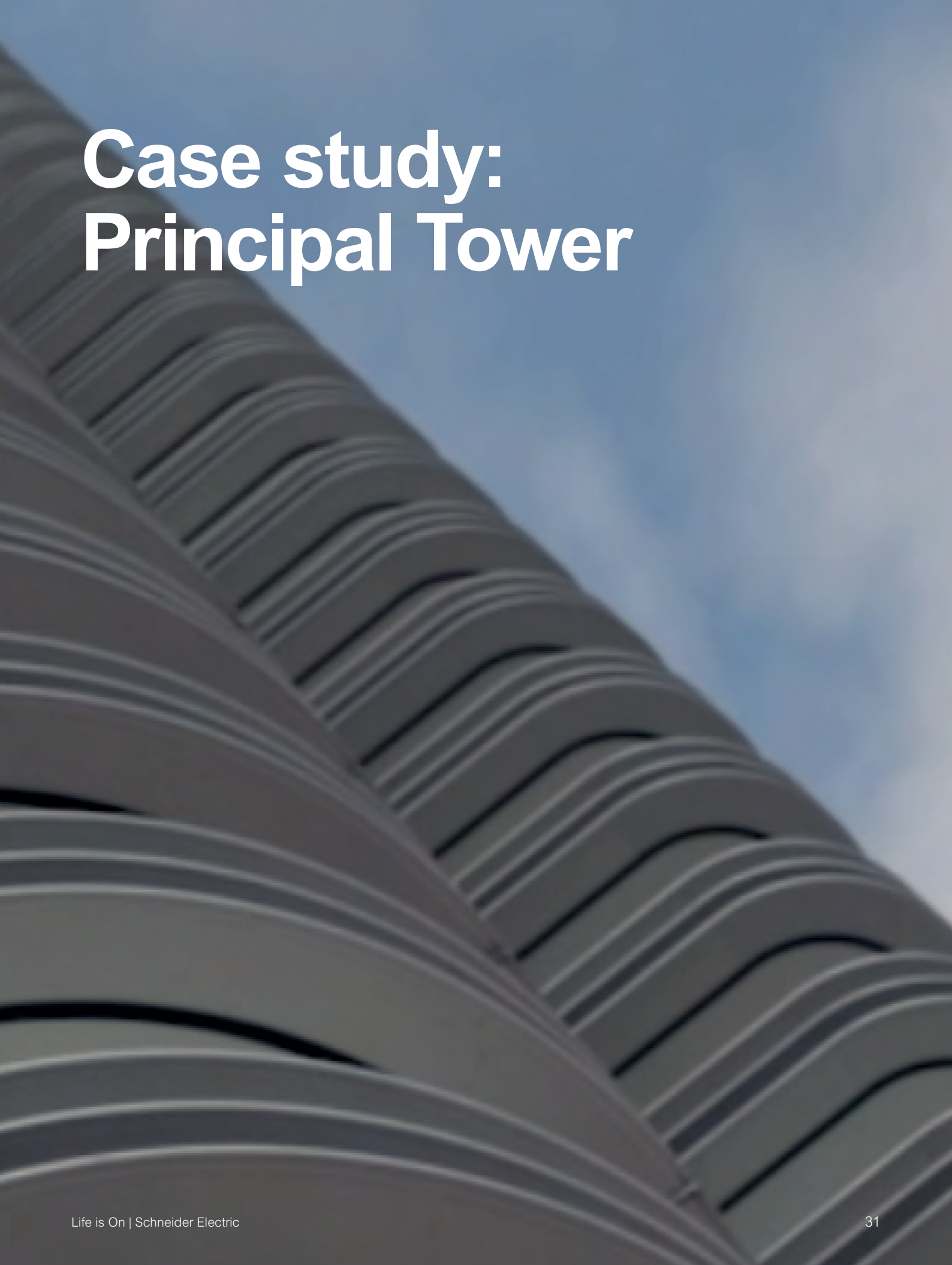
**Recommend installing electric vehicle charging points** — even if a client is not there yet, having the provisions for charging electric vehicles in the future will help them transition.

