Sustainable Buildings Monitor

Charting a net zero legacy for our cities, towns and communities

ISG's research and insight report
Understanding the UK's built environment emissions

The built environment has a critical role to play if the UK is to become carbon neutral by 2050. It's all about sustainable spaces.

ISG's Sustainable Buildings Monitor

ISG's Sustainable Buildings Monitor provides data on the regional variations in the carbon emissions and energy consumption due to the operation of commercial buildings across the UK.

By understanding the data, we can better support those parts of the UK that have the most work to do in cutting the carbon emissions associated with their building stock, and provide help in improving the energy-efficiency standards of these buildings.

Together, we can take radical steps on the journey to securing a net zero legacy for our cities, towns and communities.

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Foreword

As we emerge from the COVID-19 crisis, the eyes of the world will turn towards the UK to take a leading role in solving an even bigger crisis. In November 2021, the UK government will host the COP26 climate summit in Glasgow. Buildings will be an area of focus; in the UK buildings are responsible for 39% of energy-related CO_2 emissions, and therefore have a major role to play in enabling the UK to meet its 2050 net zero carbon goal.

The UK's property and construction sectors are stepping up to the challenge, and we echo this report's sentiment that collaboration is the only way to solve this shared responsibility. Another crucial component is data, as time and capital are limited, and the net zero challenge is complex. This report helps shine a light on the geographical and sector disparities in the scale of the challenge, as well as how improved data would enable greater analysis and more targeted solutions.

UKGBC's Advancing Net Zero programme is helping to drive the transition to net zero carbon buildings, including through its publication of the Net Zero Carbon Buildings Framework Definition in 2019. We have also convened a diverse set of stakeholders from across the built environment to create a Whole Life Carbon Roadmap for the UK, which will be launched at COP26. It will deliver a common vision and agreed actions for achieving net zero carbon in the construction, operation and demolition of buildings and infrastructure.

We welcome this report from ISG, which provides a useful and timely contribution to the industry's work to improve data, targets and action across our different built asset types.

The UK's property and construction sectors are stepping up to the challenge, and we echo this report's sentiment that collaboration is the only way to solve this shared responsibility.

Alastair Mant, Director of Business Transformation, UK Green Building Council (UKGBC)

UK GBC
Together for a better built environment

The road to envisioning a net zero carbon future

The upheaval caused by COVID-19 has reverberated across all four corners of the world. Amid all the pandemic-induced change and confusion, one of the few issues that has remained topical throughout is the impact we continue to have on our environment.

Many view the COVID-19 pandemic as an opportunity to reset and assess the impact we are having on the planet – an opinion that moved beyond mere rhetoric in 2020, as environmental, social and governance (ESG) stocks outperformed the wider stock market, and led many to speculate that the COVID-19 recovery could in fact be a green one.

We saw how quickly things can change. Enforced lockdowns, travel restrictions and a dramatic reduction in social and economic activity quickly reduced carbon emissions, brought cleaner air back to our cities and biodiversity flourished in our waterways. Our priorities changed as we put people first, championed well-being, and reminded ourselves of the importance of nature.

Before the pandemic hit, the UK government had committed to reducing net emissions of greenhouse gases to zero by 2050 – a target that forms the legal basis of the UK's attempts to support the long-term goal of limiting global temperature increases to below two degrees Celsius, as set out in the Paris Agreement*. In April of this year, the UK government went yet further and will now set into law the world's most ambitious climate change target, to cut emissions by 78% by 2035 compared to 1990 levels. We now have less than 14 years to reduce carbon emissions by over three quarters of current levels.

If the COVID-19 pandemic has taught us anything, it is that coming together as a global community means we can solve the big problems that our world faces. For some, the route includes temporarily purchasing carbon offsets, and for others, it involves going straight to the ultimate solution of achieving the required energy-efficiency performance in the operation of their buildings.

There is no doubt that the built environment has a crucial role to play in lowering emissions and hitting these carbon reduction targets. Transforming the energy efficiency of the buildings that form the fabric of our cities, towns and communities will be a key component if we are to cut the level of energy consumption to that required to reach net zero carbon in the UK.

To envision a brighter, more sustainable future for our planet, we have a collective responsibility. We must embrace the care and togetherness that defined our human response to the COVID-19 pandemic. We must seize the moment. We must make good on bold pledges. We must act.

ISG's Sustainable Buildings Monitor uses data to assess the regional variations in the emissions produced by commercial buildings across the UK to better understand the quantum of the challenge we face as a society in achieving our ever-more-stretching carbon-reduction targets.

This analysis also serves as a broader rallying call for greater collaboration and consensus on establishing universal data collection and common standards, to accurately chart and benchmark the progress of the UK's efforts at achieving carbon neutrality.

To envision a brighter, more sustainable future for our planet, we have a collective responsibility.

Using publicly available information, regional estimates of the emissions and energy consumption generated by business activities are compared with commercial property stock location. The Sustainable Buildings Monitor has therefore been created in two parts – an Emissions Intensity Index and an Energy Intensity Index.

Debbie Hobbs, Group Director - Sustainable Business, ISG

* See note on page 21.

Emissions Intensity Index

According to the International Energy Agency (IEA), a quarter of global CO_2 emissions came from buildings in 2017. From this data, it is apparent that reducing emissions emanating from the property sector must form a central pillar of any successful carbon reduction plan.

Everything from the way a building is designed, to the materials used throughout the structure, can have a sizeable effect on the whole-life carbon footprint of a building. However, it is the way in which a building is operated that can often have the biggest impact, on both the lifetime energy performance of the property, and the carbon it generates.

Understanding that 80% of the buildings that will exist in 2050 have already been built, recognises that this is a challenge primarily focused on the refurbishment and retrofit of current building stock. Indeed, the case for reimagining and adapting existing structures may become even more compelling as the bar is raised for sustainable compliance in new build projects.

Increasingly, the environmental calculus will focus on whether the balance of superior new build energy performance can be successfully weighed against the cost of the carbon impact of new materials, the ability to successfully transform and adapt existing structures, and the process of construction itself.

Data for the Emissions Intensity Index is derived from carbon emissions statistics produced by the Department for Business, Energy & Industrial Strategy (BEIS) for each local authority in the UK.

It assesses the emissions performance of an area's typical commercial property, so only a subset of these statistics is considered covering the emissions produced by industrial and commercial use of gas and electricity. This excludes some large industrial sites, transport and domestic emissions, as well as the use of other fuels (e.g. coal).

Since not every area has the same number or type of businesses, the results presented are standardised per square metre of commercial floorspace recorded in the same location, for comparison purposes.

