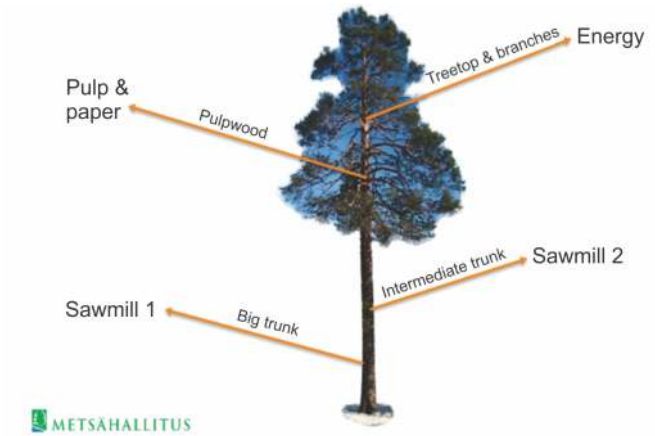
Säätötuli® CANADA

Municipal biomass heating

EN June 2019

Biomass heating

Heating with residual biomass aims to use all the parts of the trees that are not commercially used and convert them into thermal energy. These include mostly treetops and branches, as well as the non-commercial species and the trees cut during thinning operations. It is therefore a carbon-neutral heating energy, as the trees will capture the carbon in the atmosphere when they grow, but also because the carbon in these leftovers will anyways end up in the atmosphere during the natural decomposing process. Making a clear cut in the forest just for heating makes no sense whatsoever economically and ecologically.



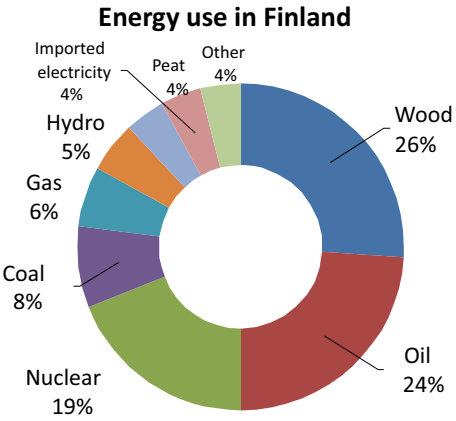
The boilers are also able to use leftovers from wood transformation industries. Using leftovers from the logging industry and the wood transformation industry also guarantees that the fuel is not competing for the resource, meaning that the price level stays low and relatively stable on the long term.

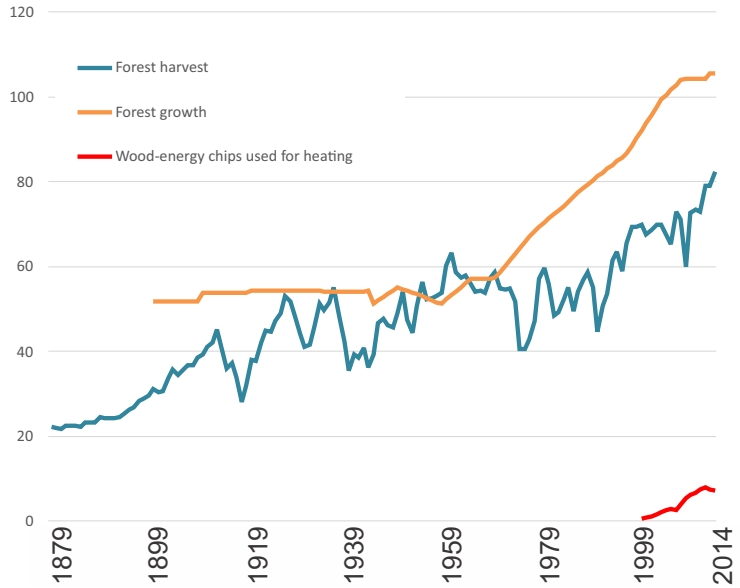
Biomass must be transformed into chips of the right size and humidity. Transporting wood-energy chips on long distances makes no economical sense. Therefore, biomass heating is a green energy that has a positive Impact on local employment.

The Finnish model

Finland is a polar country in Northern Europe with long and cold winters, just like in Canada. Finland is one of the pioneers in biomass heating with thousands of boilers installed in municipalities, industries, farms and even for residential heating. In 2017, wood represented 26% of the total energy consumption of the country.

