

Tall buildings in the Eastern Cluster of the City of London, with a shadow map for 1pm in mid-December



SHADOWLANDS

A new wave of tall buildings is reshaping London's skyline. Many will claim to be at the cutting edge of energy efficiency – but what about the effects they will have on the buildings below them? **Julie Fatcher** reports

6 The effect that high-rise neighbours can have on other buildings' energy demand, and the urban heat island, is an overlooked aspect of the debate

Tall buildings don't always make good neighbours. It's not just a question of looks, and the brash way that they tend to dominate the landscape. When Rafael Viñoly's 'Walkie Talkie' tower, in the City of London, directed last summer's sun onto nearby properties and parked cars – blistering paintwork and melting wing mirrors – it was a vivid reminder of the physical impact that these towers can have on their neighbours. It was timely too: there are 230 buildings of 20 storeys or higher planned for Greater London.

With the 2016 and 2019 zero-carbon deadlines – for residential and non-residential buildings respectively – fast approaching, the effect that high-rise neighbours can have on other buildings' energy demand, and the urban heat island, is an overlooked aspect of the debate.

No building is an island

One of the ironies of the Walkie Talkie is that, viewed in isolation, it has an impressive environmental performance. It has an excellent BREEAM rating and

uses just 76% of the energy that it would if built to existing standards. It was because of this that the City of London Corporation was able to overcome the obstacle of neighbouring properties' right to light. Usually, the right to daylight cannot be interfered with without the consent of the owner, and any obstruction that results in a loss of daylight can be challenged legally, and redress sought. However, Viñoly's tower was deemed to be of sufficient economic, social and environmental value for the Corporation to invoke compulsory purchase powers to buy the right to light from the properties that were obstructed.¹ While the building itself is efficient, it has been allowed to have a dramatic effect on the energy loads of neighbouring buildings.

Urban forms can have a significant impact on local climate and, consequently, on energy demand in the surrounding area. Many factors can have a fundamental effect on temperature, air quality and wind speed, including: the choice of construction materials; whether the land is paved or vegetated; the dimensions



solutions (AS), which is essentially offsetting carbon emissions through actions off site. AS is intended to be in place for domestic buildings by 2016, with a similar scheme for non-domestic buildings implemented by 2019. AS could address some aspects of the urban problem, but this will greatly depend on how it operates. If no geographical limits are placed on the off-site solution, the cost may be paid by those living and working in the urban environment, while benefits are accrued elsewhere. (See page 18 for more on AS timescale).

Love thy neighbour?

The example of the Salesforce Tower – formerly the Heron Tower – in the City of London illustrates the potential dangers of relying on the first two zero-carbon approaches in isolation from the wider urban context. This tall tower’s BREEAM rating of excellent is due both to its envelope design and its low-energy technologies, which include PV cells that are embedded in its south-facing glass façade.

Its unobstructed access to the sun for most of the day allows this building to acquire sufficient renewable energy to supply about 2.5% of its energy needs.³ However, it does not have a right to this resource, so access to it – and the energy derived from it – is predicated on nearby developments. Unfortunately, when a new tall building at nearby 100 Bishopsgate is completed, it will shadow the energy-generating façade for much of the day.

To examine the effects of 100 Bishopsgate on its neighbour, De Montfort University used the dynamic thermal simulation tool, EnergyPlus, to create a theoretical building, and analyse the relationship between the two structures.⁴ The results are shown here as the changes to annual illuminance (see colour rendering of facade on next page), with a difference in energy production of about 40%.

EnergyPlus also simulated the regulated energy demand for a space directly behind this façade, which is currently unoccupied. One response could be to change its use. If it was converted to offices – which have a daytime occupation pattern – then the shadowing effect from 100 Bishopsgate could be beneficial. The model estimates that the shadow lowers the energy needed to satisfy the cooling demand by 30%. Although it would also increase the predicted heating demand by 35% – a small proportion of the total energy demand (4%).

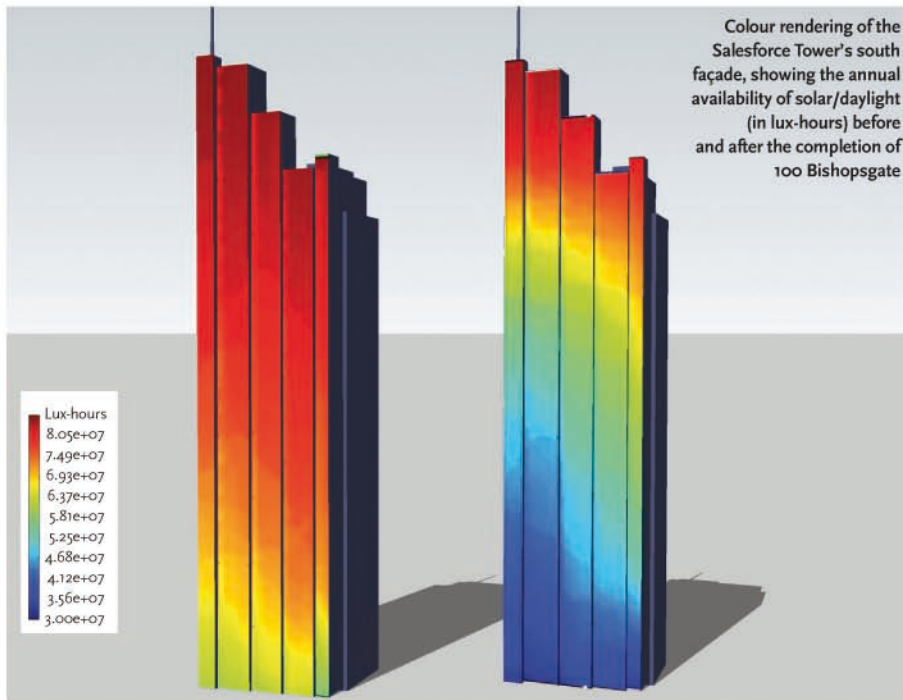
However, if this space was to be used for residential purposes, with an evening energy demand, then the shadowing effect may be undesirable. This illustrates the relationship between the form of the building – and its



