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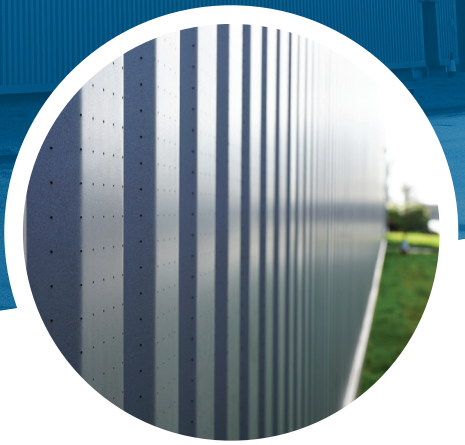
Solar Heat Storage:
Eliminating Gas Heating



Heating of space and water in buildings accounts for about a quarter of all energy consumption*; as a result, it is the biggest single challenge in the drive to provide affordable, secure and low carbon energy.

At peak demand in winter, UK gas usage exceeds electricity use by around five times: there is not enough capacity in our electrical grid to meet the demand for heating. Alternative solutions must be found in order to deliver UK carbon reduction targets.

Solar air collectors such as Tata Steel's Colorcoat Renew SC® are very effective at capturing solar heat energy for use in buildings. However, heating is most often required at night or in winter, when the sun is not shining.

Heat storage is therefore a key enabler of solar heat technologies.

[References: *Technology Innovation Needs Assessment: Heat, LCICG (2012)]

Led by:

Swansea University
Prifysgol Abertawe

Funders:

EPSRC
Engineering and Physical Sciences Research Council

We work with Innovate UK

UNDEB EWROPEAIDD
EUROPEAN UNION

Llywodraeth Cymru
Welsh Government

Cronfa Datblygu Rhanbarthol Ewrop
European Regional Development Fund

Mae'r ddogfen hon ar gael yn Gymraeg hefyd

From Day to Night

The first prototype of our diurnal heat storage system has been used on an industrial unit in Port Talbot since 2012, and the gas supply to the building has been eliminated. Hot air from the solar collector can be supplied directly into the building or stored in a large water tank to be used the following day.

Warm air is passed through a heat exchanger creating warm water, which in turn is routed to a heat pump which raises the water temperature to around 50°C. The hot water can then be used directly or is stored in a water tank until required, with release via fan coil units or highly efficient radiators.

Currently, 30% of the building's heating comes directly from the solar air collector and 70% comes via the diurnal storage system.

From Summer to Winter

We are also investigating inter-seasonal heat storage using thermochemical materials, which will enable longer-term storage of heat. Our first full building-scale demonstration has been constructed at our Solar Heat Energy Demonstrator (SHED) building in Margam.

- The thermochemical storage materials utilise the fully reversible hydration and dehydration reactions of chemical salts such as CaCl2.
- To store energy, hot air is passed over the SIM (Salt in Matrix), removing moisture and storing the energy via an endothermic reaction.
- To recover the energy, humid air is passed over the salts, causing an exothermic reaction, releasing heat that can be directed to the zone requiring warmth. This can be repeated over numerous cycles.

SPECIFIC aims to develop heat storage systems that will enable solar air collectors to deliver 100% of a building's space heating requirements all year round. Such solar thermal systems could reduce large buildings' heating demand by 80%. This technology has the potential to be truly transformative

THE SOLAR HEATING SYSTEM HAS REPLACED GAS SUPPLY SINCE 2012

FOR EVERY 1 UNIT OF ELECTRICITY USED, 5.5 UNITS OF HEAT ARE GENERATED

365 DAY OPERATION

THE SOLAR WALL GENERATES 125,000KWH/YEAR = 8.5 HOUSES

SALT IN MATRIX CAN BOOST AIR TEMPERATURE BY UP TO 20°C

THE SOLAR COLLECTOR HAS UP TO 75% CONVERSION EFFICIENCY