**Use WELL concepts as a checklist** — the 10 concepts[59] offer a holistic framework for creating a human-centered environment.

But, how do you get your client on board, so that they want to invest in all these things? We'll look at a business case to sell it to them next.



# Case study: Principal Tower



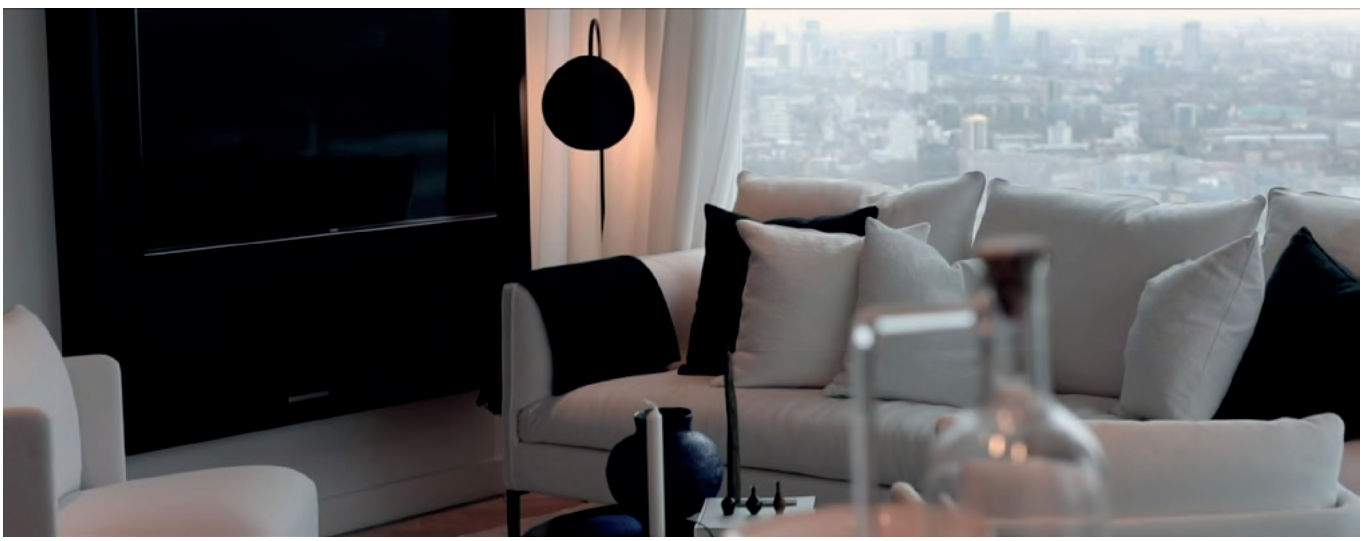
# Principal Tower
## Location: London, Shoreditch
## Completion: 2020
## Plot: 34,900m$^2$

