# ARE YOU READY FOR NCC2022?

*Cover images by* **Christopher Frederick Jones**

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Leaders in Thermal & Architectural Building Solutions

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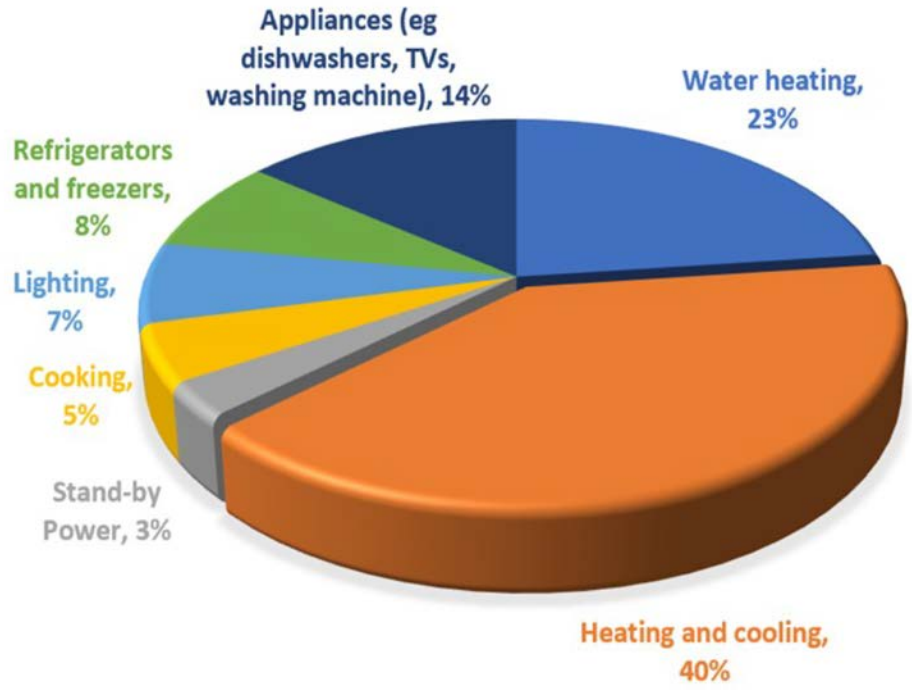
## INTRODUCTION

In Australia, the residential sector is a big consumer of energy – in fact 57 percent of emissions from the building sector come from housing and apartments and 40 percent of that is related to heating and cooling.

But the changes to the National Construction Code (NCC) 2022 aim to go beyond reducing the environmental impacts. In recent times much of Australia has experienced extreme weather conditions and the ability of our homes to provide comfortable living conditions, without fully relying on air-conditioning, has gained more attention – focusing on improved occupant comfort, reduced energy wastage and improved resilience to extreme weather.




# Residential sector is a big consumer of energy and a significant carbon emitter

# 57% of emissions from the building sector come from housing and apartments (GBCA)

# 40% heating and cooling

Research conducted over the past 10 years by the Queensland University of Technology, in conjunction with Bondor® Metecno, Australia's leading manufacturer of insulated building panels, is showing the way forward. Innovative insulated panel products can help reduce the heating and cooling bills for Australian home owners, as well as the energy demand of Australia's buildings, contributing to lowering the nation's carbon footprint.

## Queensland University of Technology Studies 2012- 2015

From 2012 – 2015, housing design and energy efficiency were the subject of several studies conducted by the Queensland University of Technology. The studies sought to demonstrate that innovative products such as Structural Insulated Panels (SIPs) which eliminates traditional framing, bricks and plasterboard, can create a well-sealed thermal barrier that significantly reduces air and heat leakage and improves energy efficiency.

## QUT STUDY - 15 houses in SEQ & Townsville

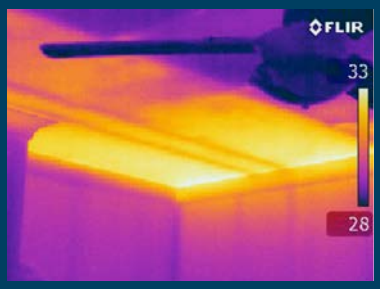
This study looked at 15 traditionally framed homes, using thermal imaging to look at how the insulation was installed to identify potential problems with the current building practices.

