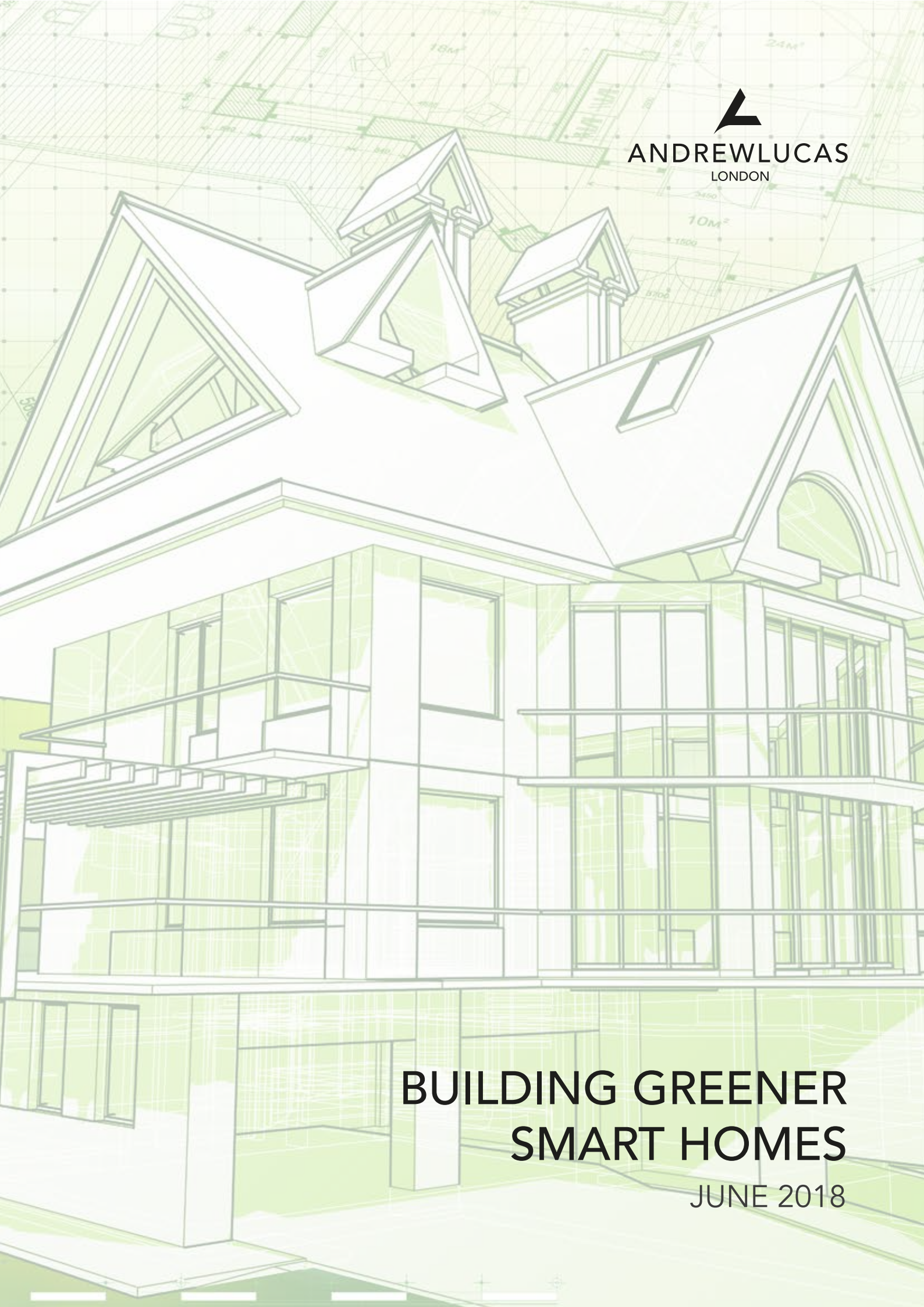


ANDREWLUCAS
LONDON

BUILDING GREENER SMART HOMES

JUNE 2018

CONTENTS

OVERVIEW:
THE CASE FOR GREENER HOMES

It is well within us of all to live more sustainably. As a society, we are aware that we need to change our behaviour if we are to tackle climate change in a meaningful way. On an individual level this is relatively simple, including things as simple as recycling more or buying local more often. Yet there also a need for wide-scale changes to the way that we go about our daily lives – including the buildings we dwell in.

