Homes That Count

The Living House Sustainability Story

RTA STUDIO

FISHER & PAYKEL APPLIANCES

THE LEVER ROOM

1. Executive Summary

What if our homes didn't just shelter us, but actually made life better – for people, for the planet, and for generations to come?

The Living House is proof that they can. Designed in Aotearoa and brought to life by RTA Studio in partnership with Fisher & Paykel Home Solutions and The Lever Room, The Living House is a light, generous, warm, and cheerful home. Three-bedroom house: six-week build, affordable path to homeownership, with modelling showing it can be net climate-positive over 50 years.*

In short, it's a house that gives more than it takes.

This project is more than clever design or smart technology. It's about rethinking housing as infrastructure for the future: affordable, climate-positive and culturally grounded. And the best part? It's not a one-off. The Living House shows what's possible when architects, innovators and systems thinkers join forces – and it offers a replicable blueprint for New Zealand and beyond.

Because if a house can store carbon, support human health and still look beautiful – it's not just building, it's changing the game.

Climate-positive scenario result depends on stated assumptions, including timber carbon storage and benefits from exported solar electricity.

2. Introduction: Homes That Count

The Living House is more than a prototype – it's proof that housing can actively address some of the biggest challenges facing Aotearoa New Zealand. At a time when the climate crisis, housing crisis, and cost-of-living crisis converge, the Living House shows that healthy homes can be climate-positive, affordable, culturally relevant and commercially scalable.

This project is a collaborative achievement between RTA Studio, Fisher & Paykel Home Solutions and The Lever Room. Together, the partners have created a housing model that goes beyond reducing harm to deliver net benefits – capturing carbon, supporting wellbeing and creating a replicable blueprint for the future. It is a demonstration of what happens when architecture, technology and systems thinking unite around a common purpose.

3. The Challenge & Response

Why Homes That Count, Matter.

The built environment contributes nearly 40 percent of global carbon emissions, and in New Zealand, housing affordability has dropped to its lowest point in decades.

In 2024, The Lever Room comprehensively measured the indoor environments of 258 households and found:

- Only 1 in 3 bedrooms kept above 12C° during winter evenings (the threshold for acute respiratory events and cardiovascular impacts).
- 3 out of 5 children were shivering indoors.
- Over 2/3 of households feel stressed, worried or a sense of dread when receiving their electricity bill.

Around the world, governments and communities are asking the same question:

> **How do we house people affordably without deepening the climate crisis?**

The Living House offers a solution. It shows that housing can be climate aligned, safeguard the health of our families, and be commercially viable at the same time.

By combining low-carbon materials, renewable energy, and cultural intelligence, the project sets a precedent for how housing can shift from being a net burden on the planet to being a net positive contributor.

Turning Housing into a Carbon Store.

A key contribution of the Living House is the biogenic carbon stored in its timber structure. Timber absorbs carbon dioxide during growth, and when used in long-life applications such as housing, much of that carbon remains stored for the life of the building.

The Lever Room's whole-building LCA modelling, aligned with international standards (IPCC, ISO 14040/44) and using New Zealand-specific data, models the Living House to achieve a net climate-positive outcome under the stated assumptions (including timber carbon storage and exported solar electricity).

Key insights include:

- Cross-Laminated Timber (CLT): The prefabricated timber structure stores biogenic carbon while providing high structural performance.
- Operational savings: Integrated renewable energy and high-efficiency appliances further reduce emissions over time, creating a home that consistently performs better than conventional builds.
- Landfill science: In New Zealand, over 90 percent of construction timber ends up in landfills, where anaerobic conditions slow degradation to near zero. Studies confirm that Radiata pine has a degradable organic carbon fraction (DOCf) of just 0.1 percent, meaning the carbon remains locked in place for extremely long timescales.

This level of detail matters. It positions the Living House as a transparently modelled solution that policymakers, developers and investors can assess with confidence.

4. What Makes the Living House Different

The Living House stands apart because it brings together qualities that are rarely achieved in a single project. Whole-building LCA modelling indicates a net climate-positive outcome under defined scenarios assuming timber biogenic carbon storage and exported PV electricity. At the same time, it is affordable and accessible, with an estimated base price of NZ$335,000 including GST, and an open-source design package that makes wider adoption straightforward. By using natural materials and integrating Fisher & Paykel's energy-efficient solutions, it offers a healthier, warmer family home.