Most of the houses studied displayed issues – which highlights that: it is one thing is to get the regulations right, the other is to come up with solutions that offer reliability of the outcome – in practice.

The study concluded that the thermal performance of the building to a great degree depends on the experience and quality of the installers.

QUT study 2012/ 2013

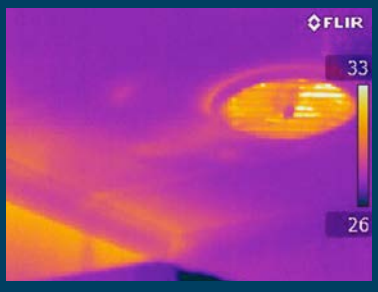
- 15 houses in SEQ and Townsville, including 2 display homes
- Traditional framing methods (wall and roofs)
- Thermal imaging was conducted
- Most displayed some problems with insulation installation that would make them non-compliant with building regulations (minor to serious) e.g. poor perimeter coverage and leakage around windows and doors
- Negative impact, to varying degrees, on the thermal performance of the building
- Two homes showed significant non compliance issues




Poor perimeter coverage (typically 300 -600mm around perimeter of internal ceilings), with particularly poor coverage in the corners of hip roof designs

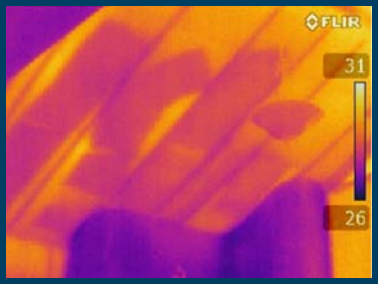

Patchy (or absent) ceiling coverage in general


Entry hallways, utility rooms (e.g. bathrooms, laundry) and bulkheads often not insulated correctly (similar with garage ceilings and walls adjoining main house)




Poor insulation around exhaust fans, lights, roof access covers


Leakage around doors and windows




Two of the homes revealed extensive and serious non-compliance issues that required house owners to seek restitution from the relevant builders

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## Impact of poor insulation

When considering the overall thermal performance of the building – proper installation of insulation does matter.

To demonstrate this, QUT used the NCC table for “compensating for loss of ceiling insulation” to work out the reduction in R values due to missing insulation.

| % not insulated | R1.5 | | R2.5 | | R3.5 | | R4.5 | |
|---|---|---|---|---|---|---|---|---|
| | % reduction In R-Value | New R-Value | % reduction In R-Value | New R-Value | % reduction In R-Value | New R-Value | % reduction In R-Value | New R-Value |
| 2% | 17% | 1.25 | 25% | 1.88 | 31% | 2.42 | 36% | 2.86 |
| 4% | 29% | 1.06 | 40% | 1.50 | 48% | 1.83 | 54% | 2.08 |
| 6% | 39% | 0.92 | 50% | 1.24 | 58% | 1.46 | 64% | 1.61 |
| 8% | 47% | 0.80 | 58% | 1.05 | 66% | 1.20 | 71% | 1.31 |
| 10% | 53% | 0.71 | 64% | 0.90 | 71% | 1.02 | 76% | 1.09 |

For example depending on what R value you are aiming for taking away 10% of the insulation will reduce R value by a staggering 53 – 76%

## Panel Construction

Another study looked at five houses made out of insulated panel, built by five different builders, for five different clients, in five different climate zones.

Clearly being made out of insulated panel, meant that the insulation was continuous, but each house was subject to a blower door test, infrared scanning and smoke tracer – to check the effectiveness of thermal and building sealing.

In summary:

This study reinforced that using Structural Insulated Panels (SIPs) ensures a reliable outcome – and, that lack of experience does not affect the thermal performance.

Where there is continuous insulation in the walls and ceiling, the main area of thermal loss is through the glazing.

