NBS Sustainability Report 2014

"We can see that people's views on sustainability are, on the surface, varied. The industry faces an ongoing challenge to define and describe what sustainability means for the design professions, for clients, and for contractors."

Richard Waterhouse
CEO, NBS and RIBA Enterprises

Introduction

I am pleased to introduce this second NBS report on the issue of sustainability. As the contributors to this report explain, and as the findings from our survey show, sustainability is a diverse topic. But there are few topics more vital to those working in the construction industry.

We can see that people's views on sustainability are, on the surface, varied. The industry faces an ongoing challenge to define and describe what sustainability means for the design professions, for clients, and for contractors. But below that heterogeneous surface lies a homogeneous understanding that, simply put, sustainability is about creating an environment (ecological, built and economic) that is fit to meet all of our needs, as well as those of future generations.

Sustainability is not a recently emerging issue for the construction industry, and nor is it one that is going to go away. Making incremental improvements to the thermal performance of buildings may not excite many, but in the EU, buildings account for around forty percent of energy consumption (more if you include embodied energy). As an industry we are in a position to make real changes to the sustainability of our ways of living. Belief in the important contribution that the construction industry can make runs through the survey findings.

The report outlines some ways in which respondents feel that we can do better. Tighter legislation, removal of VAT on renovation and repair, harmonisation of green accreditation schemes, and improved guidance are some examples. Within the professions, awards should not be made on simply aesthetic grounds, but on grounds of sustainability too. All of this is tied to improving the performance of a building throughout its life, for its users and for the environment.

Measuring and then improving a building's future performance is not straightforward, however. Predictions of energy use can be thrown by unanticipated human activity. Systems and components can be incorrectly maintained and so their performance degrades. Specifications can be altered to reduce construction costs, whilst increasing lifetime costs. A changing climate means today's solutions may not work in the future.

But we are better able to put these things right than we have ever been. We are in the midst of an exciting time in the industry: one where our ability to record, share and use information about buildings, from inception to recycling, is improving rapidly. This has come about through us having more information and having better tools to derive value from it. Some of the biggest improvements in sustainable design will come through developments in information use. We are already seeing improvements to building design and performance that would not have been possible five years ago, just as we have seen sophisticated modelling dramatically improve the performance of cars (or bicycles!), for example. However, the gap between design performance and in-use will continue to be one of the most pressing issues in this area.

The report uncovers deep commitment to improvement, and suggests some ways that we can bring it about. But there is still a great deal of progress to be made if we are to meet our 2050 emissions targets. At NBS we will continue to chart that progress, and through our design tools we will continue to provide design knowledge to support it.

Is the future here already? Adapting buildings to climate change

Bill Gething
Professor of Architecture, University of the West of England and Principal: Bill Gething: Sustainability + Architecture

2014 may have marked a turning point where climate change stopped being perceived as a distant future threat mired in uncertainty and became recognised as a phenomenon whose effects are starting to have an identifiable impact on current extreme weather events. The UK Adaptation Subcommittee Progress Report, published in July, is relatively circumspect:

"The attribution of individual weather events is still an area in which the science is developing, but there is emerging evidence that man-made greenhouse gas emissions have already made heatwaves, and possibly flooding, more likely in the UK." However, the latest US National Climate Assessment is less guarded, concluding that "the evidence of human induced climate change continues to strengthen and impacts are increasing across the country."

In this context, it would be a brave designer or building client, however sceptical, who dismissed the issue of a changing climate out of hand. Buildings last a very long time – certainly when compared with typical timeframes for business decision-making and political cycles - and their users have a not unreasonable expectation that they should perform adequately throughout their service life (or at least the service life of their replaceable components). They will potentially be affected by projected changes, particularly in terms of summer overheating, resilience of construction and how they deal with water, both too much (flooding) and too little. Up until now, designing to meet 'reasonably' extreme environmental conditions has been entirely adequate, agreed by consensus and based on analysis of past experience. However, if there is a likelihood that environmental conditions will change during this period, should this not be taken into account in building design? Certainly lawyers, perhaps scenting a rich future seam of lucrative cases, are starting to express the view that, as it is 'common knowledge' that the climate is changing, this should surely be taken into account in building design and specification.

That said, almost without exception, our current standards and regulations do, indeed, ignore the issue (in contrast to climate change mitigation strategies, such as reducing carbon emissions to limit future climate change, which are firmly embedded in current and future regulations).

Designers (and clients too) thus find themselves on the horns of a dilemma: to what extent, if any, should they take the changing climate into account when their competitors are under no obligation to do so? What incentive is there to take an additional headache on board for an already complex construction process when surely, if it was a genuinely important issue, it would be covered by regulations?

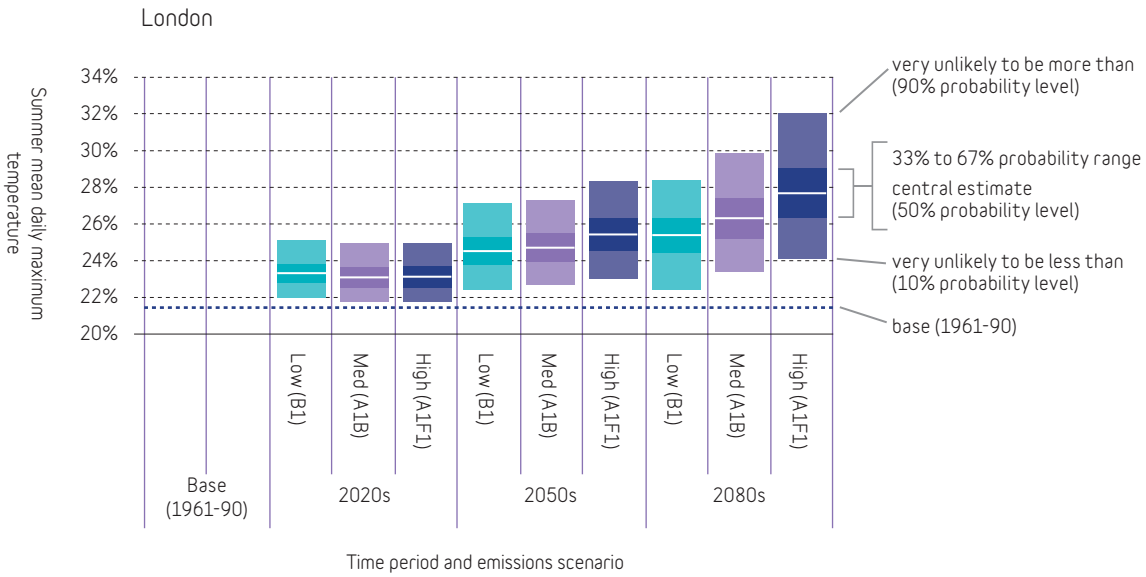
To tackle this policy vacuum, a staged approach has attractions. Clearly, as specialists in the field, designers have a duty to develop their understanding of the issue and its potential impacts on the built environment. They have a similar duty to make their clients aware of these potential impacts and seek confirmation of the extent to which potential change should or should not be taken into account. However, it is not difficult to understand why many clients may simply instruct their designers to ignore the issue and design to the minimum legal requirement.

In the absence of compulsion and in the exclusively self-interested commercial context of many development projects, the business case for additional expenditure to design for a changing climate can appear weak. Why would a client wish to increase the design and construction costs of a building in which they have no interest beyond a successful sale on completion? Future owners, tenants or users do not necessarily attach a corresponding value to potential benefits. There are similar situations where costs are borne by one party and benefits accrue to another: for example, increasing urban green space on a given site may, in fact, provide limited benefits for the site itself but, particularly as part of a coordinated planning strategy, could have significant benefits for the wider urban area.

The speed and extent of climate change is inherently uncertain and offers an open-ended, moving target, so where a client agrees that the issue should be taken on board, again in the absence of regulation, it is important that parameters are agreed on the approach: how much change the project as built should be designed to accommodate, which strategies or interventions are available for further future change and what ultimate limits can be allowed for.

"The attribution of individual weather events is still an area in which the science is developing, but there is emerging evidence that man-made greenhouse gas emissions have already made heatwaves, and possibly flooding, more likely in the UK."

Relevant survey statistics →
A significant number of those who took part in the survey are also looking for demanding legislation for new builds too, with almost half telling us that there should be a legal requirement for all new builds to be zero-carbon.



There is a wealth of information on future climate change available through the UK Climate Impacts Programme.

ukclimateprojections.metoffice.gov.uk

However, the quantity of data and the probabilistic approach used to produce it can appear daunting for designers. Happily 'translations' into forms that are compatible with standard industry design tools are available for some aspects, for example, the future weather files available from CIBSE (Chartered Institution Of Building Services Engineers) and the PROMETHEUS programme at Exeter University.

emps.exeter.ac.uk/research/energy-environment/cee/projects/prometheus/

However, before using these specialist tools, it is necessary to establish the broad parameters of change that are to be considered for a project. The Probabilistic Climate Profiles (ProCliP), available free of charge from CIBSE, provide a useful way of visualising the range of predicted values for a number of environmental variables for different locations to help designers select appropriate design parameters for their project.

For example, a designer considering overheating in London might use the ProCliP chart of values for summer mean daily maximum temperature shown above. This provides an overall view of the complete range of projected values through the century, indicating the central estimate and the 'likely' and 'very likely' ranges for each of the UKCP09 emissions pathways.

One of the key points illustrated is the significant difference between the spread of values for the 2020s and the dotted base case value (1961 to 1990). We are already in the 2020s period (a 30-year period centred on 2025), and this clearly shows the dangers of relying on, effectively, out-of-date historic data as a basis for design.

In terms of future change, designers will need to agree with their clients where their particular project should sit on the probabilistic range, in relation to the anticipated lifespan of the building or major replacement of some key components such as windows or building services.

Clearly it is only the most enlightened clients who will currently have the intellectual and financial commitment to engage in the agenda. The Adaptation Subcommittee Progress Report recognises this market failure, certainly as far as overheating of homes is concerned, and calls specifically for government to review the evidence and evaluate options for standard or other requirements on overheating. It remains to be seen whether the Greenest Government Ever will take the action necessary to secure the common good. ●

Bill Gething is an architect and sustainability consultant, having been a long-standing partner of Feilden Clegg Bradley Studios.

He is Professor of Architecture at the University of the West of England and a Visiting Professor at the University of Bath. He was an RIBA Council member from 2002 to 2008 and the President's Sustainability Advisor from 2002 to 2009.

He wrote the briefing report to support design teams involved with the Technology Strategy Board's 'Design for Future Climate' programme, and his recently published book, Design for Climate Change, draws out lessons learnt in the first tranche of 24 'Design for Future Climate' projects providing practical guidance and examples of best practice for the industry.

He also led the team that developed the Green Overlay to the RIBA Plan of Work and contributed to the development of the RIBA Plan of Work 2013.

He is a Design Council CABE Built Environment Expert, vice chair of BRE Global's Governing Body and chair of the Concept Design and Planning stage workgroup contributing to the Zero Carbon Hub's programme aimed at narrowing the gap between design intent and built performance of new housing.

The importance of building maintenance and commissioning to achieve good building performance

Sofie Pelsmakers
Chartered architect
and doctoral researcher
at the UCL Energy Institute

"Once a building is in-use, occupant behaviour, building technology interfaces and operational issues can all have an impact on a building's energy use."

BIM, Soft Landings and FM: what do they have in common and what do they have to do with us?

Very often, the new buildings we design and build do not perform as well as intended: there is a 'gap' between the predicted and the actual performances. For instance, some buildings require up to five times more energy to operate than initially predicted. This means that our buildings' environmental impacts are underestimated, leading to smaller carbon reductions and higher running costs for our clients/ building users than anticipated.

Some of the reasons for this performance gap may be due to false assumptions about materials, systems performance and operation in building models at design stage, as well as workmanship on site. Once a building is in-use, occupant behaviour, building technology interfaces and operational issues can all have an impact on a building's energy use. Indeed, facilities management (FM) and maintenance practices have an influence on the building's performance and its running and maintenance costs.

A maintenance-free building probably does not exist: buildings need to be maintained and cared for once constructed. Failure to do so impacts on a building's longevity, aesthetics, the thermal comfort of occupants, and on energy use.

