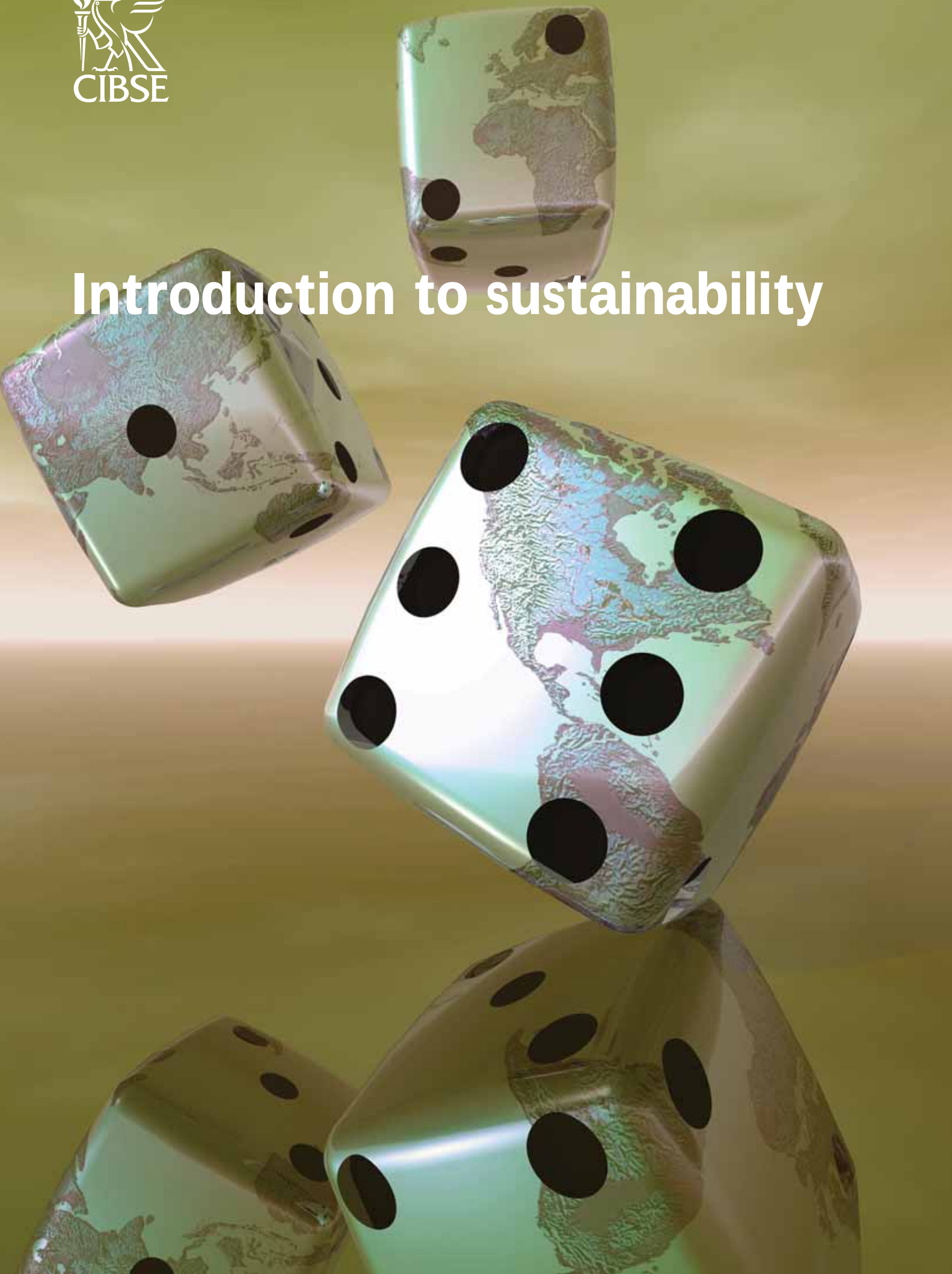
CIBSE

Introduction to sustainability



Registered charity number 278104

ISBN 978-1-903287-81-1

Typeset by CIBSE Publications

Printed in Great Britain by Page Bros. (Norwich) Ltd., Norwich, Norfolk NR6 6SA

Cover image © Photolibrary

Printed on 100% recycled paper comprising at least 80% post-consumer waste

Introduction to sustainability

Principal author
David Cheshire (Faber Maunsell)

Contributing authors
Miles Attenborough (Faber Maunsell)
Zac Grant (Faber Maunsell)

CIBSE Steering Group and Technical Managers
Brian Moss (*chairman*)
Laurence Aston (AMEC)
Andrea Beddard (Arup)
Vic Crisp (*project manager*) (CIBSE)
Hywel Davies (CIBSE Research Manager)
Andrew Ford (Fulcrum Consulting)

Editors
Helen Carwardine
Ken Butcher

Contents

1 What is sustainability?

Sustainable development (or sustainability) is about enabling all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life for future generations.

Climate change is the most high-profile and urgent sustainability issue. However, sustainability covers a wide range of issues, many of which are either exacerbated by climate change or are contributing towards it. For example:

— Over 2 million properties in England and Wales are currently at risk from flooding; changes in our climate, such as rising sea levels, more severe storms and wetter winters, will increase that risk.
— There are more frequent water shortages in the UK and average household water demand has increased by 55% since 1980.
— There has been a serious decline in wildlife habitats in the UK over the last 60 years, due to pressure on land and changes in farming practices.
— Each person in the UK generates just over half a tonne of household waste per year, on average; UK household waste increased by 15% per person between 1995–6 and 2004–5.

What do we mean by 'sustainability'

The best known definition of sustainable development is from the Report of the World Commission on Environment and Development: *Our Common Future*[3] popularly known as 'The Brundtland Report' and is most commonly quoted as follows:

> 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'

The UK Government Sustainable Development Strategy sets out five Guiding Principles for sustainable development:

— living within environmental limits
— ensuring a strong, healthy and just society
— achieving a sustainable economy
— using sound science
— promoting good governance.

2 Crisis? What crisis?

The UK Government's report on climate change, the Stern Review[1], states that:

> 'The scientific evidence is now overwhelming: climate change presents very serious global risks, and it demands an urgent global response'.

Building services engineers have a crucial part to play in promoting sustainable buildings and they have to get involved in finding a collective way forward rather than waiting for other groups to take a lead. To quote Stephen Matthews, CIBSE's Chief Executive:

> 'The work of the building services professional is crucial to the quality of life on our planet today and tomorrow'.

