



ADVISORY NOTE

2016-1

Free-running Dwellings

<i>Application</i>	
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<i>Section/Part:</i>	<i>Part 2.6 – Energy efficiency</i>
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Introduction

The National Construction Code (NCC) has contained energy efficiency requirements for dwellings since 2003. However, there is some uncertainty over how these requirements apply to free-running dwellings, which are typically constructed in hot climates where cooling is the main consideration. Free-running dwellings are those that are deliberately designed to not enclose conditioned air, but instead, to use natural air-movement as a substitute for artificial cooling (or air-conditioning).

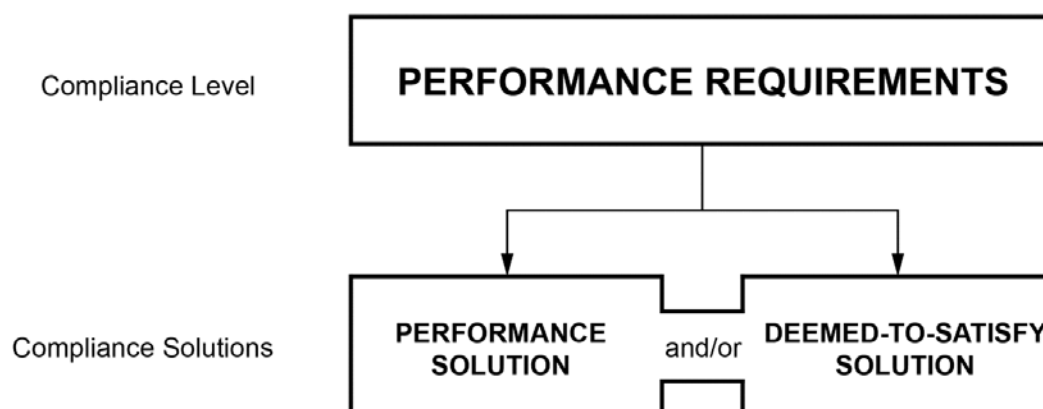
The purpose of this document is to describe how a free-running dwelling can use a Performance Solution to meet the NCC requirements.

Background

The NCC is a performance-based code. It contains mandatory Performance Requirements, which state the level of performance that a Performance Solution or a Deemed-to-Satisfy (DtS) Solution must meet. *For energy efficiency, P2.6.1* in NCC Volume Two is the Performance Requirement relevant to free-running dwellings.

A Performance Solution and/or a DtS Solution can be used to comply with the NCC Performance Requirements. The reference building Verification Method V2.6.2.2 is an example of a means of verifying whether a Performance Solution meets the Performance Requirement. A NatHERS (Nationwide Housing Energy Rating Scheme) energy rating is an example of a means of achieving a DtS Solution. A Performance Solution that directly satisfies the Performance Requirement, without using either of these approaches, can also be used.

Figure 1 NCC Compliance Structure



NCC energy efficiency provisions

Energy efficiency is the prudent, or smart, use of energy. In relation to dwellings, the NCC energy efficiency provisions are two-fold: firstly, related to the structure; and secondly, to the fixed services within the structure.

The structure determines the way that heat flows in and out of the dwelling through its walls, floors, roof and glazing. Services are features such as lighting, air-conditioning and heating (and other domestic services) that directly consume energy.

In terms of the structure, dwelling design, material selection, and construction will determine the amount of heat flowing in and out. This in turn determines how hard any air-conditioning serving the dwelling has to work. A combination of these elements, as well as occupant behaviour, contributes to the total amount of energy consumed.

The philosophy underpinning the NCC Volume Two energy efficiency provisions is that both economic and human comfort benefits are achieved by having a dwelling designed with greater levels of energy efficiency. This means a dwelling's interior is likely to stay warmer in cold weather and cooler in hot weather. When the internal environment conditions are tolerable for the occupants, it should minimise the need for artificial cooling and/or heating, reducing the amount of energy the occupants use. Consequently, the amount of greenhouse gas emissions attributable to a dwelling's artificial cooling and/or heating should reduce. However, the NCC's primary goal is not optimal occupant comfort, because comfort is a subjective perception that varies between individual occupants.

Free-running Dwellings - Design features

Free-running dwellings are designed to use air movement from fans, roof ventilators, stack ventilation and cross-ventilation, instead of artificial cooling.¹ They are typically constructed in hot climates where there is no need for heating. Instead of artificial cooling systems, free-running dwellings facilitate human comfort by including features such as the following:

- Extensive use of large openable windows, doors, and screen systems to encourage natural air flow.
- 100% openable windows, such as louvers or casement windows.
- Well shaded walls and openings.
- Using areas or levels of the dwelling as a means for migrating and releasing heat.

¹ Your Home, fifth edition, Commonwealth Department of Industry, Innovation and Science, pg. 93, 2013.

- Low or no thermal mass in sleeping spaces to reduce re-radiation of accumulated heat at night time.
- Thermally reflective wall and roof claddings.
- A maximum amount of external wall areas to the north and south orientations, with minimal eastern and western facing walls. This helps to keep the unwanted summer sun out.
- Designs with one room depth to encourage cross-ventilation.
- Elevated dwellings to permit air flow beneath floors.
- External areas where the occupants are likely to spend a large amount of time.