But what does this have to do with architects?

While architects are not usually involved in the maintenance of buildings, designers have to make assumptions about how and when the building will be used, and specify products and materials that have future obligations which have an impact on both building operation and maintenance over the building's lifespan. As designers, we are aware of our responsibilities under the CDM (Construction Design and Management) Regulations, where we have the duty to ensure that we design buildings that are safe to use and maintain; but how often do we go beyond this? What are the precise future maintenance requirements and lifecycle costs of the materials and products that we specify? How are systems and services meant to work? How much energy do they or the building use or (in the case of renewables) produce? How are they maintained? How will the building be metered, monitored and maintained? If services do not perform as intended, how will they be identified and rectified? Have such assumptions and decisions been made in consultation with the client and their FM team, ultimately the people responsible for the building upon handover?

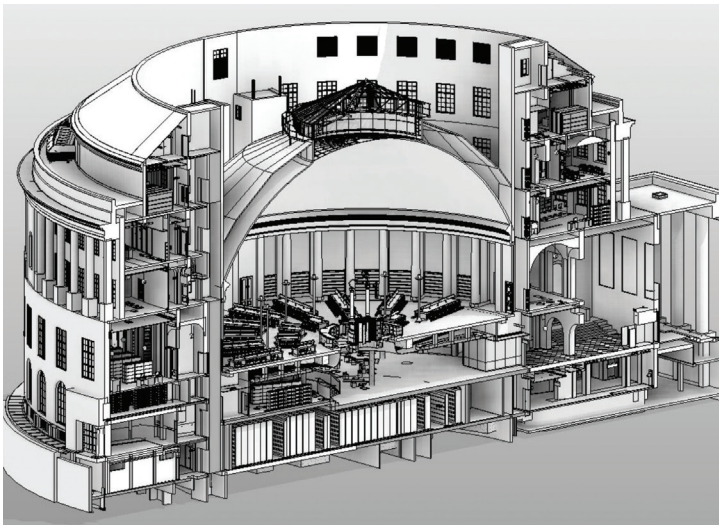
Without input from the FM team, the appropriateness of these assumptions and obligations cannot be sense-checked, and future obligations may only be revealed at (or after) handover stage when it is too late to make changes or allocate appropriate resources. Excluding FM expertise at early stages means we design and build buildings that the FM team may not have the resources or knowledge to maintain and operate, which in turn has a negative impact on building performance, whole life costing, building longevity and design intentions.

Good facilities management can reduce a building's energy use and increase occupant thermal comfort and satisfaction by providing better and healthier internal conditions. And to support good facilities management, early involvement of FM professionals in the design and construction process is necessary.

Yet for architects, facilities management and a building's 'in-use' or operational stage are often an afterthought. This will soon (have to) change. Clearly, it is too late to start thinking about building management, commissioning and building maintenance at handover: we need to manage projects differently and have discussions with the people who are going to be using and looking after the building at the very early stages of the design process to ensure their expectations and needs are met by the available resources. It is about early planning of commissioning, and handover, and how the building will be operated and maintained. To do so, the people responsible for those stages will have to be an integral part of the design process. This is what government has in mind too: on all (centrally procured) publicly-funded projects from 2016, the Government Soft Landing (GSL) programme and BIM (Building Information Modelling) Level 2 will be required. The RIBA Plan of Work 2013 has also reintroduced an 'In Use' work stage since its removal of 'Stage M Feedback' in the 1970s.

Relevant survey statistics →

Almost a third of people are starting to take sustainability into account at stage 0, and by stage 2, 83% have taken sustainability into account, so there's a lot of good practice out there. But those who are only beginning to consider sustainability at stage 3 and beyond may have left it a little late to create a sustainable design.



BIM played a central role in this complex refurbishment project for Manchester Central Library (left) and and in the design of the Leeds Arena

Why BIM and GSL?

The idea is to design and construct buildings that consider facilities, maintenance and building operation at the early stages, enabled by a Soft Landing framework and BIM as a collaborative communication process. GSL will require early involvement from FM and end-users during the design and build process to develop a maintenance strategy alongside design strategies. This puts building operation and energy use, maintenance and building management at the heart of the architect's design process.

Information flow between all parties is crucial at the early stages; likewise for information flow at construction and in-use stages to ensure that design changes are properly logged and the impact on building performance is fully understood. A building's history can be built up this way in BIM, including manufacturers' literature, specifications, maintenance and replacement schedules, alongside the design and services information and information on decision-making processes.

As designers, we need to stop walking away once the building is built: we simply cannot know if a building works well and is sustainable unless we find out how it performs once it is in use, and after fine-tuning. 'Aftercare' is required by the design and construction team alongside the FM team and probably includes both Post Occupancy Evaluation (POE) and Building Performance Evaluation (BPE) in the first few years, with more regular 'seasonal commissioning' during the first year of operation. This is also often undertaken for the Passivhaus certification process, and the Zero Carbon Standard is also proposed to be linked to as-built performance.

Sofie Pelsmakers, chartered architect and doctoral researcher at the UCL Energy Institute

Sofie Pelsmakers is a chartered architect and environmental designer with more than a decade of hands-on experience designing, building and teaching sustainable architecture. She taught sustainability and environmental design and led a masters programme in sustainable design at the University of East London. She is currently a doctoral researcher in building energy demand reduction at the UCL Energy Institute, researching the actual heat-loss from suspended timber ground floors in pre-1919 dwellings and how best to reduce this.

She is co-founder of Architecture for Change, a not-for-profit environmental building organisation and is author of 'The Environmental Design Pocketbook', which synthesises her practical and academic expertise to support the building industry towards a significant change in its design and building practices. The second edition has included an increased focus on good practice building maintenance and commissioning issues as part of delivering sustainable buildings.

"Given the increasing complexity of buildings and the costs associated with operating and maintaining them, planning for commissioning, care and maintenance is crucial in reducing associated costs and energy use."

The role of BIM will also change: at present BIM is used in the construction industry for collaborative design and construction on some projects. For BIM to be useful to FM teams beyond the design and construction stage, it needs to include FM information: for example regulations, health and safety, maintenance requirements and routines. But BIM will need to be maintained throughout a building's lifecycle – requiring the skills to use and maintain the database and also to accept that software evolves and changes over the building's lifespan. Just as 'Soft Landings' helps to achieve an integration of facilities management in the early stages of the design and construction process, there are many potential benefits, including the following:

- The FM team can use this information-rich centralised model to update changes that have taken place, such as new space planning, replacement products or changed specifications. This streamlines the process and keeps everything in one place, making it easier to update and check.
- Product specifications are retained in the model and checked for replacements, giving quantities and properties of components to ensure that replacement parts or services or other envisaged changes do not run counter to intended specifications.
- Future building changes can be checked immediately in 3D or in sections and intelligently quantified to investigate their impacts and any unintended consequences.

There are also several benefits for architects arising from the collaborative approach described above, including the following:

1. Capital cost decisions will benefit from whole life costing discussions: it is not just about the cheapest product or material, but also about its future maintenance and replacement costs. This process may favour long-lasting materials and products over short-lived ones.
2. It brings the design team closer to the building end-users, enabling a better understanding of the needs and expectations (and hence ability) to include those requirements in building design.
3. It provides a feedback loop for the design and construction team, enabling them to learn and improve.
4. There is an increased likelihood that material and product replacement and maintenance will occur as intended rather than not at all, or with inferior specifications.
5. While there may be additional costs to the client to retain the design and construction team for longer during handover and commissioning, this could pay for itself, especially as design fees are usually a small proportion of a building's running costs over its lifetime: i.e. the fine-tuning to operate the building as intended is likely to reduce energy costs over the building's lifetime.

All of the above is likely to reduce the performance gap, leading to buildings that use less energy and reduce their environmental footprint as originally intended.

Given the increasing complexity of buildings and the costs associated with operating and maintaining them, planning for commissioning, care and maintenance is crucial in reducing associated costs and energy use. Planning very early on for building commissioning and maintenance ensures that the building performs – and continues to perform – as intended, ensuring that it will have a long life. It means that we need to integrate the FM team into the design and construction process, utilising a more collaborative information and communication flow, such as BIM.

BIM and Soft Landings are here to stay. But neither is a panacea for bad design, bad construction or a lack of keeping the building's in-use information up-to-date. They are processes to support good design and construction and the operation/management of buildings afterwards in an integrated and collaborative way. We need to work as an interdisciplinary and integrated team to achieve this – collaboration is indeed key here.

Thanks to Casey Rutland at Arup Associates and Elrond Burrell at Architype for input.

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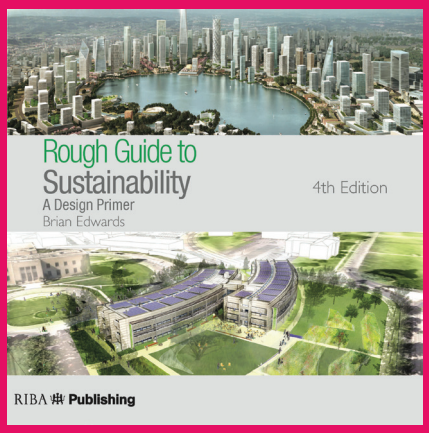

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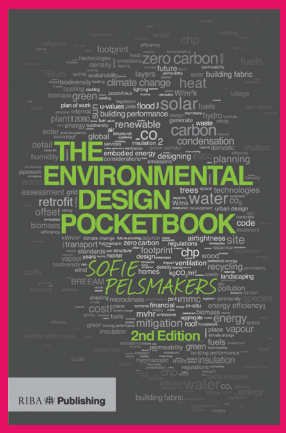

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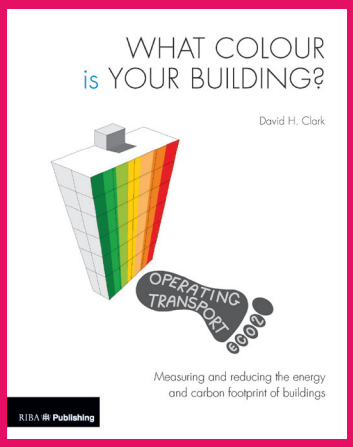

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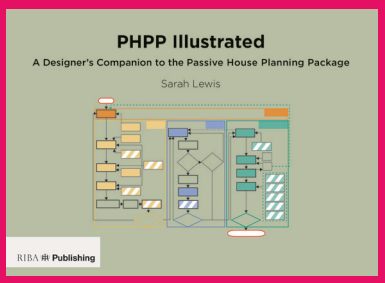

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NBS Sustainability Report 2014

Adrian Malleson
Head of Research, Analysis and Forecasting, NBS

"Within practices, individuals were taking on a wide range of roles directly associated with sustainability. Nearly 80% saw themselves as taking on at least one role, and many were taking on several."

Introduction

"The future has to be a sustainable one and the built environment professions are central to this. Government and the industry must show leadership on the sustainability agenda and the critical proactive planning that is required as a result of climate change."
The Farrell Review, p. 145

The views of the construction industry are not always homogeneous. A variety of opinion does not always lend itself to leadership.

Through industry research on a range of topics, NBS has been trying to achieve if not harmonisation, then at least quantification, of the views of the construction industry on a range of topics, including BIM, specification, contracts and law and here, sustainability.

Here is an overview of our findings on sustainability. We ran a survey in spring 2014; it was the development of a survey that we reported on in 2012.

www.thenbs.com/pdfs/NBS-Sustainability-Survey-2012.pdf

This allows us to make comparisons between the two sets of results. The survey covered a range of topics within the often disparate field of sustainability. We looked at themes such as personal and professional views on sustainability, government policy, sustainability in practice and how often it is achieved, as well as looking at the available professional support and certification for sustainability.

As you read this report, you will see graphs that enumerate the attitudes of the industry; but of course, much is lost by reducing people's views to data points. It is perhaps in the comments that people gave us that we begin to see the real depth of feeling about sustainability among construction professionals. These comments are anonymously given in italics throughout the report.

In those comments, some general themes emerge:

- There is a strong belief, widely held, that the construction professions are at the heart of achieving sustainability.
- There is frustration at the weakness of mandate coming from legislative bodies to compel sustainable design.
- Any suggestion that climate change is either not real, or not man-made, belongs at the very fringes of the debate. We can now move on to addressing the problem, and away from establishing its existence.