The home is also fast to build, modular, and scalable – thanks to prefabricated cross-laminated timber panels, it can be assembled in just six weeks without compromising quality. Equally, it is culture-led, with indigenous design principles woven into its form and function, ensuring that it not only performs environmentally but also resonates socially and culturally.

Together, these elements create a housing model that is practical, replicable, and transformative.

Framing the Future.

The Lever Room has helped elevate the Living House from a single innovative build into a replicable model for healthy climate-positive housing. A cornerstone of this contribution has been carbon intelligence.

Through an evidence-based, standards-aligned whole-building LCA, The Lever Room has modelled the Living House's full life-cycle impacts (materials, construction and operations) and found a net climate-positive outcome when accounting for timber biogenic carbon storage and exported solar electricity.

In addition to this technical modelling, The Lever Room has provided strategic alignment by ensuring the project is mapped to national climate policy frameworks. This alignment positions the Living House as an exemplar project that can inform regulatory pathways and support emerging performance standards for the built environment.

Equally significant has been The Lever Room's framing of the project. By demonstrating that carbon performance, human health and affordability are not mutually exclusive – but are in fact mutually reinforcing – it has reframed climate-aligned housing as financially viable at scale. The Living House's base cost and rapid prefabricated assembly serve as proof points that high performance can coincide with cost efficiency and much needed accessibility.

The Lever Room's technical rigour, both in this project and in earlier measurement work with Raukawa Energy Innovation, illustrates how design, science and strategy can be bridged to deliver transformative outcomes. It ensures the Living House is not only a technically robust demonstration, but also a credible, repeatable blueprint that can be scaled across diverse communities.

6. From Prototype to Policy: A Pathway for Aotearoa

The Living House is more than a singular project – it is a demonstration of what is possible when housing, climate, and culture are treated as interdependent.

The project also demonstrates how new policy mechanisms – such as MultiProof consenting, carbon-based procurement weighting and investment in prefabrication – can accelerate deployment at scale. These levers are essential if Aotearoa is to move from bespoke, low-volume housing to a scalable, climate-positive system.

The Lever Room's contribution ensures that the project is not only technically robust but strategically aligned with where the sector needs to go to align with climate science. It offers policymakers a model to support, developers a path to scale, and communities a home that reflects values and needs. RTA Studio's design leadership proves that affordable housing can embody cultural richness and architectural excellence, while Fisher & Paykel Home Solutions' systems integration demonstrates that energy efficiency and user experience are best achieved together.

Collectively, the Living House shows that only through partnership across disciplines can we unlock new standards for housing.

7. Looking Ahead: A Blueprint for the World

While grounded in Aotearoa, the Living House offers lessons that reach well beyond. Every nation is wrestling with the challenge of how to house people affordably without worsening the climate crisis, while also embedding cultural intelligence into the built environment. The Living House quietly demonstrates that it is possible to weave these threads into a replicable model.

By proving that homes can give more than they take, the Living House sets a precedent that can inspire international solutions. Together, they demonstrate a model of collaboration—not claiming to have all the answers, but showing what is possible, and achieving a result that is greater than the sum of its parts.

8. Closing: A New Standard

The Living House demonstrates that homes can be climate positive, community-focused, affordable, and beautiful. It sets a new benchmark for housing: not just minimizing harm, but actively contributing to people, planet, and economy.

This vision is made possible through the fusion of RTA Studio's architectural design, The Lever Room's carbon intelligence and Fisher & Paykel's technological innovation—together creating a living model for the future of housing.

It is not just a house, but a blueprint for a future where homes truly count and give more than they take.