There are a range of factors that feed into the level of CO_2e emissions produced by the commercial sector. These include the energy efficiency of a building's fabric and systems, the energy source being used, and crucially, how the building is operated and maintained. Progress will be necessary on all these fronts to achieve a meaningful and sustained reduction in the CO_2e emissions generated by commercial buildings.

Table 1: Regional ranking of emissions efficiency index

#	Region	Total tCO_2	Total floorspace (thousand m^2)	kg CO_2/ m^2
1	**Scotland**	7,249,656	59,521	**122**
2	**Wales**	4,320,810	40,021	**108**
3	**London**	10,200,242	100,715	**101**
4	**North East**	3,555,837	36,154	**98**
5	**Yorkshire and the Humber**	7,623,363	84,388	**90**
6	**North West**	9,821,079	111,306	**88**
7	**East**	6,676,145	77,839	**86**
8	**South East**	8,816,213	103,394	**85**
9	**East Midlands**	5,953,011	70,990	**84**
10	**West Midlands**	6,766,818	89,105	**76**
11	**South West**	5,542,230	76,158	**73**
	GB total**	**76,525,404**	**849,591**	**90**

Source: Valuation Office Agency, Scottish Assessors, BEIS, CEBR calculations

** Lack of public data on commercial property in Northern Ireland means we have not been able to estimate emission efficiency coefficients for Northern Ireland.

Energy Intensity Index

To reach zero-carbon targets, the global community needs to reduce building energy consumption by over 80%. If the UK is to match zero carbon energy generation with consumption trends by 2050, all regions, industries and sectors need to reduce their current levels of energy consumption.

In line with the Paris Agreement* and the UK's goal of becoming carbon neutral by 2050, the UK Green Building Council (UKGBC) has released a Net Zero Carbon Buildings Framework, which is designed to provide clarity and guidelines for the construction sector on how to reduce its carbon emissions by the 2050 target date.

The core measure of energy intensity used by the UKGBC reflects a set of science-based targets. In this context, a target is defined as 'science-based' if it is developed in line with the scale of emissions reductions specified in the Paris Agreement*, i.e. the level required to keep global warming below two degrees Celsius from pre-industrial levels.

The Sustainable Buildings Monitor is aligned with the UKGBC operational efficiency target, which represents the total reduction in energy demand required for UK building stock to meet the goal of net zero emissions by 2050.

These targets for the operational efficiency of buildings are measured in kilowatt hours of electrical energy equivalent (kWhe/m^2) to align with the UKGBC view of the UK's capacity to generate zero-carbon power in the future. The UKGBC has formulated a zero-carbon power target of 374 terawatt hours of electrical energy equivalent (tWhe) to be generated in the UK by 2050 – well below our current energy consumption levels which stand at 944 tWhe.

For example, in offices, the UKGBC is targeting a reduction in operational energy use to 70 kWhe/m^2 of the net lettable area in the 2035-2050 period. This compares to an estimated level of energy efficiency for the median office of 233 kWhe/m^2 in 2019, reflecting a required reduction of 70%.

The Energy Intensity Index is designed to measure energy use in typical commercial properties, as well as the role of buildings in driving energy consumption. As a consequence, the Index focuses on consumption of gas and electricity by industrial and commercial users, excluding transport and domestic use as well as some large industrial installations and other fuel types. In the data, the total consumption of gas and electricity by industrial and commercial users in England, Scotland and Wales reached 350,828 GWh. Due to the different carbon intensity of electricity from other fuels, the Better Buildings Partnership (BBP), a group of leading UK commercial property owners that are working together to improve the sustainability of existing commercial building stock, suggests applying a scaling factor of 0.4 to gas consumption, to produce the electrical energy equivalent value used by the UKGBC. This brings total gas and electricity consumption to 241,225 GWhe.

When the total energy consumption is split across an estimated 849.6 million m^2 of floorspace, the average energy intensity across England, Scotland and Wales stands at 284 kWhe/m^2. A regional breakdown of this measure shows that the energy intensity of buildings varies between an average of 236 kWhe/m^2 in the South West and 370 kWhe/m^2 in Scotland.

Table 2: Regional ranking of average energy intensity score

#	Region	Energy consumption million kWh_e	Floorspace million m^2	kWh_e/m^2
1	**Scotland**	22,050	59.5	**370**
2	**Wales**	13,780	40.0	**344**
3	**London**	33,416	100.7	**332**
4	**North East**	10,978	36.2	**304**
5	**South East**	29,019	103.4	**281**
6	**East**	21,346	77.8	**274**
7	**Yorkshire and the Humber**	22,954	84.4	**272**
8	**North West**	29,793	111.3	**268**
9	**East Midlands**	18,672	71.0	**263**
10	**West Midlands**	21,216	89.1	**238**
11	**South West**	18,001	76.2	**236**
GB total**		**241,225**	**849.6**	**284**

Source: Valuation Office Agency, Scottish Assessors, BEIS, CEBR calculations

** Lack of public data on commercial property in Northern Ireland means we have not been able to estimate energy efficiency coefficients for Northern Ireland.

* See note on page 21.

Indicative 2021 perspective

Underlining the message that we must prioritise the agreement on consistent and timely measurement of data to enable effective benchmarking of performance, this report recognises the significant contribution of green energy generation in the period since 2017.

The rapid decline in the use of coal to generate electricity and the contribution of renewable sources, including major new on- and off-shore wind farms coming on stream – such as Hornsea One in the North Sea, which in 2019 became the largest wind farm in the world, has transformed the emissions intensity of electricity. The net result has seen a reversal in the relative emissions intensity of electricity v gas over the past four years. Based on preliminary estimates published by BEIS on the level of emissions emitted by power stations and the amount of electricity consumed in 2020, our research estimates that the carbon intensity of electricity in 2020 was approximately 0.18 $KTCO_2$ per GWh, compared to a figure of 0.25 in 2017 (which the figures presented in this report are based on).

This transformation of the UK's electricity generation will have had an impact on the relative level of emissions generated in different parts of the UK. In the rankings presented in this report, regions with a higher reliance on electricity, holding all else constant, are shown to have a relatively higher level of emissions. This is due to the fact that in 2017, the carbon intensity of electricity was higher than it was for gas. Were the UK's electricity mix in 2017 to have resembled what it is today, regions such as London and the South East, with a higher reliance on electricity, would have performed better in the regional rankings.

Table 3: Movements in the Emissions Intensity rankings if the lower carbon intensity of electricity in 2020 is applied to 2017 data

Region	Regional ranking of emissions intensity (2017)	Illustrative regional ranking of emissions intensity in 2017 with the carbon intensity of electricity in line with 2020 levels
Scotland	1	1
Wales	2	2
London	3	4
North East	4	3
Yorkshire and the Humber	5	5
North West	6	6
East	7	7
South East	8	9
East Midlands	9	8
West Midlands	10	10
South West	11	11

Source: BEIS, CEBR calculations

The limited change seen in regional rankings, when the impact of 'cleaner' electricity is factored into the equation, further highlights the need for a proactive response to the consumption and emissions challenge. Cleaner energy inputs cannot alone change the prevailing narrative, with urgent action required to reduce energy demand through smart retrofit solutions and exemplar new build schemes, alongside enhanced maintenance regimes to optimise operational efficiencies and bringing renewable energy supplies on stream.

