

Example energy efficiency calculation

NCC 2022 Volume Two Deemed-to-Satisfy elemental provisions, climate zone 2

This case study provides an example of the calculations required to demonstrate compliance with the Part H6 Energy Efficiency Performance Requirements H6P1 and H6P2 using the Acceptable Construction Practice elemental provisions in H6D2(1)(b) and H6D2(2) of NCC 2022 Volume Two. The example building is a timber framed house located in Brisbane, Queensland. The case study shows how to calculate the requirements for the building fabric, ceiling fans and the net equivalent energy usage. Example calculations for building sealing and services are not included as no changes are proposed to these provisions in NCC 2022 Volume Two.

Example calculations for external glazing and shading have not been included as these may be carried out using the NCC 2022 Volume Two glazing calculator as an alternative to the elemental provisions. Detailed calculations using the elemental provisions have been provided in the alternative case study for climate zone 6, Melbourne.

Construction and site details

Table 1 Site and construction details (Plans in Attachment A)

Building element	Detail
Building location	Queensland
NCC climate zone	2
NCC building classification	Class 1 detached house with an attached unconditioned Class 10a garage

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Roof & ceiling general arrangements	<ul style="list-style-type: none"> • Pitched with flat ceiling • Eaves with 600mm overhang • Timber framed • Metal sheet roof – colour – Colorbond “Surfmist” – Solar Absorptance (SA)=0.32 • Downlights (to 0.5% of plan area of ceiling)
External wall general arrangements	<ul style="list-style-type: none"> • Timber framed - brick veneer to lower storey, Colorbond metal sheeting to upper storey • Brick colour – PGH Bricks & Pavers “Hotham” – SA ≤ 0.475 • Colorbond metal sheeting colour - Colorbond “Wallaby” – SA = 0.64 • Wall height – 2700mm
Floors and subfloor wall general arrangements	<ul style="list-style-type: none"> • Concrete slab on ground • Floor area of building Class 1 part of building = approx. 287m²
Main type of heater	Reverse cycle ducted air conditioner – 2.5-stars (GEMS 2019)
Main type of cooler	Reverse cycle ducted air conditioner – 2.5-stars (GEMS 2019)
Type of water heater	Electric storage (peak)
Installed capacity of photovoltaics	5 kW
Swimming pool	Volume of swimming pool – 44,800 Litres. Pool pump – 6-star GEMS rating.
Spa	Volume of spa – 4800 Litres

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Calculations

Compliance Pathway: Compliance with the Performance Requirements is achieved as a Deemed-to-Satisfy Solution following the Acceptable Construction Practice set out in H6D2 Application of H6D2(1)(b).

Part 13.2 – Building fabric

1. Clause 13.2.1 - Building is Class 1 with an attached Class 10a garage, therefore clauses 13.2.2 to 13.2.6 and 13.2.7 apply.
1. Clause 13.2.2 – Where the following checks confirm that insulation is required, insulation shall comply with clause 13.2.2. This relates to material selection and construction/installation and is not described in detail here.
2. Clause 13.2.3 – For climate zone 2 roof minimum R-Values sub-clause (a)(ii) applies.
 - a. Roof is pitched with flat ceiling, therefore Table 13.2.3c applies.
 - i. SA for Colorbond roof is 0.32 (based on product technical literature)
 - ii. Roof is considered standard (no wind driven or powered roof ventilators)
 - iii. Therefore adopt option of either:
 - A. Foil insulation installed under roof (with R-Value = 0) and R2.5 ceiling insulation, or
 - B. R3.0 ceiling insulation and no under roof insulation.

Adopt Option 2 – R3.0 ceiling insulation with no foil insulation installed under roof.

Note, clause 10.8.3, as referenced in sub-clause 13.2.3(3), does not apply to buildings in climate zone 2.

3. Sub-clause 13.2.3(4) – Where ceiling insulation is reduced due to presence of downlights, this is compensated by increasing ceiling R-Value in accordance with Table 13.2.3s.
 - a. Area of ceiling insulation is reduced by 0.5%, therefore, adjusted ceiling minimum R-Value = 3.4.
4. Roof is constructed from timber framing, therefore thermal bridging sub-clause 13.2.3(5) does not apply.