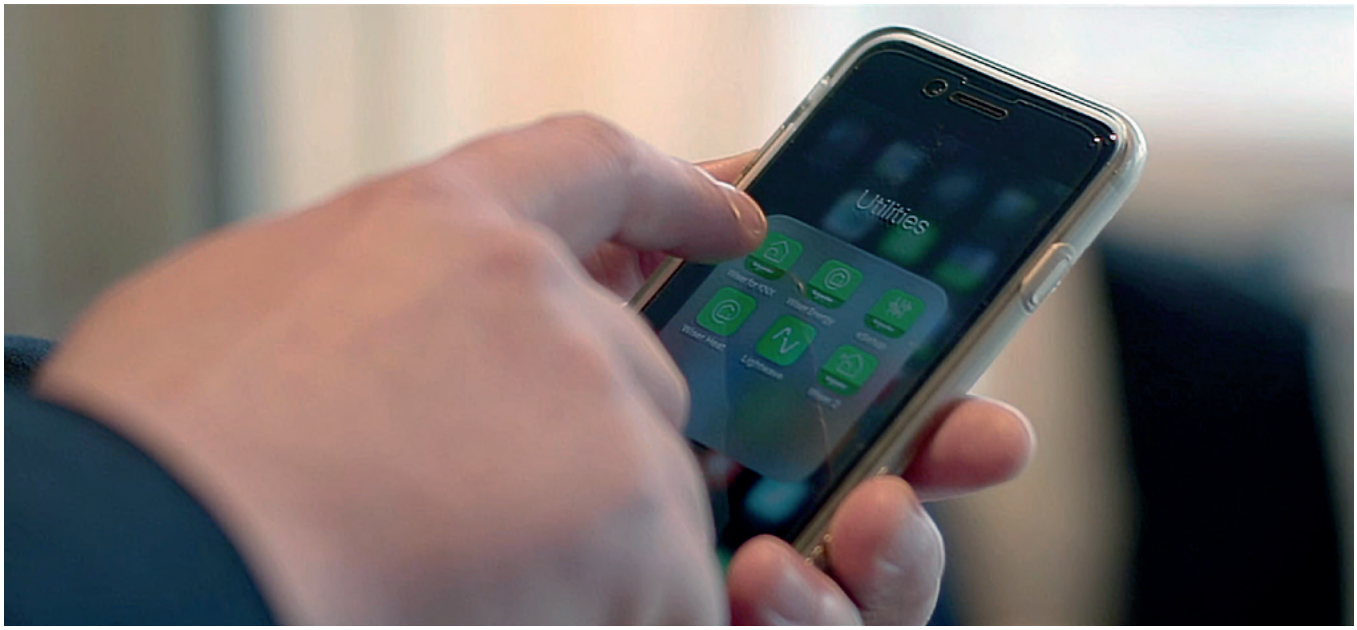
The main objective for the 175-meter, 50-story Principal Tower – Foster + Partners' first residential skyscraper in London – was to "create something individual and unique to London — a residential property that has the ambiance of a hotel but still feels like home."

Each floor typically consists of four two-bedroom and four one-bedroom apartments, with larger apartments and penthouses at the top. Each apartment has a private corner balcony that allows for double-aspect views, and the interior design has been kept minimal and simple to appeal to the contemporary buyer and not detract from the views.

The building features:

- A gym, pool, sauna, and steam room for self-care
- A cinema, residents lounge, grand lobby, bar, and coffee
- bar for socializing and entertainment
- Six restaurants at street level (as part of the wider
- Principal Place Estate)
- Lots of natural light and far-reaching views (about 50% of each apartment is floor-to-ceiling glazing protected by shading fins)






We interviewed Daniel Jordaan, the General Manager at Principal Tower, who told us:

"You do get a feeling that the residents have a sense of pride living here. We've ticked the innovation box, we've ticked the technology box, we've ticked the sustainability box. I tend to think that is what's important to people."*

At the moment, the tower has 75% occupancy. This has a lot to do with the location (between Shoreditch and the financial district) and the demographic of the residents — often professionals who work in the city but have a second home elsewhere.

"Before COVID, for a lot of people well-being would have meant a sense of community and interaction with other people. Well-being now means that you feel comfortable at home, where you are for almost 24-hours a day — ambiance and mood setting are important."




In terms of well-being, the lights in Principal Tower are warm, almost yellow lights, installed for residential living as opposed to bluer light that can negatively affect circadian rhythms and sleep. The Schneider Electric KNX touch screens can also be swiped to change the light intensity, and occupants can create 'scenes' for different times of day using their smartphones.

However, with a touch-screen switch linked to the KNX system from Schneider Electric in every room, the controllability goes much further than just lighting.

*All quotes throughout are taken from our conversation with Daniel Jordaan, General Manager at Principal Tower.



> “You can control everything, from your curtains, lights, side or table lamps, to your towel racks, heating, cooling, and under-floor heating.”

The ‘brain’ — a bigger control pad located in the utility room — allows you to set up different modes, such as summer, winter, holiday, office, or evening mode. You can even put in your holiday dates so that the system ensures the lights, heating, and cooling are turned off whilst you are away. It is completely adaptable and made to suit changes in occupant needs — particularly important since COVID has meant a shift to working, exercising, and socializing from home.