Results interpretation

Despite the absence of formalised targets for the majority of our sectors, the data is clear that there is a significant gulf in how UK regions need to respond to hit 2050 net zero targets.

While the relative density and type of commercial buildings in each UK region undoubtedly has an important impact on their ranking in both indices, the data also shows that the energy efficiency of buildings and the proportion of newer v older properties are also key factors, as is over-reliance on one source of energy over another.

The relative paucity of data makes comparisons difficult, and even when we look at the median energy-efficiency data for standard offices as a benchmark, the Index shows a wide disparity, which can be explained through its composition of a wide range of property types and industry sectors. Indeed, offices use less energy relative to their floorspace than many other property types. Figure 1 presents benchmark data from the US which shows that properties in the hospitality, health and retail sectors often require significantly higher energy consumption to operate.

The regional industrial mix and building quality both factor into the final Energy Intensity Index. For example, Scotland is an outlier in both the Emissions Intensity Index and Energy Intensity Index. While Scotland stands out in having a separate source for floorspace data to English regions and Wales, crucially, it also has a different sectoral mix.

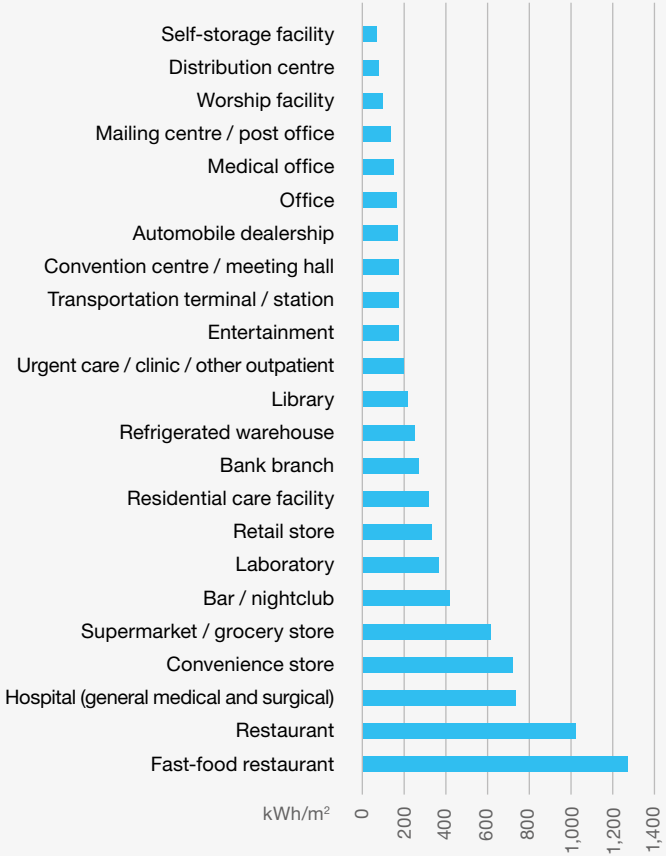
A higher proportion of businesses in Scotland operate in the hospitality sector, with 4.5% of Scottish firms providing accommodation and food services, compared to just 3.3% in the rest of the UK. Meanwhile, some low energy intensity office-based activities, such as real estate or information and communications, are less well represented in Scotland's business demography. Notably, the proportion of Scotland's businesses and employment involved in the mining and power generation industries is far higher than the UK average.

The high Emissions Intensity Index and Energy Intensity Index scores for Wales may also reflect the mix of business types. For example, a higher than average proportion of employment in Wales is found in the manufacturing sector (15%) compared to the UK average (10%), which might point to higher energy requirements.

The size of Scotland's businesses may also affect the energy intensity of the buildings they use. Scottish businesses are more likely to be small, with 28% employing between one and 49 people, compared to a UK average of 24%. These businesses may well require a different type of commercial space to the sole traders or medium / large firms that constitute a larger share of UK businesses.

Finally, the average temperature is lower in Scotland, where the Met Office recorded an average of 7.7 degrees Celsius for the 2010-2019 period, compared to the UK average of 9.2 degrees Celsius. Although energy consumption statistics do adjust for fluctuations in weather conditions over time to establish the underlying trend in energy demand, locations with lower temperatures will tend to generate a consistently higher level of energy demand.

Figure 1: Selected property types, median energy use in the US kWh/m²



Source: Energy Star, benchmark median Energy Use Intensities, converted to kWh/m²

Results interpretation

Positional changes between the Emissions Intensity Index and the Energy Intensity Index are caused by the variance in gas-to-electricity consumption ratios. This is because there are differences in the level of carbon emissions assumed to be produced by a given level of energy consumption. The Energy Intensity Index converts energy consumption to kWhe using the BBP's recommended scaling factor of 0.4 for gas consumption. For the emissions data, BEIS applies an estimate of carbon intensity per fuel that applies a ratio of 0.73 between gas and electricity consumption. This means the consumption of gas is penalised by comparison on the Emissions Intensity Index. As reflected in Table 4, Yorkshire and the Humber has the highest gas-to-electricity consumption ratio of all regions, and rises from seven on the Energy Intensity Index to five on the Emissions Intensity Index. Conversely, the South East has the lowest gas-to-electricity consumption ratio, and falls from fifth on the Energy Intensity Index to eighth on the Emissions Intensity Index.

As highlighted, there are a broad range of factors that impact an area's emissions performance. Figure 2 reflects the varying industrial mix between regions as one contributing factor impacting the performance in the indices.

Table 4: Gas-to-electricity consumption ratios by region

Region	Gas-to-electricity consumption ratio
Yorkshire and the Humber	1.5
North West	1.4
Scotland	1.4
North East	1.2
West Midlands	1.1
East Midlands	1.1
Wales	1.0
East	1.0
South West	0.9
South East	0.8
London	0.8
GB	1.1

Source: BEIS, Sub-national total final energy consumption data, 2017

Figure 2: Breakdown of gross value added (GVA) by industry for each region

	Production sector*	Construction sector	Service sector (office-based)**	Service sector (non-office-based)***
Yorkshire and the Humber	18%	6%	37%	38%
North West	18%	6%	39%	37%
Scotland	17%	6%	41%	36%
North East	20%	6%	38%	36%
West Midlands	20%	6%	36%	38%
East Midlands	22%	7%	33%	39%
Wales	22%	6%	36%	36%
East	15%	9%	40%	36%
South West	16%	7%	42%	35%
South East	12%	7%	47%	35%
London	3%	5%	65%	27%

Source: Office for National Statistics (ONS)

* The production sector includes agriculture, mining, manufacturing and utilities.
** The office-based service sector is defined as information and communication, professional services, financial services, real estate, administrative and support service activities, and public administration and defence.
*** The non-office-based service sector includes wholesale and retail, accommodation and food services, transportation and storage, education, human health and social work, and arts, entertainment and recreation.

