AUSTRALIAN ZERO CARBON HOUSING CHALLENGE RULES

The *Australian Zero Carbon Housing Challenge* (the Challenge) is a volunteer non-profit initiative which seeks to reveal the ways in which good design is contributing to the lowering of the carbon footprint of architect-designed residential.

It supports architects to whole-of-lifecycle carbon assess (LCA) low to medium density residential up to 3-storeys and showcases attainable low to net-zero carbon exemplars to the wider public across communications channels.

The Challenge seeks entries that:

- Demonstrate a 50% improved (minimum) to 100% (net-zero or better) carbon footprint;
- Are completed or in-progress houses, townhouses, duplexes, triplexes, alterations and additions, 'granny flats' or multi-family homes. It excludes apartments over 3-storeys);

GWP improved on benchmark house:	Detached new house	Alterations + additions	Attached multi-unit
≥ 100% (net-zero)	✓	✓	✓
≥ 50% minimim	✓	✓	✓

- Demonstrate compelling and diverse architectural solutions to the crucial issue of lowering carbon. The Challenge welcomes all approaches to tackle this issue. Strategies might include improved energy efficiency, solar passive design, smaller houses with space-saving ideas, recycled and low embodied energy materials, use of on-site solar, reuse of existing houses, clever solutions for car parking or car sharing, and landscape integration for heat mitigation, drought tolerance and streetscape character.

Step 1. carbon model → **Step 2. prepare your poster** → **Step 3. ENTER !**

Key dates:

Challenge Launch and Information Session

13 Nov 25	Launch event (5pm Thu online)

2025-2026 Challenge Round

13 Nov 25	Challenge commences/RapidLCA app access
Early 26	Use your LCA result and report in your Sustainable House Day
Feb-Mar 26	Last chance to append your LCA report to residential awards entry
Mid-26	Last chance to be shortlisted for the national exhibition and publication

Whole-of-Life Carbon

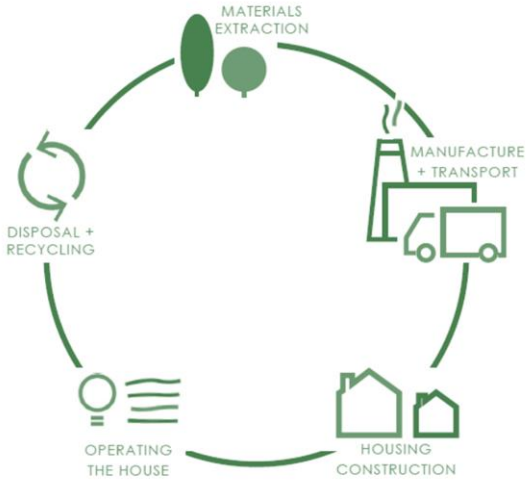
The Australian Institute of Architects defines whole-of-life carbon as "*the total carbon emissions over a building's entire lifecycle, including upfront, operational, maintenance, refurbishment, and end-of-life phases*" (Decarbonisation Plan 2025).

Why it matters:

- it offers a comprehensive view of environmental impact, and is
- critical for regenerative, circular, and decarbonised design

ISO 14044:2006 outlines life cycle assessment principles for environmental management and reports on housing emissions, aligning with EN 15978. From clearly defined goals, assumptions and scope to cut-off rules, benchmarking, and design recommendations (Cerclos 2022), the methodology is rigorous. Algorithms and datasets are third-party peer-reviewed and submitted Challenge projects undergo spot checks for data consistency.

Figure 1: From 'cradle to grave' whole-of-life carbon stages of a house



LCA analysis and data are context- and climate- and project- specific within a defined bounded LCA study system and methodology (Zuo et al. 2017). LCA carbon modelling is not an audit, nor does the Challenge provide a 'sustainability rating' for submitted houses. Instead, LCAs offer a dynamic and evolving approach to understanding environmental impacts over a 55-year lifecycle. They account for known, predicted, and some generalised aspects of a house.

How will the outcome of this Challenge be used?

