Kuittila Power
Small Scale Biomass CHP

Introduction

The CHP project of Kuittila Power was initiated by the entrepreneur/farmer interested to decrease the energy costs and produce own energy for the farm and co-located company. One of his staff and a development company introduced the solution. The reference site and a manufacturer were visited, after which a feasibility study was carried out.

As there was positive result, the investment project was initiated and 35% co-financing negotiated from the local authority. The manufacturer provided the technical planning, and investor took care of micro DH network construction and required connections (with the electricity company). A local constructor made the building construction.

The investment initiated in April, was ready in October 2012. The first winter included only test-runs, as there was no available high quality wood fuel. In spring, own fuel supply (with dryer solutions from the reference site) was established and plant started operating.

The first year included technical operations to improve the performance; technical support was received through the manufacturer. The plant is operating now a 3 year at a roll, and received significant status of small-scale CHP demonstration in the region, nationally and internationally.

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

The CHP system manufactured by Finnish Volter Ltd, is based on the woodchips gasification technology. The 140kW (40 kW electricity and 100 kW heat) plant can produce annually up to 1200 MWh of energy. Woodchips are burned to process gas (incl. CO, H2, CH4) that is used in combustion engine (AGCO Sisu Power). The plant uses annually about 1400 loose cubic of wood chips that are dried by using natural drying and excess heat from the plant.

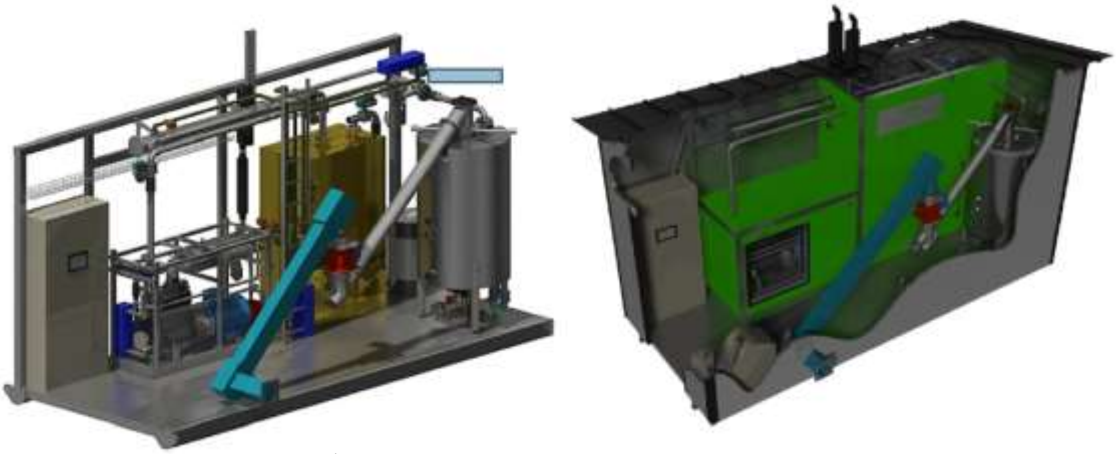

Figure 1. Volter Ltd. CHP –unit[1]

The plant uses dry woodchips fed to the gasifier. Woodchips are pre-heated before gasification in pyrolysis area.Gasification temperature is 900-1200 C. gas components are 25 % carbon monoxide, 18% hydrogen and 3%methane. Gas is cooled from 550 C to 200 C filter temperature. Fine soot is filtered, after which gas is cooled to 50 C, and ready for combustion. Combustion engine runs the generator, producing high-quality electricity for the farm and the rest is sold to the national grid. The heat from the gas and engine cooling is utilised in the farm micro scale heating network.

Small-scale CHP technology is innovative in the region, as this investment is the first industrial application in North Karelia. Innovativeness is in modern and specified application of gasification technology in small-scale. The technology was demonstrated earlier in Kempele ecovillage in operational environment (about 5000 h). Currently there are 8 domestic applications and 22 exports (2015), so the market access is growing.
There are some similar type applications in the market (such as Spanner Re2 applied also in Sukeva, N-Savo).

Technology has been proven to work in its final form under the expected conditions. However, there have been several local adjustments and system improvement activities.
Product support for the technology is available via manufacturer, including:

- Product warranty 12 months
- Maintenance training included
- 24/7 free phone support
- Spare parts and consumables
- Maintenance and the installation of most spare parts can be done by the operator.