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5. Note, although this is a metal sheet roof, sub-clause 13.2.3(6) does not apply as this roof has a flat ceiling lining which is not attached directly to the purlins, rafters or battens, regardless of whether any of the purlins, rafters or battens are metal.
6. Clause 13.2.4 does not apply as there are no roof lights in this building.
7. Clause 13.2.5 – walls are:
 - a. Brick veneer for lower storey, therefore sub-clause 13.2.5(1) applies to lower storey, and
 - b. Lightweight construction for upper storey, therefore sub-clause 13.2.5(2) applies to upper storey.
 - c. Therefore for climate zone 2:
 - i. Minimum R-Values for lower storey are in accordance with Table 13.2.5c or 13.2.5d and
 - ii. Minimum R-Values for upper storey are in accordance with Table 13.2.5c with R0.3 added.
 - d. For lower storey brick veneer, Table 13.2.5c applies.
 - e. SA value for bricks is ≤ 0.475 , therefore adopt 0.475 as design value.
 - f. For 600mm roof overhang and 2700mm wall height, minimum required R-Value is:
 - iii. For upper storey, lightweight wall construction applies with $SA=0.64$, therefore minimum required R-Value = 2.0 with R0.3 added, therefore R2.3. However as this is two storey construction R0.8 is added in accordance with note 4. Therefore the minimum design R-Value is R3.1.
 - iv. For lower storey – R2.5 However, in accordance with note 4, add R0.8 as this is a two storey building, therefore minimum required R-Value for lower storey is R3.3 with no reflective.
 - g. Wall framing is timber, therefore thermal bridging clause 13.2.5(4) and clause 13.2.5(5) do not apply.
8. Note, where the lower storey roof abuts the upper storey wall, continuity of the wall insulation is required to form a continuous barrier in walls and ceilings.
9. Clause 13.2.6
 - a. Construction is a concrete slab-on-ground in climate zone 2 with no underfloor heating, therefore sub-clause (1), (2), (3), (4) and (5) do not apply.

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10. Clause 13.2.7 – The roof of the garage room of the building is not a shared a common roof with the Class 1 part. Therefore it is practical to design this as a separate part to the building. In this case the shared internal walls between the garage (Class 10a part) and Class 1 part require continuous insulation as detailed above for the external walls of the Class 1 part. Otherwise the garage external fabric can be insulated as required above with no internal wall insulation required to the shared walls.

Part 13.3 – External glazing

Example calculations for glazing and external shading have not been included. These shall be in accordance with Part 13.2, or the 2022 NCC glazing calculator.

Part 13.4 – Building sealing

Example calculations are not included for building sealing as there are no changes for NCC 2022.

Part 13.5 – Ceiling fans

1. In accordance with clause 13.5.2, ceiling fans are required as this building is in climate zone 2.
 - a. Ceiling fans to be permanently installed and have a speed controller.
 - b. In accordance with Table 13.5.2, ceiling fans are required in daytime habitable spaces and bedrooms, which for this building includes as a minimum:
 - i. Games room (approx. 20m²)
 - ii. Meals room (approx. 16m²)
 - iii. Family room (approx. 25m²)
 - iv. Living 1 room (approx. 25m²)
 - v. Study room (approx. 10m²)
 - vi. Living 2 room (approx. 16m²)
 - vii. Bedroom 1 (approx. 20m², excluding walk in robe and entrance alcove)
 - viii. Bedroom 2 (approx. 11m²)
 - ix. Bedroom 3 (approx. 12m²)
 - x. Bedroom 4 (approx. 11m²)
 - c. Therefore ceiling fans are required as follows:
 - i. Games room – minimum 1 x 1400mm
 - ii. Meals and Living 2 room – minimum 1 x 1200mm per room
 - iii. Family and Living 1 room – minimum 2 x 1200mm per room
 - iv. Study room – minimum 1 x 900mm

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- v. Bedroom 1 – minimum 1 x 1200mm
- vi. Bedroom 2, 3 and 4 – minimum 1 x 900mm

Part 13.6 – Whole-of-home energy usage

1. In accordance with clause 13.6.1 this part applies to the Class 1 building only as the class 10a garage is not a conditioned space.
2. Clause 13.6.2 – Net equivalent energy usage
 - a. The net equivalent energy usage is calculated in accordance with sub-clause 13.6.2(1)(a) as follows:
 - i. $(A \times E_e) + E_p + E_s - E_R$, where
 - A. $A = 287 \times 0.0087 = 2.497$
 1. Where the floor adjustment factor 0.0087 is taken from Table 3.12.5.1a.
 - B. $E_e = 2.224$ (from Table 2.2.2 in ABCB Standard : Whole-of-home efficiency factors)
 - C. $E_p = V \times F_p / 1000$, where
 1. $F_p = 0.014$ (from Table 13.6.2c)
 2. Therefore, $E_p = 45000 \times 0.014 / 1000 = 0.630$
 - D. $E_s = V \times F_s / 100$, where
 1. $F_s = 0.053$ (from Table 13.6.2d)
 2. Therefore, $E_s = 4800 \times 0.053 / 100 = 2.544$
 - E. $E_R = 5.0$ (5kW photovoltaic panels installed on roof)
 - ii. Therefore, equivalent energy usage = $(2.497 \times 2.224) + 0.630 + 2.544 - 5.0 = 3.72$
 - b. The allowable net equivalent energy usage is calculated in accordance with 13.6.2(1)(b) as follows:
 - i. $A \times E_F$, where
 - A. $E_F = 1.78$ (from Table 13.6.2b)
 - ii. Therefore, allowable net equivalent energy usage = $2.497 \times 1.78 = 4.44$.
 - c. The net equivalent energy usage does not exceed the allowance, therefore meets the requirements of 13.6.2.

