Heritage and Sustainability
How Commercial Building Perform

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Heritage and Sustainability

Outline

- Examine opportunities that exist for improving environmental performance of existing commercial buildings with heritage values
- Outline the approach to environmental sustainability adopted by Heritage Victoria
- Consider opportunities and strategies for improving environmental performance through retrofitting

Embodied Energy - UK

=

200,000 km

Embodied Energy - UK

=

35 tonnes CO_2

Embodied Energy - US

=

1,344,000 aluminium cans

Embodied Energy - Australia

Embodied energy of Australia's building stock

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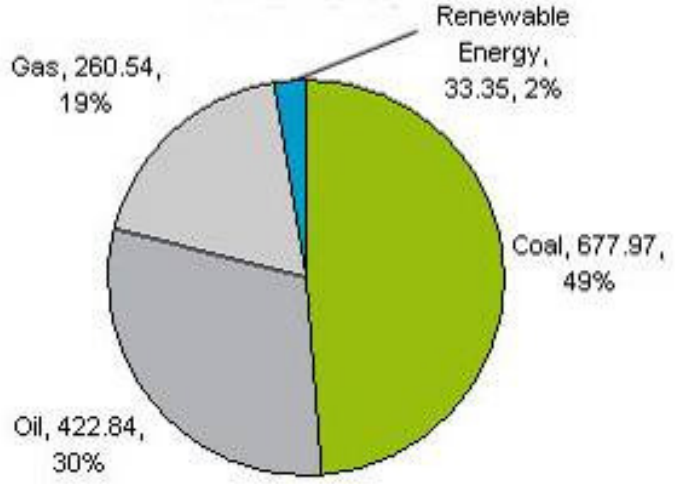

10 years of Australia's total energy consumption (≈50,000 Petajoules)

Victoria's response to date

POLICY NOTE

Heritage and Sustainability

Policy

The retention and conservation of heritage places has an important part to play in our actions to protect the environment, creating vibrant communities and sustaining local economies.

Background

The conservation of heritage places makes an important contribution to enviro social and economic sustainability. The environmental sustainability benefits af the retention of heritage places (through conservation and appropriate maint include the substantial reduction in building, demolition and new construction wa the conservation of embodied energy in the existing buildings.[1]

Embodied energy is the energy consumed by all of the processes associated production of a building. The energy embodied in existing building stock is equi ten years of the total energy consumption for the entire nation.[2] While it h recognised as a global priority to continue to use existing heritage building st energy efficiency can be improved.[3] Existing building stock has been regard significant source of wasted energy in relation to energy consumption.[4] A Improve energy efficiency for heritage places – either as a particular environmental reasons or as part of an alteration or adaptation – should traditional building performance by reducing and monitoring energy usage and c with relevant legislation.

Environmentally sustainable heritage conservation

Sustainable development is integral to heritage conservation. Retaining heritag amounts to a substantial environmental and financial saving in embodied energy the need for replacement building materials or the creation of waste. F embodied energy savings increase dramatically once a building reaches over 50 age.[5] The reuse of building materials generally provides a 95% saving of e energy that would otherwise be wasted.[6]

Retaining building materials *in situ* has a much higher embodied energy saving t removal and reuse. Some materials including bricks and tiles can suffer damag up to 30% in reuse.[7] Consideration should be given to the many simple and cost actions that can be undertaken to improve the energy efficiency of heritage including, where appropriate, the introduction of insulation and double or s glazing.

TECHNICAL LEAFLET

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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TECHNICAL LEAFLET

Heritage Buildings and Energy Efficiency Regulations

Purpose

To develop appropriate design strategies for the improvement of energy efficiency in heritage buildings to achieve the integration of sustainability and heritage conservation.

Objectives

Water conservation (Brad Sorace, DSE)
Placing tanks underground enhanced the energy efficiency without having an adverse impact on significant fabric.

To provide guidance on formulating design solutions for heritage buildings in order to satisfy the performance requirements of the Building Code of Australia (BCA) through:

- understanding how the energy efficiency requirements for different classes of buildings may be applied to heritage buildings
- recognising that the BCA Deemed-to-Satisfy Provisions may not be appropriate to heritage buildings
- understanding the scope for flexibility and employing innovative design solutions to achieve compliance
- considering cultural heritage significance in developing sustainable design solutions
- identifying solutions that optimise the traditional building performance
- including information on the Performance Assessment Report as part of an Alternative Solution
- incorporating Sustainability Measures as part of the Alternative Solution.

