
# Round Table: 'Big data analytics in the built environment'

## Discussion Summary
## 12th October 2015

This round table was the second in a series of events held in partnership with the University of Oxford, accompanying the UK Research Council-funded research programme 'Working with Infrastructure, Creation of Knowledge, and Energy Strategy Development' (WICKED), which looks at energy strategy development in the retail sector.

Participating Individuals & Organisations:

British Board of Agrément
British Retail Consortium
Capital and Regional
$CO_2$ Estates
Oliver Colvile MP
Department for Business Innovation & Skills
Department of Energy and Climate Change
Home Retail Group
Lightsource Renewable Energy Ltd.
Policy Connect
Tom Tugendhat MP
UCL
University of Exeter
University of Oxford
Westminster Sustainable Business Forum
WSP

UNIVERSITY OF OXFORD

WICKED EPSRC
WORKING with Infrastructure Creation of Knowledge and Energy strategy Development

policy connect

## Event Summary

This round table was the second in a series of events held in partnership with the University of Oxford, accompanying the UK Research Council-funded programme 'Working with Infrastructure, Creation of Knowledge, and Energy Strategy Development' (WICKED). The event focused on big data analytics in the context of the built environment and discussed the role of big data analytics and its purpose and effectiveness in the wider industry and the retail sector, more specifically. Round table participants further discussed how big data can be best collected and stored, explored questions around who should be able to have access to it, and how conclusion drawn from its analysis can inform industry decisions.

## Key Themes

### Big data analytics – an overview

In the built environment, big data usually refers to the aggregation of sensor information on different aspects of a building's performance and use, such as smart meter data on levels of electricity and heating usage, or occupancy data detailing the actual usage of built space. Analytics takes data and converts it into meaningful, actionable information, thereby facilitating evidence-based decision-making. Data analytics therefore has the potential to improve levels of energy and resource efficiency and incentivise good sustainability practice on the part of both consumers and industry professionals. The construction and building sector has been relatively slow to adopt big data approaches, with a few exceptions. Only recently, the issue has been receiving more attention.

The Green Construction Board – the sustainability work stream of the Construction Leadership Council – emphasises big data in the context of the board's recent efforts to overhaul its industry-led action plan. Further, in her speech to the Conservative Party conference in October 2015, the Secretary of State for the Department of Energy and Climate Change (DECC), the Rt Hon. Amber Rudd MP, highlighted big data as a priority, focusing specifically on smart meters. DECC's stated aim in this context is to improve and accelerate the uptake of energy efficiency measures, with core efforts being placed on increasing currently low demand. Data analytics can help with accelerating demand by assisting with the sharing of information and the development of sound business cases through the establishment of benchmarks and the demonstration of energy efficiency impacts on risks and costs. The hope is that increased demand then further encourages the creation of a mature pipeline of implementation projects, which will deliver the targeted energy savings and productivity enhancements. Furthermore, the Department for Business, Innovation and Skills (BIS) is currently undertaking a programme on 'Bigger, Better Data' with the Green Construction Board looking at barriers and solutions to greater operational energy measurement, reporting and data sharing. It is expected that BIS will be seeking further evidence, particularly in relation to the Government's climate commitments.

### The business case for big data analytics

Making a solid business case for improving the energy efficiency of their buildings and operations still poses a considerable challenge for businesses. A lack of knowledge and understanding of the immense potential of energy efficiency upgrades as well as a lack of time, staff and monetary resources prevent many organisations, and especially small businesses, from adopting strategies to improve their efficiency levels. In general, efficiency improvements are difficult to gain senior management's buy-in, especially in organisations that are not placing enough attention to their energy data. It is therefore common for energy or facility managers to struggle to have their messages passed to senior management and as a result access to corporate finance has been challenging. Round table attendees suggested that by facilitating the communication of results of efficiency upgrades, big data could help overcome distrust that is common among lenders as they receive more concrete information on investment returns of energy efficiency projects.

DECC further considers big data highly important in overcoming the barriers currently hampering the uptake of energy efficiency as big data can help both large and small businesses navigate the diverse and complex options for retrofit improvements by better matching their energy needs and profiles with potential retrofit options. With its smart metering programme, DECC intends to create a level playing field by providing access to big data through a central body, which will allow users to seek third-party analysis of their data. Discussants agreed that support was

needed with the initial roll out of smart-meters to enable this, while also highlighting that consumption data alone is of limited benefit without the accompanying 'meta-data', which gives an insight into the nature of the built environment in question and the behavioural patterns of occupants.

