Sustainable Heritage: How does it rate?

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Abstract

The integrity of heritage places and the authenticity of the features that demonstrate their values are crucial to retention of significance in their conservation. This issue has been highlighted by the energy efficiency regulations in the new Building Code of Australia (BCA) of 2008 and their implications in terms of modifications that might be required to heritage buildings. In relation to sustainability there is more to consider than star ratings for operational energy efficiency. In America, Canada, and the United Kingdom environmental assessment systems are beginning to recognise the need to also assess social and cultural factors. Accurate measurement of the lifetime embodied energy of heritage buildings in relation to their operational consumption, and adequate recognition of this has been considered key to any assessment. As outlined in Heritage Victoria's Technical Leaflet *Heritage Buildings and Energy Efficiency Regulations*, embodied energy savings in the retained building fabric (in situ) may be considered as part of an alternative path to compliance. Recent research in the UK, Canada, and Australia suggests that avoidance of demolition waste is a major consideration. This paper explores the concept of a credit point system for heritage buildings in the context of their overall contribution to sustainability.

Introduction

Since the turn of the millennium there has been a renewed focus on the issue of heritage buildings and their sustainability. To those of us who began a professional career in architecture at the end of the 1960s there are echoes of the concerns of the 1970s for the recycling of old buildings in the context of the oil crisis and consequent energy conservation initiatives. An interest in the benefits of the reuse of historic buildings for energy conservation was manifested in a study by Booz, Allen, and Hamilton in the late 1970s commissioned by the US Advisory Council on Historic Preservation. This considered embodied energy and various methods for its measurement, none of which were accurately applicable to historic buildings over their lifetime.

Recent research by the RMIT Centre for Design (Wong and Sivaraman 2010) includes measurement of the embodied energy, maintenance, and operational energy consumption of a small number of heritage buildings over their lifetime. Obviously there are difficulties with this as software programs are not geared for the complexity of maintenance and conservation works that might be applied, or the varying lifetimes of historic materials. Certain assumptions have to be made, such as accepting a 50, 75 or 100 year lifecycle, depending on the type of historic building under consideration. Public buildings built in the nineteenth century could have an eventual overall life of several centuries. It has generally been assumed that pre-WWI buildings would have a much greater embodied energy component of overall life-cycle energy consumption than post-WWII buildings, due to the use of durable, bulky materials and large volumes (Jackson 2005: 51). However when operating consumption (heating, cooling, lighting, and other services) to present day standards is measured over the lifecycle of the building, this is not necessarily the case. Again, software programs do not account for the fact that for the first 70 years of today's 100 year old building, mechanical cooling was not provided, heating was rudimentary, lighting was to a much lower level and communications meant the telephone.

As Mike Jackson noted in 2005 most environmental benefit studies focused on operating energy improvements and that is still the case. Nevertheless it is recognised that when the embodied energy is recaptured by renovation and reuse instead of demolition and redevelopment, the equation is greatly altered over a more realistic lifetime.

The problem with reducing operating energy consumption in heritage buildings relates to their heritage status – the historic, architectural, social and/or scientific values that make them significant, and the need to maintain their integrity and authenticity in relation to those values. Fossil fuels are a non-renewable resource, but so are the buildings created by nineteenth and early twentieth century craftsmen. They have been made from natural resources and imbued with a cultural life embodied in attributions of significance, meaning, and value. Such artefacts are reinterpreted and renewed by each passing generation, thus keeping them relevant to contemporary society (Cassar 2009: 9).

In addition there are the particular aspects of heritage buildings as living organisms to consider. Sealing leaking windows when a previously unheated 100 year-old house is to be heated needs to be considered in relation to the properties of the materials with which it is decorated. Will there be an increase in humidity and how might that affect the joinery and wallpaper for instance? Similarly, wall insulation can result in a colder and wetter exterior finish – in the case of painted weatherboards this can affect long term durability and maintenance needs (Jackson 2010: 16). The effects of such measures will be different in different climates. And installing insulation above an old and fragile lath and plaster ceiling can add further complexity to an already fraught process. As May Cassar (2009: 10, 8) has noted, we have borrowed cultural assets from future generations and we need evidence to justify the inevitable changes in significance and value that major interventions to reduce and improve energy use entail. Equally we need hard evidence to support avoidance of interventions in the face of overwhelming pressure to reduce energy consumption. The proper measurement of the embodied energy in heritage buildings and the operational energy they consume is one part of this.