Current climate models show that, if we take no action to reduce carbon dioxide emissions, then there is the risk of serious, irreversible climate change. The Intergovernmental Panel on Climate Change (IPCC) report[2] states that:

> '... warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level.'

Figure 1 shows a reconstruction of temperatures in the northern hemisphere for the last 1000 years. The graph shows a rapid increase in temperatures for

A capricious beast

'The climate system is a capricious beast, and we have been poking it with a sharp stick' — *W S Broecker*[4] (1987)

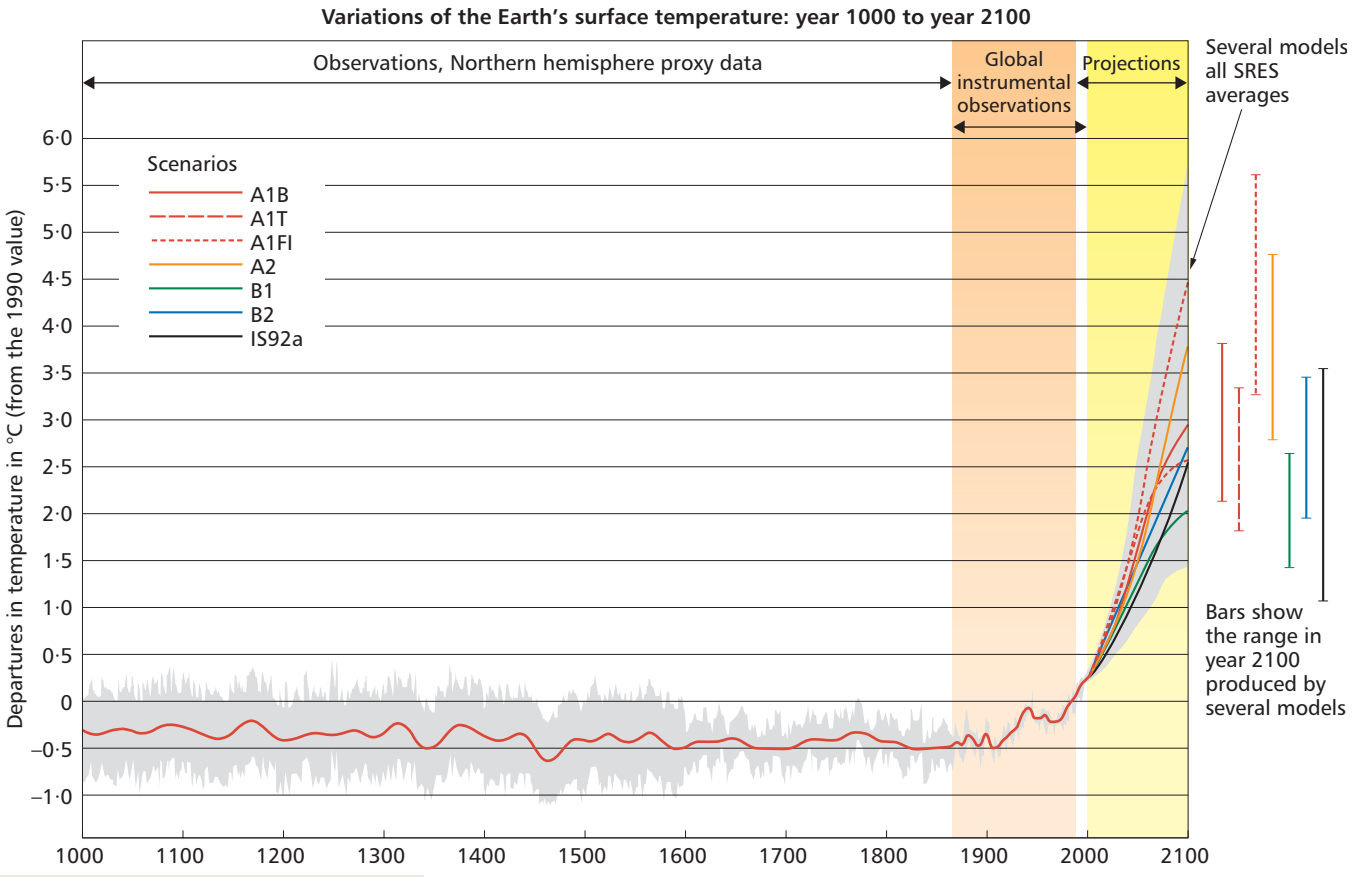


Figure 1: **Reconstructions of northern hemisphere temperatures** (source: *The Stern Review*[1]; Crown copyright)

the last 100 years that is far out of proportion to the previous 900 years. The predictions for 2100 show at least a 2 °C rise in temperatures for the most conservative scenario.

The climate models show that there is a high chance of global temperature rises exceeding 2 °C, which increases the risk of irreversible change. Figure 2 shows the close historic relationship between global temperature and atmospheric carbon dioxide concentrations. It also shows the huge rise in projected carbon dioxide emissions (to the right of the diagram) which are expected to have profound consequences on global temperatures.

Figure 3 shows the potential changes due to climate change, depending on the rise in global temperature.

Taking action now can still avoid the worst impacts of climate change by stabilising CO_2 emissions into the atmosphere.

The 'hockey stick' graph

Figure 1 shows reconstructions of northern hemisphere temperatures for the last 1000 years. This graph has been dubbed the 'hockey stick' graph as it shows a relatively flat period from AD 1000 to 1900 (the 'shaft') after which the temperatures increase rapidly (the 'blade').