Introduction

In an effort to promote sustainable development, there are legislative requirements for building energy efficiency and water conservation in the *Building Regulations 2006*. The Regulations reference the *Building Code of Australia (BCA)* which contains many of the technical provisions that affect sustainable building work.
Any new building work (which includes alterations and additions) to a heritage building will have to comply with the Regulations. In some instances, where the building work exceeds 50% of the volume of the existing building, the existing building may also need to be brought into compliance.

Generally, the Regulations provide the Relevant Building Surveyor with discretion as to how these requirements are applied.

Just as changes to heritage buildings often require imaginative design solutions to retain their cultural significance, it is possible to develop alternative design strategies to the BCA prescriptive measures provided they meet the required level of performance.

This Technical Leaflet provides a basic understanding of the relevant parts of the Building Regulations and the *BCA* relating to energy efficiency, and ways in which alternative performance-based assessments may be achieved when carrying out building work on heritage buildings in Victoria.

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Heritage and Sustainability – Domestic

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Heritage and Sustainability – Summary (1)

- Building characteristics are a principal factor in energy consumption - both operational and embodied - over the lifetime
- Operational energy accounts for a major part of the life cycle energy consumption
- Production of building materials is a significant component of embodied energy
- Embodied energy accounts for 4% - 19% of lifetime energy for residential buildings - this is likely to increase in importance as operational energy is reduced

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Heritage and Sustainability – Summary (2)

- Heritage buildings often have lower initial and recurring embodied energy due to low energy-intensity materials
- Energy for maintenance and refurbishment varies - depending on the materials used and frequency of replacement
- Upgrading to improve performance must be tailored to the individual building and climate
- Extending the life of a building by retrofitting is more efficient than demolition and replacement

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Heritage and Sustainability – Commercial

- review of policy and regulation
- identify embodied energy in typical commercial office building types
- model operational performance and water usage
- calculate GHG emissions and other impacts
- assess and review of various interventions on energy and water usage
- identify of a range of suitable design solutions to achieve acceptable levels of sustainability and satisfy current building legislation requirements

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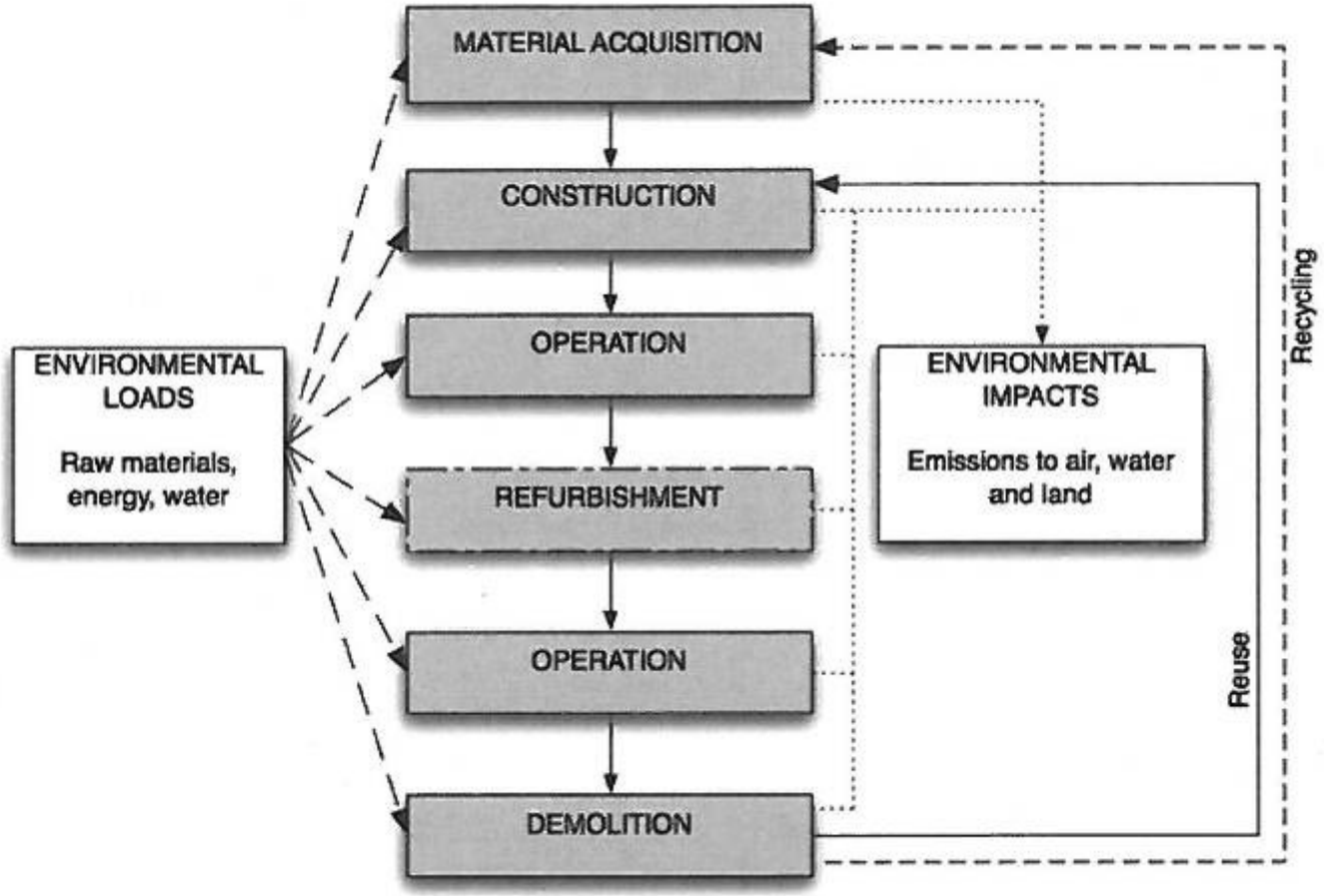
LCA approach



