SOLCER HOUSE

ENERGY POSITIVE - LOW CARBON - LOW COST

Cyngor Cyllido Addysg Uwch Cymru
Higher Education Funding Council for Wales
hefcw

ERDF
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Welsh Government
Ewrop & Chymru: Buddsoddi yn eich dyfodol
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LCRI LOW CARBON RESEARCH INSTITUTE

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

BACKGROUND

The Welsh School of Architecture has designed and built Wales' first low cost 'energy positive' house. The Solcer House is capable of exporting more energy to the national electricity grid than it uses, in an attempt to meet tough new targets for zero carbon housing. The UK Government – like governments across the world – has set a target for zero carbon housing. This means that if we are to have an impact as a research community, we have to rise to that challenge and develop innovative new ways to build houses of the future.

AFFORDABLE SYSTEMS APPROACH

The Solcer House's unique systems approach to design combines, for the first time, renewable energy supply, thermal and electrical energy storage and reduced energy demand, to create an energy positive house at an affordable cost. The Solcer House is located at the Cenin site in Stormy Down, and has been designed to meet social housing standards. The house was constructed in 16 weeks using local supply chains.

AWARDS

Young Achiever of the Year
CONSTRUCTING EXCELLENCE IN WALES

Innovation in Sustainability Award
Innovation Network

CERTIFICATES

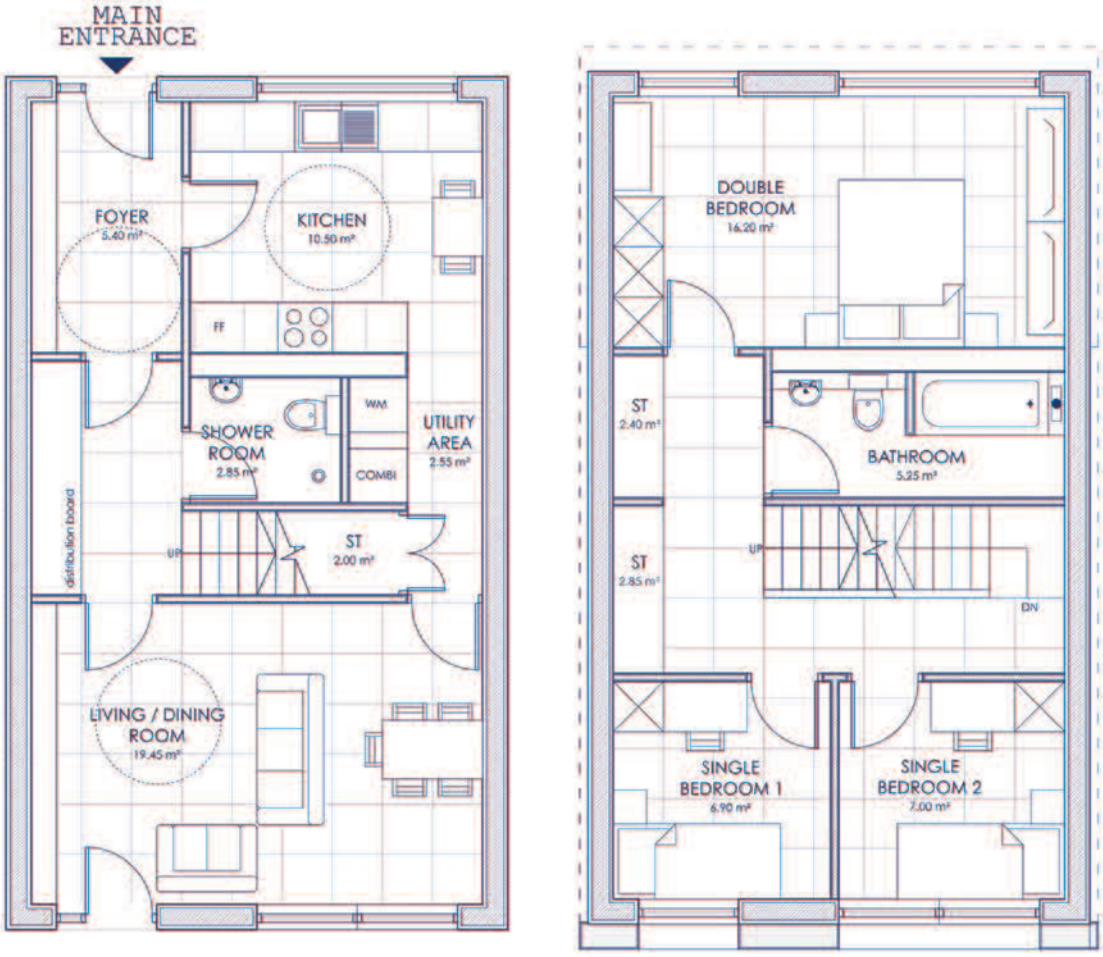
CONSIDERATE CONSTRUCTORS

NICEIC

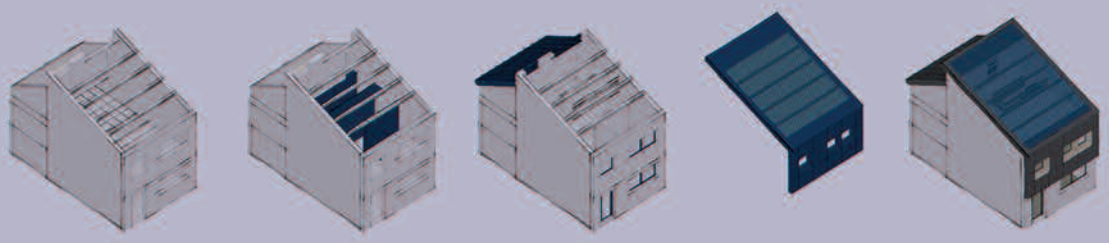
BREEAM

Lifetime Homes

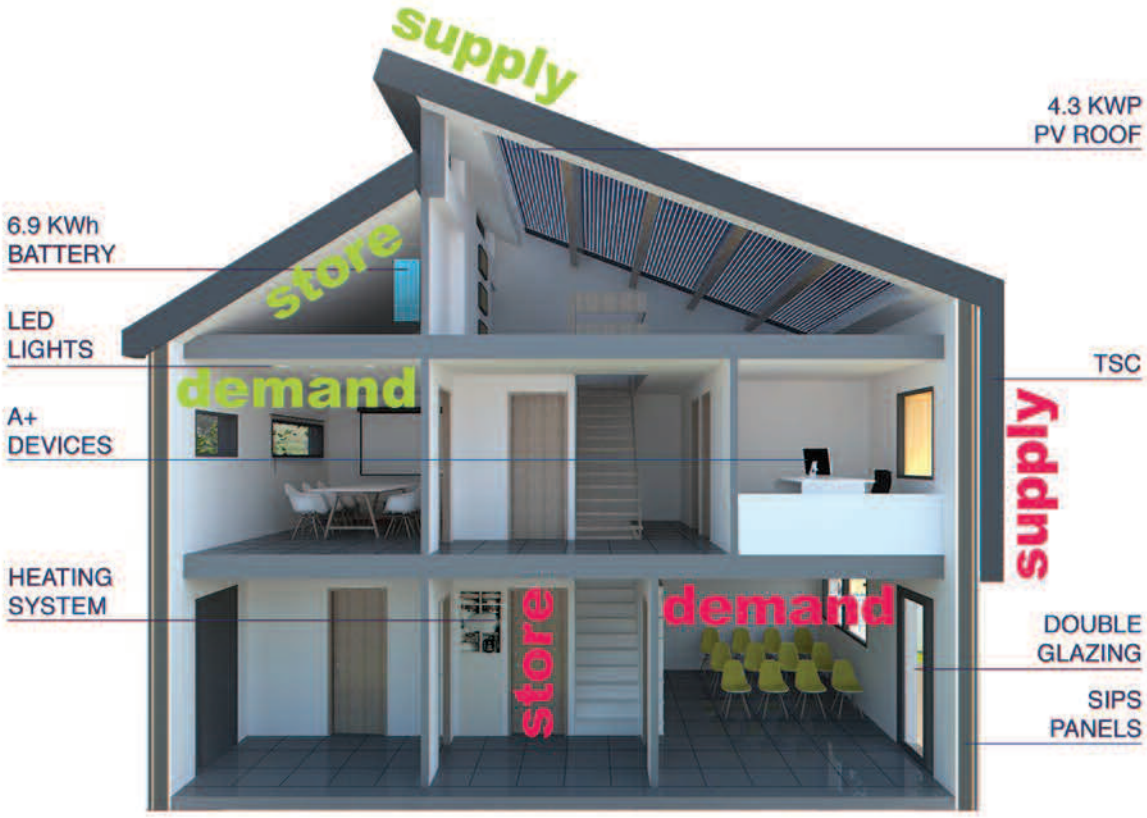
LOW ENERGY CONSTRUCTION



In order to minimise the energy demand, the house was built with high levels of thermal insulation and reduced air leakage. It uses an innovative energy efficient design which includes low carbon cement, structural insulated panels (SIPS), external insulated render, transpired solar air collectors (TSC) and low emissivity double glazed aluminium clad timber frame windows and doors. The integrative approach to construction uses renewable energy systems as building elements; the upper first floor wall incorporates the TSC solar air collector, and the south facing roof is the 4.3kWp PV panel system. This reduces costs and improves aesthetics, avoiding the 'bolt-on' approach often associated with renewable energy systems. The aim of the design was to reduce the embodied energy in the building construction, as well as reducing the operating energy over its lifetime use.



