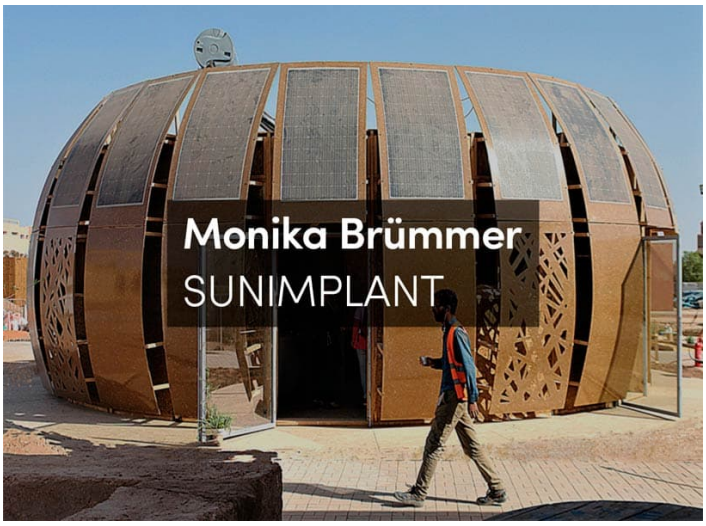

SUNIMPLANT: AN AVANT-GARDE OFF-GRID HEMP BUILDING

Posted on April 21, 2021 by martabuges

Categories: Designing Matter, Energy and sustainability, Low Density, Monika Brümmer, Project

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The hemp-built project Sunimplant took part in the recent edition of Solar Decathlon, the first to be held in Africa. The biannual editions of this international competition challenge teams, which include students, to develop highly efficient and innovative buildings, exclusively powered by solar energy. Sunimplant aims to be truly sustainable and therefore does not use technology alone to resolve higher energy-efficiency requirements, climate emergency demands considering environmental health by using corrective knowledge. Comfortable spaces let habitants maximize their well-being.

The modular, off-grid hemp home is inspired by the needs of remote regions like the Moroccan Central Rif. A spherical building skin made from a hemp fibre bio-composite integrates frameless

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PV-technology of crystalline silicon cells, the most efficient on the market, whose output is optimized through the insulating carrier substrate. The vacuum-injection-made panels were resolved with plant-based resins in the highest percentage, which show elevated UV-resistance compared to synthetic resins and accomplished a passage of 2.35 m through a dense arrangement of hemp fibres.

The material- and energy-saving design, inspired by archaic African architecture, was further developed with a circular arrangement of hemp concrete walls of high thermal effusivity (~525 $J/m^2Ks^{1/2}$) and adequate thermal conductivity (~ 0,145 W/mK), formulated using the region's locally processed agricultural waste (hemp stem materials). This practice is seen as a model for rural

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African socio-economic development and green technology evolution.

Construction's contribution to climate change (~40% of global energy and resource consumption is generated by the building industry) is prevented by an overall concept of renewable and recyclable hemp aggregate and hemp fibre materials. These materials respond to the pursuit of carbon sequestration in new buildings, the reduction of embodied energy through energy-saving processing, and the increase of energy efficiency through insulation and passive thermal performance. Positive health aspects are achieved through the hygrothermal behaviour of the multi-porous plant aggregate concrete, which contains local clay, lime and pozzolanic additive. Lime contributes to excellent air quality through osmosis, while clay provides the hemp concrete with a

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balanced environmental impact, associated with all the stages of its lifecycle.

The project takes additional advantage of the aforementioned material qualities through a compact, aerodynamic design that minimizes exposure to the environment. A bioclimatic layout, inspired by the vernacular architecture of the region in question, functions with natural ventilation, a favourable orientation of the habitable spaces, and an optimised arrangement of openings. A high-end glassing completes the performance.

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Sunimplant aims to set new standards by pioneering a hemp design outfitted with a 360° arrangement of glass-free, frameless, flexible and ultra-lightweight photovoltaic technology, suitable for extreme weather conditions and long lasting. The curved carrier material of the hemp fibre composite is likewise reflective, insulating, shading and ventilating, thus creating a microclimate behind the massive wall elements of hemp concrete against the severe, semiarid climate conditions of Benguerir.

