Important Notice and Disclaimer

The Australian Building Codes Board (ABCB) and the participating Governments are committed to enhancing the availability and dissemination of information relating to the built environment. Where appropriate, the ABCB seeks to develop non-regulatory solutions to building-related issues.

This Handbook titled “Using On-site Renewable and Reclaimed Energy Sources” is provided for general information only and should not be taken as providing specific advice on any issue. In particular, this Handbook is not mandatory or regulatory in nature. Rather, it is designed to make information on this topic readily available to the industry.

Neither the ABCB, the participating Governments, nor the groups which have endorsed or been involved in the development of the Handbook, accept any responsibility for the use of the information contained in the Handbook and make no guarantee or representation whatsoever that the information is an exhaustive treatment of the subject matters contained therein or is complete, accurate, up-to-date or reliable for any particular purpose.

The ABCB, the participating Governments and groups which have endorsed or been involved in the development of the Handbook expressly disclaim all liability for any loss, damage, injury or other consequence, howsoever caused (including without limitation by way of negligence) which may arise directly or indirectly from use of, or reliance on, this Handbook.

Users should exercise their own skill and care with respect to their use of this Handbook and should obtain appropriate independent professional advice on any specific issues concerning them.

In particular, and to avoid doubt, the use of this Handbook does not–

- guarantee acceptance or accreditation of a design, material or building solution by any entity authorised to do so under any law;
- mean that a design, material or building solution complies with the National Construction Code (NCC); or
- absolve the user from complying with any local, State, Territory or Australian Government legal requirements.
Preface

The Intergovernmental Agreement (IGA) that governs the ABCB places a strong emphasis on reducing reliance on regulation, including consideration of non-regulatory alternatives such as non-mandatory guidelines, information handbooks and protocols.

This Handbook is one of a series produced by the ABCB. The series of Handbooks is in response to comments and concerns expressed by government, industry and the community that relate to the built environment. The topics of Handbooks expand on areas of existing regulation or relate to topics which have, for a variety of reasons, been deemed inappropriate for regulation. The aim of the Handbooks is to provide construction-industry participants with best-practice, non-mandatory advice and guidance on specific topics.

The use of on-site renewable energy sources and reclaimed energy sources has been identified as an issue that requires relevant and uniform guidance.

The “Using On-site Renewable and Reclaimed Energy Sources” Handbook has been developed to increase the awareness of the opportunities to use on-site renewable energy sources and reclaimed energy sources in order to comply with the BCA. This Handbook addresses the issues in generic terms, and is not a document that sets out specific requirements or recommendations for any project.

This handbook has been peer-reviewed by the Clean Energy Council to ensure the technical accuracy and product feasibility in meeting the identified opportunities. The ABCB acknowledges the valuable contribution made by the Clean Energy Council through this process.
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1 Introduction

Reminder:
This Handbook is written in generic terms and is not mandatory or regulatory in nature. It should only be read and used subject to, and in conjunction with, the general disclaimer at page ii.

In no case does this Handbook override the building legislation or other legislative requirements that are applicable in the relevant State or Territory jurisdiction, or any directives by the Building Control Authority. Appendix A lists the contact details for the State and Territory Administrations.

1.1 Background

Energy efficiency provisions have been introduced into the Building Code of Australia (BCA) in a number of stages. The first was in 2003 for Class 1 and 10 buildings (BCA Volume Two Housing Provisions). This was followed in 2005 by provisions in Volume One for Class 2 buildings (apartments), Class 3 buildings (hotels, motels dormitories etc) and Class 4 parts of buildings (a residence in a building of a different Class). Energy efficiency provisions for Class 5 to 9 buildings (all other applications) were added to Volume One in 2006. At the same time, the provisions for Class 1 and 10 in Volume Two were made more stringent. In 2010 the stringency of the provisions in both Volumes was again increased. Note that these dates were when the provisions were introduced into the national BCA and not necessarily when individual States or Territories adopted them into their building law. For this information refer to the History of Adoption at the back of the BCA.

1.2 Purpose

This Handbook is targeted at designers, energy efficiency consultants and building certifiers who are responsible for designing or approving buildings. The intent is to explain the trade-offs available for the energy source of services through the use of on-site renewable energy sources and reclaimed energy sources.

This Handbook does not override or replace the BCA, but rather provides additional information and guidance with the principles explained. It also uses examples to aid the user in the application of the BCA energy efficiency provisions. It is recommended that users of this Handbook seek specialist advice in its application to specific projects.

1.3 Limitations

This Handbook is not intended to:

- override or replace any legal rights, responsibilities or requirements; or
- provide users with specific relevant content of the BCA.
This Handbook is intended to make users aware of provisions that may affect them, rather than what is required by those provisions. If users determine that a provision may apply to them, they should read the BCA to determine the specifics of the provision.

