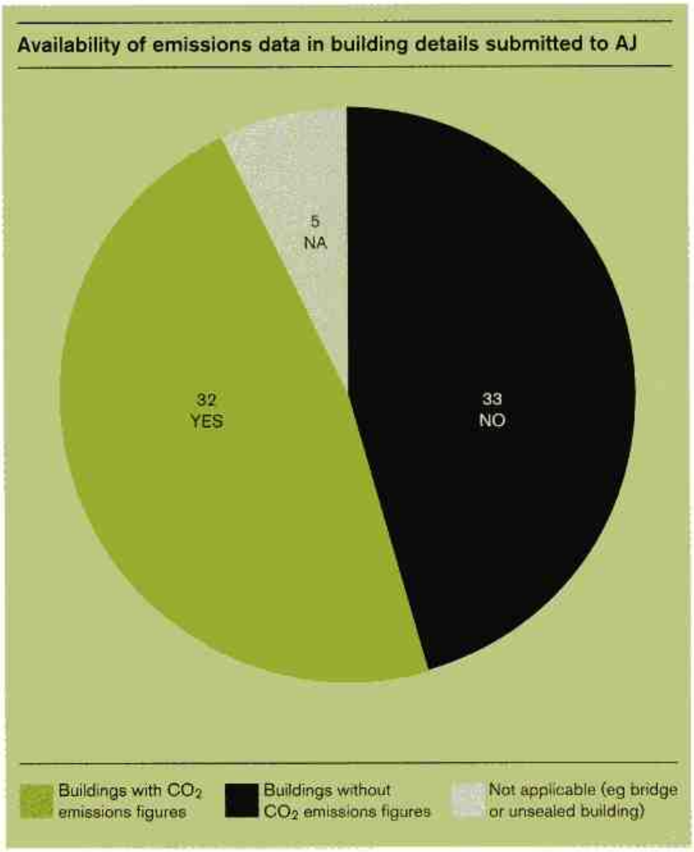
Sustainability in Practice

Low-carbon building

Architects should be ashamed of their abysmal record on carbon emissions data, says *Hattie Hartman*



As the AJ's sustainability editor, my inbox regularly overflows with emails about projects claiming to be the latest example of low-carbon building. Project descriptions typically enumerate a long list of eco-features and often a BREEAM 'Excellent' rating, but how do we assess how green a building really is?

The only meaningful way is to measure energy use. Almost two years ago, the AJ began asking architects to submit annual CO_2 emissions data for buildings whose details were due to be published in the magazine. Since then, less than half have provided this data. For those who have, it was often only sent in after insistent phone calls and a flurry of emails to service engineers.

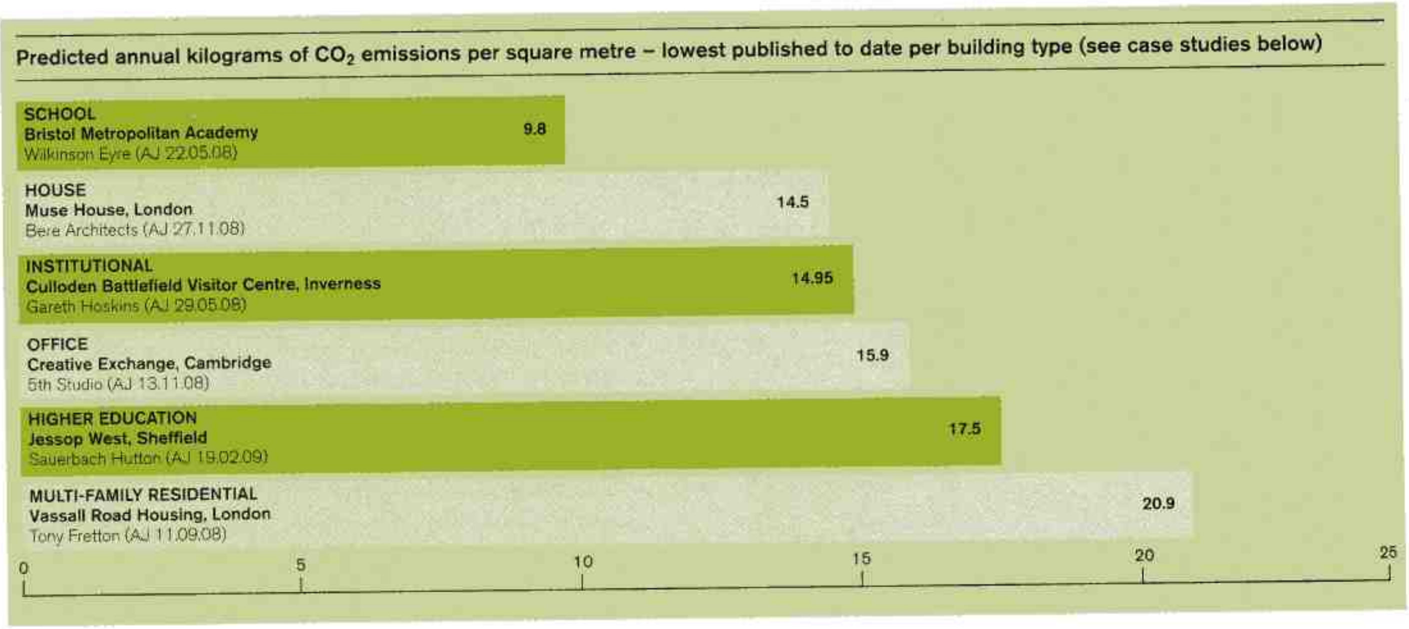
Architects are notoriously bad when it comes to numbers. The profession needs to reach the point where provision of energy-use statistics becomes second nature, on a par with a building's cost or its square footage. Best-practice benchmarks for common building types should be a matter of general knowledge.