With such heavy use of wood for energy, it is essential to be able to measure the impact on the country's forests of the biomass heating. Many official studies have been made in recent years.



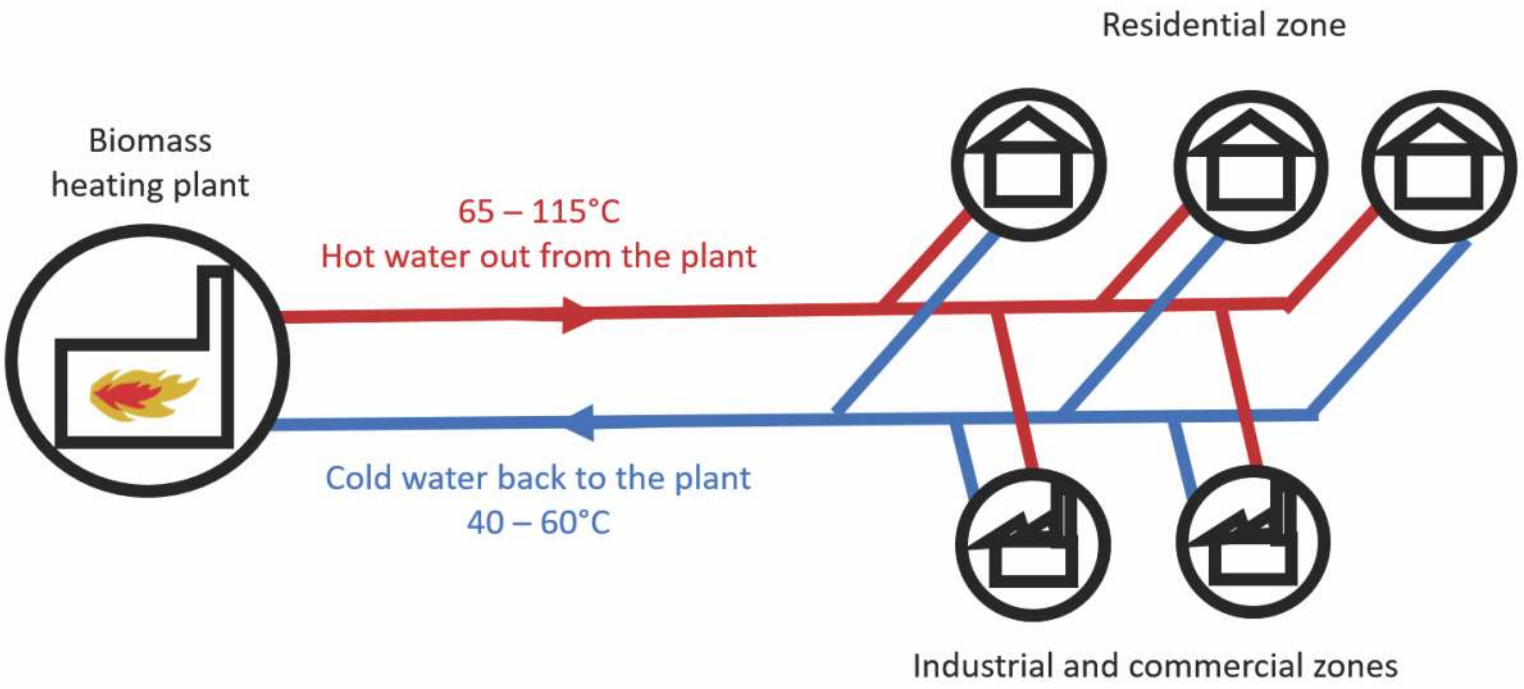


The data on the left is published by Luke, the natural resources institute of Finland.

This data shows that the logging industry begun to go over the forest's ability to regenerate in the 1950's. New methods of sustainable management of the forests were implemented to try to solve the problem and their positive effects can be seen from the 1960's.

The red curve shows the use of wood-energy chips for heating. As it can be seen, even if the number of biomass heating plants was doubled, the forests will still be able to grow more than they are used. Population density in Finland is about 4 to 5 times superior to Canada. Therefore, the whole of Canada could be heated with biomass in a sustainable manner as long as the forests are well managed.

Biomass heated municipal heat network



What is a biomass heated municipal heat network?

