Energy Performance Certificates p.37 // How to build a greener practice p.40 // Collaborating with engineers to create low-carbon designs p.45

Sustainability in Practice

ILLUSTRATION BY JAY TAYLOR

In the second part of the AJ's Sustainability in Practice series, we look at how fundamental practice changes, such as working with engineers early in the design process, can lead to greener projects

ENERGY PERFORMANCE CERTIFICATES

THE SPREAD OF CERTIFICATION

From next month Energy Performance Certificates will be legally required for all buildings. *Terry Dix*, a director at Arup, outlines the legislation and what it means for architects

Last August saw the introduction of Energy Performance Certificates (EPCs) for the residential sector. From April 2008 it will become a legal requirement to produce an EPC for all buildings whenever they are constructed, sold or rented out (*see panel on page 38 for timetable*). This legislation is designed to bring the UK in line with the EU Energy Performance of Buildings Directive (EPBD) – which aims to reduce carbon emissions from buildings, thereby helping countries to meet the Kyoto Protocol commitment, which requires an 8 per cent reduction in greenhouse gases across the EU by 2012.

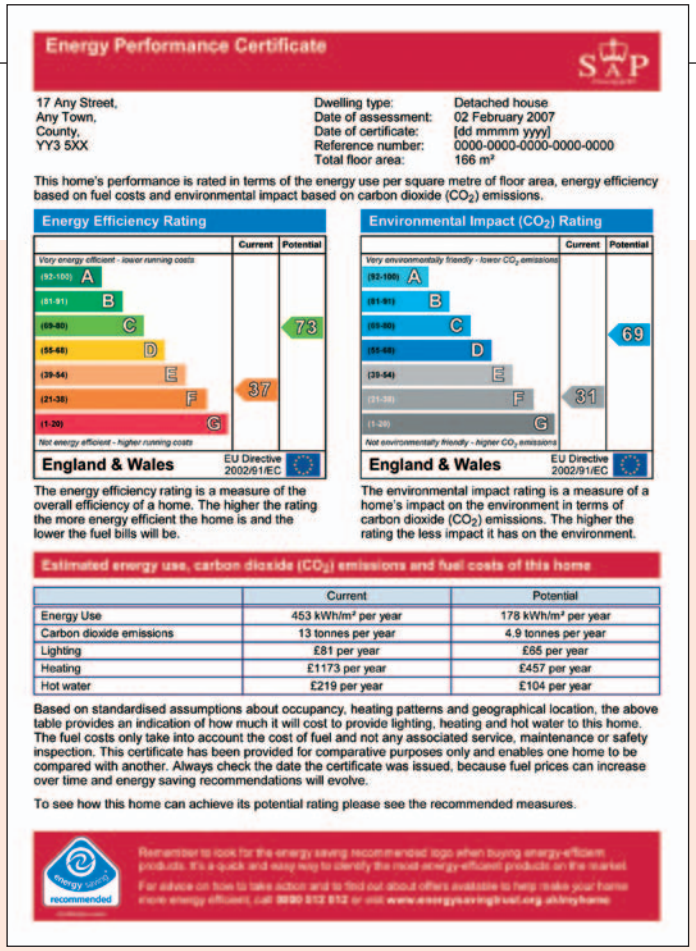
To comply with the requirements of the EPBD, an EPC may only be provided by an accredited energy assessor, who will need to have satisfied the requirements of the accreditation body and demonstrate knowledge of the process. With the first phase of the implementation programme commencing on 6 April, the race to train and accredit energy assessors is under way.

Certain requirements set out in the EPBD were met by the 2006 revisions to Part L of the Building Regulations. These made it madatory for all buildings to undergo a nationally approved carbon-performance assessment procedure. For dwellings, this >>

takes the form of SAP (Standard Assessment Procedure) calculations, and for non-dwellings, a BEM (Building Energy Model) or an approved dynamic simulation programme. The same calculation routines will also play a role in the production of EPCs.

When a building is constructed, the production of an EPC should be a relatively easy process, as most of the analysis work necessary to produce the EPC will have been undertaken by following the simulation processes used to demonstrate compliance with Part L. The same analysis procedure will provide the building with an Asset Rating based on the theoretical performance of the building. This will be displayed graphically on the EPC by the use of a multicoloured performance chart. In addition, EPCs will indicate the national benchmark values for buildings of similar use, together with advice on how energy use may be reduced.

