

MODERN GREEN HOMES

Sanctuary

ISSUE
66

Small space success in a Canberra apartment; moving your rental garden;
eco lining boards; introducing the Sustainable Builders Alliance

**Sustainable
House Day 2024**

Open homes are back!

Previews and event
program inside



WIN

A Stiebel Eltron hot water
heat pump valued at \$6,250,
provided by Goodbye Gas.

Offer open to Australian residents. Details page 85

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DECISIONS, DECISIONS

Above Andrew Pickard and Hannah Angus, creators of the Powerhaus app. Image: Greg Selby

New Powerhaus app makes it easier

Energy ratings are great, but the existing software can make them laborious to use as a design tool. Enter a new app plugin that's set to be a game-changer for energy efficient design: Hannah Angus of creator Powerhaus Engineering walks us through it.

Building or renovating a sustainable home that is both comfortable and healthy can be complex. At first it seems simple: orientate to the north and insulate well. But as the design progresses, details become more challenging – which windows offer the best balance between cost and thermal performance? Should you invest in a larger solar system or in better airtightness? The number of interconnected decisions goes up quickly.

For over twelve years my partner Andrew Pickard and I have had the goal of making sustainable building decisions easier. Beginning as a mechanical engineer, Andrew has spent the last decade thermally modelling, testing and retrofitting homes as an energy assessor. I started in the federal Department of Climate Change, moving into science communication. In 2022 we rebranded to Powerhaus Engineering to better communicate our mission: helping people build efficient houses that power themselves.

STAR RATINGS AS A DESIGN TOOL?

Regular *Sanctuary* readers will be familiar with the idea of using NatHERS energy ratings (Star ratings) to guide design and sustainability decisions; in fact, it's often suggested that ratings are used iteratively as a design tool. However, modelling a house design using one of the NatHERS software packages can be a laborious, time-consuming process, and changing parameters to test their effect on the overall rating is not generally quick or easy. It's also difficult to connect ratings with the many other sustainability decisions in a home, such as choice of heating system or how much solar you need, and see how each decision affects the others.

So, while Star ratings are critical for moving the industry forward, they have not typically been easy to use as a design tool. We wanted to make energy efficiency easy, and accessible to everyone. We also wanted to show the whole picture of thermal performance, electrical systems and solar generation coming together for increased sustainability.

THE POWERHAUS APP

We took the intricate back-end data from a NatHERS energy rating – providing hour-by-hour predictions of a home's heating and cooling needs across the year – and displayed it in an interactive app plugin. It's effectively a dashboard that gives greater visibility into the information already entered into the NatHERS software, and offers much easier interactivity. We then



CASE STUDY

Margaret and Rowan of Gundaroo, New South Wales, were aiming for the trifecta with their new build: a comfortable and beautiful home, with an optimised Star rating, that didn't blow the budget. When their designer, Architecture Republic director Tristan Ryall, modelled their dream high-performance design and took a look with the Powerhaus app, things took an unexpected turn.

They initially intended to use an internal wrap to achieve the Passive House standard for airtightness of less than 0.6 air changes per hour at 50 pascals pressure (ACH50). The app indicated that this would actually make very little difference to the home's overall performance, and it would have added \$80,000 to their build cost. By testing other parameters using the app, they found that the greatest efficiency gains could be achieved by optimising standard construction using an external, taped wrap and aiming for airtightness of 2–3 ACH50 instead.

The app also helped identify that triple-glazing the north-facing windows would not allow enough solar gain during winter, reducing the energy rating. Having assumed that triple glazing was better than double, the couple were surprised to discover that switching to double glazing on the northern and eastern facades reduced both construction costs and their projected energy consumption across the year.

Tristan says the Powerhaus app helped them challenge assumptions while delivering impressive financial results. "It was surprising to see how certain cost-saving measures actually enhanced the home's performance. Rowan and Margaret saved around \$100,000, while building a more comfortable house."