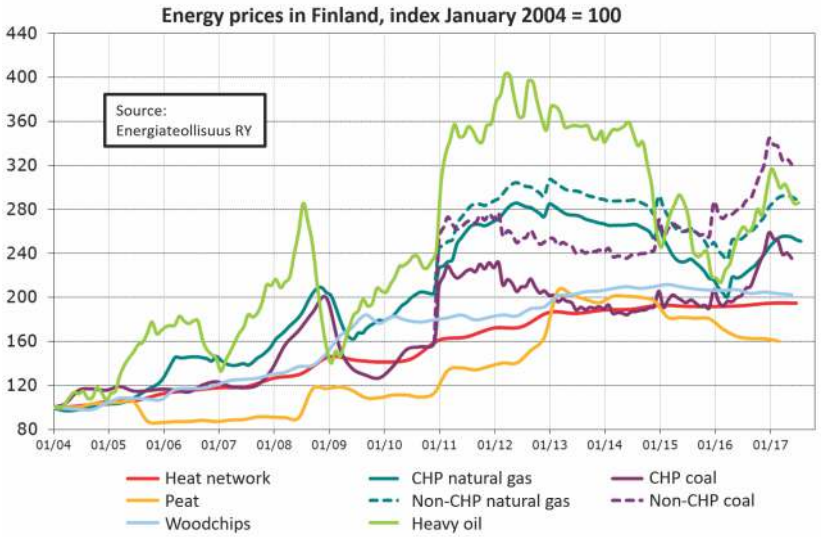
A biomass heating plant heats up water. The hot water is sent to a network of insulated underground heating pipes that go through the town. Buildings nearby the heating network grid can be connected to the network. In that case, the heating pipes are connected between the network and the building. A heat exchanger with an energy counter distributes the heat inside the building.

Customers of the municipal heating network can be municipal, commercial industrial or residential buildings. Customers simply pay a utility bill for their heat, the same way they pay for electricity.

Heating with a heat network has multiple advantages for the users:

- Maximum availability with an average downtime between 2 and 3 hours annually.
- A green energy providing local jobs.
- A stable and economical price.
- No boiler maintenance. Hot water can be made with the heat network thus eliminating the need for a water heater.

In Finland, 46% of the heating energy need is provided through heat networks. 42% of the heat of the networks is made with biomass. The biggest heat network covers more than 770 km in the town of Oulu and is 80% biomass fueled.



Green heat entrepreneurship

A biomass heat network operator selling heat (kWhs or BTUs) to his customers is commonly called a “green heat entrepreneur”. His customers pay his utility bill based on the reading of an energy counter. In exchange, the heat entrepreneur is in charge of delivering the heat to the customer and ensuring the operation and maintenance of the boiler plant and the heat network, including the fuel deliveries to the boiler.

The heat entrepreneur is also responsible to ensure a high level of redundancies in the heat production and network operation, thus reducing downtime to a minimum. The pellet heating plant on this picture contains a gas-fired backup boiler (second chimney) and an electrical backup generator. All the pumps of the network are also doubled.

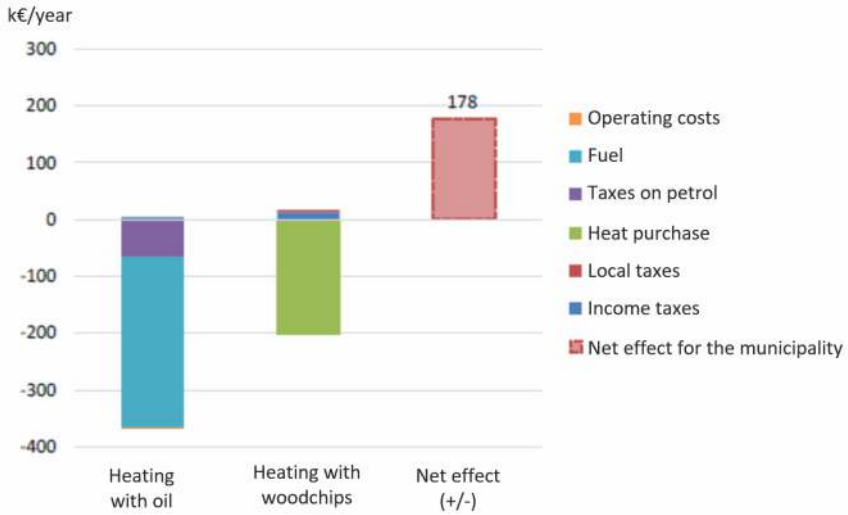
The green heat entrepreneur can be a private company (usually a forestry cooperative or a farmer), a semi-private company or a public company (usually belonging to the municipality). Depending on the case, the heat entrepreneur can be the owner of the heating plant or only its operator. For a municipality, being the owner of the network and the heat plant gives more control over the service and pricing. On the other hand, letting the heat entrepreneur invest in the equipment can have a positive effect on the municipal budget.