INNOVATIVE ENERGY SYSTEMS

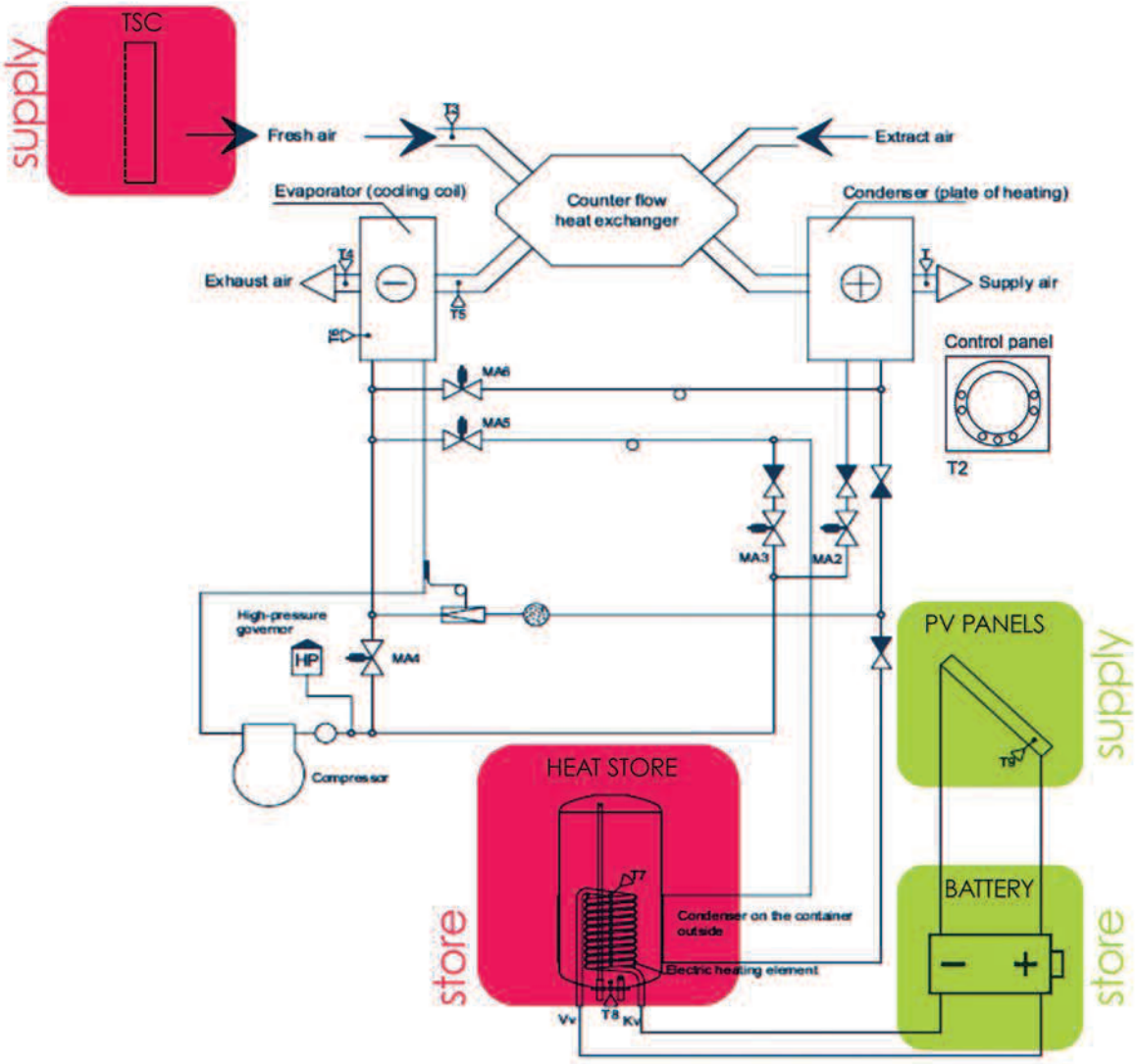


The energy systems combine solar generation and battery storage to power both its combined heating, ventilation, hot water system, and its electrical power systems which includes appliances and LED lighting. In winter, space heat is provided by passing external air through the upper south facing transpired solar air collector (TSC), then through a mechanical ventilation heat recovery unit (MVHR), and then delivered to the space. Exhaust air is passed through the MVHR and then through an exhaust air heat pump, which heats the thermal water store. The thermal store heats domestic hot water (DHW). The heat pump is powered by the PV and battery storage system. The house uses grid electricity supply when the PV - battery system is exhausted. The predicted energy performance is 70% autonomous, with a 1.75 grid export-to-input energy ratio.

6.9 KWh BATTERY

4.3 KWP PV ROOF

HEATING SYSTEM



Now the house has been built the key task is to ensure that all of the measures that have been put in place are monitored to assess operational energy use. This information will be used to inform future projects and industry with the aim of ensuring that Wales remains at the heart of the development of a zero carbon housing future. The building demonstrates a leading edge low carbon supply, storage and demand technologies at a domestic scale which we hope will be replicated in other areas of Wales and the UK in the future.

