

Hempcrete Modular Panels – Industry Insights and Future Action for Affordable Carbon Housing

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Photo credits: Duna gro (2024)

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The findings, interpretations, and conclusions expressed in this presentation are solely those of the authors and do not necessarily reflect the views of the individuals or organizations acknowledged above.

OUR OBJECTIVES

- Exploration of hempcrete potential to support sustainable housing construction in Australia.
-> **Scalable modular panels and alignment with national carbon reduction targets.**
- **Stakeholder engagement** across the construction, hemp, and policy sectors
- Identification of **challenges and outlining strategic recommendations**

Outputs:

Policy Brief:

Affordable Carbon Housing: A Scalable Solution for Low-emission Housing Using Modular Hempcrete Technology, March 2025.
<https://doi.org/10.26181/29151971>

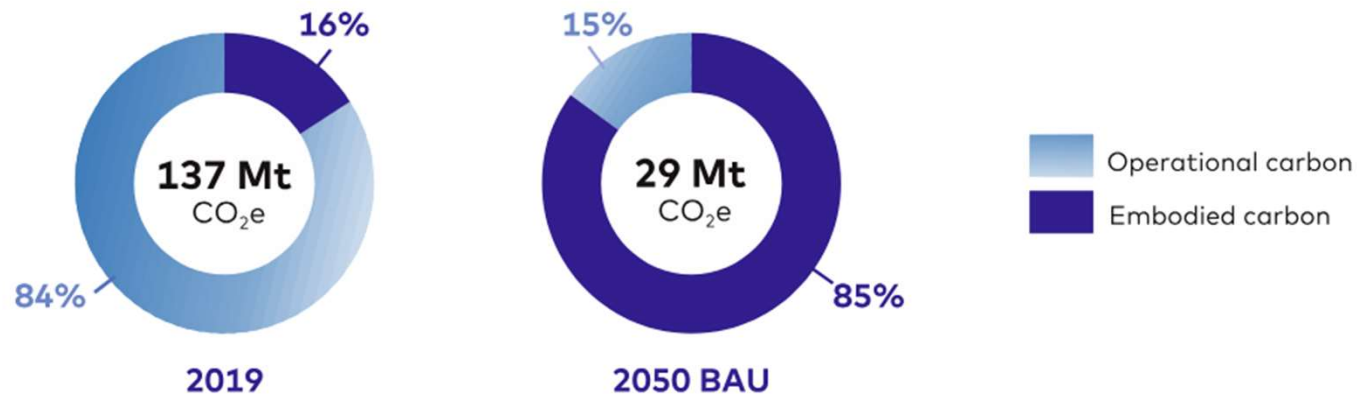
Report:

Building Australia's Future: Industry Perspectives on Hempcrete Panels for Affordable Carbon Housing, March 2025.
<https://doi.org/10.26181/29126492>

GLOBAL CONSTRUCTION INDUSTRY CARBON EMISSION TARGETS

- The global construction industry contributes 38% of global energy-related CO2 emissions (UNEP, 2021).
 - 26% from embodied carbon (emissions from material production and construction).
 - 74% from operational carbon (energy use in buildings).
- Current focus:** global efforts are concentrated on reducing operational carbon
- Challenge for Australia:** traditional materials with high embodied carbon still dominate

Carbon emissions in Australia's construction sector



Source: GBA & thinkstep (2021).

- In 2019, **16%** of building carbon emissions in Australia were from **embodied carbon**.
- By **2050**, this is projected to rise to **85%** due to the decline in operational emissions.

Adopting bio-based materials in Australia can contribute to meeting net zero 2050 targets and support sustainable development.

Australian construction policies & standards

International standards like **ISO14040** and **AS ISO 14064** guide emissions calculations (Climate Action, 2023).

Guidelines for calculating carbon-neutral buildings and reducing embodied carbon across various building classifications.

Resistance to adopting sustainable practices?

National construction code (NCC) updates & energy efficiency

•NCC updates:

- The **2022 update** introduces stricter **energy efficiency provisions** for residential buildings, raising the **NatHERS rating** from 6 to 7 stars.
- The aim is to reduce **greenhouse gas emissions** and improve thermal comfort in homes.

