Engineering Sustainability
Volume 170 Issue ES2

Editorial
Calautit

ice | proceedings

Proceedings of the Institution of Civil Engineers
Engineering Sustainability 170 April 2017 Issue ES2
Pages 63–64 http://dx.doi.org/10.1680/jensu.2017.170.2.63

Editorial

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This issue of *Engineering Sustainability* is the second part of our themed issue on 'Sustainability and energy in buildings', which includes the selected papers from the proceedings of the seventh International Conference on Sustainability and Energy in Buildings 2015 (SEB15). 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. Part one of the issue (Calautit, 2017) explored 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. Part two focuses on topical issues in engineering sustainability including embodied energy and emissions, energy modelling, external wall insulation, in-construction testing methods and energy sources in non-interconnected regions.

Embodied energy and carbon dioxide are increasingly being used to measure the sustainability of a building's structure (Brás, 2016; Knight and Addis, 2011). Although operational energy is presently the focus of sustainability in building regulations, embodied energy and carbon dioxide impacts are becoming more significant as operational energy consumption is reduced. As a result, more attention is being paid on the measurement of building's embodied energy and carbon dioxide (Hammond and Jones, 2008). The first article (Lupíšek *et al*., 2017) introduces the building design strategies developed by the International Energy Agency (IEA, 2017) for reducing the levels of associated embodied energy and carbon dioxide emissions and presented the application of these strategies to case studies from the Czech Republic.

The first case study showed the environmental performance optimisation of a curtain wall facade using a wood-based panel, a bio-based material. In the second case study, the structural system of a multi-floor building was optimised by using ultra-high-performance concrete composed of a mixture of waste wood shavings and cement. The third case study revealed that the utilisation of timber-based structures as replacements for ceramic or concrete blocks can lead to reduction in embodied energy and carbon dioxide emissions. The three case-studies presented in this paper showed that the method of applying the proposed design strategies was beneficial for improving the environmental indicators of construction solutions. However, it also highlighted that the reduction in embodied energy and carbon dioxide emissions are in some cases accompanied by an increase in other environmental impact and indicators and should be further investigated in more case studies comprising a wider spectrum of indicators.

The intensified research efforts by the scientific community and energy industry in recent years have led to development and improvement of prediction models for building energy demand (Capozzoli *et al*., 2017; Gagliano *et al*., 2017). The increasing interest is influenced by several factors, such as the integration of renewable energy sources and distributed generation, availability of energy storage, limitations of the infrastructure for the production of energy, growing number of electric vehicles and the opportunities to create business models. The second article in this issue (Gruber *et al*., 2017) presents an innovative tool that combines the prediction of the building energy demand and related supply costs with a sensitivity analysis to investigate the influence of small variations in the building design. The proposed method takes into account the design of the building and user interactions with the building. The assessment tool was applied to a case study office building located in Spain to demonstrate its capabilities and for validation.

A large percentage of existing building stock requires thermal efficiency improvements to the building envelope. One technique which can be employed is external wall insulation (EWI). EWI is mainly suitable for those buildings which could benefit from aesthetic improvement and thermal comfort improvement, such as 'hard-to-treat' properties. The third paper (Atkinson *et al*., 2017) discussed the results of the energy performance assessments undertaken to establish the effectiveness of retrofitted EWI at five case study dwellings in Swansea, UK through the 'Arbed' scheme (Welsh Government, 2017). The scheme is part of the Welsh government's carbon dioxide emissions reduction and fuel poverty policy objectives. The results demonstrated that, although some carbon dioxide emission savings were achieved, none of the occupants were taken out of fuel poverty due to very limited reduction in energy consumption. Therefore, the retrofitted EWI was unlikely to contribute to meeting the requirements of the Welsh government's emissions reduction targets.

Optimum design of building fabric can reduce heating or cooling requirements, and because space heating or cooling accounts for a large proportion of final consumption, increasing the thermal efficiency of building fabric plays an important role in the overall achievement of carbon dioxide reduction targets. The increasing demands in the design and construction of building fabric efficiencies are driven by increasingly stringent regulations and standards. However, there is increasing evidence of a 'performance gap' between designed and as-built performance of building fabric such that inefficiencies inherited by new dwellings during the construction process, which are unobserved or hidden during building testing and assessment, contribute to the decreased energy and carbon dioxide efficiency. The authors of the fourth paper (Littlewood and Smallwood, 2017) attempted to address this issue by developing a diagnostic in-construction testing (iCT) methodology, which can be utilised during the construction stage and also during commissioning of the dwellings, prior to occupancy. Furthermore, the paper discussed that by using the iCT method, potential problems with compartmentation between dwellings were also identified, which was a far greater issue than reduced energy performance. The paper highlights the importance of standardising diagnostic testing during the construction process and commissioning of buildings.

The final paper (Zafeiratou and Spataru, 2017) presents a feasibility study for establishing energy solutions in non-interconnected islands in Greece, which account for 20% of the country's land area. Linking the non-interconnected islands with the national power grid is expected to resolve electricity supply adequacy and cost issues. The current work focuses on the interconnection of four Cycladic islands with the mainland, transforming the region into a wind energy hub. The authors proposed an action plan for wind energy development based on collected and projected data from public authorities. The methodologies were based on Weibull distribution and life-cycle cost analysis.

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 Chairs and Organising committee, I would like to thank all the authors, speakers and delegates for their contributions and support to the SEB conference. Thanks to the members of the International Programme and Scientific 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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