International rating systems

Discussion of green rating systems in the United States and Britain indicates that while both give recognition of the advantage of renovating historic housing over new construction where most of the embodied energy of the historic building is recaptured in new use, the amount of recognition varies considerably (Jackson 2010: 16–17). The American LEED (Leadership in Energy and Environmental Design) system developed by the US Green

Building Council (USGBC) gives credit according to life cycle assessment (LCA) criteria. Version 3 (2009) gives credit points for building reuse involving retention of existing walls, floors, and roofs. The USGBC is developing an alternative compliance path *Life Cycle Assessment of Building Assemblies* that will be an optional path to use the materials and resources credits through addressing the durabilty and embodied energy of existing materials using LCA for assemblies (Campagna 2009). The next version of LEED due in 2011 is expected to address the contribution made by social and cultural factors in awarding credit points. It is proposed to recognise heritage listing; the ability of occupants to manage their interior environment; the contribution that existing buildings make to a sense of place within neighbourhoods, and utilisation of existing infrastructure (Campagna 2009). Campagna had earlier made the point that embodied energy is not necessarily the silver bullet, quoting a pie chart from the Athena Institute in Canada that showed that over the life of a building, typically about only fifteen *per cent* is from embodied energy, ten *per cent* from recurring embodied energy used in maintenance and renovation and the rest (75 *per cent*) from operating energy (Campagna 2008). Many questionable assumptions about building performance are made in the process of obtaining these results however. The Athena Institute (2009) has since carried out a specific study of historic buildings for Parks Canada, which measured the embodied energy of four historic Canadian buildings using architectural drawings, utility bills, renovation histories and site visits to confirm documentary information. The study did not compare the proportion of operational to embodied energy, but was used to analyse what environmental impacts were avoided by preserving and reusing the buildings rather than demolishing them and constructing new buildings of the same size to meet current functions. It used LCA modeling to show that with appropriate interventions, the historic buildings consumed an equivalent amount of operational energy as the new buildings.

The English BREEAM (Building Research Establishment Environmental Assessment Method) Ecohomes system gives maximum credit for existing elements reused in situ (BREEAM 2006: 4, mat. 2) on the basis that reuse has far less environmental impact, not only in terms of the energy involved in creating a replacement element, but also in terms of waste avoidance. A 2009 study in Britain (conducted by The Housing Forum) measured energy consumption for four categories of Housing: a Period Terrace; a Tenement/Low Rise Block; a High Rise Block and a 1950s Semi Detached house and used computer modeling to measure the impact of various improvement measures. It concluded that at a cost it is possible to upgrade housing to achieve an 80 *per cent* reduction in energy consumption. However in relation to Heritage buildings it concluded that:

> Although there is a need for all domestic properties to reduce their carbon emissions, it may be difficult in areas or properties deemed rich in heritage or where maintaining the external features may be a priority. Refurbishment in such situations must be handled sensitively and all alternative efficiency measures (such as internal wall insulation) and energy systems should be explored before specifying any which would modify the building's external façade and features. (2009: 16)

The BRE (Building Research Establishment) Global arm is currently working on a standard to enable the sustainable refurbishment of existing housing. At this stage it is not clear how it will address heritage buildings. If it is to operate on a credit point system, methods will need to be established to measure the value attributed to heritage that is inherent in the above statement. Clearly such measurement must go beyond the hard quantity of embodied energy and somehow encompass the 'soft' quantity of social and cultural value.

English Heritage has taken the bull by the horns and developed a research project monitoring the energy use of occupied historic terraces and villas to work out how to best measure energy efficiency and evaluate options for interventions aimed at reducing energy consumption. The results are now incorporated on its *climatechangeandyourhome* web site (English Heritage 2010) where a home owner can select a picture of a house most like the owner's own in the area where he or she lives and find direct advice about appropriate energy-saving actions for the house. The web site also gives the owner advice about how to deal with the Building Regulations and points out that the regulations require only that 'when undertaking work on or in connection with buildings with special historic or architectural value, the aim should be to improve energy efficiency where and to the extent that it is practically possible'. It also points out that the regulations state that work should not 'increase the risk of long term deterioration to the building fabric or fittings' – recognising that certain works (e.g. to reduce ventilation) may not have immediate negative consequences, but that interference with the traditional performance of the building could have harmful long-term effects.

