SUCCESS STORY:

Cooperation made the heating plant successful

INVESTMENT CASE
Title:
Wood chips fired district heating plant in Marum, Netherlands
Year (commissioned):
2012
Location:
Marum / Groningen Province, Netherlands

Stakeholders:
1. Bio Forte BV*
2. Municipality of Marum*
3. Local farmers' association*
* role in detail described on page 4

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In 2004, two local farmers' associations in the Marum area together with the local municipality took the initiative for a bioenergy plant with a district heating network. The aim was to make better use of the produced wood chips from landscape maintenance, while contributing to both renewable energy production and employment generation. However, due to over dimensioning of the plant to 1 MW and suboptimal selection of certain plant components, the economic feasibility of their initiative was inadequate and the project was halted in 2008. Bio Forte BV, an Energy Service Company specialised in biomass combustion plants, was then involved to design, finance, build and operate the plant. This led to a smaller plant of 500 kW, with a heat buffer (water displacement tank) of 20 m^3. The plant was realised in 2012.

Maximised collaboration

To keep the operational costs low, collaboration with local actors was maximised. The local installer was involved for the technical installation. The technician from the open-air swimming pool is responsible for operations, and a truck driver from the local municipality is responsible for timely refilling of the fuel bunker. Additionally, about 10 people from deprived backgrounds have become involved in the fuel supply.

A new boiler house was built next to the open-air swimming pool to accommodate the bioenergy plant. To minimise the investment, the boiler capacity was minimised, while short peaks in heat demand are delivered from the heat buffer of 20 m^3. The plant is equipped with hydraulic fuel feeding. The gas-fired boiler, previously used to heat the swimming pool, is now used as peak and backup boiler.

A full plastic pipe heat distribution network was installed with a total trench length of about 1.5 km and 10 consumers, saving approx. 250.000 Nm^3 of natural gas, equivalent to 200 households. While the open-air swimming pool only requires heat in summer time, the other consumers predominantly require heat in winter time. This results in a high number of full load hours for the installation. In 2018 the district heating network was expanded to include a newly built housing area and a commercial building.

The plant now burns approx. 800 tons of wood chips every year, which is delivered from farmers in the area

Fuel type:
- Wood chips from landscape maintenance

Feedstock origin:
- Domestic silviculture residuals from thinning, tops, branches etc
- Domestic forestry by-products/ residuals: bark, wet wood chips, etc

Conversion system:
- Boiler combustion, e.g. stand-alone boiler plant including co-firing and combined heat and power

Co-fire:
- Heat generator (i e boiler) is 100 percent biomass-fired.

Heating system heat sources:
- Heat generator is part of a system with fossil fuel fired boilers

Comments:
- In the last five years, biomass provided approximately 97 percent of the annual heat demand.

The boiler house contains a Binder 500 kW wood chip fired boiler with a moving grate furnace, a heat buffer of 20 m^3 and a fuel bunker

around the village. The wood is produced as a by-product from landscape maintenance and was previously burned in the open air, leading to unwanted air pollution. With the arrival of the biomass combustion plant, farmers no longer obtain permits for open air burning, but get paid for their wood chips instead. This way the bioenergy plant contributes to sustainable landscape management while delivering renewable heat at competitive prices for the users. The delivery of wood is facilitated by the local municipalities infrastructure.

The installation gained support from two investment support subsidies due to its contribution to local development and the innovative district heating system. The plant is in fact the first installation in the Netherlands that benefits from the Renewable Heat Subsidy Scheme.

The investment and its technology

The investment consists of a new boiler house containing a Binder 500 kW wood chip fired boiler with a moving grate furnace, a heat buffer of 20 m^3 and a fuel bunker. The heat is distributed to ten existing utility buildings in the village using a newly built district heating network with a trench length of approx. 1.5 km. To minimise construction time of the district heating network to two weeks only a full plastic piping system concept was chosen for the district heating network pipes. This was delivered on drums with lengths of 120 m, enabling very rapid construction. As a backup to the

Relation to Sustainable Development Goals:

Ensure access to affordable, reliable, sustainable and modern energy for all

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Ensure sustainable consumption and production patterns

Take urgent action to combat climate change and its impacts

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Comments:

- The project led to a stop on open air burning of wood residues, which previously resulted in significant air pollution. The wood chips are now burned under controlled conditions in a boiler with flue gas cleaning.