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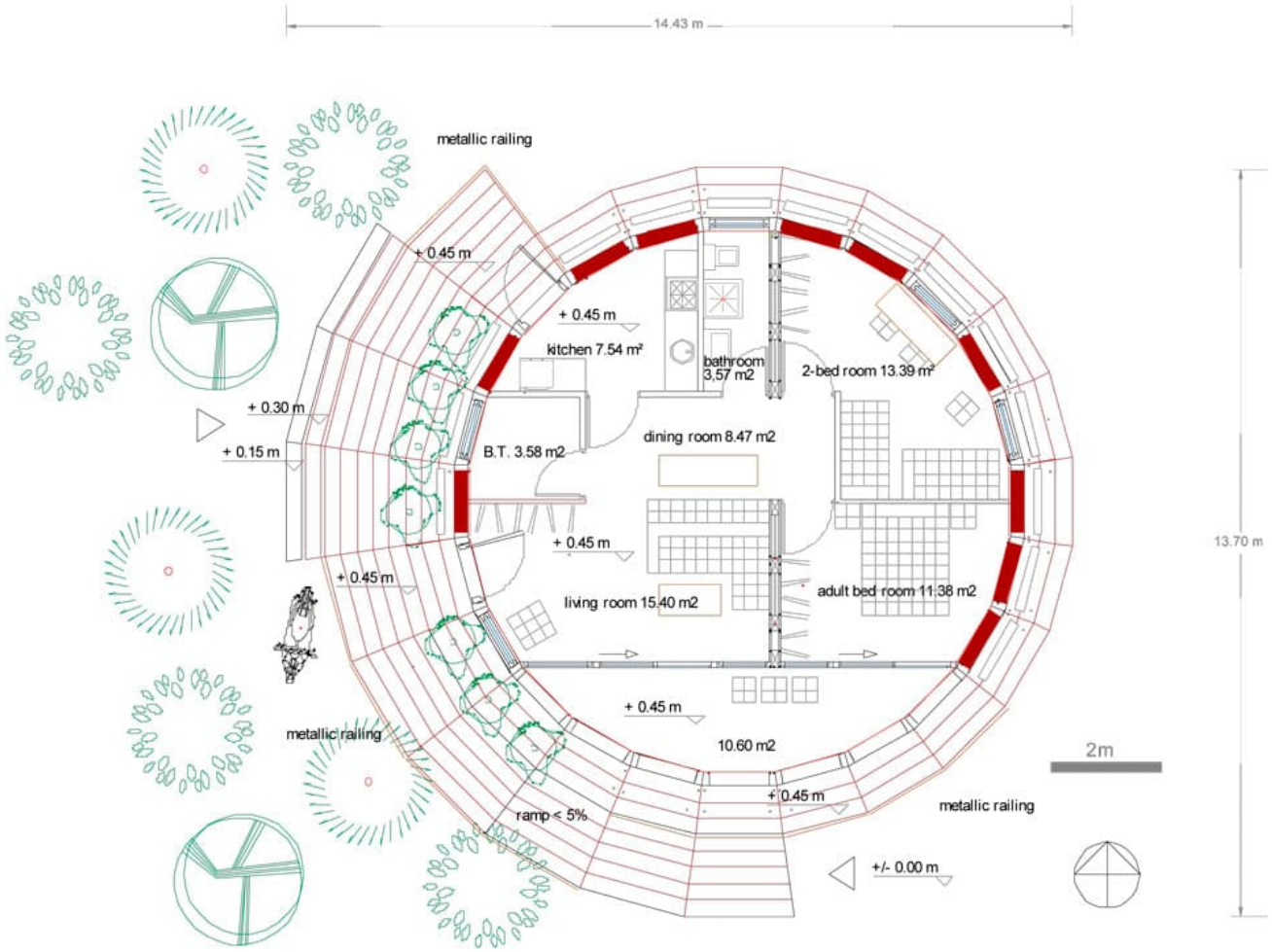

