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Editorial

John Kaiser Calautit BEng (Hons), PhD, CEng, MIMechE
Assistant Professor, University of Nottingham, UK; Visiting Professor, University of Sheffield, Sheffield, UK

This themed issue includes the selected papers from the proceedings of the seventh International Conference on Sustainability and Energy in Buildings 2015 (SEB15), which was successfully held in the vibrant city of Lisbon, Portugal and was organised by the Universidade Nova de Lisbon (New University of Lisbon) in partnership with KES International. Annually, the conference brings together researchers and government and industry professionals to discuss the future of energy in buildings, neighbourhoods and cities from a theoretical, practical, implementation and simulation perspective.

Built upon the success of previous conferences, the seventh conference in the SEB series attracted a large number of submissions from all around the world, which were subjected to a two-stage peer review process. With the objective of producing a high-quality conference, papers were selected for presentation at the conference and publication in the proceedings. The scope of Sustainability and Energy in Buildings is extensive and 57 oral presentations were delivered during SEB15. Extended and revised versions of the top eight articles, which were selected by the SEB scientific committee and *Engineering Sustainability* editorial panel, are included in this and a subsequent themed issue to disseminate further the leading research in this field first presented at SEB15. The selected papers cover emerging research topics in the areas of energy and buildings, including big data, renewable energy integration, energy performance gap, advanced materials and technologies in building construction, hybrid energy systems and smart cities.

Recently, the big data concept has been gaining considerable attention for tackling complex and challenging engineering problems; in particular, it is notably impacting the civil engineering sector. Big data analytics is transforming the way civil infrastructure systems are constructed, operated and maintained. It provides valuable insights from a large amount of data collected through various sources to optimise decision-making, save energy, improve safety and reduce cost. Some of its applications in the civil engineering sector include structural health and environmental monitoring (Yeum *et al*., 2016), waste and water management, urban planning and operation (Tkachenko *et al*., 2015), smart buildings (Gruber *et al*., 2016) and mobility (Valdez *et al*., 2015). The first article in this issue (Capozzoli *et al*., 2017) presents a data mining-based methodology for setting decision-making rules to identify the energy consumption patterns of a large data set of flats and investigate different energy retrofit actions. The influence of four attributes on the normalised primary energy demand of 92 906 flats in northern Italy are analysed. The paper covers crucial aspects of practical relevance for authority planners and building energy experts and designers.

Similar to the work of Capozzoli *et al*. (2017), the method proposed by Gagliano *et al*. (2017) in the second paper aims to support decision makers to estimate the energy consumption of residential, commercial and industrial buildings and evaluate the possible effects of different energy strategies. The complexity of urban energy supply and demand is increasing rapidly with the diversity of energy technologies that participate in the energy system, such as integration of renewables, electric vehicles, storage and combined heat and power; therefore, the development of urban energy analysis tools has become indispensable. One of the biggest issues for the energy analysis of large urban areas is the scarcity of energy consumption measurements. Gagliano *et al*. (2017) propose the application of a geographical information system (GIS)-based method to support the development and management of a sustainable energy action plan at the urban level. The GIS provides a geo-referenced representation of the municipality that can be enhanced with data on the actual energy requirements of the municipality and the local production of energy.

One of the most critical challenges faced by the built environment sector today is the ‘energy performance gap’, which is the difference in energy use and emissions of buildings, from predicted performance at the design stage to performance in use (Johnston *et al*., 2015; Robinson *et al*., 2016). Underestimating the likely energy consumption of buildings creates a number of potential risks including impacting on carbon dioxide reduction targets, higher than expected energy bills and undermining buyer confidence in new low-carbon dioxide buildings (Zero Carbon Hub, 2013). Findings from the studies of the Carbon Trust (2011) demonstrated that the measured energy use can be as much as five times higher than predicted energy use. In the third paper of this issue, Baborska-Narozny and Stevenson (2017) discuss the underlying factors that contribute to the performance gap between design intentions and actual in-use performance in relation to the operation of continuous mechanical ventilation systems installed in two case study housing developments. Informed by the results of a 1-year-long in-depth building performance evaluation, the study develops a process diagram which identifies and situates the interdependencies between occupant and the dwelling environments in terms of ventilation practices.

The final paper of this issue (Isaia *et al*., 2017) evaluates the thermal performance of a vacuum insulation panel, a promising technology that can potentially contribute to energy demand reduction in the building sector. The thermal properties of this superinsulation material make it possible to obtain highly insulated building envelopes with low thickness, offering exciting opportunities for both new and retrofitted buildings. However, despite its great potential, the technology is still poorly adopted due to high cost and difficulties in assessing its thermal performance in real applications, particularly relating to thermal bridging effects. To address the second issue, the authors developed a numerical model for the evaluation of the thermal bridging effect that occurs when vacuum insulation panels are coupled with joints at the building scale.

This themed issue disseminates state-of-the-art research on sustainability and energy in buildings and I hope you are inspired by the articles to contribute new knowledge in the field.

On behalf of the SEB15 Chairs and Organising committee, I would like to thank all the authors, speakers and delegates for their contributions and support to the SEB15. Thanks to the members of the International Programme Committee who have done an excellent job of providing their reviews of the papers, ensuring appropriate quality. Many thanks also to the reviewers for their suggestions which have improved the quality of the articles presented in this themed issue.

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