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HEMP: VIABLE FUTURE CONSTRUCTION MATERIAL?



A pioneering project has taken root on Noordhoek's verdant fynbos slopes, creating an eagerly anticipated stir in the construction industry.

Hemp House is an ecological and sustainable building inspired by constructional developments with hemp, prized for its carbon negative rating, lightness, thermal properties and eco-friendliness

as an alternative to brick and mortar. In terms of sustainability, industrial hemp is the highest biomass producer of all agricultural crops (25t/30t per hectare). Its growth rate outclasses that of trees: hemp produces per hectare in four months the equivalent to what trees produce in seven years. In addition, hemp is a high carbon sequestrator, both as a crop and when used as a construction material.

It is the first time that hemp has been used as a material in a modular building system in South Africa, and possibly the world. This innovative project in Noordhoek aims to illustrate the environmental and commercial advantages of building houses of hemp. Local hemp entrepreneurs and Hemporium owners Tony Budden and Duncan Parker saw potential in the National Organic Produce Initiative "Grow Your House" project¹, which aims to build 20 000 hemp

houses within the Clean Development Mechanism (CDM) framework. In keeping with Hemporium's primary goal of showcasing all that hemp has to offer, the idea to build a house from hemp was conceived.

GROUNDWORK AND INITIAL OBSTACLES

Budden, an active hemp campaigner, has lobbied government on hemp's merits and his original groundwork included meetings with Minister of Social Development Edna Molewa, Max Mamase (MEC for Agriculture Eastern Cape Provincial Legislature), Tasneem Essop (Minister of Environmental Affairs and Development Planning, Western Cape Legislature) and Dr Mamphele Ramphela, who actively promotes sustainable economic growth in South Africa.

However, Budden soon realised that the next logical step was to build a house and overcame his initial resistance against importing hemp at a staggering R75 000 for a container's worth.

He said absorbing that kind of material cost is obviously not viable "but it was necessary to build this showcase hemp house in order to promote the resource and push for a change in legislation.

¹ "Grow Your House" project is now a partnership between a number of role players such as Hemporium and Perfect-Places which are members of a national initiative called ECOCONI (Ecological Construction National Initiative). The CSIR MSM and the University of Wits School of Architecture and Design, as well as the Sustainability Institute are also members of the ECOCONI.



