

## The Each Leim Microgrid Energy Storage



### Introduction

This project was a demonstration project under the GREAT Project (Growing Renewable Energy Applications and Technologies) which is an EU funded project under the INTERREG IVB NWE Programme.

GREAT aimed to encourage communities and small to medium size enterprises (SMEs) to develop technological solutions for Smart Grid, Renewable Energy and Distributive Generation; to research and develop policy issues for regulatory authorities and to provide structured co-operation opportunities between SMEs and research institutes / technology developers.

Údarás Na Gaeltachta was lead partner on the GREAT Project, with two full-time staff allocated to the co-ordination and implementation of their project aims. Each Leim Enterprise Centre was selected as a demonstration site.

The Sustainable Energy Authority of Ireland (SEAI) also provided funding for this demonstration project under the Better Energy Communities (BEC) programme, and Údarás Na Gaeltachta utilized the expertise available in the SEAI in the development of the smart grid.



## Case Study Approach

The data on the market access of renewable energy technologies were collected both from the case studies in different renewable energy technology projects and from the secondary sources. To collect specific project data, a template was established with following subsections:

- **Technology description and a project summary**
  - Innovative characteristics
  - Technology readiness level
  - Available product / service supports from the manufacturer
  - Any standard procedures / requirements for integrating the technology into existing electricity networks, buildings and/or mainstream energy appliances / systems
- **Commercialisation of the technology**
  - Is the technology already a commercial solution?
  - Are there re-sellers of the technology, or is the technology available only from the manufacturer?
  - Identified main market area
- **Cooperation partners and networks**
  - Description of the roles of the co-operation partners and networks in the RE technology project.
  - How have they supported the market access of the technology?
- **Assessment of the technical and economic risks**
  - What kind of procedures have been made for assessing the technical and economic risks of the project
  - Who is bearing the risk of the investment (manufacturer, client, shared between them)?
  - Is the public sector involved in risk sharing? (e.g. co-financing, or platform for technology demonstration)
- **Drivers and barriers in the RE technology project**
  - Main drivers in carrying out the RE technology project
  - Barriers, and how they have been overcome (such as price of energy, availability of resource, specific expertise, policy enabling the technology)
- **Funding and support mechanisms**
  - The financial support received by the project: amount/support rate, type and purpose of the support, agency providing the support, significance of the support for the project
  - Types of soft support/advisories received during the project: the use of soft supports (advisory, training, mentoring etc.) during the technology development or implementation, and how successful these have been
- **Monitoring the performance**
  - How are the technical/non-technical aspects of the RE technology case monitored?
  - Information on the design, installation requirements and procedures, operational performance, and costs/financial arrangements
- **Conditions for the technology transfer & adaptation in different partner regions**
  - What are the main requirements/preconditions for transferring the technology and applying it in other partner regions?
  - Description of the main drivers and barriers for the technology transfer (such as. Energy price, resource needs, certain support etc.)
- **Project results**
  - Benefits & lessons learnt
  - Post- project benefits

## Technology Description

Each Leim Údarás Na Gaeltachta Enterprise Centre microgrid has an 11kW PV array with a 5-40kWh REDT Vanadium battery system, 3 x SETS (Smart Electrical Thermal Storage) (Dimplex Quantum), a Building Management System (BMS) to allow remote access and monitoring.

The 5-40kWh Vanadium battery system is developed by REDT<sup>1</sup>. This vanadium flow battery is a unique storage technology as it provides one of the lowest available levelised cost of energy storage over the life of the system. Coupling storage with PV requires storage technologies that can handle a long charge cycle during the day and a long discharge cycle during the night, which often leads to rapid degradation using conventional storage technologies such as lead and lithium. REDT's vanadium energy storage is durable and can handle such long discharge cycles. REDT have recently launch the Vanadium battery on the commercial market.

The SETS (Smart Electrical Thermal Storage) Quantum developed by Dimplex is the world's most advanced electric space heater. It uses low-cost, off-peak energy, making it the most economical electric heating system on the market today. Quantum SETS adapts to match lifestyle and climate conditions, delivering heat only when it's needed. SETS allows the one-way storage of renewable energy as heat, which can then be used for space heating and hot water at a later point in time. SETS can be used to provide decentralised space heating and hot water, and can act as an energy storage system to provide distributed flexibility to the electricity grid. Quantum stores energy up during periods of low demand, turning it into efficient heat only when needed. Quantum is up to 27% cheaper to run than a standard storage heater system. Quantum is fitted with an iQ controller which so users can pre-set their heating requirements.