Adrian is Head of Research, Analysis and Forecasting at NBS

With ten years' experience in the construction industry, Adrian has carried out extensive research within the sector, including the NBS National BIM Survey (2010 to 2014), the IFC/COBIE Report 2012, the NBS Sustainability Survey 2012 and 2014, and the NBS National Construction Contracts and Law Survey 2012 and 2013. Leading a research team, he has also carried out an extensive research project into the Approved Documents for DCLG, as well as a number of research projects for the RIBA and NBS.

He is chair of the RIBA NBS Economics Panel, and a regular contributor to the RIBA Journal.

Relevant survey statistics →
Within practices, individuals were taking on a wide range of roles directly associated with sustainability. Nearly 80% saw themselves as taking on at least one role, and many were taking on several.

The respondents, their roles and qualifications

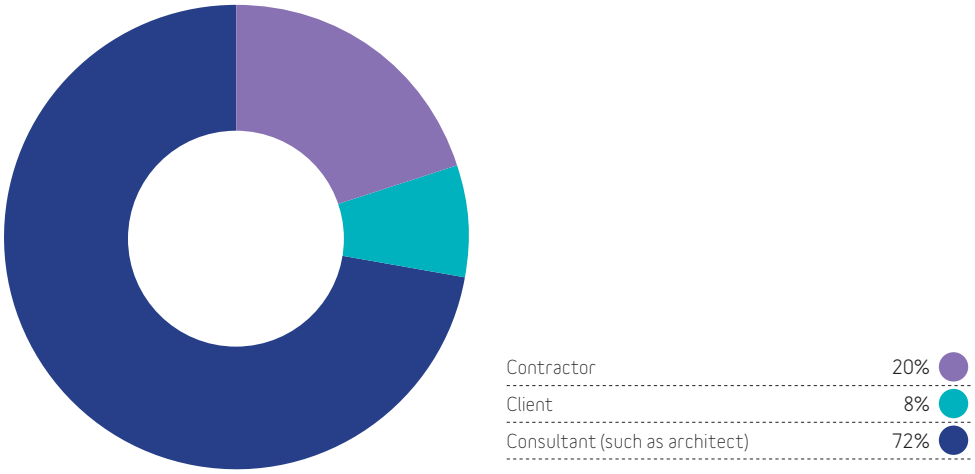
This year's survey ran from May to June in 2014 and attracted respondents from a range of disciplines. Around a third of the respondents were architects, but this was a cross-industry survey and we also received responses from multi-disciplinary practices, contractors, quantity surveyors, project managers, structural engineers, architectural technologists, building surveyors, local and regional government, civil engineers, property developers, landscape architects and building services engineers, among others. Overall, 72% described themselves as consultants, 20% as contractors, and 8% as clients. These clients tended to be from very large organisations and from governmental bodies.

A wide range of practice sizes responded to the survey. A third of respondents came from large organisations, employing five hundred people or more, although smaller companies also took part: 27% worked in firms with a staff of one or two people.

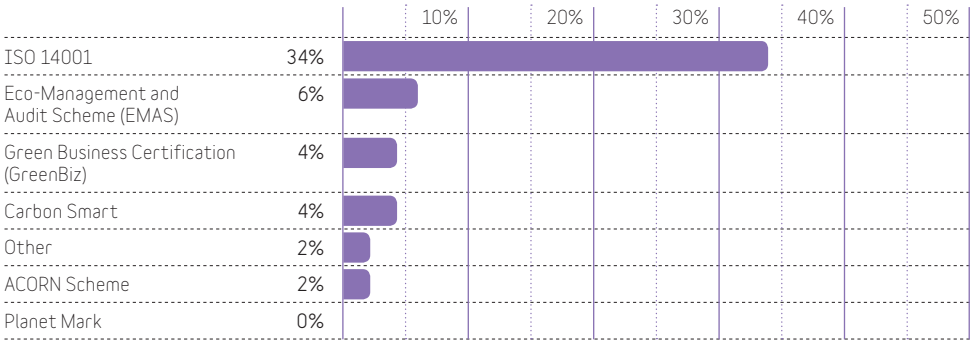
We asked whether the companies had a formal certification of sustainable standards. We found that the majority did not, but if they did, they were most likely to use ISO 14001 (Environmental Management). BSI describes this as 'an internationally accepted standard that outlines how to put an effective environmental management system in place'. Over a third of organisations had adopted this standard.

Within practices, individuals were taking on a wide range of roles directly associated with sustainability. Nearly 80% saw themselves as taking on at least one role, and many were taking on several. The most common role was simply that of making green product selection, choosing products to further sustainable goals. This goes hand in hand with providing client advice on sustainability, the second most adopted role. There were more formal activities too, such as carrying out BREEAM assessments, or managing corporate sustainability policy. The role least likely to be adopted was that of 'Green Deal Advisor' – perhaps just as well as this year's cash-back scheme has now closed.

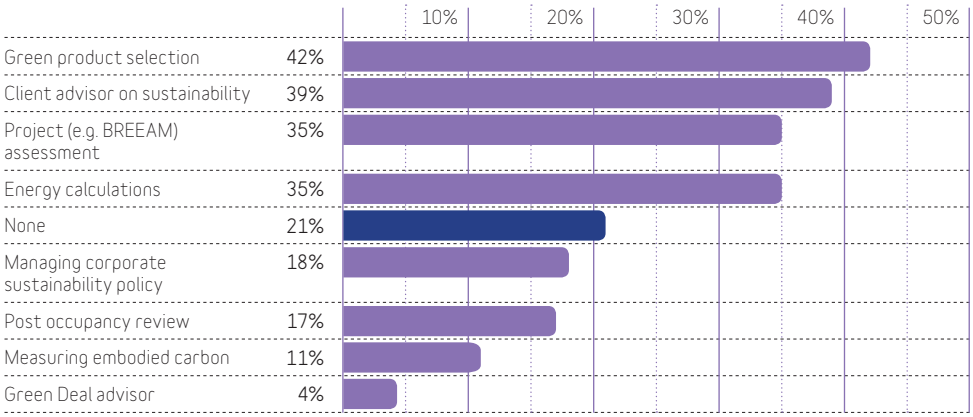
Overall, would you describe your company as being a...



What certification does your organisation have?



When it comes to sustainability, what roles do you carry out?



Defining sustainability and achieving it

"Arriving at a commonly accepted definition of 'sustainable development' remains a challenge for all the actors in the development process."

'Making Common Cause',
Ottawa, 26-27 May 1986

Seventy-seven percent of those who took the survey told us that they agreed that the industry was not clear enough on what sustainability was. With this in mind, we asked people to describe, in their own words, what they consider sustainability to be. It was striking that, whilst there was often different emphasis and tone, there was much commonality. Very broadly speaking, people considered sustainability to be about reducing the impact of our activities on us, our planet and our future generations, whilst allowing the basic needs of all people to be met.

"Sustainable development should enable people throughout the world to satisfy their fundamental needs, ensure a better quality of life, protect and enhance the environment and use resources without jeopardising quality of life for future generations."

There was also an emphasis on the responsibilities of those who create and maintain the built environment:

"Bring back together architecture, communities, resources and environment."

"Building for today's needs without compromising quality of life or environment for future generations."

The word cloud below is a representation of the words people used to describe sustainability. The larger the word, the more frequently people used it.

Respondents frequently mentioned the three elements of sustainability:

"Sustainability has three dimensions: social, economic and environmental, and sustainable decision-making must balance all three. Sustainability can be considered to be the destination, and sustainable development is the journey from current physical, organisational and thought systems towards sustainability."

Each of these three elements was ranked as either 'important' or 'very important' by a very large majority of respondents, with over 90% ranking environmental sustainability in this way (a 4% percentage point increase on the 2012 survey figure). Overall, 89% ranked economic sustainability as important or very important, and 80% similarly ranked social sustainability.

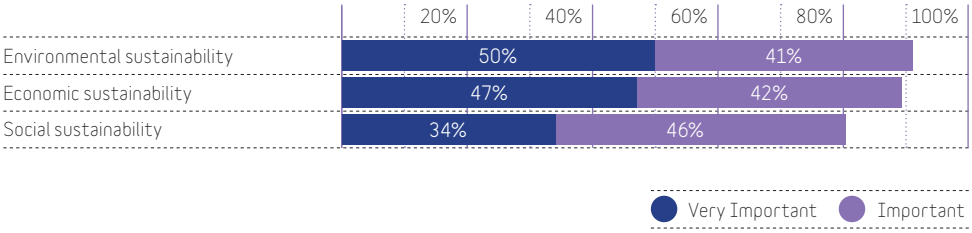
"A large number of individuals and practices are achieving what they understand sustainability to be, and significant numbers are getting external certification in one form or another."

So that gives us a picture of what those in the construction sector mean by sustainability. We then went on to explore how often people felt that it was achieved.

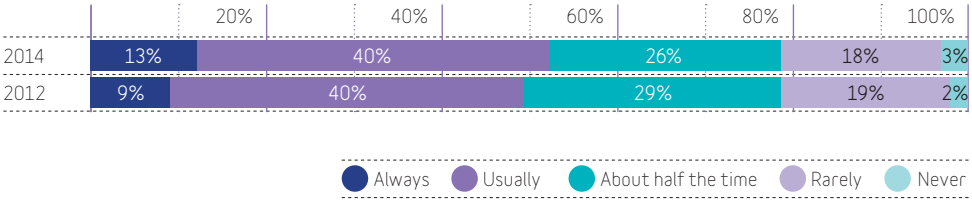
As you might expect, sustainability is not universally achieved on all projects, but it often is. Thirteen percent tell us that they always achieve sustainability (up from 9% in 2012), and 40% tell us that they usually do so (the same as in 2012). Less than a quarter 'rarely' or 'never' achieve sustainability.

The picture is mixed then. A large number of individuals and practices are achieving what they understand sustainability to be, and significant numbers are getting external certification in one form or another. Still, almost one fifth of respondents tell us that sustainability as they define it is rarely achieved on projects, and one third have no policy, certification or Corporate Social Responsibility Programme.

Generally how important are the following aspects of sustainability to the projects you work on?



How often is sustainability, as you define it, achieved on your projects?



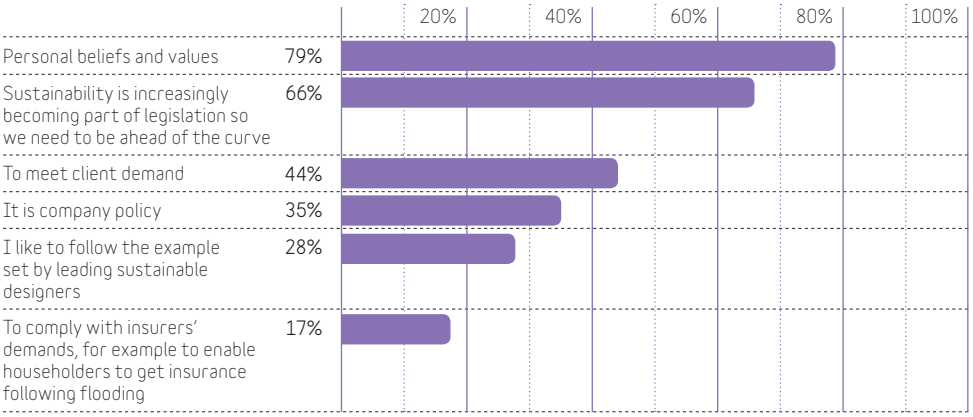
Views on sustainability – the personal and the professional

The design and construction of buildings does not just involve the execution of a set of pre-determined tasks: it is the practice of a range of professions. These professions are made up of people, and these people bring with them a range of personal beliefs and values, expressed through their professional practice. This is also true of sustainability, so we wanted to understand people's views on sustainability.

Whilst much debate about sustainability is at times characterised by opposing camps holding fast to views of varying degrees of extremity, and failing to influence one another, this was not what we found among those who took part in the survey. In contrast, sustainability is often achieved through co-operative working.