When a building is sold or rented out, the process becomes more complex, as an SAP, BEM or dynamic simulation



Energy Performance Certificate

SAP

17 Any Street,
Any Town,
County,
YY3 5XX

Dwelling type: Detached house
Date of assessment: 02 February 2007
Date of certificate: [dd mmmm yyyy]
Reference number: 0000-0000-0000-0000-0000
Total floor area: 166 m²

This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92-100) A		
(81-91) B		73
(69-80) C		
(55-68) D		
(39-54) E	37	
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		
England & Wales	EU Directive 2002/91/EC	

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Environmental Impact (CO_2) Rating

	Current	Potential
Very environmentally friendly - lower CO_2 emissions		
(92-100) A		
(81-91) B		
(69-80) C		69
(55-68) D		
(39-54) E		
(21-38) F	31	
(1-20) G		
Not environmentally friendly - higher CO_2 emissions		
England & Wales	EU Directive 2002/91/EC	

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m² per year	178 kWh/m² per year
Carbon dioxide emissions	13 tonnes per year	4.9 tonnes per year
Lighting	£81 per year	£65 per year
Heating	£1173 per year	£457 per year
Hot water	£219 per year	£104 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market.

For advice on how to take action and to find out about offers available to help make your home more energy efficient, call 0800 512 012 or visit www.energysavingtrust.org.uk/myhome

Energy Performance Certificates will use colour-coded charts

How long before organisations shun F-G rated buildings?

programme will need to be run for the building for the first time. This will involve inputting the building's geometry, facade performance (U-values), heating and cooling system characteristics, and building usage into the simulation software.

For public buildings, the certificate must be put on display. This certificate is referred to, imaginatively, as a Display Energy Certificate (DEC). Unlike EPCs, a DEC is based on the measured energy over a calendar year and includes a bar chart to show the trend in performance over the last three years.

SO HOW DOES THIS AFFECT THE ARCHITECT?

Even the most commercially minded building developers, owners and operators are starting to see how this assessment process could affect the value or letting potential of their building or portfolio.

We are now seeing clients specify the need to achieve an A or B rated building, so this will clearly have an impact on the design process. A non-air-conditioned building with gas-fired heating, compliant with Part L 2006, should achieve an EPC rating at around the B-C boundary. The top of an A rating band describes a carbon-neutral building. Clearly there is some gradation between these markers, and the architect and engineer will have to work together closely to achieve the client's specification.

One of the main aims of introducing EPCs for existing buildings is to inform potential buyers or tenants about energy performance, so that they may consider energy efficiency as part of their investment decision or tenancy agreement. With the growth in Corporate Social Responsibility statements, the existence of EPCs will also provide a clear measure to help demonstrate (or not) the intent of an organisation. So how long will it be before organisations shun F-G rated buildings, or use poor performance as a negotiating tool in purchase or tenancy agreements?

The hope is that this market transformation process will encourage more investment in energy-efficiency-led refurbishments. If this proves to be the case, then expertise in how this may be effectively accomplished will be a critical skill for the future, and one that both architects and engineers need to hone to help meet carbon reduction targets. ■

The AJ's Understanding Energy Performance Certification conference takes place on 22 April at CBI Conference Centre, London WC1. **www.ajenergycertification.co.uk**

EPC TIMETABLE

6 April 2008
- EPCs required on construction for all dwellings
- EPCs required for construction, sale or rent of non-dwellings with floor area over 10,000m²

1 July 2008
- EPCs required for construction, sale or rent of non-dwellings with floor area over 2,500m²

1 October 2008
- EPCs required on sale or rent of all remaining dwellings
- EPCs required on construction, sale or rent of all remaining non-dwellings
- Display certificates required for all public buildings less than 1,000m².

MEASURING SUSTAINABILITY

A GREENER WAY OF WORKING

For low-carbon design to take root, sustainability must be more deeply embedded in practice management and projects' CO_2 emissions must be benchmarked, says *Hattie Hartman*

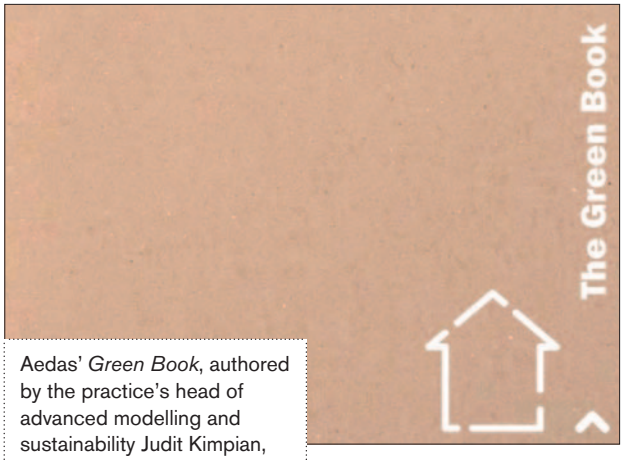
While for many, delivery of a low-carbon building is simply a question of good design, there are a growing number of architects who believe sustainability should start at home. This may require a step-change in the design process, and in some instances a complete overhaul of practice procedure. Aedas is about to release its *Green Book* and nine *Green Design Guides*. They are intended as reference documents for staff and outline an approach to practice that tackles carbon reduction from as many angles as possible.

