

Edge Debate 55: The Politics of Carbon Emissions

6 March 2013: Ecobuild, Excel Centre, London

CHAIR'S INTRODUCTION

Simon Foxell – The Architects Practice & Edge Member

As an interdisciplinary construction industry think tank, sustainability and carbon are large on the Edge's agenda. Energy is a key and increasingly scarce resource, yet we know surprisingly little about how it is used in our buildings and the carbon impacts – as frequently evidenced by the performance gap between prediction and measurement. The privatisation of data, their metrics and other factors that are often cited as contributory are the subject of this Debate.

LET'S MEASURE SOMETHING MEANINGFUL

Prof. Doug King – Chief Science and Engineering Advisor, BRE & Edge Member

Are we measuring the right thing(s)? The 2012 Jones Lang La Salle Report using data from the Better Building Partnership's buildings showed that Energy Performance Certificates, EPCs (giving predicted 'regulated' energy use), were virtually meaningless as an energy ranking mechanism because they were contradicted by measured total energy (from Display Energy Certificates, DECs). So EPCs may not be appropriate as a comparison metric.

With building selection, complexity at system level is compounded by bigger issues at city level. While we choose cars by intuitively balancing a range of attributes, our selection of workplace buildings is dominated by one criterion – location - EPCs barely feature in the reckoning. Even multi-criteria assessments, like BREEAM, which aid evaluation, do not necessarily balance 'location' as a driver.

But with UK's carbon reduction commitment, cost is increasingly important – recognising the trajectory resets the optimal play between capex and opex. The Innovate Green Office (illustrated) was designed to be a low cost office with excellent carbon performance but without employing any renewable energy technology. Its lower operating cost added 10% to the landlord's yield.



A low carbon future for homes involves life style changes as well as technology. Their confluence to achieve zero carbon homes demands both shift equally from 'business as usual' – with a 'comfortable' compromise formed short of the zero target.

Socio-economic factors apply. Normal metrics of societal progress like GDP, RNNI and RHA appear to have scant bearing on judgements of 'life satisfaction' [see also *Edge Debates passim*]. Similarly, the standard metric of carbon performance - kgCO_2/m^2 – is crude and often unhelpful per se and in comparisons between functional categories (like schools and lecture halls, hotels and hospitals, etc.) More radical metrics might see school emissions expressed as $\text{kg}/\text{student}$ or $\text{kg}/\text{learning-outcome}$ or even $\text{kg}/\text{teacher-stress-index}$; offices – kg/desk or $\text{kg}/\text{productivity-index}$. More far-reaching metrics are important. Romero House, CAFOD's HQ, ranked badly on a kg per m^2 basis but was best of class on kg/desk .

WHY IS DATA SO IMPORTANT FOR A LOW CARBON FUTURE?

Prof. Tadj Oreszczyn – Director, UCL Energy Institute.

Data capture and application is vital in moving from demonstration to deployment. UK's carbon plan sees all buildings moving to a 'near-zero' CO_2 footprint by 2050 – a huge undertaking with neither time nor resources to 'get it wrong'.

Data needs to be used better – to inform policy, design & construction; to save money; to frame further research and to 'ground' energy prediction in fact.