Overall, we found, with the exception of a small handful of respondents, that sustainability was important to people and that variance of opinion was more about the best means of achieving sustainability, rather than whether sustainability itself was worth aiming for.

Why do you personally consider sustainability?



The primary motivation for considering sustainability comes from personal beliefs and values, with almost four fifths citing this. This is far ahead of those who are following company policy, with just over a third telling us that this is a reason. Are practices behind those who work within them?

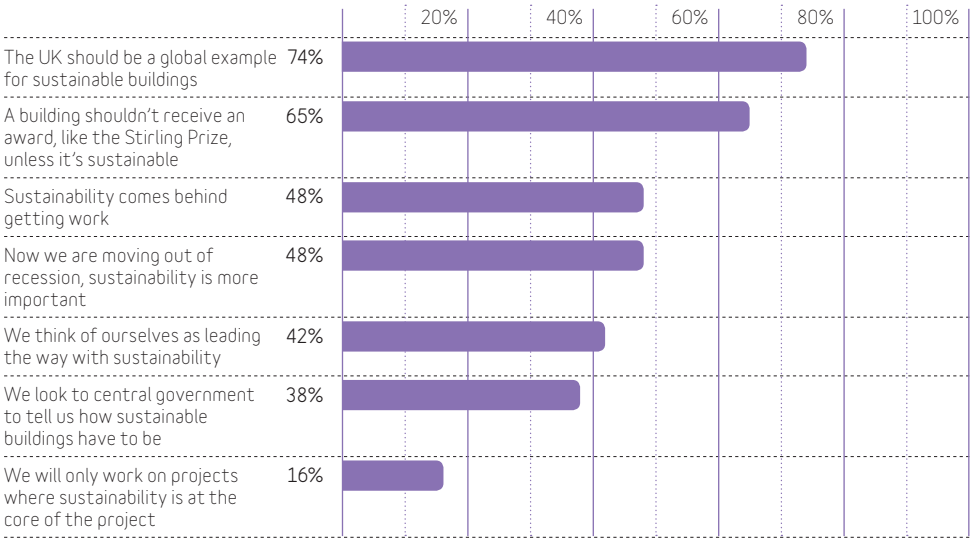
Clients also play a role, but a much lesser one, with 44% telling us that this is a reason for considering sustainability. Legislation is significant, with two thirds wanting to be 'ahead of the curve'.

Personal beliefs and values inform views about professions and professional practice. Almost two thirds would not want a building to receive the Stirling Prize unless it was sustainable. Three quarters think that the UK should be a global example for sustainable buildings. Only a minority take their lead from central government.

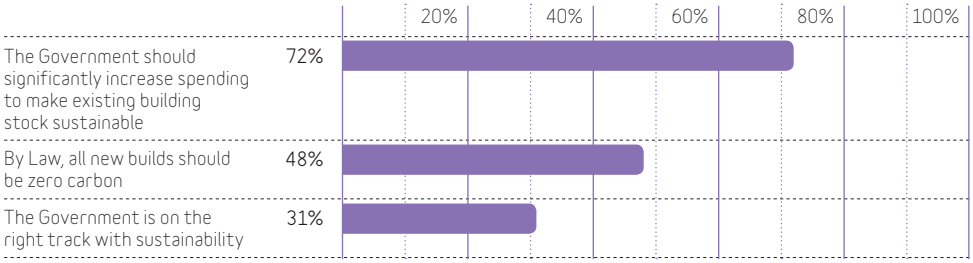
Whilst bills still have to be paid – fewer than one in five tell us they will only work on projects where sustainability is at the core of the project. Fewer than half (48%) tell us that sustainability comes behind getting work.

The survey respondents also suggested that there is scope for the Government to do more to help us achieve a sustainable built environment, and to be a global example. Top of the list came an increase in spending on existing building stock, with almost two thirds telling us that the Government needs to significantly increase spending here.

Thinking about your organisation and sustainability, do you agree with the following statements?



Thinking about your own opinions, how strongly do you agree or disagree with the following statements about sustainability



"Almost two thirds would not want a building to receive the Stirling Prize unless it was sustainable. Three quarters think that the UK should be a global example for sustainable buildings."

"It is estimated that 60% of the buildings that will be standing in 2050 have already been built."
Low Carbon Refurbishment of Buildings, The Carbon Trust

"All new homes should be zero carbon homes and lots more of them in both the private and public sectors."

A significant number of those who took part in the survey are also looking for demanding legislation for new builds too, with almost half telling us that there should be a legal requirement for all new builds to be zero-carbon. We might infer from these findings that the two thirds who do not agree that the Government is 'on the right track' feel that way because the Government is insufficiently ambitious in its sustainability legislation, guidance and spending.

More specifically, a number of people mentioned that charging VAT on refurbishment of buildings is a barrier to improving the sustainability of our building stock.

"Remove VAT from refurbishment to encourage the upgrading of existing building stock."

Others looked to the Government to provide positive incentives for refurbishments, such as grant provision:

"More grant assistance for retrofitting existing building stock."

Later we will look at existing regulations, including the recent revisions to Part L, to see what else people felt that the Government could be doing to help us achieve a sustainable future.

Sustainability in practice

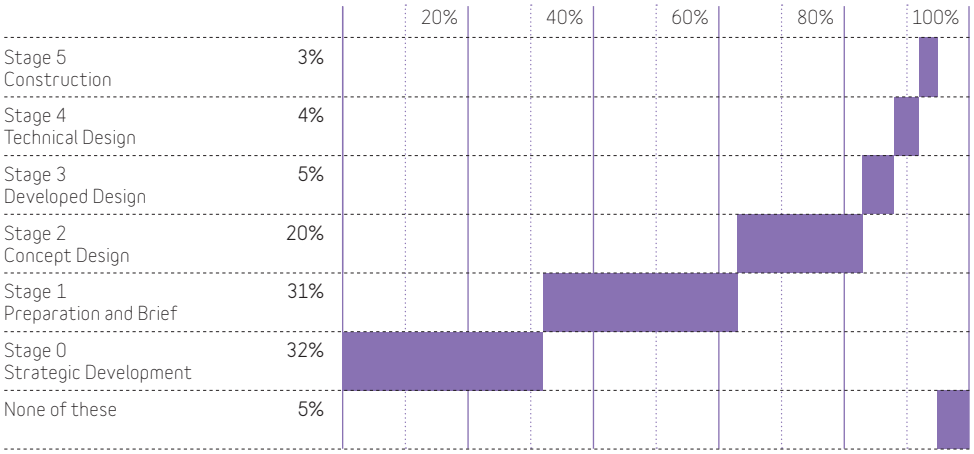
In the RIBA Plan of Work 2013, www.ribaplanofwork.com sustainability checkpoints are in place for every work stage. At stage 0 (strategic definition), the RIBA Plan of Work invites professionals to 'ensure that a strategic sustainability review of client needs and potential sites has been carried out'. By stage 1 there are detailed requirements for sustainability targets and for environmental requirements to be stated in the project brief, so the recommendation is that sustainability should be taken into account right at the start of any project.

We wanted to see if this recommendation is being widely acted upon. Almost a third of people are starting to take sustainability into account at stage 0, and by stage 2, 83% have taken sustainability into account, so there's a lot of good practice out there. But those who are only beginning to consider sustainability at stage 3 and beyond may have left it a little late to create a sustainable design. The Plan of Work recommends stage 3 as the time to 'review and update the sustainability strategy' – not start to think about it.

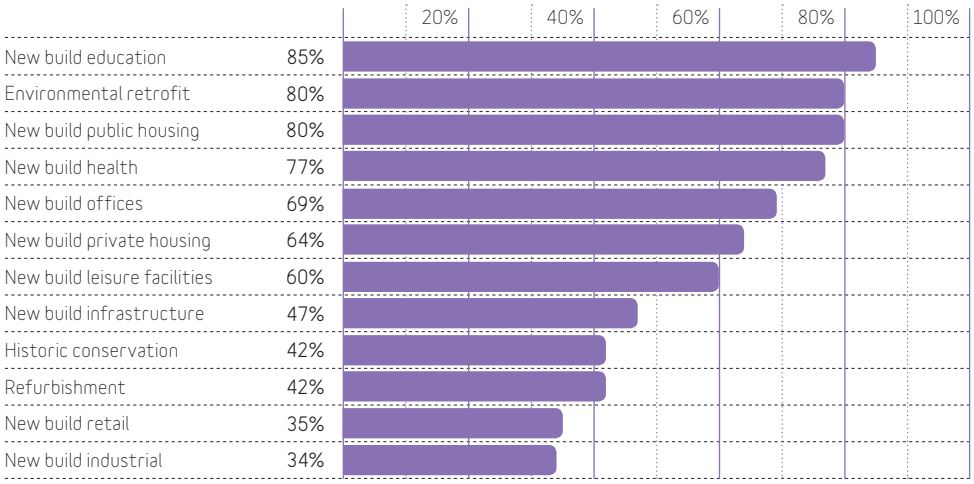
Irrespective of when sustainability is taken into account, we wanted to uncover which kinds of buildings are more likely to be sustainable. There was significant variance. The graph below shows, unsurprisingly, that industrial construction is the least likely to be sustainable. The retail sector also has much work to do, it seems.

New build education is the most likely to be sustainable. Of the top four for sustainability, three are, generally speaking, publically funded (the other being explicitly environmental in intent). So whilst we have seen some criticism of government policy towards sustainability, governmental bodies do look like pretty good clients for sustainable design.

At what stage in the building process (as described by the RIBA Plan of Work) do you usually start to take into account sustainability?



Which kind of projects are more likely to be sustainable?

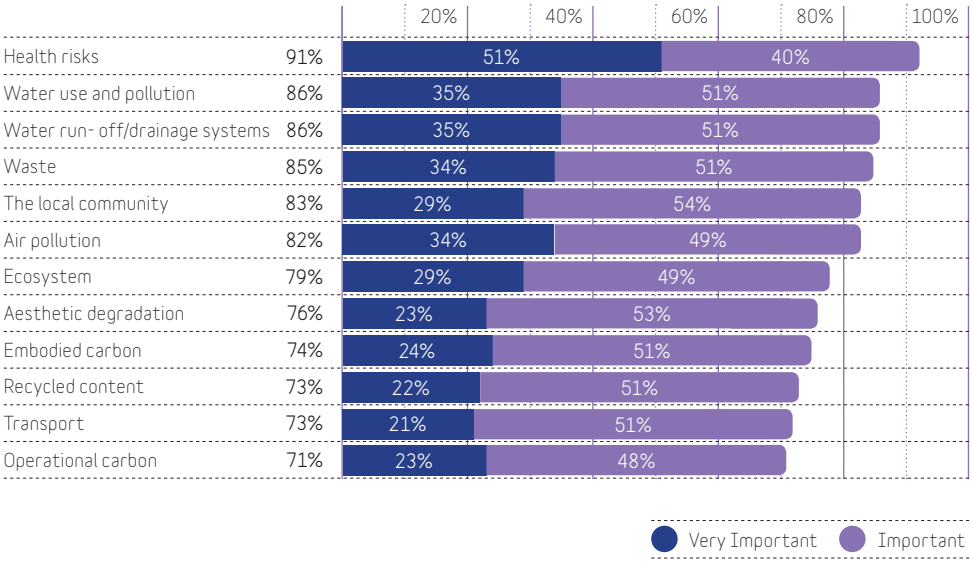


"New build education is the most likely to be sustainable. Of the top four for sustainability, three are, generally speaking, publically funded (the other being explicitly environmental in intent)."