Last year, the Chartered Institution of Building Services Engineers (CIBSE) updated its CO_2 emissions benchmarks. It is easy for architects to say, in the face of such initiatives, that it is the engineers who 'own' the emissions numbers, but architects must at least be familiar with the assumptions underlying the numbers. They must be able to scrutinise their accuracy and know where to make amendments if we are to meet zero-carbon targets.

Understanding the numbers is only the first step. Ensuring their accuracy is critical. Researching a recent feature on healthcare buildings, I found one statistic was way off because the engineer had not divided the annual carbon emissions by the building footprint to provide a square metre figure, and this erroneous information had been submitted to the RIBA as part of an awards submission. No one had noticed. On another occasion, the figures submitted were inconsistent because different fuel conversion factors had been used to convert gas and electricity meter readings to CO_2 emissions data, skewing the results by up to 15 per cent.

It's also important to remember that the emissions data is not actual, only predicted, and it only includes regulated building energy loads, not incidental occupant loads such as emissions generated by IT and catering. Accurate actual emissions data, which is far more useful, can only be obtained after a building has been occupied for at least two years. By then, architects are well into the next contract, so often lose the benefit of feedback knowledge gained from previous projects.

The most comprehensive emissions benchmarking tool >>



Bristol Metropolitan Academy

WILKINSON EYRE ARCHITECTS

Services engineer Buro Happold
Annual predicted CO_2 emissions 9.8kg/m^2

Classrooms have cross-ventilation and air is evacuated through wind cowls on the roof. The client's requirement for a 4 per cent daylight factor, rather than the typical 2 per cent, meant reduced demand for lighting. A biomass boiler supplies 80-90 per cent of heating and hot water. Buro Happold says reduced electrical use is more critical in schools than heating loads or envelope U-values.

Muse House, London

BERE ARCHITECTS

Services engineer Max Fordham
Annual predicted CO_2 emissions 14.5kg/m^2

Bere Architects' home and studio in London uses PassivHaus principles to achieve very low energy use. A highly insulated envelope incorporates a minimum of 300mm of insulation in walls and roof, with triple-glazed argon-filled windows throughout. Airtightness of approximately 0.6m^3/m^2/hr@50 Pa, while common in Germany, is exceptionally low for the UK.

was pioneered by Bill Bordass and the Usable Buildings Trust. Loads are broken down into four categories: heating and hot water; cooling, fans and pumps; and lighting. Unregulated loads, including 'special' loads such as IT, are also measured.

To deliver low-carbon buildings, we need to become conversant with the nuances of these numbers. To this end, London and Edinburgh-based practice Bennetts Associates recently convened a workshop with half a dozen of its service engineers from different consultancies to compare data from its projects, ensure that it was reported consistently, analyse which buildings performed best and find out why. The findings of this workshop have made Bennetts secure in the knowledge that it can design buildings to perform at $30kgCO_2/m^2/yr$. In a similar initiative, architectural practice Architype won £15,000 in the Ashden Awards for Sustainable Energy to undertake post-occupancy monitoring of its projects.