Homes constructed from SIPs are quite air tight at 2-9.6 Air Changes per Hour, compared with the traditional houses tested by CSIRO showing 1-39 air changes.

Hence this study identified that SIPs do have a role to play in the residential sector in resolving insulation and air tightness issues.

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## Findings:

- Even first-time users of this product can produce well-sealed homes
- Unsurprisingly the largest area of thermal loss was through glazing
- SIP houses provide a very high level of airtightness:
- SIP: 2-9.6 ACH at 50Pa
- Traditional construction: 134 houses tested by CSIRO: 1-39 ACH at 50Pa
- There is a role for SIPs in residential building sector in resolving existing air and thermal leakage issues

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## Bondor® InsulLiving Home

In the first study we highlighted some problems with the way we build houses in Australia.

The second study showed that not only at the design stage – or theoretically, but also at hand over – or as built, we can expect massive improvements by utilising SIPS in housing.

But how about the live in/occupancy experience?

This house at Brisbane was built entirely out of insulated panel, housing a family of four for 12 months.

The house was designed for panel taking advantage of the large spans with a raked ceiling.

The external wall, frame, insulation and plasterboard, were all replaced with 140mm wide panel.

The internal framing and plasterboard were replaced with 90mm panel.

The roof sheet, trusses, insulation and ceilings were replaced with roof panel.

This is showing the difference between a 9-star home as designed – and what was actually achieved during the 12 months of occupancy

The house was modelled in BERS software as a conditioned house. And as a 9-star home you would expect it to be within a comfort range of 18-28 degrees 92.5 percent of the year.

The second bar is showing it modelled as a free -running mode (hence no AC) and you would expect to be in the comfort range 87% of the year.

But in fact, during the 12 months that the house was being monitored, using some air-conditioning the occupants chose to be within that comfort range, 96.5 percent of the time – and this is with minimal use of air conditioning as we will see a little later on – which equates to 9.5 star.


Comparison of temperature histogram for Insulliving actul data and software simulations