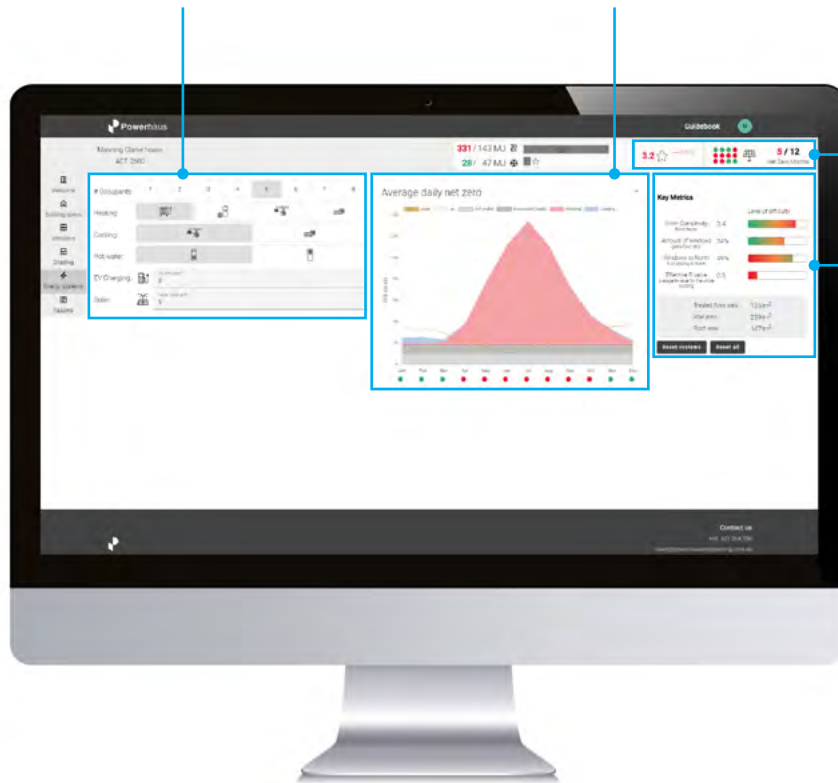
Design render: Architecture Republic

Home energy budget

See how different heating, cooling, hot water and EV choices will impact your home energy budget

Daily net zero: meet your energy needs with solar

The key sustainability measure we use is daily net zero, which measures whether the energy coming into your home can meet your energy needs



Star rating at a glance

Key design metrics that drive the building's energy efficiency

ENERGY SYSTEM VIEW

Connects your Star rating with your electrical system choices

integrated solar production models and other energy use data for homes – information not yet covered by NatHERS – offering a comprehensive view of energy efficiency and climate impact.

One big advantage of the app is that it walks people through their design, showing the impact of energy efficiency decisions as a whole, through some key components:

- **Building design ratios:** The app shows three key design ratios not easily accessible in NatHERS ratings, that influence thermal comfort and give a quick indication of home efficiency: building form complexity, glass-to-floor-area ratio, and percentage of glass facing north. Optimising these makes high Star ratings more attainable.
- **Insulation and airtightness:** Testing the impact of insulation levels and airtightness on predicted energy use means you can find the best 'bang-for-buck' solution. NatHERS doesn't yet include airtightness, despite its huge impact on comfort and energy efficiency.

– **Window specification:** Arguably the trickiest part of any design! The app lets you quickly and easily test different window U-values for the whole house, or change window types on each facade, to see what works best.

– **Energy systems:** See how the energy use for your system choices (including heating and cooling, hot water, and electric vehicle charging) will balance with your solar PV system size; tweak your systems, or jump to the insulation tab to see if bumping it up will allow you to reduce your solar system size.

The dashboard provides immediate feedback on the impact of your decisions.

THE POWER OF 'DAILY NET ZERO'

To make it clear to homeowners how close their home is to powering itself with solar generation on each day of the year, we added a new metric: daily net zero.

