

The SPECIFIC Innovation and Knowledge Centre (IKC) has developed the **buildings as power stations vision** where integrated systems allow buildings to generate, store and release their own energy. The centre brings together world class academic and industrial expertise in a range of technology areas that include photovoltaics, solar thermal, heat and electrical storage and cooling.

SPECIFIC has unique facilities which include pilot manufacturing scale up facilities, world class research laboratories and innovation space for industrial interactions.

The only centre developing the complete Buildings as Power Stations concept, SPECIFIC's goal is to nucleate a new industry and close the gap between research and exploitation.

## Buildings as Power Stations

2010

2020's...

### Inputs

Infrastructure - Funding, expertise, facilities, research excellence, technology integration  
 Ecosystem - Vision, stakeholder alignment, early adopters, policy alignment, innovative companies

#### Functional Coating



#### Product Concept



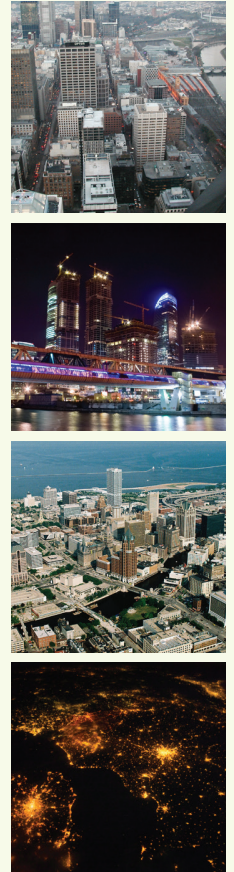
#### System Integration



#### Building as a Power Station with Multiple Systems



#### Connected Communities Resilient Energy



### Outputs

Economic - Jobs, wealth creation, new business models, IP, new products and services, skilled people  
 Commercial - Value add products & systems, disruptive technologies, demonstrations, new markets  
 Sustainability - Greener solutions, distributed energy, efficiency of energy use, lower carbon, security

# Partnerships

Working with leading research centres and innovative companies, our network combines technology and innovation to create integrated systems and solutions for many types of buildings, both new and retrofit.



## Concept to commercialisation platform

SPECIFIC's aim is to enable rapid commercialisation with industry. A unique and growing network of leading universities, companies from multinational corporations to innovative SMEs and other organisations sharing the vision and working together to **scale-up technologies, develop supply chains and identify routes to market.**



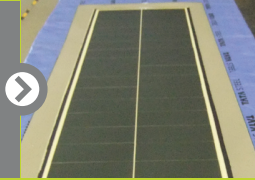
## Technology scale-up capability

Four integrated facilities delivering lab to line capability – including brand new state-of-the-art laboratory facilities at Swansea University, pilot manufacturing lines delivering building-scale products and a full-scale Technology Demonstrator Building. Industrial partners can co-locate at Baglan Bay Energy Park.

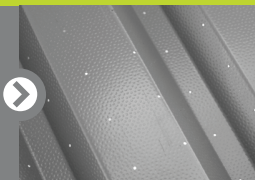
# Aims and Objectives for 2016-2021

## Technology Breakthrough

20p per watt peak building integrated photovoltaics



Inter-seasonal solar thermal generation and storage

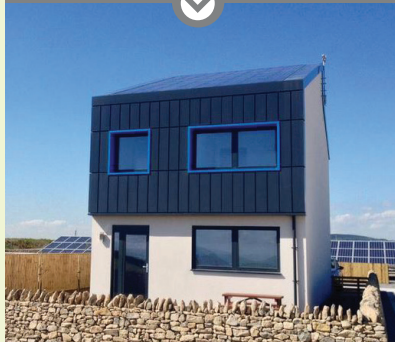


Building scale batteries offering grid parity storage

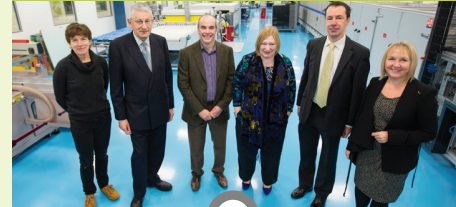


## Demonstration

105 full-scale building demonstrators in residential, industrial and commercial sectors, including new build and retrofit, and leading to large scale deployment.