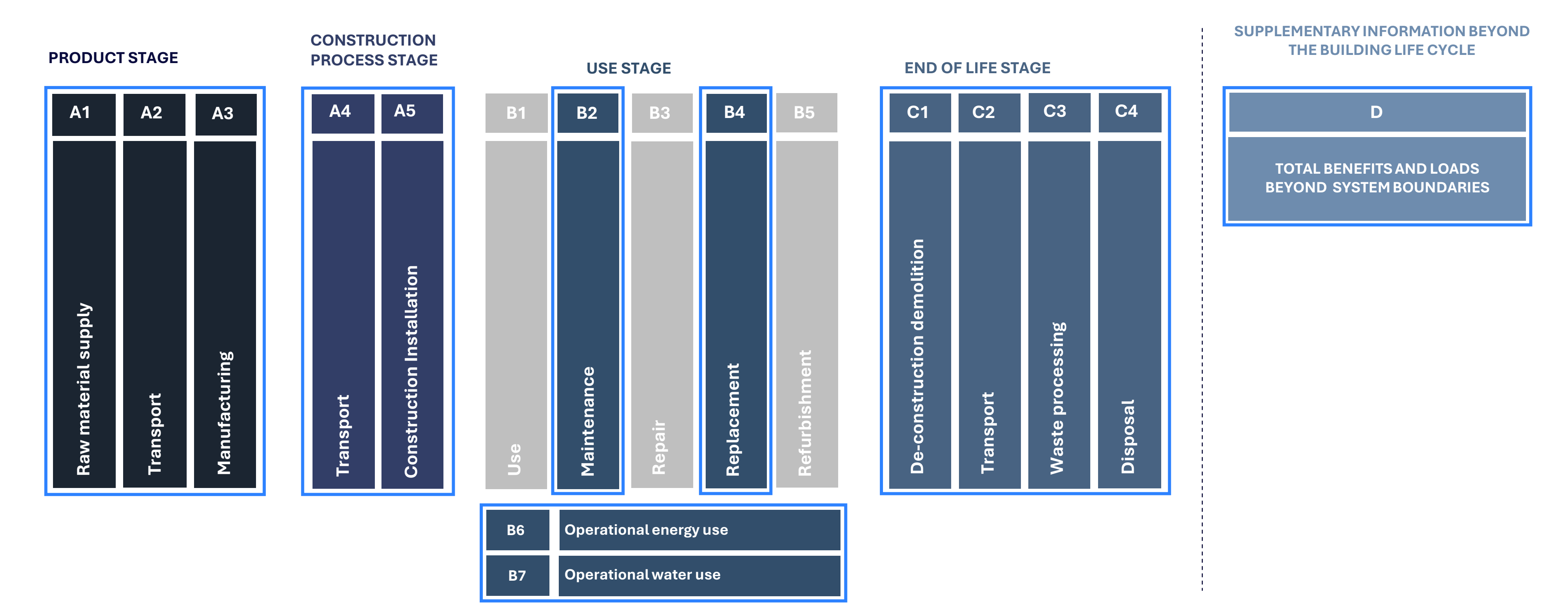
In summary, the Living House offers a vision for housing in Aotearoa that is regenerative, inclusive, and practical. It is an evidence-based response to intersecting crises, and a demonstration of what is possible through cross-sector collaboration.

By centering climate performance, affordability and culture, it establishes a new standard for housing that respects both people and planet.

9. Technical Appendix: LCA Analysis

The Lever Room conducted this Life Cycle Assessment (LCA) to evaluate the greenhouse gas (GHG) profile of the Living House and associated Fisher & Paykel Home Solutions technologies.

This whole-building LCA was developed using the BRANZ LCAQuick tool and supported by Environmental Product Declarations (EPDs) from Fisher & Paykel Appliances.



Note: LCAQuick automatically estimates emissions for water supply and treatment (B7) even when operational energy (B6) is excluded. In Scenario 1, these values are retained to illustrate the tool's default assumptions but are not part of the embodied-only boundary.

Scope & Methodology.

BUILDING TYPE	Stand-alone residence.
BUILDING AREA (TOTAL)	85m^2 Gross Floor Area.
INPUTS	RTA Studio drawings, specifications, and engineering calculations; Fisher & Paykel data for solar energy, hot water, and appliances.
ASSESSMENT HORIZON	50
SCENARIOS ANALYSED	Embodied emissions of the building. Embodied + operational emissions. Embodied + operational emissions including a solar photovoltaic system (default scenario).
KEY RESULT	The Living House achieves a net negative greenhouse gas (GHG) balance of –12,056 kgCO_2e over its assessed life cycle in the default climate positve scenario. This result is primarily attributable to the biogenic carbon stored within timber building materials, in combination with the avoided emissions generated through the use of on-site solar energy and the export of surplus electricity to the grid.