Sector innovations

Reducing energy consumption is now a universal driver for every UK region – as it is for every industry sector – and the scale of this challenge can vary significantly. Industries cluster in preferential locations that provide commercial advantage – from access to a highly skilled localised workforce, to proximity to multiple transport nodes, access to large bodies of water for free cooling, or abundant energy supplies.

This brief insight shines a spotlight on how some of our most influential sectors and organisations are innovating to tackle the net zero challenge head on.

Our industry's challenge is to support the growing need for greater capacity among many sectors, while working collaboratively to reduce the environmental impact of building at scale and pace.

Sector innovations

Spotlight on... offices

The global pandemic has normalised the concept of working from home for a broad cross section of society. Our 'The power of place' research has established that a blended pattern of office and home-working is now predicted for a significant proportion of workers, but the message is clear that the office still plays an invaluable role in our productivity and the attraction and retention of talent.

Although the comparative scale of the challenge for offices to reduce their carbon emissions is not as great as other sectors, the ubiquitous nature of the office across the UK suggests that transforming our property assets to perform better is a matter of priority.

CISL: A world-first sustainable office retrofit

The sector is starting to seriously embrace the retrofit agenda, and ISG's project for the University of **Cambridge Institute for Sustainability Leadership** (CISL) headquarters in Cambridge, UK, will set new standards for low energy use, carbon emissions, its impact on natural resources, and user experience and well-being.

Spotlight on... education

The UK's world-leading education sector has long had a reputation for innovation and has demonstrated its resilience and ability to adapt in the testing circumstances of recent times. Now more than ever, we need to provide sustainable spaces that support the future of these vital institutions, and the role they play in supporting the ambitions of both domestic and international students.

In England and Wales, the 41,000 properties recorded by the Valuation Office Agency (VOA) in the education sector account for approximately 2.1% of the UK's 1.9 million total non-domestic building stock. The vast majority of these properties are schools (26,000) and nurseries (12,000), with further education colleges (1,400) and universities (1,000) making up the majority of the remaining building stock.

According to BEIS, excluding transport energy consumption, the education sector accounted for 2.8% of the UK's total energy use in 2018, or 26,910 GWh. After also excluding domestic buildings, the sector accounted for 5.7% of UK energy use.

The discrepancy between the proportion of educational properties and their energy use is in part due to the scale of buildings in the sector. In 2015, BEIS estimated that in 2014-15, floorspace in the education sector was 10.2% of total non-domestic floorspace (80 million m^2) in England and Wales. The same study by BEIS indicated that educational buildings had a median energy intensity of 191 kWh/m^2.

Despite accounting for just 0.1% of non-domestic properties, universities used 8,307 GWh of energy in 2018, equivalent to 0.9% of total energy use in the UK, outside the transport sector.

Llancarfan Primary School / Vale of Glamorgan Council: One of the first net zero carbon schools in Wales

The project was referenced in the Welsh government's draft budget for 2021 as a key scheme in its bid to move to net zero carbon schools, demonstrating the commitment the Welsh government has in achieving the targets before the 2050 deadline.

Building upon the low-carbon, all-electric solution, the team developed a net zero carbon in-use model. To achieve this, the all-electric model was revised with additional renewables for the school. In-use net zero carbon will be achieved through improved building fabric, maximising solar gain, installing photovoltaic panels and an air-source heat pump. As with the low-carbon model, careful consideration has been taken to select materials that are healthy, have lower embodied energy and are easy to construct and maintain.

Sector innovations

Spotlight on... healthcare

The UK healthcare industry has played a pivotal role in responding to the COVID-19 pandemic, protecting the health and well-being of the population while delivering around-the-clock critical care at the same time. However, with global warming presenting the greatest threat to the health of the planet and population yet, time is ticking. The role of the healthcare estate in being able to respond to the challenges ahead is more crucial than ever.

In the health sector – which includes surgeries, clinics and hospitals (both NHS and private) – the VOA recorded just under 28,000 properties in England and Wales in 2018. This comprised 1,600 NHS hospitals and clinics, 650 private hospitals and clinics, and 25,710 surgeries, clinics or health centres. According to BEIS, the total energy consumption of the UK's health sector in 2018 was 27,814 GWh. Hospitals accounted for 25,639 GWh or 92% of this energy consumption, while health centres accounted for the remaining 2,175 GWh.

According to our estimates, health sector buildings consumed 617 kWh of energy per square metre of floor space, generating 96.2 kg of CO_2e emissions per square metre. This is significantly higher than the levels of emissions per square metre in other sectors, reflecting the long operating hours of medical facilities, the energy intensity of the machinery and equipment involved, as well as a relatively high reliance on natural gas.

Healthcare: Defining a pathway to net zero

The National Health Service (NHS) has already defined a pathway to net zero, which it acknowledges will not be easy and will require significant investment and ambition to achieve. The UK government's commitment to build 40 new hospitals by 2030 will certainly play a role in narrowing this carbon gap if procurement focuses on net zero as a primary driver, however, the biggest challenge is inevitably the legacy healthcare estate.

We will need to design and construct differently – making greater use of Building Information Modelling (BIM) and a Platform approach for Design for Manufacture and Assembly and Disassembly (P-DfMA+D). Procuring with whole-life costs in mind, designing for deconstruction and recovery through nature-based construction solutions and maximising social value outcomes, will all drive the correct behaviours that will normalise our pathway to net zero.

Sector innovations

Spotlight on... logistics and distribution

Logistics and distribution has been a burgeoning sector for many years, but after a year of lockdowns online sales have skyrocketed, and the consequent space race in warehousing is driving a shift in the retail infrastructure.

Ecommerce growth is creating a rise in demand for large warehouses and distribution facilities, located in close proximity to population centres and key transport nodes, to accelerate delivery to customers – speed to market being a crucial competitive advantage for retailers.

Investors are increasingly moving away from measuring the quality of their investments by financial returns alone. In fact, the pursuit of the most-coveted five-star funds increasingly address sustainable considerations beyond the purely economic to include environmental and social, adding further pressure to revolutionise the way they plan their investment portfolios. Key occupiers of these facilities are also setting out their allegiance to sustainable ambitions.

