



COUNTING the CARBON

Counting the carbon in a house requires data on all the building materials. It can be hard to find,



says ROGER HUNT

As homes become more efficient and their operational CO₂ emissions are reduced, it makes sense to consider the significant amounts of carbon used in their construction and maintenance and to understand the interrelationship between embodied and operational carbon usage. All these factors are largely ignored by current construction legislation, perhaps with good reason – they are hugely difficult to calculate because, until now, few tools have been available to help.

The recent RICS research report 'Redefining Zero: Carbon profiling as a solution to whole life carbon emission measurement in buildings' proposes a solution with a new, simple carbon metric known as Carbon Profiling. This quantifies all sources of emissions associated with buildings and links operational and embodied carbon usage so that they can be considered together. Crucially it evaluates the impacts of time and of when the emissions take place. ►

ABOVE Archtype sees Redefining Zero as a good start in the effort to set up a common and understandable carbon measurement system



LEFT All Sandtoft's clay pits are adjacent to the factories where its tiles are manufactured which reduces the amount of carbon used in the manufacturing process **BELOW FAR LEFT** Caledonian Building Systems provides modular solutions where the processes and techniques facilitate a reduction in embodied carbon **BELOW** The Prince's Foundation's Natural House at the BRE Innovation Park is based on the concept of simplicity and creating a robust, high performance structural envelope based on NBT ThermoPlan insulating blocks

OPPOSITE PAGE

RIGHT Glasgow Housing Association has teamed up with architects PRP to build four prototype houses which feature high standards of insulation, coupled with low energy running costs and simple technology, cutting carbon in use **FAR & BOTTOM RIGHT** Social housing contractor United House on site, carbon needs to be considered at every stage of a project



Within the report embodied carbon is defined as carbon dioxide emissions that are generated from the formation of buildings, their refurbishment and subsequent maintenance. Importantly this is different to the more commonly understood term, embodied energy. The level of embodied energy remains the same no matter what the source of energy that has been used. The level of embodied carbon will depend entirely on the means of generating that energy. For example, if a brick is fired using energy generated by wind or hydro power there will be little carbon in it; if the energy used is coal, gas or oil the level of carbon is likely to be high. Naturally this concept extends through the energy used at all other stages of the process from the extraction of the raw materials to transportation to site.

For Simon Sturgis, managing director of Sturgis Carbon Profiling and one of the report's authors, the key need is to quantify and bring together the disparate elements of carbon usage.

"Everyone is conversant with EPCs and Part L of

the Building Regulations which deal with the operational carbon usage – the heating, the cooling, the lighting of the building. We wanted to get all carbon usage into one simple picture and then we also hit upon the whole lifespan issue."

Sturgis puts this into context by using brick as an example. He explains that, although it can take considerable energy to make, the fact that a brick may last 200 years means that it is potentially carbon efficient. "Once we had brought carbon and lifespan together in the embodied sense, mathematically we had the same equation as everybody uses for operation, in other words kilograms of carbon per annum – per metre square is then easy. Once you're linking those two things you can combine operational and embodied carbon into a single metric which is understandable and so every building can be given a number which relates to its carbon performance."

In practice, this means that the carbon profile of one home can be directly compared to that of

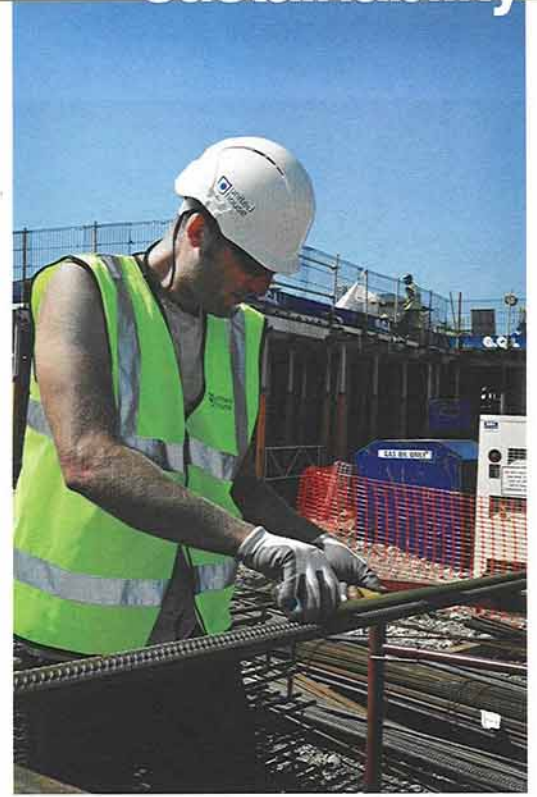
another as a per square metre rate, just as one might with build costs.

At architectural practice Archtype, director Ben Humphries sees Redefining Zero as a good start in the effort to set up a common and understandable carbon measurement system.

"The carbon profiling model proposed is important because it factors in demolition of existing carbon resource and, importantly, life expectancy of components. The non-inclusion of end of life recycling is contentious, but does omit speculation.