With energy as the second highest cost to retailers, expanding big data analytics and the feed-in of real-time data into system operation management represents big opportunities for the sector. Round table participants placed great emphasis on the importance of understanding and interpreting big data in the context of the different building types. Shopping centres, for instance, operate on long-term leases, with long-term goals on how their energy is used, while supermarket chains often operate premises on a rental basis, paying a service charge on common areas, with a cap being placed on the combined cost of rent and service charge. Distribution centres, in turn, will have a significantly different energy profile given their extensive use of refrigeration. Policy-makers must further be mindful that even when informed by data, some businesses will still choose more energy intensive practices for a variety of factors, such as higher lux levels attracting more customers in retail, or because of issues around energy storage. Round table attendees therefore entertained the idea of appealing to retailers' reputations by having shops display their energy efficiency rating visible for consumers. On the other hand, the round table pointed out that, since retailers already conduct a great deal of analysis regarding their sales, there should be a good chance of successfully convincing them of the merits of energy data analysis through comparing these to efforts they are already undertaking and benefiting from.

Physical building data can enrich consumption data by giving context to energy data findings, improving transparency, helping to identify the source of inefficiencies and to overcome the landlord/tenant divide. Capturing physical building data can be daunting in terms of people, cost and time, but occurs through compliance driven audits. In terms of building information management (BIM), the round table agreed that the Government's backing of energy modelling will allow for more robust energy models for existing building stock, which is often neglected. CO2 Estates is currently attempting to create a 'dynamic simulation', which considers consumption data and overlays it with asset data (the actual physical characteristics of that building), with the hope of better modelling on how buildings can be improved.

## Standardisation, data access, and the need for new skill sets

A lack of standardisation currently makes data difficult to be transferred and the round table agreed that Government needs to ensure that a common standard is established. One of the discussants brought up the example of analysing big data in solar energy generation by referring to a site in the UK where half-hourly readings gave around 1,000 data points per megawatt generated. The half-hourly readings enable a high degree of granularity; however, unlike the heavily regulated market in the south of Europe, there is little standardisation of data collection in the UK, resulting in considerable hassle when new sites are acquired. Further, concerns around what happens to data when consumers switch energy suppliers need to be addressed to avoid the loss of historical information, which would render some analytic aspects non-functional. Data will need to be stored on the meter-point and accessible post switchover. Previously, the requirement was to store data for 13 months, and this has recently been increased to 24 months.

Access to data sets is, on the one hand, important for energy suppliers as they require the fundamental ability to conduct monthly readings. Increasing the frequency of meter readings could enable suppliers to provide further analytical services and give consumers more detailed reports on their level and efficiency of energy usage. Accessing data is also useful for network operators themselves to better understand peak demand at local levels. In terms of individual access at an end user company level, round table discussants suggested that data should be accessible by everyone in a business whose work links to energy. However, with a lack of general 'kilowatt-savviness', this access does not necessarily translate into the correct interpretation of the analysed data and the drawing of adequate practical conclusions. The hope that a currently prevalent deficiency in understanding energy use would be resolved through education did not materialise as there is still a lack of specialist teachers in schools. One possible solution according to round table attendees could be to make energy conservation a bigger part of school curriculums beyond its current place in environmental studies.

Further, there is a skills shortage with a relatively low number of specialist energy managers being available throughout the UK. What is more: many of these energy managers are, in fact, engineers who have been assigned energy management responsibilities. The energy manager role, however, requires a range of additional competences, including transforming data into a business case and presenting it to company boards and project managers, which engineers are not typically trained for. Therefore, many retailers currently rely on third parties to handle and analyse their data, creating an increasingly competitive market for this service. Nevertheless, the round

table argued that companies must appreciate that hiring a third party to manage their data does not mean risk is entirely managed and recommended that electricity bills should be put clearly on the cost sheets of companies' accountants for them to become part of core considerations.