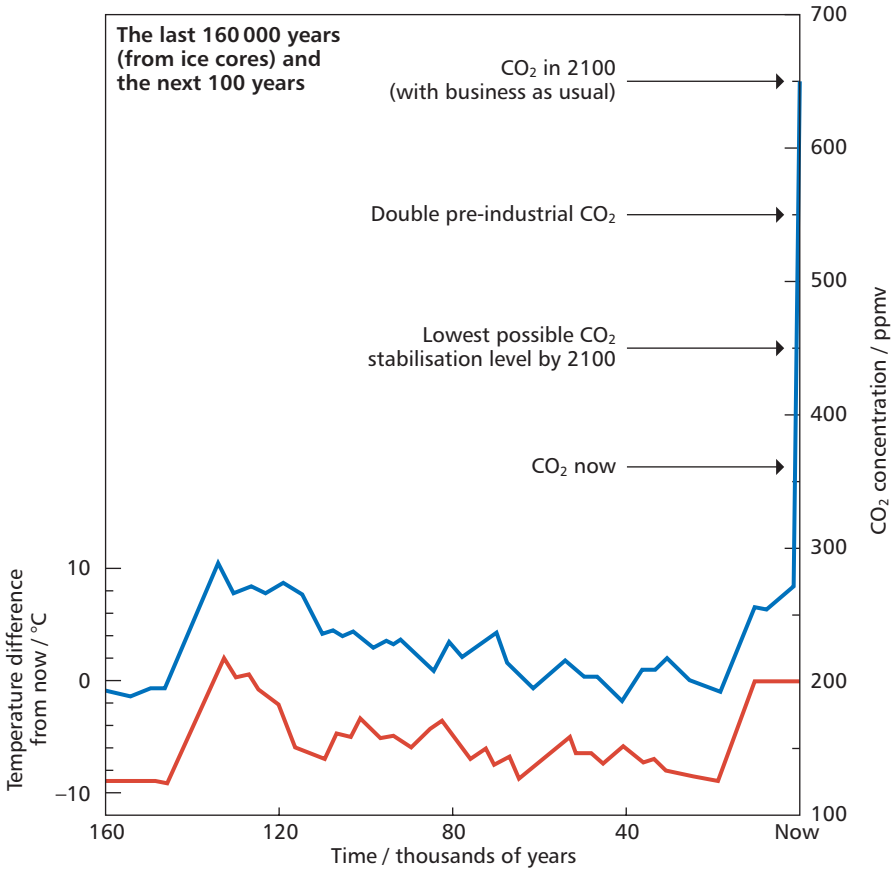


Figure 2: **Atmospheric temperature and carbon dioxide concentration as measured from the Vostok ice core from Antarctica** (source: Sir John Houghton: The science of global warming; *Interdisciplinary Science Reviews*[5])

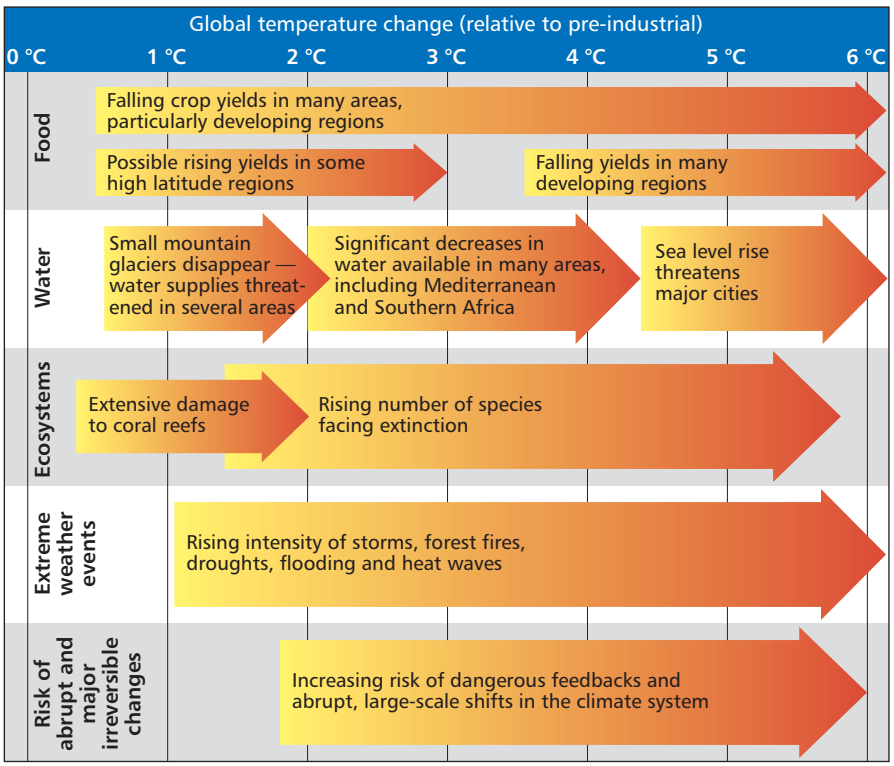


Figure 3: **Projected impacts of climate change** (source: *The Stern Review*[1]; Crown copyright)

What is sustainable construction?

Department for the Environment, Food and Rural Affairs (DEFRA) has defined sustainable construction as follows:

— A building that leaves as small an environmental footprint as possible, is economic to run over its whole life cycle, and fits well with the needs of the local community.

— A building that is energy and carbon efficient, designed to minimise energy consumption, with effective insulation and the most efficient heating or cooling systems and appliances.

— A building built with good access to public transport in mind.

— A building built with a minimum of waste in its construction and which looks to maximise reuse of on-site materials such as waste soil.

— A building designed and constructed to enable its occupants to use less water, through, for example, the installation of more efficient fittings and appliances.

— A building designed to make recycling and composting easy for the occupants.

What does an engineer do?

'Engineers use creativity, technology, and scientific knowledge to solve practical problems' — *Wikipedia*[8] (2007)

3 Don't panic!

Climate change has become the most high-profile and urgent sustainability issue. Faced with the predicted impacts of climate change it is easy to dismiss the problem as insurmountable, and just carry on as usual.

The Stern Review states that:

> 'There is still time to avoid the worst impacts of climate change if strong collective action starts now.'

This means that we all have to contribute through our professional and personal behaviour, wherever we live or work. While many of the examples given in this publication to support that behaviour relate to the UK, and UK legislation, the principles of sustainability apply wherever in the world we practice and wherever our designs or projects are undertaken

3.1 CIBSE's role in sustainability

Building services engineers work within an industry that has significant environmental and social impacts (see box on page 5). Building services engineers are directly responsible for ensuring that buildings:

— provide acceptable thermal comfort for occupants
— use minimum amounts of fuel and energy
— are adequately and attractively lit
— provide good indoor air quality
— deal effectively with wastes, and
— are adaptable to climate change
— are properly operated and maintained.

All of these responsibilities have a direct impact on the sustainability of buildings and many will influence the fabric and form of the building. CIBSE has taken a leading role over the pursuit of 'building sustainably' and expects its members to take forward this initiative.

This expectation is enshrined in the CIBSE Code of Conduct which requires members to 'have due regard to environmental issues in carrying out their professional duties'. CIBSE policy statement *CIBSE Members and Sustainable Development*[6] sets out the Institution's policy for sustainability and the responsibilities that its members should accept. This includes taking 'environmental factors into account during the design, installation and operation process, in order to minimise environmental impacts and to enhance the built and natural environments'.