1.4 Other energy efficiency-related guides by the ABCB
The ABCB has produced a range of Handbooks relating to energy efficiency in buildings, including:

- BCA Section J - Assessment and Verification of an Alternative Solution (2010).

Other educational material produced by the ABCB relating to energy efficiency in buildings includes:


1.5 Building control
Building control is the responsibility of each State and Territory. The BCA is adopted via the State and Territory building legislation as the technical standard for the design and construction of buildings. The legislation generally applies the BCA to new buildings, new building work in existing buildings and changes in building classification or use.

Typically, the legal arrangement is such that the BCA contains the technical provisions, while the building administrative procedures are contained in an Act and usually supported by associated Regulations. Refer to Figure 1.1 for an overview of the legislative hierarchy.

1.6 The BCA
The BCA is Volume One and Volume Two of the National Construction Code (NCC). The BCA is produced and maintained by the ABCB on behalf of the Australian Government and the State and Territory governments. The BCA has been given the status of building regulations by all States and Territories.
The goal of the BCA is to enable the achievement of nationally consistent, minimum necessary standards of relevant, health, safety (including structural safety and safety from fire), amenity and sustainability objectives efficiently.

This goal is applied so–

- there is a rigorously tested rationale for the regulation;
- the regulation generates benefits to society greater than the costs (that is, a net benefit);
- the competitive effects of the regulation have been considered and the regulation is no more restrictive than necessary in the public interest; and
- there is no regulatory or non-regulatory alternative that would generate higher net benefits.

The BCA contains technical provisions for the design and construction of buildings and other structures, covering such matters as structural integrity, fire resistance, access and egress, services and equipment, and energy efficiency as well as certain aspects of health and amenity.

1.6.1 Defined terms

The BCA contains many definitions in Part A1 Interpretation (Volume One) and Part 1.1 (Volume Two). These definitions are shown in the text of the BCA in italics. When readers come across defined terms they should refer to the definition as it can be very different from what may
be considered common usage or what a dictionary contains. The definitions are specifically tailored for the BCA context.

1.6.2 Building Classifications
Part A3 of the BCA contains descriptions of the various building classifications, such as a Class 5 building being "an office building used for professional or commercial purposes, excluding buildings of Class 6, 7, 8 and 9". Where there is doubt as to a buildings classification the Building Control Authority should be consulted.

1.7 The BCA performance hierarchy
The Objectives, Functional Statements and Performance Requirements form the BCA performance hierarchy. The Performance Requirements have been developed to satisfy both the BCA Objectives and Functional Statements.

The Objectives and Functional Statements are provided as guidance. The Performance Requirements are the mandatory component of the BCA. The Deemed-to-Satisfy (DtS) Provisions are typical solutions that are deemed to comply with the Performance Requirements. Figure 1.2 provides a summary of this performance-based compliance framework.

1.7.1 Objectives
The Objectives describe the community expectations for buildings. Objective JO1 in BCA Volume One and Objective O2.6 in Volume Two are both "to reduce greenhouse gas emissions".

1.7.2 Functional Statements
The Functional Statements describe how buildings achieve the objectives. In relation to Objectives JO1 and O2.6, Functional Statements JF1 and F2.6 differ only in reference to domestic services:

Functional Statement JF1
To reduce greenhouse gas emissions, to the degree necessary—
(a) a building, including its services, is to be capable of efficiently using energy; and
(b) a building’s services for heating are to obtain their energy from—
   (i) a low greenhouse gas intensity source; or
   (ii) an on-site renewable energy source; or
   (iii) another process as reclaimed energy.
1.7.3 Performance Requirements

The Performance Requirements outline the level of performance which must be met by building materials, components, design factors and construction methods in order for a building to meet the Objectives and Functional Statements. The Performance Requirements are generally qualitative. The relevant Performance Requirements for Volume One are analysed in detail in Sections 3.2 and 3.3 of this Handbook; those for Volume Two are in Section 4.2 of this Handbook.
1.7.4 Building Solutions

Compliance with the Performance Requirements is achieved by using a Building Solution, which is defined as:

**Building Solution** means a solution which complies with the *Performance Requirements* and is—

(a) an *Alternative Solution*; or

(b) a solution which complies with the *Deemed-to-Satisfy Provisions*; or

(c) a combination of (a) and (b).