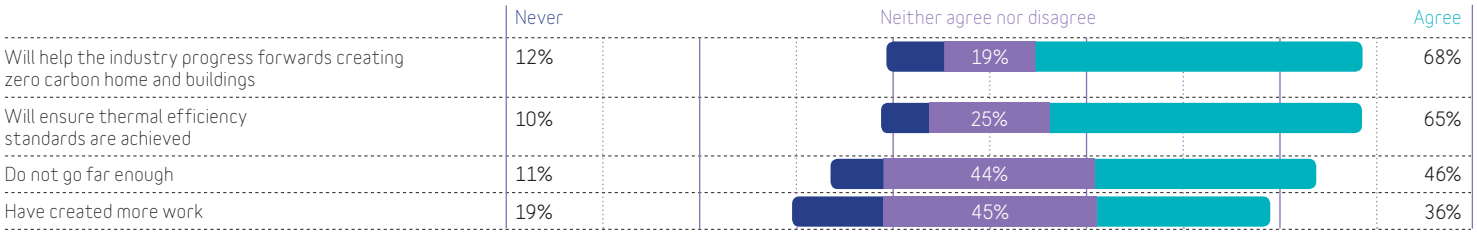
Aligned to which projects are most likely to be sustainable is the question of which aspects of sustainability are important. As in 2012, 'health risks' were seen as the most important. The majority of respondents recognised the importance of all aspects of sustainability. Surprisingly, operational carbon is at the bottom of the list, though a large majority (71%) still saw it as important or very important. In 2014, embodied carbon is now seen as marginally more important, with 73% seeing it as important or very important.

We ran this survey in the spring of 2014, shortly after a very wet winter in the UK in which there was widespread flooding. This may be an influence on the high place given to 'water run-off and drainage systems' as well as 'water use and pollution', although it may also suggest that we are moving from sustainability being about avoiding climate change towards it being about climate change mitigation.

Thinking about specific elements of sustainability, how important are the following aspects of sustainability to the projects you work on?



The changes to Part L of the Building Regulations...



Making buildings sustainable

We have seen that many respondents want to go further than legislation and statutory guidance requires. In early 2014, the Department for Communities and Local Government (DCLG) made significant changes to Part L of the Approved Documents: the Part that deals with conservation of fuel and power. Seventy-eight percent of respondents were aware of these recent changes, so we were interested to see what reactions people had towards the changes, and towards the Approved Documents in general.

Some noted that they did not feel the Approved Documents went far enough:

"Adopt more strict building standards."

"Energy regs - Part L - don't go far enough."

Some wanted the Passivhaus standard to be mandatory for new build:

"Make Passivhaus part of building regulations."

There was also a feeling that the Approved Documents need to link better with other sustainability standards:

"Create a clear, cohesive, joined up policy rather than the 'competing' elements of the Approved Documents, CfSH, BREEAM, etc. etc."

"The minimum requirement of the Approved Documents, e.g. energy conservation, should be co-ordinated and matched with the performance requirements for 'sustainable' accreditation. The current mis-match across these documents only serves to prolong the challenge for improved performance."

And whilst the Approved Documents help us reach sustainable goals, they are, by their nature, limited:

"Zero carbon Part L for new builds is fine but that is a tiny fraction of the energy we are going to use for the next 30 years."

Others were looking for simplicity and constancy:

"Simplify building regs and don't change them for ten years."

"Stop changing legislation/regulation to the detriment of sustainability, i.e. removal of Code for Sustainable Homes, going back on zero carbon commitment – the industry is set to go back by approx. 10 years at this rate."

As for the recent changes to Part L, people were more likely to view the changes positively than not. Sixty-eight percent think that they will help create zero-carbon homes, and 65% that they will ensure that thermal efficiency standards are achieved. Whilst it's a minority – 46% – who agree that the changes don't go far enough, that's still 35% more than those who disagree.

Overall then, the changes are viewed positively, but they might have gone further, they need tying up with other standards, and they don't address sustainability outside of new builds.

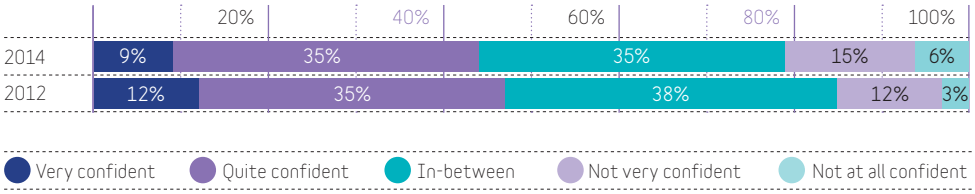
Help in achieving sustainability – assessment methods and information sources

To bring about sustainability, we not only need legislation but also competence, guidance and methods of assessment.

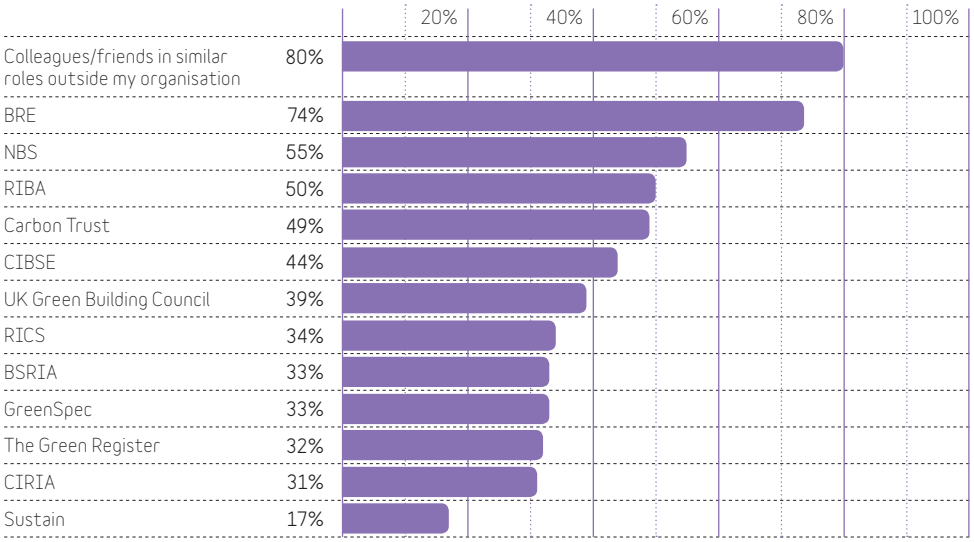
We asked how confident people are in their knowledge of and skills related to sustainability. We found that overall, 44% described themselves as confident (9% 'very', and 35% 'quite'). This marks a slight decrease to the 2012 figures. Twenty-one percent describe themselves as not confident (15% 'not very' and 6% 'not at all'), a slight increase compared with 15% in 2012.

Perhaps stability and simplicity in guidance would help improve confidence, but for now at least, guidance is not simple and it does change, so people need accurate, up-to-date information to inform their design decisions. Where do people go for information? As we have found in other areas, the first port of call is colleagues and friends, with 80% choosing this route. Next comes the specialist organisation – the BRE at 74%, then NBS at 55%. A majority turn to the RIBA too.

How confident are you in your knowledge and skills of sustainable design?

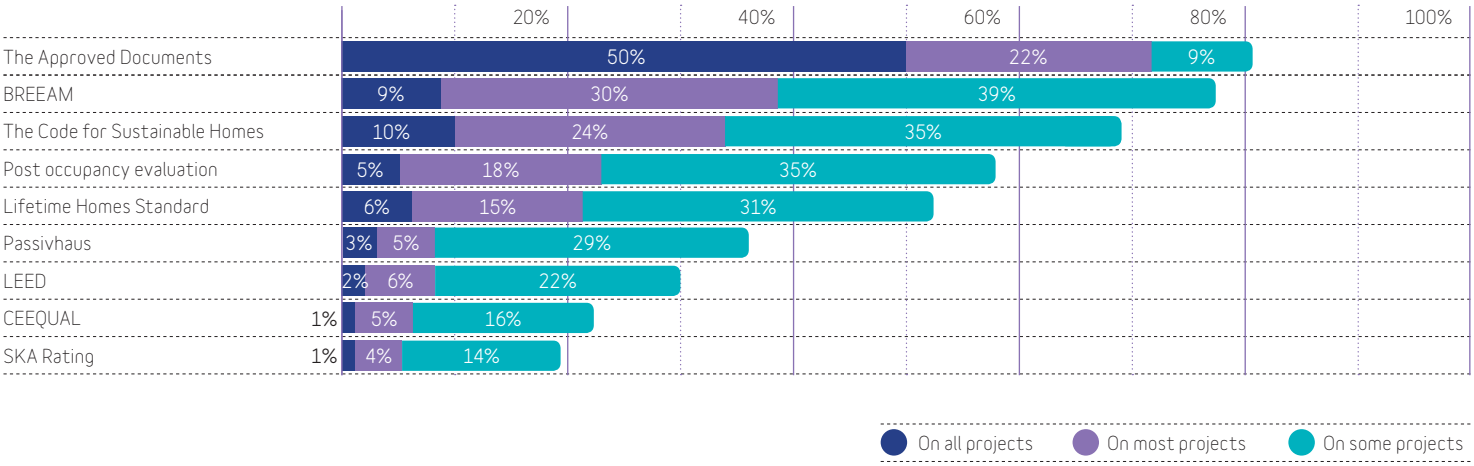


How likely are you to turn to the following sources of information about sustainability? (very or quite likely)



"Perhaps stability and simplicity in guidance would help improve confidence, but for now at least, guidance is not simple and it does change, so people need accurate, up-to-date information to inform their design decisions."

When working on projects, how would you describe your use of the following assessment methods to help you create sustainable buildings?



"We wanted to uncover which assessment methods respondents use to help them create sustainable buildings and whether they use them on some, most or all projects."

We also looked at how construction is assessed. Assessment methods give a degree of objectivity to design decisions. This is particularly important in sustainability where there can be disagreements about what constitutes sustainable design. We wanted to uncover which assessment methods respondents use to help them create sustainable buildings and whether they use them on some, most or all projects.

The most-used assessment method is the Approved Documents, with over four fifths of people telling us that they use them on at least some projects. Of course, the Approved Documents are statutory guidance, so we would expect their use to be widespread.

BREEAM is also widely used, with almost 80% of respondents using it on at least some projects. Passivhaus is growing, with over a third using it on at least some projects.

Fifty-eight percent carry out post-occupancy evaluations for at least some of their projects. The RIBA Plan of Work recommends this, suggesting that at Stage 7 ('in use') observation of the building operation in use and assistance with fine tuning and guidance for occupants should be undertaken, and the energy/carbon performance declared.

"Assessment methods give a degree of objectivity to design methods. This is particularly important in sustainability where there can be disagreements about what constitutes sustainable design."

Of those assessment methods people used, we asked how useful they found them. Passivhaus proved to be the most valued among its users, with 64% finding it 'extremely' or 'very' useful in helping create sustainable buildings. There were many free text comments advocating its broader adoption:

"Move away from the carbon obsession when designing buildings and base good sustainable design on energy use and comfort (as practiced by Passivhaus) in order to combine economic, environmental and social targets."

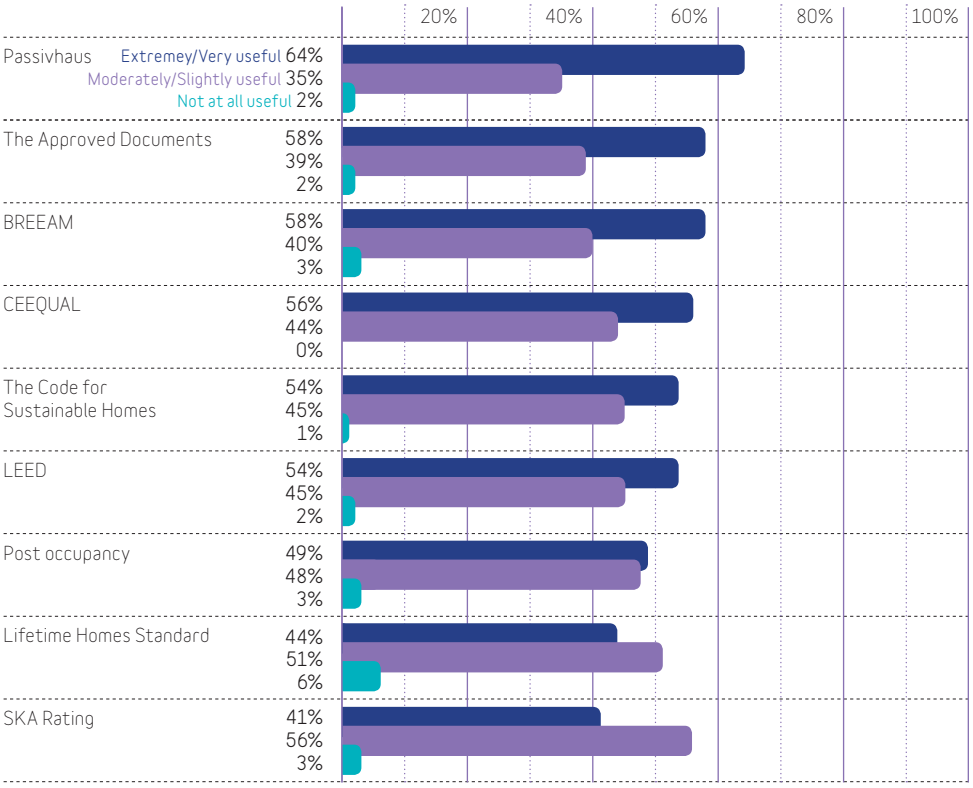
"Follow the German example and make Passivhaus a minimum standard for all new houses."

