MODERN GREEN HOMES

Sanctuary

ISSUE 63

HEMP BUILDING SPECIAL

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Hemp Sensation

Seven gorgeous hempcrete homes inside

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HEARD ABOUT HURD?

The latest on hemp building in Australia

WORDS Kirstie Wulf

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Andi Lucas, founder of startup hemp processing operation X-Hemp in northern Tasmania, with a hempcrete demonstration wall. Image: Moon Cheese Studio

With its insulative and thermal mass properties plus its breathability, carbon-negative hempcrete is something of a dream building material. Happily, it's also becoming more widely available in Australia. Building designer Kirstie Wulf explains what's to love about building with hemp, and the latest developments in the local industry.

In the past ten years, hempcrete has risen from a newcomer in the Australian construction industry to become a popular natural building material choice, and with all its benefits, it's easy to see why.

Hempcrete is a lightweight, vapour-permeable and insulating material that is resistant to both fire and pests. It is made from a mixture of hemp hurd or shiv (the woody inner part of the hemp stalk) and a lime-based binder. Typically, the hempcrete mix is tipped from tubs into formwork surrounding a timber frame and lightly tamped down. Once it's set, the formwork is removed and the walls are finished with a lime or

clay render. Hempcrete is easy to install, even for DIYers.

The insulative value of hempcrete is generally assessed as R3.3 to R3.5 for a 250-millimetre-thick wall, and R4 to R4.25 for 300 millimetres. However, studies have shown that it actually performs better than these values due to its thermal mass and its ability to absorb and release water vapour, allowing it to act like a phase change material as well as providing passive humidity control.

Hempcrete is an excellent choice in the push for zero-carbon building materials. A hemp crop will grow in three to four months and requires minimal fertiliser and little to no pesticide. The hemp plant takes in carbon during its growth, which is then locked up in the building material. Even accounting for the lime binder, the resulting hempcrete is a carbon-negative material, meaning it sequesters more carbon than is emitted during its production (although if it's sourced from a long way away, transport emissions can affect this). Once the hempcrete is in place, the lime component continues to absorb carbon dioxide from the atmosphere, hardening and getting stronger as the years go by. [*Ed note:* see 'Hemp, hemp masonry and hempcrete' in *Sanctuary* 43 for more on hempcrete and its attributes.]

One often unheralded benefit of hempcrete is that compared with many other natural building materials, it fits in well with conventional construction. It is installed around a standard timber frame, and plumbing and electrical cabling can be put in place prior to the hempcrete going in. It's also relatively easy for owner-builders to tackle themselves, though someone with experience on your team is recommended. "We are finding that to issue building approval to owner-builders, building surveyors are requiring at least one or two of the labour team have some experience with hempcrete," says builder Joe D'Alo, a hempcrete installer, supplier and educator who runs the Hemp Building Company in Victoria. Happily, hempcrete installers are setting up shop around the country, so there are options if DIY is not for you.

Hempcrete also simplifies the wall structure. Building designer Daniel Prochazka participated in a hemp building workshop at Sarah and David's hemp home in Lyonville, central Victoria (see p40 for more), and has chosen hempcrete for the cohousing project he is developing with his partner Nicola in nearby Castlemaine. "Standard Passive House wall construction requires six or seven layers of often synthetic materials, to shed rain, stay airtight, manage moisture, and provide insulation. What really sold hempcrete to me was that, with a lime render, it achieves all those functions extremely well with just two layers of natural materials. It's incredibly elegant!" he says.

THE TICK OF APPROVAL

While hempcrete used to be a bit of an unknown quantity and therefore potentially difficult to get approval for, council-approved hempcrete builds have now taken place in all Australian states and territories.

Hempcrete meets the requirements of the National Construction Code (NCC) through a Performance Solution pathway, which shows how a material meets the performance requirements of the code. This can be in the form of a report from an engineer or other suitably qualified person, or an accepted third-party certification such as a CodeMark Certificate of Conformity.

Commercial hemp binder suppliers can provide you with the Performance Solution documentation or CodeMark certificate to support their product. This is one of the advantages of using a commercial binder, and locally manufactured options are starting to become available – such as from the Australian Hemp Masonry Company, which ships nationally from its base in New South Wales. If you want to use your own binder recipe, you will need to obtain the necessary testing and Performance Solution report yourself, which is a complex and expensive process.

AUSSIE HEMP TAKING OFF

To match the growth in interest from homeowners, the industrial hemp industry in Australia is developing fast – and spreading from its original bases on the east coast.