Bericote Properties: Raising the bar on energy efficiency

Commercial property developer, Bericote Properties, set out its bold ambition to create an energy-efficient distribution centre with a record-breaking 3.5 megawatt (MW) solar power array, the highest capacity installation on a building of its kind in Europe. The pioneering ambitions didn't stop there – it will also be the first in its portfolio to rely solely on electricity for its operations.

The net zero carbon ready design:

- The re-design of the building aims to achieve a BREEAM 'Excellent' accreditation, recycling 98.98% of the former power station and operating on a 100% renewable energy tariff – which will be backed by the REGO scheme.
- Maximising the solar generation on the roof, the 3.5MW of photovoltaics will supply circa 30% of forecast building demand.

Sector innovations

Spotlight on... datacentres

Datacentres are the vital infrastructure that enable today's digital society and economy to function. The greatest challenge the sector has faced is around the demand for resilient energy to power and cool the technology housed within datacentres.

According to a 2018 report by UK technology trade association, Tech UK, titled 'Data Centre Energy Use: How Much is Hot Air?', energy is usually the largest single element of operational cost, accounting for 25-60% of total running costs.

Based on our analysis, we estimate that 0.6% of all industrial and commercial energy consumption was attributable to datacentres. Since datacentres need a constant and reliable power supply, many cannot rely exclusively on renewable energy sources, which can be intermittent. To meet the net zero target there is an urgent need to reduce datacentre energy demand through greater efficiency, and improve the reliability of the renewable energy that datacentres utilise.

Datacentres: A sector renowned for its innovation

The sector is renowned for its innovation and adoption of cutting-edge solutions – these are some of the ways it is responding to the climate challenge:

- Free cooling from large bodies of fresh or salt water – and Microsoft's innovative underwater datacentre.
- Quantum computing will potentially reduce the scale of datacentres, but will require greater cooling mechanisms at near absolute zero.
- Battery or hydrogen UPS systems to provide resilient power – moving away from diesel generators.
- The use of hybrid energy mix – hydroelectric, wind,solar, hydrogen, battery – or locating close to wind farms. ISG is working with the University of Twente, which is based in Enschede in the Netherlands, on developing the future of green datacentres with hydrogen fuel cells.

Spotlight on... emerging sectors

Many of the fastest-growing and most innovative brands fall within new and emerging sectors. Born of the accelerating sustainable revolution, organisations within these sectors are evolving and expanding at pace to support the sustainable development of wider industries.

- **Gigaplants** – creating one of the key components of emission-free vehicles, operators of high-tech battery manufacturing facilities recognise the importance of sustainable and ethical construction solutions as integral to their reputational credibility. **ISG will deliver the £2.6bn Britishvolt manufacturing base** in Blyth, UK, which includes the remediation of a former coal power station and the use of free cooling from the North Sea.
- **Vertical farms** – the growth in this sector globally has been driven by absolute control over the growing conditions of produce. Water conservation and careful management of temperature and lighting controls create an intensive use of energy and emissions, but this should be balanced with increased yield and the reduction in 'food miles' carbon emissions from traditionally produced crops.

Key considerations

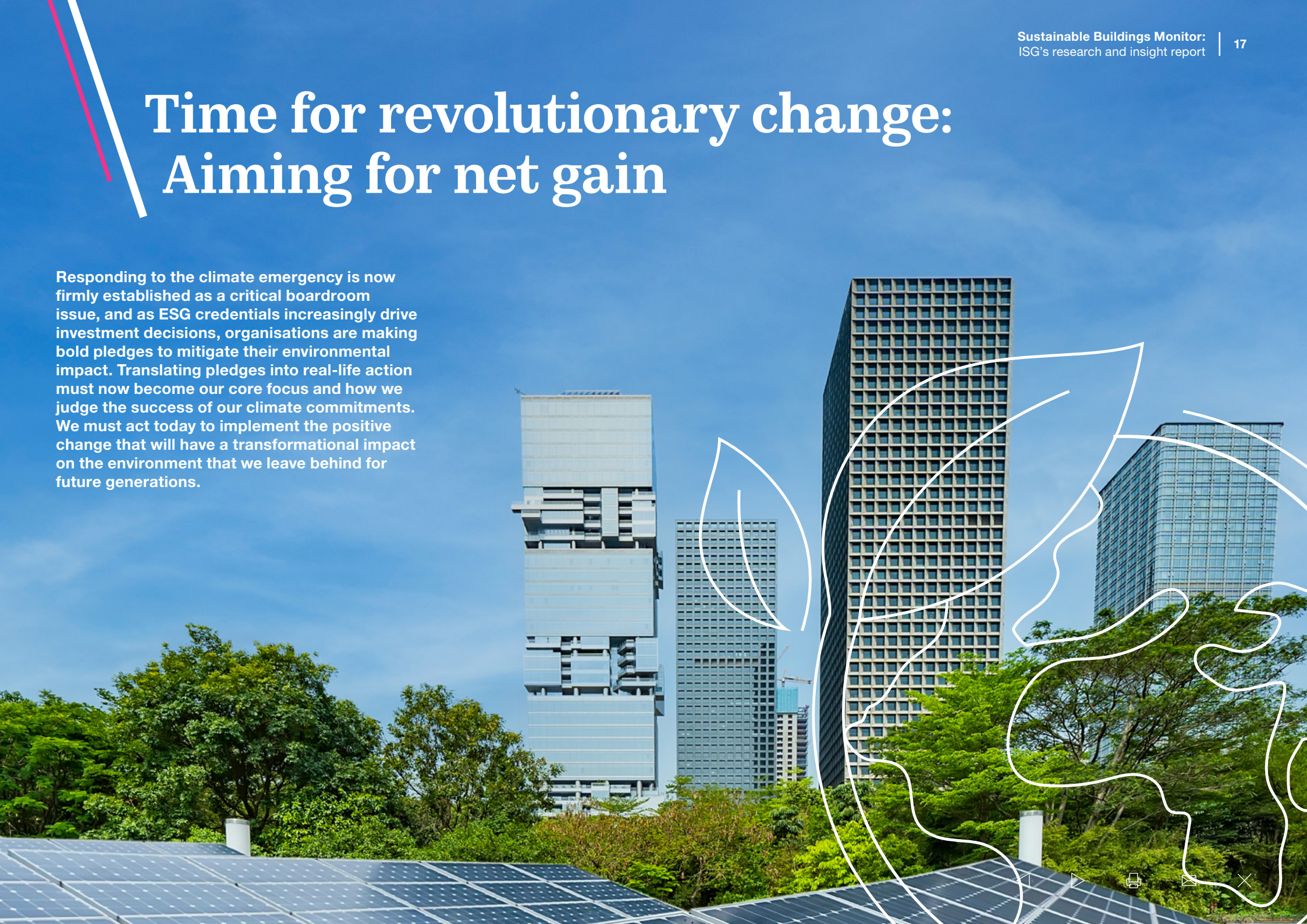
The net zero challenge is complex, with each region and sector facing its own unique challenges and opportunities. It's through effective collaboration, the sharing of knowledge and innovations, and by championing best practice solutions, that collectively we can accelerate our trajectory to hitting net zero by 2050.