The DtS Provisions in the BCA prescribe the requirements for one type of Building Solution that will meet the Performance Requirements. An Alternative Solution is a Building Solution that is outside the DtS Provisions yet is found to be compliant with the Performance Requirements using one of the four Assessment Methods as shown in Figure 1.2. A third kind of Building Solution uses a combination of the DtS Provisions and Alternative Solutions to demonstrate compliance.
2 Renewable and Reclaimed Energy Sources

The BCA defines renewable energy as “energy that is derived from sources that are regenerated, replenished, or for all practical purposes cannot be depleted and the energy sources include, but are not limited to, solar, wind, hydroelectric, wave action and geothermal.” On-site renewable energy sources (or “on-site renewables”) refer only to those renewable energy sources that are on, or impact upon, the same allotment as the building.

Reclaimed energy sources use energy that would otherwise be rejected as waste, such as heat from co-generation, tri-generation or an industrial process. While not strictly a renewable energy source, reclaimed energy can assist with reducing greenhouse gas emissions.

In this Handbook the term “Alternative Energy Sources” will be used to refer collectively to on-site renewable and reclaimed energy sources.

BCA 2011 provides some scope to facilitate the use of Alternative Energy Sources to achieve compliance with the Performance Requirements for commercial buildings, apartment buildings and for the lighting and hot water requirements in houses. However, Alternative Energy Sources have been considered to be a companion to, and not a replacement for, good levels of building fabric performance. This position is consistent with international building codes.

2.1 Renewables recognised in the BCA

The BCA refers to some specific renewable energy sources and technologies that are acceptable for reducing greenhouse gas emissions, as listed in Table 2.1 below.

Table 2.1 – Recognised renewable energy sources and technologies

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar heater</td>
<td>Solar hot water systems used for heating of domestic hot water supply, swimming pools, spa pools or space heating.</td>
</tr>
<tr>
<td>Solid-fuel heater or biofuels</td>
<td>Heaters that burn wood or biomass. Biomass includes any kind of organic matter, eg. agricultural waste, forestry by-products, etc.</td>
</tr>
<tr>
<td>Photovoltaics</td>
<td>Photovoltaics (PV) come in a number of forms, one of which is the typical &quot;solar panel&quot;. They convert solar energy directly into electricity.</td>
</tr>
<tr>
<td>Geothermal</td>
<td>Geothermal energy is heat energy derived from the earth's natural (subsurface) heat.</td>
</tr>
<tr>
<td>Wind power</td>
<td>Wind power typically uses tower- or roof-mounted turbines to convert the movement of the wind into electricity.</td>
</tr>
<tr>
<td>Other on-site renewables</td>
<td>Any other energy source that is listed in Appendix B that is renewable on-site.</td>
</tr>
</tbody>
</table>

The types of on-site renewable technologies and the concessions for them available in the BCA are consistent with international building codes.
2.2 Renewables not recognised by the BCA

Energy suppliers may offer to supply electricity purchased on behalf of the consumer from renewable energy sources such as the sun, the wind, water and waste. The government accredits such products under the GreenPower scheme, identified by the GreenPower ‘tick’. These schemes are not recognised as on-site renewables in the BCA because the energy was not generated or harvested on-site and the consumer can terminate supply contracts at any time.

2.3 Co-generation and tri-generation

Co-generation and tri-generation systems can be effective in reducing greenhouse gas emissions. They typically use natural gas or biogas as the fuel for an engine that drives an electric generator. Co-generation systems – often referred to as combined heat and power (CHP) systems – reclaim waste heat from the engine driving the electric generator and use that energy for heating. Tri-generation systems – often referred to as combined heat, cooling and power (CHCP) systems – can be thought of as a co-generation system with some of the heating energy diverted to drive an absorption-cycle chiller. While not yet as common as chillers based on the vapour-compression cycle, absorption-cycle chillers are very economical for supplying a base cooling load where a heat source is available. Figure 2.1 below shows the main components of a tri-generation system and approximate proportions of the energy outputs. The heating energy output can also be used to produce steam in applications such as factories or hospitals. Co-generation and tri-generation systems operate from domestic-scale through to district-scale.

Figure 2.1 – Co-generation and tri-generation system diagram
3  BCA Volume One and Alternative Energy Sources

This section details the opportunities available for using on-site renewable and reclaimed energy sources in meeting the BCA Volume One Performance Requirements for greenhouse gas emission reduction and energy efficiency in Class 2 to 9 buildings.

3.1 Compliant Alternative Energy Sources

Table 3.1 below summarises the compliance paths by which various on-site renewables and reclaimed energy sources can be used to achieve a Building Solution. A reference to JP1 or JP3 means that an Alternative Solution is required to demonstrate compliance with the relevant Performance Requirement. Verification Method JV3 may be used to verify compliance with JP1. A reference to a provision in Section J (shaded in blue) means that a DtS solution is available, although an Alternative Solution could also be used. Descriptions of the energy sources can be found in Section 2.1.