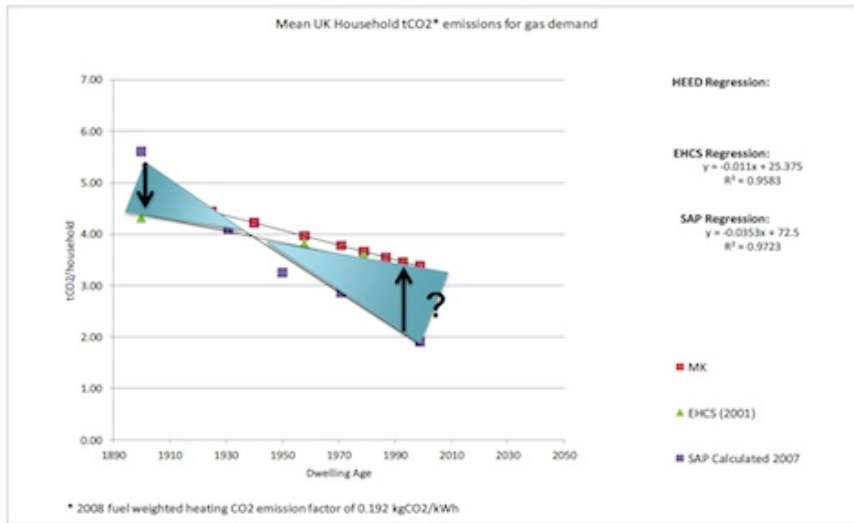
Analysis of historic gas use data for dwellings shows some correlation between increasingly stringent energy regulations and demands - but with a shallow decrement curve from 1965 (when U-values were first codified) with scant relationship to the requirements of the zero carbon building challenge- the curve to 'where we need to be' by 2016 is precipitous.

Yet we know how to do better as evidenced in the past – with exemplar houses in the 70s using half the energy of their peers: results halved again by 80s exemplars.

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There is a gap between theory and practice – SAP analyses predict a far steeper CO₂ decrement than the plot discussed above. There are a number of causes - applying the wrong physics, vagaries between design and construction and the unpredicted effects of occupant behavioural (such as ‘rebound’).



Yet we still depend heavily on theory last validated 20 years ago – because field-measurement has been expensive compared with modelling and energy industry privatisation has made data-access difficult.

Things however have changed. ‘Retrofit’ promises to be a £multi-billion new industry but its success will depend on applying sound, evidence-based, solutions. Now, Government has legislated carbon targets, it has access to annualised meter readings (and energy interventions undertaken) for every dwelling, energy monitoring is now easier and far cheaper (e.g., with smart meters) and Government operates an open-data policy.

Thus UCL has been funded by the UK Research Council to undertake a novel approach to ‘mining’ such data using the principles of health epidemiology. Its analyses marries energy epidemiology (at population scale) with building science (building typology) and behavioural science (people) to better understand ‘causes and effects’.

The Centre for Energy Epidemiology (CEE) deals with the whole energy system rather than its sub-systems, it focuses on outcomes such as reduced delivered energy or carbon emissions rather than intermediate performance indicators. It is interdisciplinary, facilitating enquiry from the perspectives of economics and social science as well as thermodynamics. It will support the developments of technologies, changes in behaviour and policies - and it is action-oriented.

The CEE will involve and provide the secretariat for an international network of similar research.

Its challenge lies in accessing wider contextual data.

PRIVATISATION OF KNOWLEDGE – PITFALLS AND OPPORTUNITIES FOR CO₂ REDUCTION

Lynne Sullivan OBE, Sustainability By Design LLP and Edge Member

Lynne’s prime focus, as a member of the Green Construction Board (GCB), is on skills and knowledge where she acts as the ‘sponsor’ of a sub-panel.

She explained that the GCB’s agenda was to ‘know where the carbon is’ and then to map actions needed to reduce it. She referenced GCB’s Carbon Route Map (launched the previous day at Ecobuild), designed to scenario-plan carbon reductions to 2050. It is intended to be a structured and logical route-map to view the timeline of key interventions and their contribution to carbon reductions. To achieve the target by 2050, emissions from the built environment will need to decrease to 46 million tonnes, or by 77% from 2010 levels. There were concerns that the Route Map only dealt with ‘regulated energy’ (which as Doug King had noted earlier was not a reliable proxy of total energy) and it did not really inform demand reduction.