In its current state, the global building sector accounts for emissions roughly the same as those of China[1]. For the world to get close to keeping the rise in the global average temperature at less than 2°C above pre-industrial levels, as set out in the Paris Agreement, this sector needs to start operating at 'net zero carbon'.

Accomplishing this will be difficult. Right now, only 500 commercial buildings and 2,000 residences worldwide have been designated as having a 'net zero carbon' footprint. This is a long way off where we need to be if we are to make a meaningful difference to our environmental emissions

There are more than just environmental reasons why we should look to build greener homes – there are also financial incentives for going greener. Research by the Sustainable Energy Association suggests that implementing greener building design practices in the UK could save the country as much as £12.1 billion a year by 2050[2].

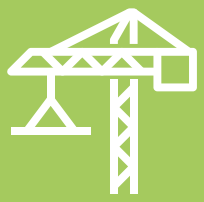
WHAT DOES 'NET ZERO CARBON' MEAN?

A net zero carbon footprint, also referred to as carbon neutrality, describes a situation where the carbon released is matched by an equal amount that is either captured or offset by other means such as clean energy generation.

Across the country, energy consumption per household is on the rise,increasing by 2.6% between 2014 and 2015[3]. As a net importer of energy, the UK is more sensitive to price fluctuations in its energy supply than many other countries. This is made worse by the poor state of the current UK housing stock – approximately 6.6 million homes are rated as having poor energy efficiency (achieving band E, F or G on their Energy Performance Certificates). Yet for these poorly-insulated properties to become energy efficient by 2025, more than three times the number of retrospective measures need to be installed each year[4] than are currently being implemented.

While there is a clear need for more energy efficient housing in the country, it is on the way to becoming mandatory in London. The Greater London Authority has decided to press ahead with the UK Government's abandoned plan to require new builds to be zero-carbon[5]. This means residential building projects in the capital will need to consider how to reduce CO2 emissions while keeping energy costs low for the homeowner.

There are several ways of doing this, from installing better insulation measures to eco-friendly power and even passive house design, where the property is designed to make maximum use of the surrounding environment to heat and cool the space. Home technology systems – such as smart lighting or heating – also have an important role to play in making a home more sustainable and increasing energy efficiency.



THE GLOBAL BUILDING SECTOR CAUSES EMISSIONS ROUGHLY THE SAME AS THOSE OF CHINA

GREENER BUILDING DESIGN PRACTICES COULD SAVE THE UK £12.1 BILLION A YEAR

ENERGY CONSUMPTION PER HOUSEHOLD INCREASED BY 2.6% BETWEEN 2014 AND 2015

6.6 MILLION HOMES ARE RATED AS HAVING POOR ENERGY EFFICIENCY (E-, F- OR G-RATED FOR ENERGY EFFICIENCY)

LONDON IS LEADING THE WAY IN THE UK IN TERMS OF ZERO-CARBON LEGISLATION

THIS SECTOR NEEDS TO BE 'NET ZERO CARBON' TO MEET PARIS AGREEMENT GOALS

THE TECHNOLOGY COMPROMISE

When we talk about ecological homes, many will imagine a picturesque cabin in the woods, utterly disconnected from the modern world. While there are a few who choose to live entirely off-grid, most of us are more and more reliant on technology in our daily lives which, on the surface, means that we're more energy-dependent than ever.