Table 3.1 – BCA Volume One – allowable Alternative Energy Sources by end-use

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Domestic Hot Water</th>
<th>Space Heating</th>
<th>Space Cooling</th>
<th>Swimming Pool Heating</th>
<th>Spa Pool Heating</th>
<th>Other Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar heater</td>
<td>JP1(h)</td>
<td>J5.4(b)(ii)</td>
<td></td>
<td>J7.3(a)</td>
<td>J7.4(a)</td>
<td></td>
</tr>
<tr>
<td>Solid-fuel heater or biofuels</td>
<td>JP1(h)</td>
<td>J5.4(b)(ii)</td>
<td></td>
<td>JP1(h)</td>
<td>J7.4(a)</td>
<td></td>
</tr>
<tr>
<td>Photovoltaics</td>
<td>JP1(h)</td>
<td>J5.4(b)(ii)</td>
<td></td>
<td>JP1(h)</td>
<td>J7.4(a)</td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td>JP1(h)</td>
<td>J5.4(b)(ii)</td>
<td></td>
<td>JP1(h)</td>
<td>J7.4(a)</td>
<td></td>
</tr>
<tr>
<td>Wind power</td>
<td>JP1(h)</td>
<td>J5.4(b)(ii)</td>
<td></td>
<td>JP1(h)</td>
<td>J7.4(a)</td>
<td></td>
</tr>
<tr>
<td>Other on-site renewables</td>
<td>JP1(h)</td>
<td>J5.4(b)(ii)</td>
<td></td>
<td>JP1(h)</td>
<td>J7.4(a)</td>
<td></td>
</tr>
<tr>
<td>Reclaimed energy</td>
<td>JP1(h)</td>
<td>J5.4(b)(ii)</td>
<td></td>
<td>JP1(h)</td>
<td>J7.4(a)</td>
<td>J5.2 *</td>
</tr>
</tbody>
</table>

* Preconditioning outside air: J5.2(a)(ix)(B), J5.2(b)(ii)(A)(cc), J5.2(b)(ii)(B)(aa) and J5.2(d)(i).
3.2 Performance Requirement JP1

A building, including its services, must have, to the degree necessary, features that facilitate the efficient use of energy appropriate to–

(a) the function and use of the building and services; and

(b) the internal environment; and

(c) the geographic location of the building; and

(d) the effects of nearby permanent features such as topography, structures and buildings; and

(e) solar radiation being–

   (i) utilised for heating; and

   (ii) controlled to minimise energy for cooling; and

(f) the sealing of the building envelope against air leakage; and

(g) the utilisation of air movement to assist heating and cooling; and

(h) the energy source of the services.

JP1(h) requires the energy source of the service (be it cooling, heating, ventilation, hot water supply, lighting or vertical transportation) to be considered. The greenhouse gas emission levels from a building are determined by both the absolute energy consumption and the greenhouse gas intensity of the energy sources.

The applicability of on-site renewable and reclaimed energy when Verification Method JV3 is used to verify compliance with JP1 is detailed in Section 3.5.

3.3 Performance Requirement JP3

Heating such as for a conditioned space must, to the degree necessary, obtain energy from–

(a) a source that has a greenhouse gas intensity that does not exceed 100 g CO₂-e/MJ of thermal energy load; or

(b) an on-site renewable energy source; or

(c) another process as reclaimed energy.

JP3 applies to all conditioned spaces in Class 2 to 9 buildings but is limited to energy used for heating. The overall intention is to reduce the amount of greenhouse gas emissions from each unit of energy used in heating by favouring low-intensity, on-site renewable or reclaimed energy sources.
JP3(a) sets a limit for the greenhouse gas intensity of the energy source, targeting the use of solar, natural gas, LPG or heat pump heating in preference to electric resistance heating. Since the limit is expressed in terms of emissions per unit of thermal energy load, it allows the energy efficiency of services plant to be taken into account. Limits calculated on this basis can permit the use of grid distributed electricity as the source for high efficiency plant such as heat pumps.

JP3(b) recognises only on-site renewable energy sources so, as detailed in Section 2, GreenPower does not qualify.

JP3(c) refers to energy sources such as reject heat from a refrigeration chiller, co-generation, tri-generation, or industrial process equipment.

### 3.4 Deemed-to-Satisfy Provisions

The DtS Provisions permit the use of reclaimed energy for complying with JP1 as described in Table 3.2 below. The descriptions provided below are indicative only and do not detail all of the requirements or concessions found in the BCA.

