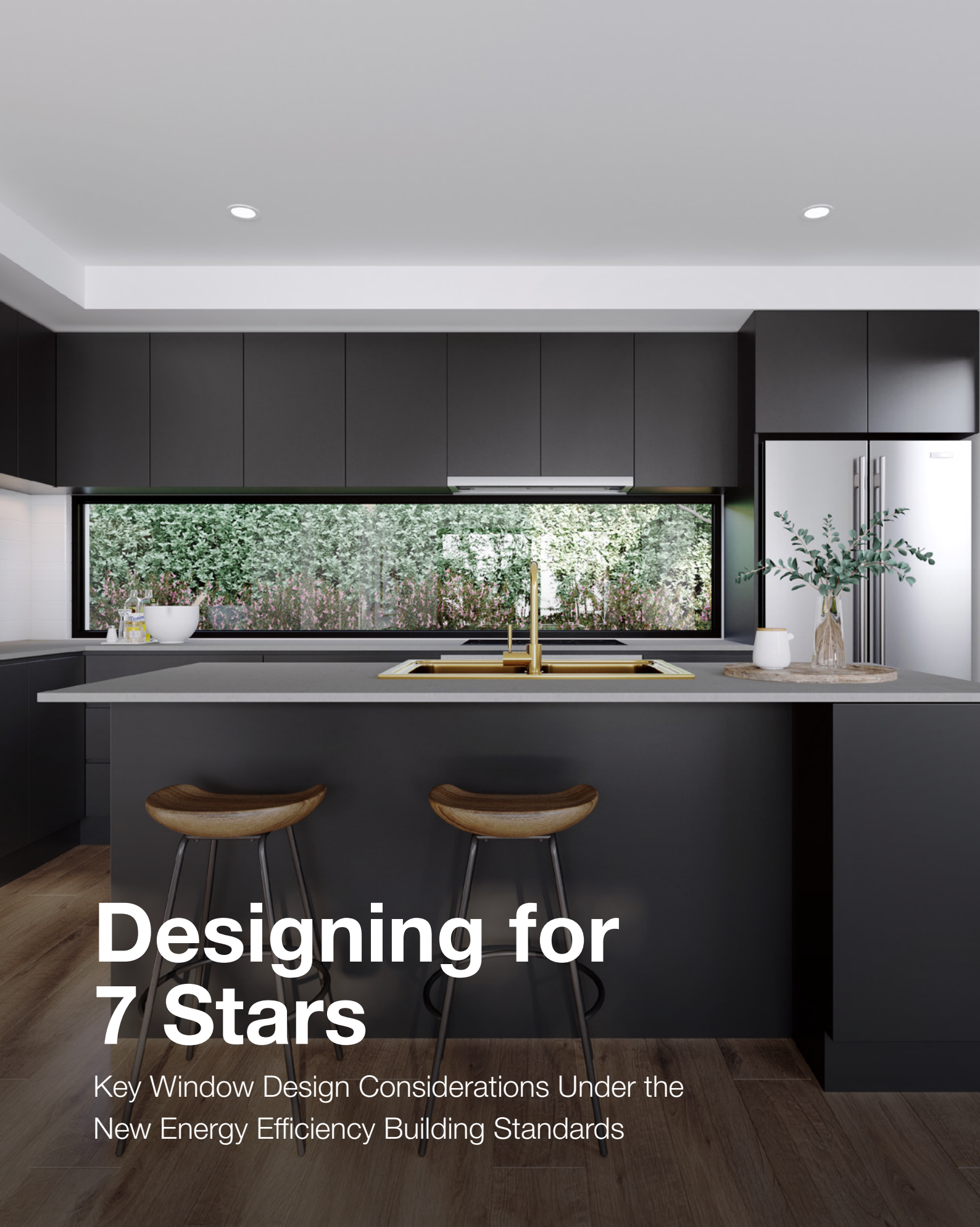