Further changes to higher rating standards?

Prefabricated modular housing potential

•Government housing initiatives:

- National Housing Accord to build **1 million homes by 2029**, increasing demand in the construction sector (Treasury, 2024).
- Prefabricated construction is gaining traction due to its sustainability benefits: reduced construction time, quality control, and lower disruption.
- The Government will provide **\$3.5 billion** to support the delivery of new homes and has committed \$350 million to support the delivery of 10,000 affordable homes, with the potential for an additional 10,000 affordable homes (Treasury, 2024).
- Funding of \$30.38 million is being invested to build 114 modular homes in Victoria
<https://www.premier.vic.gov.au/modular-homes-housing-people-across-victoria>

Demand for sustainable construction materials in Australia

- Increased consumer awareness and the rising cost of energy-efficient homes.
- **Hempcrete** and other renewable materials are gaining traction in bespoke construction.
- Builders face challenges due to high construction costs and limited adoption of sustainable materials.

• **Barriers:** Supply chain gaps, interest rates, and builders' resistance to change.

Competitive sqm price point of hempcrete panels compared to mainstream materials:

\$2,000 – 2,500 for a 3BR dwelling

\$2,700 – 3,500 for a 4BR dwelling

Average cost per square metre to build a new home in Australia in 2023

Construction type	Level of finish		
	Low	Medium	High
3BR weatherboard project home	\$1,817	\$2,034	\$2,516
3BR brick veneer project home	\$1,936	\$2,157	\$2,576
3BR full brick project home	\$2,012	\$2,235	\$2,794
4BR weatherboard home	\$2,551	\$2,726	\$3,402
4BR brick veneer home	\$2,711	\$2,839	\$3,573
4BR full brick home	\$3,032	\$3,464	\$3,817
3BR brick veneer project home	\$2,019	\$2,231	\$2,752
3BR full brick project home	\$2,094	\$2,355	\$2,889
4BR brick veneer home	\$2,834	\$3,203	\$3,718
4BR full brick home	\$3,132	\$3,596	\$3,926
Architecturally designed executive residence	\$4,157	\$5,322	\$7,444

Source: [BMT Quantity Surveyors](https://www.bmtqs.com.au/construction-cost-table) (2023) Retrieved from www.bmtqs.com.au/construction-cost-table on 15th August 2024.

HEMPCRETE CHARACTERISTICS AND KEY BENEFITS

•Sustainability benefits:

- **Low embodied carbon:** Hemp captures carbon during its growth cycle and locks it into the final product, making Hempcrete **carbon-negative** (Ip & Miller, 2012).
- **Renewable and low-input:** Requires minimal pesticides, synthetic fertilizers and water, relative to other fibre crops (Li, 2021).
- **Soil regeneration:** Hemp improves soil health and supports biodiversity, promoting sustainable agriculture.

Hempcrete can sequester carbon, with up to 165 kg of CO² per cubic metre (Daly et al. 2013).

Currently, **standard residential construction processes emit 228 kg CO²e for a 1 m² section.**

HEMPCRETE CHARACTERISTICS AND KEY BENEFITS

•Fire resistance:

- Rated for up to **1 hour of fire exposure** (ASTM standard), with potential to withstand **up to 120 minutes** when plastered (Arch Daily, 2021).
- It does not contribute to fire severity, making it a safer construction material.

•Durability and reusability:

- **Durable:** Resistant to rot and pests, with a long lifespan that reduces maintenance costs.
- Can be **crushed and reused** in new building projects, offering a circular economy approach.