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biomass boiler an existing 500 kW gas-fired boiler, formerly located at the technical room of a public swimming pool, was modified to enable complementary heat to the district heating network.

Farmers are paid to deliver wood chips by tractor to a covered long-term storage, constructed specifically for this purpose by the local municipality since it enables drying of the wood chips during storage. The storage capacity is sufficient for approximately 8 months, which enables drying of the material while it is stored, also when delivered during winter. To keep logistical costs low, refilling of the fuel bunker is done by an employee of the municipality who has remote access to a camera in the fuel bunker.

The aim of the project was to stop open air burning of wood waste, while generating renewable energy and delivering cost savings for the clients. The financial aspects regarding fixed and variable costs are tailored to the individual client as local conditions vary. The variable heat costs are approximately 5% lower than the natural gas reference. While new clients pay a fixed fee for their avoided costs of owning and maintaining a gas-fired boiler, clients that decided to keep relying on their existing gas-fired boiler pay no fixed fees, as only variable costs are avoided .

While approximately 75% of the heat is delivered for space heating of utility buildings, depending on the outdoor temperature, the remaining 25 % of the heat is used to heat an open-air swimming pool in summer time. This results in a more even utilisation of the plant capacity and a relatively large number of full load hours of the boiler.

Factors behind the decision

The investor, Bio Forte, decided to proceed with the investment (total approx. 1.2 million Euro) as the project's economy was deemed sufficiently viable. The project was the first project in the Netherlands to make use of the renewable heat incentive scheme, which rewards heat generation per GJ of heat generated. Nevertheless this operational support was insufficient to generate a feasible project as the actual costs of the district heating network was much higher than assumed in the renewable heat incentive scheme. However, an investment subsidy of approx. 500,000 Euro, obtained due to the innovative character of the project, made the project economically viable.

To mitigate long term risk perception it was agreed to use same price indices for fuel purchase as for heat sold.

Lessons learned

The success of this project can largely be attributed to the cooperation of the local municipality. They took responsibility for providing the needs for transport and logistics between farmers and the heating plant. Furthermore they helped by connecting their own property and convincing existing clients and enforcing new clients to connect to the district heating network. The municipality also helped as owner of the local public swimming pool by enabling the use of the obsolete gas boiler as backup boiler in the new system.

The project showed that it is essential for the feasibility of a biomass fired district heating network to obtain a sufficiently high load density. This requires that as many clients as possible are connected.

Success factors

The operational costs could be kept low by involving the municipality in the fuel logistics and contracting a local technician of the existing swimming pool for operation of the plant, in addition to remote monitoring.

Despite the relatively high investment costs, due to the district heating network, the project was made possible through to the availability of investment subsidies. Unwanted open air burning of wood residues could be stopped by creating an alternative use of this material.

The biomass boiler has a relatively high number of full

Comments: (continued)

- The 7000 GJ/y of heat produced results in approx. 250 000 m^3 less natural gas consumption, or 450 ton of avoided CO_2 per year.
- In the supply of wood the municipality has involved approx. 10 persons with a deprived social background. The built district heating network is flexible and can accommodate other renewable energy sources in future (e.g. solar).

Replicability potential:

- High local replicability
- Medium regional replicability
- Medium national replicability
- Medium international replicability

Scale-up potential:

- Medium local potential
- Medium regional potential
- High national potential
- High international potential

Comment:

- The existing project is relatively small and therefore somewhat expensive. New projects that are currently built are approximately 5-10 times larger.

load hours due to the combination of a demand for space heating and heating an open-air swimming pool.

Constraints

The largest obstacle was the creation of a feasible business case. Another obstacle was the novelty of biomass fired boilers for heating which initially made some potential customers hesitant to connect.

Stageholder roles

1. Bio Forte BV –Investor and operator of the biomass heating plant and the district heating network
2. Municipality of Marum – Permitting, coordination of fuel supply, policy support for expansion of the DH network. Issuing ban on open fires of wood residues after establishment of the heating plant. Providing incentives for re-employment of people with deprived social backgrounds in fuel supply.
3. Local farmers' association – wood chips production and

Web sites:
www.bioforte.nl
www.ri.se
www.energimyndigheten.se/en/
www.iea.org/tcp/
www.ieabioenergy.com

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