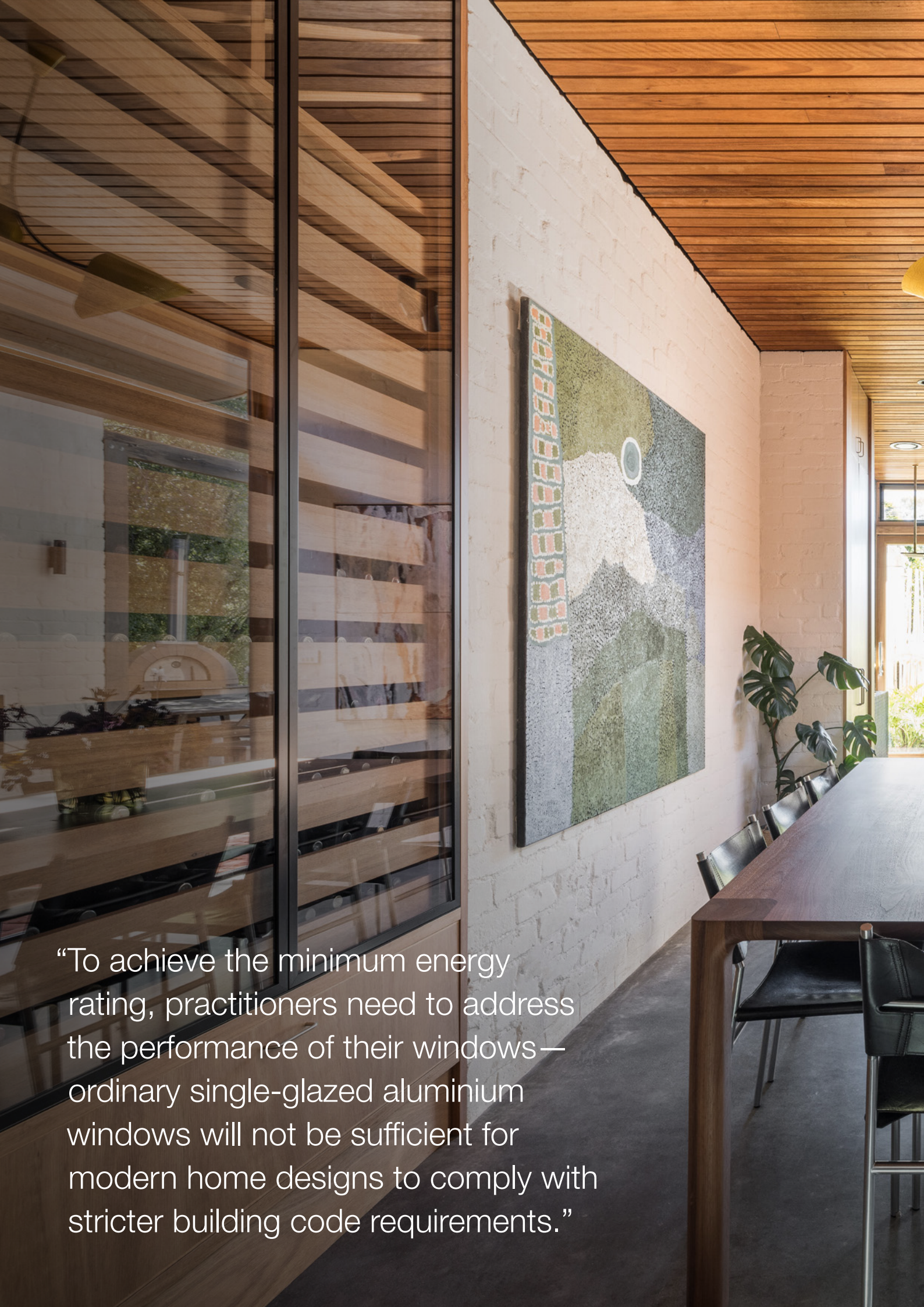