It is important to recognise that organisations are operating against a backdrop of wider change, balancing a range of factors that impact future business performance and sustainable goals. There is no one-size-fits-all panacea to this immense challenge, but a focus on carbon reduction as a core driver in spatial planning will help businesses, large and small, navigate a course towards enhanced efficiencies.

- Flexible working necessitated by COVID-19 will have long-term implications on building occupation levels, density ratios and physical presence specifically in high street retail. ISG's '**The power of place**' research strongly indicates that offices will continue to be a central asset for most organisations, however, how space is used will change. Smart technology will increasingly direct office workers to available desks to optimise occupancy levels and environmental conditions across floor plates, and close down unused spaces to reduce energy demand. Buildings without this technology could prove increasingly inefficient to operate, as blended working hours reduces 09:00-17:00 office demand.
- The demand for greater decentralisation of amenities, with many workers wanting more accessible spaces closer to their homes, may drive the case for smaller satellite offices. However, the smaller a company's stake in a building is, the less control it has over its carbon footprint strategy, and it will be sharing the overall building's occupancy with parties that may have different goals. Businesses will have to carefully weigh up and balance their sustainability objectives, and talent attraction and retention goals.
- Should it matter how much energy we consume if that energy is ultimately emission free? The simple answer is yes – demand for power continues to rise and sustainable energy supplies cannot currently provide comprehensive resilience that our networks require. The conversion of natural gas supply networks to hydrogen will be exceptionally costly and isn't seen as practical in the short to medium term without breakthrough innovations. Reducing the energy dependence of buildings through intelligent retrofitting must be a fundamental component of the global response.
- Transitioning an organisation's physical estate to a net zero portfolio is a complex process when taking individual building re-leasing arrangements into account. As the availability of net zero office infrastructure grows, this will help alleviate demand side issues, and create a virtuous cycle of greater incentivisation to retrofit buildings, with demand from tenants for the best-performing spaces.
- Poorly maintained buildings, regardless of age, contribute to a significant proportion of excess energy consumption and associated carbon emissions. Understanding and quickly acting upon building underperformance issues is an important operational step all organisations can make today to enhance operational efficiencies. Technological solutions will facilitate far greater transparency on how our buildings perform, and the commercial imperative will also be driven by enhanced taxation.

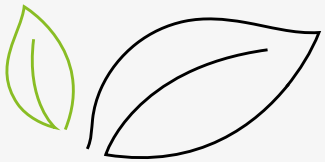
Time for revolutionary change: Aiming for net gain

Responding to the climate emergency is now firmly established as a critical boardroom issue, and as ESG credentials increasingly drive investment decisions, organisations are making bold pledges to mitigate their environmental impact. Translating pledges into real-life action must now become our core focus and how we judge the success of our climate commitments. We must act today to implement the positive change that will have a transformational impact on the environment that we leave behind for future generations.



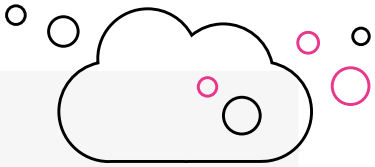
Time for revolutionary change: Aiming for net gain

The aim shouldn't be to minimise damage to the environment, but to ensure that every action we take leaves a net gain to society. With the steps we are taking as a business to commit to a sustainable future, we are dedicated to ensuring that we accelerate this change as soon as we can, by taking our employees, suppliers and contractors on the journey with us. With this ambition, and our stakeholder engagement activities, we are focused on four core areas:



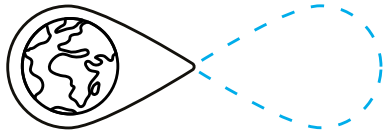
Environmental management

We aim to fulfil our environmental obligations by efficiently managing environmental performance, and taking all reasonable measures to conduct our business activities in a safe and responsible manner. Our objective is to continually integrate the assessment, management and control of environmental issues into the management of our business, to minimise negative impacts to the environment and continually provide positive enhancements.



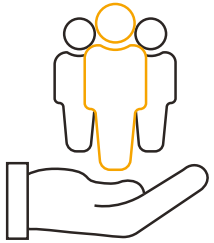
Climate change and carbon

We are committed to helping our clients create buildings in a carbon-neutral manner, and doing our bit by achieving net zero carbon emissions in our operations by 2030. We have established our zero-carbon targets using a science-based target methodology and aim to exceed these, and we will work collaboratively with our supply chain to innovate and implement lower carbon construction practices.



Circular economy

Being a founding programme sponsor of the UKGBC's circular economy strategy, which features comprehensive guidance to promote the practical application of product, material and goods reuse on construction projects, we are committed to assisting clients in creating buildings that follow circular economy principles. This goes beyond standard responsible sourcing and supply chain management to ensure reuse, as well as leaving a digital legacy with each client that commits to using these models, for ongoing operational efficiency and materials management.



Social value

We aim to produce and support sustainable business, which has a positive impact on existing, new and evolving communities through added social value. We aim to make a real difference to people's lives by enhancing the social, environmental and economic well-being of the communities in which we operate.

Conclusion: So, what does this all mean?

Our exercise to establish a benchmark for regional energy and emissions performance has highlighted the urgent need for greater collaboration between government, industry and key stakeholder groups, to establish a consensus on common standards and approaches for measuring and evaluating our societal impact on the environment and climate.

In this vein, we welcome the current **BEIS consultation on compulsory performance ratings** for existing commercial buildings over 1,000 m^2.

The dynamic nature of transformational change in how we generate our power, innovations in new materials and approaches to constructing and refurbishing our buildings, and the pace of change from governments responding to the climate emergency are not reflected in the availability of current data sets that we use to chart our progress. The most obvious example of this rapid change is the scale and speed at which coal has been phased out of the UK's electricity generation mix, to be replaced by on- and off-shore wind farms that are now the second largest contributor to our electricity inputs.

As the goalposts are shifted (positively from the UK's April carbon-reduction acceleration announcement) we must collectively ensure that we are able to dynamically assess the impact of increased investment, and the beneficial scale of change provided by increasing impetus and scrutiny at the highest levels. This is a fundamental requirement if we are to benchmark, monitor and continually improve our response. Our ability to calculate the quantum of change we deliver will highlight best practice, showcase outperformance, and enable us to focus on areas that have the greatest impact, while quickly turning our attention to regions and sectors that have the greatest challenges.