In Western Australia, Gary Rogers of Hemp Homes Australia started out building hemp masonry houses, but with no local hemp processing, the hurd had to be imported from the eastern states or overseas. "To address this issue, I got involved in growing and processing my own hemp," he says. "Local support and a government grant helped get the project off the ground."

In Tasmania, founder Andi Lucas' X-Hemp processing plant has been successfully operating since November 2021, notwithstanding a lack of government support in her case. There has been strong demand for X-Hemp's locally grown and processed product: the operation has supplied the fibre for 15 houses so far, and created six jobs for women in Tasmania's north. Andi has put a huge amount of time and energy into the project. "I'm glad I just pushed ahead and did it," she says, "though more investment will provide the ability for more mechanisation, greater efficiency and higher output."

South Australia is following suit, with Vircura setting up the state's first hemp hurd and fibre processing plant at the Monarto Innovation Precinct. The team at Vircura is also researching the production of hemp blocks and panels, as well as other building products and uses for the fibre, hurd and fines from the hemp varieties. "By utilising hemp crops specially grown for hurd and fibre to produce sustainable building materials here in South Australia, we are opening up a new market for local growers, who previously only had an end-use market for hemp seed," says Adam Djekic, Vircura's General Manager Operations.

INSTALLATION OPTIONS

Until recently, most hempcrete in Australia has been cast in situ by pouring the mixture into formwork and manually tamping it down. The ease of this method means that there will always be a place for owner-builders to construct their own walls – a cost-effective option when you are not paying for labour. You can also choose to make it a community build to give your

house a history and sense of place before it is even finished. Joe D'Alo estimates that 60 to 70 per cent of the people attending his hemp installation training are owner-builders.

However, in-situ casting and hand tamping is labour-intensive and can add significantly to the cost of a hempcrete build if you are not going the owner-builder route. Happily, other installation methods are gaining ground.

Spray application is the method of choice in Europe and is finally catching on in Australia. Thomas Cunliffe of Resolute Construction Solutions in Brisbane switched from hand-casting hempcrete to spray application, resulting in faster, more cost-effective installations and (in his view) a better finished product. "With this application method, the hemp and lime binder are combined as they are being sprayed onto the wall. This adds more air to the mix and results in a less dense and more insulating wall," he explains. Research at the University of Bath in the UK has verified the higher insulation value of spray-applied and precast hempcrete panels, and attributes this partly to the different orientation of the fibres.

Furthermore, when spray-applying hempcrete the windows are installed first, meaning that the material is sprayed right up to the frame, avoiding the usual small gap left to facilitate later window installation. Spray application also deals well with awkward spots like under high eaves. As the number of hemp builds increases, it is likely that dedicated hempcrete installers will move toward more efficient spray application, with hand installation and tamping reserved for walls that will remain unrendered (where the neat, flat finish offered by formwork is desirable).

HEMPCRETE TIPS FOR DESIGNERS AND OWNER-BUILDERS

- Use eaves to protect your walls, as rendered hempcrete is water-resistant rather than completely watertight; eaves help keep walls dry.
- Make sure you use a vapour-permeable finish such as lime render (outdoors) and clay render (indoors).
- Avoid very thin sections of wall with lots of timber, as it makes it difficult for the hempcrete to 'key' into itself from one side of the frame to the other.
- Take care with large lintels and provide mechanical support to the hempcrete in these areas, as the lintel creates a barrier preventing the hempcrete from 'keying' into itself from one side of the wall to the other.
- Hemp can also be used as insulation under a raised floor and as ceiling insulation, using a much lighter mix than for walls as it does not need to be self-supporting in these contexts; an added benefit is that the lime binder discourages rats and termites.

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Balanced Earth, based in Byron Bay, NSW, is a long-established building company with a sister architecture firm, Balanced Earth Architects. Both businesses are focused exclusively on hemp construction. The team has completed over 40 hemp houses including co-founder Michael Leung's own family home in Mullumbimby, pictured here. Their work also includes the architectural design and hemp installation for the Innovation Centre at the Cape Byron Steiner School, and they are working on renovations to the Living School at Lismore in the aftermath of the 2022 floods. Image: Anna Hutchcroft

Another option is hemp blocks. Kat Ashworth and her partner have just moved into their new home in south-east Queensland, possibly the first hemp block house in Australia (see case study on p62). The blocks were imported from Europe as there are currently no locally manufactured blocks on the market, though this is likely to change in the future. (In the meantime, it's very important to check with your local planning authority that they will approve the use of your blocks before you purchase and import them.) Kat reports that the interlocking blocks were easy for the two of them to lay, but the assistance of a bricklayer who was familiar with a similar concrete form system was helpful. "Blocks provide the benefit of not having to wait for the hempcrete to cure for four weeks before rendering," she says.