## Commercial Impacts

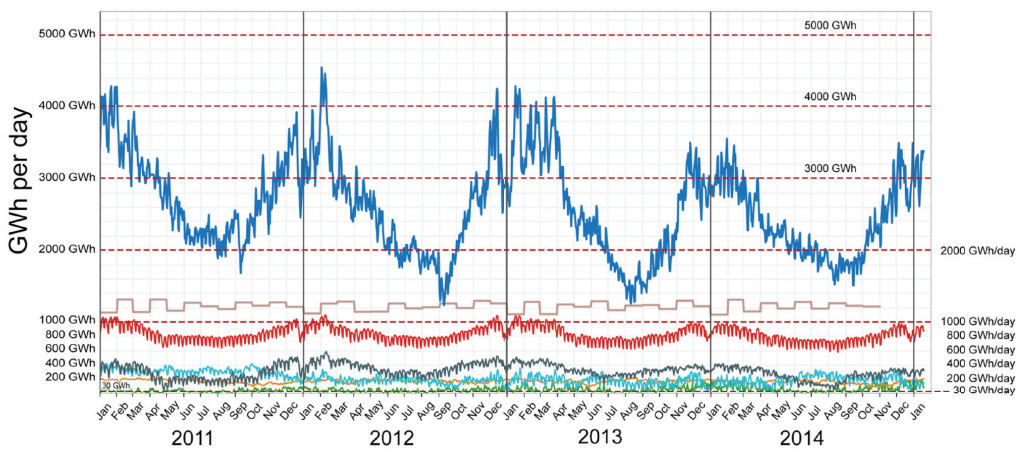


- A concept to commercialisation delivery platform
- A unique network of aligned industry and academic partners
- Catalyst for a new industry worth £1 billion
- Creation of 5000 jobs through the supply chain

## Energy Landscape

Great Britain's Energy - in GWh per day

**EPSRC**  
Pioneering research and skills



Measure Names

- Gas Total Demand
- Elec Total (INDO)
- Elec from Coal
- Elec from CCGT
- Elec from Nuclear
- Elec from Wind
- Transport MS+DERV

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The UK energy challenge is demonstrated by this diagram showing the significance of the demand for heat and electricity on a daily and seasonal basis. The roadmap for decarbonisation of heat relies on the migration away from gas to electricity. This is problematic because of the disharmony between diurnal variability in the electricity demand and the seasonal variability of gas demand. The UK strategy<sup>(1)</sup> for gas to electrical heating means that the electrical grid will require massive redundancy to cope with the peak heat demand.

(1) Smart Systems and Heat - Decarbonising Heat for UK Homes (2013) ETI

# The energy “trilemma” addressed by the Buildings as Power Stations solution



Affordability

- Reduces demand from the largest users of energy – buildings
- Buildings become generators and exporters of energy



Security

- Buildings as Power Stations offers more stable, decentralised solutions at point of use
- Eliminate gas usage at building scale
- Reduce reliance on fossil fuels



Carbon Emissions

- Solutions and systems are solar based
- Eliminates carbon emissions in use of the building
- Creates demand side reductions

## Impact and Scale of Opportunity

- A low risk solution and compelling case for low carbon at no cost
- Reduction in electrical distribution grid stress
- Cost reduction for capital investment in central electrical energy generation infrastructure
- A complementary approach to existing requirements for new build and retrofit, yielding a significant demand side reduction in energy
- Decarbonisation of heat by elimination of fossil fuels for space heating for buildings
- A tangible energy offering putting the consumer in control
- Potential for significant impact on fuel poverty



Strategic Partners



TATA STEEL



Funders

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# New 'Solar Homes' given the go ahead

We've just been granted planning permission for 16 homes in Neath, that will combine innovative technologies to allow the homes to generate, store and release their own energy.

The concept for the homes goes beyond that of a carbon neutral model towards the overproduction of energy and will actively reduce the impact of fuel poverty and carbon emissions.

We've designed the layout of the 1, 2 and 3 bedroom homes to maximise solar gain; technologies include solar roofs, solar heat collectors on south facing walls and shared battery storage so that excess energy can be stored and used when its needed.

The Active Homes Neath Project is a partnership with Neath Port Talbot Council and SPECIFIC Innovation and Knowledge Centre and is set to become the first development of social housing to use these technologies in the UK.

Our Director of Development (West), Jonathan Hughes, said:

## Back to August



## Cardiff Pride, Visits by VIPs and afternoon teas!

“We are really excited about the integration of these technologies into new homes; the ability to generate energy from roof and wall coverings and store excess energy in batteries has the ability to make a real difference to the lives of the residents by reducing the amount they spend on energy bills. But also, we’re promoting a cleaner form of energy that has numerous benefits for the wider environment.”