[1] Volter Ltd. 2012

Figure 2. Woodchip dryer and storage[2]

TRL and Technology Scale

The case applies existing technology from a Finnish manufacturer Volter Ltd. Gacification of biomass has long traditions, but this solution utilises the technology in advanced manner. TRL is 9 (System proven in operational environment)

Cooperation partners and networks

The cooperation network included technology manufacturer Volter Ltd., a new established company Kuittila Power Ltd. (investor), Pielinen Karelia Development Company PIKES Ltd., and Karelia University of Applied Sciences.

Volter Ltd., as technology manufacturer provided the technology and the system design in cooperation with the investor, new established company Kuittila Power Ltd.
The machinery works, Ylä-Karjalan korjaamo, located at the same estate, supports the service and maintenance activities.

PIKES Ltd. coordinated ERDF co financed project (Pielinen Karelia Bioenergy Networks and Flows), where Karelia UAS was a partner. PIKES Ltd. provided linkages to the technology manufacturer and reference sites, and provided assistance in business planning and applying the co-financing together with Karelia UAS.

[2] Karelia University of Applied Sciences 2017.

Risk assessments and supports received

There was a feasibility study, where two economic scenarios with support rates of 35% and 15% were established. Those were based on investment budgets, production estimates, and average cost levels. The technical risks and operational failures could have been included better to the scenarios. The entrepreneur investing in the technology is bearing most of the investment risk. The technology manufacturer has agreed guarantee with correct operational use, but it is rather limited in time.

The public sector is involved in risk sharing through the investment support of 35%, exceeding the conventional level (15%). The total project was 402 000 €'s, of which the CHP-unit & building was half - 203 000 €'s.The Ministry of the Employment and the Economy provided the support via local Centre for Economic Development, Transport and the Environment. The support was very essential, even if the cost calculation provided reasonable numbers also with 15% support level. The risk was bigger than in conventional technologies, and payback time was estimated to be over 10 years with successful operation.

Drivers and barriers

The main driver was the economic, i.e. energy cost saving. In addition, the energy independency and security of supply were mentioned, as well as, positive image and environmental benefits.

The fuel quality was a challenge in the beginning; it was improved and controlled with the supplier. Own fuel dryer was invested (model from Kempele reference site) ensure the good quality.

Conditions for the technology transfer, adaptation and new market deployment

The main preconditions for transferring the technology and applying it in other partner regions are related to the expertise and experience on wood-based energy production systems and quality assurance of wood fuel production to meet the fuel quality requirements.

Potential drivers for the technology transfers are high electricity prices, available production supports for RE (heat & power), existing and high quality supply-chain structures, installers with expertise and experience on biomass systems.

Potential barriers are related to the relatively high investment costs and long payback period; lack of open reference data on the operational performance; small number of local demonstrations/reference sites; long distance to the manufacturer / technical support; variations in wood fuel quality; lack of experience in district heating systems or biomass systems in general.

The plant can operate off-grid, which makes it unique solution also for the isolated communities with available high quality wood fuel.

Project Results

Benefits

The energy system improves the security of the energy supply for the farm and co-located estates. The improved energy self-sufficiency reduces the risks associated with climatic and weather conditions.

Biomass is harvested mainly from local forests with available thinning wood for energy. The harvesting of small-sized wood improves the forest growth and provides high-quality fuel. The high quality pre-dried fuel, together with advanced combustion technology ensure low emissions and avoids harmful environmental and health impacts. The resulting ash can be used as forest fertiliser.

The own energy production with biomass CHP and PV system produces annually 190 MWh of electricity and 375 MWh heat. Earlier energy system was based on average Finnish electricity purchased from the markets. Therefore, carbon emission reductions are significant. There is significant emission reduction potential if the technology will be rolled-out to the industry, commerce and farms.

The construction phase of the plant generated 2.2 FTE jobs, and operation about 0.2 FTE jobs. The total income impact of the plant operation is about 50 000 €/a, and avoided electricity from the markets, up to 25 000 €'s, generates annually one additional job in farming. As there are number of available locations for similar schemes, the replication can generate significant rural development benefits.