Raw Materials and Appliances.

Timber for the Living House is supplied by Red Stag from New Zealand plantation-grown radiata pine. Because it is plantation-grown timber, it is a renewable material resource. Red Stag also holds FSC Chain of Custody certification, which provides traceability of FSC-certified material through the supply chain (Red Stag Timber Ltd, 2025). Steel used in roof and wall cladding is supplied by New Zealand Steel. Glass and aluminum windows and doors, including their frames, are supplied by APL and are represented by the Environmental Product Declaration (EPD) from APL (APL Window Solutions, 2023).

The appliances supplied by Fisher & Paykel are primarily represented by a LCA of various appliances completed by thinkstep (Fisher & Paykel Appliances, 2022). The solar panel system is represented by the BRANZ dataset in their online tool LCAQuick (BRANZ, 2023).

Construction.

Transportation of materials and products to site, as well as on-site construction activities cannot be represented by activity data from RTA Studio, as Living House may be constructed in a diverse range of geographies with alternate local suppliers. The construction impacts have therefore been estimated using the impacts approximated from within the BRANZ LCAQuick tool, which derives its data from EPDs provided in addition to or instead of generic data, as described in the BRANZ New Zealand whole-building whole-of-life framework: LCAQuick v3.4 – a tool to help designers understand how to evaluate building environmental performance (Dowdell, Berg, Butler, & Pollard, 2020).

Operations & Maintenance.

The operational energy consumption for the Living House is provided by Fisher & Paykel based on design criteria for the HVAC, solar system, and thermal profile of the house. This accounts for interior design conditions, the building envelope, consumption profiles, and heat loss (W/K) for the floors, roof, walls, skylights, and glazing in walls and doors. The embodied and operational GHG emissions from the dishwasher, cooktop, rangehood, and oven are extracted from the associated LCA (Fisher & Paykel Appliances, 2022).

BRANZ's Photovoltaic Generation Calculator was used to estimate the photovoltaic solar system output. This tool evaluates the expected annual generation based on system size and location-specific solar data. This data was then input into the BRANZ LCAQuick tool, which applies an annualised GHG emission factor to account for grid displacement using a weighted yearly average (Dowdell, Berg, Butler, & Pollard, 2020).

This provides an annualised calculation as a balanced, conservative estimate of the overall GHG emissions savings from the solar system across a full year. Fisher & Paykel have separately calculated the estimated energy consumption from the heat pump water heater, and the estimated energy consumption of the air conditioning unit based on the thermal load of the Living Home. The embodied GHG emissions of the solar system are estimated from an EPD of 1m^2 manufactured photovoltaic module (REC Solar , 2023) and an EPD of the Fronius Primo Gen24 Plus inverter (Fronius, 2021).

The embodied carbon emissions associated with Fisher & Paykel appliances are scaled to reflect an assumed lifetime of 20 years, which is represented via two replacements over time: one after 20 years, and one after 40 years. The lifetime of the photovoltaic solar system is assumed to be 30 years, and so one replacement is assumed across the buildings' 50-year life cycle.

End-of-Life.

At the end of life of the Living House, it is assumed the building is deconstructed/demolished and most materials are unsuitable for direct reuse. End-of-life waste pathways (reuse, recycling, energy recovery and landfill) are modelled using BRANZ LCAQuick "current practice" defaults for New Zealand. (BRANZ, 2020) Timber and engineered-wood products contain biogenic carbon; radiata pine stores around ~0.9 tCO_2 per m^3 (density dependent). (Scion, 2019) Consistent with MBIE/BRANZ guidance, timber reaching landfill is modelled to include ongoing storage of remaining biogenic carbon after degradation and associated methane/carbon dioxide release under the landfill scenario used. (MBIE/BRANZ, 2023)

Greenhouse Gas Emission Results.