Figure 1. The 11 kW Solar PV and 40 kWh Vanadium battery system at the Each Leim site.<sup>1</sup>

<sup>1</sup> WDC 2017.

## TRL and Technology Scale

The technology readiness level of the 11kW PV array and the 3 x SETS (Dimplex Quantum) are 10. The REDT Vanadium battery system at the Each Leim site has a technology readiness level of 9 as REDT have recently installed in some commercial sites.

In determining the scale of the demonstration project at Each Leim Enterprise Centre, Údarás Na Gaeltachta took advice from the expertise available from the stakeholders in the project. The SEAI promoted the development of micro grids, and their expertise was used to determine the building load, and therefore, the size of the PV array. Based on experience in other enterprise centers, it was possible this would not be fully utilized, and building services and engineering personnel in Údarás Na Gaeltachta recommended using two electrical loads. The first change was made with the installation of the 3X SETS. REDT were engaged and size of battery was dictated by REDT unit and their recommendations.

## Cooperation partners and networks

This microgrid demonstration project was installed in December 2015, and is not yet operational and is still in its implementation phase. The suppliers of the Vanadium Battery, REDT, will provide support from twelve months from operational completion. The Electricity Supply Board (ESB) has strict procedures regarding the integration into the existing network and was heavily involved with this. Project. For the use of PV, the required inverters was specified. For this reason, the three Vanadium battery inverters were procured from the same manufacturer as PV inverter for ease of integration.

As promoters of this microgrid demonstration project Údarás Na Gaeltachta brought together stakeholders would were able to contribute to the development of the project as the only microgrid site in the West of Ireland.

The Each Leim Enterprise Centre is owned by Údarás Na Gaeltachta. Údarás na Gaeltachta is the regional authority responsible for the economic, social and cultural development of the Gaeltacht (Irish Language) region. The GREAT Project (Growing Renewable Energy Applications and Technologies) was an EU funded project under the INTERREG IVB NWE Programme.<sup>1</sup>

GREAT aimed to encourage communities and small to medium size enterprises (SMEs) to develop technological solutions for Smart Grid, Renewable Energy and Distributive Generation; to research and develop policy issues for regulatory authorities and to provide structured cooperation opportunities between SMEs and research institutes / technology developers. Údarás Na Gaeltachta was lead partner on the GREAT Project, with two full-time staff allocated to the co-ordination and implementation of their project aims. Each Leim Enterprise Centre was selected as a demonstration site.

The Sustainable Energy Authority of Ireland (SEAI) provided funding for this demonstration project under the Better Energy Communities (BEC) programme, provided design and technical expertise in the development of the smart grid. Mayo Co. Co. administered the 50% BEC funding for the project. In addition to this, REDT, the developers of the Vanadium battery, and the main contractor, Sean Horan Ltd. were important stakeholders providing technical, electrical and mechanical advice.

## Risk assessments and supports received

As this was a demonstration site for a new technology, no formal risk assessment was carried out. In developing this project, the GREAT Project prepared a justification to Board of Directors of Údarás Na Gaeltachta on incurring this expenditure and the benefits of this project in energy saving and the promotional aspect as this is first energy storage site in the West of Ireland. The collaborating with SEAI was invaluable for the design and technical expertise, as well as the use of experienced contractors in the mechanical and electrical installations.

As the promoter and owner of the project, Údarás Na Gaeltachta bear the risk of the project, with the contractor, Sean Horan Ltd. bearing some of the cost until the demonstration site is operational. Údarás na Gaeltachta as a public regional authority is responsible for the risk involved in this project.

Type and purpose of the support	€	Funding providers
<b>11kW ground mounted PV</b>	22,000	50% Údarás Na Gaeltachta & 50% SEAI BEC
<b>5-40 REDT Vanadium Battery</b>	35,000	55% Údarás Na Gaeltachta & 45% SEAI RD&D
<b>3 x SETS (Dimplex Quantum)</b>	2,550	50% Údarás Na Gaeltachta & 50% SEAI BEC
<b>Building Management System</b>	10,000	100% Údarás Na Gaeltachta
<b>Electrical Integration</b>	10,000	100% Údarás Na Gaeltachta
<b>Groundworks/Construction</b>	15,000	100% Údarás Na Gaeltachta
<b>Broadband upgrade</b>	1,000	100% Údarás Na Gaeltachta
<b>Total</b>	95,550	

Table 1. Project costs and funding providers.<sup>2</sup>

The cost of this project was funded by Údarás Na Gaeltachta and the SEAI under the Better Energy Communities and Research Development & Demonstration (RD&D) programmes (Table 1). This funding is also an example of public sector involvement in sharing the risks of technology demonstration in operational environment and promoting its market access.