Within the tower, there are various sustainable features that are both environmentally and financially friendly, including:

- Schneider’s KNX system, which results in 30% less energy used than in an average tower
- Photovoltaic panels on the roof that generate a percentage of energy for some of the building’s management systems
- A gray water system that treats and enables wastewater from showers and basins to be used to flush toilets
- Light settings in the public areas that automatically dim at night
- Food waste, recycling and bulky waste collections, twice a week
- A chute system that enables waste sorting in the basement
- A cycle store that fits 400 bicycles
- A Community Energy Center in the basement - a combined heat and power plant
- The tower targets the UK government’s ‘Code for Sustainable Homes’ Level 4[60]



"Hackney is really at the forefront of sustainability in London. The local authority has been very strict with giving permission for this to be built; a lot of consideration went into the planning for the architects and contractors to get it right, so that the building would be as sustainable as possible. I think we are doing pretty well — Fosters and the local authority are proud of what has been introduced into this building, like the waste management and the cycle schemes. Generally, the people living here are on board with sustainability."

Now, when it comes to resilience and future--proofing, COVID has left many architects and designers questioning how we design homes for the future. Do we design COVID-times friendly buildings, or will things go back to normal?

According to Jordaan, one thing we can be sure of is that future-proofed buildings will need to be adaptable and upgradeable.

"When Schneider introduced the KNX system, they had future-proofing in mind 100%; they have integrated their system with Alexa, Siri, Google, smart speakers, and different apps. Schneider have fitted cabling into the KNX system which allows people to install additional speakers, blinds, and curtains. So, the facilities are available for people to start adapting their existing system and making it more bespoke. And that's where the futureproofing comes in, because it's available to be done."

# Case study: Bass Houses' Agua Marina



# Bass Houses' Agua Marina

## Location: Benalmádena, Spain
## Completion: 2020
## Project size: 400 m2

BASS HOUSES is a bio-construction project, born in 2015, to create modern and stylish homes that are sustainable and efficient at the same time. The AGUA MARINA house, located in Benalmádena (Málaga, Spain), facing the sea, has been designed as a 'didactic meeting point' and showroom, to show the possibilities of their own construction system, BASS SYSTEM, both to professionals in the sector and to potential clients.

BASS SYSTEM combines traditional ecological construction with the most advanced technologies, using a bioclimatic architecture and the best natural resources.

The combination of natural, breathable and insulating materials optimize the energy efficiency of these homes, considerably reducing energy costs. The bio-construction with structural wood allows to design light and resistant spaces, in combination with other natural materials such as handcrafted lime and natural cork oak. The wood used is a hygroscopic material that naturally and constantly regulates the humidity inside the houses. In addition, it is a natural thermal insulator that completely eliminates thermal bridges and energy losses. This, together with a high-performance envelope, allows to minimize the consumptions of the house.

Indoor air quality and humidity regulation are other important points in this system. Thanks to a controlled dual-flow ventilation system with heat recovery, these houses do not need heating or cooling, offering a healthy space, with optimal CO2 levels and a stable temperature all year round.

### Smart Home technologies

AGUA MARINA is a fully automated home, and with this in mind it has incorporated a wide range of Schneider Electric devices. Thanks to these solutions, owners can control their house from anywhere in the world, something important considering that many are second homes. "At BASS HOUSES we firmly believe that automation is the perfect ally for the energy efficiency of the home", assures Cristina Le Peuch, founder and director of BASS HOUSES.

The home acts in autonomously and intelligently in many of its operations, reducing and optimizing consumption. Thanks to the incorporation of the D-Life and SpaceLogic KNX range, different lighting environments can be created. In addition, the lighting control can be both conventional and by presence detectors through sensors installed throughout the house.



Considering the contribution of sunlight is another of the energy saving advantages offered by the home automation system. Thanks to the light sensors, the Venetian blind, adjustable both in height and inclination, will regulate the entry of sunlight, maintaining the required level of brightness at all times, and the luminaires will also be adjusted accordingly.