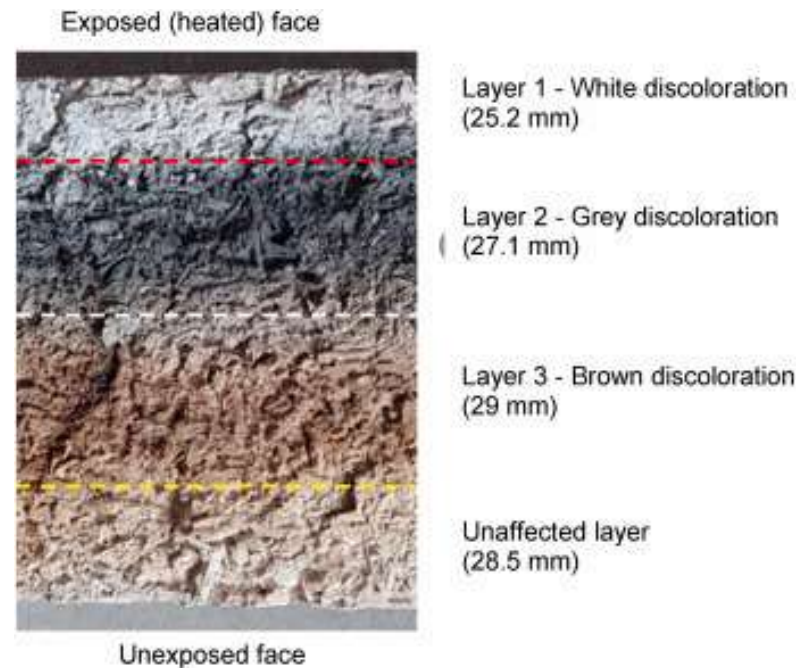
•Health impact:

- Improves **indoor air quality** by managing humidity and reducing mould growth (Bevan & Woolley, 2008).

Sound insulation:

- Acoustic absorption of 40-50% of sound signals (medium, 2022).

Effect of 120 hempcrete exposure to fire.



Source: Shewalul et al. (2023)

HEMPCRETE STRUCTURAL INSULATED PANELS (SIP)

- Hempcrete SIPs are more commonly manufactured by laying wood frames flat and filled with a hempcrete mixture.

- Differences in panel design varies:

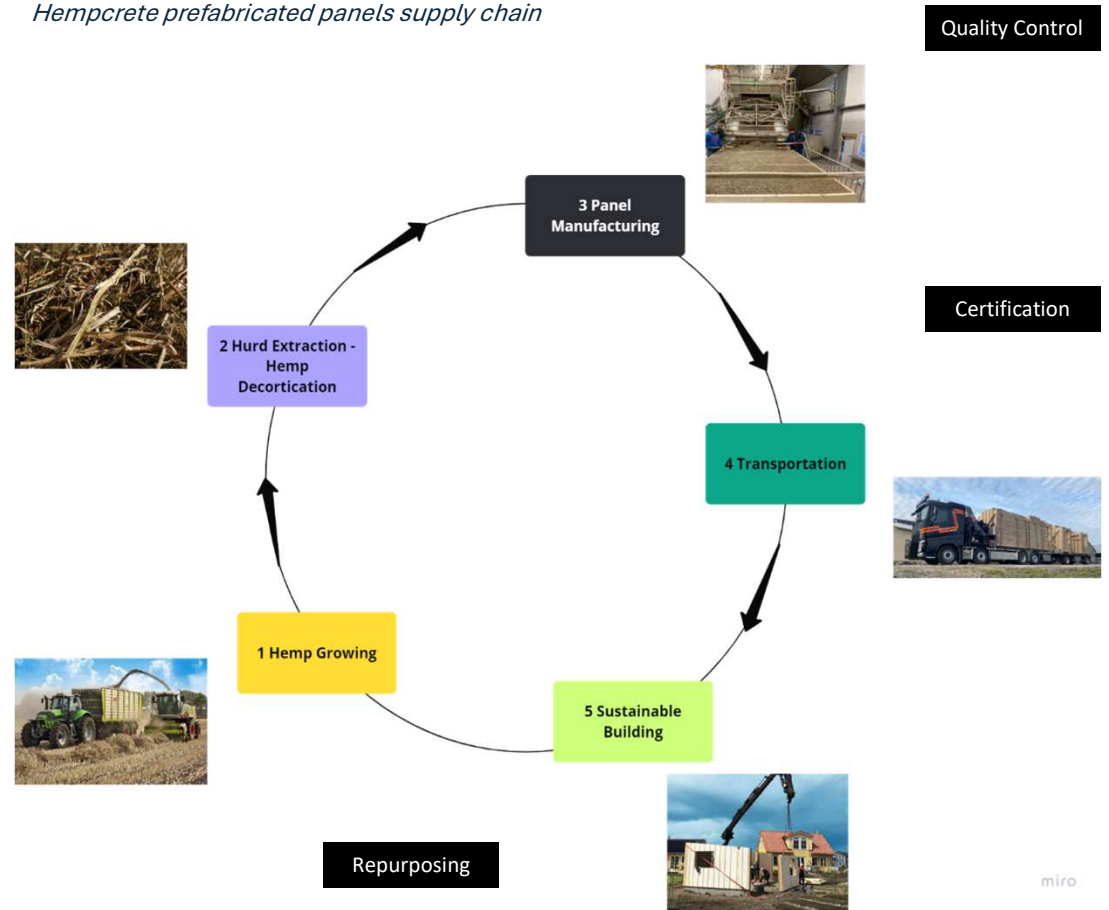
- **Homeland Hempcrete of Bismarck**, ND, USA, **0.9 metres by 2.4 metres**, **thicknesses of 23 cm and 30.5 cm**. Each panel weighs approximately 159-200 kg, with a curing time of 30 days before shipment.
- **Dunagro**, Netherlands, **2.8 metres by 5 metres**, **thicknesses ranging from 12.7 cm to 50.8 cm**, depending on insulation requirements. The weight of these panels varies according to size and thickness, and they require a 45-day curing period before installation.
- **Hemp Home**, NZ, **2.4 metres by 2.4 metres**, each weighing around 1 tonne. These panels incorporate about 17 kg of hemp shives per sqm at a typical **thickness of 26 cm**, along with approximately 30 kg of binder, requiring about 35 metres of timber for structural support.