Terry Wyatt's 2003 CIBSE Presidential Address[7] predicted that the world of building services engineering was going to change and that CIBSE had to

'adapt or die'. One of the key changes he identified was climate change and the emergence of a carbon management market. It is becoming clear that providing advice on building sustainability is essential for all CIBSE members and is crucial for the long-term survival of the profession.

3.2 What should building services engineers do?

Building services engineers have an opportunity to become sustainability experts for the built environment. It is important that building services engineers consider sustainability before being appointed and that sustainability advice is offered, even if there is no explicit requirement in the brief. At the very least, a review of planning policies and key targets should be undertaken before being appointed, as planning is becoming one of the key drivers for sustainability.

Sustainable development is now 'the core principle underpinning planning'[10] and providing advice on how projects can respond to planning policies is one of the key business opportunities for building services engineers; see Appendix A for a list of relevant planning policies. Building services engineers should recommend that best practice sustainable construction is about going beyond legislative requirements (such as building regulations) and planning policies.

Building services engineers now have the opportunity to expand their role to include sustainability advice at the early stages of projects and in the operation and maintenance of buildings. This means being far more involved in:

— the briefing and concept stages of a project to ensure that sustainability issues are considered
— ensuring that buildings really do work as designed and that buildings are operated and managed sustainably.

This means re-training and taking on new functions and skills as the business environment changes.

Building services engineers have a direct influence over issues such as:

— carbon emissions from buildings
— use of water
— the indoor environment
— the way that buildings can be adapted for climate change
— reducing the use of potential pollutants (e.g. refrigerants).

As building professionals and engineers, CIBSE members also have to have an increasing awareness of the wider sustainability agenda. In particular, sustainable drainage systems, flood risk, ecology, materials selection and the social impacts of building design, construction and operation.

Environmental and social impacts

Environmental and social impacts of construction and operation of buildings:

— Household water consumption accounts for around two thirds of water in the public supply (excluding leaks).
— The construction, occupation and maintenance of buildings accounts for around 50% of UK emissions of carbon dioxide.
— The construction industry uses over 420 million tonnes of material resources each year.
— Waste from the construction sector generates 92 million tonnes of waste a year, of which 13 million tonnes are unused new materials (i.e. materials delivered to the site, unused and then sent away for disposal).
— In England and Wales an estimated 2.3 million properties (9% of all properties) lie in areas at risk of flooding. The construction of new buildings in flood risk zones increases the risk of flooding in other areas.
— The UK construction industry is one of the country's leading industries, employing some 2.1 million people in the UK.

Vision

'Engineers in the 21st century will have a broader range of expertise to work in partnership with other disciplines and stakeholders to provide holistic, sustainable solutions. Their integrity and commitment to sustainable development will be enshrined in the philosophy of the professional engineering institutions, to a level parallel with the ethical framework for doctors.' — *The engineer of the 21st century inquiry*[9] (2000)

Figure 4: **'Green' wall at a community centre in Paradise Park, Islington**

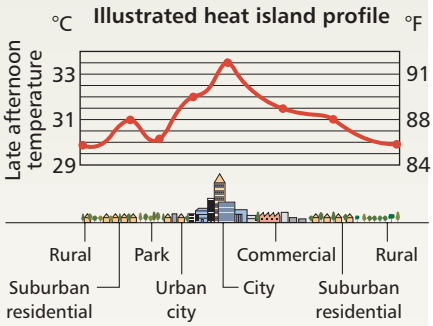
Issues such as ecology in relation to engineering are not often discussed, but features such as green roofs or walls (see Figure 4) are very relevant to building services engineering as they can reduce heat flow through the building envelope[11]. Vegetation and green roofs (see Figure 5) can also contribute towards reducing the urban heat island effect[12]. Green roofs have other benefits, such as helping to attenuate the amount of rainwater run-off from buildings.

CIBSE Guide L: *Sustainability*[14] provides building services engineers with guidance on how to respond to the sustainability agenda. It sets out the actions that building services engineers should take to enable their work to deliver sustainable outcomes. The online tool accompanying the Guide is a searchable online database of good sustainable practice.

4 What are the drivers for change?

There are many pressures on the construction industry to become more sustainable, many of which are driven by international and European targets. Building services engineers are familiar with legislative requirements such as the Building Regulations, but are often less familiar with planning policy commitments and wider environmental legislation (e.g. the F-Gas Regulation[15]). Figure 6 summarises the pressures on building services engineers.

Figure 5: **Sketch of an urban heat-island profile** (adapted from U.S. Environmental Protection Agency website[13])



4.1 Client requirements

Clients increasingly require building services engineers to provide advice on sustainability. For example, clients need to be given early advice on the implications of compliance with Part L of the Building Regulations for England and Wales[16] and the equivalent legislation for Scotland[17] and Northern Ireland[18], and the implications of all relevant planning policies (such as the London Plan[19]).

Many large client organisations now have sustainability commitments in the form of 'Corporate Social Responsibility' reports. These reports often contain objectives and targets relating to measurable environmental performance, and improvement targets for issues such as: energy/CO_2 emissions, water and waste. Also, clients increasingly set targets for BREEAM[20]/Code for Sustainable Homes[21] (formerly EcoHomes) ratings for new and refurbished buildings.

The Government estate and government-related organisations (e.g. The Housing Corporation) have targets and assessment methods that have to be met.

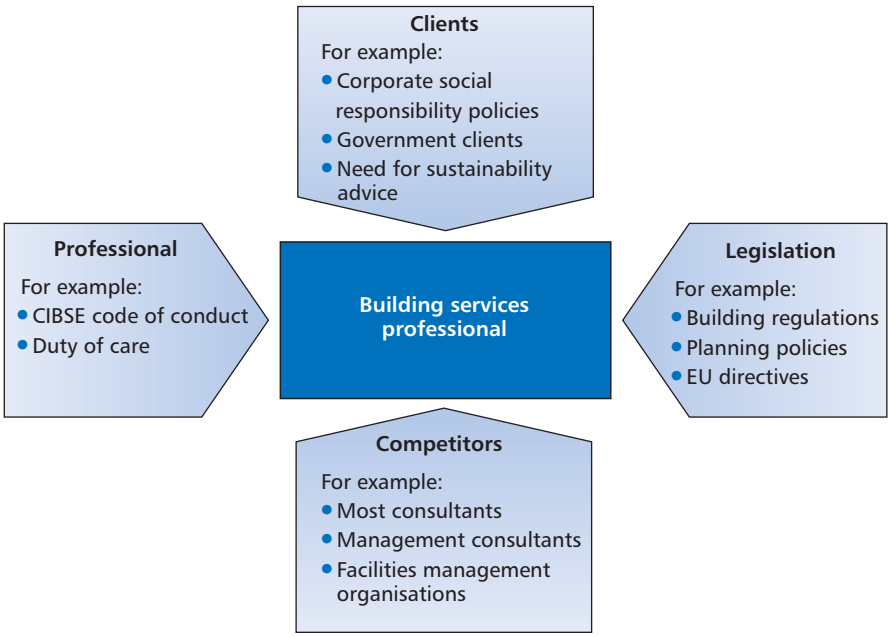


Figure 6: **Summary of the pressures on building services engineers**

For example:

— all new housing funded by The Housing Corporation must achieve environmental sustainability targets, most notably new housing has to achieve a Level 3 rating under the Code for Sustainable Homes[21] (formerly EcoHomes) from 2008 (see www.breeam.org.uk)

— the Ministry of Defence (MoD), the Prison Service, the Department for Education and Skills (DfES), and the National Health Service (NHS) all have their own environmental assessment methods (based on BREEAM[20]) that must be undertaken for all projects

— the Government estate has specific targets for carbon emissions, renewables etc. for all projects (e.g. central Government's office estate to be carbon neutral by 2012). (For more information, see: http://www.sustainable-development.gov.uk)

4.2 Professional responsibility

CIBSE expects its members to take a leading role in sustainability. Building services engineers have a professional responsibility to give advice that helps to reduce the environmental impact of their work.

4.3 Competitors

There is increasing demand for sustainable engineering and increasing competition to provide these services. This competition is not just provided by building services engineering consultancies, but from disciplines outside the profession. For example, management and cost consultancy firms are offering carbon management advice to clients with large property portfolios.

Proposed EU energy policy targets and objectives

- Reducing greenhouse gas emissions from developed countries by 30% by 2020.
- The EU has already committed to cutting its own emissions by at least 20% and would increase this reduction under a satisfactory global agreement.
- Improving energy efficiency by 20% by 2020.
- Raising the share of renewable energy to 20% by 2020.
- Increasing the level of biofuels in transport fuel to 10% by 2020.

4.4 Legislative drivers

Drivers for sustainability include international agreements (e.g. Kyoto targets for reducing greenhouse gas emissions), European Directives that are enacted through UK law (e.g. the Energy Performance of Buildings Directive) and the UK Government strategy.

These are implemented through various mechanisms including:

- Building Regulations (England, Wales and Northern Ireland) or Building Standards (Scotland)
- national, regional, sub-regional and local planning policy
- the Code for Sustainable Homes[21]
- the Climate Change Levy and Enhanced Capital Allowances

There are a number of European Directives that are being, or will be enacted into UK law. For example:

- F-Gas Regulation[15] (see section 5.3 in CIBSE Guide L: *Sustainability*[14] for more information)
- Energy Performance of Buildings Directive[22] (see *Energy and carbon emissions in buildings: a guide to legislation*[23])

References to these documents can be found in Appendix A.

Building services engineers will be familiar with many of the mechanisms listed above. However, providing responses to planning policies is an area of work in which engineers traditionally have had little involvement, even though these mechanisms are driving considerable change in the construction and refurbishment of buildings.

For example, major projects in London now have to comply with *Sustainable Design and Construction — Supplementary Planning Guidance*[24]. This guidance includes specific targets for a range of sustainability issues.

For example:

- in addition to energy efficiency measures and low carbon technologies, carbon emissions from the total energy needs of the development should be reduced by at least 10% by the on-site generation of renewable energy
- residential developments should achieve average water use in new dwellings of less than 40 m^3 per bedspace per year
- all new gas boilers should produce low levels of nitrous oxides, and
- developments should achieve 50% attenuation of the undeveloped site's surface water run-off at peak times.

Many local planning authorities are also adopting policies on sustainability.

Building services engineers will be expected to appreciate planning policies, particularly those related to CO_2 emissions, water use and other issues directly affected by building services design.

4.5 What does this all mean?

Building services engineers will now have to make a major contribution to projects through the provision of advice on sustainability, because sustainable construction is being driven by a large number of compulsory and voluntary mechanisms. There are risks that important targets are missed, or that proposals may not be compliant with environmental legislation.

Building services engineers have to be increasingly aware of sustainability issues and ensure that these issues have been raised, ideally before the project is started.

It is very difficult to incorporate sustainability measures into projects later in the design process. It can also be very costly, both in terms of design fees and the capital cost of additional measures. Therefore, it is advisable to use the guidance and references in CIBSE Guide L: *Sustainability*[14] in order to understand the implications of meeting the various sustainability objectives and targets for a project.

The options for measures should be identified as early as possible in the design (e.g. before RIBA Plan of Work[25] Stage C) and some indication of cost should be included in the initial cost estimates for the project.

5 What are the critical issues?

Sustainability covers a wide range of issues and various lists have been prepared. A useful starting point for a comprehensive list is the UK Government Sustainable Development Strategy, *Securing the Future*[26], which includes a list of 68 indicators. These indicators cover everything from 'renewable electricity generated as a percentage of total electricity' through to 'households satisfied with the quality of the places in which they live'. A proportion of these indicators can be applied to building engineering projects.

The key issues that can be applied to a construction or engineering project are set out in Table 1.

A set of principles can then be applied to implement each of these sustainability issues. These principles underpin the key sections of CIBSE Guide L: *Sustainability*, and the online tool.

Table 1: **Key sustainability issues for construction and engineering projects**

Sustainability issue	Examples of design and construction objectives
Energy and CO_2	Reduce predicted CO_2 emissions by applying energy efficient design principles and utilising low and zero carbon technologies.
Water	Reduce predicted water use by integrating water efficient plant, appliances and fittings.
Waste	Reduce construction and demolition waste going to landfill and enable in-use recycling in accordance with the waste hierarchy.
Transport	Increase the use of sustainable modes of transport when the building is in use.
Adapting to climate change	Improve the capacity of the building to operate successfully under the different and demanding conditions predicted in future.
Flood risk	Mitigate the risk of flooding (and design for flood resilience).
Materials and equipment	Reduce the embodied lifetime environmental impacts by selecting on the basis of environmental preference.
Pollution	Reduce unavoidable building related emissions and the risk of accidental pollution.
Ecology and biodiversity	Enhance the ecology and biodiversity of the site by protecting existing assets and by introducing new habitats and/or species.
Health and wellbeing	Provide a safer, more accessible, healthy and comfortable environment.
Social issues	Reduce crime and adverse effects on neighbours throughout the lifetime of the development through design and good practice in construction and operation.