The practice, which employs more than 2,000 people in 32 offices around the world, has set itself an ambitious target of reducing its carbon emissions, both generated in-house and from its projects, by a total of 50 per cent by 2011.

At the recommendation of environmental consultancy XCO2, Aedas began by measuring its own carbon footprint, which represents only a fraction of the CO_2 generated by its projects (*read more comments by XCO2's Ricardo Moreira on pages 45–47*). The firm looked for potential savings in employee travel patterns and the energy consumed in its offices before turning to external projects.

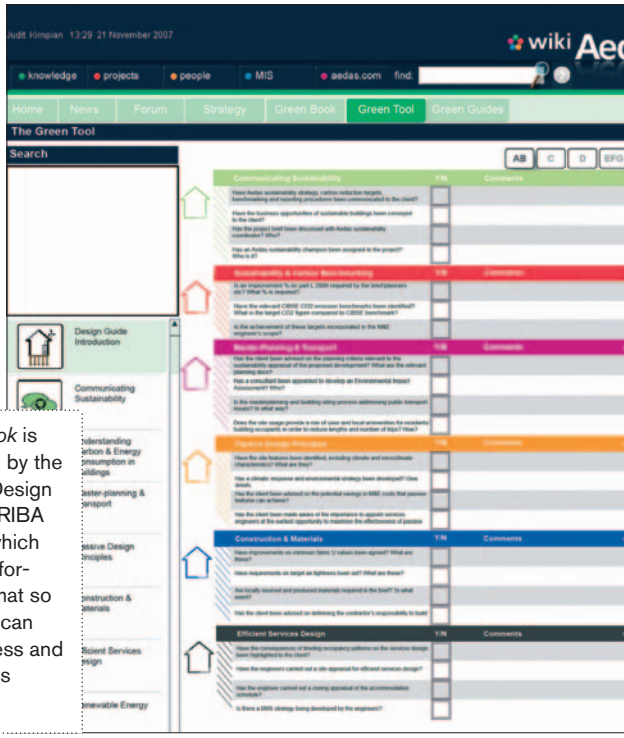
The *Green Book* offers a multi-pronged 'sustainable design process', including working with clients, setting targets, and measuring results. To deliver these goals, the practice has sustainability champions who meet regularly and are responsible for both operations (through office managers) and projects (through project champions). They also capture project information on data sheets on the office intranet.

Though it is early days for completed project data sheets, Aedas' head of advanced modelling and sustainability and *Green Book* author Judit Kimpian is confident that >>

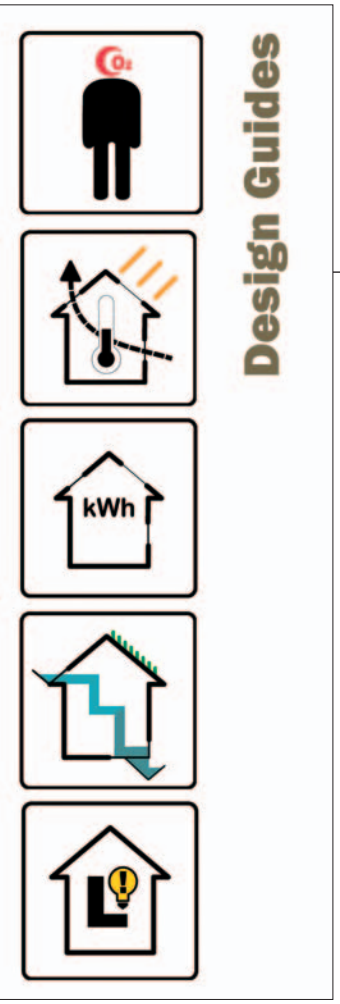


Aedas' *Green Book*, authored by the practice's head of advanced modelling and sustainability Judit Kimpian, with energy consultant XCO2 is a guide to sustainable practice for internal use. The book sets targets across many areas of practice