English Heritage has apparently leapt beyond making arguments about embodied energy/operational energy lifetime values and gone straight to devising sensible guidelines established through practical research which it knows other government agencies will accept. Another useful document available on the web site is a Home Information Pack for Domestic Energy Assessors, who are required to certify all homes being sold that have more than three bedrooms. It is expected that all buildings will be covered by this requirement during the next two years (English Heritage 2007). This makes several points that are relevant to the measurement of the energy consumption of heritage buildings in Australia in the context of the Building Code of Australia (BCA).

Intervention issues

In particular it is clear that computer models used to generate envelope thermal performance ratings may be flawed because traditional buildings such as masonry buildings with a high thermal mass or passive solar design do not conform to a standard model. A low rating may imply the need for improvements that turn out to be expensive, ineffective, and possibly harmful. Modern buildings are designed to keep moisture out by sealing them tight against the weather. Older, traditional buildings relied on the use of materials that would breathe. The introduction of modern heating and cooling of the interior environment, coupled with interventions aimed at preventing heat loss or gain from the interior needs to be considered in the context of the original performance design. The English Heritage guide for assessors sets out the standard improvements generated by the energy assessment software against the suitability of each one for traditional buildings. It points out that it is important that a balance be struck between energy conservation requirements and building conservation. There could be a perception that Heritage has always rated higher in the United Kingdom than in its far flung former colonies, not least because tourism – a major arm of the country's economy – depends largely on heritage and its proper conservation, management, and presentation. However a 2005 report on the value of heritage demonstrated that Australians' views about historic heritage are comparable with those of people from the United Kingdom, even though the age and nature of the heritage places in Australia and the United Kingdom are very different (Allen Consulting Group 2005: 28, table 4.2).

Unfortunately the Australian Government's *Your Home* website does not address heritage issues beyond providing one case study dealing with a house covered by a Heritage Overlay in Victoria (see Commonwealth of Australia n.d.). This is not encouraging for those interested in the retention of heritage values in Australia, and apparently many are. The Allen Consulting Group surveyed 2,024 adult Australians in 2004 and found that 92.3 *per cent* see heritage as forming part of Australia's identity. Almost the same proportion (93.4 *per cent*) believe that it is important to protect heritage places, even though they might never visit them, and 78.7 *per cent* believe their life is richer for having the opportunity to visit or see heritage. As well, 62 *per cent* believe that inadequate support is provided for heritage conservation (Allen Consulting Group 2005: 27–28 table 4.1 and figure 4.1).

Valuing heritage

The Heritage Economics Workshop, convened by the Federal Department of Environment, Water, Heritage and the Arts (DEWHA) in 2007 looked at the application of various methods of valuing heritage and concluded that traditional valuation techniques, such as cost-benefit analysis, fail to adequately capture the intangible benefits of heritage. As Susan Macdonald noted (2009: 8–9), the multifaceted nature of heritage makes application of the usual valuation methods difficult and complex. There was however some tentative agreement that the discrete choice modelling method may be the most useful method of analysis. 'In the end it always comes back to values and the fact is that the community on the whole values its heritage and expects it to be conserved for future generations. Heritage conservation is value laden, which makes the application of straightforward economic theory difficult and in the end may not change the demands of the local community' (Macdonald 2009: 9).

Intrinsic to the value of heritage are the concepts of integrity and authenticity. These guide the assessment of heritage value and relate to the particular attributes of a building or place. Its significance depends on how truthfully and credibly the place expresses its values in terms of its design, materials, use, setting, and other factors, and whether sufficient of these remain intact to demonstrate significance. So the impact of modifications that affect the authentic design and materials of a building is a key consideration in terms of its retaining heritage value.