Round table attendees moved on to suggest that a platform is needed for big data analytics innovation. Various technologies are being developed, including disaggregation – the 'fine-grain' analysis of electricity data through sophisticated computer software, which can identify how much electricity is being used by various individual features of a building, such as lifts or heating. For retailers, data analytics can help demonstrate the correlation between heat consumption, footfall and sales and maximise energy use in a way that fully stretches assets. Energy managers can also use data to determine outliers and devote their limited resources accordingly. Customising load profiles to a consumer point of view can also catalyse changes in behaviour, as already happens with fuel usage for cars. It also allows an understanding of the different types of energy profiles within sectors.

## Case study – the Home Retail Group

With around 1,200 sites, including distribution centres and offices, the Home Retail Group spends around £38 million on electricity and gas, £3 million on CRC, and £22 million on diesel. Half-hourly meter readings produce 35 million readings per annum. The use of this stock of data is not simple, particularly after hard system resets and further problems can arise from telecom issues blocking the functionality of the system. The Home Retail Group's data loggers contain batteries and store between five and eight years of data. Data collected includes gas and electricity storage, floor areas and weather data among others. Regional and divisional managers can inspect energy usage data for specific stores, which are presented as simple dashboards. Energy managers are incentivised to improve performance by the linking of energy targets to salary bonuses. Targets are set with consideration given to weather and store activity, with half-hourly reading enabling different targets for different periods of operation. Store managers will receive reports which indicate which areas are not performing to standard and can take appropriate action.

Big data requires a 'quantum change' in behaviour from companies and individuals in order to truly understand its significance and reap the benefits from its analysis. Scale matters in the built environment, and current and future energy use services and systems need to be reliable and robust, both in terms of supporting critical functions of businesses and supporting consumer confidence.

## Encouraging data collection

Commercial real estate is already a well-established asset class that must satisfy a number of stakeholders. Big data can help deliver transparency around energy efficiency performance and enable building improvements. The Minimum Energy Efficiency Standards (MEES) will, from 2018, restrict properties under a certain threshold from being rented out and the round table emphasised that data will play a key role in mitigating risks associated with the necessary retrofitting. Further, under the EU Energy Use Directive, there will be a requirement to display energy certificates. The round table, however, highlighted that generally attitudes towards such rating systems can at best be considered reluctant, with, especially, Local Authorities viewing the Energy Performance Certificate (EPC) scheme as a hassle rather than a tool as they lack the resources for its enforcement. A broader weakness of the EPC system is that building requirements and features are often too broad to fit into the categories of a simple letter system.

Moreover, many buildings with lower EPC ratings behave as high-performing buildings in practice due to the simplicity of their operations. Conversely, relatively new buildings with originally high energy efficiency performance certificate ratings can end up with lower display energy certificate levels than EPCs originally anticipated. This is often due to building usage and uncompromising mind-sets among the people who manage buildings and big data usage. The round table therefore expressed concern that integrating too much equipment into a building could have the unintended, perverse consequence of increasing energy use. The round table pointed out that there is a huge opportunity for the public sector to lead, which could then create the demand for supply chains in the private sector to respond. The public estate can lead by example by showing what can be achieved through energy management in large buildings and making this information publicly available.

Commercial building landlords have a plethora of schemes under which they must provide data, including Greenhouse Gas Reporting, the CRC, ESOS, the Retail Environment Benchmark, the Green Real Estate

Sustainability Benchmark and localised Mayoral requirements. Outside regulatory instruments, data provision can be encouraged in a voluntary form, with the Business Energy Challenge organised by the Mayor of London as one example. Through the competition, City Hall has been gaining access to the energy use data of a range of participating London-based businesses and increasing the profile of energy efficiency at board-level. Such efforts fit well with the Government's localism agenda and could be expanded through the concept of the 'Northern Powerhouse'.

### Areas for concern: finance, security, accountability

Collecting, storing and managing data comes with considerable costs and it must be ensured that these costs are minimised in order for industry to be able to reap the benefits from big data analytics. Despite regulation in the commercial sector having laid a basis for incentivising buyers and tenants, round table attendees warned against an embryonic market that has not yet fully understood the importance of energy efficiency. It was also pointed out that retail companies rarely consider utility costs when assessing new properties, focusing instead on location, design and other factors. In an effort to counter this, DECC is currently providing supermarkets and other large tenants with advice papers, aiming to put efficiency and data management on corporate agendas. However, for large retailers normalisation can be a challenge, with every store being different.