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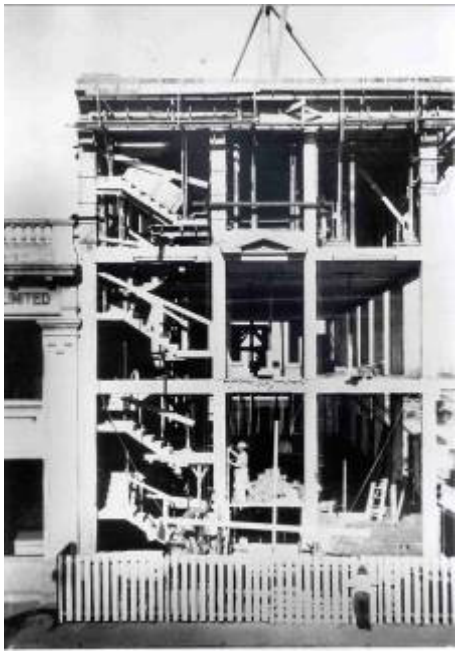
Heritage and Sustainability
Case study – Townsville, QLD

- Dates from 1938
- Five storeys (including basement)
- Gross floor area 1500 sq.m
- Steel framed with reinforced concrete floors, and rendered brick external walls
- Sash windows with single glazing (and low-e film)



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Heritage and Sustainability – Commercial

- Quantity of materials and resources used in production of the building (from drawings)
- Occupancy
- Details of HVAC systems
- Lighting for each space
- Assessment of energy and water used for operation (verified from utility bills)
- Construction details
- Orientation and climate data
- Heritage significance

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Heritage and Sustainability Case study – Townsville

Preliminary modelling

Delivered energy

- Cooling load = 710 MJ/m^2/yr
- [Heating load = 259 MJ/m^2/yr]

Life cycle primary energy over 100 years

- Initial embodied energy = 6,260 MJ/m^2
- Cooling = 64,400 MJ/m^2
- [Heating = 53,500 MJ/m^2]

Life cycle carbon emissions

- Embodied = 545 kg CO_2/m^2
- Cooling = 5,990 kg CO_2/m^2
- [Heating = 3,130 kg CO_2/m^2]

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Heritage and Sustainability Case study – Townsville

How does this compare?

Building	State	Size m^2	Energy use $MJ/m^2.yr$	Green power %
Townsville	**QLD**	**1,500**	***710***	**0**
40 Albert Rd, Melbourne	**VIC**	**1,215**	**312**	**100**
Midland Government Offices	WA	1,100	113	0
Westpac 111 Phillip St, Parramatta	NSW	1,872	647	45
Dept of Disability, Aging and Home Care	NSW	1,262	393	0
Dept of Commerce, Lismore Regional Office	NSW	1,554	485	9
William McCormack Place	QLD	6,642	568	0

Source: www.abgr.com.au (from Australia's Energy Efficiency Market and Industry Capability Report, 2006. Australia Business Council for Sustainable Energy).