The background paper by DEWHA for the Heritage Economics Workshop divided the value of heritage into 'use' and 'non-use' benefits. Whereas 'use' benefits can be financial (in terms of real estate value), aesthetic, improving of the community image, or opportune through enabling new uses, 'non-use' benefits relate to community perceptions. They include 'existence value' (knowing that a heritage building exists and deriving a sense of identity from that), and 'bequest value' (knowing that a heritage building can be bequeathed to future generations and deriving a sense of stability and continuity from that). In relation to real estate value David Throsby (2007: 3) noted in his paper for the DEWHA workshop that 'On the whole, the market seems to suggest that these sorts of direct use values are positive in so far as studies of the effect of heritage listing on the price of houses or other buildings mostly indicate a positive premium (see, for example, Shipley 2000; Leichenko et al. 2001; Deodhar 2007)'.

Throsby (2007: 4) also identified a third type of benefit that he called 'beneficial externalities', which are positive spillovers – such as the pleasure a passer-by may gain from observation of the aesthetic or historic qualities of a heritage building.

As with environmental value, economists have developed non-market valuation techniques to quantify these benefits that exist outside of the normal market, which seek to express their value in terms of the community's willingness to pay. They classify non-market valuation techniques into 'revealed preference techniques' and 'stated preference techniques'. One common example of the former is 'hedonistic pricing', based on the idea that a market benefit can be affected by a non-market benefit – for instance house prices may increase in the vicinity of a heritage building or within a heritage conservation area. This can be modelled as: Price = size + age + location + heritage attributes (DEWHA 2007: 3).

The two most common stated preference techniques are 'contingent valuation' and 'choice modelling', which hypothesise future consumer behaviour towards non-market benefits by surveying consumer preferences. However application of non-market valuation techniques to heritage has been very limited to date. The DEWHA background paper noted that a 2005 survey found only 33 studies in existence, most using contingent valuation. On the other hand, progress has been made in the field of environmental economics through the ongoing trial and error of practical application of these techniques. Further research needs to be conducted into how they might be applied in a heritage context.

While the difficulties of measuring the value of heritage to the community are considerable, the fact that benefits exist is undisputed as acknowledged by Tony Hinton (former Commissioner of the Productivity Commission and co-author of *Conservation of Australia's Historic Heritage Places, Report No. 37*) who states: 'The value of heritage is not under challenge [...] The Productivity Commission's Report clearly articulated the sorts of benefits that flow from heritage' (2007: 1). Certainly it would seem reasonable therefore to set the value attributable against the overall energy cost (embodied plus operational) of a heritage building in some way.

A credit point system

If, as proposed in the United States, the social and cultural benefits of heritage value are recognised by giving credit for heritage listing (Campagna 2009), how would that be allocated? Within the NatHERS system for instance, is it reasonable to claim one star for heritage buildings of local significance (around 100,000 in Victoria), two stars for State heritage listing (around 2,000 in Victoria), three stars for national significance (less than 20 in Victoria), and four stars for World Heritage inscription (only one – the Royal Exhibition Building in Victoria)? And for what other factors might a heritage building make a claim for credit points? Clearly it should gain credit for saving waste of both energy and materials (if in continued or new use) as might any (re)useable existing building, as recognised by the English

BREEAM. In the United States it is also proposed to claim credit for the contribution that existing buildings make to a sense of place within neighbourhoods, and the fact that they utilise existing infrastructure.

Donovan Rypkema (2007: 4) reported at the DEWHA workshop on a 2005 survey in the United States by the federal agency that owns all the Federal Government buildings and leases private buildings for Government Agency use. This survey compared the operating cost of the 400-500 historic buildings in their portfolio with the cost in the industry as a whole and found that:

The overall operating cost, per rental square foot of the historic buildings in their portfolio was ten *per cent* less than the industry average for non historic buildings;

- Cleaning costs were nine *per cent* less;
- Maintenance costs were ten *per cent* less;
- Utility costs were 27 *per cent* less;
- The highest operating costs of all the buildings were buildings built in the 1970s;
- The highest customer satisfaction was in their oldest buildings.