CIBSE Guide L: *Sustainability* sets out the fundamental principles for delivering more sustainable buildings. It emphasises the importance of influencing the brief and sets out the opportunities that are open at the early design stages of a project. It also includes summaries of sustainable engineering techniques and technologies.

The CIBSE online sustainable engineering tool is a searchable, online database of good practice. It allows users to generate a shortlist of measures related to a specific sustainability issue, along with references to relevant guidance documents. The database then identifies approaches and measures that can be applied.

6 Key actions

Table 2 shows key actions cross-referenced to CIBSE Guide L: *Sustainability*. Although the table mainly applies to major new and refurbishment projects, the principles apply to all types of projects.

Table 2: **Key actions**

Key stage	Key actions	Guide L section number
Pre-inception	Identify all drivers for sustainability and ensure that appointment allows for project team to respond to these drivers.	2.1 and 2.4
	Identify risks associated with project that relate to sustainability (e.g. flood risk assessments, damage to ecological habitat, transport impacts etc.).	2.1 and 2.2
	Determine potential impact of sustainability targets (e.g. a target for a 'zero carbon development' is likely to have implications on whole project team).	2.2
	Include scope and fees for early-stage predictions of energy and water use in scope of work (early-stage energy/carbon assessments are becoming essential).	2.4
	Determine whether an Environmental Impact Assessment is required.	2.4 and 4.5
Strategic brief	Provide a response to the strategic brief by considering drivers for sustainability and raising issues early in the project.	2.1
	Identify any requirements in the brief that could conflict with sustainability objectives (e.g. design targets for low internal temperatures in summer).	2.2
	Identify requirements for input from specialist consultants (e.g. ecologists, acousticians etc.).	2.4
	Identify site opportunities and constraints that relate to sustainability (e.g. likely ground conditions for ground source heat pumps).	3
Project brief	Propose sustainability objectives and targets, in particular carbon and water targets in response to drivers for sustainability.	2.2
	Determine whether assessment methodologies are required (e.g. BREEAM, NEAT) and ensure that project contributes towards all relevant targets.	2.2
	Ensure that design responsibilities are allocated for all critical sustainability targets, especially those relating to carbon and water use.	2.2
Strategy	Undertake an initial site analysis against sustainability targets, including determining infrastructure capacity, establishing ground conditions etc.	3
	Provide rules of thumb and design guidance for project team on key issues (e.g. number of wind turbines required to meet predicted loads, or likely spaces for an energy centre).	3
	Develop an energy and carbon emissions strategy by following the principles set out in CIBSE Guide L: Sustainability.	3.1
	Develop a water management strategy by following the principles set out in CIBSE Guide L: Sustainability.	3.2
	Develop a strategy for adapting to the effects of climate change, by following the principles set out in CIBSE Guide L: Sustainability.	3.3
	Recommend that the project team establishes the flood risk of the site and consults with local authority to determine whether a strategic flood risk assessment has been undertaken.	3.4
	Incorporate flood resistant principles into design of building services and work with the design team to raise awareness of flood risk and flood resistance.	3.4

Table 2: **Key actions — *continued***

Key stage	Key actions	Guide L section number
Strategy (*continued*)	Recommend that project teams give consideration to the incorporation of sustainable drainage systems and the potential to integrate with rainwater collection.	3.5
	The project team should liaise with transport planners, in order to identify the scope of transportation work required by the local authority.	3.6
	Recommend that a suitably qualified ecologist be involved to undertake an ecological appraisal of the site.	3.7
	Inform project team of shading benefits of vegetation integrated into the building design and landscape (e.g. green roofs or walls).	3.7
	Incorporate access and inclusion measures identified in the accessibility audit.	3.8
	Recommend that a waste management strategy be prepared for the operation of the building.	3.9
	Consider potential for energy from waste systems.	3.9
	Establish the need for and feasibility of waste management facilities such as compactors, serviced storage spaces etc.	3.9
	Recommend that the life cycle impacts of materials and equipment are considered by the project team and that these are considered during the selection of construction methods in terms of ventilation strategies, appropriate thermal mass etc.	3.10
	Make the project team aware of the principles of designing for deconstruction and consider the whole life of services components for recycling or reuse at the end of their life.	3.10
	Recommend that there is active engagement and consultation with the local community	3.11
	Highlight the need for consultation with the local police Architectural Liaison Officers on safety and security.	3.11
	Determine planning strategy and establish the information that is required for the submission. In particular, determine whether an Energy Strategy Report and Sustainability Statement are required for application.	4
	Contribute towards Environmental Impact Assessment (if required), particularly in relation to air quality, noise, microclimate issues, etc.	4.5
Design	Identify the options for reducing demand, supplying efficiently and for providing low or zero carbon technologies.	5.1
	Propose feasible technologies and techniques to meet carbon emissions targets.	5.1
	Identify the options for reducing water demand, supplying water efficiently and for use of rainwater or treatment and reuse of water.	5.2
	Propose feasible technologies and techniques to meet water use targets.	5.2
	Advise clients on the maintenance and operational implications associated with using F-Gas refrigerants, such as R134a and R407c.	5.3