Lessons Learnt

Technology required some modifications for the operational use. The importance of the high quality wood fuel was considered and supply-chain developed to meet the quality requirements. Cost efficiency of the system depends much on the heat demand, and thus on the weather conditions.

Post Project Benefits

The case has demonstrated the CHP technology in a real operational environment. It has been disseminated both nationally and internationally and thus supported the market development of the technology manufacturer.

For the project holders, investment project has provided increased self-sufficiency and lower energy costs. It has opened additional business opportunities to utilise excess heat in drying of forest fuel, and potentially also in other farming activities.

Contact Information

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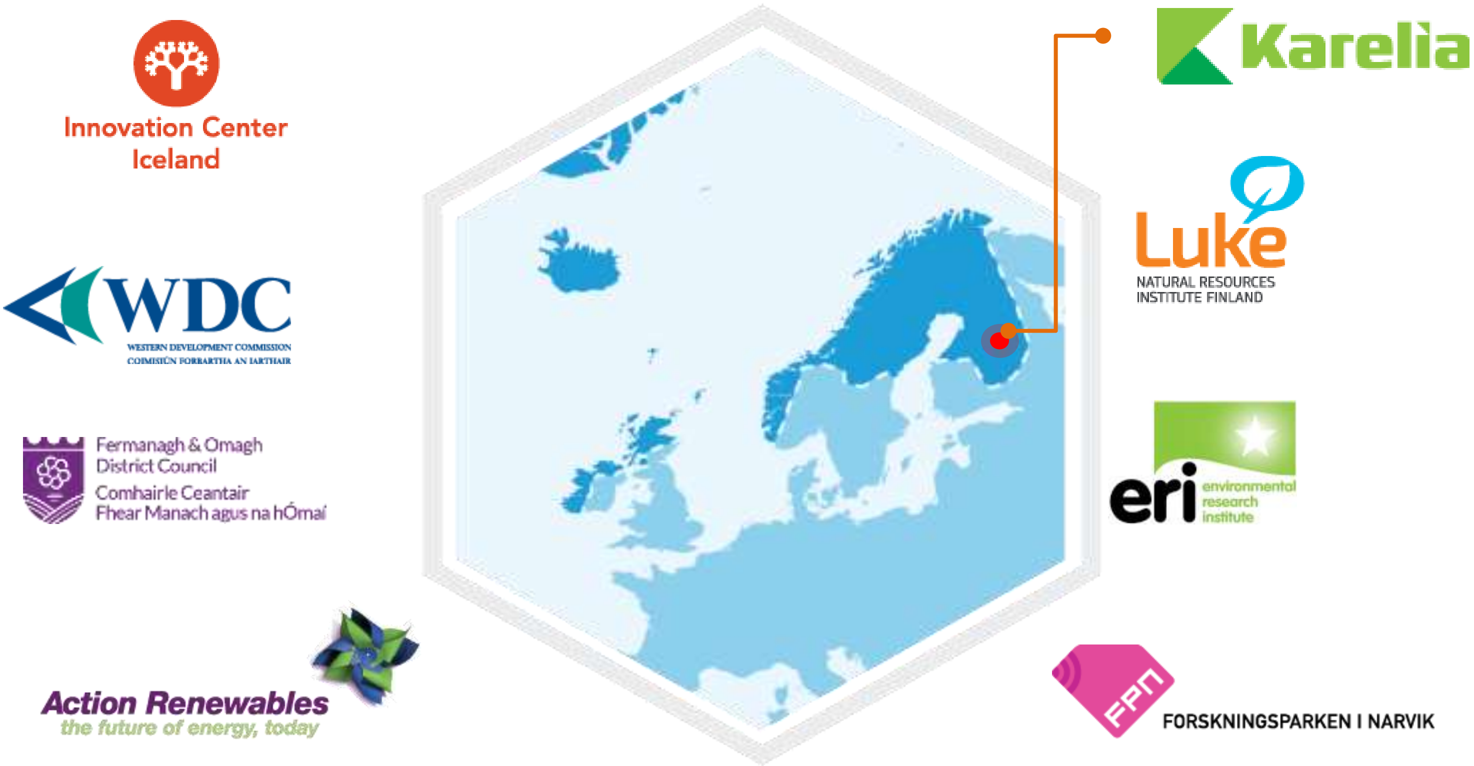
PARTNERS

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

Karelia University of Applied Sciences



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