Designing for 7 Stars

Key Window Design Considerations Under the New Energy Efficiency Building Standards

A modern interior space featuring a ceiling with horizontal wood slats. A white brick wall is on the right, with a large abstract painting in a black frame. To the left is a large glass window with a black frame, reflecting the interior. In the foreground, a dark wooden dining table with black leather chairs is visible. A potted plant is on the table. The floor is dark grey.

“To achieve the minimum energy rating, practitioners need to address the performance of their windows—ordinary single-glazed aluminium windows will not be sufficient for modern home designs to comply with stricter building code requirements.”



Introduction

The house energy rating, which is determined by the Nationwide House Energy Rating Scheme (NatHERS), is a common yardstick by which to assess a home's energy efficiency. The minimum standard energy rating for new residential builds was 6 stars, but with recent changes to the National Construction Code (NCC) that commenced on 1 May 2023, this has increased to a minimum 7-star NatHERS energy rating or its equivalent.

According to the Department of Industry, Science, Energy and Resources, in a typical Australian household, 40% of energy is used for heating and cooling.¹ As Australia's fifth-largest source of greenhouse gas emissions is from household carbon emissions, it is clear that more energy-efficient and environmentally sensitive housing is needed. Elevating energy efficiency standards is one way to lower emissions, while also helping owners and residents save money on energy costs.²

As we move towards a 7-star future, designers and architects are considering a range of strategies to increase the energy efficiency of Australian homes. To achieve the minimum energy rating, practitioners need to address the performance of their windows—ordinary single-glazed aluminium windows will not be sufficient for modern home designs to comply with stricter building code requirements.

In this whitepaper, we examine effective strategies in window design that will improve the efficiency of windows and help buildings meet the new energy efficiency requirements under the NCC 2022.

What is changing?

The most common method of achieving the NCC's minimum energy efficiency standards is through NatHERS assessments. The possible 0 to 10 stars in the NatHERS scale indicates the energy efficiency of a dwelling factoring in climate zone adjustments. A home with a star rating of 0 offers no protection from the outside temperature, whereas a home with a star rating of 10 can keep its interior at a comfortable level regardless of external temperatures.

The 2022 update of the NCC requires all new Australian houses and apartments to meet a minimum energy efficiency rating of 7 stars under NatHERS. Other NCC compliance pathways, including Deemed-to-Satisfy elemental provisions and the Reference Building Verification Method, are subject

to equivalent increases. In most locations, the increase to a minimum 7-star rating means it will take 20 to 25 percent less energy to heat and cool a home.³

The updated energy efficiency requirements also include a new 'Whole of Home' approach and 'energy budget'. A Whole of Home assessment can determine whether a home will be net zero for operational energy, which means that it will produce as much energy as it uses (or even more) over the course of a year. The energy budget establishes a maximum annual energy use for heating, cooling, hot water, lighting, and, if applicable, swimming pool and spa pumps that can be reduced by installing solar photovoltaic systems on the property.





Getting your building to 7 stars

With energy requirements for new home builds shifting from 6 stars to 7 stars, there will be a greater focus on higher performing window systems across Australia. Up to 87% of a home's heating energy can come in, and 40% of it can be lost, through windows, according to the Australian Glass and Window Association.⁴ The Australian government has advised that improving glazing and window design is necessary to meet the 7-star standard.⁵

Australia falls short of other countries in several areas when it comes to the design of thermally efficient windows. For instance, double glazing is a requirement for newly constructed homes and replacement windows in the United Kingdom. Many of the single-glazed windows that are commonly installed in Australia would either be prohibited or strongly discouraged in Europe and the United States. Europe, who are over ten years ahead of Australia in terms of thermally efficient construction, also use uPVC, a material that is significantly more insulating than aluminum, in windows more frequently.

There is a common misconception that designers will need to reduce the number of windows, or opt for smaller windows in their design, under the stricter energy efficiency regime. However, it is possible to increase the thermal efficiency of windows with solutions currently available on the market, allowing designers to achieve a 7-star NatHERS rating without compromising on aesthetics or functionality. Over time, we expect double or triple glazing, low-E (low emissivity) insulated glass units, as well as less conductive framing materials, such as timber and uPVC, will be required as the minimum.

Both standard and custom window options are available in NatHERS.⁶ In general, choosing defaults will result in a lower rating, so switching to a custom window where all the specifications are known allows for more flexibility. Other factors to consider include window placement, size, and shading, all of which should be climate-appropriate.

Strategies for improving window efficiency

Choose the right framing materials

A window's frame contributes 10% to 30% of the unit's weather resistance.⁷ Though the glazing accounts for a majority of the unit's energy efficiency, it is possible to negate the benefits of high-performance glazing by using a frame that allows rapid heat transfer.⁸

Aluminum is a popular choice for window frames due to its light weight, strength and durability, but the material conducts heat very rapidly, resulting in significant heat energy loss through the frames in winter and excess heat gain in the same way during summer. Newer units may include a 'thermal break' that is incorporated into the frame's profile to improve performance.