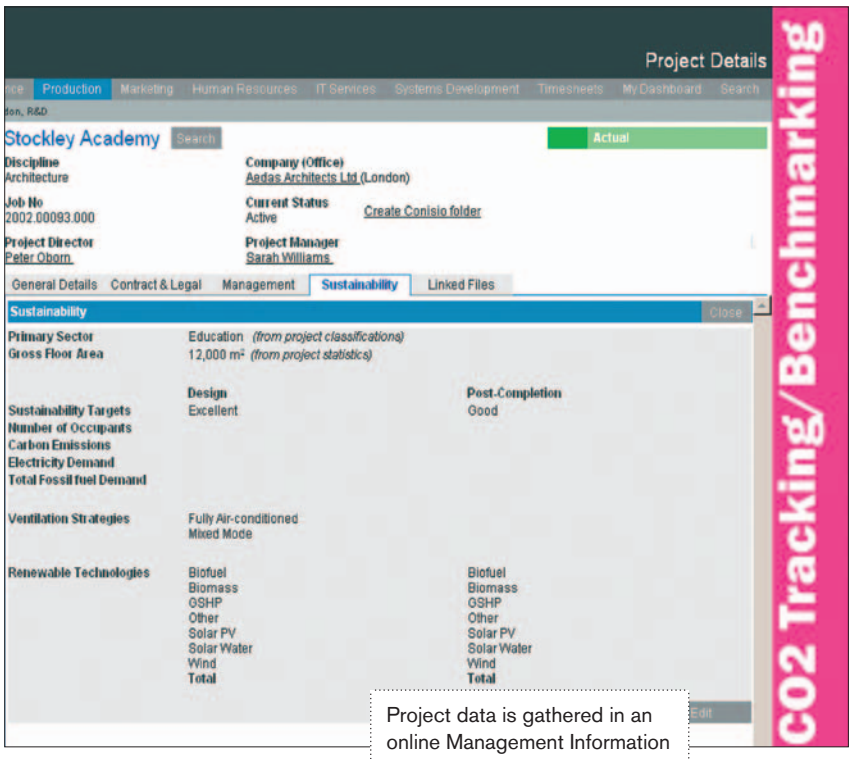
Aedas' *Design Guides*, also for internal use, will accompany the *Green Book* and provide further technical detail on nine topics across the design process, such as communicating sustainability and refurbishments



The *Green Book* is also supported by the online Green Design Tool, keyed to RIBA work stages, which uses a straightforward Q&A format so that architects can effectively assess and track a project's sustainability



Wiki Sustainability Pages, available on the Aedas intranet, will be constantly updated with policy changes, project data, and new technologies, in order to keep architects as up to date as possible with developments which might affect designs



Project data is gathered in an online Management Information System database to establish Aedas benchmarks by building type. The database tracks emissions information at design and completion stages

Exemplar projects are shown on the intranet. Each Aedas UK region is committed to delivering a carbon-neutral scheme by the end of 2011

with procedures now in place, comparative data from projects across a range of sectors will be available by 2009. The aim is to reference project data against established performance criteria, such as the updated Chartered Institute of Building Services Engineers benchmarks, to be released this spring, and against exemplar projects.

According to Kimpian, one of the main aims of the Aedas sustainability strategy is to help architects liaise better with engineers. The practice is getting architects to familiarise themselves with M&E reports, and teaching them to get their points across to engineers (*read Barrie Evans' article on integrated design on pages 45–47*). Another objective is to develop a carbon-neutral project in every office by the end of 2011.

Aedas began by measuring its own carbon footprint

But while many architects may claim an interest in sustainability without actually providing measurable results, Aedas succeeds most convincingly in its emphasis on quantitative measures. Stride Treglown is another practice which has taken a quantitative approach to sustainability subsequent to ISO 14001 (environmental management) accreditation in July 2005. It measures a project's sustainability by internally developed Sustainable Design Indicators (SDI) in percentage terms against 'ambition' at RIBA Stage C and 'achievement' at Stages E, F or G. These indicators include building parameters, building fit out, water features, site ecology and specification.