1. To promote Challenge outcomes, design excellence and the value of architecture.
2. Qualifying houses and the winners will be:
    - displayed at public exhibition (s);
    - showcased in the event catalogue, website and through social media and promotional articles. Promotional materials would not identify the client name, address or interior floorplan layout;
    - feature in the exhibition launch attended by industry professionals, developers, builders, and government representatives.
3. The Challenge also serves as a research project and will be accompanied by a research report analysing and comparing potential housing carbon footprints and their design characteristics. Case study information will be limited to the modelled house performance and promotional materials supplied by participants;
4. Housing case studies may be used for training purposes in future rounds of the Challenge.

Format of your Challenge entry

5. This is a single stage Challenge open to architects working around Australia;
6. Architects can enter as many residential projects as they wish;
7. Architects will prepare and submit the lifecycle assessment of their house using Cerclos' RapidLCA app which will be made available to Challenge entrants;
8. There is no direct entry cost for the Challenge. Separate to the Challenge, a discounted flat fee per house of $89.00 (GST incl) applies to RapidLCA app usage;
9. The volunteer Challenge organisers provide LCA training and assistance;
10. For the residential project (s) you have LCA modelled, you are required to upload your:
    - **Completed Entrant Checklist (s)**
      The Checklist are kept confidential and serve to assist our internal data analysis and peer review processes.

    - **Completed Poster Template (s) which is for publication.**
      1 x A1 landscape format high resolution PDF per project on the supplied template.
      MAXIMUM PDF size OF 10MB

Using RapidLCA

RapidLCA is a housing app that streamlines LCA by offering a curated selection of pre-built component libraries from the larger eTool engine. It draws on reliable data sources, including AusLCI, Chenath, and EPDs. Cerclos takes reasonable steps to ensure LCAs accurately reflect housing environmental impacts, and, where assumptions are necessary, exercises care to maintain data integrity to support design decisions.

Architects have the opportunity within RapidLCA to reduce the whole-of-life carbon impact of their residential design compared to the benchmark (measured by tonnes of carbon saved and percentage improvement in global warming potential - GWP).

Benchmarking LCA Modelled Projects

In the previous Canberra rounds, Cerclos and the Challenge organisers set the benchmark using ABS-CommSec (2018) and CSIRO (2021) datasets. It reflected an average new detached Canberra home with 6-star NatHERS energy efficiency; ~250 sqm floor area and compliance with ACT and other applicable regulations.

For this round of the Challenge, LCA modelled projects will be assessed against the Australian Average Residential Benchmark that represents a mix of 'business-as-usual' (BAU) residential typologies and specifications to account for the variances across the different regions. Refer **Appendix A** for a detailed outline of benchmark data sources.

Figure 2: 'BAU' design characteristics of the benchmark house scaled from local to national

Average Dwelling Attributes	Previous Canberra Challenge	National Challenge Benchmark
No. dwellings	1	1 (10)
House size (GFA incl garage)	250sqm	2.75sqm (2748.2sqm)
No. storeys	1	2
Design life	55years	55years
No. bedrooms	4	3 (31)
No. of occupants	2.6	2.6 (26)
NatHERS star rating	6	6.4
Thermal demand: - Cooling - Heating	 22 MJ/m2 143 MJ/m2	 26.16 MJ/m2 73.19 MJ/m2
Kilowatts of solar	0kW	1.9kW (19.2 kW)

Regional Baseline House Revisions

Cerclos have prepared regional baselines aligned to the GBCA 'reference home' (2025 report) with it's state and territory variations.