Table 2: **Key actions — *continued***

Key stage	Key actions	Guide L section number
Design (*continued*)	Ensure that the proposals provide comfortable and appropriate internal conditions that promote health and wellbeing, as set out in the relevant guidance.	5.4
	Ensure that storage space for efficient management of waste and recyclable material during operation is incorporated into the layout and that this space is correctly serviced and managed.	5.5
	Select and source materials based on the overall environmental impacts and suppliers' declarations.	5.6
	Avoid use of environmentally-hazardous materials such as insulants with global warming gases (HFCs).	5.6
	Avoid selecting or locating plant that may create additional noise over the existing background level.	5.7
	Consider alternative arrangements for providing and maintaining infrastructure and delivering services, such as ESCOs and multi-utility joint ventures.	5.8
	Incorporate all technologies and techniques, as identified in the earlier design stages and refer to the CIBSE online sustainable engineering tool to identify detailed measures.	Online tool
Construction	Recommend that contractor selection takes account of environmental credentials.	6.1
	All relevant tender packages should be reviewed against the sustainability requirements for the project.	6.1
	Recommend that sub-contractor and supplier selection takes account of environmental credentials.	6.1
	Recommend a periodic review of sustainability performance against objectives and targets.	6.1
	Ensure that the engineering services that are procured and delivered to site meet the performance standards relating to sustainability, and that the requirements are fully addressed.	6.1
	Observe construction site practices and comment on practices that could have a significant impact on the environment.	6.2
Commissioning	Ensure that systems building commissioning/re-commissioning results accord with sustainability targets and that the contractor is notified of any issues with performance.	7.2
Building handover	Provide building log book and occupant user guide for projects and ensure that there is a clear explanation of design targets and assumptions to allow comparison with actual, operational energy use.	6.4
Operation	Ensure that the system is operating according to design intent, which may involve periodic recommissioning and post-occupancy evaluation.	7
	Recommend that sustainability be addressed when the building owner or occupier specifies tenders and evaluates contracts for the operation and maintenance of facilities.	7
	Ensure that refurbishment or refit projects implement the relevant sustainability principles, as set out in this document.	7
	Undertake energy and water management activities including audits and benchmarking to identify potential for further savings.	7

Table 2: **Key actions — *continued***

Key stage	Key actions	Guide L section number
Operation (*continued*)	Recommend that projects to re-engineer systems consider potential re-use of materials or systems.	7
	Ensure that audits and condition surveys include assessment against key sustainability drivers and targets, as identified in this document.	7
	Refer to CIBSE online sustainable engineering tool to identify detailed measures for improving performance.	7 and online tool
Deconstruction	An audit should be undertaken prior to demolition commencing to identify the potential for cost-effective recovery of material from demolition.	8

7 Conclusion

Sustainability, particularly the problems of climate change, presents an urgent challenge, to which we must all respond.

Building services engineers have an opportunity and professional responsibility to provide strategic input on sustainability issues much earlier in the design process and to follow this through to detailed design and operation. By influencing key decisions at an early stage, building services engineers can play a major role in delivering more sustainable outcomes.

The drivers for sustainable development are likely to become stronger and those who embrace and understand this agenda are likely to see an increased demand for their skills.

References

1 Stern N *The Economics of Climate Change — The Stern Review* (Cambridge: Cambridge University Press) (2006) (http://www.hm-treasury.gov.uk)

2 Intergovernmental Panel on Climate Change *Climate Change 2007: The Physical Science Basis — Summary for policy makers* (Geneva, Switzerland: Intergovernmental Panel on Climate Change (2007) (http://www.ipcc.ch/SPM2feb07.pdf)

3 World Commission on Environment and Development *Our Common Future* (Oxford: Oxford Paperbacks) (1987)

4 Broecker W S quoted in Weart S R *The Discovery of Global Warming* (Cambridge, MA: Harvard University Press) (2003)

5 Houghton J 'The science of global warming' *Interdisciplinary Science Reviews* **26**(4) (2001)

6 Amey J *CIBSE Members and Sustainable Development* CIBSE Policy Statement (London: Chartered Institution of Building Services Engineers) (http://www.cibse.org/policy)

7 Wyatt T *Adapt or Die: The major challenges ahead for the building services industry* CIBSE Presidential Address (London: Chartered Institution of Building Services Engineers) (2003) (http://www.cibse.org/pdfs/terrywyattaddress.pdf)

8 http://en.wikipedia.org/wiki/Engineer (accessed 2/04/07)

9 *The Engineer of the 21st Century Inquiry: Engineers for sustainability* (London: Forum for the Future) (2000)

10 *Planning Policy Statement 1: Delivering Sustainable Development* (London: The Stationery Office) (2005) (http://www.communities.gov.uk)

11 Wong N H, Chen Y, Ong C L, Sia A 'Investigation of thermal benefits of rooftop gardens in the tropical environment' *Building and environment* **38** 261–270 (2003)

12 *London's Urban Heat Island: A Summary for Decision Makers* (London: Greater London Authority) (2006) (http://www.london.gov.uk/mayor/environment/climate_change/)

13 *Heat island effect* (website) (Washington DC: US Environmental Protection Agency) (http://www.epa.gov/heatislands/about/index.html) (accessed 2/04/07)

14 *Sustainability* CIBSE Guide L (London: Chartered Institution of Building Services Engineers) (2007)

15 Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases *Official J. of the European Union* L 161/1 (14.6.2006) (Brussels: Commission for the European Communities) (2006) ('The F-gas Regulation')

16 The Building Regulations 2000 Part L Conservation of fuel and power Approved Documents L1 and L2 (London: The Stationery Office) (2006)

17 The Building (Scotland) Regulations 2004 Scottish Statutory Instruments 2004 No. 406 (London: The Stationery Office) (2004)

18 Building Regulations (Northern Ireland) 2000 Statutory rules of Northern Ireland 2000 No. 389 (London: The Stationery Office) (2000)

19 *The London Plan: Spatial Development Strategy for Greater London* (London: Greater London Authority) (2004) (http://www.london.gov.uk/mayor/strategies/)

20 *BREEAM: BRE Environmental Assessment Method* (Garston: BRE) (http://www.breeam.org)

21 *Code for Sustainable Homes — a step-change in sustainable home building practice* (London: Department for Communities and Local Government) (2006) (http://www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf)

22 Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings ('The Energy Performance Directive') *Official J. of the European Communities* L1/65 (4.1.2003) (Brussels: Commission for the European Communities) (2003)

23 *Energy and carbon emissions in buildings: a guide to legislation* (London: Chartered Institution of Building Services Engineers) (to be published summer 2007)

24 *Sustainable Design and Construction — Supplementary Planning Guidance* (London: Greater London Authority) (2006) (London http://www.london.gov.uk/mayor/strategies/sds/sustainable_design.jsp)

25 *RIBA Plan of Work* (London: Royal Institute of British Architects) (1999)

26 *Securing the future — Delivering UK sustainable development strategy* (London: The Stationery Office) (2005) (http://www.sustainable-development.gov.uk/publications/uk-strategy)

27 *Technical standards for compliance with the Building Standards (Scotland) Regulations 1990* (as amended) (London: The Stationery Office) (2001)

Appendix A: Summary of drivers for sustainability

The following provides only a sample of some of the key drivers for sustainability. There are too many different documents to provide a comprehensive list.

A1 Legislative drivers

A1.1 International

Kyoto Protocol (1997)

The UK Government has a target under the Kyoto Protocol to reduce greenhouse gas emissions by 12.5% below base year (1990) levels by 2008-12.