Part 13.7 – Services

Example calculations are not included for building services as there are no changes proposed for NCC 2022.

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Summary of design requirements

Table 2 Summary of design requirements

Building element	Minimum requirements	Notes
Roof	R3.4 ceiling insulation (with no under roof foil or insulation).	Roof framing is constructed from timber, therefore thermal bridging is not considered.
Walls	Colorbond cladding upper storey – R3.1 wall insulation. Brick veneer lower storey – R3.3 wall insulation.	No reflective foil insulation required in this instance. Wall framing is timber therefore thermal bridging is not considered. Wall insulation to be continuous where lower storey wall abuts upper storey wall (garage and games room).
Slab	No requirement.	Construction is slab-on-ground with no underfloor heating, therefore no insulation required.
Glazing	In accordance with NCC 2022 Glazing Calculator, or NCC Volume Two Part 13.3.	It is expected that design will be commonly carried out using the glazing calculator, hence example calculations are not included.
Building Sealing	In accordance with NCC Volume Two Part 13.4.	No changes to technical content of the building sealing provisions from NCC 2019 amdt 1, hence example calculations are not included.

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Building element	Minimum requirements	Notes
Ceiling Fans	<p>Games room – 1 x 1400mm ceiling fan.</p> <p>Meals and Living 2 rooms – 1 x 1200mm ceiling fan per room.</p> <p>Family and Living 1 rooms – 2 x 1200mm ceiling fans per room.</p> <p>Study room – 1 x 900mm ceiling fan.</p> <p>Bedroom 1 – 1 x 1200mm ceiling fan.</p> <p>Bedroom 2, 3 and 4 – 1 x 900mm ceiling fan.</p>	<p>Other rooms are not considered daytime habitable, therefore no requirement for ceiling fans.</p> <p>It is expected that ceiling fans will be installed in locations that achieve practical coverage for the expected use of those rooms.</p>
Class 10a part (garage)	<p>Shared internal walls to be insulated in accordance with the requirements for walls above.</p> <p>No insulation requirements to external fabric (external walls, roof, slab).</p>	<p>As the garage is separated from the Class 1 part by construction having the required level of thermal performance, no insulation requirements apply.</p>

Notes:

Compliance with other NCC provisions (such as fire, waterproofing, condensation, etc.) is not considered. This shall be considered separately when determining required construction arrangements and details.

These requirements are considered general in nature. Specific detailing requirements as required by NCC, relevant codes and standards and supplier product technical requirements are not included (such as fit-up and installation detailing, abutting and fixing of insulation, etc.). This shall be considered during design and construction.

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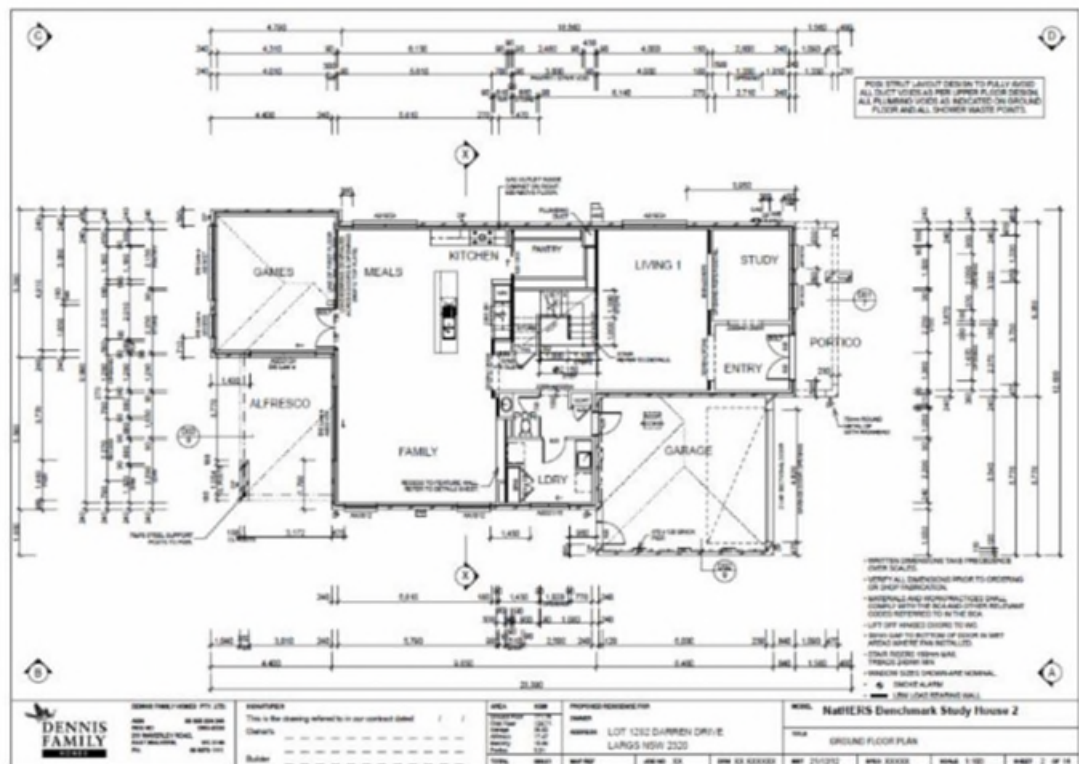
Attachments