The motion sensor system also acts as security sensors and sends alarms to the owners' phone in the event of an unusual event.

## Some of the Project features are:

Efficiency and energy saving

Efficiency and saving of water

Quality of the indoor air and environment

# Partnering with Schneider



All BASS HOUSES houses are equipped with Schneider Electric solutions. Specifically, AGUA MARINA has the D-Life series of mechanisms, with Multitouch KNX to control the temperature and with KNX Pro to create scenes. Its LED luminaires, with DALI protocol, have regulated circuits to optimize consumption.

Regarding the air conditioning, both the double flow ventilation system and the meteorology station are controlled with a KNX gateway and connected to the thermostats. Even the motor-driven window in the living room is connected to the KNX system and can be activated by voice recognition.

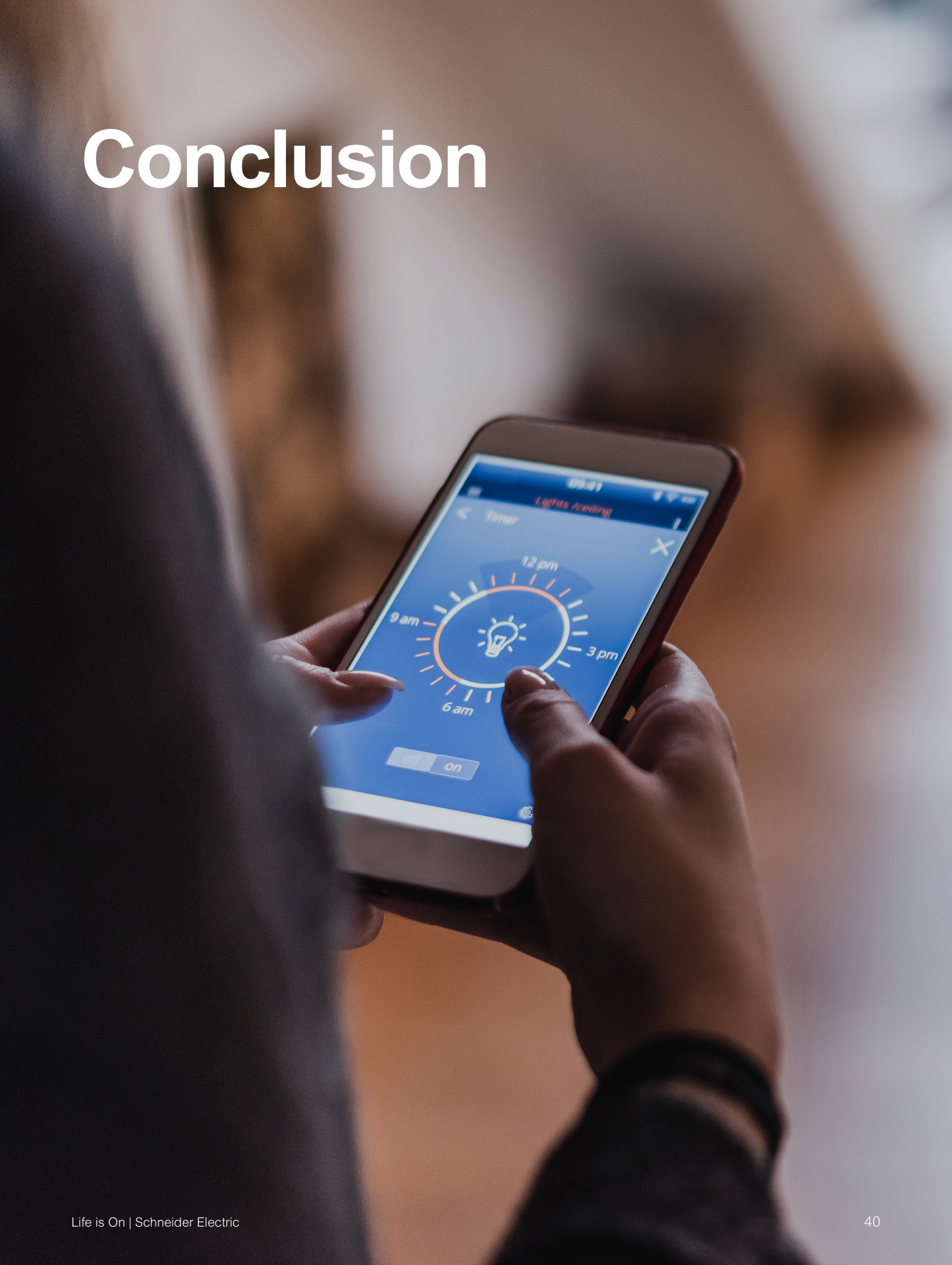
In short, all the connectable systems in the house are controlled with Wiser KNX, which acts as the heart of the installation. Thanks to this, customers will be able to see analytics and graphs of consumption, water consumption, solar incidence, and electricity consumption to check the real savings and efficiency of the home.

