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LOCAL ENERGY CHALLENGE FUND GCF 138 - HEAT SMART ORKNEY

END OF PHASE 1 GRANT REPORT

PROJECT DATES:	July 2015 to March 2016
APPLICANT:	Michelle Koster Rousay Egilsay & Wyre Development Trust Manse Rousay Orkney KW17 2PR
DELIVERY PARTNERS:	Community Energy Scotland Vcharge (UK) Ltd Catalyst
AWARD:	£0

Aims

Rousay Egilsay & Wyre Development Trust's (REWDT) Heat Smart Orkney project aims to tackle fuel poverty by providing supplementary heat and hot water, in addition to participating householders' existing heating systems, by diverting electricity from an otherwise curtailed wind turbine, and to operate independently of any existing contractual agreement or tariff already in place with the Distribution Network Operator (DNO) Scottish and Southern Energy (SSE).

The project will switch on additionally installed electrical loads via device controllers, in the form of flow boilers, storage heaters and immersion heaters. As a result, the existing non-electric system, or simple direct open fire, will not need to work as hard and the householders can take advantage of a reduced per kWh rate for the additional electricity used, paid for by the increased generation at the wind turbine.

Community Rationale

The community drive and rationale of the Heat Smart Orkney (HSO) project is based on a wish to find constructive solutions to use our own resources to directly address the staggering levels of fuel poverty within our communities. By redressing the seriously elevated and prolonged extent of production curtailment experienced by the wholly community-owned wind turbine in Rousay, and other similar installations in Orkney, we will be further able to indirectly combat fuel poverty as well as generating more community funds for local initiatives.

Development of Heat Smart Orkney in the North Isles

The community-owned turbine groups around Orkney have collaborated since their inception in 2009, through membership of the consortium, Community Power Orkney (CPO), led and co-ordinated by Heat Smart Orkney delivery partners, Community Energy Scotland (CES). Between them, the CPO groups and CES have undertaken a number of studies and practical research projects to investigate options in Demand Side Management (DSM).

In 2014 two CPO members, REWDT and Hoy Energy Ltd, with CES support, embarked on a technical pilot to demonstrate a demand side management system through a grid-smart EV charging trial, as well as a grid smart heating trial through dispatchable domestic heat devices including storage heaters, immersion hot water tanks, and (in radiator-equipped homes) thermal stores and flow boilers. The trial outcomes informed the HSO project by providing realistic information about the practicalities of installation, householder behaviour and device suitability.

Local Energy Challenge Fund – Round 2 Phase 1

Building on the technical pilots, Round 2 Phase 1 of the Local Energy Challenge Fund allowed REWDT to appoint project partner Vcharge to test the resilience of the communications over broadband between the aggregation system located in the cloud, and the heating device controllers (called 'dynamos'), located within six trial households.


Flow boiler and dynamo installation in Rousay

Utilising funding from the Big Lottery Fund, the trial households were selected from a pool of applicants, due to the varying nature of the installations as well as the variety of broadband connection options. Each property was surveyed by project partner, Catalyst, who advised householders on the most suitable equipment.

As a result, 4 x Quantum storage heaters, 1 x flow boiler and 6 x parallel immersions were installed across the trial households. Digital meters to record kWh usage for each individual device, were also installed alongside each dynamo.

Each household entered into a Minute of Agreement with REWDT regarding the service being provided, together with expectations, obligations, maintenance arrangements and, should it be required, the ability to terminate or transfer the arrangement if necessary.

A system was designed to allow householders to benefit from rebates, the cost of which would initially be met by REWDT.

Vcharge aimed to control household loads, in real time, to demonstrate the increase in electrical demand during periods of generator curtailment. This involved:

- Hardware – the dynamo control units were connected to each heating device and were in turn connected, via broadband, to the cloud-based control system. Communications units were connected at each wind generator via 'Vscon' SCADA units.
- Software – The central, cloud-based control system would calculate the needs of each load, and predict future curtailment events using weather and generation feeds from the generators. The system dispatches loads using a 'market based' algorithm to maximise curtailment abatement while delivering heating needs at lowest cost. Intelligence in each dynamo control unit allows fall-back settings should communications be lost.

Whilst none of these elements were new, bespoke work was required to adapt the software to the specific requirements and network topology of Orkney.

The newly installed Vscons were able to identify the generator's 'marginal' curtailment. This occurs when the turbine is curtailed but is first in the DNO's Active Network Management system priority stack to receive extra export capacity. It is vital to know when this is the case, as only when the turbine is marginal will extra local load directly benefit the participating turbine, rather than others in the Orkney grid.

Every second, raw data and processed marginal curtailment data was forwarded via a secure Virtual Private Network (VPN) connection to the VCharge Cloud Control Centre (VCCC). The picture to the right shows the data as received at the VCCC (note that in addition to Rousay (green), data feeds are visible from Vscons installed at Eday (orange) and Shapinsay (purple).

Next Steps

At the time of submitting the HSO Phase 2 application to the Local Energy Challenge Fund, trials were still in progress.

The successful application for Phase 2 LECF funding of the HSO project, has seen the project awarded up to £1,281,900. Heat Smart Orkney Ltd, the project delivery company will engage with members of the REW community, to roll out the commercial scale trial, whilst REWDT and delivery partner, CES, will tender for the contractors to deliver the heating devices installations.

Michelle Koster
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