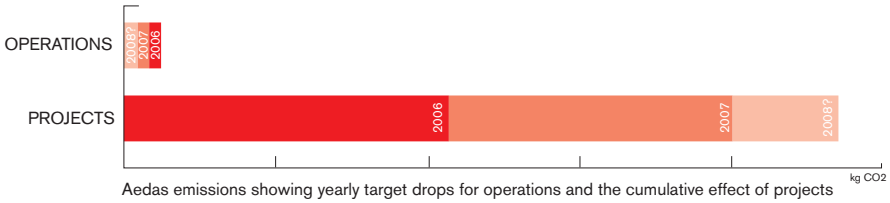
Feilden Clegg Bradley Studios uses a checklist which classifies sustainable features in four categories (good or best practice, innovative, pioneering). Renewables are assessed according to financial payback and CO_2 saved (*see diagram 3*).

While these approaches of standard assessments and targets seem logical, other practices maintain that they aren't the only way to ensure sustainable design. Grimshaw, known for green projects like the Eden Centre and the National Institute for Research into Aquatic Habitats in Bedfordshire (currently at the design stage), has, as yet, no quantitative measures in place for tracking projects. Director Christopher Nash explains that this is because so many Grimshaw projects are hard-to-classify one-off buildings. 'We don't have a bank of data,' says Nash. 'This is more the engineer's domain; architects are becoming more carbon literate, but not in terms of numbers.'

While the firm does have a 'green' research and development group, it has a more speculative focus. Ex-director Michael Pawlyn, who leads the group on a consultancy basis, sees its remit as acting as a radar for new technologies. Pawlin set the group the task of scanning the last 12 years of the *New Scientist*, and each participant selected five ideas to present back to the group. 'Most of the ideas are in too early a stage to be applied in projects and are more likely to be found in development in university laboratories', Pawlyn says.

Jestico + Whiles, which has had ISO 14001 since 2004, has its green strategy well in order: the office uses an elaborate matrix to ensure that sustainable design strategies are incorporated into projects at every stage. But the firm as yet has no quantitative approach to benchmarking. In 2006 it had its carbon footprint assessed by Carbon Smart (**www.carbonsmart.co.uk**), but these one-off measures are insufficient for practices that evaluate each project at every stage.

Ultimately, Aedas' comprehensive and holistic approach, which incorporates everything from carbon emissions from the office to working with services engineers to optimise building performance, provides a model that more practices should look to. There may be a lot to change, but the results demonstrate that it is necessary to make the effort. ■



Aedas emissions showing yearly target drops for operations and the cumulative effect of projects

DIAGRAM 1

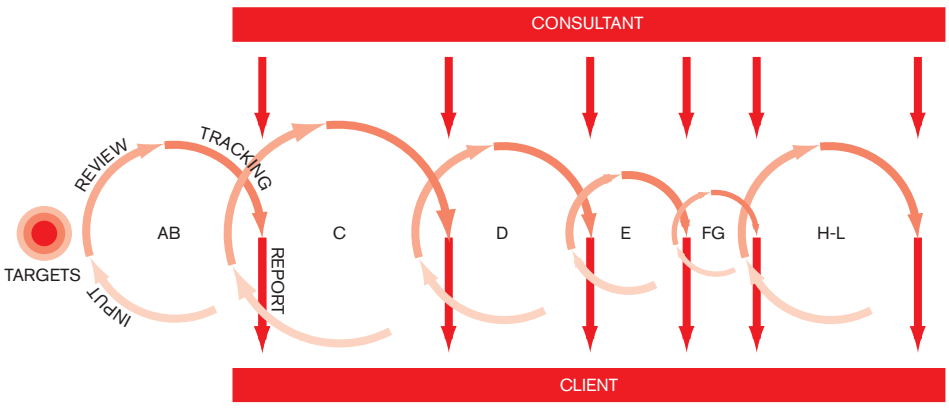


DIAGRAM 2

Diagram 1 Aedas' bar chart shows CO_2 emissions from operations are a fraction of those from projects

Diagram 2 Architect, engineer and client must review and track sustainability targets at each stage in the Aedas workflow

Diagram 3 Feilden Clegg Bradley Studios' diagram compares CO_2 savings of renewable technologies

Diagram 4 Aedas' practice structure of sustainability champions

Diagram 5 Stride Treglown's internal assessment method for tracking sustainability