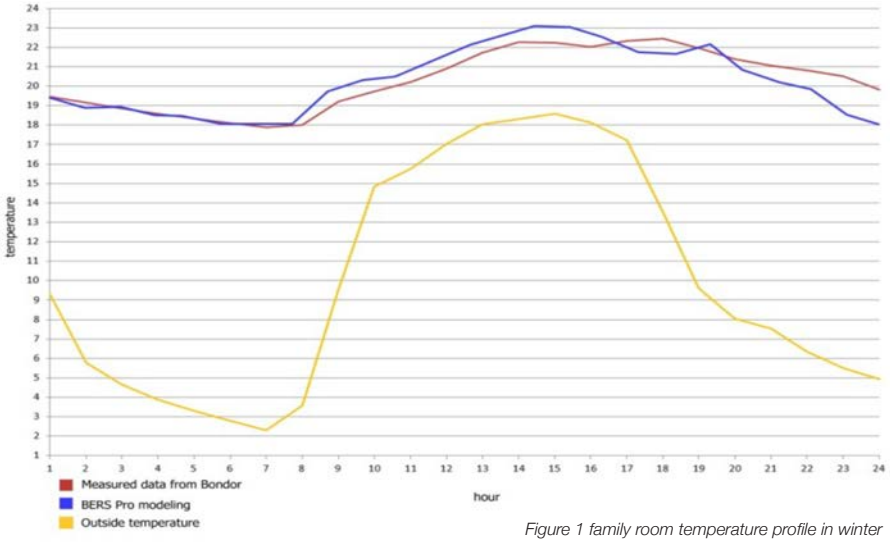



*Figure 1 family room temperature profile in winter*

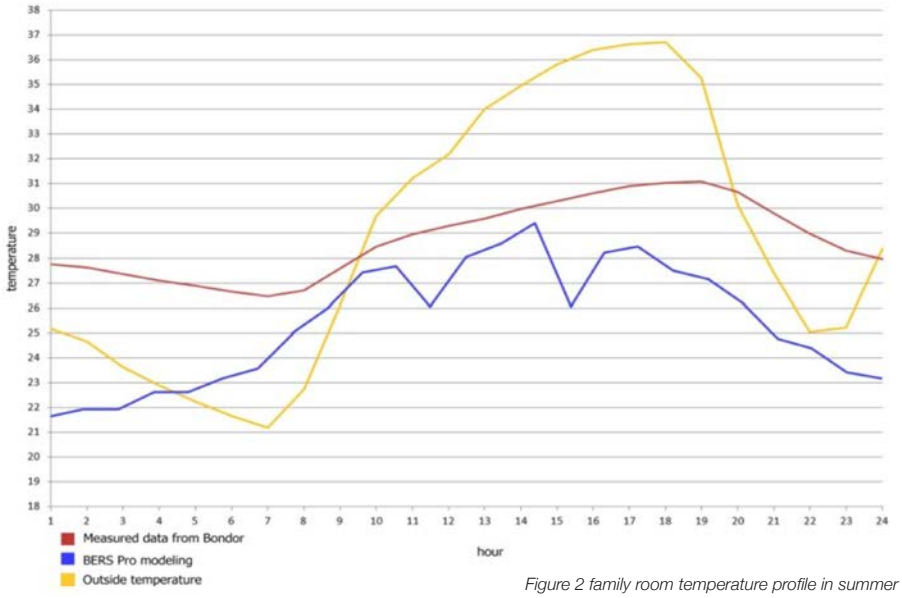



*Figure 2 family room temperature profile in summer*

The graphs above are showing the temperature fluctuations on a winter day and a summer day.

The yellow line is showing the outside temperature which was measured through a weather station that was located on the roof of the house.

The blue line is showing what is expected through BERS modelling for a 9-star home, and the red is showing the actual temperatures.

As the red lines demonstrate we have a well-insulated house with minimal temperature fluctuations that is cooler in summer and warmer in winter.

A point worth highlighting here is the stakeholder's influence – the bottom graph shows that the occupants could have opened the windows to ventilate the house overnight during summer to take advantage of the cooler outside temperature which would have then dropped the red line to temperatures within the "comfort range" of 18-28 the next day – further reducing their reliance on A/C.

The overall results using the insulated Structural Insulted Panels were quite impressive:

- Their electricity consumption was 48 percent less than SEQ
- Even by using A/C to get to 96.5% comfort level, only 13 percent of their energy was used for cooling and heating, this compares to a national average of 39 percent at the time of the study
- As mentioned before the house was modelled as a 9 star but achieved 9.5 stars in occupancy
- With a high level of comfort with minimal space heating or cooling
- They achieved net zero for space heating, cooling, lighting and most water heating using a 2.1kW solar system – a typical 5kW system would have achieved a total net zero
- And as mentioned this was achieved by first time users of this product.

This demonstrates that Insulated Structural Insulted Panels are reliable, affordable and sustainable solutions that meet and exceed the new thermal performance requirements of NCC, provide comfortable living conditions and are suitable for Australia's extreme weather conditions.

## Bondor® Metecno

Bondor® Metecno is Australia's leading manufacturer of insulated building panels. Founded in the 1950s, the group is constantly working on solutions for industrial, commercial and residential building customers across Australia and offers the most comprehensive range of insulated panel products and systems available. Having operated in the industry for 65 years, Bondor takes pride in being an Australian manufacturer.