As of Q1 2017, 89% of adults in the UK had used the internet in the past three months[6]. What's more, one in four consumers in the UK now own at least one smart device[7]. A total of 21.7 million IoT connections are expected to exist by the end of 2017, a number rising to 155.7 million by 2024[8]. The increasing amount of technology we surround ourselves with means that our overall energy consumption (and energy costs) will soar unless we start thinking more carefully about what we are using and when.

Unlike with a conventional property, many technologies in the modern smart home – such as intelligent lighting, smart heating control and motorised shades – are designed specifically to reduce a building's energy usage, along with the benefits they bring in terms of convenience and enjoyment.

Yet there is a troubling tendency for many older, legacy smart home systems to use more energy than they need thanks to high stand-by power wastage. In some cases, this can be up to 10% of total residential energy consumption. This is particularly pertinent when it comes to equipment for home entertainment – such as receivers and set-top boxes – which can draw quite a lot of energy whilst in stand-by mode.

WE ARE BECOMING MORE AND MORE RELIANT ON TECHNOLOGY IN OUR DAILY LIVES

An area where energy usage often passes unnoticed is in a smart home's technology rack (or head end), which efficiently organises a number of AV and smart home sources in a single location for more effective building management. This should be thermally managed so that equipment is maintained at a temperature to allow it to perform at its maximum efficiency for the entirety of its expected lifetime, but this isn't always the case.

"Many installers leave several components – including multi-channel amps, network switches, AV sources and receivers and processors – switched on constantly," explains Krystian Zajac, founder and chairman at Andrew Lucas London. "Although some of these are justifiable (it's good to have your network switch always on, for example), an installer might be able to optimise the programming of the control system so that devices that aren't being used are automatically turned off."

Even if some devices need to remain on at all times, they can often be maintained more efficiently. A well-designed rack includes both natural ventilation as well as effective airflow management so that cold air is taken in and hot air expelled quickly from the unit rather than allowed to circulate.

This is an area of the home that generally needs to be left to a specialist; as such, it is always worth approaching a home technology provider to see whether anything can be done to reduce any unnecessary energy use in a home's rack without compromising on device performance.

Unless you are looking to build that cabin in the woods, thinking about IT, power and smart technology provision before starting to design a home is a sensible idea. Homes that are designed to adapt to both environmental and technological changes will be better at providing a platform for sustainable, carbon-neutral dwellings going forwards.

89% OF ADULTS IN THE UK USED THE INTERNET IN THE PAST THREE MONTHS

ONE IN FOUR CONSUMERS IN THE UK NOW OWN AT LEAST ONE SMART DEVICE

LEGACY SMART HOME POWER WASTAGE CAN BE UP TO 10% OF TOTAL CONSUMPTION

BUILDING GREEN POWERED HOMES

A few years ago, the idea that sustainable energy sources could supply more than a fraction of the country's power requirements was laughable. Since then technology has progressed at a startling rate. 21st April 2017 was the first working day without any coal power in the UK since the start of the Industrial Revolution[9], while 8th June 2017 saw the first day where more than half of the country's electricity came from renewable sources[10] (this actually rises to 72.1% once nuclear power generation is included).

However, on the latter date only 1% of this energy provision came from renewable energy that had been stored for later use. For renewable energy to become a more reliable (and long-term) solution, more progress must be made on this front.

There are multiple energy suppliers that offer green tariffs (i.e. they pledge to buy at least the amount of green energy as that of the energy demand of these customers). Some of these offer 100% clean electricity tariffs, which they provide through a mix of their own renewable energy sources and third party renewable energy suppliers. One such provider, Good Energy, has calculated that switching to a property to a clean energy supply in this way is enough to halve an individual's personal carbon footprint[11].

Householders wanting to embrace green energy but looking to save on their bills could consider integrating alternative energy generation into their homes. In the UK, there has been a large expansion of the use of photovoltaic systems (also known as Solar PV), particularly in the South West of England, which have been driven largely by Government- and community-backed schemes. The Wadebridge Renewable Energy Network (WREN) in Cornwall[12], which has seen more than a thousand solar micro-installations on properties in the area, is one such example of localised efforts to create a more sustainable energy mix.