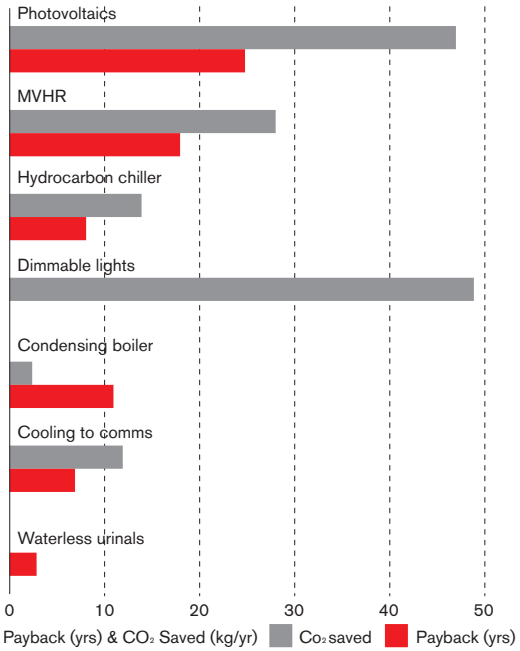


DIAGRAM 3

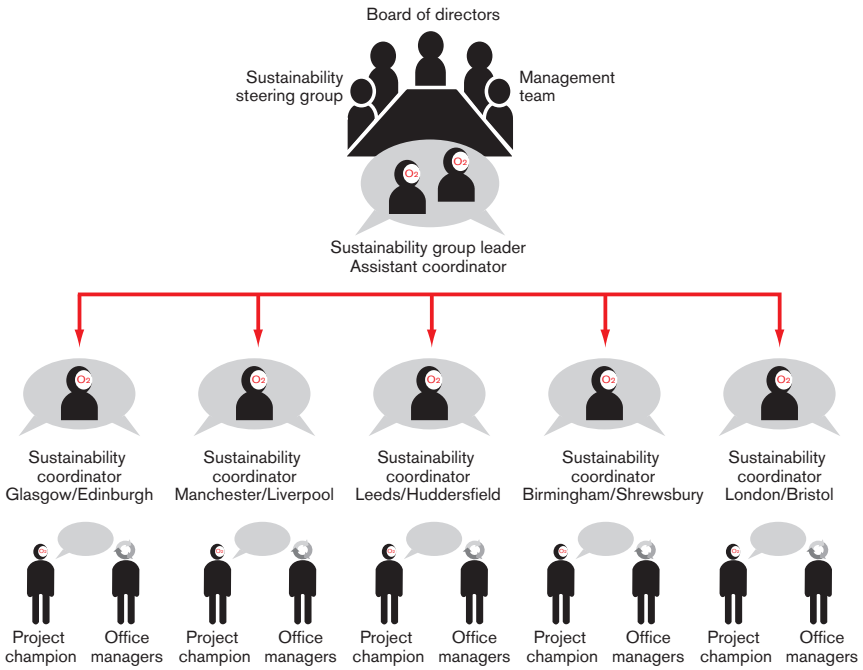


DIAGRAM 4

DIAGRAM 5

INTEGRATED DESIGN

JOINED-UP WORKING

Architects need to collaborate closely with engineers to execute low-carbon designs, writes *Barrie Evans*