The global response to COVID-19 has demonstrated the efficacy of a unified approach to a global crisis, and we must take these lessons and build upon the goodwill and collaboration that has led to the creation of novel vaccines and treatments in previously unthinkable time frames. The climate change challenge is of course at an entirely different scale and requires solutions on multiple fronts, from significant investments and development of new technologies and power sources, innovative carbon-capture solutions, and a willingness by society to think and act differently.

By acting now to achieve net zero carbon energy-efficiency targets – as defined by UKGBC and the London Energy Transformation Initiative (LETI) – we can improve the impact that our buildings have, both existing and future, on the world around them. Harnessing the raft of technology at our fingertips from renewable energy sources to the benefit of smart building operation and maintenance will be key in this regard.

Education is a crucial element too. Achieving optimal results is reliant on everyone being on board, and we have a responsibility to educate people about the full operational potential of their spaces. For those involved in bringing spaces to life, that includes sharing the vast potential that accurate building data gives owners and occupiers in the operation and management of their buildings.

The cost associated with transforming our power grid to net zero, while also retrofitting the 80% of buildings that exist today and will do so in 2050, is at an unprecedented level. Energy prices and carbon taxes will inevitably rise as we move to renewables, as will the cost of purchasing offsets for those businesses that rely on them to achieve net zero ambitions.

There's no discrimination when it comes to net zero targets – it's a shared responsibility – but with a focus on collaboration rather than competition, we can take legacy-defining strides towards a more vibrant future.

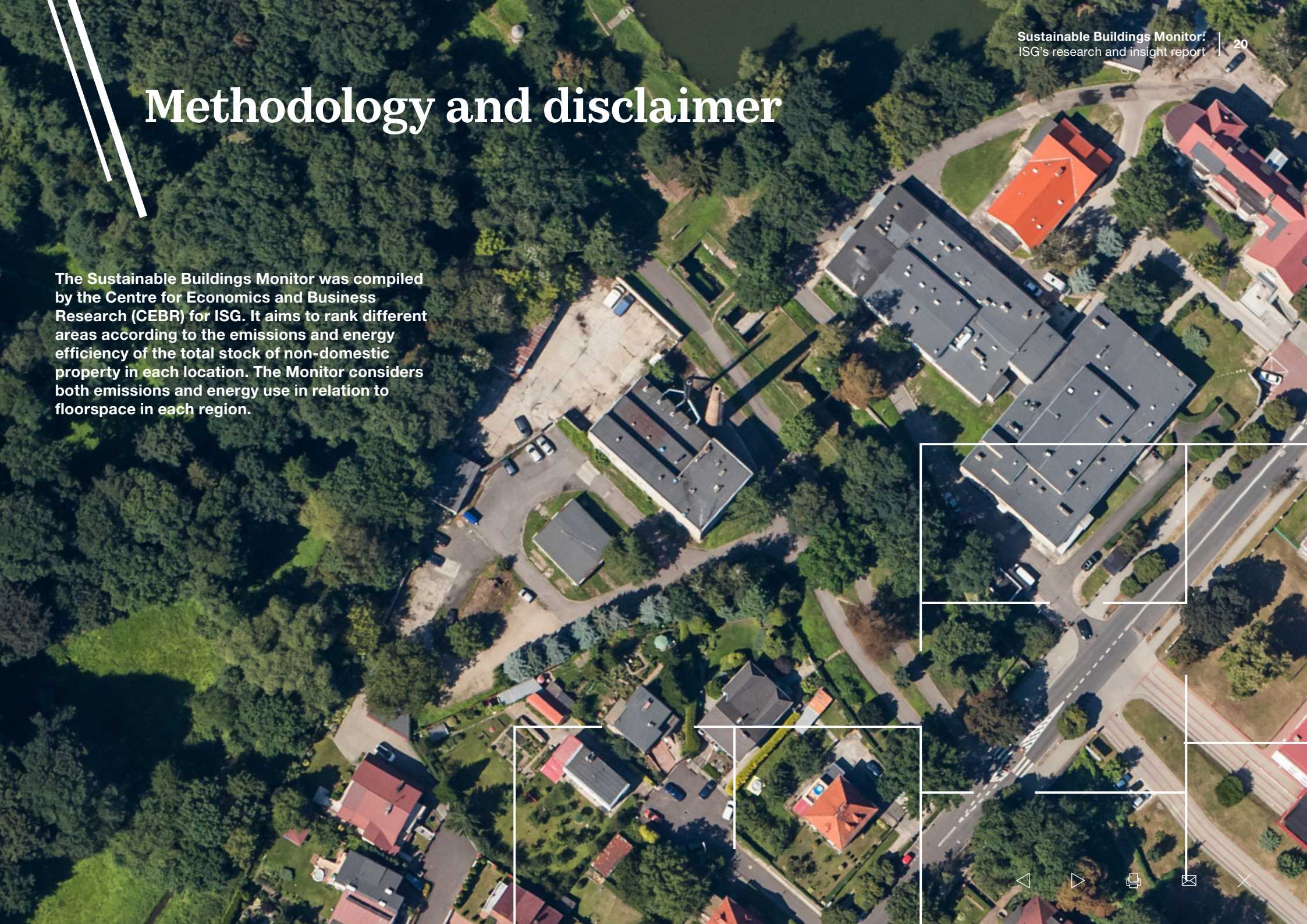
The capacity and resource challenge that the construction industry faces with every day lost, and the compression of the timeline to 2050, is a key factor.

With less than 10,500 days until 2050, what is clear is that we cannot wait for technology to ride to the rescue, and that we must act now to reduce our demand for energy, which drives the emissions cycle. The built environment has a pivotal role to play in our global response, and we must now place energy conservation and operational efficiency at the heart of property master planning. We must quickly learn from pioneering projects across all of our commercial sectors, and implement these innovations in every future built environment plan.

We can only do it together. There's no discrimination when it comes to net zero targets – it's a shared responsibility – but with a focus on collaboration rather than competition, we can take legacy-defining strides towards a more vibrant future.

Methodology and disclaimer

The Sustainable Buildings Monitor was compiled by the Centre for Economics and Business Research (CEBR) for ISG. It aims to rank different areas according to the emissions and energy efficiency of the total stock of non-domestic property in each location. The Monitor considers both emissions and energy use in relation to floorspace in each region.



Methodology and disclaimer

Data

In order to create our emissions and energy efficiency indices, we make use of the following publicly available data sources:

Carbon emissions data: UK local authority and regional carbon dioxide emissions national statistics: 2005-2017. Published by BEIS, CO_2 emissions data is available down to local authority level. The data is published as kilotonnes of CO_2, broken down by the following sources:

- Industry and commercial electricity
- Industry and commercial gas
- Large industrial installations
- Industry and commercial – other fuels
- Agriculture
- Domestic, transport and land use change categories

Energy consumption data: Sub-national total final energy consumption statistics 2005-2017. Published by BEIS, energy use is available broken down by fuel type and local authority. The data is published in both gigawatt hours (GWh) and kilotonnes of oil-equivalent (ktoe) units.