BREEAM was widely appreciated too, with 58% finding it 'extremely' or 'very' useful. But comments about BREEAM were often more critical than those about Passivhaus:

"Make the BREEAM process less complicated. It is a clumsy tick boxing exercise which enters into the detail of design which is quite unnecessary."

"Scrap BREEAM as an environmental assessment method and develop a new bench marking system which truly reflects sustainability."

Of the assessment methods you have used, how useful are the following in terms of helping you create sustainable buildings?



"If clients wish to commission sustainable buildings, they can be built. If legislators wish to mandate sustainable design, sustainable designs will be created."

Closing remarks

Looking through the findings of the survey, some things are clear. There is a deep level of personal and professional commitment to sustainability. It is often those outside of the professions that are seen to be holding back sustainable design and building.

If clients wish to commission sustainable buildings, they can be built. If legislators wish to mandate sustainable design, sustainable designs will be created.

Though widely used, guidance and standards are at times seen as fragmented, contradictory, bureaucratic and difficult to keep up-to-date with. This means that not all people are confident in their skills, but many are. There are trusted sources of information, whether they are colleagues' advice, specialist organisations or professional bodies. The Government's role might be stronger, and many more would welcome a tightening of sustainable requirement designs than a loosening. It's not the Government that's seen as the lead in sustainability: it's the professionals themselves.

The embodied impact of construction materials

Jane Anderson
Principal Consultant,
PE International

"The world of embodied energy has moved on considerably since work started in the 1990s, and embodied carbon, EPD and Building LCA are now increasingly common in construction."

I first heard about embodied energy in 1997, at a lecture during my MSc course by Nigel Howard, who was leading BRE's work on Environmental Profiles and the Green Guide. I was fascinated that we knew so little about the impacts of producing and using construction materials, and how important it was for buildings, so for my thesis I explored the embodied impact of housing and increasing energy efficiency levels. Luckily, BRE were recruiting, and I was able to work there for the next ten years as we tried to bring embodied impacts into the hands of designers through the Green Guide to Specification, Envest and (more recently) the IMPACT LCA tools, and tried to give manufacturers the opportunity to demonstrate their environmental credentials through Certified Environmental Profiles. But it is only relatively recently that people have stopped asking 'Do people really do that?' when they find out what I do, and started saying 'Oh yes, I've heard of that'.

The last two years really have brought great changes to the world of embodied carbon and Life Cycle Assessment (LCA) in the construction industry. Most importantly, at the beginning of 2013, the final European Standard covering embodied impacts for construction was published – BS EN 15804:2013 provides the core Product Category Rules (PCR) to produce Environmental Product Declarations (EPD) for construction materials, and is intended to ensure that manufacturers are not required to provide EPD with different methodologies and formats in each country where they sell products. Towards the end of 2013, BRE launched their EN 15804-compliant EPD scheme, and now there are compliant schemes in the UK, France, Belgium, the Netherlands, Germany, Sweden, Norway and the United States. EcoPlatform members (the organisation of EPD Programme Operators that provides over 2000 EPD) and three of the major EPD programmes – IBU (Germany), International EPD® (Sweden) and UL Environment (USA) – now have mutual recognition agreements in place. In the UK, EN 15804-compliant EPD for brick, cement and reinforcing steel have been published by their UK sector organisations, and many more EPD are in progress for UK companies and trade associations.

On a European level, the Commission has stated that it intends to use EPD to address life cycle environmental impacts through Basic Works Requirement 7 of the Construction Product Regulations. To this end, it has encouraged Product Technical Committees to start work (in advance of regulation) to implement EN 15804 within their product standards, with Timber (CEN/TC 175) having published their PCR standard, BS EN 16485:2014, and at least 12 other TCs starting work on standards. And as part of the Commission's focus on resource efficiency, it has stated through its recent communication on 'Resource Efficiency Opportunities in the Building Sector' that it will develop a framework, through consultation and based on the TC 350 standards, to assess the environmental performance of buildings throughout their life cycle, including embodied impacts of construction materials and products. This framework will be free to use, enabling affordable assessment for all building projects.

And whilst the UK has stated that any regulation of embodied impact here is unlikely until after 2020, other countries have already legislated. France, as part of the Grenelle Environnement, legislated in 2013 to ensure that any environmental claims made in France about construction products would have to be supported by an EPD lodged with the Government, and Belgium enacted similar legislation, which will come into force in 2016. The Netherlands has used a different legislative route, requiring a building level LCA within their Building Act for all housing and office projects since 2013. Based on the CEN/TC 350 standards for products and buildings, the Government has provided a database of generic construction product LCA data and building level methodology. LCA tools which use these are approved for use for the assessments, and the Government has stated that in the future it intends to introduce limit values for Embodied Carbon and Resource Depletion.

Although regulation seems some way off in the UK, major developers here have recognised the significance of embodied carbon within their corporate activities, and sponsored the extremely popular UKGBC Embodied Carbon Week earlier in 2014. Many developers and clients are now routinely measuring and looking to reduce embodied carbon, and many of the case studies (such as those for Sainsbury, Marks & Spencer, British Land and Bioregional) show that significant reductions are possible, often accompanied with economic savings. As part of the event, WRAP launched their Embodied Carbon benchmarking database, providing a platform to allow users to benchmark the embodied carbon of buildings against others using similar scopes. Both GLA and RICS have published Building Level Embodied

Relevant survey statistics →
Seventy-three percent see embodied carbon as an important aspect of sustainability, in the projects they work on.

Carbon methodologies following the TC 350 standards, which aim to enable those new to the subject to start evaluating embodied carbon. Another driver for the increased focus on embodied carbon has been the inclusion of Building LCA credits within both BREEAM and LEED. Using the power of BIM to take material quantities calculated from CAD models to link them to LCA data is the focus of two tools: IESVE's IMPACT complaint suite and the Tally® Revit plug-in, which both aim to make building LCA a true design tool, used to adapt the design to reduce impact, rather than a compliance assessment completed long after the design has been finalised. The Technology Strategy Board, which funded IMPACT, has also funded a number of other embodied carbon tools such as Butterfly.

Both BREEAM and LEED have also increased the focus on Responsible Sourcing, with LEED including credits for responsible sourcing for the first time in Version 4, launched in 2013. What has previously been a focus on BES 6001 in the UK and on timber chain of custody internationally has now moved, with the EU Timber Regulation banning illegally harvested timber from sale in the EU, and bodies such as the Aluminium Stewardship Council, the WBCSD Cement Sustainability Initiative and the Australian Steel Stewardship Forum all taking responsible sourcing schemes forward.

LEED v4 has also placed a focus on transparency of product constituents, with credits for the use of Health Product Declarations (HPD) which declare all the inputs to a product. While in Europe REACH legislation and Safety Data Sheets provide data on hazardous substances within products, the level of transparency provided is far less than that of an HPD.

Both LEED and BREEAM provide additional opportunities to gain credits for materials with EPD. At present, this is more about encouraging the provision of EPD than making use of the information. In the US, UL Environment's Sustainable Product Database now lists over 250 construction products with EPD, a significant increase driven by the LEED credit. LEED also provides a 'multi-attribute optimization' or ecodesign credit, allowing products which can demonstrate that they have significantly lower embodied impacts than the industry average to gain credits. Products with manufacturer-specific EPD can use this to demonstrate how they perform when compared with published industry generic EPD to obtain this credit, or alternatively, Type 1 Ecolabels may demonstrate improved embodied impacts.

Combined ecodesign and EPD tools using EN 15804 methodology and indicators are now increasingly being used by manufacturers throughout the product design process to reduce product impact, and to allow EPD to be produced 'on demand' across large product ranges and for client-specified products. Our EPD tools are being used by clients such as Zumtobel to provide EPD on demand for any of the 10,000 products in their lighting catalogue, and Kalzip can provide an EPD on demand for any project's cladding specification, taking account of different profiles, fixings, inclusion and coatings. Groups of manufacturers, through bodies such as the Mineral Products Association, Wood for Good, British Precast and UK CARES, have also started to develop EPD tools to allow their members to produce low-cost EPD quickly, and make use of the tools' ecodesign facilities to improve and benchmark their products.

All these different initiatives mean that the world of embodied energy has moved on considerably since work started in the 1990s, and embodied carbon, EPD and Building LCA are now increasingly common in construction. Research which we undertook for the Commission suggests that European construction uses over 90% of all cement, aggregates and bitumen, 80% of flat glass, over 55% of PVC, timber and clay, and 25-40% of steel, aluminium and copper. The same research also calculated that, as a proportion of impacts from the built environment, materials are responsible for over 90% of elemental resource depletion, over 40% of POCP (summer smog) and ozone depletion, over 20% of water consumption, fossil fuel depletion and acidification, and over 10% of global warming potential. Compared to the impact of Europe as a whole, the UK-consumed construction materials are responsible for 10% of elemental resource depletion, 3% of fossil fuel depletion, nearly 2% of POCP (summer smog), and around 1% of global warming and acidification.

As mentioned above, numerous case studies have suggested that assessing Embodied Carbon and Building LCA quickly leads to the identification of savings, both environmental and economic. In fact, the Green Construction Board has estimated that reductions (from 2010 levels) of nearly 40% are possible by 2050, with over 20% reduction to be achieved by 2022. Starting to measure embodied carbon, and making changes to designs and specifications to reduce impact are both essential, and offer a huge opportunity to reduce our impacts in an affordable way. ●

Jane Anderson, Principal Consultant, PE International

Jane Anderson is one of the UK's leading experts in the embodied impacts of construction materials, having worked on Life Cycle Assessment and Environmental Product Declarations (EPD) for construction products for over 15 years. She led the development of the 2007 update of the BRE Environmental Profiles Methodology, and co-authored the original BRE Environmental Profiles Methodology published in 1999 and all of BRE's Green Guides to Specification from 2000. She is the UK expert on CEN/TC 350 WG3, the working group which developed the European Standard EN 15804, providing a consistent set of rules for EPD for all construction products across Europe. With PE INTERNATIONAL, she has recently worked on the development of an EPD tool for UK cement for the Mineral Products Association, the Wood for Good Lifecycle database for the UK timber industry and has just started work on a trade association EPD and tool project for precast and ready mixed concrete in the UK. With Jane Thornback, she wrote the Construction Product Association's 'Guide to understanding the embodied impacts of construction products'. She tweets and blogs as @constructionlca.

Sustainability in Australia

John Gelder
Lecturer in Construction, School of Natural and Built Environments, University of South Australia

In the survey, 74% agreed that 'The UK should be a global example for sustainable buildings' (but 6% disagreed). Other countries have similar expectations for themselves, of course. There is no reason why there can't be many 'global examples'. Is Australia another? John Gelder, until recently the Head of Sustainability at RIBA Enterprises, investigates.

Sustainability in Australia is a mixed bag at the moment, with some recent controversial decisions made by the Federal Government. It recently abolished the carbon tax scheme introduced by the previous Government.

www.environment.gov.au/climate-change/repealing-carbon-tax

It has also approved the Carmichael Coal Mine, for the growing Indian market, which requires dredging and dumping for a new terminal (carefully) near, and shipping the coal (carefully) around, the Great Barrier Reef.

www.abc.net.au/environment/articles/2014/07/28/4025069.htm

These decisions have made the headlines internationally, but what else is going on?