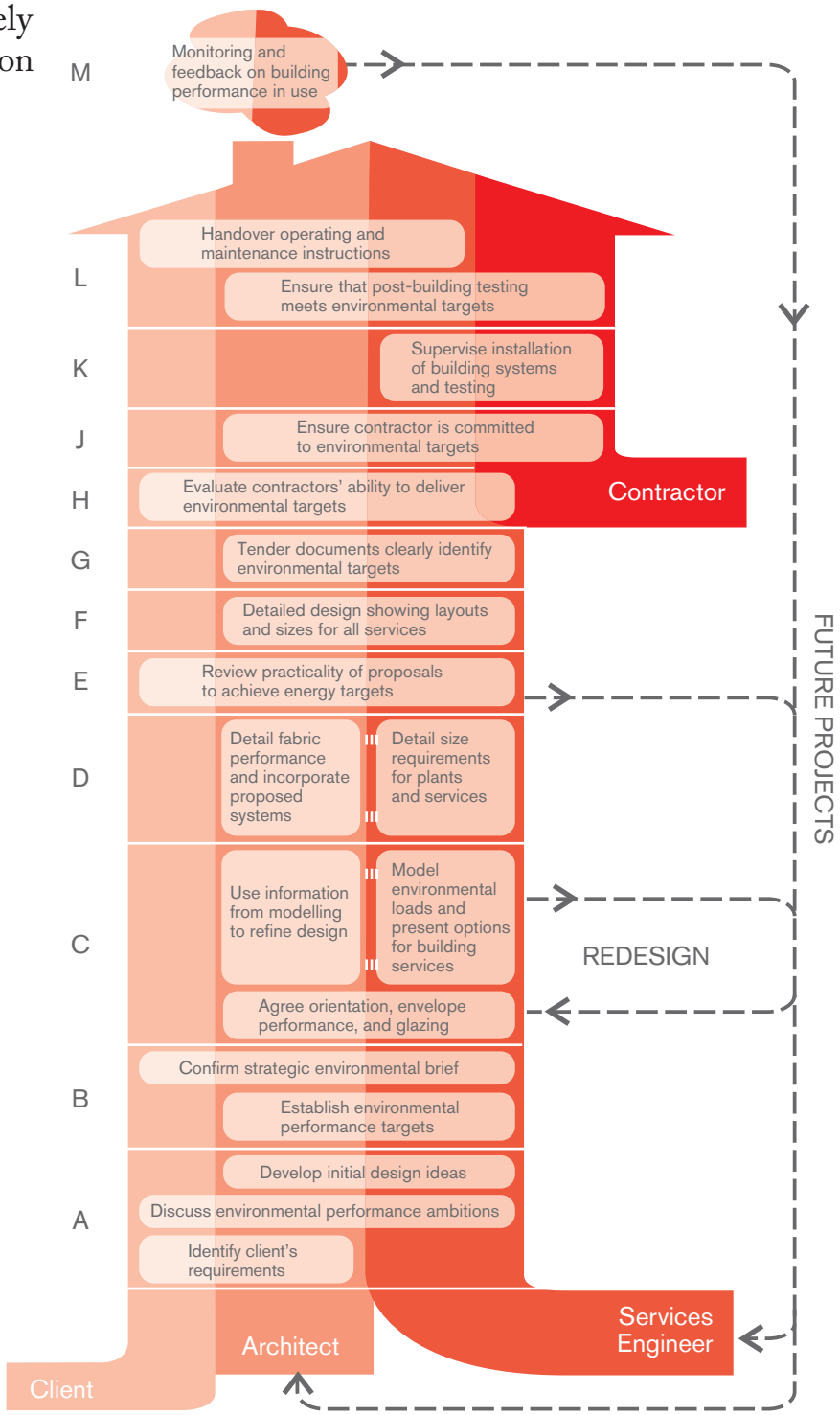
At the heart of most low-carbon projects lies an intimate collaboration between architect and environmental engineer. While this was previously the province of a small coterie of like-minded professionals, now, as regulations become more stringent and clients more demanding, integration is moving from the exception towards becoming the norm, and architects must learn more of the language of building engineering.

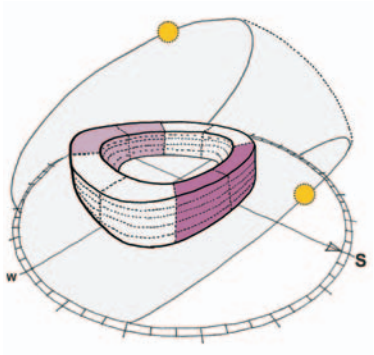
Practices are increasingly bringing engineers into projects at the concept stage, when major energy savings can be achieved through passive design measures. Early collaboration is necessary in order to effectively quantify and cut CO_2 emissions, and is enhanced by relatively recent concept-stage modelling software, like IES VE and Ecotect, which caters to architects (*see IT in Practice, AJ 24.01.08*).

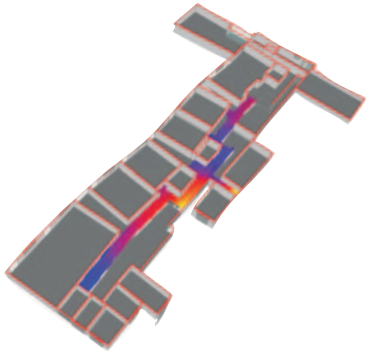
Ricardo Moreira, of energy consultancy XC02, typically works with practices up to Stage D in projects. 'We have a responsibility to raise the standard of what's submitted to planning,' he says. An architect himself, Moreira says that architects need to familiarise themselves with quantitative measures in carbon reduction. He says: 'One of the most effective ways to make this happen is if architects do their own homework first and quantify their practice's carbon footprint.'

Many firms are responding by developing an in-house sustainability group (which may not be made up exclusively of architects) providing research and consultancy to the rest of the office. Another approach to learning is to attend assessors' training for BREEAM and SAP (the government's Standard Assessment Procedure for Energy Rating of Dwellings). Peter Rickaby of environmental consultant and training organisation Rickaby Thompson Associates says he sees as many architects as engineers on SAP courses. >>

Below An XCO2 diagram of client/architect/services engineer workflow







Far left An Atelier Ten concept-stage diagram highlighting the sections of a building which are best orientated for passive climate control
Left Atelier Ten diagram assessing daylight factors in a proposed school corridor
Above Stride Treglown's scheme for a passive solar nursery building near Gloucester features a rammed-earth wall

His sense is that these trained people will mostly work in-house as part of a practice's sustainability group. Smaller practices outside major cities are likely to offer SAP assessment as a service to others locally.