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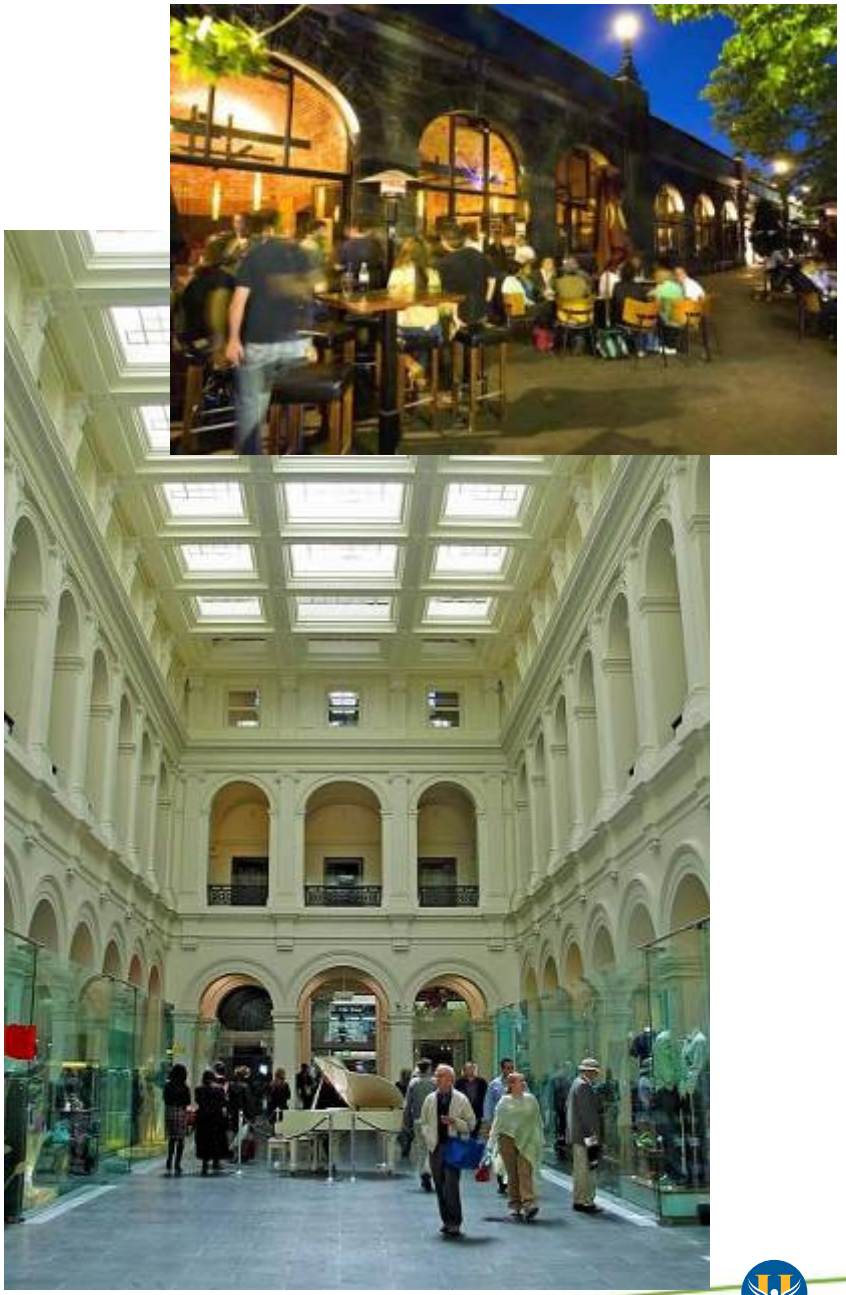
Heritage and Sustainability Case study – Townsville

How does this compare?

