GREBE

Northern Periphery and Arctic Programme 2014–2020

EUROPEAN UNION
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European Regional Development Fund

Small Scale Hydro

BMJ Energy

Introduction

BMJ energy was founded 2008 and is owned by Bjarni Malmquist and SER ltd (Startup Energy Reykjavik). The start of the company was when Bjarni designed and installed a small hydro power plant on the family farm. In the fall 2009 Bjarni graduated from Reykjavik University as electrical engineer with specializing in design and construction of load control system for small hydro power stations.

The goal is to develop and penetrate the market with low – cost but secure control system for small home hydro power plants. Furthermore, they aim to explore and develop control system for the speed of the generator which will enable utilization of the water power in the home stream in the best possible way.

The system ambition is to achieve the best possible control over the water source both in terms of electricity utilization and supply.

The main focus of the company is on production of 30kW hydro power stations aimed to power partly or fully a household along with the control system and spare parts.

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

Small hydropower (SHP) is characterized by the use of hydraulic energy by local, small hydropower plants that do not -generally involve any significant environmental impact. Most of the plants are on small rivers and do not have a reservoir as they use water basins of different size and construction. SHPs can be constructed on existing dams. By using existing structures, only minor new civil engineering works are required, which reduces the cost of this component of a development. As seen on the picture, manpower is used to construct the pipeline from the stream.

Manpower used to construct the pipeline from the stream

Figure 1. BMJ Energy [1]

BMJ Energy is using similar technique as used abroad, with the difference that additional research has been undertaken on the equipment. BMJ energy provides low-cost small hydro power plants for households to enable them to generate power from their home stream.

The company's focus is on 30kW power plants with average 40l/s pressure pipe. They are conventional PEH pipes and are installed in different sizes and thickness depending on the drop and diameter. The pipes which are mostly used are 75-200 mm across.

The scale of the technology lays in the equipment itself with an ambition to maximize the outcome both in terms of electricity usage and water supply utilization. The type of turbine used depends on the rate of flow and head height (pressure) of the water. They use Turgo turbines which are the ultimate type for drop of water from 20 – 200 meters. They also use Pelton turbines for higher drop, while for smaller drops they use Crossflow, Francis and Kaplan turbines.

[1] Innovation Center Iceland 2016.

Figure 2. The generator and the motor [2]

The most critical matter in the development of the product line is the spot where the water is driven into the pipes. They have now designed and produced a box which should have significant positive effect. This design should minimize sand and mud that before have caused blockage in the pipes e.g. in case of loads. This design is made out of pipes from round bale plastic film which is the most effective storage method of hey.

The water from the stream goes into the box and the mud goes through the pipes in the middle and the water into the pipe connected to the box, which is clearly shown in the pictures here below. The pipe above the vertical pipes is also an experimental construction and BMJ has interest in viewing for example coanda screen where the pipes are in the shape of a triangle and are constructed as stairs. The idea behind the box is to prevent loads and building dams. Therefore it is less costly and hopefully more efficient.

Figure 3. The box which should filter mud and sand more efficiently than before. [3]

[2] Innovation Center Iceland 2016.
[3] Ibid 2.

Figure 4 The box which drives the water from stream into the pipes [4]

Figure 5 The box installed into the stream.[5]

Figure 6. The box in action [6]

[4] Ibid
[5] Ibid
[6] Ibid

With a box like this, individuals which would like to test their stream, could cheaply and easily install it and check if their stream is convenient and efficient.

Bjarni mentions that further cooperation and assistance from mentors and researchers regarding calculations of the vertical pipes in the box would be beneficial for advancing the technology.

TRL and Technology Scale

The technology is considered to be TRL 9.
The scale of the SHP is - 30kW power plants with average 40l/s pressure pipe.

Cooperation partners and networks

In the process BMJ has had cooperation with Innovation Center Iceland through both the seminar Orkubóndinn which has played the role of networking, education, mentoring and development in technique. The project is still in developing phase and mainly selling solutions locally even though his aim is to be able to introduce the solution for the rest of the country.