For BREEAM, a much more complex process than SAP, BRE delegate counts indicate that architects currently represent about a third of assessor trainees, alongside engineers and other professionals – primarily local authority staff. Since the early 1990s, over 4,000 individuals have trained, and approximately 1,000 are currently licensed. The three-day training comprises an introductory day, a second day devoted to a particular building type, and a half-day top-up a month later followed by an exam. Initial assessments by newly-qualified assessors are subject to quality control by BRE Global. Alan Yates, BREEAM Technical Director at BRE Global, notes that there is a 50-50 split between architects who go on to work as assessors and those who use the training for internal consultancy within their practices.

'Our architects benefit hugely by having an engineer in-house'

At Stride Treglown, five architects have trained as BREEAM assessors, an area of the practice's work which has expanded dramatically recently. According to Stride Treglown associate Anna Da Col, 35 BREEAM assessments are currently under way for a variety of clients, ranging from developers to contractors to M&E practices. A core team of three people undertakes most of the assessments, both in-house and for external clients.

Another possibility is renewed growth of multidisciplinary practices – witness the recent merger of Worcester-based architect Panton Sargent and Birmingham-based services and electrical engineer Mansfield Ravenhall into a new practice, named One. One director Matthew Tebbatt says that the merger was driven by the desire to have all disciplines truly collaborate from the outset of a project to its completion. He says: 'Services engineers work in a very different way to architects. If we can crack that working relationship, then we can crack anything.' Benedict Zucchi of BDP is also very positive about multidisciplinary working, noting: 'Our architects benefit hugely by having an engineer in-house.' He adds that some recent recruits to BDP cite its holistic approach as a reason for joining.

At engineering firm Atelier Ten, ex-Pollard Thomas Edwards architect Emma Marchant acts as an interface between engineer and architect. Marchant says: 'It's quite a lot more exciting than being an architect, with five to six projects on the go at any one time. Architects rely on us to show them what's possible because they don't necessarily have the knowledge.' While studying architecture at Cambridge, Marchant also took an MPhil in Environmental Design, and learned to use quantitative modelling to influence early-stage design. Marchant now sees herself as an environmental specialist, but doesn't rule out a return to mainstream practice one day.

EMMA MARCHANT
ATELIER TEN

After completing her diploma and an MPhil in Environmental Design at the University of Cambridge, Marchant spent three years at Pollard Thomas Edwards Architects, where she was a leader of the internal green group. In 2007, she moved to consulting environmental engineer Atelier Ten, where an important part of her role is to interface with architects.

ANNA DA COL
STRIDE TREGLOWN

After graduating from a BSc in Architectural Studies at Bath University in 2001, Da Col joined Stride Treglown and completed an MSc in Energy Efficient Buildings at Oxford Brookes University in 2004. She is now an associate and environmental performance manager at Stride Treglown, and was accredited as a BREEAM assessor in 2006.

RICARDO MOREIRA
XC02

With a first degree in architecture and five years experience as a practising architect in the USA, Moreira moved to the UK to join the Bartlett's MSc in Environmental Design and Engineering, which he completed in 2005. He joined energy consultancy XC02 in the same year and now works with architects at concept stage on sustainable design.

Despite the various approaches to cross-disciplinary working, the skills shortage across professions is a persistent theme. Jules Saunderson, UK Green Building Council technical director on secondment from Fulcrum Consulting, says: 'What we need are people who can understand all the issues and communicate them in order to deliver robust engineering solutions.' He adds: 'This must come through higher and further education. In the UK this problem is exacerbated by the rapid decline in people studying maths and sciences. If we don't reverse that trend, we'll end up reliant on other countries' skills bases.'

Some architects are becoming specialists, with a foot in each camp. But most practices will have to take positive steps to reshape the way they work – setting up in-house sustainability teaching and support, learning modelling skills, and finding specific ways to work more effectively with engineers. Over the years the architect has largely lost structural engineering, costing and project management specialisms to other professions. Low-carbon design should not be a specialism – it is too integral to architecture. ■

This image XCO2's Fiag Lodge in Scotland, currently under construction, features a hydroelectric turbine