**Table 3.2 – JP1-related DtS Provisions for reclaimed energy**

<table>
<thead>
<tr>
<th>BCA Reference</th>
<th>Description of Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>J5.2(a)(ix)(B)</td>
<td>The power for a fan in an energy reclaiming system that preconditions outside air need not comply with the total fan power limits for air-conditioning units or systems.</td>
</tr>
<tr>
<td>J5.2(b)(ii)(A)(cc)</td>
<td>Mechanical ventilation systems serving a conditioned space may provide in excess of 20% over the minimum quantity required by Part F4 where there is an energy reclaiming system that preconditions all the outside air.</td>
</tr>
<tr>
<td>J5.2(b)(ii)(B)(aa)</td>
<td>An energy reclaiming system that preconditions outside air is one of two options required for densely occupied spaces in other than climate zone 2.</td>
</tr>
<tr>
<td>J5.2(d)(i)</td>
<td>The power for an energy reclaiming system that preconditions outside air need not comply with the fan power limits for general mechanical ventilation systems.</td>
</tr>
</tbody>
</table>

For the specific case of heating as required by JP3, on-site renewables and reclaimed energy may be used in accordance with the following provisions:
J5.4 Heating and cooling systems

(b) A heater— …

(ii) for heating a space other than via water must be—

(A) a solar heater; or

(B) a gas heater; or

(C) an oil heater, but only if reticulated gas is not available at the allotment boundary; or

(D) a heat pump heater; or

(E) a solid-fuel burning heater; or

(F) a heater using reclaimed heat from another process such as reject heat from a refrigeration plant; or

(G) a combination of (A) to (F); or

(H) electric only— …

J7.3 Swimming pool heating and pumping

(a) Heating for a swimming pool must be by—

(i) a solar heater not boosted by electric resistance heating; or

(ii) a heater using reclaimed energy; or

(iii) a gas heater; or

(iv) a heat pump; or

(v) a combination of 2 or more of (i), (ii), (iii) and (iv)...

J7.4 Spa pool heating and pumping

(a) Heating for a spa pool that shares a water recirculation system with a swimming pool must be by—

(i) a solar heater; or

(ii) a heater using reclaimed energy; or

(iii) a gas heater; or

(iv) a heat pump; or

(v) a combination of 2 or more of (i), (ii), (iii) and (iv)...
Note:
A corrigendum was issued to amend BCA 2011 and clarify that only spa pools that share a water recirculation system with a swimming pool are subject to restrictions on the type of heating able to be used. These provisions do not apply to portable spa pools.

Use of on-site renewable or reclaimed energy sources beyond the above provisions would need an Alternative Solution.

Example: Space Heating
A Class 8 building is to be used for the processing of food, and the design is otherwise DtS compliant. A by-product of the processing is a large amount of agricultural waste. To comply with J5.4(b)(ii), the designer proposes that the space heating be provided by a heater fuelled by burning the agricultural waste.

Example: Swimming Pool and Spa Pool Heating
A Class 3 hotel building is to have a swimming pool and spa for the use of its guests. Due to site constraints there is insufficient roof space available to fully heat the pool using a solar heater. To comply with J7.3(a) and J7.4(a), the designer proposes a system that heats water for the swimming pool and spa by a combination of a rooftop-solar heater and a heat pump.

3.5 Alternative Solutions using Verification Method JV3
For Verification Method JV3 the calculated annual energy consumption of the proposed building may be reduced by the amount of any energy generated on-site from sources that do not emit greenhouse gases, such as solar and wind power, or energy reclaimed from other processes. Before BCA 2010, Specification JV allowed only 50% of the energy generated on-site or reclaimed from other processes to offset the annual energy consumption; since BCA 2010 a full offset has been available but it is conditional on the availability of the energy being maintained.

JV3 Verification using a reference building
(a) …
(b) The annual energy consumption of the proposed building … may be reduced by the amount of energy obtained from—
   (i) an on-site renewable energy source; or
   (ii) another process as reclaimed energy…
Further information on this issue can be found in the Handbook on BCA Section J–assessment and verification of an Alternative Solution (ABCB, 2010a), and in Chapter 4 of the Handbook on Energy Efficiency Provisions for BCA 2010 Volume One (ABCB, 2010b).

**Example: Photovoltaics**

A Class 5 building is being designed but cannot meet the DtS provisions for the mechanical services. An Alternative Solution is prepared using Verification Method JV3, and while the fabric passes, the annual energy consumption with the proposed services exceeds that of the reference building. The designer proposes that a rooftop photovoltaic (PV) system be installed to offset some of the additional energy consumption in the mechanical services. In the Alternative Solution, when the proposed building is modelled with the proposed services drawing some of their power from the PV system, the design can now comply.

