



## Energy Efficiency in Heritage Buildings — Future Challenges and Research Needs

Kalliopi Fouseki & May Cassar

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# Editorial: Energy Efficiency in Heritage Buildings — Future Challenges and Research Needs

KALLIOPI FOUSEKI and MAY CASSAR

## Introduction

This special issue explores through interdisciplinary perspectives the growing theoretical discourses, policies, and practices related to the topical and often contentious issue of improving the energy performance of historic and traditional buildings. It does so by bringing together contributions from academics as well as practitioners of different disciplines with experience in relevant projects from the UK, Italy, and Sweden. This volume is timely. Current national and international imperatives to reduce greenhouse-gas emissions across Europe<sup>1</sup> have triggered intensive efforts to refurbish ‘old’ buildings in order to render them energy efficient. Taking into consideration the general assumption that older buildings consume more energy than modern structures,<sup>2</sup> the issue of how best to balance energy-efficiency measures with the values attached to heritage buildings becomes a critical one.

The term ‘heritage values’, in this special issue, refers to the meanings and significance attached by those who use or manage traditional or historic buildings. Heritage values thus can encompass aesthetic, historic, social, and other values, although not necessarily monetary ones.<sup>3</sup> The term ‘heritage buildings’ is preferred in the Editorial over the term ‘historic’ or ‘traditional’ buildings because it also can encompass more recent structures which potentially may be perceived as heritage by specific groups of people. Although the contributors to this issue deal specifically with historic and traditional buildings, modernist architecture should not be neglected. As Dulla points out: ‘modernist buildings have a very specific aesthetic value, which is severely endangered by their often not being recognised as fully “valid” instances of architectural heritage’.<sup>4</sup> While Dulla’s analysis focuses on the aesthetic significance of modernist architecture, there are other sets of values that are often ignored, especially in the context of built heritage.

So far, as indicated in the wider literature on this topic and demonstrated also by the papers in this issue, a value-led approach to the energy efficiency of ‘heritage buildings’ reflects predominantly the perspectives of the experts — mainly conservators, engineers, and architects. Indeed, the papers in this volume stress emphatically that only historic or aesthetic values are considered during the introduction and implementation of energy-efficiency interventions, thereby neglecting social, economic, or other values that might be more relevant to non-expert users of heritage buildings (such as residents). For example, the afore-mentioned study by Dulla shows that the

main priority is retention of the original function and traces of time.<sup>5</sup> Thus, focus is placed on the impact of energy-efficiency interventions, such as thermal insulation, on the building's exterior form. Another study from Sweden similarly stresses the importance of retaining the authentic, original, architectural, and historic features of historic buildings during an energy-efficiency project.<sup>6</sup>

Prior to outlining the contributions in this volume, this Editorial will attempt to summarise current research on the topic of energy efficiency of heritage buildings and the tension this can create with heritage values. It is argued that there are great challenges to be faced if decarbonisation policies are to succeed within the historic built environment. We advocate for the development of cross-disciplinary, sophisticated methods for understanding and integrating heritage values into decision-making frameworks that revolve around the improvement in energy performance of the heritage building stock. We contend that such projects should not only include conservators, architects, and engineers, but also involve heritage managers, sociologists, and anthropologists in order to investigate and address the sensitive balances which need to be achieved between the preservation of heritage significance and the need for energy efficiency. Our ultimate goal is to conclude with areas for further research that will address the way forward for this urgent matter.

### **Energy efficiency and heritage values in 'heritage buildings'**

Current literature on energy efficiency and values of built heritage so far has been generated in the context of research projects intended to develop decision-making frameworks for assessing energy consumption and energy performance of historic buildings in order to inform the best retrofit solutions that are compatible with the historic and aesthetic values of a historic building.<sup>7</sup> Indeed, there is a growing number of national and European research projects aimed at developing holistic decision-making frameworks that will help professionals decide on the most appropriate retrofit solution.<sup>8</sup> These projects acknowledge the critical need to integrate heritage values into environmental sustainability projects, a need that has been widely acknowledged in recent literature.<sup>9</sup> However, despite a general recognition of this need, not much has been achieved by actually fully understanding and integrating heritage values into decision-making frameworks for energy-efficiency projects.

