Heritage Buildings and Sustainability

Purpose

To promote environmental and sustainable performance measures for existing heritage buildings without adversely impacting their cultural heritage significance.

Objectives

To increase awareness of the contribution of heritage conservation to sustainability, through:

- developing an understanding of the attributes of heritage buildings
- considering the options available for the improvement of environmental performance (in particular reducing energy and water consumption) and evaluating whether these measures are appropriate to heritage buildings
- identifying the main issues which need to be addressed in optimising the performance of heritage buildings.

Introduction

It is recognised that the retention of heritage buildings has environmental sustainability benefits. Conserving heritage buildings reduces energy usage associated with demolition, waste disposal and new construction, and promotes sustainable development by conserving the embodied energy in the existing buildings. Life-cycle analyses of building fabric: structure, envelope, interior elements and systems – and ongoing management and use – need to be considered as part of the conservation process to achieve optimum energy efficiency outcomes.

St Vincent Place (DPCD)
Conserving heritage buildings reduces energy usage associated with demolition, waste disposal and new construction

This Technical Leaflet gives a basic understanding of how sustainability may be optimised and energy and water consumption reduced in existing buildings, and how sustainability practices may be maximised when new work is proposed. The information is performance-based and is intended to provide a basic guide to sustainable building. More detailed research and assessment on the modelling of embodied energy, building performance and energy efficiency calculations specific to heritage buildings is currently being undertaken on behalf of the Heritage Council of Victoria and Heritage Victoria.

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Victoria The Place To Be — Department of Planning and Community Development

1. Embodied Energy Savings in Existing Building Fabric

What is embodied energy?

Embodied energy is the energy consumed by all of the processes associated with the production of a building. This includes the mining and manufacturing of materials and equipment, transportation of materials and administrative functions.

Existing buildings and conservation of embodied energy

The existing building stock has been recognised globally as a significant source of energy consumption. However, the retention of existing heritage buildings helps to conserve embodied energy and contributes to a substantial saving in energy consumption through savings in building construction. Many traditional building materials, such as timber, concrete and brick, have lower scale embodied energy than modern materials such as glass, steel or aluminium.

2. Optimising Existing Traditional Building Performance

Optimising the existing traditional building performance of heritage buildings may assist in achieving energy efficiencies and broader sustainability objectives. Nineteenth and some early twentieth century masonry buildings, for example, have very different functional characteristics than more modern buildings with their contemporary moisture barriers, damp-proof courses, membranes, cavity walls and insulation. Maintenance and repairs to heritage buildings will assist in ensuring the ongoing significance of the place and enhance its longevity. This contributes to improved energy efficiency and sustainability outcomes. In addition to the maintenance of building fabric, consideration should be given to repairing leaking taps, toilets and pipes and other faulty building services from a water conservation perspective.

In most instances the benefits obtained from the preservation of original building fabric will outweigh any benefits to be achieved by attempting to retrofit or upgrade the building with measures such as thermal insulation. Careful investigation of all possible options – based on informed expert opinion – should be considered before deciding on an appropriate solution.

Other considerations in optimising existing traditional building performance include:

- Thermal Mass: Traditional masonry and stone buildings have a high thermal mass. In summer months, the high thermal mass building slows the transfer of outdoor heat to the inner cooler surfaces of the building, allowing a comfortable internal temperature. This is particularly beneficial in locations where the nights are significantly cooler.

In winter, the high thermal mass building stores the daytime heat from both the sun and any heating system and re-radiates it at night. Ensuring that the existing fabric is performing as originally intended, and correctly utilising the thermal mass of the masonry and stone construction, will increase comfort and reduce energy costs. It is important to appreciate that many thermal modelling programs such as *FirstRate* may not provide sufficient credit to high thermal mass buildings. Furthermore, the performance benefits of thermal mass in sustainability terms need to be balanced against the energy consumption required to achieve acceptable thermal comfort at particular times of the year. This will depend on a number of factors including the location, orientation, construction and use of the heritage building.

- Controlling Moisture: Heritage buildings of masonry construction or buildings with timber floors were designed to allow natural ventilation to reduce dampness. Sealing the external building envelope to traditional masonry buildings may be counter-productive and damaging to the historic fabric. The installation of insulation in ceilings may also prevent the necessary evaporation of moisture in certain buildings and, where ceiling fabric is required to be removed to install the insulation, it can have an adverse impact on the integrity of the interior. Ensuring that the existing building fabric continues to breathe – by controlling moisture as well as avoiding possible long term damage – has the potential to reduce energy consumption.
- Passive Heating and Cooling: Many heritage places have been passively designed whereby the combination of building materials, orientation, sunlight and shade, and ventilation assist to maintain thermal comfort without the need for mechanical heating or cooling. Some measures that may improve passive thermal performance and which could be documented include:
  - Repairing damaged windows, doors and seals (to avoid excessive air infiltration).
  - Unblocking boarded-over window openings.
  - Removing introduced glazing over openable windows, unblocking ceiling vents and flues and opening doors to reinstate air movement for cooling.
- Existing Heating Systems: Regular maintenance and re-evaluation of the performance of existing heating systems may reduce energy consumption. Where a historic heating system contributes to the significance of the building, careful consideration needs to be given to the affects of any changes on its heritage value. Making these systems more energy efficient may still be a valid option. Overhauling existing heating systems may be a worthwhile option if the projected performance outweighs the energy costs associated with the installation of a new system. For many 19th and early 20th century buildings in rural areas open fires may continue to provide satisfactory energy performance as their function and construction is integrated with the design and performance of the building. Timber is a renewable energy source if it originates from sustainably managed forests. However, the continued use of fireplaces in urban areas is generally not desirable due to the local air pollution they create.