Figure 2 Example of extensive use of openable louver windows (Source: Your Home, Edition 5)



Free-running dwelling designs are predominantly used in the northern tropical climates of Australia (NCC climate zone 1) for example in locations such as Darwin, Cairns, Townsville and Broome. Refer to www.abcb.gov.au for the NCC Climate Zone maps.

Performance Requirement P2.6.1

The relevant² Performance Requirement for energy efficiency is P2.6.1. This Performance Requirement applies to free-running dwelling designs. It states:

² Note there is also the energy efficiency Performance Requirement P2.6.2, in NCC Volume Two, which covers domestic services. However, this is not relevant to the information contained within this Advisory Note on free-running dwellings.

A building must have, *to the degree necessary*, a level of thermal performance to *facilitate* the efficient use of energy for artificial heating and cooling appropriate to—

- (a) the function and use of the building; 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 cooling.

The terms “**to the degree necessary**” and “**facilitate**” are important in explaining the intent of Performance Requirement P2.6.1 as it applies to free-running dwelling designs.

“To the Degree Necessary”

The flexibility provided in the Performance Requirement P2.6.1 through the term “to the degree necessary” accounts for specific situations where there may not be a need to provide heating and cooling such as for free-running dwellings.

Due to the design intent and construction techniques used in these designs, the inclusion of artificial cooling in these dwellings at the time of construction, or post occupancy, is highly unlikely. Significant alterations would be needed to enable the containment of conditioned cooled air in free-running dwellings, which is likely to require new building approval.

“Facilitate”

When dwellings designed for northern Australian climates are considered, the vast majority are designed assuming artificial cooling will be installed to provide occupant comfort. They must provide thermal performance features that ‘facilitate’ the efficient use of energy as outlined in Performance Requirement P2.6.1. This also includes situations where artificial cooling is not installed during construction but is likely to be installed later.

Factors influencing the likelihood of artificial cooling being installed later include:

- dwelling alterations or additions resulting in a need to contain artificially cooled air;
- post occupancy need to cool the dwelling beyond what can be naturally achieved;
- the likelihood of changing occupant needs; and
- increased capacity to afford artificial cooling.

NCC Explanatory Information

The Objective O2.6 and Functional Statement F2.6 relate to the Performance Requirement P2.6.1 and may aid its interpretation. They are located in NCC Volume Two as Explanatory Information.

Objective O2.6 states:

The Objective is to reduce greenhouse gas emissions.

Free-running dwellings could be considered to meet this Objective because they do not require, and are unlikely to require the installation of artificial cooling. There are no associated greenhouse gas emissions.

Using a Performance Solution

As with all new dwellings, a free-running dwelling is required to satisfy Performance Requirement P2.6.1, as part of demonstrating compliance with the NCC³.

Compliance can be achieved either by a Performance Solution, DtS Solution, or a combination of both.

The NCC Volume Two DtS Provisions were developed primarily for dwellings designed to have an artificial cooling and/or heating system installed during construction or on the assumption that one will likely be installed later. This reflects typical construction practices in most Australian locations.

For free-running dwellings, a Performance Solution is likely to be the only option to satisfy Performance Requirement P2.6.1. This type of solution maintains the design integrity of the dwelling, whilst aligning with the intent of the energy efficiency measures in the NCC; being the reduction of greenhouse gas emissions through the efficient use of energy. Note that ultimately the documentation required to demonstrate that a free-running dwelling's Performance Solution complies with P2.6.1 will be the decision of the building approval authority/ building certifier.