Meanwhile, a £1 billion solar energy installation programme for up to 800,000 homes has also been announced by the UK Government[13], which will see low-income social housing supplied with cheaper, cleaner energy.

As the technology evolves, the price of installing solar panels is beginning to fall, and there are signs that the next generation of solar power for the home could be on the way. Electric car giant Tesla's solar roof tiles, when combined with a pair of the company's Powerwall solar storage units, promise to be able to power a whole three-room house for a full day, reducing a home's reliance on purchasing more expensive power from the grid.

As well as solar panels, localised wind turbines, ground source heat pumps and – in some cases – micro-hydroelectricity systems might also be an option for homeowners looking to generate their own power at home.

EFFICIENT HOME DESIGN

Lighting, heating and shades are a fundamental part of any home's design, and how they are integrated into a property will go a long way towards whether or not a building is a eco-friendly place to live in.

An efficient smart lighting system is one that only illuminates the areas of the property that are needed at any given time. Traditional lighting schemes put the onus on residents to physically switch a room's fixtures on and off as they need them; this means energy is wasted unnecessarily if they forgets to turn off a light when leaving a room.

Another way that lighting can be made more energy efficient is the introduction of 'rollback' functionality i.e. where a lighting fixture dims slightly over time. While this reduces the amount of energy in the room, this keeps the room bright enough and happens slowly enough that anyone present in the room won't be aware that it is happening.

Occupancy and vacancy detectors are both useful devices to implement in an energy-saving smart home. Both perform a similar function (i.e. turning lights on or off automatically), although they do this in slightly different ways.

An occupancy sensor recognises when someone enters and leaves the room, and switches on and off accordingly. A vacancy sensor, meanwhile, will also turn off when motion is no longer detected, but the light will need to be switched on manually when the occupant enters the room. The latter is more environmentally friendly, as it means that artificial lighting is only activated when required, as opposed to whenever someone enters the monitored space.

This type of sensor can be tricky to set up, as it will need to be sensitive enough to detect someone performing a largely stationary activity, such as reading a book or watching television. Units such as Lutron's sensors with proprietary XCT signal processing technology[14] are able to identify this type of 'fine motion' activity can be identified, meaning that the lights won't turn themselves off at an inconvenient moment. Likewise, a system that incorporates ambient light sensors

FEATURES OF THE GREEN SMART HOME

guarantees that lights will come on only when illumination levels in a room drop below a certain level, rather than always coming on every time someone walks into a room.

Motion sensors can also be incorporated into heating systems, automatically turning on energy-saving mode if no presence has been detected for a prolonged period. For properties in hot climates, having south-facing shades or awnings mechanised means they can be set to extend or descend when the sun reaches a certain point in the sky, which reduces the demand on the property's air conditioning system during the day.

Thanks to high-profile companies such as Nest and Hive, the smart thermostat is now one of the best-known elements of the smart home. These add a layer of intelligence to your heating systems, allowing the user to create set points and keep their homes at a comfortable temperature during certain times of day. Some systems go further than this and introduce an element of intelligent learning, where the unit becomes accustomed to a household's daily habits and begins to program itself to suit those living there.

For larger properties, smart thermostats allow homeowners to zone their property, so that different areas of the home are only heated when they need to be. By programming the system so that the temperature is reduced in rooms that aren't needed at certain times of day (for example, communal areas during the night), a home can be made more energy efficient, without the need for constant management on the part of the user.

In some cases, a more comprehensive solution is needed. Adding smart radiator valves a smart home control system makes room-by-room heating control possible, even if you only have a single zone heating system (a common problem in many existing homes). Integrating a more advanced heating system (such as Heatmiser) takes this one step further, allowing you to fully integrate your HVAC with the rest of the smart home.