Figure 3: Regional Baselines align to GBCA's 2025 reference home and regional variants

Gross floor area (m^2) – 234 m^2 (area within orange boundary)
Conditioned floor area (m^2) – 160 m^2 (highlighted in dark green)
Net floor area (m^2) – 181 m^2 (highlighted in dark and light green)

States / regions	Building elements					
	Substructure	Roof	External walls	Windows	Internal walls	Internal finishes
VIC	Waffle pod slab	Timber truss with roof tiles	Brick veneer	Double glazed	Plasterboard walls	Engineered timber carpet and ceramic tiling
ACT & TAS	Waffle pod slab	Timber truss with corrugated steel roof sheeting	Brick veneer	Double glazed	Plasterboard walls	Engineered timber, carpet, and ceramic tiling
NSW	Waffle pod slab	Timber truss with corrugated steel roof sheeting	Brick veneer	Double glazed	Plasterboard walls	Engineered timber, carpet, and ceramic tiling
NT & FNQ	Slab on ground	Timber truss with corrugated steel roof sheeting	Concrete blockwork	Single glazed low-e	Plasterboard walls	Ceramic tiling and carpet
QLD	Slab on ground	Timber truss with corrugated steel roof sheeting	Brick veneer	Single glazed low-e	Plasterboard walls	Engineered timber, carpet, and ceramic tiling
SA	Slab on ground	Timber truss with corrugated steel roof sheeting	Brick veneer	Double glazed	Plasterboard walls	Engineered timber, carpet, and ceramic tiling
WA	Slab on ground	Timber truss with corrugated steel roof sheeting	Double brick wall	Double glazed	Brick walls	Engineered timber, carpet, and ceramic tiling

Please note:

- 110mm thick brick veneer is used for the analysis and it includes the timber stud framing, waterproofing, insulation and internal plasterboard lining with paint finish.
- Building elements that do not vary across state variants are excluded from Table 2. These include structural walls, doors, services, external works and joinery; they are based on the reference home design.
- The following building elements which are typically included in the Standard Method of Measurement as outlined by ICMS-3 / RICS have been excluded from the scope of the life cycle assessment: demolition, fire services and preliminaries as no data is available.

Whole-of-life net-zero carbon (or 100% improved GWP) requires design strategies to minimise energy and material-related carbon over its 55-year lifecycle.

LCA enables architects to interactively and iteratively analyse complex project design, regulatory, and context- and climate-specific carbon impacts and interdependencies aligned to international standards for data quality.

Within the mentioned LCA stages, designing for reduced upfront carbon provides early opportunities to reduce environmental impact through material choices, efficient logistics, and low-waste construction practices, broadly categorised as:

Upfront carbon	Description
A1 – Raw Material Supply	Extraction and processing of raw materials (e.g. mining, harvesting, recycling).
A2 – Transport	Transportation of raw materials to the manufacturer. Includes fuel use and emissions.
A3 – Manufacturing	Production of construction products, including energy use and waste generation.
A4 – Transport to Site	Delivery of finished products to the construction site. Mode and distance matter.
A5 – Construction/Installation	On-site activities: assembly, energy use, and waste from installation processes.

Challenge Round Support for Architects LCA Modelling

Following the Challenge launch, architects have access to RapidLCA, where they populate menus for:

– Integrated Services – Plug Loads (aka appliances) – Outdoor Services – Structure – Finishes

Relevant quantitative design information found on drawings and in product schedules is used to populate the reasonably intuitive RapidLCA menus. Support to do this is also provided to architects in the following ways:

– requests for specific materials templates to be added to RapidLCA
– resources: information, links and videos shared via the webpage and newsletters
– modelling tutorials for architects, held with Cerclos and the Challenge team
– the Challenge Registrar regularly published FAQs for all participant questions.

FAQs also capture detailed explanations and diagrams on some of the many RapidLCA modelling parameters and carbon impact analyses, accompanied by examples of their compliance with standards. Importantly, each RapidLCA menu item contains the requisite audit trail of carbon impacts, calculations and assumptions; accessed via an information button and links. For readers wishing to explore more topics and videos:

https://www.lowcarbonhousing.com.au/resources and RapidLCA support page.

Eligibility and exhibition shortlisting

11. Within the app portal you have access to your houses only and no access to other entries;
12. To be shortlisted, we require houses entered to demonstrate a minimum of 50% improvement on Global Warming Potential (GWP) when compared to the average Australian benchmark house (derived from CSIRO and ABS data);
13. Peer review spot checks of lifecycle assessed (LCA) models will be conducted.
14. No explanation, justification, or opportunity to seek feedback will be provided to unsuccessful entrants.