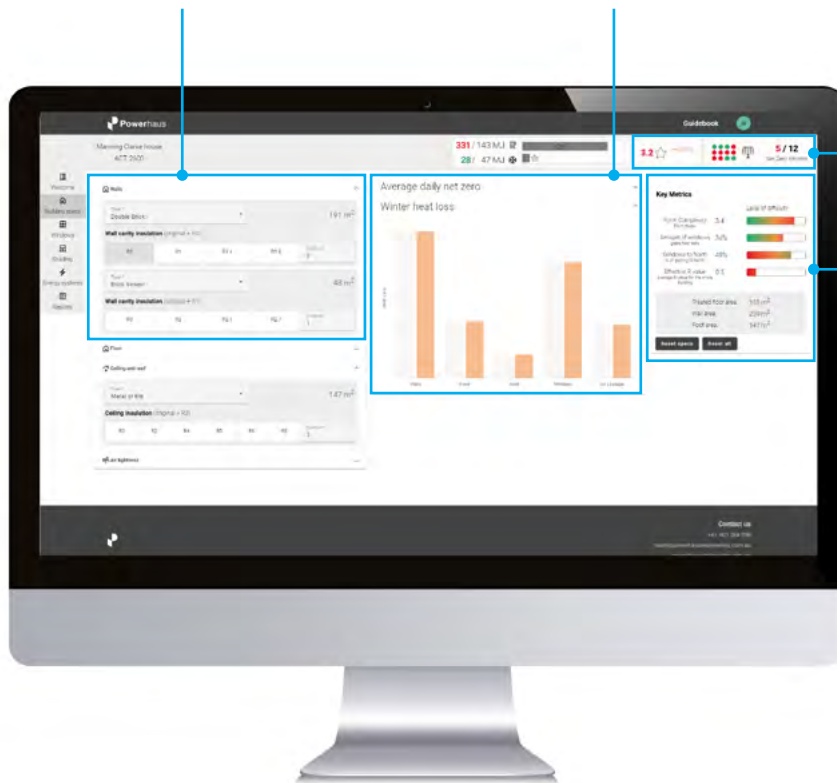
Many houses in Australia – even solar-equipped ones – cover their winter energy shortfall with fossil fuels [*Ed note: less so*]

Insulation

See how different insulation levels will increase your Star rating

Identify the weak spots of your building

See where heat is lost in the building, and where the biggest improvements can be made



Star rating at a glance

Key design metrics that drive the building's energy efficiency

BUILDING FABRIC VIEW

Upgrade insulation or change construction and see Star rating impact instantly

in states where the electricity grid has a higher proportion of renewables). Increasing winter energy efficiency can have a tangible impact on fossil fuel use, and measuring daily net zero brings everything together: the efficiency of electrical systems and the building envelope, thermal comfort, and where energy comes from (the solar versus grid balance).

One pitfall of NatHERS is that small houses tend to score lower Star ratings despite using less energy overall! Measuring daily net zero tells a different story: it is immediately obvious that smaller houses can more easily power themselves with solar.

HOME ENERGY EFFICIENCY MADE EASY

Last year, we beta-tested the app with our friends at Canberra-based Light House Architecture and Science, and it was great to get this feedback from director Jenny Edwards: "For years, the true potential of the NatHERS software as a design tool was only accessible if paired with a trained thermal performance assessor. This often made the design process slower, more expensive, and limited the ability of architects to learn directly

from the software. The Powerhaus dashboard is a game-changer. Its superbly designed interface allows designers to instantly test the impact of various critical parameters, giving them a clear understanding of the most effective levers for any particular design."

After a year of client testing, the app is now ready for all users. It's compatible with NatHERS models created using FirstRate5 or Hero software, and while it's aimed mainly at building professionals, the dashboard is also user-friendly for informed homeowners. For the best experience, though, we suggest using it alongside your architect or designer, or work with our team. Pricing starts at \$180 per project when you supply the NatHERS model, or \$480 if we do the initial modelling for you. [S](#)

To find out more or try it out, visit:
powerhausengineering.com.au/app