### 3.6 Other Alternative Solutions

As Performance Requirement JP1 deals with the efficient use of energy considering the building fabric, the services and the energy source of the services, it is technically feasible to develop an Alternative Solution that trades any over-performance of the services or any energy from on-site renewable or energy reclaiming technologies against under-performance of the building fabric. Be aware that this trade-off would only be allowed in exceptional circumstances as it is contrary to the general intent of the energy efficiency provisions to emphasise the performance of the building fabric as it is expected to be in place much longer than any services. An Alternative Solution, using a Verification Method other than JV3, would be required as the three modelling runs in JV3 prevent this trade-off.
4 BCA Volume Two and Alternative Energy Sources

This section details the opportunities available for using on-site renewable and reclaimed energy sources in meeting the BCA Volume Two Performance Requirements for greenhouse gas emission reduction and energy efficiency in Class 1 (residential) and Class 10 buildings.

The Volume Two Performance Requirements relating to energy efficiency deal with the building fabric and the building's domestic services separately. This is a result of governments wanting the long term benefit of a good building fabric, which could be in place for many years, rather than being traded for less durable and less reliable engineering solutions which may be replaced in only a few years.

In addition, a recent review of overseas practices undertaken by the ABCB indicates reluctance to trade between building fabric and services even if the energy source is totally renewable. On-site renewables are seen overseas as a companion to, and not a replacement, for good levels of building fabric performance.

Note:
The Queensland Development Code offers a nominal house star rating credit for installing a suitable photovoltaic system.

While not directly related to compliance with the BCA, some governments offer incentives such as rebates and subsidies for installing renewable energy sources.

4.1 Compliant Alternative Energy Sources

Table 4.1 below summarises the compliance paths by which various on-site renewable or reclaimed energy sources can be used to achieve a Building Solution. A reference to P2.6.2 means that an Alternative Solution is required to demonstrate compliance with the relevant Performance Requirement. A reference to V2.6.3 (shaded in yellow) means that this Verification Method is available to demonstrate compliance. A reference to a provision in Part 3.12 (shaded in blue) means that the solution is available as Acceptable Construction Practice, though an Alternative Solution could also be used. Descriptions of the energy sources can be found in Section 2.1 of this Handbook.
Table 4.1 – BCA Volume Two – allowable Alternative Energy Sources by end-use

<table>
<thead>
<tr>
<th>Domestic Services</th>
<th>Space Heating</th>
<th>Space Cooling</th>
<th>Swimming Pool Heating</th>
<th>Spa Pool Heating</th>
<th>Other Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar heater</td>
<td>3.12.5.6</td>
<td>P2.6.2</td>
<td></td>
<td>3.12.5.7(a)</td>
<td>3.12.5.7(b)</td>
</tr>
<tr>
<td>Solid-fuel heater or biofuels</td>
<td>V2.6.3</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>3.12.5.7(b)</td>
</tr>
<tr>
<td>Photovoltaics</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
</tr>
<tr>
<td>Geothermal</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
</tr>
<tr>
<td>Wind power</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
</tr>
<tr>
<td>Other on-site renewables</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
</tr>
<tr>
<td>Reclaimed energy</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
<td>P2.6.2</td>
</tr>
</tbody>
</table>

4.2 Performance Requirement P2.6.2

A building’s domestic services, including any associated distribution system and components must to the degree necessary—

(a) have features that facilitate the efficient use of energy appropriate to—

(i) the domestic service and its usage; and

(ii) the geographic location of the building; and

(iii) the location of the domestic service; and

(iv) the energy source; and

(b) obtain heating energy from—

(i) a source that has a greenhouse gas intensity that does not exceed 100 g CO₂ e/MJ of thermal energy load; or

(ii) an on-site renewable energy source; or

(iii) another process as reclaimed energy.

4.2.1 P2.6.2(a)(iv) – energy source for the domestic services generally

For P2.6.2(a)(iv) the energy source can be a consideration if, for example, renewable energy such as electricity from a photovoltaic panel or a wind turbine was used to meet or supplement the lighting or cooling electricity load. For P2.6.2 (b)(ii) similar sources could meet or supplement the heating load.
For the purposes of P2.6.2 the renewable source must be on-site (so not GreenPower) and includes solar, geothermal and wind. Reclaimed energy can also have a role in meeting this Performance Requirement.

4.2.2 P2.6.2(b) – energy source for heating

The overall intention of P2.6.2(b) is to reduce the amount of greenhouse gas emissions from each unit of energy used in heating by favouring low-intensity, on-site renewable or reclaimed energy sources.

P2.6.2(b)(i) sets a limit for the greenhouse gas intensity of the energy source, targeting the use of solar, natural gas, LPG or heat pump heating in preference to electric resistance heating. Since the limit is expressed in terms of emissions per unit of thermal energy load, it allows the energy efficiency of services plant to be taken into account. Limits calculated on this basis can permit the use of grid distributed electricity as the source for high efficiency plant such as heat pumps.