The Active Homes model integrates innovative technology using the ‘buildings as power stations’ approach developed by SPECIFIC, the national Innovation and Knowledge Centre led by Swansea University. Chief Executive at SPECIFIC, Kevin Bygate, explained what this could mean for the average household:

“A report released this week has found that energy bills could be cut by more than 60% saving the average household over £600 a year if homes could generate, store and release their own solar energy.”

Active Homes Neath is a flagship development within the ‘Homes as Power Stations’ Swansea Bay City Deal project led by Neath Port Talbot Council. Councillor Anthony Taylor, Deputy Leader of Neath Port Talbot Council explains more:

“‘Homes as Power Stations’ is a very exciting project which places Neath Port Talbot and the Swansea Bay City Region at the forefront of work to address two of the UK’s most pressing environmental and social issues – energy efficiency

and fuel poverty.

This pilot scheme, as the precursor of one of the City Deal's biggest projects, also provides a major opportunity to utilise locally-developed technology to help safeguard and create jobs in the construction sector and to develop a highly skilled and technologically advanced supply chain within the region.

The scheme will play its part in shaping the next generation of housing design and I am looking forward to seeing its benefits being felt in our local communities."

## WHO'S IN OUR GROUP?

Charter Housing Association  
Gwalia Care and Support  
Solas Cymru  
Derwen  
Reach (Supported Living)  
**Serenliving**  
Gwalia  
Gwalia Trust

## CONNECT WITH US



## CONTACT US

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# The SOLCER House

*Low carbon, energy positive full scale building demonstrator*

The Welsh School of Architecture, at Cardiff University, in partnership with the SPECIFIC Innovation and Knowledge Centre, based at Swansea University, 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, effectively turning the building into a power station. Despite the UK Government dropping its 2016 zero carbon homes target, the Solcer House shows that it is possible to achieve this now, and all at an affordable cost.



The house uses the Buildings as Power Stations concept developed at SPECIFIC. SPECIFIC initially constructed a demonstrator 'pod' combining generate, store and release technologies under one roof to function as an off grid building.



The Solcer House has taken this concept further to create an energy positive house at an affordable cost. The house has been designed by the Welsh School of Architecture to meet social housing standards and was constructed in 16 weeks using local supply chains.

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.



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.

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.



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.



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.

The components of the building have been sourced from Welsh manufacturers and installers where possible, and the house will be used as a demonstration of advanced Welsh construction technologies.

SPECIFIC is led by



Swansea University  
Prifysgol Abertawe

SPECIFIC is funded by



Engineering and Physical Sciences  
Research Council







Technology Strategy Board



Cronfa Datblygu  
Rhanbarthol Ewrop  
European Regional  
Development Fund



# SOLCER House Benefits

 <p><b>Affordable</b></p>	 <p><b>Achievable</b></p>	 <p><b>Energy Positive</b></p>	 <p><b>Low Carbon</b></p>
<p>built for £120000 with the team expecting reductions of 10 to 15% for building at scale</p>	<p>built in just 16 weeks using local supply chains</p>	<p>for every 1kWh it imports from the grid, it exports 1.75kWh to the grid during sunny weather. Over a year, the house is energy positive</p>	<p>built using commercially available low carbon technologies</p>

The key task now is to ensure that all 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 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.

*The Solcer House demonstrates the successful collaboration between academia, industry and government that has taken place as a result of the LCRI's HEFCW Reconfiguration and WEFO Convergence Programmes (2008 to 2015).*

*It brings together two major research initiatives – LCRI and SPECIFIC – as well as academic and industrial partners **confirming Wales as a leader in low carbon technologies.***

The House is one output of the SOLCER (Smart Operation for a Low Carbon Energy Region) research project that ran from 2012 to 2015. SOLCER was funded by the European Regional Development Fund and forms part of the Low Carbon Research Institute (LCRI) programme, set up to unite and promote energy research in Wales and help deliver a low carbon future by uniting the diverse range of low carbon energy research across Welsh universities, working closely with industry and government.

The SPECIFIC Innovation and Knowledge Centre was established in 2011 comprising grants from EPSRC, Innovate UK and the Welsh Government, together with investment from Swansea University and strategic industrial partners Tata Steel, BASF and NSG Pilkington.



Cyngor Cyllido Addysg  
Uwch Cymru  
Higher Education Funding  
Council for Wales



## SOLCER House Project Partners



## Academic Partners



Swansea University  
Prifysgol Abertawe