<sup>2</sup> WDC 2017.

In developing this project, the GREAT Project prepared a justification to Board of Directors of Údarás Na Gaeltachta on incurring this expenditure and the benefits of this project in energy saving and the promotional aspect as this is first energy storage site in the West of Ireland. The financial support from the SEAI under the Better Energy Communities and Research Development & Demonstration (RD&D) programmes assisted in the delivery of the project.

In addition to the funding provided by Údarás Na Gaeltachta and SEAI, personnel resources were provided by three Údarás Na Gaeltachta staff, three SEAI staff and REDT. Design and technical support was provided by SEAI and the contractor Sean Horan Ltd. provided mechanical and electrical expertise.

No calculations have been made on payback periods as this is a demonstration site. In developing this project, the GREAT Project prepared a justification to Board of Directors of Údarás Na Gaeltachta on incurring this expenditure and the benefits of this project in energy saving and the promotional aspect as this is first energy storage site in the West of Ireland.

## Drivers and barriers

The Each Leim Microgrid project was one a demonstration project under the GREAT Project (Growing Renewable Energy Applications and Technologies) which is an EU funded project under the INTERREG IVB NWE Programme. GREAT aimed to encourage communities and small to medium size enterprises (SMEs) to develop technological solutions for Smart Grid, Renewable Energy and Distributive Generation; to research and develop policy issues for regulatory authorities and to provide structured co-operation opportunities between SMEs and research institutes / technology developers. Údarás Na Gaeltachta was lead partner on the GREAT Project, with two fulltime staff allocated to the co-ordination and implementation of their project aims. Each Leim Enterprise Centre was selected as a demonstration site.

The Sustainable Energy Authority of Ireland (SEAI) provided funding for this demonstration project under the Better Energy Communities (BEC) programme, and Údarás Na Gaeltachta utilized the expertise available in the SEAI in the development of the smart grid.

The main barriers to the development of this project for Údarás Na Gaeltachta was technical support. The addition of the SEAI to the project team overcame this by providing the design and technical expertise that staff in Údarás Na Gaeltachta did not have. The main contractor on the project, Sean Horan Ltd. were able to provide mechanical and electrical expertise to support other personnel from the building services department within Údarás Na Gaeltachta. As a partner in the GREAT Project, they were able to provide dedicated personnel resources for the implementation of the project aims, and by this to the microgrid demonstration project. The funding by the SEAI in both the Better Energy Communities (BEC) and the Research Development & Demonstration (RD&D) was beneficial to the project in sharing the risk of the microgrid development.

## Conditions for the technology transfer, adaptation and new market deployment

As the Each Leim microgrid is a demonstration site, transferring the technology and replicating it in other regions should be relatively simple, as similar standards and operating procedures are in place in other regions. Full open access will be available for researchers and academia. When the microgrid is operational, three researchers will record the data produced and analyse it. Údarás Na Gaeltachta hosted a site visit by the GREBE Project partners to the Each Leim Enterprise Centre in February 2016. It is estimated that the need for grid-connected energy storage systems will grow worldwide due to the expansion of production variations of renewable energy sources and the need for services of power quality and energy management<sup>1</sup>. Electrochemical storage systems are considered as suitable solution because of their localization flexibility, efficiency, scalability, and other appealing features. Among them redox flow batteries (RFBs), used also in case of Each Leim Microgrid, exhibit very high potential for several reasons, including:

- Power/energy independent sizing
- High efficiency
- Room temperature operation,
- Extremely long charge/discharge cycle life.

“RFB technologies make use of different metal ion couples as reacting species. The best-researched and already commercially exploited types are all-vanadium redox batteries, but several research programs on other redox couples are underway in a number of countries. These programs aim at achieving major improvements resulting in more compact and cheaper systems, which can take the technology to a real breakthrough in stationary gridconnected applications.”<sup>1</sup>

## Project Results

### Benefits

Since the battery has been installed over 5.5MWh of electricity has been produced, and due to the vacancy in the building, it is estimated that 4MWh of electricity from the PV array has been inputted into the grid.

### Lessons Learnt

This microgrid demonstration project was initiated in early 2015, and after 18 months this is not fully working. The main delay was getting battery delivered to the site and the technical integration. REDTs Vanadium Battery is a new technology, and the battery at Each Leim was one of the first ten to be installed. At the time, this was not a commercial product, and as this is a demonstration site, the development of this was a learning opportunity for REDT, and the Vanadium Battery has since been launch on a fully commercial basis.