We maintain that successful integration of heritage values into decision-making frameworks for energy efficiency has not progressed partially due to the lack of collaboration of the professionals involved in such projects who hold theoretical and practical expertise in heritage-management methods and tools for understanding heritage values. Indeed, as several authors outline in this special issue, the research projects that have taken place in the wider European context are indicative of the difficulty which researchers face to conceptualise the notion of 'heritage values' — although they use the term — and to develop and apply methods for assessing and prioritising 'heritage values'. Most often, reference to or consideration of values is an afterthought in the process since the key priority driving energy-efficiency projects is the improvement in energy performance and decarbonisation, which may be understandable given the legislative drivers for this.

We would argue therefore that heritage values should have an equal position with energy priorities at the beginning of any project. In other words, incorporation of the

principles outlined in the widely-recognised Burra Charter ‘Process of Managing Places of Cultural Significance’<sup>10</sup> — which prioritise assessment of the heritage significance of a place prior to any intervention — are fundamental for any intervention project in the historic built environment. In order to achieve this, the driving question for energy-efficiency projects should be not only ‘what energy interventions will zero-carbon a heritage building?’, but also ‘what does this building mean for those who “use” it?’ and ‘what interventions (if any) can be implemented that could co-exist harmoniously with those meanings?’ Of course, there is the risk that the second question might jeopardise the decarbonisation agendas or that a ‘do nothing’ approach could be adopted. The latter is mostly the case with listed buildings of the highest grade protected by law wherein heritage preservation may conflict occasionally with users’ needs for thermal comfort and reduced energy bills. This tension between heritage preservation and the need for thermal comfort is probably a bigger challenge than finding retrofit solutions that respect the aesthetic and historic significance of a building. Indeed, a study conducted by the Bath Preservation Trust showed clearly that, although residents of listed buildings in Bath valued the historic significance of their houses, their main struggle was how to make those houses feel warm.<sup>11</sup> It is this delicate balance between human comfort, cost-effective energy technologies, and heritage preservation that needs to be achieved and this only may be feasible if there is willingness for dialogue, compromise, and negotiation among different professions.

Studies of occupants’ attitudes and behaviour with regard to energy-efficiency interventions are critical. How people use a building often will be more important than the type of energy-efficiency technologies selected. This realisation has led researchers to conduct research on occupants’ behaviours which mainly focus on how much energy occupants use and how they use a building (i.e. how often and when they open windows etc.). The majority of such studies have taken place in modern buildings in which the materials and construction are better known and modelling future behaviour of the building can work more efficiently. One of the very few existing studies of occupants’ behaviours towards heritage areas is a study from the world heritage site of the Nanjing Tulou buildings in China — a complex of residential buildings in south-eastern China which were inscribed to the World Heritage List in 2008.<sup>12</sup> This research project aimed to argue, through a quantitative survey and the study of energy consumption, that the traditional buildings in this area were more energy efficient than modern ones. In addition, their residents overall were feeling more comfortable than those in modern buildings. However, there are limitations in such isolated quantitative studies as human comfort is largely subjective and rarely can be measured in numbers or compared unless large-scale studies take place. An additional complexity is that temperatures of surfaces and air temperatures can vary significantly within the same space and thus human comfort can vary even within the same room. One step forward was achieved in the study of residents’ behaviours and perceptions in the case of the Barbican Centre in London — a Grade II-listed residential and cultural complex built during the 1960s and a typical example of Brutalist architecture.<sup>13</sup> A residents’ survey was conducted to characterise levels of occupant comfort and satisfaction, identify any problems experienced by the residents, and explore possibilities to improve the energy performance of the estate without compromising its status as an iconic example of post-war architecture and planning. This study showed that overall levels of satisfaction and comfort were high but residents were dissatisfied with the limited heating control. However, how the occupants

valued the heritage significance of this estate and the role this has in selecting particular energy-efficiency interventions has not been examined in this or similar studies. While studies of occupants' behaviours in residential buildings, to a great extent, omit their potential heritage values (including aesthetics and originality), sociological research on renewable energy technologies (RETs) is rather extensive on the visual impact of RETs on cultural landscapes.<sup>14</sup> However, RETs have not been fully examined within the domestic context.