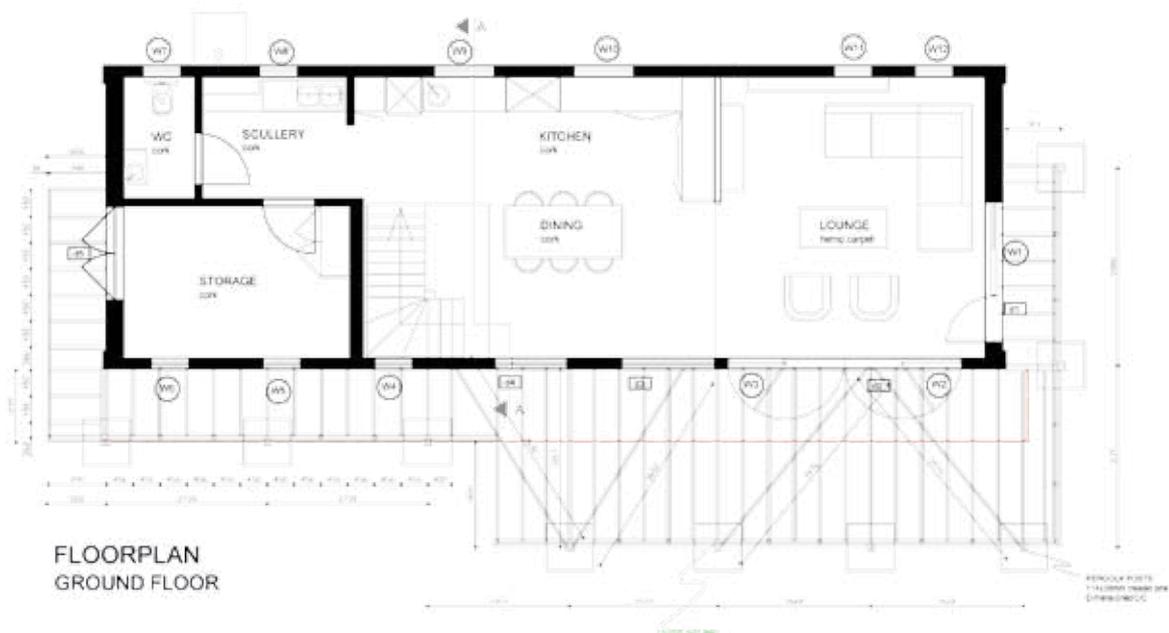
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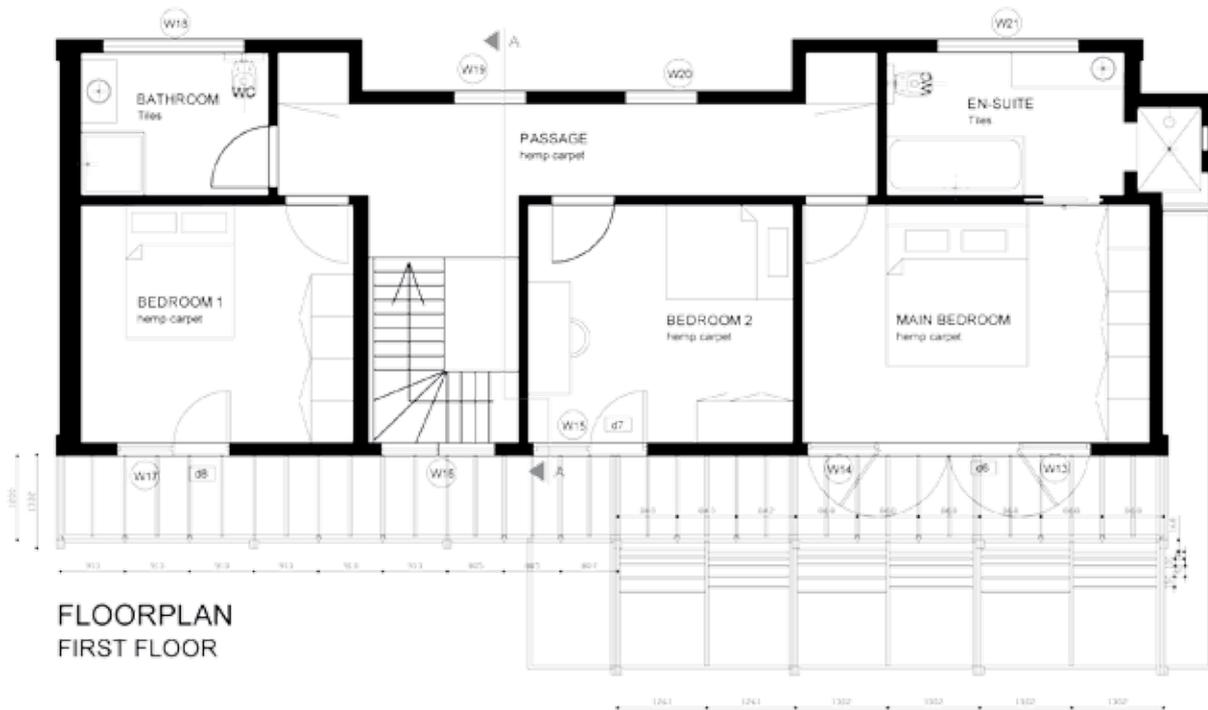
Location Noordhoek
Size of property 168 m²
Number of rooms 7
Started 16 October 2010
Completed 25 May 2011
Cost Construction R7500/m² (when the decorative finishes, furniture, home automation, solar panel, water filtration system are included the price is R10 500/m²)



“Our goal is to build cost-effective, sustainable modular hemp houses in South Africa.”

Tony Budden (left) and Erwin van der Weerd





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However, he believes changes may be coming, as the Director: Regional Industrial Development from the Department of Trade and Industry, Dr Neil Trollip and Sunshine Blouw of the CSIR visited the site twice in February 2011, the last time with Llewellyn Van Wyk (CSIR: Built Environment), “who left very impressed and motivated”.

To become skilled at hemp design and construction techniques and finding the right suppliers, necessitated travelling to the UK to meet pioneers of hemp building in the UK, *Radical*², as well as several other hemp building specialists.

In 2009, Budden attended the International Hemp Building Symposium in Ireland to present South Africa as a potential hemp industry and user of this building resource. This proved extremely beneficial in establishing valuable connections and he was consequently invited back to this year’s event in Spain.

The renewed enthusiasm that followed the Irish symposium catapulted the design for Hemp House, which was smoothly approved by council². But enthusiasm was short-lived when building tenders

² The building and engineering is all around a wood frame. It didn’t need special approval as long as the engineer approved the structure. Hemp forms the mass of the walls, but is not load bearing, and has a lime render coat on the outside. Thus, the approval is for a timber frame building with cellulose walls.

came back outrageously high. Builders were nervous because they had never worked with the materials before and the uncertainty of the duration of the construction added substantial contingencies for wages. It became apparent that the whole project was going to be over-priced and even if some of the materials were brought in cheaply, it would be extremely difficult to find someone to build with hemp. The possibility of the house becoming a reality was dimming.

It was around this time that Budden was approached by local Dutch architect Erwin van der Weerd from Perfect-Places, who was trying to source hemp building products for the patented modular building systems that he wanted to design and manufacture in an eco-friendly manner.