Energy supply

Australia is blessed with energy choice: both non-renewables (oil, gas, coal, uranium) and renewables (solar, wind, tidal, geothermal, waste). Domestic take-up of the renewables (they can't be exported) is becoming more significant. The national use of renewables is around 11% – mostly hydropower (e.g. the Snowy Mountains Scheme, built from 1949 to 1974.

www.snowyhydro.com.au/energy/hydro/snowy-mountains-scheme

But South Australia – with 37% of the country's wind farms – got up to 65% of its energy just from wind power in strong winds in June 2014! Victoria got up to 12%.

www.abc.net.au/environment/articles/2014/06/26/4033893.htm

Targets are ambitious: the Australian Capital Territory is aiming for 90% renewable, for example.

www.environment.act.gov.au/energy/90_percent_renewable

But all is not going swimmingly: a new wave power machine was recently stranded offshore in South Australia en route to its final location, putting its manufacturer out of business.

www.energybusinessnews.com.au/energy/tidal/oceanlinx-wreck-will-take-a-year-to-remove/

"Australia is blessed with energy choice: both non-renewables (oil, gas, coal, uranium) and renewables (solar, wind, tidal, geothermal, waste)."

John Gelder is Lecturer in Construction at the University of South Australia, and is a member of buildingSMART

John Gelder is an architect, registered in both Australia and the UK. He was with RIBA Enterprises from 2000 to 2014, latterly as Head of Content Development and Sustainability. During this time he was involved in the development of NBS Create and Uniclass2 (both launched 2012), and of the NBS Sustainability Survey 2012. He participated in iCIM, a TSB-funded research project with Northumbria University and others, which prototyped the automation of the calculation of embodied carbon and other attributes (first shown in 2012). John was a member of the RIBA Sustainable Futures Group and BSI committee B/558 Sustainability of construction works, and was on the BRE Green Guide to Specification and TSB IMPACT Project Steer Groups. He has written many articles on aspects of sustainability for thenbs.com and others.

John is now a Lecturer in Construction at the University of South Australia, and is a member of buildingSMART. Before joining NBS, he was involved in the development of the AIA Environment Design Guide (EDG), first published in 1995, and the AIA Environment Policy. He edited International Construction Information Society (ICIS) Report 3 Environmentally responsible specifying – an international survey (1999). He retains his interest in sustainability, and is renewing involvement with the EDG.

Relevant survey statistics →
Almost two thirds would not want a building to receive the Stirling Prize unless it was sustainable.

Australia earns export dollars by shipping non-renewables to overseas markets, and this sort of thing buffered the Australian economy during the GFC (Global Financial Crisis). Australia was the world's third biggest exporter of uranium in 2013, and the biggest exporter of coal (it doesn't use uranium for power domestically, but it does use coal, which provides around 75% of electricity generated nationally).

www.originenergy.com.au/energymix

But these export figures raise the question: 'Against which country should the consumption and consequences of these materials be tallied?' The supplier, or the purchaser, or both?

Despite being the largest producer of oil and the second-largest producer of natural gas in the EU, the UK became a net importer of fossil fuels in 2013, for the first time since the 1970s. Partly for this reason, the UK is aiming for 15% renewables by 2020, in accordance with EU targets, following the 2011 UK Renewable Energy Roadmap.

www.gov.uk/government/uploads/system/uploads/attachment_data/file/255182/UK_Renewable_Energy_Roadmap_-_5_November_-_FINAL_DOCUMENT_FOR_PUBLICATIO___.pdf

In the second quarter of 2013, the UK generated over 4% of its energy supply from renewables. This is still quite modest.

Water supply

Australia is the driest inhabited continent: a third of it produces almost no run-off at all. Only a coastal strip – from Melbourne through Brisbane to Broome – receives more than 600 mm a year.

About a third of Australia's capital city water supplies are met by desalination plants (Adelaide, Perth, Melbourne, Sydney, Gold Coast), but they are mostly used as back-ups rather than as regular sources.

desalination.edu.au/

The country is at the mercy of the elements in this regard; this winter has been kind to Adelaide, for example: all of its reservoirs are 88% full.

www.sawater.com.au/SAWater/WhatsNew/WaterDataUpdate/ReservoirHome.htm?ReservoirSystem=StateSummary

But in other years at this time, they have been close to empty, which is why Australia pays close attention to El Niño.

www.bom.gov.au/climate/enso/ninocomp.shtml

It surprises Australians, but drought can be a problem in the UK too.

www.bbc.com/news/magazine-26049927

Some eastern parts receive less than 700 mm a year. It has been suggested that water from Kielder Reservoir could be piped south, to address the problem.

www.theguardian.com/environment/2011/nov/08/water-supply-infrastructure

Construction products

Australia is a small and dispersed market – with 23.5 million people at an average density of 3 people per square km[1]. A consequence is that Australia imports many construction products (e.g. 88% of ceramic tiles used in Australia in 2011 were imported, mostly from China) and the raw materials to make them (e.g. 100% of vinyl chloride monomer – for making PVC – is imported, again mostly from China). Australia produced 5.37 million m^3 of sawn wood in 2007-08, mostly softwood, but imported just 0.78 million m^3, mostly from New Zealand.

www.abs.gov.au/ausstats/abs@.nsf/0/D7C98F8F2FB52D95CA25773700169CBD?opendocument

The Illegal Logging Prohibition Act Amendment Regulation 2013 controls the importing of illegally-felled timber. Some hardwood reforesting is underway.

www.carbonneutral.com.au/about-us/planting-sites.html

Imported products and materials are expensive in embodied energy, although the travel distances may be comparable with domestic travel distances, e.g. Melbourne–Darwin is 5915 km by sea, and Hong Kong–Darwin is 5540 km by sea.

The environmental performance of products may be certified under the Green Tag product certification scheme. Products from some 90 manufacturers are covered. The certification runs from Bronze to Platinum, and is split into LCARate and GreenRate – some products have both.

www.globalgreentag.com/

Though restricting the design palette to locally-made products can be limiting, doing so produces a localised style of construction, especially apparent in buildings remote from the urban centres, such as much of Glen Murcutt's work.

www.ozetecture.org/glenn-murcutt-projects/

Europe and the UK have much higher populations, and densities: Europe averages 72 people per square km, and the UK has 263 per square km! There are therefore much smaller distances between manufacturing centres and markets, and much more choice of locally-made products. It could be argued that UK construction is spoilt!

As part of this European trade network, the UK also imports construction materials. For example, in 2012 it produced 3.41 million m^3 of sawn wood, mostly in Scotland, but imported 5.18 million m^3.

www.forestry.gov.uk/pdf/FCFS213.pdf/$FILE/FCFS213.pdf

The EU Timber Regulation 2013 should reduce the amount of illegally-felled timber coming into the UK.

ec.europa.eu/environment/eutr2013/index_en.htm

It's time to reforest those uplands, to reduce imports, provide carbon offsetting, mitigate floods, and help re-wilding.

www.canadiangeographic.ca/magazine/jf11/canadian_trees_british_forests.asp

[1] But as elsewhere on the planet, the population is concentrated in cities – Sydney and Melbourne each have about 4 million people, for example

National Construction Code (NCC)

The NCC applies across Australia and is performance-based, with deemed-to-comply solutions. It has three parts, as follows:

- Building Code of Australia (BCA) Volume 1 (non-housing).
- Building Code of Australia (BCA) Volume 2 (housing).
- Plumbing Code of Australia (PCA).

Operational energy is the environmental sustainability focus of the BCA.

Section J (Energy efficiency) covers building fabric, including glazing and sealing, and building services, including air-conditioning and ventilation, lighting and power, and hot water supply. The requirements are elaborate and extensive. For example, minimum total R-values are specified for each building class, building element, and climate zone. For example, for Class 2 or 3 buildings, the minimum total R-value is specified for a roof or ceiling generally, for climate zones 4 to 8 (not Köppen-Geiger), for ranges from 2.7 to 4.3 $m^2{\cdot}K/W$ (corresponding to maximum U-values of 0.37 to 0.23 W/m2·K) with upward heat flow (table J1.3). This is augmented by deemed-to-satisfy R-values for standard constructions (in Specification J1.3). Air movement is specified in terms of ventilation openings in rooms with or without ceiling fans or evaporative coolers, by climate zone (table J4.2). The minimum energy efficiency ratio for packaged air-conditioning equipment and refrigerant chillers is specified (table J5.4), as are maximum illumination power densities (table J6.2b), and so on.

Energy efficiency installations are subject to maintenance requirements (Section I, Maintenance), i.e. requirements beyond the completion date 'to reduce greenhouse gas emissions by efficiently using energy throughout the life of the building'. This applies to building services.

Water efficiency is covered in the PCA, e.g. through the mandatory WaterMark Certification scheme.

www.abcb.gov.au/product-certification/watermark.aspx

Australia is probably tougher than most countries in this regard.

In the UK, the regulations are also performance-based, but there are different deemed-to-comply requirements for each jurisdiction. For England, Approved Document L2A Conservation of fuel and power in new buildings other than dwellings 2013, Table 3, specifies limiting (maximum) U-values, e.g. 0.25 $W/m^2{\cdot}K$ for roofs and floors, but U-values of standard constructions are not given. For Scotland, Technical Handbook Non-domestic: Energy 2013, Table 6.7, has maxima of 0.27 $W/m^2{\cdot}K$ for walls, and 0.2 $W/m^2{\cdot}K$ for roofs for the insulation envelope, but gives other maxima for other building types, e.g. shell and fit-out. Just the one national set of deemed-to-comply solutions is really all that's warranted.

Building certification schemes

Australia straddles 12 Köppen-Geiger climate zones, from alpine to arid. A third of the country is north of the Tropic of Capricorn. Parts of the country are vulnerable to various combinations of bushfires, termites, cyclones and earthquakes. This all makes life interesting for Australian designers, regulators and environmental certifiers.

This is one reason that Australia has its own environmental assessment scheme for buildings and other developments, called Green Star, and promulgated by the Green Building Council of Australia (in the same way that LEED is promulgated by US-GBC).

www.gbca.org.au/green-star/

There are several operational rating tools (e.g. Green Star – Education), some at pilot stage (e.g. Green Star – Communities), one under development (Green Star – Design & As Built), and a 'rating tool development service' (Green Star – Custom).

The National Australian Built Environment Rating System (NABERS) is a certification scheme run by the NSW Office of Environment & Heritage on behalf of all Australian governments.

www.nabers.gov.au/public/WebPages/Home.aspx

It covers offices, shopping centres, hotels, data centres and homes, and looks at energy, water, waste and the indoor environment of the building in use. It offers up to 6 stars, and is part of the Federal Government's Commercial Building Disclosure Program.

www.cbd.gov.au/

However, assessment schemes from elsewhere are also used. For example, the Pixel Building in Melbourne achieved what was then the world's highest LEED rating (105 out of 110 points) in 2012.

www.gbca.org.au/news/industry-news/leed-rating-for-pixel/

Passivhaus is also used in Australia.

passivehouseaustralia.org/

The UK has just one Köppen-Geiger climate zone: CfB.

people.eng.unimelb.edu.au/mpeel/koppen.html

BREEAM is geared to the UK climate, and so cannot cope with the range of climates found in Australia, the USA and so forth. In particular, it wasn't considered adequate with respect to air-conditioning.

www.building.co.uk/breeam-leed-and-green-star-whos-the-fairest?/3146922.article

A memorandum of understanding that BREEAM signed with LEED and Green Star in 2009 should be improving the consistency of measurement of CO2 equivalents in all three schemes.

http://www.breeam.org/newsdetails.jsp?id=542

Presumably this is being implemented in the 2014 edition of BREEAM.

www.breeam.org/filelibrary/BREEAM%20UK%20NC%202014%20Resources/BREEAM-UK-New-Construction-2014-FAQs-v1.1.pdf

"The National Australian Built Environment Rating System (NABERS) is a certification scheme run by the NSW Office of Environment & Heritage on behalf of all Australian governments."