— DEFRA: http://www.defra.gov.uk
— UN FCCC: http://unfccc.int

A1.2 European

Energy Performance of Buildings Directive

The directive requires member states to measure energy use in buildings by: introducing agreed measurements of relative energy performance; regular inspections and re-evaluations; requiring higher standards for upgrading larger buildings; improving standards for new buildings. See CIBSE's *Energy and carbon emissions in buildings: a guide to legislation*[23].

— http://www.cibse.org

F-gas Regulation

The F-gas Regulation requires member states to regulate aspects of the use of fluorinated gases (e.g. the containment of HFCs — which is a common refrigerant). UK Government guidance and a copy of the Directive can be found at:

— http://www.dti.gov.uk

A1.3 National

Draft Climate Change Bill (DEFRA 2007)

This Bill proposes the introduction of a long-term framework for the UK to achieve its goals of reducing carbon dioxide emissions and ensure steps are taken towards adapting to the impacts of climate change. Legislation would set targets in statute for reducing carbon emissions by 60% by 2050 and 26–32% by 2020 against a 1990 baseline.

— http://www.defra.gov.uk

Energy White Paper 2003: Our Energy Future — Creating a Low Carbon Economy (DTI 2003)

The Energy White Paper sets out a target for 10% of electricity to be obtained from renewable sources nationally by 2010 and twice this by 2020. The United Kingdom has made commitments that extend beyond this requirement.

— http://www.dti.gov.uk

Securing the future – the UK Government sustainable development strategy (HM Government 2005)

'The goal of sustainable development is to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations.'

— http://www.sustainable-development.gov.uk

A review of sustainable construction (DTI 2006)

A review of what has been achieved during the five years from 2001 was published in October 2006. This includes targets and visions for sustainable construction in 2015 and beyond.

— http://www.dti.gov.uk

Building Regulations Part L 2006: Conservation of fuel and power (CLG 2006)

The Regulations that came into force in England and Wales in April 2006 require that reasonable provision should be made for the conservation of fuel and power in buildings. The updated regulations are designed to reduce regulated carbon dioxide emissions in new buildings by 20–25% compared to buildings complying with the 2002 regulations.

— http://www.communities.gov.uk/

In Scotland the Building (Scotland) Regulations 2004[17] and the supporting guidance provided in Section 6 of the Technical Handbooks[27] apply and in Northern Ireland Part F (Conservation of fuel and power) of the Building Regulations (Northern Ireland)[18] applies.

Sustainable and Secure Buildings Act 2004 (ODPM 2004)

The Sustainable and Secure Buildings Act 2004 extended the Building Act 1984, to include the following additional purposes for which building regulations may be made: furthering the protection or enhancement of the environment; facilitating sustainable development; and furthering the

prevention and detection of crime.
— http://www.communities.gov.uk/

Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations (CLG 2007)

These new Regulations implement the provisions of Articles 7–9 of the Energy Performance of Buildings Directive in England and Wales. They cover energy performance certificates on construction, sale or rental, as well as display certificates for public buildings. They also cover plant inspection requirements.

Separate Regulations have also been published for Home Information Packs (HIPs), which are to be introduced from 1 June 2007 under the Housing Act 2004.

A Departmental Circular has also been issued by the Department for Communities and Local Government, which explains some of the background to the Regulations and details of their implementation. The Departmental Circular can be found at:
— http://www.communities.gov.uk/pub/193/Circular0207TheEnergyPerformanceofBuildingsCertificatesandinspectionsEnglandand7_id1509193.pdf

The new Energy Performance Regulations can be found at:
— http://www.opsi.gov.uk/si/si2007/20070991.htm

The HIP Regulations can be found at:
— http://www.opsi.gov.uk/si/si2007/20070992.htm

Code for Sustainable Homes (CLG 2006)

The Code replaces EcoHomes as an environmental assessment method for new homes. It is mandatory for homes built on public sector land or with public sector money.
— http://www.communities.gov.uk

Planning Policy Statements

Planning Policy Statement 1: *Delivering Sustainable Development* (2005), states that 'Sustainable Development is the core principle underpinning planning.'
— http://www.communities.gov.uk

A Planning Policy Statement on climate change is being developed as a supplement to Planning Policy Statement 1 to make it clear that the location and design of new developments should support the reduction of carbon

emissions. It will support the use of more sustainable energy sources including microgeneration, combined heat and power, and the development of sites that reduce the need for travel and have a mix of uses. It also proposes giving local authorities the power to apply default 10% renewables targets for new development.

— http://www.communities.gov.uk

Planning Policy Statement 22: *Renewable Energy* (2004), allows local authorities to set policies which require a percentage of the energy to be used in new residential, commercial or industrial developments to come from on-site renewable energy developments

— http://www.communities.gov.uk

Planning Policy Statement 25: *Development and flood risk* (2006) is a key document that sets out to ensure that appropriate planning decisions are made in relation to development and flood risk.

— http://www.communities.gov.uk

A1.4 Regional

Regional Spatial Strategies (RSS)

These used to be called 'Regional Planning Guidance' (RPG). These are regional spatial plans published by each Regional Assembly overseen by the Government Offices for the Regions.

— http://www.gos.gov.uk

A1.5 Local

Supplementary Planning Documents

Many local Councils have developed Supplementary Planning Documents giving guidance on sustainable design and construction, and some have sustainability checklists for new developments.

A2 Client drivers

Targets for sustainable operations on the government estate (2006)

In June 2006, the Prime Minister launched new targets for sustainable operations on the Government estate. The targets replace those in the *Framework for Sustainable Development on the Government Estate* (originally published between 2002 and 2004). This includes a commitment for the Central Government's office estate to be carbon neutral by 2012.

— http://www.sustainable-development.gov.uk

There are also environmental assessment tools and reports available for various departments, for example:

Ministry of Defence Sustainable Development and Environmental Manual (2005)
— http://www.mod.uk

NHS Environmental Assessment Tool (NEAT) (2005): The NHS Environmental Assessment Tool (NEAT) is a software tool designed to assess the negative impact of healthcare facilities on the environment.
— http://www.dh.gov.uk

CONTACT US AT:

The Chartered Institution of Building Services Engineers
222 Balham High Road
London SW12 9BS

Membership enquiries: 020 8772 3650
Events: 020 8772 3660
General enquiries: 020 8675 5211

General information: info@cibse.org
Website: www.cibse.org

CIBSE is a Registered Charity No 278104