Heating, ventilation and air conditioning (HVAC) systems in the home are also make-or-break decisions that can vastly affect the property's overall energy bills. Radiant heating systems (i.e. in-floor or in-wall) are generally considered to be more efficient that radiator-based units, while ground source heat pumps can optimise the heat distribution in the home, generally costing no more than gas-powered central heating while improving the home's green credentials.

GREEN BUILDING MATERIALS

Implementing green smart technology into the home can go a long way towards creating a more sustainable property, but it is most effective when the house itself has been designed with energy efficiency at its core. By aligning buildings and positioning windows to make the most of prevailing winds, natural light and heat from the sun, the energy and artificial lighting needs of the house can be greatly reduced. Additionally, the materials used in construction also play a big part in ensuring that the home is well-insulated and retains heat effectively.

Windows are far more fundamental parts of a home's design than might be imagined; a glass window will either lose or gain up to ten times more heat than a similar sized wall[15]. Many modern buildings designed with increasing amounts of glass to let in as much natural light as possible, which makes it crucial where you place your windows, what coatings (if any) are used and what shading options are selected. These elements are critical to ensure a property will warm up naturally whenever possible, but will also retain heat during winter months.

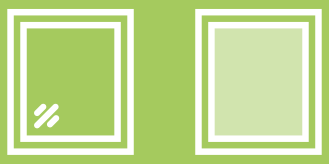
Thermally-insulating coating can reduce the rate of heat loss, while south-facing windows might benefit from solar control glass which reduces the rate of heat absorption. While still in its very early stages, 'smart windows' using electrochromic (EC) glass, which transitions between clear and tinted states, is anticipated to become a $3 billion market by 2020[16]. While there are multiple potential markets for this product, including the aerospace and automotive industries, the use of EC glass in residential and commercial buildings is expected to be one of the largest growth areas for this technology.

Another way that the built form and orientation can help save energy is to create more efficient passive insulation and heat flow through the building. The Passivhaus standard, which is being used in more than 30,000 buildings worldwide, is designed to create low-energy buildings that require almost no additional heating or cooling beyond that which occurs naturally in the property.

A Passivhaus follows five specific principles – continuous insulation to avoid thermal bridging (where heat drains from an uninsulated section), an airtight building envelope, high-performance windows, a heat- and moisture-recovery system and, where possible, carefully managing solar gain to increase the amount of natural light and heat present in the winter and reducing it in summer.

Passivhaus is by no means the only green building standard that can be applied to the home – others include Leadership in Energy and Environmental Design (LEED) and the International Green Construction Code (IgCC) – but ensuring that your home is designed in line with a green standard can help point towards the the materials and systems that will be most appropriate for your property.

A WINDOW CAN LOSE/GAIN TEN TIMES MORE HEAT THAN COMPARABLE WALL SPACE

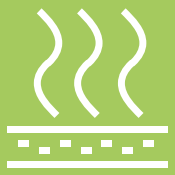


ELECTROCHROMIC (EC) GLASS COULD BECOME A $3BN MARKET BY 2020

THE PASSIVHAUS STANDARD HAS BEEN APPLIED TO 30,000 HOUSES WORLDWIDE

MOST PASSIVE HOUSE CONSTRUCTIONS HAVE BEEN IN EUROPEAN COUNTRIES

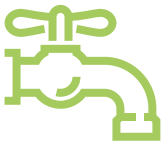
SOUTH-FACING PROPERTIES WILL GET THE MOST SUNLIGHT THROUGHOUT THE DAY



26% OF ENERGY USED IN UK CURRENTLY GOES ON SPACE HEATING

WATER MANAGEMENT

Water might be an essential service for homes, but it's one that is slowly becoming more expensive. Average UK water and sewerage bills have risen by 40 per cent above the rate of inflation since 1989[17] and have gone up by 2% year-on-year between 2016 and 2017[18]. Finding ways to reduce excess water consumption, or finding ways to use this water supply more efficiently.