The synergy between Van der Weerd and Budden became a partnership and using a modular system for building a hemp eco-house in South Africa became a *fait accompli*. As an added bonus, the internal modular walls which were made with hemp insulation and magnesium oxide boards on the outside, and the hemp particle boards on the inside came out less expensive than normal brick and mortar. This meant

“Hemp is fast growing and requires minimal irrigation, fertilisers or pesticides and when grown in summer, can also be rotated with flax a winter crop.”

the possibility of promoting modular hemp housing *vis-à-vis* selling only the materials.

MATERIALS

The end goal is to grow and produce hemp construction materials locally, but in order to showcase the potential of the product, the various hemp materials needed for the house had to be sourced internationally.

Hemporium required a completely environmentally friendly eco-board and pushed their Chinese suppliers to remove all the formaldehyde from the binder they were using. Although the end result is good, the board cannot be used in kitchens and bathrooms or hold heavy-duty hinges for long periods. They may have to relent a bit and go back temporarily to an E1 binder instead of the E0 they desire.

BELOW The custom made staircase consists of a laser cut steel frame and local Ash wood.

GLOSSARY

Hemp Hurds

...are the leftover fragments of the stems and stalk once all the fibres have been removed
...are untreated and unrefined, they can be used as cement and insulation

Hempcrete

...density is 15% of traditional concrete and it is carbon negative
...is a mixture of hemp hurds (shives) and lime used as a material for construction and insulation
...acts as an insulator and moisture regulator
...lacks the brittleness of cement and consequently does not need expansion joints



SUSTAINABILITY FEATURES

- Industrial hemp products
 - ☑ bio-degradable
 - ☑ contains no fibreglass
 - ☑ constantly absorbs carbon
 - ☑ the reaction that takes place between the hemp and lime while it is
- setting absorbs atmospheric carbon
- timber from Forest Stewardship Council (FSC)-approved forests
- hemp insulation in the walls and roof
- double-glazed doors and windows
- natural air flow
- natural cooling home automation
- north/south orientation
- eco paint products
- reclaimed stone
- natural fibre coir carpets
- cork flooring
- LED lamps
- rain, grey & black water systems
- 85% of all furniture & cabinetry made from hemp board



“We chose to bring in tried and tested products as we did not want to take any chances with the prototype house.”

“However,” according to Budden, “these boards are perfect for panelling, walling and shelving and experimental results with a new soy-based binder suggest ultimately producing them locally as multi-use products. The commercial trial runs until 2013 and by then the industry should be large enough to supply us with the necessary raw materials. The hemp hurds and binder for the hempcrete and the insulation mats for the internal walls and floors were competitively sourced from France, but we are looking at importing raw fibre to manufacture these locally as soon as the end of this year.

“The binder for the hempcrete is a lime-based mineral that takes a fraction of the amount of energy to produce compared to cement, and South Africa is naturally rich in this mineral. However, hydraulic lime, a part of the hemp/lime binder, is not locally available and Hemporium is working with local companies to develop alternatives to circumvent future imports. To catch high and low sound frequencies, two types of insulation with superior thermal properties used in conjunction with each other were imported from France. We chose to bring in tried and tested products as we did not want to take any chances with the prototype house,” explains Budden.

A FUTURE FOR HEMP HOUSES?

The biggest challenge is red tape.

It has been illegal to grow hemp in South Africa since the 1940s. As a result, marijuana is an export crop, while the natural fibres industry is largely undeveloped but according to Sunshine Blouw of the Port Elizabeth-based CSIR textile technology division “there are signs that this will change. A special licence was granted for Eastern Cape trials, and both the CSIR and agricultural bodies are lobbying government to change the law. What has been amended is that the Department of Agriculture no longer classifies hemp as a weed. Now we are waiting for the National Department of Health to change as Act 101 of 1965 does not differentiate between hemp and marijuana.”

Hemp is fast growing and requires minimal irrigation, fertilisers or pesticides and when grown in summer, can also be rotated with flax a winter crop. The European Union subsidises its industrial hemp farmers and it is already big business in Lesotho. Trials conducted by the CSIR in Qamata, Libode, Addo and East London have confirmed that the Eastern Cape Province has the right climate for hemp and flax. One Yugoslavian and five French varieties of hemp have been grown in the province with good results. The Agricultural Research Council is working on developing a hybrid that would be ideally suited to local growing conditions.



The CSIR is working with the House of Hemp³ to develop a potential multi-billion rand agri-business. Thandeka Kunene from House of Hemp has just completed the first of a three year commercial trial aimed at proving the viability of hemp for farmers and industry. Though there are still hurdles to overcome in the management of legislation issues and the controls needed, this is seen as very encouraging by Budden, who is working with them to include Western Cape farmers and help create the market that can drive the industry. He views it as a move out of agricultural research into commercial viability studies.