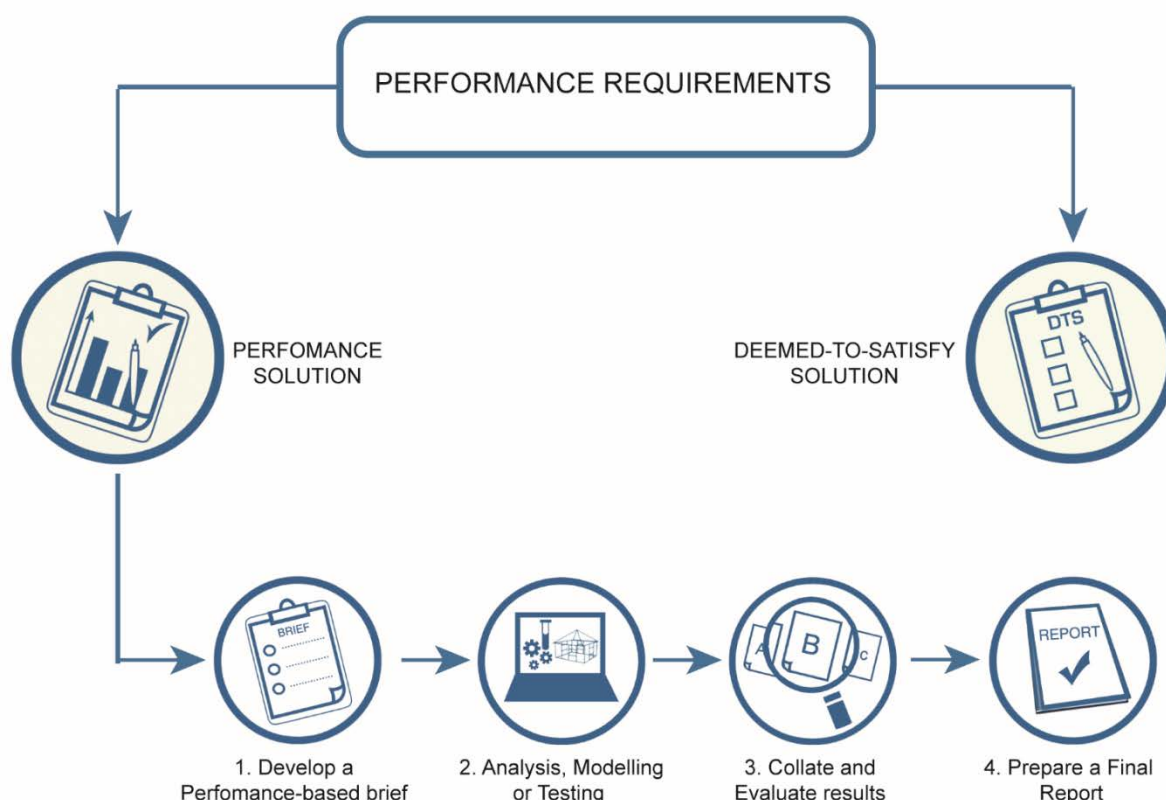
³ Note that compliance with Performance Requirement P2.6.2 would also need to be demonstrated for dwelling services.

It is important to note that in order to satisfy the Performance Requirement, it is not mandatory to use a DtS Solution, which can be inflexible for some design scenarios.

Process to develop a Performance Solution

Developing a Performance Solution is a collaborative approach based on a performance-based design brief. It is applicable to both simple and complex Performance Solutions.

Figure 3 Developing a Performance Solution



The following four step process may be used in formulating a Performance Solution for a free running dwelling.

Step 1 – Prepare a performance-based design brief

The design brief is a document developed with key stakeholders as part of a performance-based design and approval process. It is the platform upon which the proposed design is constructed and must identify critical activities and outcomes.

For a free-running dwelling, this should contain information on how the design, satisfies P2.6.1 (based on the intent of P2.6.1 and “to the degree necessary”). Key stakeholders to this process may include the builder, designer and the appropriate approval authority (e.g. building certifier).

Step 2 – Carry out analysis, modelling or testing

Given that every Performance Solution is unique, each proposal will require a specific analysis, modelling or testing method, depending on its complexity. The Assessment Methods in the NCC include: Expert Judgement, Verification Methods and/or Evidence of Suitability.

Expert Judgement is an example of an Assessment Method that could be used for a free-running dwelling. In this situation, the NCC definition of “Expert Judgement” is the judgement of a person who has relevant qualifications and experience to determine whether a Building Solution complies with NCC Performance Requirements.

This may include, but is not limited to, architects, energy efficiency consultants, building designers and/or engineers with expertise in energy efficiency. State and Territory interpretations of the definition of an “expert”, may differ. Ultimately what constitutes “Expert Judgement” is at the discretion of the relevant building authority.

For further clarification, Assessment Methods are described in the General Requirements of NCC Volume Two.

Step 3 - Collate and evaluate results

This stage involves the evaluation of results to draw conclusions to for the final report

During the process of analysis, multiple trials and design scenarios may have been explored. It is therefore critical to compare the assessed solution against the agreed acceptance criteria in the performance-based design brief from Step 1. If the solution does not meet the agreed acceptance criteria, further evidence or another opinion may be needed.

Step 4 – Prepare a final report

Detail the final Performance Solution into a report with the relevant documentation.



The final report should demonstrate that compliance with the NCC Performance Requirements, as per the performance-based design brief, has been achieved. The report should be accompanied by any relevant documentation for submission to the relevant approval authority.

Further information

Further guidance, information and resources on the NCC Volume Two energy efficiency measures, and developing a Performance Solution, are available from the ABCB website at www.abcb.gov.au.

The Queensland Department of Infrastructure Local Government and Planning (DILGP) has further information available on the use of Expert Judgement within its guideline document “Assessing energy equivalence using the peer review process” issued in October 2010. This document is available from the DILGP website at www.dilgp.qld.gov.au

The Northern Territory Department of Lands, Planning and the Environment (DLPE) has further information in Building Note 68 - “BCA Energy Efficiency Provisions” issued on 5 May 2010. This document is available from the DLPE website at www.lands.nt.gov.au

The Western Australia Department of Commerce has further information in Advisory Note 023 - “Meeting the new energy efficiency requirements for residential buildings in the BCA 2012 [Alternative Solutions]” issued in October 2012. This document is available from the Department of Commerce website at www.commerce.wa.gov.au