SINCE 1989, WATER AND SEWERAGE BILLS IN THE UK HAVE GONE UP 40%

While still a fairly new concept for the residential market, smart water valves are set to become a useful tool for households looking to reduce their water consumption. These can compress excess amounts of air in the water pipes, which can vary hugely over time. Water pressure and flow can also be regulated using these devices – particularly useful in cities where water pressure tends to be higher.

Smart valves can also monitor for leaks and pipe bursts, potentially significantly reducing water wastage in these scenarios by either providing an early warning to homeowners or even containing the issue by turning off the water supply until it can be dealt with.

UK RESIDENTS PAY 2% MORE FOR THIER WATER SUPPLY THAN LAST YEAR

Beyond smart valves, rainwater harvesting (RWH) measures might make a positive impact on overall water and energy consumption. As more than a third (36%) of all water use in the UK is used for greywater applications[19] (i.e. flushing toilets or watering the garden), it makes sense that if rainwater can be resused rather than a fresh water supply, it should be; in fact, the UK Environment Agency suggests that: "Exploring ways to reduce demand for mains water is essential to ensure a sustainable future for water resources."[20]

As well as reducing demand for mains water supply, an RWH system reduces the threat of flooding and pollution by reducing the amount of water flowing through drainage systems during heavy rain.

MORE THAN A THIRD OF WATER USE IS ON GREYWATER APPLICATIONS

How effective a rainwater harvesting system will be depends largely on where you live, as areas that receive more rain will be able to collect more water. Generally, a rainwater collection tank should be around 5% of the average rainwater supply for the region it's installed in, which allows for all but the most extreme weather events.

The above systems should not necessarily be implemented in isolation. The UK Environment Agency recommends that systems such as rainwater harvesting should be used as part of a 'reduce, reuse and recycle' strategy, including devices such as low-flush toilets to reduce water use.

CONCLUSION:
CREATING A GREEN SMART HOME

As the energy landscape of the UK changes, our homes will need to adapt accordingly to reduce our environmental impact. By building our current generation of houses along sustainable lines with smart technology and intelligent design, energy bills and carbon impact can be reduced significantly.

While heating, lighting and water supply are obvious areas where energy savings can be found through smart technology, there are other areas that could be optimised, such as window treatments and the management of electricity-intensive technology such as home entertainment systems and kitchen appliances.

For new build projects, making a home smart and energy efficient is a relatively straightforward task, as the property can be designed and wired with the required technology in mind (and green standards such as Passivhaus applied to the build). With pre-existing properties, however, this can be trickier due to the limitations of the property – uneconomical layouts, wasteful heating systems and the construction material used can all play a part in reducing a house's potential energy-saving ability.

In both cases, smart technology and green building principles can be applied hand-in-hand and, when applied properly, can complement each other to create ultra-low energy residential environments to live in. While building net-zero-carbon properties might seem challenging (Not including the increased expenditure it requires in the short-term), the benefits to both individual homeowners and society at large are significant.

As a growing population means already limited resources such as electricity and water must be balanced on an ever-finer knife edge, green smart buildings offer a blueprint for an urban environment that enables us to live cleaner, more comfortable lives while retaining all of the contemporary benefits of modern life.

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ABOUT ANDREW LUCAS LONDON

Andrew Lucas London believes in enhancing lives through technology. Long-term stalwarts in the custom install industry, the business specialises in highly intelligent smart homes that enhance our clients' lifestyles. All of our projects are based upon five key principles: that the smart homes we create must be green, secure, effortless, beautiful and genuinely intelligent.

Andrew Lucas London also runs a virtual reality design consultancy, **Andrew Lucas Studios**, which creates photorealistivc animated VR and AR experiences for creative, commercial and residential projects

This publication has been written in general terms and thus should not be relied on to cover specific situations; the application of the principles set out will depend upon the specific circumstances involved, As such, it is recommended that professional advice is sought before acting (or not acting) on the contents of this publication.

Andrew Lucas London would happily offer advice to readers on how to apply the principles set out in this publication to their specific circumstances. Andrew Lucas London accepts no duty of care or liability for any loss occasioned to any person acting or refraining from action as a result of any material in this publication.