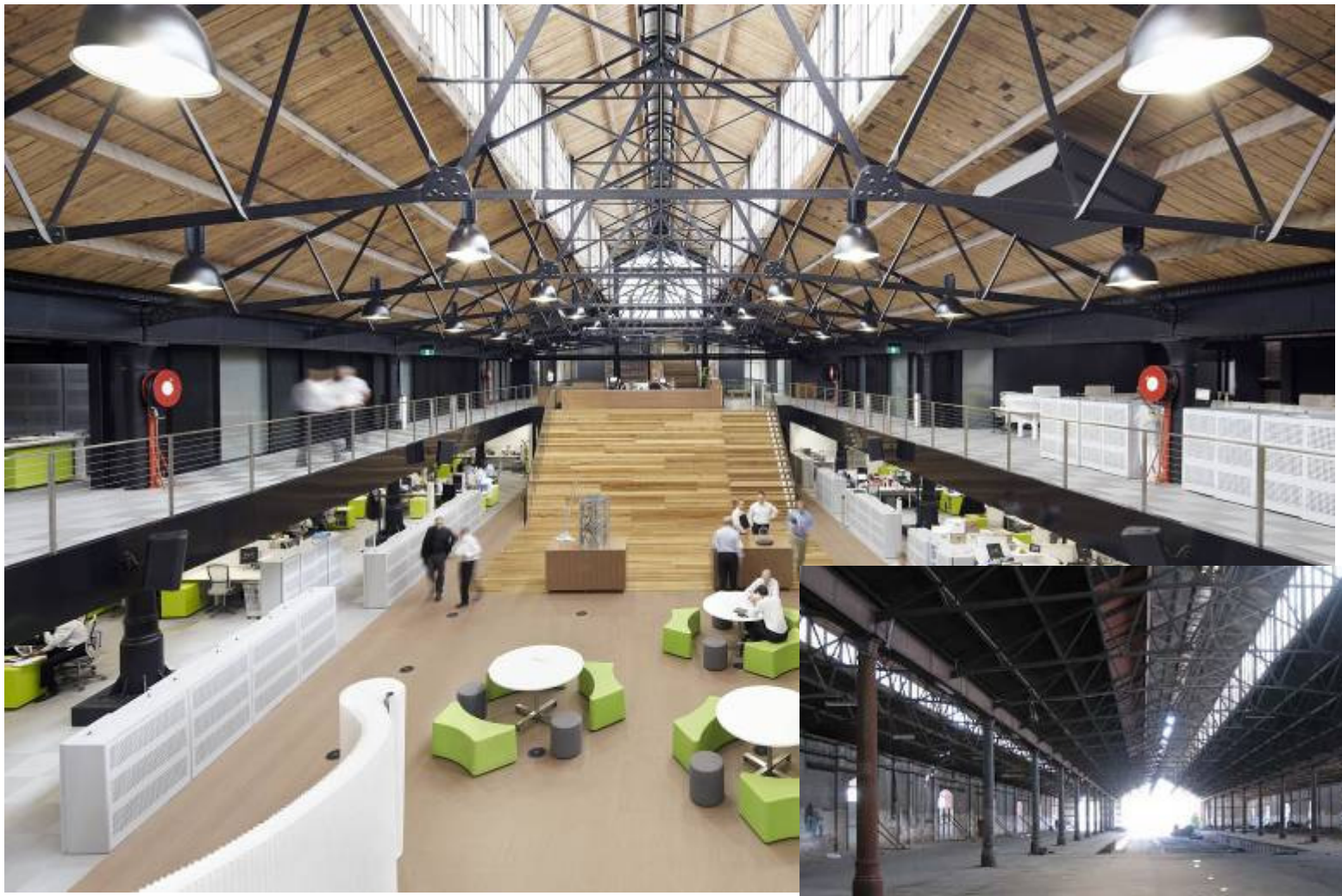
Building	Location	Size m^2	Embodied energy MJ/m^2
Building	Townsville, QLD	1,500	6,260
3-storey office building	Melbourne, VIC	11,600	8,000

What next?

- Produce targeted fact sheets for each of the domestic case study examples
- Full LCA modelling of commercial buildings
- Testing of interventions to improve energy and water efficiency – HVAC systems, glazing, insulation etc.
- Develop fact sheets for each commercial examples
- Promote case studies and promote adaptive reuse projects



Goods Shed North, Docklands, Victoria



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“Demolishing [historic] buildings should be a last, not a first resort. The mounting environmental cost of wasting embodied energy should make us take heritage seriously”

Robert Bevan, ‘Demolish and build anew at nation's peril’, ***Australian Financial Review*** (August 15-17, 2008, p. L14)