Bjarni also took part in Reykjavik energy start up program in 2014 which also contributed to the networking and mentoring. Through the seminar Orkubóndinn and Reykjavik energy start up accelerator BMJ has expanded their network, insights to new methods and also been able to communicate their product to prospective buyers.

Risk assessments and supports received

CBMJ has received no loans during the process and the costs are unknown.

In 2016 BMJ energy received in total 14 million ISK from Rannís (Icelandic Center for Research) equally divided between 2 years. From its foundation in 2010, BMJ energy has received in total 5 million ISK from various companies and institutions. These are Landsbankinn (bank), Nýsköpunarmiðstöð Íslands(ICI), Íslandsbanka(bank) and Orkusjóði(energy fund)

The seminar Orkubóndinn, where the owner of BMJ energy taught individuals how to start their own sustainable energy supply. Through the seminar Bjarni has strengthened his network. Also through Startup energy Reykjavík 2014 program Bjarni validated that his idea was viable. According to Bjarni, it is relatively easy to seek help from the mentors.

Furthermore, Bjarni has learned greatly from other farmers both in his area as well as in other parts of the country.

Drivers and barriers

Main driver in carrying out the RE technology project is that Bjarni wishes to see more farms like being able to be powered by local resources.

Conditions for the technology transfer, adaptation and new market deployment

The project is very small and in a R&D stage.

The ambitions of BMJ energy are to introduce their product in Iceland next year. The product is known internationally but the innovative part is the adaption of the micro hydro plants to rough weather and nature conditions.
The main barriers for SHP is connection to the grid, since it is too expensive to connect 5-10kw plant to the grid, where they even need to pay extra the first 20 –25.000 kw hours.

BMJ has not begun transferring the technology to other regions. The intentions are to begin with Iceland and then transfer it to other countries.

Project Results

Benefits

BMJ is using SHP in his farm and powering 50% of the daily usage. His goal is to be able to share his knowledge around the country.

Lessons Learnt

Bjarni knew nothing about micro hydro plants when he started the process. He has learned from experience about how the landscape can be unpredictable and how to react to mud flows in severe rain.

Furthermore, he has become more connected in the entrepreneur society, has more mentors to look to, and is more familiar with business booking and finance in general.

Post Project Benefits

The project is still R&D phase. He has informed interested candidates about his technique in the seminar Orkubóndinn. BMJ is continuously developing the equipment in order to reactive to changes in landscape, weather and other challenges.

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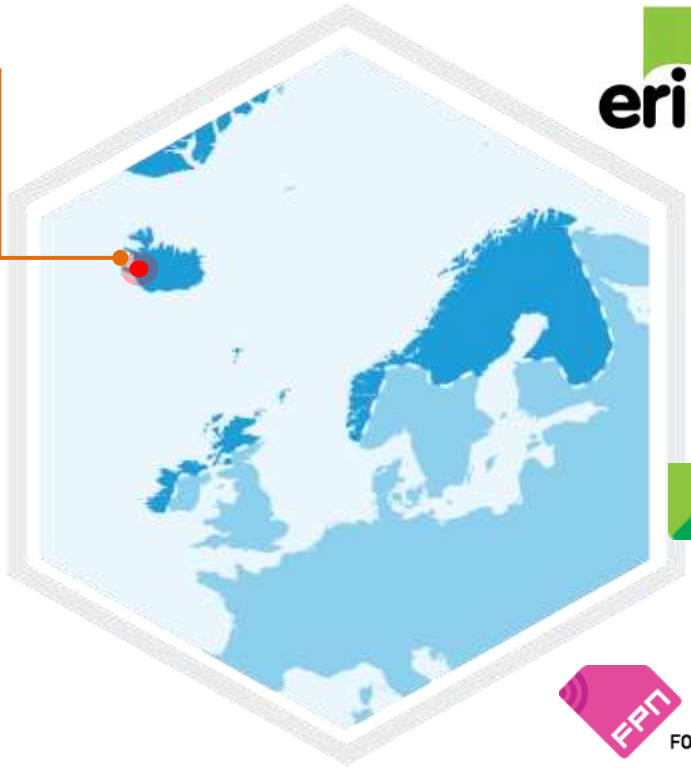
PARTNERS

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

Innovation Center Iceland



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