P2.6.2(b)(ii) recognises only on-site renewable energy sources so, as detailed in Section 2, GreenPower does not qualify.

P2.6.2(b)(iii) refers to energy sources such as reject heat from a refrigeration chiller, a co-generation- or tri-generation-type process, or industrial process equipment. One example, though rare in Australia, is a district heating scheme where heat reclaimed from waste disposal is used to provide hot water to a community.

4.3 Acceptable Construction Practice – Part 3.12.5

Performance Requirement P2.6.2 is satisfied by complying with Part 3.12.5 for the building’s services. This Part covers electric resistance space heating, hot water supply systems and swimming pool or spa pool heating.

For electric resistance space heating, 3.12.5.4 specifies the required controls and maximum power loads. The use of on-site renewable or reclaimed energy is not recognised.

3.12.5.6(a) sets out the requirements for hot water supply systems. Subclause (b) sets out the minimum performance, depending on the number of bedrooms, in either the number of Renewable Energy Certificates or as a percentage energy saving compared to the appropriate AS/NZS 4234 system.
### 3.12.5.6 Water heater in a hot water supply system

(a) A water heater in a hot water supply system must be—

(i) a solar heater complying with (b); or

(ii) a heat pump heater complying with (b); or

(iii) a gas water heater complying with (c); or

(iv) an electric resistance heater only in the circumstances described in (d)...

For swimming pools, 3.12.5.7(a) specifies that any heating must use a solar heater without electric resistance boosting.

For spa pools that share a water recirculation system with a swimming pool, 3.12.5.7(b) sets out the options for a heating system. The heating system may include a solar heater.

**Note:**

A corrigendum was issued to amend BCA 2011 and clarify that only spa pools that share a water recirculation system with a swimming pool are subject to restrictions on the type of heating able to be used. These provisions do not apply to portable spa pools.

### 4.4 Alternative Solutions using Verification Method V2.6.3

#### V2.6.3 Verification for a heater in a hot water supply system

(a) Compliance with P2.6.2 for a heater in a hot water supply system is verified when the annual greenhouse gas intensity of the water heater does not exceed 100 g CO₂-e/MJ of thermal energy load determined in accordance with AS/NZS 4234.

(b) The annual greenhouse gas intensity of the water heater in (a) is the sum of the annual greenhouse gas emissions from each energy source in g CO₂-e divided by the annual thermal energy load of the water heater.

(c) The annual greenhouse gas emission from each energy source in (b) is the product of—

(i) the annual amount of energy consumed from that energy source; and

(ii) the emission factor of—

(A) if the energy source is electricity, 272 g CO₂-e/MJ; or

(B) if the energy source is liquefied petroleum gas, 65 g CO₂-e/MJ; or

(C) if the energy source is natural gas, 61 g CO₂-e/MJ; or

(D) if the energy source is wood or biomass, 4 g CO₂-e/MJ.
The BCA includes Verification Method V2.6.3 to demonstrate compliance of a heater in a hot water supply system with P2.6.2(b). Note that compliance with P2.6.2(a) and (b) still needs to be demonstrated for any other domestic services, but could be done through a comparison with the Acceptable Construction Practice or by using another Verification or Assessment Method.

**Note:**

It is important to use the correct climate zone for each relevant document.

AS/NZS 4234:2008 (Standards Australia, 2008) defines four climate zones, which are not directly related to the eight BCA climate zones.

AS/NZS 3500 series defines three climate regions that each cover a number of BCA climate zones. The relationship is described in the Standard as well as in the Information Handbook on Energy Efficiency Provisions for BCA 2010 Volume Two (ABCB, 2010c).

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**Example: Electric-boosted Wood-fired Water Heating System**

An electric-boosted, wood-fired water heating system could be used if it can be shown to comply by using Verification Method V2.6.3. The greenhouse gas (GHG) intensity allowance of 100 g CO₂-e/MJ can be multiplied by the annual thermal energy load (in accordance with AS/NZS 4234) to determine an annual GHG emission allowance.

The designer has determined that the relevant AS/NZS 4234 input data is a medium system load in zone 3 (as defined in the Standard). The annual thermal energy load is then calculated to be 12,546 MJ. Multiplying that load by the maximum allowable GHG emission factor (100 g CO₂-e/MJ) gives the annual GHG emission allowance, which is 1,254,600 g CO₂-e.