In this scenario, the Living House has a modelled net balance of -12,056 kgCO_2e over an assumed 50-year building life. It includes embodied emissions, operational emissions, and a rooftop solar PV system. Emissions from operation and non-timber materials are more than offset by biogenic carbon stored in the timber and the benefits of PV generation and exported solar electricity. This equates to -140 kgCO_2e/m^2 (Figure 1, right). Note: operational electricity emissions are netted to zero here due to PV generation, so they are not shown on the graph; export benefits are shown separately based on the modelled surplus electricity sent to the grid.

Across all three scenarios, steel roofing was a major contributor to the building's carbon footprint, accounting for +4,248 kgCO_2e emissions. This was followed by polyurethane insulation at +3,548 kgCO_2e and carpets at +1,120 kgCO_2e emissions. These materials add significantly to the embodied carbon due to their manufacturing processes and material composition. In contrast, Cross-Laminated Timber (CLT) - the primary structural material - provided a substantial carbon benefit, sequestering -37,765 kgCO_2e through stored biogenic carbon. This underscores the role of timber in reducing the overall impact of the building's embodied emissions. Results are generated by the BRANZ LCAQuick tool (Dowdell, Berg, Butler, & Pollard, 2020).

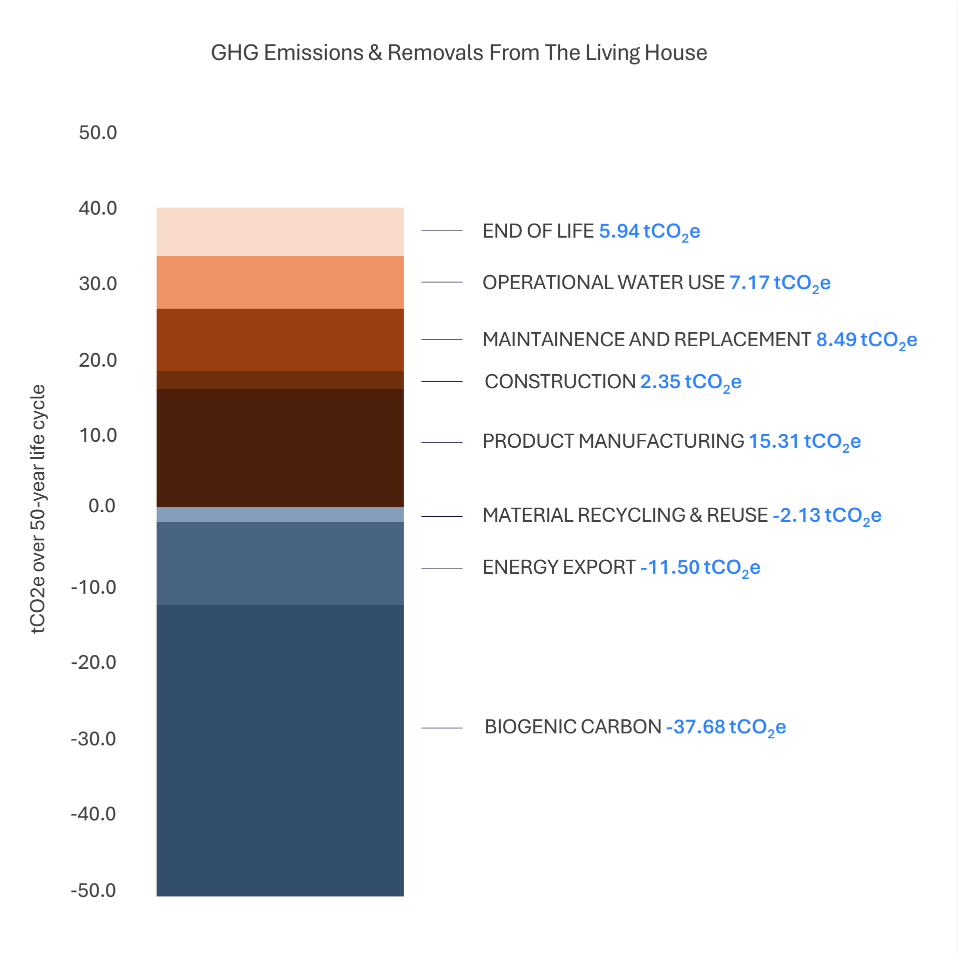


Figure 1: A summary of the GHG emissions and removals from the Living House (Default scenario: building, energy use, solar system, and energy export).