More practices should follow suit. The work is time-consuming and painstaking, but essential. Environmental project data, such as target envelope U-values, glazing ratios and airtightness factors, need to be developed. Now that workloads are down, this is an ideal time for architects to take charge of these numbers.

Organisations already exist for specific building types which can provide a natural home for this research: the British Council for Offices, the CIBSE School Design Group and the Construction Industry Research and Information Association's Learning Network for Sustainable Healthcare Buildings, for example. CarbonBuzz, the joint RIBA/CIBSE online tool for energy-use monitoring (www.bre.co.uk/carbonbuzz), is the ideal repository for gathering and comparing this information as it becomes available.

Is it really too much to ask architects to take as much care with energy data as they do with photographs for a building study?

Far left The six buildings with the lowest predicted annual CO_2 emissions for their type (school, house, institution, office, higher education building and multi-occupancy block), as published in the AJ to date

Culloden Battlefield Visitor Centre, Inverness

GARETH HOSKINS ARCHITECTS

Services engineer Max Fordham
Annual predicted CO_2 emissions $14.95kg/m^2$

A low, compact form reduces heat loss and wind exposure, and the orientation maximises natural ventilation and daylight. South-facing glass is screened by the roof overhang and external louvres. Wind-driven passive ventilation is supplemented by fans in the roof cowls. The biomass boiler, using wood chips harvested within a 10 mile radius, reduces CO_2 emissions by an estimated 55 per cent.

Creative Exchange, St Neots, Cambridgeshire

5TH STUDIO ARCHITECTS

Services engineer ZEF
Annual predicted CO_2 emissions $15.9kg/m^2$

The building's compact form and open vertical interior space enables good daylight penetration, natural ventilation and passive cooling. Exposed concrete provides thermal mass. The 900mm diameter, 900m-long earth tube preconditions incoming air throughout the year. Solar thermal panels on the roof provide the majority of the building's limited hot water requirements.

Jessop West, Sheffield University

SAUERBRUCH HUTTON/RMJM

Services engineer Arup
Annual predicted CO_2 emissions 17.5kg/m^2

The building is 90 per cent naturally ventilated with exposed concrete soffits to maximise thermal mass. The west facade is triple glazed with perforated stainless-steel panels below the windows, allowing fresh air intake through an acoustic labyrinth. The building is served by a district heating system. Predicted emissions are 60 per cent less than an equivalent air-conditioned building.

Vassall Road Housing, London

TONY FRETTON ARCHITECTS

Services engineer Bailey Associates
Annual predicted CO_2 emissions 20.98kg/m^2 (end maisonette)

Units are oriented with glazing and balconies facing south to maximise solar gain. Although designed four years ago, to meet NHBC requirements, Vassall Road was designed to meet the current Part L requirements. Cellotex insulation with taped joints was used in the walls and roof, with on-site supervision from the design team. Double-glazed Velfac windows were used.

Bad practice AJ building studies for which no CO_2 emissions data was provided

Rogers Stirk Harbour + Partners
Heathrow Terminal 5
Stanton Williams
Belgrade Theatre
Page\Park
Eden Court Theatre
Evans Vettori
Cotes Farm
Toh Shimazaki
London Rowing Club
Sheppard Robson
Alan Turing Building
McCullough Mulvin
Oak Park Research Facility
McCullough Mulvin
Engineers Ireland
McCullough Mulvin
Lincoln Place
David Chipperfield Architects
Empire Riverside Hotel
Tony Fretton Architects
Fuglsang Art Museum
Glenn Howells Architects
National Film and Television School
Stock Woolstencroft and S333
Tarling Estate
Sergison Bates
Parkside
Keith Williams Architects
Wexford Opera House
FAT
Heerlijkheid Hoogvliet
Elder and Cannon
Moore Street
Clash and Hawkins/Brown
The Level Centre
Pringle Richards Sharratt
Herbert Museum and Art Gallery
Ushida Findlay
Poolhouse 2
Elder and Cannon
Niddrie Mill and St Francis Primary Schools
Robbrecht en Daem
Whitechapel Gallery
Rick Mather Architects
Towner Gallery
MacCormac Jamieson Prichard
British Embassy, Bangkok
Will Alsop
CHIPS
ORMS
Teenage Cancer Centre Trust
Page\Park
Fettes College
David Chipperfield Architects and b720
City of Justice, Barcelona