Background eTool, RapidLCA usage for the Challenge

15. In 2020/2021, a review of relevant research papers was conducted and several LCA academics and sustainability engineers were interviewed. During a trial phase, Cerclos' RapidLCA was found to be a relatively easy to use residential carbon modelling platform. eTool is the software engine underpinning RapidLCA. The links below provide further information on eTool:
    - conformance with international ISO Standards for LCA https://cerclos.com/company/trust-centre/;
    - Cerclos (then eTool) has been the subject of several research papers:
        - https://www.researchgate.net/publication/273704589_Measuring_Carbon_for_Urban_Development_Planning
        - https://www.researchgate.net/publication/264638215_Residential_Building_Sustainability_Rating_Tools_in_Australia
        - https://researchrepository.murdoch.edu.au/id/eprint/35823/
    - eTool was used to carbon model two previous Canberra Carbon Challenges, the SA *Zero Carbon Challenge House* competition and the WA *10 house Living Labs* project, and has been accredited and/or used in conformance with the Living Building Challenge, Greenstar, IMPACT, BREEAM, ISCA and LEED;
16. Collaborating once again with the Challenge and the Institute, Cerclos is an established Australian company with a global presence. Together with their software users, they have saved more than 22 million kgCO2e and modelled over 70,000 LCA strategies, while Cerclos has certified more than 1,000 lifecycle assessments (LCAs) across Australia and internationally.
17. Powered by eTool, Cerclos' world-leading LCA software, the RapidLCA app is a streamlined tool that simplifies LCA for anyone, enabling architects and designers to assess residential carbon footprints and identify practical strategies to reduce emissions. RapidLCA enables users to make data-informed design decisions that help minimise the environmental impact of residential properties while remaining aligned with international ISO standards.
18. Refer to our previous Challenge modelling results completed using RapidLCA for further insights.
19. Cerclos is generously supporting architects in this Challenge by waiving their usual subscription charges, and providing a Challenge-specific modelling overlay, which includes additional materials templates and training support for architects.

The Challenge Registrar

20. Is responsible for the governance of the Challenge and undertakes to:
    a) act in accordance with and ensure compliance with the conditions outlined herein;
    b) make no attempt to unfairly or inappropriately influence the exhibition shortlisting or curation process; and
    c) accept the decision of the exhibition curator as final.
21. The Registrar will:
    d) Ensure that the Challenge is conducted fairly, equitably and with integrity and is authorised by its organising Taskgroup to prepare and coordinate it and to make all necessary decisions and determinations in relation to it;
    e) Protect the anonymity of entries, where required by these conditions;
    f) Ensure that confidentiality of submitted materials is maintained;

g) Ensure that all entries comply in all respects with these conditions, and disqualify (in writing) non-compliant or late entries;
h) facilitate the opportunity for entrants to ask questions and receive answers to all questions asked by entrants;
i) communicate prompt notification of entrants of any material change in the Challenge conditions and/or key dates;
j) take appropriate action should an actual, potential or perceived conflict of interest arise.

22. Where an entrant needs to communicate with the Registrar in accordance with these conditions, such communication must be via email addressed as follows **registrarAZCHC@gmail.com.**