Security aspects of big data analytics and the sharing of information remain a big public concern. The Government's policy in terms of data privacy and consumer protection to date is characterised by precaution, prioritising emerging consumer confidence. DECC might be considered to be 'leaning into the wind' with regards to the level of data control given to consumers, with round table attendees anticipating that this would be an ongoing development.

In the context of a wider smart-meter rollout, the round table considered the aspect of data veracity and the potential of smaller metering errors – in aggregate – to undermine the reliability of the entire system. This raises questions around who will be responsible for smart meter data and who will bear the cost of any mistakes. Historically, the energy supplier has been responsible for errors – the future might bring a situation where landlords will be similarly responsible. Unresolved issues also exist in the ownership of the meters itself. Further, discussants emphasised the need to ensure that physical building data gathered during the construction stage of a building is passed over to the building's operational managers when the construction phase is completed. Similarly, a lack of understanding regarding what happens to buildings after retrofit measures are installed was outlined, and it was suggested smart meters focus on assessing the difference in performance before and after meter installation.

One of the round table participants further cautioned against a sole focus on upstream data activities as these are likely to become irrelevant in the face of a steady increase in downstream demand, that is, demand at an individual or company level. It is necessary to create a standard of service, which will be difficult, with an attendee suggesting that in retail only 10% of retailers are in a position to understand and accurately interpret their collected data. Data is not considered important in many organisations, with the majority being oblivious to the fact that data which is not stored is irretrievable.

## Conclusion and outlook

Big data analytics opens up a range of new opportunities to increase energy efficiency in the built environment in general, and the retail sector in particular. True to Lord Kelvin's adage 'if you cannot measure it, you cannot improve it', big data analytics enables access to a currently untapped pool of information that can also help communicate the benefits of efficiency upgrades to investors, improve transparency and thereby help overcome the landlord/tenant divide. A lack of standardisation of data collection, however, is still acting as barrier to the wider adoption of big data approaches. Further, with a skills shortage and new technologies still in their infancy, the UK is far from being able to reap the benefits that big data could provide. Data collection and management needs to be further encouraged, beyond existing regulatory drivers, while aspects around costs, both in monetary form and in terms of data privacy and security will need more attention. There also remain complex questions on the carbon footprint of data management itself. The carbon impact of electronic information – exemplified by the 20 million tonnes of $CO_2$ resultant from electronic spam – needs to be taken into the equation, with data centres become a larger and more important part of the economy. The data landscape of the future and the question whether the next three or four decades will see as much technological change as the last years are just as much issues for consideration as the implications arising from this for the retail industry and its energy usage.

## About the Organisers

► The Westminster Sustainable Business Forum (WSBF) is a high-level coalition of key UK businesses, Parliamentarians, Civil Servants and other organisations. Providing a politically neutral environment for knowledge sharing and discussion on sustainability policy, we help to inform the wider sustainability agenda in government and are a trusted source of independent information and advice for policymakers. We publish authoritative research reports; impact on government policy through our in-depth round table policy discussions and outputs; and inform the wider sustainability debate by convening Parliamentarians, senior Civil Servants, business experts and other stakeholders at our larger policy events and seminars. The WSBF works in the policy areas of sustainable construction, sustainable infrastructure, water, sustainable planning, green finance and natural capital. We are cross-party, independent and not-for-profit.

► The University of Oxford is addressing the major technical, social, economic and policy challenges of providing secure, affordable and sustainable energy for all. Its researchers engage with a large number of industrial and academic partners, as well as key stakeholders around the world, such as governments and NGOs to work on different aspects of the energy challenge, which must be addressed holistically. The 'Working with Infrastructure, Creation of Knowledge, and Energy Strategy Development' (WICKED) is one of six grants funded in 2014 by the Engineering and Physical Sciences Research Council and the cross-council Energy Programme. WICKED investigates energy strategy development in the retail sector, which is one of the largest commercial property sectors and a vital part of the UK economy. In particular, WICKED explores energy management practices and retrofit technology adoption across a range of retail organisations, including owner-occupiers, landlords, and tenants, working with both the “data rich” (those organisations with energy managers and automated meter-reading) and “data poor” (those without).. WICKED bridges these gaps through scientific research on buildings, energy and organisational behaviour with a cooperative research programme, using a mix of partner engagement, big data analytics, and empirical research to investigate the retail sector at multiple scales. WICKED links to other energy research at the University of Oxford through the Oxford Energy Network.