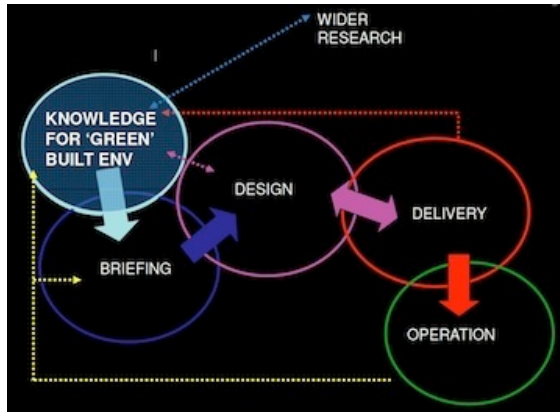
The knowledge & skills group has been looking at the wider landscape; the feedback loops to knowledge bases and where useful knowledge lies. Often this is outside the normal ambit of built environment processes – such as the psychology of energy use, metered and field measurements, performance data and the like. It embraces not only numeric data but also experiential and lesson learnt information.

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The aim is to create a knowledge hub with protocols for data collection and presentation. The challenges lie in developing a common language and a structure to coordinate learning and skills programmes, in identifying specific skills needs and then in stimulating take up by those seeking to involve in the market opportunity.

The knowledge hub will involve inputs from the usual players – government, developers, institutions, academe, etc.; whereas its beneficiaries would be users or those looking to up-skill or to differentiate their offering. Thus disclosure will be a key challenge unless the hub offers something for everyone in terms of new opportunity, policy or training.



The hub will endeavour to comprise both regulated and unregulated energy. A key aim will be to close the 'performance gap' (between prediction and actuality). Here data from self-builders (with vested interest in outcomes) may be particularly valuable in understanding the behavioural 'scatter' of results. The Passivhaus knowledge community, (where prediction and outturn energy performance closely calibrate) also offers learning and important benchmarks. Other sources include Carbon Buzz, the Technology Strategy Board, housing associations & trusts, national statistics, institutions and industry bodies. The aim will be to use such data to test current guidance.

A Green Construction Board project is being launched to establish a standard set of data collection protocols which could underpin voluntary declaration and lead to 'genuine' case studies - where data is collected and developed into knowledge that is tailored for different parties and skills sectors.

DEBATE/ DISCUSSION:

Q1. It was interesting to see the range of data available to the panellists. How would each describe their data and what data they lacked?

TO: 'Huge' data accumulated over many years – including data covering pre- and post-retrofits. CEE lacks access to valuation office and census data – so it can't fully interrogate the data it holds!

DK: There is much 'little' post-occupancy data around that is not in circulation but which is capable of yielding much knowledge.

LS: Post-occupancy evaluation data is rarely available at the moment.

Q2. Will the roll-out of smart meters, giving more detailed data, help? Do the large volumes of very simple retrofits carried out by energy companies provide the information required?

TO: Smart meter data are extremely useful in policy evaluation terms – but accessing them may be problematic.

Q3. Planning Controls need standards – but the ones in CfSH have been killed off whereas Belgium is adopting Passivhaus. Are we going backwards?

DK: Standards set minimum criteria. Shouldn't Planning be more aspirational (as in the past)?

LS: Time has shown there's a gap between planning aspiration and what actually happens – but yes, planning conditions are critical.

TO: No one has ever been imprisoned for offending the energy regulations – so energy codes are obviously not taken very seriously!

Q4. TSB is attempting to release as much information on retrofitting projects as it holds (see www.retrofitanalysis.org) and it welcomes feedback. On a different angle, the discussion has focused on data with nothing on modelling. We need to validate our models to be sure of our tools!

TO: Data is only the start of a long process – and modelling is an element of that process. But models are being updated from data. We need better systems for validating models.

DK: We don't 'destruction-test' our models (like structural engineers) – so we have less understanding of their boundaries.

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Q5. Surely we should be dealing with order of magnitude issues rather than minute detail?

TO: Data is useful in many ways and some things do require detail (e.g., U-values used for solid walls have only recently been discovered by detailed investigation to be wrong)!

LS: Passivhaus is a near-zero heating standard but it barely addresses hot water consumption – so here further detailed work would be valuable.