Other Challenge Conditions

23. conditions are based on the *Model Conditions for an Architectural Competition*, published by the Australian Institute of Architects;
24. It is not the organisers intent to engage the authors of the shortlisted project in any further work;
25. The organisers can, and have undertaken carbon models of their houses, but are not eligible to compete in the Challenge. Like other projects, their houses add to the comparative case study understanding of low carbon housing, sought by this initiative.
26. To ensure that all entrants are treated equally and have the same access to participation in the Challenge, each entrant must:
    a) comply in all respects with these conditions;
    b) be responsible for the accuracy of their submitted house carbon footprint modelling;
    c) not act or behave in any way that could bring the Challenge into disrepute or compromise its integrity;
    d) not communicate with the exhibition curator, request assistance, preferential treatment nor seek to influence any outcome of the Challenge;
    e) inform the Registrar of any actual, potential or perceived conflict of interest;
    f) co-operate fully with the Registrar to provide any reasonable information requested, or to assist any investigation into potential breaches of these conditions;
    g) not make or be associated with any public comment about the Challenge or another entrant, nor make public any Challenge information obtained;
    h) not engage in any collusion, anti-competitive conduct or similar conduct with any other entrants.
27. An entrant may be immediately disqualified for any collusive or anti-competitive conduct;
28. Entrants must take all reasonable steps to conform with these conditions, which you agree to by entering the Challenge;
29. A 'conflict of interest' will occur where an entrant or any associate has any business, personal or other relationship that could result in, or could reasonably be perceived to result in, the entrant gaining a benefit (includes non-financial) not available to all other entrants in the Challenge ;
30. All complaints in relation to the Challenge must be addressed in a timely manner and in writing to the Registrar, who will investigate and make a determination in relation to the complaint. Any such determination of the Registrar is final;
31. The written complaint must set out, at least:

a) the circumstances forming the basis of the complaint;
b) the impact of the complaint on the person making the complaint;
c) any other relevant information, and
d) the remedy or corrective action desired by the person making the complaint.

32. An entrant may withdraw their entry at any time before the deadline for submitting entries in the Challenge. Notice of withdrawal must be given via email, addressed to the Registrar;
33. An entrant may not withdraw from the Challenge after announcement of the shortlisted projects for exhibition.

Permissions and Disclaimers

34. From 2026 onward, the Challenge has the right to store, publish or reproduce submitted entry materials in any way relating to the conduct or promotion of the Challenge and its associated research. To this end, the entrant grants the Challenge and its partners (the Australian Institute of Architects and Cerclos) a royalty free, non-exclusive, perpetual, and irrevocable licence to use, edit, exhibit and reproduce the entrant's materials, subject to full and accurate attribution and conformance with the entrant's moral rights in each instance;
35. Ownership of all intellectual property rights and copyright in submitted materials and concepts remains with the entrant;
36. The entrant warrants that in preparing their entry there has been no infringement of the intellectual property, moral right and copyright of others, and that they have obtained any necessary licences or assignments from third parties;
37. The Challenge and its Registrar will accept no responsibility for any costs incurred by an entrant resulting in any way from their participation in the Challenge;
38. All costs associated with the preparation and submission of an entry in the Challenge, including RapidLCA app use, labour, materials, and any indirect costs such as photography, travel and sub-consultant costs must be met by the entrant;
39. Entrants are responsible for the lifecycle assessment (LCA) modelling of their submitted houses. The Challenge is not responsible for entrants, their clients or members of the public relying on information about potential carbon footprints, their design characteristics or housing case studies;
40. Carbon modelling is not an audit, nor is the Challenge offering a carbon or sustainability rating for your house. LCAs are a dynamic and evolving means to understand environmental impacts. They account for known, predicted and some generalised aspects of a house over its lifecycle using reliable data sources such as AusLCI.
41. The entrant will indemnify the Challenge organisers and Registrar and keep them indemnified in respect of any loss suffered, as a result of:
    a) breach of these conditions by the entrant or any associate;
    b) negligence of the entrant or any associate, and
    c) any unlawful act, omission or fraud of the entrant or any associate.
42. These conditions are governed by the laws applying in Australia and entrant must comply with all relevant laws in preparing and submitting their entry and participating in the Challenge.

Appendix A: Australian Residential Benchmark Update – 2025

Cerclos have updated the eTool Residential Benchmark for Australia to reflect the most recent data and better represent the current mix of residential building types across the country. This update ensures that your project assessments align with the latest trends and statistics in Australian housing when you use RapidLCA in the Challenge.

What's New? The benchmark now incorporates the latest dwelling approval data from the Australian Bureau of Statistics (ABS) for the 2024–25 financial year, released in July 2025. This data reflects a shift in the types of homes being built across Australia.