HEMPCRETE PANELS SUPPLY CHAIN

Hemp growing:

- 14 metric tonnes of hemp hurds required per residential house.
- 1 hectare of hemp yields 10-20 metric tons; 30-40% usable as hurds (Muir, 2024; Daly et al., 2013).
- This suggests that building a **single hempcrete house** could require hemp grown on approximately 0.7 to 2 hectares.
- **Tentative competitive price of Australian Hurd should be \$1,600-1,800 / tonne**

Hempcrete prefabricated panels supply chain

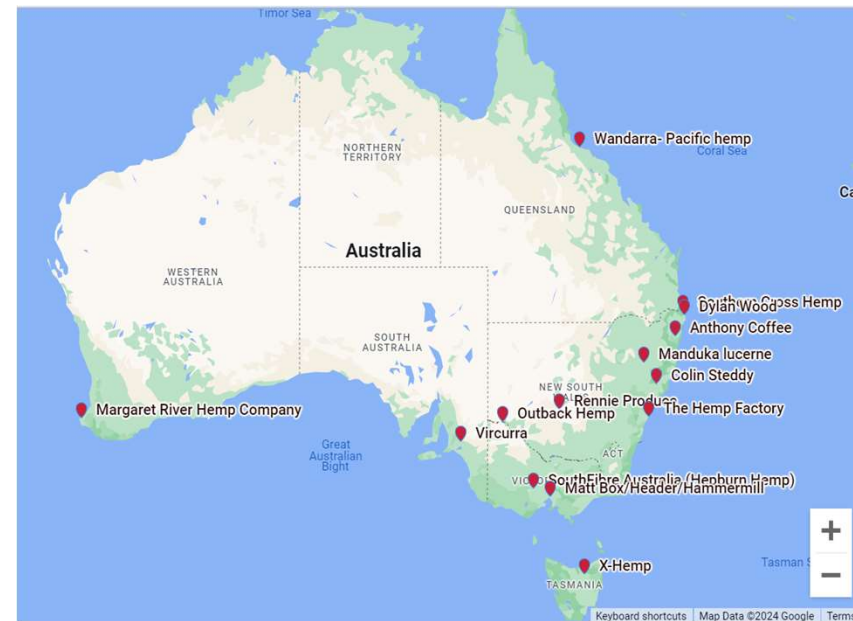


Source: Based on diagram and photos courtesy of Dunagro ([www.dunagrohempgroup.com/hemp\)construction/](http://www.dunagrohempgroup.com/hemp)construction/))