Additional Scenario 1: Building Only

This scenario represents the embodied emissions of the building materials and construction only. The LCAQuick tool automatically includes a small contribution for operational water use (B7) based on default occupancy and national water treatment factors. No operational energy (B6) is included in this scenario - the water component remains only to show the model's default baseline and should not be interpreted as a complete operational phase.

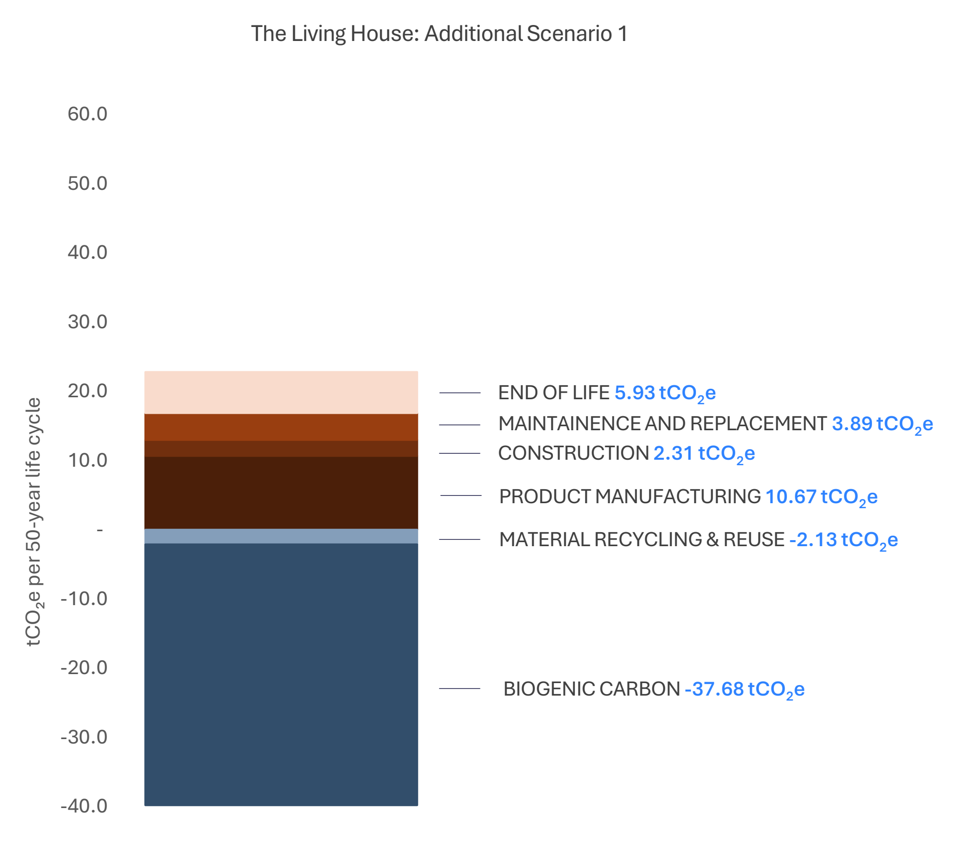


Figure 2: A summary of the GHG emissions and removals from the Living House (Scenario 1: building only).

Additional Scenario 2: Building and Energy Use

This scenario examines the building and the energy consumption patterns of occupants, but without the installation of the photovoltaic solar system. In this scenario, the operational energy and water use is included, which are the biggest drivers of carbon emissions alongside maintenance and replacement.