Interestingly, while there is an obvious lack of knowledge regarding occupants' perceptions, attitudes, and behaviours, there are numerous policies and guidance documents which again reflect the professional expertise and occasionally may fail to address the needs of the wider public. This crucial issue (partially covered by several authors in this volume as outlined below) also has been stressed in the current literature. Gram-Hanssen, for instance,<sup>15</sup> has illustrated that policies and even motivations for energy renovation projects have not had an impact on the decisions of the owners regarding improvement of the energy performance of their dwellings. In the case of Denmark, Gram-Hanssen contends that the reason why the majority of home owners do not eventually renovate their houses for energy performance, despite the economic motivations and incentives provided by the state, is because renovation policies are unrealistic and fail to take into consideration the complexities implied for owner-occupied houses. In addition, Gram-Hanssen argues, that policy has mainly focused on rational economic reasons for energy renovation rather than other motives and values such as aesthetics or the idea of home-making.<sup>16</sup> Similarly, a European study conducted in Denmark, Latvia, Portugal, and Belgium also shows that the European Directive on the Energy Performance of Buildings — which intends to promote opportunities for energy retrofitting — has not been adopted by the majority of homeowners in the aforementioned countries.<sup>17</sup>

In addition to theoretical discussions on how energy-efficiency interventions can co-exist with heritage values, there are ongoing projects that experiment with a diverse range of retrofits. A case in point is a project in Yangzhou, China. An innovative, energy-efficient design for traditional-style houses was developed and implemented as part of an urban rehabilitation project. An experimental building was used to show how energy-saving measures and traditional building styles could be combined to improve thermal comfort and living quality for the residents while maintaining the unique character of the city.<sup>18</sup> However, as stated above, once again the leaders of this project were engineers and assessment of the impact of the proposed project on heritage values was carried out solely from an engineering perspective.

## Conclusion

This special issue constitutes the first systematic attempt to explore the contentious relationship between heritage values and energy efficiency in heritage buildings. It presents ongoing projects and research from the UK, Italy, and Sweden, all driven by the widely-recognised need for interdisciplinary work. There is still a long way to go for fully-interdisciplinary work to take place on this topical subject. The role of heritage professionals should be more active rather than merely advisory and willingness for dialogue should underpin any such venture. More importantly, the views of the people on whose behalf energy-efficiency interventions are adopted should be fully understood. Although this need has been acknowledged, existing research thus

far has focused on how people use a heritage building rather than how they view or value it. We hope that this issue will contribute to preparing the ground for the emergence of new projects on this topic and for addressing areas of further research such as:

- how people value their buildings and the impact of energy-efficiency interventions
- how energy policies are used, if at all, and what needs to be done to improve them, and
- how people feel and behave towards their built environment.

By looking at theory, policy, and practice on energy efficiency in heritage buildings through an interdisciplinary lens, policies can become useful and practices can become more relevant and pragmatic.