"Such a system does have limitations of course; Archtype knows from its own embodied energy analysis for projects in Abu Dhabi that getting hold of CO2 figures can be immensely frustrating. Also, the reliability of data is questionable."

Neil May, CEO of Natural Building Technologies (NBT) and chair of the Good Homes Alliance, believes the RICS report raises some important issues but offers no answers. "It is increasingly evident that embodied carbon is an important



factor in any strategy to reduce our total carbon emissions and impact. Furthermore the embodied impact of materials is not confined to carbon, or even carbon and energy. The embodied impact is also about resources, pollution and health."

Even when focusing just on the embodied carbon in the manufacture and transport of materials, May sees a number of real problems. Notably, like Humphries, he questions the availability of good data about the embodied carbon of building materials.

"The database most commonly referred to for embodied carbon, and which is used in this report, is the Inventory of Energy and Carbon (ICE). However, as the introduction to this database makes very clear, there are considerable limitations to the data, particularly data about embodied carbon, which, according to the Inventory, is provided usefully only in about 20 per cent of data sources."

In addition, May is concerned that there is not a clear method of defining embodied carbon in bio-

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based materials and that research and data is lacking about energy in use.

Alistair Sivill, technical director at social housing contractor United House, continues this theme. "Defining a building's carbon profile still requires making assumptions about the levels of embedded carbon in building products, as many of these have never been published and therefore the information isn't available. Measuring a carbon profile also means making an assumption about the building's lifespan, which is very subjective since the weakest link of a critical construction component will have a fundamental effect on a building's life."

While all of this poses problems for housebuilders and specifiers, the issue is no easier for manufacturers. In 2006, in a move directly to reduce the embodied energy in its products, roof tile manufacturer Sandtoft began using wind power for all its production facilities. "By making this investment we've cut the amount of CO2 we use by 25 per cent per annum," says ►



TOP LEFT & MIDDLE Social housing contractor United House states that assumptions about the levels of embedded carbon in building products still have to be made **TOP RIGHT** Architype's Stroud Co-housing project uses a timber frame construction

BELOW Warmcel insulation is manufactured from recycled newspaper and is claimed to be a better than carbon zero insulation



Nick Oldridge, Sandtoft's sales and marketing director. "The problem is, how is this benefit reflected when specifiers are comparing our products with another manufacturer?"

Similar issues are highlighted at Excel Fibre Technology, manufacturers of Warmcel insulation. Managing director Andrew Izod believes the current scoring system for building materials within the Code for Sustainable Homes is too restrictive and does not reward innovative manufacturers.

"The Code is concentrating too much on the energy efficiency benefits a product may deliver throughout its service life and fails to take into account the full lifecycle of the product from manufacture to removal. There is far too much emphasis on the softer issues surrounding carbon reduction, rather than taking a long hard look at the embodied carbon of products."

Ian Kemp, business development director at modular construction company Caledonian Building Systems, urges housebuilders to work with supply chain partners who can provide comprehensive carbon data. He believes that, in this context, modern methods of construction such as building off-site, where the processes and techniques facilitate a reduction in embodied carbon, are coming into their own.

"The significance of embodied carbon is clear in the results of an independent assessment of Caledonian's modular design and construction process for housing: material lifecycle accounts for 86 per cent of the overall carbon footprint of the building process."

"As the RICS report identifies, housebuilding must lower the carbon impact of materials and waste as well as looking to create energy efficient homes through carbon efficient construction. There are also significant opportunities to reduce carbon impact through transport during the housebuilding process."

Indeed, when Caledonian completed a 1,935 bedroom military campus, an independent study calculated that the reduced vehicle movements allowed by modular construction saved 1,290 tonnes of CO₂.

Continuing the theme of materials, Andrew

Mellor, director (environmental) PRP, believes that over time there will be a greater reuse of materials such as steelwork and that manufacturers will actively promote the levels of embodied carbon in their products as opposed to saying that they have recycled content.

"More traditional materials like lime mortar contain very little carbon and will absorb carbon over time. If housebuilders used a lime mortar rather than a cement mortar we could reuse the bricks when houses need adapting or extending, and so the lifetime of the bricks becomes hundreds of years," says Mellor.

At NBT, Neil May sees an urgent need for a proper knowledge centre and independent fully funded research. In the meantime he believes it is vital that everything is done not to make the situation worse rather than better in terms of the total carbon emissions from buildings. He advocates focusing on quality.

"This was strongly evidenced in the report where the lifespan and correct operation of building elements is a critical factor in embodied carbon impact. Secondly, focus on high performance building envelopes and structures. These should last as long as possible and do most of the work in terms of reducing carbon emissions in use." **SH**

CONTACTS

Redefining Zero can be downloaded free:

www.rics.org

Architype www.architype.co.uk

Caledonian Building Systems

www.cbbuildings.co.uk

Excel Fibre Technology www.aimlower.co.uk

NBT www.natural-building.co.uk

PRP www.prparchitects.co.uk

Sandtoft www.sandtoft.co.uk

Sturgis Carbon Profiling www.sturgis.co.uk

United House www.unitedhouse.net

Read Roger Hunt's blog: www.huntwriter.com or contact him: roger@huntwriter.com