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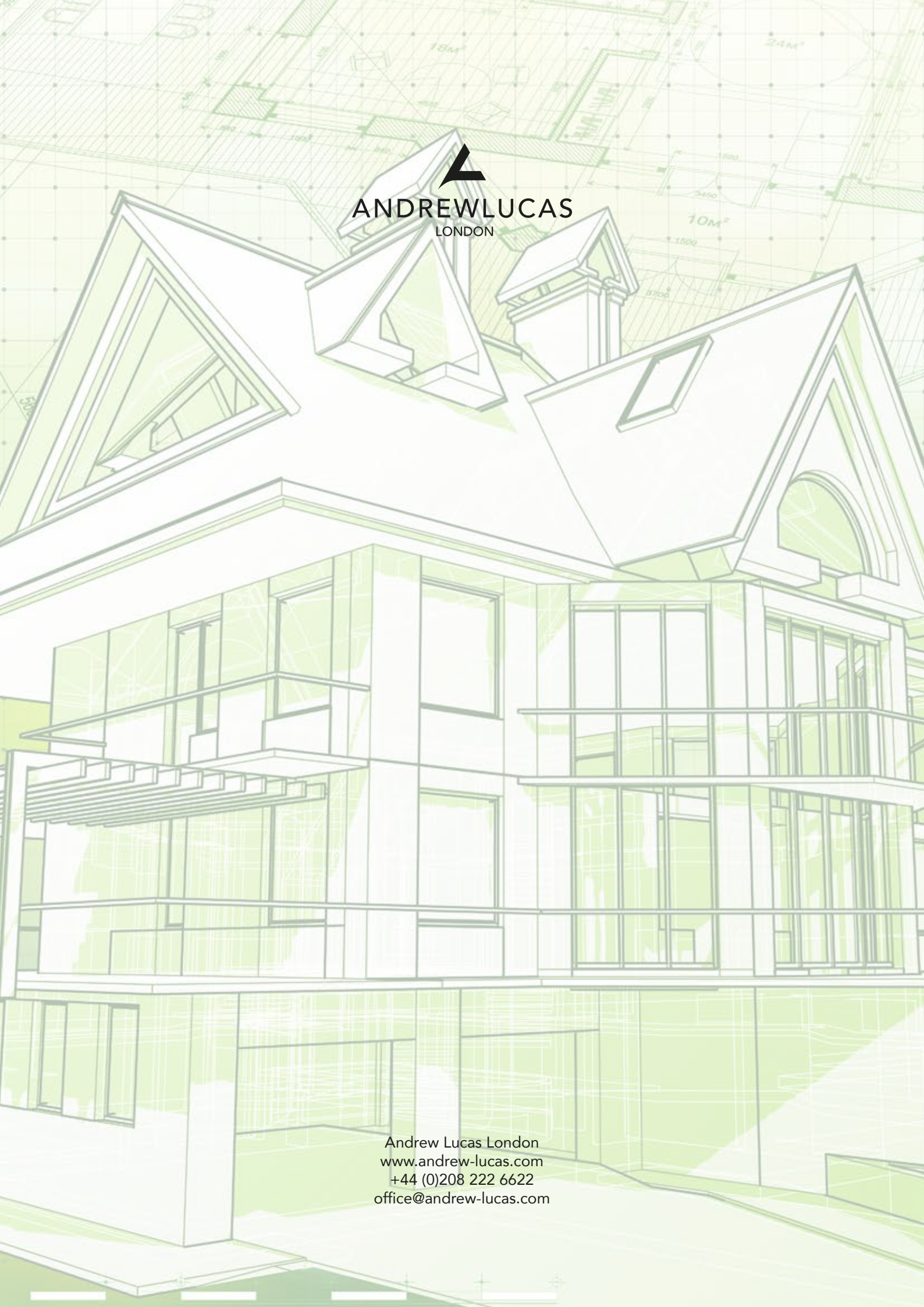

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