Regardless of whether it is thermally broken or not, aluminum cannot match the thermal performance of wood and uPVC. In a study comparing the thermal performance of frames made of aluminum, uPVC, and timber, it was found that both wood and uPVC performed significantly better than aluminum.⁹ The uPVC Windows Alliance note that the heat conductivity of uPVC is approximately 1,000 times less than that of aluminum.¹⁰

Due to their longevity, ease of maintenance and high insulation performance, uPVC window frames make up the majority of window sales in both Europe and America, regions that are far ahead of Australia in relation to energy efficiency standards.¹¹ Composite or alu-clad windows, comprising of a timber frame overlaid with a powder-coated aluminium profile externally, are also among the most popular options, whereas aluminum frames are not a common choice in these regions.

Preventing air leakage

Among the most vulnerable areas for air leakage in a building's structure are its windows and doors, especially if the system does not properly seal when the unit is closed. Air leakage decreases indoor comfort by allowing moisture and noise to enter the building, while also making it more difficult to regulate indoor temperatures. Reports indicate that, in a typical household, air leakage accounts for 25 to 40 percent of the energy used for heating and cooling.¹²

While the NCC is the standard for Australia, it is not complete as it assumes all sized windows perform the same and it does not measure air infiltration through a window. To allow designers and specifiers to make an informed choice, the Window Energy Rating Scheme (WERS) enables windows to be rated for their energy efficiency. WERS-rated windows must satisfy AS

2047:1999 "Windows in buildings—Selection and installation" for air infiltration performance, which allows a maximum air infiltration rate of 5.0L/s. m² for a closed window.

Designers and specifiers should be aware that the difference between a window that only barely meets the minimum requirement for air infiltration under AS 2047 and a window with an extremely tight seal can be as much as half a star in WERS heating performance. Windows with compression seals have traditionally tended to have superior infiltration performance, but recent advancements in sliding window seals have closed the gap.

Most windows have a single point lock, which are prone to air leaks even when the window is closed tight. Multi-point systems offer better seal performance and should be preferred.

Double and triple glazing units

While older buildings in the United States may have single glazing, almost all modern, energy-efficient buildings in the country have double or triple glazing units.¹³ Double-glazed windows can reduce heat gain or loss by almost 30%, making them significantly more energy efficient than single-glazed aluminum windows.¹⁴

However, specifying double or triple glazing is not always enough, and careful attention should be paid to the construction details of each unit. Some systems only allow a 6mm gap between the panes of glass in double glazing, but a gap of 12mm that is filled with argon gas will give you better performance. Argon is denser than air and thus provides better thermal insulation than a standard unit.

Most standard double-glazed units include thermally conductive spacer bars, which are components that separate the two panes of glass and seal them to one another. A high-quality thermal spacer will improve the thermal performance of the unit, particularly at the edge of the double glazing.

Low-E coatings

Double-glazed units with low-E coating provide additional insulation and solar protection. Low-E windows let in natural light while reflecting heat and preventing outside infrared light from penetrating the glass.

Compared to standard glass, low-E glass can reduce the amount of heat that is transmitted through the glass by about 30% and, when paired with an efficient frame, can stop up to 70% of heat loss and 77% of heat gain.¹⁵

BINQ windows help you reach 7 stars

European designed and engineered, BINQ's windows are some of the highest performing timber, alu-clad and uPVC windows in the world. Their range of window systems are made from thick, slim-line profiles that allow for glazing rebates for timber (35mm) and uPVC (40mm). This glazing rebate allows BINQ to install argon filled thermally insulated glass, with more room between each pane, and achieve U-values as low as .8.

Thermal performance from the glass is gained from two key areas. The gap separating each sheet of glass can be as much as 32mm for either double or triple glazing, well above the 6mm in standard models. BINQ also uses low-E coatings that minimise the amount of heat that passes through the glass while still allowing light to flow through. A warm-edge spacer, made from non-conductive material, is used to ensure optimal thermal performance.

The BINQ range of timber windows includes the Archetto series, which is crafted from thick 68mm timber profiles, which provide highly thermal efficient options. Within limiting hardware restrictions, the size and scale of these products are endless, allowing you the ultimate flexibility in your design.