Soon, in addition, the house will have a Smart Wallbox system for recharging the Electric Vehicle and a UPS from Schneider Electric to ensure the continuity of the electricity supply in the house.

## Schneider Electric products used in AGUA MARINA house

- Low Voltage protection: ik60 + iC60
- Switches and Sockets: DLife Niquel (KNX Pro & Multitouch) and Mureva
- Smart Home: SpaceLogic KNX
- Web server: Wiser for KNX
- Rack: Actassi + Digilink
- Panel building system: Prisma G + Pragma24

# Conclusion



The home of the future is not just efficient; it is also resilient and flexible. What we build today is what we will reap the benefits of tomorrow. It's more than just a home where issues with draughts and poorly designed heating systems have been overcome. There is a need to build well-considered comfortable home that caters for the household's activities, needs, and preferences as they change over time whilst reducing their carbon footprint.

The home of the future is its own power plant. This means it is generative (of energy) rather than just preventative (of energy loss). It is in fact regenerative to people and the planet — supporting the well-being of both. It works with natural elements like available sunlight, water, and heat, and it connects the people within it with natural systems — through awareness of the seasons and how much sunlight there is at different times of day and the year.

## The home of the future is



**Electrified** — using sustainable renewable energy to power the house and electric vehicles



**Efficient** — no energy is wasted, and $CO_2$ emissions are minimal



**Generative** —it harnesses and stores energy from solar panels, and ground or air sourced heat pumps



**Comfortable** — it supports the well-being of all occupants throughout the seasons



**Personalized** — it is customized to a household's needs, is fully controllable, and makes households aware of their energy use



**Flexible** — adapting to both the changing needs of the household as well as the climate



**Resilient** — to developments and changes in technology, using upgradeable software and hardware



**Robust** — built to last, able to be repaired, and adaptable for future needs



**Responsive** — the heating, lighting, and ventilation work in a connected network and communicate with the users

Whilst much of the technology already exists, it isn't yet in use in every home. There is a sense that resilient energy renovations aren't yet accessible for all, either financially or through it seeming too complicated. This is where home builders, architects and designers can help to clearly communicate the benefits and the options to our clients; the only way uptake will increase is by making energy resilience design and renovation simpler.

A holistic approach to energy system design, installation and use from start to finish is needed, one that looks at a home's current energy use and how well it supports the household's physical and psychological well-being and identifies opportunities for improvements. Creating a clear and simple plan for what changes, how, and when to implement is crucial. This requires thinking about the home as a system and joining all the elements in a network so that they work together.



> “Creating a clear and simple plan for what changes, how, and when to implement is crucial.”

What is clear is that a sustainable home is better for both the occupants and the planet. At a time when the home is playing an increasingly important role in our lives, its impact on occupant well-being is certainly one macro trend that we all need to focus on.

The construction sector has a serious impact on climate change. If the real estate and building sectors embrace and invest more in sustainability, it will go a long way towards transforming both current and new developments – through education, visibility, supply chain evolution, and mainstreaming green investments.

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