Dwelling Type Mix (FY 2024–25)	% of Total Approvals
Detached Houses	60.6%
Semi-Detached / Townhouses	11.8%
Low-Rise Apartments (1–3 storeys)	11.8%
High-Rise Apartments (4+ storeys)	15.7%

Source: New Dwelling Approvals – Australia (FY 2024–25, Original Terms)

Note: Minor dwelling types (e.g. boarding houses, group homes) account for ~2.2% and are excluded from the benchmark.

Floor Area - To estimate energy use and material impacts accurately, we have used the average floor areas reported by the ABS:

Dwelling Type	Average Floor Area (m²)
Detached Houses	232.3
Semi-Detached / Townhouses	151.0
Apartments (All Types)	137.0

Source: Average Floor Area of New Residential Dwellings (April 2023).

The floor area of a building reported by ABS includes useable space in a building (and its attachments) at the final stage of its construction. The boundary of the recorded floor area of a building is delineated by the external perimeter of the exterior walls of the building including garage, common areas of apartments such as foyers, lifts and resident amenities are also included. The area under unenclosed verandas, carports, etc., attached outside the exterior walls of one or more storeys, is excluded.

For each of these density types, eTool have formulated a BCA code compliant building. We have then created a nominal statistical mix of floor areas to match the average new dwelling size (Fully Enclosed Covered Area) in Australia (196 m2). In this way we come up with a "dwelling" that is a mix of densities and matches the size of the average Australian dwelling.

The ABS does not provide a breakdown of conditioned floor area (spaces that are actively heated or cooled). To address this, we have used proportional estimates from CSIRO research on typical conditioned area ratios for Class 1 and Class 2 buildings for all Australian states for the period of one year 2024/2025.

(Source: https://ahd.csiro.au/dashboards/design/area/)

In eTool, the Gross Floor Area (GFA) includes both fully enclosed spaces and unenclosed covered areas (UCA), such as verandahs, patios, balconies, and carports. However, there's no fixed percentage for how much of a home's area is considered UCA in Australia. This is because the size and presence of these spaces can vary a lot depending on the type of dwelling, the local climate, and common design practices.

For example, detached houses in warmer regions like Queensland or Northern Australia often have larger verandahs and patios to help with shading and cooling. In contrast, homes in cooler areas like Victoria or Tasmania usually have smaller outdoor covered spaces. Medium- and high-density homes, like townhouses and apartments, tend to have much smaller UCA, usually just balconies or small porches.

Because of these differences, there's no one-size-fits-all percentage for UCA. Instead, we have based our assumptions on real-world examples, climate conditions, and professional experience to reflect typical Australian housing. In this benchmark, we have assumed that UCA is around 28% of the GFA. Based on this, the total GFA for our model residential dwelling is 274.8 m2. This figure represents an average across different dwelling types and regions in Australia.

Occupancy

The average number of persons per household in Australia remained stable at 2.6, according to the ABS Census 2021. Meanwhile, the average number of bedrooms per dwelling decreased slightly from 3.2 to 3.1, reflecting a gradual shift in housing design and occupancy patterns *(Source: ABS Housing Occupancy and Costs – 2019–20)*

Solar System

The assumptions relating to solar PV systems for Australian dwellings in this benchmark are based on typical conditions and national statistics. The focus is on detached and semi-detached houses, which together make up around 73% of all residential dwellings in Australia (Australian Bureau of Statistics, 2021 Census). These housing types are the most suitable for rooftop solar installations because they usually have sufficient roof space and independent ownership structures.

We have assumed a 6.6 kW solar PV system, which represents the most common size for Australian households according to the Clean Energy Regulator and Solar Choice data. This system size is generally compatible with standard single-phase power connections, making it accessible for most detached and semi-detached homes.

In line with national adoption trends, we have also considered that around 40% of Australian homes already have rooftop solar PV installed, based on figures reported by the Clean Energy Regulator (2024). This reflects Australia's world-leading uptake of residential renewable energy.