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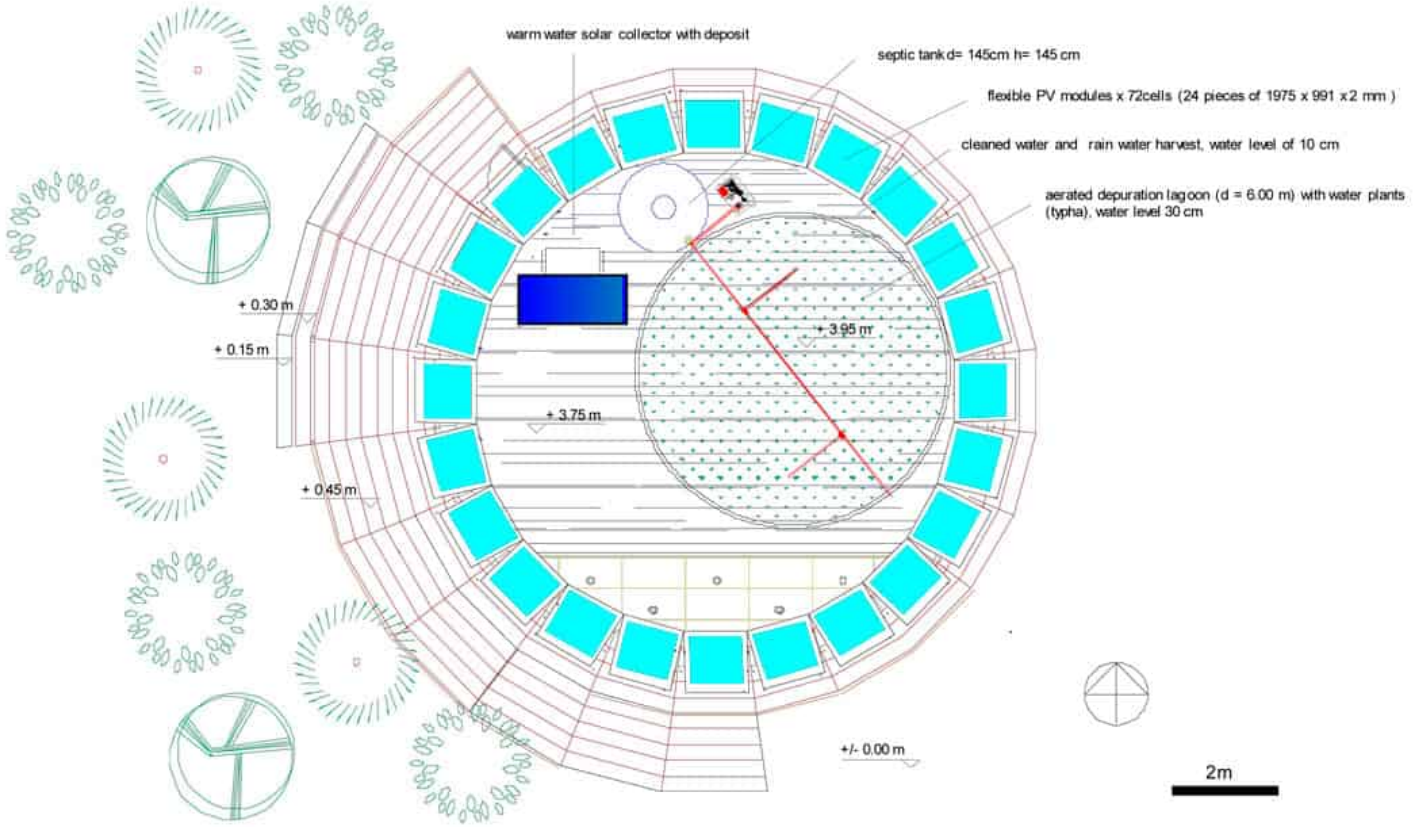

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