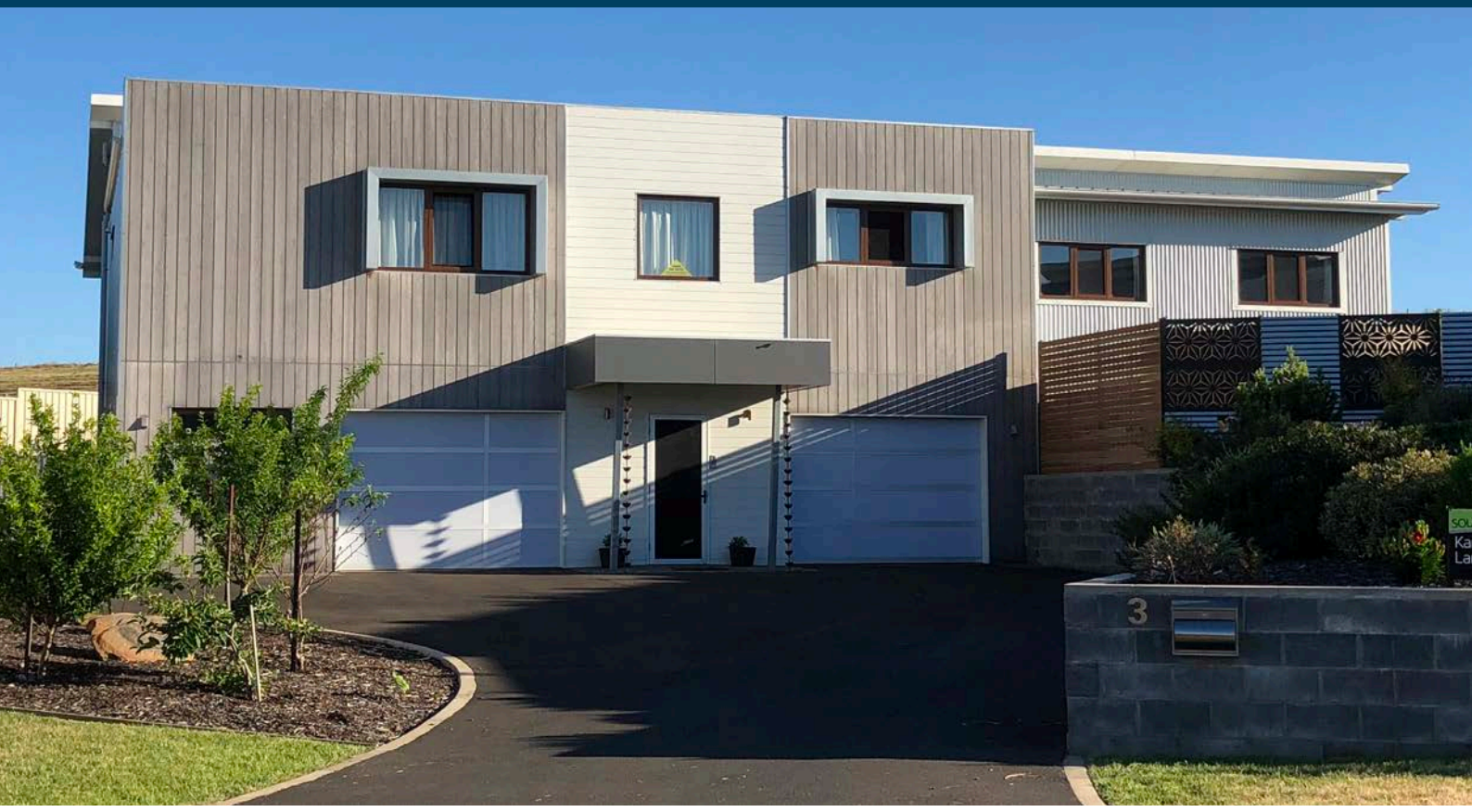
The company is a passionate supporter of Australian Standards for Australian conditions. Its products have been approved and tested to Australian standards, while adhering to the strictest international regulations. Bondor® Metecno has technical and support associations with several international building product suppliers, universities and research facilities in Australia and remains up-to-date with industry trends and regulations through its involvement with the Insulated Panel Council of Australasia and the FM Approvals International Advisory Council.

## Bondor® Metecno has a wide range of CodeMark assessed products

The Bondor® Metecno businesses have been using CodeMark Certification Scheme Certificates of Conformance since 2013. We have the largest range of CoC's in our industry covering insulated panels for walling and roofing profiles in both residential and commercial applications. These can be sourced at JAS-ANZ website as well as http://bondor.com.au/codemark

We support Australian Standards for Australian conditions and Australian testing in Australian conditions as the best way to ensure our products conform and perform in the Australian built environment.

For more information, visit the Bondor® website at http://bondor.com.au

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