

Whole House Retrofit Pilot with Swansea Council

Welsh School of Architecture at Cardiff University

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Summary

Social housing should be safe, affordable and warm - but an ageing housing stock has meant our properties are falling into disrepair with damp and mould and our tenants having to choose between food on the table or heating their homes. Many homes are also off-grid, resulting in the use of expensive alternative fuels where costs can be uncertain. Our project is about retrofitting homes to make them more energy efficient. The overall approach used in this project is about combining solutions together - choosing the appropriate solutions for the homes and then managing the process carefully to ensure that the solutions are installed correctly and the stakeholders involved in the process - occupants, supply chain, management team - are all engaged. Understanding this is the big step. Addressing the challenges faced by off-grid residents was an obvious place to start electrifying heat. By combining solutions to reduce the amount of energy used, together with installing renewable energy supply and storage we are able to not only take big steps towards becoming zero carbon but also create comfortable and affordable homes for the residents.

Our problem

Our housing stock is ageing and in need of maintenance to keep it to a satisfactory standard. Our homes can be expensive to run, leak heat and are prone to damp and mould - all public health issues. Energy bills can be very expensive in areas where there is an absence of a gas supply - which means tenants having to rely on oil, LPG (liquid petroleum gas) and electric heaters.

We have retrofitted a community of homes to be all electric, combining solar panels, battery storage and a ground source heat pump together with improvements to the fabric of the home such as increased insulation, residents have been spared an expensive and uncomfortable winter - both this year and in the future. It also means that they don't have to rely on tanks being refilled with oil or potentially dangerous heaters (while they're safe to operate inside, they do still pose burn and fire hazards). This scheme illustrates how essential retrofitting is for tackling climate change and driving down household energy costs - particularly for those on lower incomes.

Overview

Six 50-year-old council-owned bungalows located in Craig Cefn Parc (five miles north of Swansea) have undergone a remarkable transformation in a pilot that we hope to roll out across the city and south west Wales. In desperate need of renovation, all of the homes were kitted out with double glazed windows, insulated walls and roof, low energy lights and solar panels integrated into the roofs to generate electricity which is stored in Tesla batteries - all while the occupants remained living there. A Ground Source Heat Pump (GSHP) provides heat and hot water for each home and a ventilation system circulates fresh filtered air throughout the homes via ceiling

vents, which helps reduce energy use.

Before the work, the bungalows were very expensive to heat, incredibly heat inefficient and uncomfortable to live in - with damp, mould and low SAP (fuel-cost-based energy efficiency) ratings. We monitored the homes for two years before the retrofitting began and we'll be monitoring them going forwards to measure how much of an impact our upgrades have had. The residents will be paying minimal energy bills from now on, with energy bills being reduced by up to £47 per month.

The point of the whole house retrofit project is to demonstrate how and why existing housing stock should be decarbonised in Swansea, across Wales and beyond. It will act as a model from which a bigger £505 million Swansea Bay City Deal *Homes as Power Stations* (HAPS) project can work. That will see 7,000 homes being retrofitted over five years across the City Deal region, and a further 3,000 energy-efficient houses being built across the local authorities of Swansea, Neath Port Talbot, Pembrokeshire and Carmarthen.

The HAPS retrofit programme aims to use the demand reduction (energy efficiency measures and fabric improvements), renewable energy supply and storage approach but not necessarily exactly the same solutions as the bungalows. The age of a building, level of maintenance, occupancy and previous works that may have been carried out already can influence the combination of retrofit solutions that are appropriate. It will also depend on the additional funding streams available to the different types of occupants.

Many of the homes will be off-grid but not all. The bungalows have cavity walls, not solid walls and this is typical of the era when they were built. Some of the other homes that are set to be retrofitted will have solid walls (much older); that will require different solutions. It is likely that the HAPS homes will be suffering from fuel poverty, poor internal comfort conditions and that the homes will require some level of maintenance.

The project was Highly Commended in the 2020 [Constructing Excellence in Wales Awards](#) and has been shortlisted in the Best Housing, new Build and regeneration category in the APSE Service Awards 2020.

Timeline / project progress

The project has already been completed and partially evaluated. Long-term monitoring is now happening to determine just how well these technologies are working and what impact they're having on residents. That means engaging with the occupants on a regular basis.

Stakeholders

Swansea Council has engaged staff across the organisation - from senior decision makers to maintenance teams - in this project. We've worked very closely with a research team from the Welsh School of Architecture at Cardiff University, as well as the bungalow residents and operators in the supply chain. The Distribution Network Operator is a key player as residents become connected to the grid for the top up of electricity they may need.

The project has been funded by Swansea Council and the Welsh European Funding Office (WEFO) with each bungalow costing around £55,000 to complete.

Whole systems approach

This project is going to inform how Swansea Council goes about making housing schemes fit for purpose going forward. By monitoring the impact of changes to these bungalows, we can see what evidence there is for the projected savings and that data will help to inform future projects.

Swansea Council is also using the whole house approach on its new build schemes, funded by the Welsh Government and monitoring these as well to see if the performance is as good as the design.

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The bungalows now look much more attractive and are highly efficient at generating and storing their own energy and providing substantial financial savings for the residents who are now living in much more comfortable temperatures and humidity levels. SAP ratings have improved from 12 to 95 and EPC (Energy Performance Certificate) ratings from G to A.

Monitoring has confirmed that energy bills have reduced from £50 to £3 per month over the summer (work was complete in Feb 2020), and that's due to a change in fuel from oil/LPG to electric, energy generated and stored at the home and the improvement of the fabric of the homes. Between March and September 2020, 95% of electricity (only fuel source) has been provided from the double aspect PV panels and the lithium ion battery.

While the benefits to these occupants have been huge, we've found that retrofit programmes need to be managed well in order to ensure that the benefits can be realised.

Collaboration and clear communication is essential between all stakeholders involved to ensure successful delivery of whole house retrofits. Correct commissioning is essential to ensure that technologies perform as designed and the supply chain needs to work together to ensure installations align with each other.

As the residents were elderly, a lot of communication and coordination was needed about the programme of works. Additional costs were incurred to complete the project including internal redecoration and making good the gardens after the fitting of the Ground Source Heat Pumps.

This development has seen a boost to skills and employment in Swansea. Swansea Council's own Building Services team managed the project, with its own staff carrying out the construction work. The local supply chain was used wherever possible, with 14 trades people directly employed by building services. Staff who faced redundancy due to restructuring have been retrained and we had four apprentices on-site being mentored by tradespeople.

The team who has been involved in the project from Swansea Council will take the knowledge that they have learnt from working on this project to other projects.

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