Unlike traditional uPVC windows, BINQ's range of uPVC profiles are a slimline design, which minimises the amount of framing material and maximises the amount of glass, leaving you with a room full of light and an enhanced view of the outdoors. Much like timber, uPVC provides optimal thermal efficiency that will far surpass the performance of aluminum. BINQ's uPVC window systems are capable of achieving U-values of below 1 and certain systems are fire rated to up to BAL40.

Delivering real energy efficiency improvements

BINQ recently consulted with an energy rating consultancy group, EcoResults, on a development which consisted of ten 23m² double-storey townhouses by Cosentino Property Group. Originally specified with double-glazed aluminium windows and achieving an average NatHERS rating, BINQ provided EcoResults with their energy ratings for their double-glazed uPVC window systems. Simply changing the windows gained an additional 1 star, then by slightly upgrading the insulation to R2.5 underfloor insulation, adding R2.5 internal wall insulation, and increasing roof insulation from R4.0 to R5.0, an average NatHERS rating of 7.5 stars was achieved—an overall increase of 1.7 stars.

This is not the first time BINQ has collaborated with EcoResults. Previously, BINQ supplied EcoResults with the energy ratings on their high-performance Archetto series for two luxury homes and in similar circumstances saw an increase in the energy ratings by 1.3 stars—just by changing the windows.

“Over time, we expect double or triple glazing, low-E insulated glass units, as well as less conductive framing materials, such as timber and uPVC, will be required as the minimum.”



References

- 1 Australian Government. "Households: Quick wins." Energy.gov.au. <https://www.energy.gov.au/households/quick-wins> (accessed 12 July 2023).
- 2 Renew. "Households Better Off: Lowering energy bills with the 2022 National Construction Code." Renew. <https://renew.org.au/wp-content/uploads/2021/09/Households-Better-Off-full-report.pdf> (accessed 12 July 2023).
- 3 Sustainability Victoria. "Seeing 7-stars: new home energy efficiency standards explained." Sustainability Victoria. <https://www.sustainability.vic.gov.au/energy-efficiency-and-reducing-emissions/building-or-renovating/7-star-homes-program/7-star-homes-program-resources/seeing-7-stars-new-home-energy-efficiency-standards-explained> (accessed 12 July 2023).
- 4 Australian Glass and Window Association. "Your Home Guide to Glazing." AGWA. <https://awa.associationonline.com.au/wersnews/your-home-guide-to-glazing> (accessed 12 July 2023).
- 5 Australian Government. "Top tips for building for 7 Stars." NATHERS. https://www.nathers.gov.au/sites/default/files/2022-09/22726_Nathers_Newsletter.pdf (accessed 12 July 2023).
- 6 Ibid.
- 7 Tyndall, Kate. "Merits of Window Framing Materials." Remodelling. <https://www.remodeling.hw.net/products/windows/merits-of-window-framing-materials> (accessed 12 July 2023).
- 8 Ibid.
- 9 Sinha, Arijit and Andreja Kutnar. "Carbon Footprint versus Performance of Aluminum, Plastic, and Wood Window Frames from Cradle to Gate." Buildings, Vol. 2, No. 4 (2012): 542-553.
- 10 uPVC Windows Alliance. "Why Australians should choose higher-performing uPVC windows." UWA. <https://www.upvcwindows.org.au/latest-news/why-australians-should-choose-higher-performing-upvc-windows> (accessed 12 July 2023).
- 11 Vinyl Council Australia. "It's time to make the change to uPVC windows." VCA. <https://www.vinyl.org.au/item/112-it-s-time-to-make-the-change-to-upvc-windows> (accessed 12 July 2023).
- 12 Energy Star. "Air sealing." Energy Star. https://www.energystar.gov/ia/home_improvement/home_sealing/AirSealingFS_2005.pdf (accessed 12 July 2023).
- 13 Department of Energy. "Window Types and Technologies." Energy.gov. <https://www.energy.gov/energysaver/window-types-and-technologies> (accessed 12 July 2023).
- 14 Sustainability Victoria. "Home window glazing." Sustainability Victoria. <https://www.sustainability.vic.gov.au/energy-efficiency-and-reducing-emissions/building-or-renovating/windows-and-shading/window-glazing> (accessed 12 July 2023).
- 15 Connection Magazines. "Low-e glass." Build. <https://build.com.au/low-e-glass> (accessed 12 July 2023).

All information provided correct as of July 2023