SIPS PANELS

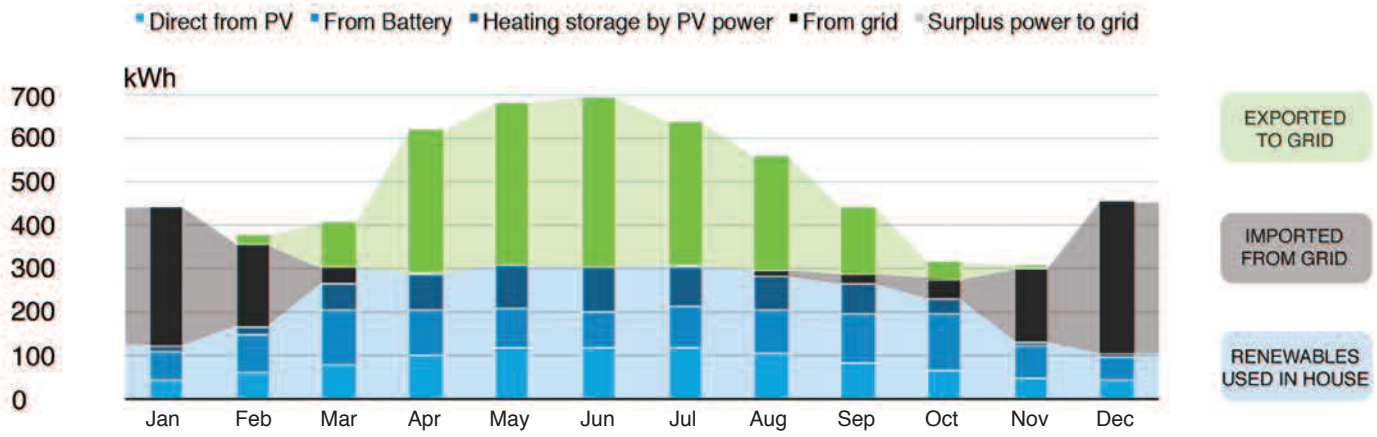
TSC

INSULATED RENDER

RESULTS

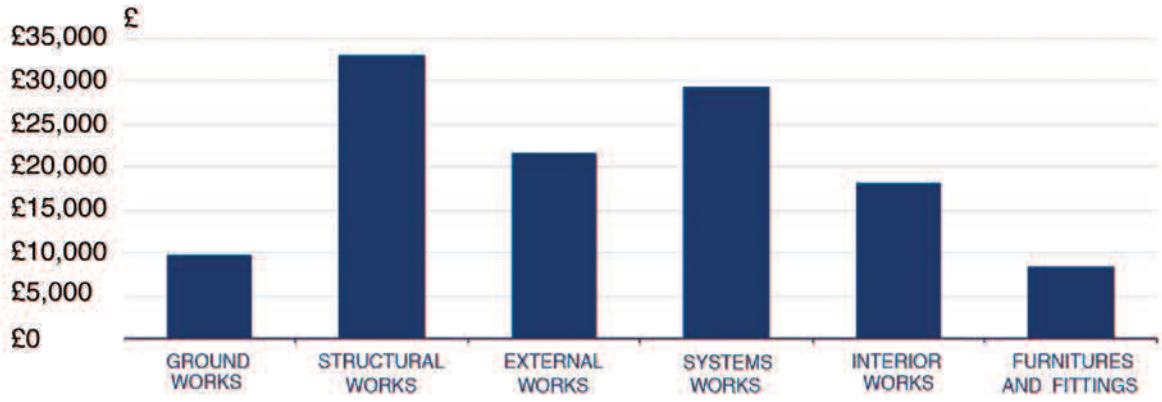
ENERGY POSITIVE

The predicted energy performance is 70% autonomous, with a 1.75 grid export-to-input energy ratio.



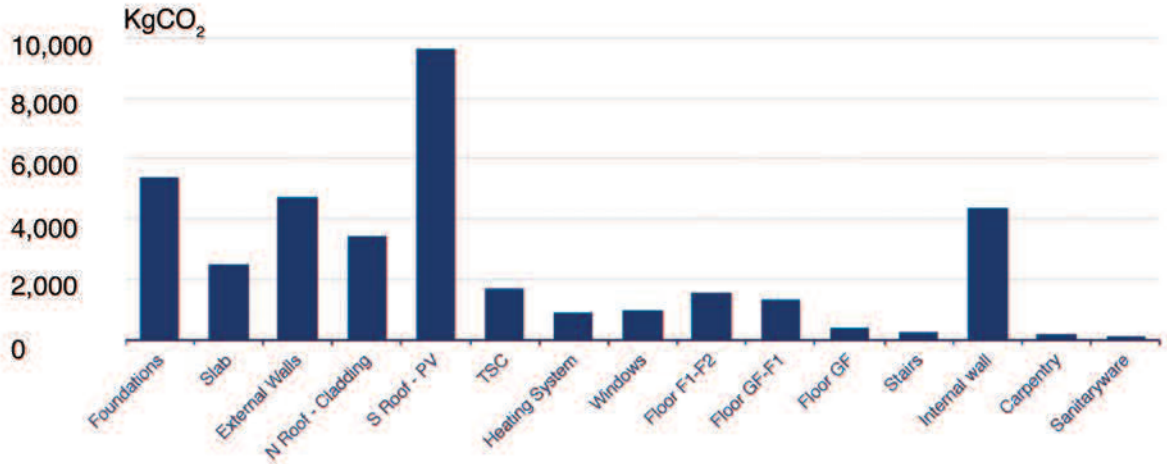
LOW COST

Estimated cost of the house is £1,000/m^2, compared with social housing benchmark of £800 - £1,000/m^2.



LOW CARBON

The embodied CO_2 of the house materials is 340 kgCO_2/m^2, compared with standard house benchmark of around 500 kgCO_2/m^2.



SUPPLY CHAIN

The components of the building have been sourced, as far as reasonably practicable, from Welsh manufacturers and installers, and the house will be used as a demonstration of advanced Welsh construction technologies. The low carbon systems have been designed to be affordable and replicable, for local developers to build houses, using market available technologies. This systems approach aims to use a very low amount of energy to provide a comfortable environment for the building's occupants.

LCRI PROGRAMME

The Solcer House was built as part of the Low Carbon Research Institute (LCRI) programme, set up to unite and promote energy research in Wales and to help deliver a low carbon future by uniting the diverse range of low carbon energy research across Welsh universities at Cardiff, Swansea, South Wales, Glyndwr, Bangor and Aberystwyth, working closely with industry and government.

The Solcer project demonstrates the successful collaboration between academia, industry and government which has taken place as a result of the LCRI's HEFCW Reconfiguration and WEFO Convergence Programmes (2008 to 2015). We aim to continue these collaborations into the future to confirm Wales as a leader in low carbon technologies.

For more information on the Solcer House, see **@LowCarbon_House**; for information on the Solcer Project, see **www.solcer.org**

PROJECT TEAM

Principal Investigator	Prof. Phil Jones
Project Manager	Dr. Jo Patterson
Architect & researcher	Ester Coma Bassas
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Monitoring team	S. Lannon & H. Jenkins
LCBE team	R. Williams & E. Doe

ACADEMIC PARTNERS

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University of South Wales
Glyndwr University

PROJECT PARTNERS

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NSG GROUP
TATA STEEL
cenin cement