The proposed system can satisfy the same 12,546 MJ load, split between the wood-fired heater and the electric booster. Using the emission factors in V2.6.3 for each energy source, the total proposed annual GHG emissions are 1,254,576 g CO₂-e. As a check, when divided by the annual thermal energy load (12,546 MJ), the proposed annual GHG intensity is just less than the 100 g CO₂-e/MJ allowance.

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Annual Thermal Energy Load (MJ)</th>
<th>Emission Factor (g CO₂-e / MJ)</th>
<th>Annual GHG Emissions (g CO₂-e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood-fired heater</td>
<td>8,052</td>
<td>4</td>
<td>32,208</td>
</tr>
<tr>
<td>Electric booster</td>
<td>4,494</td>
<td>272</td>
<td>1,222,368</td>
</tr>
<tr>
<td>Total Proposed</td>
<td>12,546</td>
<td>-</td>
<td>1,254,576 ✓</td>
</tr>
</tbody>
</table>
4.5 Other Alternative Solutions

As Performance Requirement P2.6.2(a) deals with the efficient use of energy appropriate to the energy source, it may be possible to develop an Alternative Solution to offset higher lighting or cooling energy usage by installing on-site renewable energy or energy-reclaiming technologies.
References


Legislation


*Renewable Energy (Electricity) Regulations 2001* (Commonwealth).
Appendix A  List of State and Territory Administrations

The following are the contact details for each State and Territory Administration as of 25 July 2011.

<table>
<thead>
<tr>
<th>State</th>
<th>Contact Details</th>
</tr>
</thead>
</table>
| **Australian Capital Territory** | Environment and Sustainable Development Directorate  
GPO Box 1908  
Canberra ACT 2601  
Telephone: 02 6207 1923  
E-mail: actpla.customer.service@act.gov.au  
Website: www.actpla.act.gov.au |
| **New South Wales**          | Department of Planning  
GPO Box 39  
Sydney NSW 2001  
Telephone: 02 9228 6111  
E-mail: information@planning.nsw.gov.au  
Website: www.planning.nsw.gov.au |
| **Northern Territory**       | Department of Lands and Planning  
GPO Box 1680  
Darwin NT 0801  
Telephone: 08 8999 8985  
E-mail: bas.lpe@nt.gov.au  
Website: www.nt.gov.au/lands/building |
| **Queensland**               | Building Codes Queensland, Department of Infrastructure and Planning  
PO Box 15009  
City East QLD 4002  
Telephone: 07 3239 6369  
E-mail: buildingcodes@dip.qld.gov.au  
Website: www.dip.qld.gov.au |
| **South Australia**          | Building Policy Branch, Department of Planning and Local Government  
GPO Box 1815  
Adelaide SA 5001  
Telephone: 08 8303 0602  
E-mail: plnsa.building@saugov.sa.gov.au  
Website: www.planning.sa.gov.au |
| **Tasmania**                 | Building Control Branch, Workplace Standards Tasmania, Department of Justice  
PO Box 56  
Rosny Park TAS 7018  
Telephone: 03 6233 7657  
E-mail: wstinfo@justice.tas.gov.au  
Website: www.wst.tas.gov.au |
| **Victoria**                 | Building Commission Victoria  
PO Box 536  
Melbourne VIC 3001  
Telephone: 1300 815 127  
E-mail: technicalenquiry@buildingcommission.com.au  
Website: www.buildingcommission.com.au |
| **Western Australia**        | Building Commission, Department of Commerce  
Locked Bag 12  
West Perth WA 6872  
Telephone: 1300 489 099  
E-mail: info@buildingcommission.wa.gov.au  
Website: www.buildingcommission.wa.gov.au |
Appendix B   Renewable Energy Sources

In accordance with Section 17 of the Commonwealth Renewable Energy (Electricity) Act 2000, renewable energy sources include:

(a) hydro;
(b) wave;
(c) tide;
(d) ocean;
(e) wind;
(f) solar;
(g) geothermal-aquifer;
(h) hot dry rock;
(i) energy crops;
(j) wood waste;
(k) agricultural waste;
(l) waste from processing of agricultural products;
(m) food waste;
(n) food processing waste;
(o) bagasse;
(p) black liquor;
(q) biomass-based components of municipal solid waste;
(r) landfill gas;
(s) sewage gas and biomass-based components of sewage;
(t) any other energy source prescribed by the regulations.

The same section in the Act goes on to specifically exclude the following energy sources:

(a) fossil fuels;
(b) materials or waste products derived from fossil fuels.

Section 6 of the Commonwealth Renewable Energy (Electricity) Regulations 2001 clarifies the meaning of some of the listed renewable energy sources in the Act.

Not all of the renewable energy sources listed in the Act are suitable for on-site generation.
Using On-site Renewable and Reclaimed Energy Sources