Bendigo Law Courts (DPCD)
Traditional masonry and stone buildings have a high thermal mass.

6. Reducing Energy Consumption in Existing Buildings

The installation of new sustainability measures, such as energy efficient heating, hot water systems, water tanks or other systems, may offset some of the less energy-compliant fabric and features of the heritage place. Modifications to existing fabric may also be possible. Options may include:

- installing insulation in timber buildings where the insulation will not have any impact on significant fabric
- installing double or secondary glazing (depending on the significance of existing fabric), or draught-proofing to reduce heat-gain in summer and heat-loss in winter
- installing shading devices to windows, such as reversible screens or awnings, or possibly more permanent window hoods, verandas or pergolas, depending on the location of the installations and the significance, integrity and design of the building
- lowering temperatures to existing hot water heating systems
- installing energy efficient hot water heating systems
- installing solar panels for electricity and/or hot water systems. The location of the solar panels may require careful consideration to ensure that the installation does not impact on heritage significance
- installing new heating systems where both environmental and heritage benefits have been considered. More energy efficient heating systems may be possible without compromising significant heritage fabric
- installing more energy efficient lighting. Where existing functioning light fittings have heritage value, modifications to some components may still be possible
- installing dual/low flush toilet cisterns
- installing rainwater tanks. The location and type of tanks may need careful consideration, depending on the significance of the building and its setting
- mulching garden beds

- strategic and selective watering of gardens through the provision of a watering plan
- purchasing Energy Star® compliant home office and entertainment equipment and energy efficient home appliances
- ensuring all indoor taps and showerheads are a minimum AAA water conservation rating
- ensuring all water-using appliances have a minimum AAAA water conservation rating
- switching off computers and printers and home entertainment systems (rather than leaving in standby mode).

7. Maximising Energy and Water Efficiencies in New Work to Existing Building

Where new work is proposed to an existing heritage building, energy efficiency and water sustainability measures should form an important part of the design process. Consideration could be given to:

- Orientation: the location of the new work and the orientation of windows and other openings to maximise passive heating and cooling.
- Proposed construction materials: the energy ratings of the building materials proposed and how these materials may enhance both the energy efficiencies and heritage values of the place.
- Shading devices for the new work: the design of screens, awnings, window hoods, verandas or porches where they will not have any adverse impact on the significance of the heritage building.
- Proposed energy efficiency of heating and cooling systems.
- Additional water consumption and water saving measures as a result of the new work.

8. Monitoring of Energy and Water Consumption

Establishing a management plan for monitoring future energy and water consumption in existing buildings, or as part of monitoring future energy and water consumption as a result of new work, may contribute to beneficial energy efficiency and water conservation outcomes. The plan could include:

- retaining, monitoring and comparing energy and water accounts
- purchasing green energy
- providing public information on energy and water consumption (for public and semi-public heritage buildings) to ensure a holistic effort in increasing energy efficiency awareness as part of the ongoing management of the building.

References

Further technical information relating to energy efficiencies in building design and construction may be obtained from the following:

Australian Building Codes Board (2008), *BCA Awareness Resource Kit Modular Three: Understanding Energy Efficiency Provisions for Class 1 and Class 10 Buildings*.

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RMIT Centre of Design: Sustainable Materials Program at www.cfd.rmit.edu.au

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Sustainable Energy Authority Victoria, Sustainable Energy info Fact Sheets, under Get Informed/Publications at www.sustainability.vic.gov.au

Sustainability Victoria, Building and Renovating Information Sheets under Get Informed/Publications, www.sustainability.vic.gov.au

The Chartered Institution of Building Services Engineers (2002), *Guide to Building Services for Historic Buildings: Sustainable services for traditional buildings*, London.

Tucker, S. (2000), 'Embodied and Lifetime Energies in the Built Environment', CSIRO. Further information can be found at www.cmmt.csiro.au/brochures/tech/embodied/index.cfm

For further information and assistance, visit our website at **www.heritage.vic.gov.au**

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Endorsed by the Heritage Council of Victoria and published February 2009.

Authorised by the Victorian Government, 55 Collins Street, Melbourne.

ISBN 978-921607-01-1 (online)

This publication was funded through the strategy, Victoria's Heritage: Strengthening our communities.

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