The non-commercial price of Vanadium Battery was about a third of the price of the commercial price. The risk for the delays in this was borne by Údarás Na Gaeltachta as a public body, as this is a public

demonstration site. When the microgrid is fully operational, three researchers will record the data produced and analyse it.

## Post Project Benefits

As this microgrid demonstration project is not fully operational, and the Enterprise Centre is vacant, it is difficult to quantify the post project benefits of the microgrid, as there is no available data on energy usage. Once this unit is occupied, the costs of energy will be minimal for the occupiers. This is a valid demonstration site, and the only one in West of Ireland.

Two others energy storage sites exist in the greater Dublin area, so this demonstration site is of significant national importance as it will show the benefits of energy storage to rural and peripheral regions. Full open access will be available for researchers and academia. Údarás Na Gaeltachta hosted a site visit by the GREBE Project partners to the Each Leim Enterprise Centre in February 2016.

## Contact Information

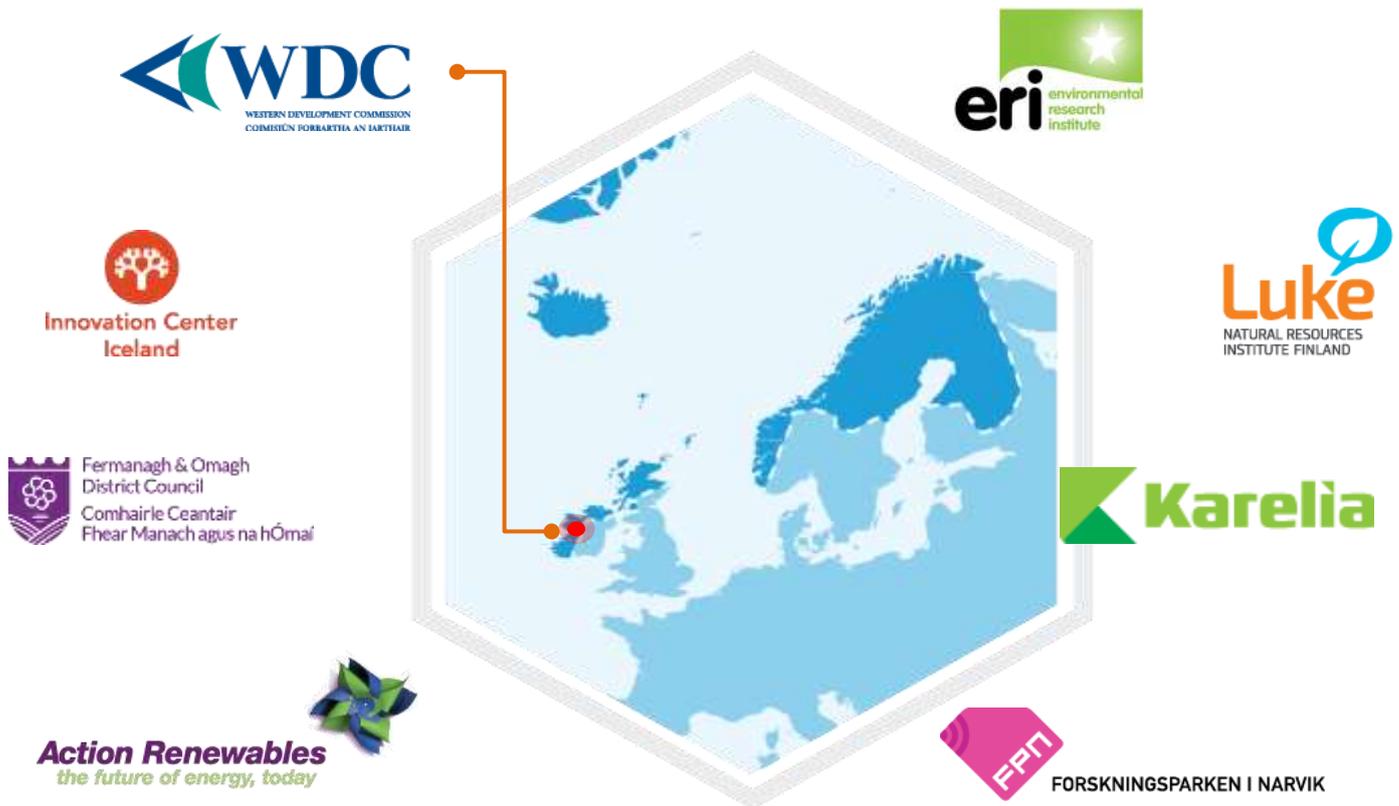
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## PARTNERS

GREBE will be operated by eight partner organisations across six regions:

### WDC



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