This suggests that credits should be awarded to heritage buildings in this respect also. Perhaps it is reasonable to suggest that all heritage buildings might claim another star for the total of these other sustainability attributes, inter alia – waste avoidance, use of existing infrastructure (rather than needing new sewerage, water and power supply, public transport), and place-making.[3]

There are clearly valuation difficulties as identified in the DEWHA workshop papers in relation to the allocation of credit for sustainability attributes of heritage buildings. In addition, the whole issue of star-rating can be seen as problematic in that difficulties have been encountered with software packages used to measure energy star ratings. For instance independent studies in Australia have demonstrated that significant variations were being calculated by the three different software tools, including the original model designed by the CSIRO, when tested on identical dwellings (Thomas 2010: 3). Nevertheless, since the national energy strategy requires that from 2011 all homes sold or leased are to be star-rated and for the rating to be disclosed, it is important to address the heritage issue in a relevant manner.

While on the basis of acknowledged heritage values and identified sustainability attributes of heritage buildings it might be reasonable to propose a two to five star award to heritage listed buildings (depending on whether they are of local, state, national or world heritage), this could result in indicating that a building has a better thermal performance than it does in fact have.' An alternative approach to achieving 'deemed to comply' status could be to lower the bar for heritage buildings by reversing the scale proposed for obtaining credit.[2] Under this system, nationally listed heritage buildings would be deemed to comply if they achieved one star, state listing would require two and local listing, three. World Heritage listed buildings would be exempt. The study recently undertaken for the Heritage Councils of Australia and New Zealand (Wong and Sivaraman 2010: 16–25) which calculated the operational heating and cooling energy of twelve case study residential buildings using *AccuRate* software and the NatHERS star-rating system indicated that the four state listed buildings achieved two stars, and two of the six locally listed achieved three stars. The other four locally listed heritage case studies achieved 0.9, 1.2, 2.3, and 2.8. These would require careful attention to intervention possibilities to bring them up to three stars, and could be problematic due to the nature of their construction. On the other hand, it might be possible to achieve star ratings above the bar in some cases, within acceptable parameters of retaining integrity and authenticity.

Conclusion

Clearly the 'deemed to comply' process for heritage buildings would be greatly simplified by the use of a 'heritage bar' type approach as described above. However certain cases would still need individual consideration if unable to meet the bar, and others could perhaps achieve higher than the bar. The English Heritage 'sensible guidelines' approach discussed earlier is intended to achieve the best possible energy saving outcome while still retaining heritage values, whether this achieves one star or several. This is the guiding principle. It would seem that an agreement by the relevant government agencies to the guiding principle is an important first step. From there development of 'sensible guidelines' applicable to locally listed heritage buildings, which form the bulk of the Australian heritage estate, and a procedure for their application in conjunction with the 'heritage bar' as part of the 'deemed to comply' process, would need to be devised and agreed. Under such a system, individual assessment would still be necessary for national and state listed buildings that failed to meet the relevant bar. However on the basis of the levels proposed in this article, there may not be many that fail.

References

Allen Consulting Group, 2005, *Valuing the priceless: the value of heritage protection in Australia*, Research Report 2, Heritage Chairs and Officials of Australia and New Zealand, viewed 30 August 2010, <http://www.environment.gov.au/heritage/publications/strategy/pubs/heritage-historic.pdf>.

Athena Sustainable Materials Institute and Morrison Hershfield, 2009, *A life cycle assessment study of embodied effects for existing historic buildings*, Parks Canada, Ontario.

Booz, Allen & Hamilton, Inc. 1979, 'Assessing the Energy Conservation Benefits of Historic Preservation: Methods and Examples', A Report prepared for the US Advisory Council on Historic Preservation, viewed 7 June 2010, <http://www.achp.gov/1979%20%20Energy%20Conserv%20and%20Hist%20Pres.pdf>.

BREEAM. 2006, 'EcoHomes 2006: updates and amendments ', viewed 7 June 2010, <http://www.breeam.org/filelibrary/03_Amendments_to_EcoHomes_2006_Guidance_2.2.pdf>.

Campagna, B.A. 2008, 'The draft version of LEED v3 2009 DOES NOT include the existing building changes – from Barbara & Patrice', viewed 24 May 2010, <http://blogs.nationaltrust.org/preservationnation>.

Campagna, B.A. 2009, 'How changes to LEED will benefit existing and historic buildings', viewed 24 May 2010, <http://www.aia.org/practicing/groups/kc/>.

Cassar, M. 2009, 'Sustainable : challenges and strategies for the twenty-first century', *APT Bulletin*, vol. XL, no. 1, pp. 3 – 11.