Hurd extraction – hemp decortication

- Modern **purpose-built decorticators** can process 1 to 2 tons of hemp per hour.
- Purpose-built hemp decortication facility in Australia can range from **AUD 1.5 to 10 million**, depending on the facility's capacity, technology, and location.
 - Consumes **10 to 15 kwh** per ton of hemp processed (shahzad, 2018)
- An alternative to purposed-built decorticators is **to repurpose cotton gins**
 - Cotton gins can be repurposed to process hemp at a cost of approximately **\$1 million**
 - Up to **20 kwh** per ton, due to their less efficient processing of the tougher hemp fibres (fike, 2016).
 - Higher maintenance costs.

Hurd processing facilities in Australia (2024)

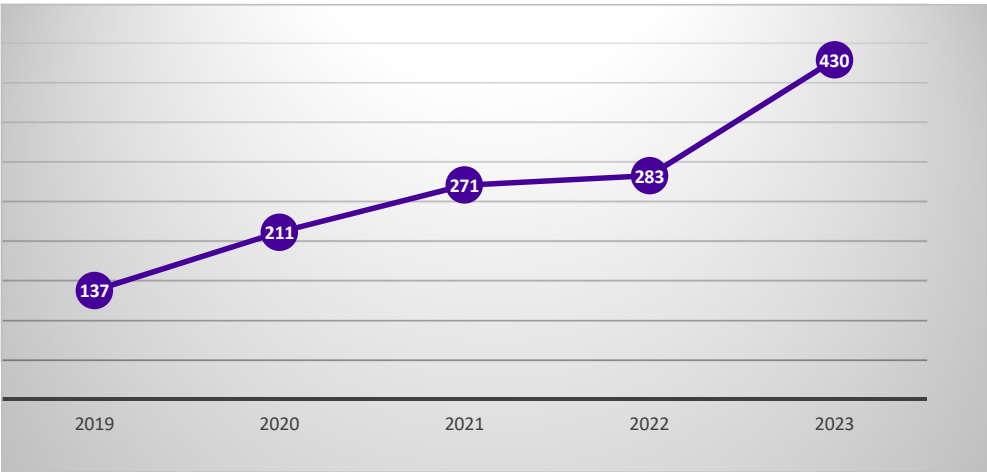


Source: iHemp Australia, and John Muir.

Australia's imports of hurd

Currently, it is priced approximately AUD 2,600 .

Hemp material imported by Australia - USD thousands (2019-2023)



Source: <https://www.trademap.org/> with data from ITC calculations based on Australia Bureau of Statistics.

Notes: HS 5302 True hemp "Cannabis sativa L.", raw or processed, but not spun; tow and waste of true hemp, incl. yarn waste and garnetted stock.

Australia's imports of hemp materials by exporter - USD thousands (2019 - 2023)

Exporters	2019	2020	2021	2022	2023
South Africa					277
Netherlands	117	150	143	143	96
France	9	20	95	104	26
Hungary					11
New Zealand				25	10
United Kingdom	6	13	11	7	2
United States of America				6	
Romania	1				
India			5		
Canada				1	
China	5	4			
Dominican Republic		2			

Source: <https://www.trademap.org/> with data from ITC calculations based on Australia Bureau of Statistics.

Notes: HS 5302 True hemp "Cannabis sativa L.", raw or processed, but not spun; tow and waste of true hemp, incl. yarn waste and garnetted stock.

Panel Manufacturing

The hempcrete mixture is **pressed into panels**, then dried and cured to achieve strength and durability

- **Curing period of 1.5 months** before transportation (Dunagro)
- Productivity can be improved with **automated mixing, moulding, and advanced curing systems**
- Manufacturing facilities for hempcrete panels may require **up to 5,000 square metres of space**.
- Establishing such a facility is estimated at **USD 12 million**.
- The entire process, from decortication to final panel production, is estimated to **consume approximately 50-70 kwh per tonne of hemp hurds processed** (Marshall et al., 2019).