The conversion factor between these units is 11.63 GWh per ktoe. The energy use statistics are broken down by the following uses:

- Industrial and commercial
- Domestic
- Public sector
- Agriculture
- Transport

Non-domestic property stock data: Business floorspace tables. Published by the VOA, the count of non-domestic properties and their total floorspaces are available by local authority. Breakdowns are for the following sectors:

- Retail
- Office
- Industrial
- Other (includes pubs, restaurants, places of worship,
- health and education)

Lack of public data on commercial property in Northern Ireland means we have not been able to estimate emission or energy efficiency coefficients for Northern Ireland.

Counts for non-domestic properties are available for Scotland. However, there is no administrative data on non-domestic floorspace for Scotland. A report from 2015 titled 'Commercial Real Estate and the Scottish Economy' provides estimates of commercial floorspace for Scotland (split by retail, office and industry). We have used the average floorspace by property, and the local authority property count, to derive an estimated floorspace for each of the local authorities in Scotland.

The VOA data is missing floorspace for some categories of building that are either not valued at all, or not valued according to floorspace (e.g. pubs). This will tend to exaggerate estimates of the energy intensity of buildings.

Building Energy Efficiency Survey (BEES): Energy intensity by sector. Published by BEIS in 2016, this survey from 2014-15 was used to generate estimates of non-domestic building efficiency across England and Wales. The energy intensity estimates here have been used for validation of the local authority estimates. The floorspace estimates (including categories excluded by the VOA) were uplifted using the ratio of total floorspace estimated from BEES, to the equivalent total recorded in the VOA data for 2014-15 across building categories.

Index calculation

Emissions efficiency indicator
The non-domestic building efficiency coefficient in area i is calculated according to the following formula: $Ci=CEi \div CUi$.

Where Ci describes the building emissions efficiency coefficient in area i, CEi is the level of emissions in area i and CUi is the total floorspace of buildings in area i.

Consumption efficiency indicator
In order to examine which areas of the UK are particularly economical in their energy use, we have applied a similar methodology as to local authority energy consumption data: $C2i=ECi \div CUi$.

Where C2i describes the building energy consumption efficiency coefficient in area i, ECi is the level of energy consumption in area i and CUi is the total floorspace of buildings in area i.

Measuring progress against science-based energy targets
The results from the energy consumption coefficients are compared to the UKGBC's energy performance targets for operational energy use which are expressed as kilowatt hours electricity (kWhe). The kWhe measure represents fossil fuel and electrical energy in the same units after accounting for the carbon intensity of different energy sources.

These targets have been set in line with the UK's goal of becoming carbon neutral by 2050. In order to make the energy consumption numbers comparable to the UKGBC's target numbers, we have converted energy consumption (GWh or ktoe) to kilowatt hours of electricity. While kilowatt hours of electrical energy are converted on a like-for-like basis, fossil fuel energy is multiplied by a factor of 0.4 to produce the equivalent kWhe.

Methodology and disclaimer

Data limitations

The Sustainable Buildings Monitor calculation depends on the reliability of its input data and any limitations of the data sets need to be mitigated in order to develop a robust ranking. Table 1 on page 6 illustrates the primary limitations of each main data set and any mitigations used.

VOA floorspace data
The VOA collects data for England and Wales as part of the process of valuing non-domestic properties. This means that some categories of property, which are not valued (e.g. places of worship) or are not valued on the basis of floorspace (e.g. pubs) are not captured in the data. This underestimates total floorspace.

The BEES collected data on energy intensity across a more complete sample of non-domestic properties in the UK, using additional data sets to enhance the VOA estimates. The 2014-15 total floorspace estimate in BEES is 784 million m^2, a 35% uplift on the 589 million m^2 in the VOA data set.

Since most of the missing floorspace is from the other categories, uplifts are applied sector by sector, in proportion to the stock of buildings recorded in each category in each local authority.

Scottish floorspace data
Scottish floorspace data is not published by Scottish Assessors (the Scottish equivalent of the VOA) so the estimates of retail, industrial and office space are from an alternative source (Commercial Real Estate and the Scottish Economy, Heriot Watt, 2015).

The data was at a total Scotland level and missing an 'other' category, so has been scaled up in line with the England and Wales categories. The local authority count of properties from Scottish Assessors was used to assign total floorspace to specific areas.

BEIS energy consumption statistics
The different fuels recorded in the BEIS energy consumption data come from different sources. Only gas and electricity consumption is drawn from meter readings. Very large consumers at unique sites are withheld from the gas and electricity consumption data.

Some businesses with low energy use (<73,000 kWh) may be classified incorrectly as domestic users. The calculations are limited to using just gas and electricity consumption, which is drawn from meter readings. Residual energy consumption is more likely to reflect specific high-energy processes, like cement production, that will skew results for other buildings.

Validating the data

The BEIS data shows that across the sectors covered there was a fairly significant spread in the distribution of energy intensities (measured as kWh/m^2). Figure 1 on page 7 shows the range of energy intensities from the lowest 10% of buildings to the highest 10% (spikes) and the interquartile range (bars).

Large properties that are occupied by few people (e.g. storage, industrial) have low energy intensity and tight distribution of energy intensities. Public services (health, emergency services) exhibit a wider distribution, probably on the basis of longer operating hours, while hospitality was found to hold a much longer tail of high energy intensity properties. The BEIS data does suggest that the regional index is of broadly the right order of magnitude.

* The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 parties at the United Nations Climate Change Conference (COP 21) in Paris, France, on 12 December 2015, and entered into force on 4 November 2016.

Its goal is to limit global warming to well below two degrees Celsius, preferably to one and-a-half degrees Celsius, compared to pre-industrial levels.

Disclaimer

While every effort has been made to ensure the accuracy of the material in this document, neither ISG nor CEBR will be liable for any loss or damages incurred through the use of the report.

This report was commissioned by ISG and informed by research produced by CEBR. The expert commentary was compiled by ISG's sustainability experts. The views expressed herein are those of the authors only, and are based upon independent research by them.

About ISG

Our vision is to become the world's most dynamic construction services company, delivering places that help people and businesses thrive.

For over 30 years, we have provided construction, fit out and engineering solutions to some of the world's most successful and enduring businesses, cities and institutions. We build relationships on trust, collaboration and open communication, because it's the only way to create places as smart and resilient as the people who use them.

If you would like to get in touch to discuss how we can help you with your future requirements, please contact us at:

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