## Notes

- <sup>1</sup> See, for instance, European Directive 2010/31/EU on the Energy Performance of Buildings and the Energy Efficiency Directive [online] [accessed 23 April 2014]. Available at: <[http://ec.europa.eu/energy/efficiency/buildings/buildings\\_en.htm](http://ec.europa.eu/energy/efficiency/buildings/buildings_en.htm)> and <[http://ec.europa.eu/energy/efficiency/eed/eed\\_en.htm](http://ec.europa.eu/energy/efficiency/eed/eed_en.htm)>.
- <sup>2</sup> Cairns, P., Cormack, D., Futak-Campbell, B., Mate, I., McLaren, D. & Walker, S. 2010. *Scottish House Condition Survey — Key Findings for 2009*. Edinburgh: Scottish Government.
- <sup>3</sup> See, for instance, Smith, G. S., Mauch Messenger, P. & Soderland, H. A. eds. 2010. *Heritage Values in Contemporary Society*. Walnut Creek, CA: Left Coast Press.
- <sup>4</sup> Dulla, M. 2010. Typologies of Structure in Modern Architecture in Terms of Preserving Their Heritage Value while Adding Heat Insulation. *Architektúra & Urbanizmus*, XLIV(3–4): 200–05 (p. 200).
- <sup>5</sup> Dulla.
- <sup>6</sup> Norrström, H. & Edén, M. 2010. Energy Efficiency and Preservation in Our Cultural Heritage in Halland, Sweden. In: *Heritage 2010: Heritage and Sustainable Development*, Vol. 1–2. 2nd International Conference on Heritage and Sustainable Development, Evora, Portugal, 22–26 June, pp. 589–99.
- <sup>7</sup> Caputo, P., Costa, G. & Ferrari, S. 2013. A Supporting Method for Defining Energy Strategies in the Building Sector at Urban Scale. *Energy Policy*, 55: 261–70.
- <sup>8</sup> See, for instance, the 3ENCULT and EFFESUS projects (the latter described in this issue) [online] [accessed 21 April 2014]. Available at: <<http://www.3encult.eu/en/project/welcome/default.html>> and <<http://www. effesus.eu>>.
- <sup>9</sup> Todorović, M. S. 2012. In Search of a Holistic, Sustainable and Replicable Model for Complete Energy Refurbishment in Historic Buildings. *Conservation Science in Cultural Heritage*, 12: 27–53.
- <sup>10</sup> International Council of Museums and Sites (ICOMOS). 2013. *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* [online] [accessed 21 April 2014]. Available at: <<http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf>>.
- <sup>11</sup> Anderson, W. & Robinson, J. 2010. *Low Carbon Bath: Report from a Local Consultation*. Bath: Bath Preservation Trust (BPT); Bristol: Centre for Sustainable Energy (CSE); Anderson, W. & Robinson, J. 2011. *Warmer Bath: A Guide to Improving the Energy Efficiency of Traditional Homes in the City of Bath*. Bath: BPT; Bristol: CSE.
- <sup>12</sup> Li, Q. D., Sun, X., Chen, C. & Yeng, X. D. 2012. Characterizing the Household Energy Consumption in Heritage Nanjing Tulou Buildings, China: A Comparative Field Survey Study. *Energy and Buildings*, 49(1): 317–26.
- <sup>13</sup> Behar, C. 2014. Utilising Resident Feedback to Inform Energy-Saving Interventions at the Barbican. *Local Environment: The International Journal of Justice and Sustainability*, 19(5): 539–59.
- <sup>14</sup> Jerpåsen, G. B. & Larsen, K. C. 2011. Visual Impact of Wind Farms on Cultural Heritage: A Norwegian Case Study. *Environmental Impact Assessment Review*, 31(3): 206–15; Pasqualetti, M. 2011. Opposing Wind Energy Landscapes. *Annals of the Association of American Geographers*, 101(4): 907–17.
- <sup>15</sup> Gram-Hanssen, K. 2014. Existing Buildings — Users, Renovations and Energy Policy. *Renewable Energy*, 61: 136–40.
- <sup>16</sup> Gram-Hanssen.
- <sup>17</sup> Bartiaux, F., Gram-Hanssen, K., Fonseca, P., Ozolina, L. & Christensen, T. H. 2014. A Practice-Theory Approach to Homeowners' Energy Retrofits in Four European Areas. *Building Research and Information*, 42(4): 525–38.
- <sup>18</sup> Zhu, L. & Gruner, A. 2009. Asia-Pacific Power and Energy Engineering Conference, Wuhan, China, March, pp. 1–4.

## Notes on contributors

Kalliopi Fouseki is a Lecturer in Sustainable Heritage at University College London. With a background in archaeology and heritage management, her research focuses on community participatory models for heritage and museums. She is co-leader of the JPI European Network on Heritage Values project.

Correspondence to: Dr Kalliopi Fouseki, Bartlett Faculty of the Built Environment, University College London, Central House, 14 Upper Woburn Place, London, WC1H 0NN. Email: [kalliopi.fouseki@ucl.ac.uk](mailto:kalliopi.fouseki@ucl.ac.uk)

May Cassar is Professor of Sustainable Heritage at University College London. With a background in history, conservation, and environmental design and engineering, her research focuses on the impact of climate change on cultural heritage and energy efficiency in historic buildings. She is Director of the AHRC/EPSRC Science and Heritage Programme and Director of the EPSRC Centre for Doctoral Training in Science and Engineering in Arts Heritage and Archaeology.

Correspondence to: Professor May Cassar, Bartlett Faculty of the Built Environment, University College London, Central House, 14 Upper Woburn Place, London, WC1H 0NN. Email: [m.cassar@ucl.ac.uk](mailto:m.cassar@ucl.ac.uk)

## Corrigendum

Faye Sayer, 'Politics and the Development of Community Archaeology in the UK', *The Historic Environment*, 5.1, (2014), 55–73.

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The author wishes to apologise for the following inadvertent error that appears in her article, at the beginning of the first paragraph on p. 59. This implies, in footnote 34, that Suzie Thomas was of the opinion that the governments of both Margaret Thatcher and John Major used heritage to foster 'traditional' values and that politicians had been using archaeology in a political way to justify the continuity of traditional values and moral fibre. This is not an opinion that Suzie Thomas has ever put forward in print, and certainly not in the article cited in footnote 34. The author's intention here was merely to signal that Suzie Thomas had noted in the cited article that the politics and policies of that era had had an impact on archaeology and on community archaeology in general.