The Pixel Building in Melbourne achieved the world's highest LEED rating in 2012

Environment Design Guide (EDG)

The survey asks about sources of information on sustainability. The EDG is one such source. It began life in 1995, and is published by the Australian Institute of Architects. Over the years, the EDG has grown into a comprehensive (over 200 notes) technical resource on all aspects of environmental sustainability, including over 20 current case studies in a consistent format for ease of comparison (e.g. CAS 50 (2008) Australian Ethical Investment Headquarters, Canberra).

environmentdesignguide.com.au/media/CAS50.pdf

and over 30 notes on products (e.g. PRO 20 (2004) Lead hazards in construction). Social sustainability is also covered, e.g. EDG 78 (2013) Social sustainability.

environmentdesignguide.com.au/media/misc%20notes/EDG_78_NP.pdf

There is no direct UK equivalent to the EDG, as far as I know. BRE's publications collectively cover many aspects of sustainability, as well as other subjects, but are rather more expensive.

www.brebookshop.com/

Specification

NATSPEC in Sydney publishes the national master specification library, which is a good source of information on sustainability. Work sections include a global green section, 0168 Green star – as built submissions, and several overtly green technical sections such as 0184 Termite management, 0323 Straw bales and 0322 Mud brick walls. Sustainability is also dealt with in the text and guidance of many other technical sections. The company publishes technical guidance, including quite a bit on aspects of sustainability, such as DES 011 Rainwater harvesting, DES 031 Specifying R-values and TR01 Specifying ESD.

www.natspec.com.au/

The guidance codes are intended to match those used in the Environment Design Guide.

Other sources of information on sustainable design include the Federal Government's Department of the Environment, which publishes guides on ESD and water efficiency for office and public buildings

australia.gov.au/topics/environment-and-natural-resources/environmental-sustainability

and online guidance for environmentally sustainable homes.

www.yourhome.gov.au/

NBS Create covers one of the green sections mentioned – Straw bale wall systems – and of course it publishes others, including some not in NATSPEC, such as Thatch roofing systems and Pond and wetland systems. NBS covers some of the guidance material in articles (e.g. Water: It's this season's energy), but doesn't publish comparable technical notes.

www.thenbs.com/topics/Environment/articles/index.asp

However, these subjects are covered in books from the RIBA Bookshop

www.ribabookshops.com/search/sustainable+development/?sort=published-date-down

which has good sustainability coverage.

The UK Government produces the Code for Sustainable Homes

www.gov.uk/government/policies/improving-the-energy-efficiency-of-buildings-and-using-planning-to-protect-the-environment/supporting-pages/code-for-sustainable-homes

and the British Council for Offices publishes guidance on sustainable office design.

www.bco.org.uk/Research/Best-Practice-Guides.aspx

The UK is probably a bit better off in this respect.

Design awards

Finally, the survey shows that 65% think that 'A building shouldn't receive an award, like the Stirling Prize, unless it's sustainable'. Australian awards don't meet this aspiration.

But all is not lost. The two co-founders of Troppo won the 2014 Australian Institute of Architects (AIA) Gold Medal, which suggests that the architectural profession takes sustainability very seriously, at least occasionally. Troppo has worked hard to develop and promote passive (fabric first) tropical architecture – a tall order.

www.troppo.com.au/background

The AIA also offers a Leadership in Sustainability prize.

www.architecture.com.au/events/national/prizes-competitions#leadershipinsustainabilityprize

UK awards do meet this goal, at least in part, in that annual energy figures must be supplied for a project to be eligible for any RIBA award.

www.architecture.com/Files/RIBATrust/Awards/RIBAAwards/RIBAAwardsEntry Information2014.pdf

The RIBA also offers a Regional Sustainability award, and there is a sustainability specialist on regional juries. But I don't think it can be claimed that any RIBA Gold Medallists won the award because of their attitudes to sustainability.

Green Contracting. Can it exist?

Roland Finch
Chartered Surveyor and Technical Author at NBS

Introduction

At NBS, one of the requests we receive on a regular basis is for advice on how to specify sustainability, or sometimes how to write it into a contract.

Before we tackle this, however, let's address a more fundamental question: 'Is it actually possible?'

If we accept that sustainability is a performance requirement, then the short answer is 'Yes', but as you might expect, it is not as simple as calling up a single clause or contract condition.

Defining 'sustainable'

It has become quite fashionable in recent years for construction clients, consultants and contractors to declare how 'green' they are.

Of course, as usual, the devil is in the detail. In particular, it depends which definition you use. Green can mean a colour evoked by light with a predominant wavelength of roughly 495–570 nm. It can mean jealous, underdeveloped, hopeful (as in green shoots), naïve, or even aliens from outer space (the 'little green men' from Mars).

Sometimes, listening to the claims people make, one is forced to conclude that they are indeed not from this planet.

When we talk about 'green' in the context of the built environment, however, the concept is even more diverse. Usually the focus turns to the use of natural resources or waste minimisation, but that's not the whole story. For some, it's associated with the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in 1992. Others associate it with Our Common Future, from the United Nations World Commission on Environment and Development (WCED) – also known as the Brundtland Report after the former Norwegian Environment Minister and Chair of the Commission.

Bruntland's report includes what has since been widely adopted as the definition of sustainable development, i.e. that which can:

"Ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs."

So how is this achieved in practice?

"If you were asked for a design that 'complied with the Building Regulations', you would immediately realise that there are a huge number of possible solutions."

Roland Finch, Chartered Surveyor and Technical Author at NBS

Roland Finch, BSc FRICS ACIArb, is a chartered quantity surveyor with over 30 years' construction industry experience in both the public and private sectors. He is the principal author of NBS Contract Preliminaries and Project Management content, has written many articles on a variety of construction-related topics, and is a former Consulting Editor for 'Croner's Management of Construction Projects'.

He is a member of the RICS UK QS and Construction Professional Group Board, and a Director of the RICS Research Trust.

Roland is the co-author of 'BIM for Construction Health and Safety.'

Relevant survey statistics →
The most-used assessment method is the Approved Documents, with over four fifths of people telling us that they use them on some projects. BREEAM is also widely used, with almost 80% of respondents using it on at least some projects. Passivhaus is growing, with over a third using it on at least some projects.

Sustainable construction

In order to specify compliance with a performance requirement, we must first define what that requirement is, and then set out the criteria which will be used to measure and enforce conformity.

Unfortunately, as we've noted, there are a lot of definitions; and therefore a lot of possible criteria.

If you were asked for a design that 'complied with the Building Regulations', you would immediately realise that there are a huge number of possible solutions. All buildings constructed in the UK are designed to meet standards for sound transmittance or air permeability, just as they are for electrical or fire safety, but each satisfies the requirements in different ways. They do this by complying with a 'model' standard, using guidance set out in the Approved Documents.

And so it is with sustainability, except that the range of solutions is much broader.

For example, there is also a social dimension to sustainability, with the focus being on the needs of communities and individuals, and their relationship with the building itself. This means that location has an impact, as well as more personal things such as appearance, usability, thermal and acoustic comfort, lighting levels and air quality, and an overarching commitment to health and safety.

Design and specification

Designers need to research, and select, products which meet certain performance criteria: perhaps those which have certain properties, or contain materials which can be assessed against published standards for embodied carbon or some other chemical constituent. The building itself is a sum of these parts, and combined together they contribute to its overall performance, in areas such as airtightness or durability.

The Construction Products Directive introduced CE Marking of construction products in 1989. Marking is a declaration by the manufacturer of the product's performance against certain requirements (although it can also mean that the product must merely declare values, not necessarily meet a minimum performance).

These are:

- Mechanical resistance and stability
- Safety in the case of fire
- Hygiene, health and the environment
- Safety in use
- Protection against noise
- Energy economy and heat retention.

It should be recognised that the majority of a building's carbon emissions result from use rather than construction: things like heating and cooling, cleaning, maintenance and so on. To some extent these are influenced by the products used in construction, but they are also a function of the design: height, alignment, space enclosure, shape, location and even human preference and behaviour.

"It should be recognised that the majority of a building's carbon emissions result from use rather than construction: things like heating and cooling, cleaning, maintenance and so on."

Procurement and Supply Chain Management

The supply chain will inevitably come under scrutiny: how responsible or ethical is it? This is particularly important for certain types of products. Are they from 'sustainable sources' or 'responsibly sourced'?

There is plenty of advice available from bodies such as the UK Waste Resources Action Programme: www.wrap.org.uk, BRE: www.bre.co.uk/greenguide/ or Sustainable Materials: www.sustainablematerials.org.uk/

Contracts

Some publishers, such as the Joint Contracts Tribunal (JCT), include clauses encouraging contractors to suggest how a particular construction project could be improved, either by refining processes or using certain products. JCT has also produced a guidance note, Building a sustainable future together, setting out their ideas for dealing with environmental sustainability within construction contracts.

In each case, however, there must be a set of rules by which the proposals may be evaluated in a fair and transparent way.

Legislation

One of the stated aims of the UK development control regime is to improve sustainability. This is addressed in a variety of ways, including Building Acts and Regulations, which prescribe minimum standards for things like durability, acoustic or thermal performance and waste minimisation, or the prevention of use of 'deleterious materials': those which may be harmful to the environment.

Specific legislation exists concerning health and safety in construction, such as the CDM Regulations, or those to do with lifting, working at height or in confined spaces, or with substances hazardous to health. These have a direct bearing on the sustainability of a project if human wellbeing is one of the assessment conditions.

Finally, pieces of legislation such as the Localism Act 2011 place power in the hands of local communities with regard to transport, planning and infrastructure.

Business case

A major obstacle to the sustainability agenda is the belief that sustainable buildings are more expensive. Some research has suggested that the cost of constructing a green building may be as much as 17% higher than the cost of building a conventional structure.

To a certain extent, this is a misplaced argument. Typically, buildings which are perceived to be sustainable are constructed to higher standards, so it follows that there will be an element of additional cost involved. Moreover, the benefits and advantages to the end-users will far outweigh the additional upfront costs, and will be realised in lower operating costs, less maintenance, greater durability and improved productivity from occupants as a result of their better general feelings of wellbeing.

Of course, the reverse is also true – a building with impeccable 'green' credentials can fall down on sustainability if its operation and maintenance is overly complicated as a result, leading to poor satisfaction ratings. For an example of the effect, just consider the increasingly polarised debate on the frequency of municipal bin collections!

Research is emerging, however, which suggests that there is a premium to be received by tenants of so called 'green' buildings – arising from businesses that see the advantages of enhancing their sustainable credentials as part of the Corporate Social Responsibility agenda. A fuller argument is presented in the World Green Building Council report: The Business Case for Green Building (2013).

www.worldgbc.org/files/1513/6608/0674/Business_Case_For_Green_Building_Report_WEB_2013-04-11.pdf

Models

When looking at a compliance model for sustainability, there is plenty of assistance out there. Assessment models such as BREEAM, LEED, CEEQual, Greenstar and others provide a series of matrices which allow targets to be set and compliance measured. They even allow different levels of compliance to be specified, although 'excellent' or 'outstanding' are the levels of choice, as they are cleverly worded to sound better than 'pass'. It is important to note, however, that these are not simply concerned with construction, meaning that location, land use, post-occupancy efficacy and user satisfaction may also be taken into account.

Building information modelling (BIM) is potentially a vital tool in this process. BIM is not just about building geometries – shape size, position and so on. BIM is concerned with information, and information which supports sustainable credentials can easily fall into this category, whether it relates to embodied carbon or risk analysis for health and safety.

The main driver of BIM is technology and its ability to quickly compare a range of different scenarios for a construction project, and by applying a set of pre-determined rules in this way, the project characteristics can be optimised for a particular outcome.

Summary

Sustainability comes in many flavours, and it sometimes needs to be taken with a pinch of salt. Anyone who has boarded an airliner in the UK recently will be fascinated to note that they all now seem to carry energy labels similar to those displayed on fridges and dishwashers. This is an EU requirement, but it is remarkable how highly some of them score when we consider the understood negative effects of burning jet propulsion fuel. The reason is that they are compared with an industry benchmark rather than an independently assessed, challenging target.

In a similar way, a construction project can be designed to align with a particular version of sustainability. The challenge here is not just to make the design compliant, but to find the version that truly delivers the results we are all looking for. ●

"BIM is not just about building geometries – shape size, position and so on. BIM is concerned with information, and information which supports sustainable credentials can easily fall into this category."

Notes

Notes

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