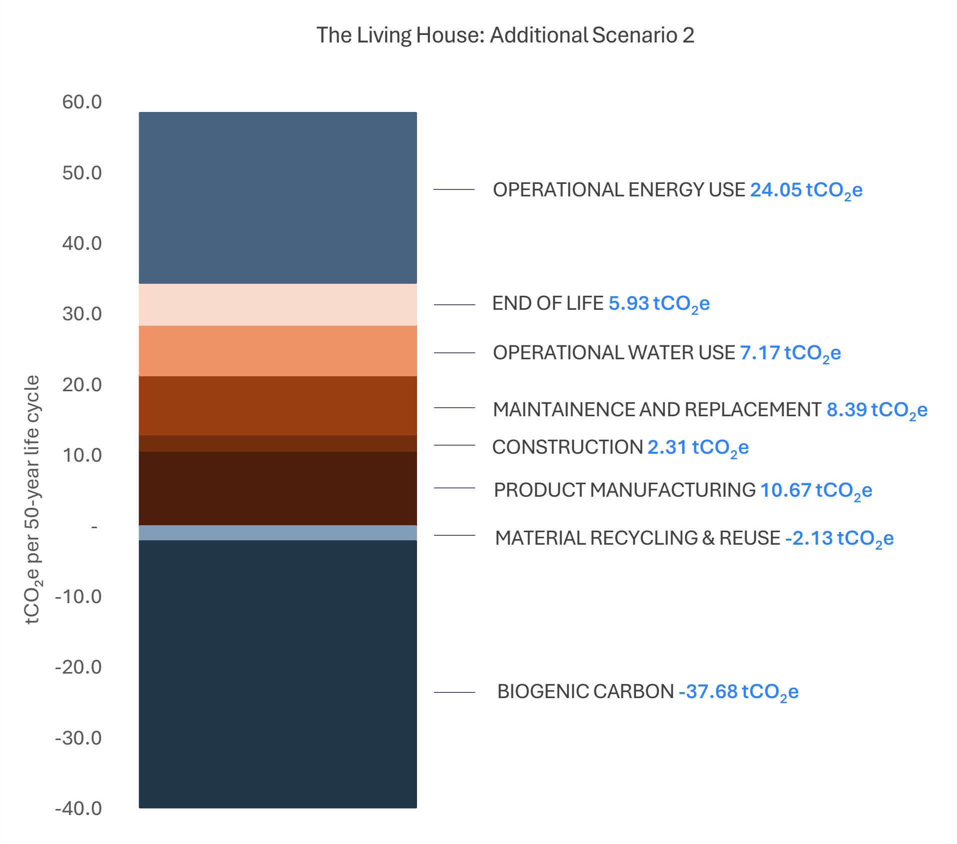


Figure 3: A summary of the GHG emissions and removals from the Living House (Scenario 2: building and energy use, without solar energy).

Fisher & Paykel Home Solutions.

The estimated embodied GHG emissions of the Fisher & Paykel appliances are provided in Table 1 below. The one-time purchase is provided (single product), as are the total emissions associated with the assumed product replacements required over the building life cycle. The heat pump and the air conditioning unit are based on approximations from bill of material data, and not complete EPDs – unlike all other appliances listed here. It is strongly recommended EPDs are pursued for all products in the future to improve the accuracy of these estimated GHG emissions. A sensitivity analysis of these two appliances was completed to determine whether they could jeopardise the climate positive nature of the Living House. It was found that even when multiplying their GHG emissions tenfold, the net emissions of the Living House were negative.

Table 1: The embodied GHG emissions of each Fisher & Paykel appliance to be installed in the Living House.

Fisher & Paykel Product Inventory	Embodied (single product) $kgCO_2e$	Embodied (building life cycle) $kgCO_2e$
Dishwasher	750	2,251
Cooktop	139	417
Rangehood	36	108
Oven	450	1,351
Heat pump water heater	101	303
Airconditioning heat pump	41	123
Solar panel	4,690	9,380
Solar PV inverter	1,307	3,921
Total	**4,797**	**14,391**

Concluding Insights.

This whole building life cycle assessment has been based on the BRANZ LCAQuick tool (BRANZ, 2023), with supplementary guidance from a range of EPDs provided by Fisher & Paykel. We recommend that to improve the accuracy and robustness of this study, a full life cycle assessment is completed in line with BS EN 15978:2011, and supplier-specific product carbon footprints or EPDs are generated in compliance with ISO 14067/EN15804+A2 for all products and materials.

In Summary.

The Lever Room's whole-building LCA modelling indicates that, under the stated timber carbon storage and solar generation/export assumptions, the Living House has a modelled net balance of -12,056 $kgCO_2e$ over an assumed 50-year service life, driven by biogenic carbon stored in the timber and the benefits of on-site solar generation and exported electricity.

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