Quality Assurance and Control

- Comprehensive quality assurance is required for hemp biomass **from cultivation to hempcrete production**, including traceability and moisture management at all stages.
- Key assessments include **decortication suitability, optimal process parameters, and particle size evaluation**.

Product Certification (NCC) - Validation

- Certificate of conformity.
- Certificate of accreditation from a state or territory accreditation authority.

Testing and certification processes **can take 1 year to complete**. Building codes must be developed and need to adopt the materials as an approved alternative.

Panel Transportation

High volume, low weight make hemp hurd costly to transport.

Efficient packaging and local production can help reduce these expenses.

Optimising Logistics: Locating production facilities near construction sites



Photos courtesy of Dunagro (www.dunagrohempgroup.com/hemp/construction/)

Building

According to Dunagro, assembling on site requires
5 days of work with 4 people on site
for a 100 sq mt house with Dunagro's panels



**KEY ACTIONS AND RECOMMENDATIONS
TO FACILITATE CONSOLIDATION OF THE INDUSTRY
IN A 5-7 YEAR TIME HORIZON**

1. Lack of standardisation and certification

Key Issue: No standardised production processes, design or certification.

Impact: Lengthy approval processes, reluctance from council officials, architects and mainstream builders.

Recommendation:

Industry collaboration to develop and introduce national certification standards to facilitate adoption.

2. Limited local access to hurd

Key Issue: 1) Limited production base—covering just 2,500 hectares in 2022-23—restricts the availability of raw material for processing; (2) shortage of processing facilities

Impact: Hurd imports, high costs and supply uncertainty

Recommendation:
Cooperative approach of the industry with growers

3. Production scale

Key Issue: Current production processes are small, laborious and time-consuming

Impact: High costs and difficult mass adoption

Recommendation:

Need to develop large commercial production facilities, ideally located in near input and demand sources

4. Logistics and transportation

Key Issue: per unit cost of transportation of hurd and risky transportation of panel

Impact: Higher risks and costs

Recommendation:
Strategic identification of optimal production sites

5. Lime availability and cost

Key Issue: While hydraulic lime is the best option to use in hempcrete, only hydrated lime is available in Australia

Impact: High costs of Lime imports

Recommendation:

Australia may have potential for Hydraulic lime extraction, which may be worth exploring further

6. Market Awareness

Key Issue: Still a lack of information in the market regarding benefits

Impact: Low demand/interest, resistance to change

Recommendation:

Industry coordinated awareness campaigns, government incentives

7. Lyfe-cycle analysis

Key Issue: Lack of a comprehensive life cycle analyses (LCAs) for hempcrete panels in Australia

Impact: Limits understanding of thorough understanding of environmental benefits

Recommendation:

LCAs would aid dissemination of the sustainability advantages to policymakers and the general public

8. Government support

Key Issue: Lack of impactful and consistent government support, unlike the sustained efforts seen in Europe or the US

Impact: Difficult regulatory environment, lack of incentives

Recommendation:

Collaborative efforts between industry and government will help overcome barriers and unlock the potential to become a mainstream housing solution

9. Cost competitiveness

Key Issue: In the current context of (still relatively) higher interest rates, new home buyers are prioritizing cost-efficient housing designs and energy-efficient appliances over the use of sustainable building materials.
Lack of product awareness.

Impact: Short-sighted view and lack of preparation for future conditions

Recommendation:

- Collaborate with government to develop **targeted incentive programs**
- Enhance **industry coordination** to launch public awareness campaigns
- Emphasize lifecycle cost savings and support **product testing and certification**
- Attract **investment** to establish **large-scale** production facilities
- Trades **training** opportunities

10. Industry dialogue and coordination

Key Issue: Lack of industry cooperation

Impact: There are ongoing difficulties in implementing supportive measures for the industry, particularly in achieving effective coordination across the vertical supply chain

Recommendation:

Vertical cooperation is a key factor in the success of Dunagro's model.

Exploring a similar vertical cooperation approach could enhance efficiency and innovation

NEXT STEPS

Report:

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