In the UK, precast panels have allowed for the use of hempcrete on larger commercial projects such as the Marks and Spencer store in Cheshire Oaks, near Liverpool. A number of Australian companies have hempcrete panels under development, so similar builds should become easier here soon too. Meanwhile, in an inspiring demonstration of local collaboration, X-Hemp is set to supply locally grown and processed hemp for use in the new University of Tasmania development.

CONCLUSION

More Australian farmers are starting to grow industrial hemp, and with local processing also coming online there will be more and more domestically grown and processed hurd available for building. In addition, more completed hempcrete homes means there are now more council planning officers, designers and builders around who are familiar with the material – all great news for hempcrete fans. If you are looking for a low embodied energy, healthy and natural building material with great performance, then look at using hemp in your next build.

MORE RESOURCES

- A Hemp Building Directory of designers, builders, suppliers and installers has recently been launched: www.hempbuilding.au
- Hemp Building Australia on Facebook: bit.ly/HempBuildingAustraliaFB

ABOUT THE AUTHOR

Kirstie Wulf is a building designer with a passion for natural building materials. She became interested in hempcrete through owner-building one of the first hemp houses in Australia. Her business, Shelter Building Design, specialises in hempcrete, natural materials, bushfire resistance and high-performance buildings. She is also a Certified Passive House Designer. www.shelterbuildingdesign.com.au

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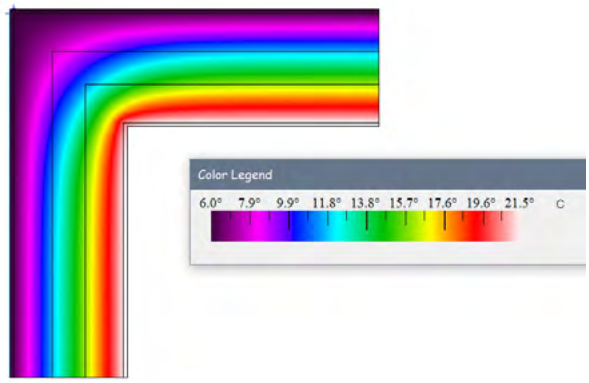
Hemp hurd, or shiv, is the shredded woody inner part of the hemp stalk. Mixed with a lime binder and water, it forms hempcrete. This handful was grown and processed by X-Hemp in Tasmania. Image: Moon Cheese Studio

HEMPCRETE AND PASSIVE HOUSE

Can you build a Passive House out of hemp? Yes, you can! As regular *Sanctuary* readers will know, Passive House is a building standard that specifies airtightness and energy use requirements for a dwelling, but there is no prescription as to the materials that can be used to achieve the standard. This can be both positive and negative: on the down side, the embodied energy and health benefits of materials used are not taken into account for certification, but on the up side, it means that there is no barrier to the use of hempcrete and other materials that are non-toxic and low in embodied energy.

For Passive House, the five key principles are a highly insulated building envelope, an absence of thermal bridges, airtight construction, high-performance glazing, and mechanical ventilation with heat recovery. Hempcrete can help achieve the first three: it is a good insulator, and as it is installed completely surrounding the structural frame, it is excellent at minimising thermal bridges. Passive House is also concerned with the temperature of indoor surfaces; this is not just about comfort but also about reducing potential cold spots that could attract condensation and hence mould. Research has shown that fibre-based materials like hempcrete have a warmer surface temperature than traditional masonry walls.



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Temperature gradients through a 300mm-thick hempcrete wall with a timber frame in the centre, from 6 degrees Celsius on the outside to around 22 degrees on the inside surface. Image: Kirstie Wulf

The monolithic construction of hempcrete means that joins are minimised, a big step towards achieving an airtight building. The hempcrete itself is quite airtight, but not sufficiently to meet the stringent Passive House standard of a maximum of 0.6 air changes per hour at 50 pascals of pressure (ACH50). Instead, an external or internal lime render usually serves as the airtight layer on the walls, taped to the floor and ceiling to create an airtight envelope.

Hempcrete Passive Houses have been built in Victoria and Tasmania, and the first in New South Wales is currently under construction.