and situation of buildings and surrounding road network; and the activities carried out within them. One of the most significant is the screening effect on other buildings, leading to a loss of both direct sunlight and daylight.

Despite this, the current strategy for achieving the zero-carbon target does not account for the interdependence of buildings. Rather, each building is treated as an isolated entity. This strategy towards zero carbon is based on three related approaches, two of which are in place and are site-based. The fundamental approach – often referred to as ‘fabric first’ – relies on construction standards that manage the regulated building energy load. This is complemented by a renewables strategy, which generates clean energy through photovoltaic (PV) cells, wind turbines and so on. Because these approaches are site-based, opportunities to reduce energy demand at larger scales, such as neighbourhoods, are lost.

The third approach has been introduced because the first two alone may not achieve the zero-carbon target within the desired timeframe.² It is known as allowable



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MODELLING THE FUTURE

Proposals for a London-wide planning strategy for tall buildings include a call by New London Architecture chairman, Peter Murray, for a mayoral Skyline Commission, a city-wide plan, and a freely available model – all of which will offer a significant contribution to resolving many of the issues associated with current methodologies.⁶ However, for this integrated approach to be successful, a suitable framework must be developed that links the urban setting at a fundamental level.

Recognising this, a joint project between University College Dublin and De Montfort University has been proposed systematically to test the positive and negative impacts of buildings in their urban setting. The project will not only evaluate the effects of the urban setting on the proposed building design, but also the effect of the proposed building on its surroundings.



When built, 100 Bishopsgate will cast a shadow over the Salesforce Tower – formerly the Heron Tower

► solar façade – and its functions.

The Salesforce Tower example highlights that the current planning system does not protect the rights to the renewable energy resource available at a site. This is especially relevant for tall buildings because they have a dramatic impact on the surrounding wind and solar environments, depriving other buildings of the opportunity to access the resource.

AS could offer some remediation, if designed appropriately to include the impact of buildings on their neighbours. The types of solution that are allowable have yet to be precisely defined, and there is still considerable uncertainty as to how they may be operated. To this point, options for the residential sector have been discussed. They include meeting

the remaining carbon abatement requirement through off-site carbon abatement actions – the 'do-it-yourself' option. This could include improving other existing buildings – for example, retrofit installations: renewable heat or energy schemes – or building to a higher standard than the current Part L requirements on developments with extant planning permission before October 2016, and 'banking' the difference.⁵

In other words, a developer could accrue carbon credits before the implementation of the zero-carbon standard. There is no indication of how these credits could be used, but one can see the potential implications in the examples presented here. Could the Salesforce Tower retain the carbon credit it could potentially derive from solar power, even though decisions off-site have diminished this resource? Should 100 Bishopsgate compensate this tower for the loss of its carbon? Should the Walkie Talkie keep all of its carbon credits, even though it may increase the heating/cooling demand in neighbouring buildings? What may be needed are solutions that address energy use at a larger scale than the building.

The debate around the proposed changes to London's skyline has drawn attention to the shortcomings in the piecemeal approach of the UK's planning system. It's imperative that a city-wide strategy is drawn up to include an integrated approach to urban planning and a model that assesses the potential impacts of new towers on their local environment. Without one, London will be in no position to mitigate against the impact of rising temperatures caused by climate change. CJ

References:

- 1 'Walkie Talkie' backers want tower protected from light blocking claims – www.theguardian.com/business/2011/may/06/walkie-talkie-planning-issue-land-securities
- 2 Allowable Solutions – Consultation (August 2013) Department for Communities and Local Government
- 3 www.construction-manager.co.uk/features/put-it-panel/
- 4 The buildings used here were created to comply with current guidelines and regulatory legislation, and are used to evaluate various scenarios by comparison.
- 5 Next steps to zero-carbon homes – Allowable Solutions – Consultation (August 2013) Department for Communities and Local Government
- 6 Peter Murray: We need a Skyline Commission <http://bit.ly/SPVcNQ>

DR JULIE FUTCHER is an architect at Urban Generation. She was assisted in this article by Dr Gerald Mills, senior lecturer, School of Geography, Planning & Environmental Policy, University College Dublin; Dr Ivan Korolija, research fellow, Institute of Energy and Sustainable Development, Faculty of Technology, De Montfort University; and Dr Yi Zhang, senior research fellow, Institute of Energy and Sustainable Development, Faculty of Technology, De Montfort University