Design plans

The plans and specifications for this indicative house design used in this case study have been kindly provided by Dennis Family to assist with the consultation process on the draft NCC 2022 changes.

Figure 1 SBH01 Large detached 2 storey, NatHERS benchmark study house No. 2 - ground floor

Ground Floor



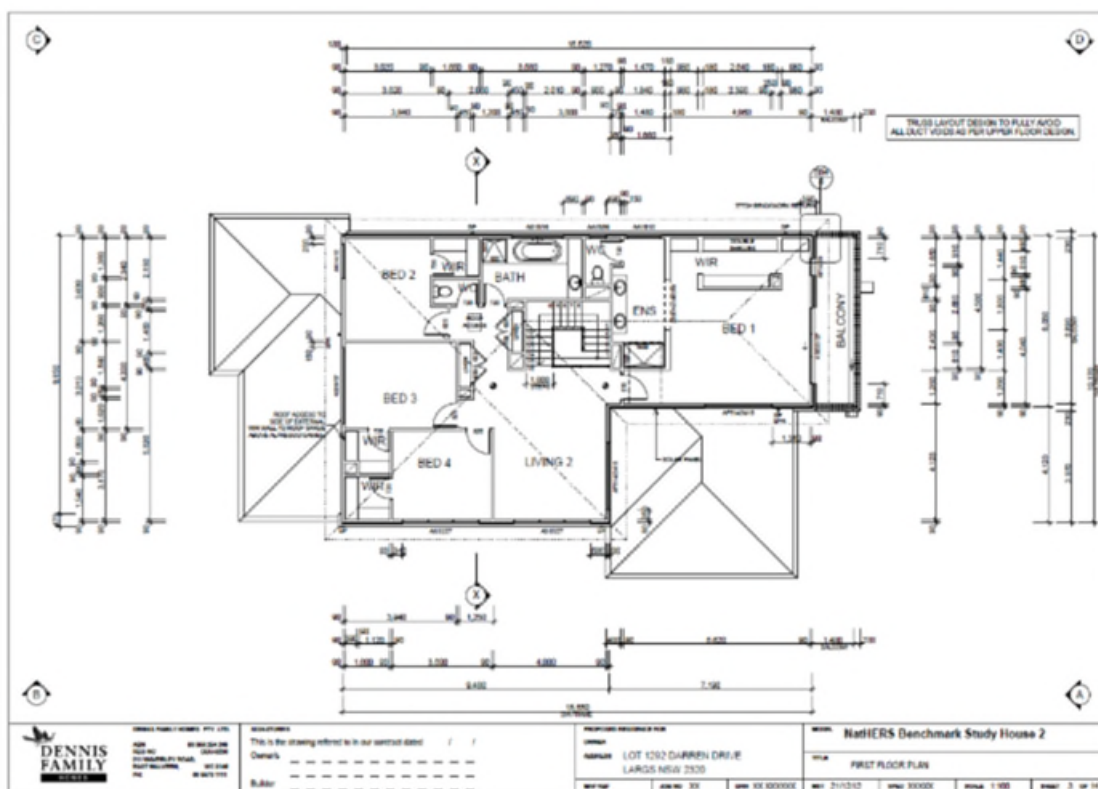
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Figure 2 SBH01 Large detached 2 storey, NatHERS benchmark study house No. 2 - upper floor

Upper floor



Elevations