Commonwealth of Australia. n.d., *Your home: design for lifestyle and the future*, viewed 26 October 2010, <http://www.yourhome.gov.au/>.

Deodhar, V. 2007, 'Economic valuation of the benefits of local heritage policy programs', Unpublished Ph.D. thesis, Department of Economics, Macquarie University, Sydney.

DEWHA. 2007, *The economics of heritage: integrating the costs and benefits of heritage into government decision making*, national workshop proceedings, 11-12 October 2007, Canberra, viewed 30 August 2010, <http://www.environment.gov.au/heritage/about/economics/index.html>.

English Heritage. 2007, *English Heritage guidance: advice for domestic energy assessors*, viewed 8 June 2010, <http://www.climatechangeandyourhome.org.uk/live/content_pdfs/16advice_for_energy%20assessors.pdf>.

English Heritage. 2010, *Climate change & your home*, viewed 8 June 2010, <http://www.climatechangeandyourhome.org.uk/live/eon_landing_page.aspx>.

Hinton, T. 2007, 'Response to Professor David Throsby's presentation on the value of heritage', in DEWHA, *The economics of heritage: integrating the costs and benefits of heritage into government decision making*, national workshop proceedings, 11-12 October 2007, Canberra, viewed 30 August 2010, <http://www.environment.gov.au/heritage/publications/strategy/pubs/economics-response-throsby.pdf>.

Housing Forum. 2009, *Sustainable Refurbishment of the Existing Housing Stock*, Interim Working Group Report, viewed 25 July 2011, <http://housingforum.org.uk/knowledge/publications/sustainable-refurbishment-existing-housing-stock>.

Jackson, M. 2005, 'Embodied energy and historic preservation: a needed reassessment', *APT Bulletin*, vol. XXXVI, no. 4, pp. 47 – 52.

Jackson, M. 2010, 'Green home-rating systems: a preservation perspective', *APT Bulletin*, vol. XLI, no. 1, pp. 13 – 18.

Leichenko, R.M., Coulson, N.E. and Listokin, D. 2001, 'Historic preservation and residential property values: an analysis of Texas cities', *Urban Studies*, vol. 38, no. 11, pp. 1989 – 2000.

Macdonald, S. 2007, 'Cost benefit analysis as a tool for local government heritage management: purpose, practicality and needs', in DEWHA, *The economics of heritage: integrating the costs and benefits of heritage into government decision making*, national workshop proceedings, 11-12 October 2007, Canberra, viewed 30 August 2010, <http://www.environment.gov.au/heritage/publications/strategy/pubs/economics-tool.pdf>.

Rypkema, D. 2007, 'The costs of heritage', in DEWHA, *The economics of heritage: integrating the costs and benefits of heritage into government decision making*, national workshop proceedings, 11-12 October 2007, Canberra, viewed 30 August 2010, <http://www.environment.gov.au/heritage/publications/strategy/pubs/economics-heritage-cost.pdf>.

Shipley, R. 2000, 'Heritage designation and property values: is there an effect?', *International Journal of Heritage Studies*, vol. 6, no.1, pp. 83 – 100.

Thomas, H. 2010, 'Energy star ratings in disarray', *Weekend Australian* 31 July-1 August, pp. F3 – 4.

Throsby, D. 2007, 'The value of heritage', in DEWHA, *The economics of heritage: integrating the costs and benefits of heritage into government decision making*, national workshop proceedings, 11-12 October 2007, Canberra, viewed 30 August 2010, <http://www.environment.gov.au/heritage/publications/strategy/pubs/economics-value.pdf>.

Wong, J.P.C. & Sivaraman, D. 2011, HCOANZ *sustainability and heritage project – residential*, Final Report for Heritage Council of Victoria, Melbourne.'

Endnotes

1 I acknowledge the reviewer for this insight.

2 I acknowledge the reviewer for this suggestion.

3 According to the latest publication of the US National Trust for Historic Preservation, *The Greenest Building: Quantifying the Environmental Value of Building Reuse (2011)*,

"It can take up to 80 years for a new energy efficient building to overcome, through efficient operations, the climate change impacts created by its construction."

<http://www.preservationnation.org/issues/sustainability/green-lab/valuing-building-reuse.html>.