CHALLENGES AND COMPLETION

Although there were many challenges – from getting the architect to comprehend the intricacies of hemp building and design, to understanding the various applications of the hemp products and finding the most efficient way of mixing and applying it to walls, as well as working around the drying time – Budden’s biggest regrets are that they needed to import the raw materials and could not use more hempcrete since “the walls have such an amazing feel to them”.

SOURCEBOOK

All hemp products Hemporium Tony Budden
www.hemporium.co.za

Modular construction architect and building and carpentry and furniture Perfect-Places (Pty) Ltd
Erwin van der Weerd www.perfect-places.co.za

Eco paint products Ecological Solutions (B-Earth)
Karel Marais www.b-earth.co.za

Double-glazed glass and doors Massclusivity Axel
Zimmerman www.dgglass.co.za

Taps and shower heads Hansgrohe South Africa
www.hansgrohe.co.za

Flooring Coirtex Natural Flooring Tracy Richards
www.coirtex.co.za

Cork flooring Cardinal Carpets
www.cardinalcarpets.co.za

Reconstituted stone counter tops L Cannata & Sons
(CAPE) (Pty) Ltd Claudia Cannata King www.cbn.co.za

LED lamps Earth Power Energy Solutions (Pty) Ltd
Chris Lear www.earthpower.co.za

Automated wireless switches Green Wind Power
& Automation Grant Colson www.greenwind.co.za

Light fittings QLite http://qlite.co.za

Solar panel geyser Kwikot www.kwikot.co.za

³ House of Hemp was founded by Thandeka Kunene as a vehicle for the collective marketing campaign of the National Hemp Foundation. It was funded by the Department of Arts, Culture, Science and Technology and launched in 2001 by Minister Ben Ngubane as a potential a community-private-public partnership. It is one of the first South African companies to sell hemp fabric directly to the public.

While the project was creatively and technically challenging for Van der Weerd, he views problems as solutions waiting to happen. “Everything in the house is custom made: kitchen, cupboards, furniture”. But he admits that working with hempcrete and hemp screed, and ensuring the mixes as well as the finish of the walls were correct, meant a steep learning curve. “It is also the first full-scale example of the Perfect-Places modular building system and has highlighted a few areas where improvements can, and will be made,” he enthuses.

While technology within the emerging sustainable built environment industry assisted Van der Weerd in his vision to make this project a reality, he concludes that “we forget sometimes to look back in history to learn from the past and reuse old knowledge and combine this with the knowledge that we have about materials now”.

Although Budden feels optimistic about the future of hemp housing in South Africa, he says that he would like to get some experts from Europe to get involved in technology transfer. In addition, he would like the CSIR to help develop local lime binders to eliminate imports. Most importantly, he would like government to create an enabling environment for the hemp industry to source all

materials locally and thus “grow” hemp houses in South Africa.

Imported raw materials escalated the cost of the house to R7 500 per m² which is significantly higher than for projects where traditional building materials are used. However, costs should decrease significantly once hemp is locally available. Also the energy-efficient benefits would be reaped in the long run.

Now nearing completion, the project is a manifestation of courage and devotion to bringing about constructive change in a country burdened by poverty, unskilled labour, unemployment and environmental challenges. While Budden will be living in the house, it is also intended as a show house to illustrate the effective uses of the hemp plant as a building material and finish. The house will be open to view once a week by appointment. ◉

BIBLIOGRAPHY

1. “Renewable Building Materials Factsheet”. National Non-Food Crops Centre, www.nnfcc.co.uk.
2. Priesnitz, Rolf B. (March/April 2006). “Hemp for Houses”. Natural Life Magazine, www.naturallifemagazine.com.
3. “Radical Hempcrete 2008 Information Pack” (PDF). American Lime Technology, www.americanlimetec.com.
4. Flahiff, Daniel (August 24, 2009). “Carbon Negative Hemp Walls are 7x Stronger than Concrete”. Inhabitat, www.inhabitat.com.

LEGISLATION AND ECONOMIC BENEFITS

There are close to 40 countries in the world that have legitimised industrial hemp, including some that have never stopped growing it. These include Canada, the United Kingdom, France, China, Australia, Germany and Hungary.

Hemp cultivation in South Africa could uplift rural communities and create hundreds of jobs, especially in the Eastern Cape, which is ideal for growing this kind of crop. Local production of hemp, which grows up to 50t/ha wet biomass in four to five months, could supply a chipboard factory which will need 6 000ha of hemp to keep it in production, provide in excess of 300 jobs and save countless trees in the process.

It is estimated that farmers will be able to earn about R5 000 a hectare. Once changes have been made to the legislation, the hemp industry could even supply the paper on which the law is written or printed!