Social impact of biomass heating

A large study was made by Motiva OY on the impact of the conversion to biomass heating for two municipal heat networks in Finland.

On the right, the results of the direct impact on the budget of the municipality of Lapinjärvi. Producing and using the energy locally has had a positive effect on the income from local taxes. The biggest economical impact remains however the savings on the heating cost of municipal buildings.

Below is a summary of the effect of biomass heating conversion of Lapinjärvi on all the impacted parties.



	Lapinjärvi
• Heat entrepreneur	+33 k€
• Private customers (companies/households)	+90 k€
• Municipality	+178 k€
• State (direct effect)	-93 k€
• Employment (FTE = full-time equivalent)	+2.5 FTE
• Trade balance	+309 k€
• Reduction of greenhouse gases	4000 tons

The only negative effect of this biomass conversion is on the budget of the Finnish state as it loses the taxes on petrol-based products. This is however compensated by the increase in employment and the positive effect on the trade balance.

Even if these results cannot be directly transposed to Canada, this study gives precious indicators on the social and economical consequences of municipal biomass heating.

The original study is in Finnish language, Säätötuli Canada can provide you an English translation.

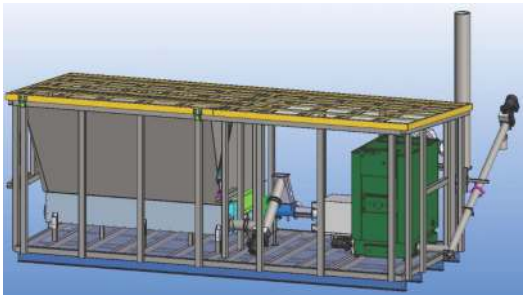
Pre-assebled biomass heating plants



The pre-assembled biomass heating plants are commonly used for municipal heat networks. They are also known as containerized or modular biomass heating plants.

A pre-assembled biomass heating plant has two parts: the boiler-room part (with the boiler, the automation controls and the piping), and the silo part for fuel storage. The size and looks of the pre-assembled biomass heating plant will depend on the output of the boiler and the type of biomass silo.

These solutions are easy and fast to implement as they are factory assembled in most part. Once on the installation site, they need to be placed and connected to the heat and electrical networks, and the chimney and ash augers must be mounted. The installation work is therefore short and requires only a concrete slab. If needed, the whole boiler plant can be easily relocated. The risk of defective electrical installation is also reduced as the plant is tested at the factory before shipping.



When selecting a containerized biomass heating plant, it is of utmost importance to check the following items:

- The boiler must be able to use the type of biomass that is locally available.
- The whole installation must comply to local standards.
- Service and maintenance ease, spare part availability and price.
- The size of the fuel silo and the way it can be filled.

If the boiler plant has not been designed in order to make maintenance and servicing easy, it can result on huge costs on the long term. If maintenance operations are difficult, they will be costly, or end up being neglected by the operator, which will decrease the overall performance of the plant and reduce its life-span. A control automation made with standard electrical components will also be a lot more economical on the long run than one with proprietary parts.

A common error is to save money by reducing the size of the fuel silo. This saving can seem to be important during the investment. However, if the silo is not able to accommodate full truckloads, the overall profitability of the plant will suffer because of the additional handling and deliveries. Even a single additional operation per week adds on to be a huge amount of extra-work when calculated on the decades the plant will be operating.



How to build a heat network ?

A biomass heat network that covers a whole municipality can't be built from scratch. Investment in a biomass heat network is huge as the heating plant is only a small part of the total cost that includes the network itself and the cost of converting the heat distribution inside the buildings.

Additionally, the biomass fuel supply chain must be able to provide enough fuel for the operation. Being surrounded by forests is not enough. The fuel must be harvested, chipped and possibly dried before delivery to the heating plant.

Many projects in Canada have been abandoned as they were too ambitious and expensive to be achieved. Instead of planning a municipal network that covers the full town, it is better to start small and have a long-term development vision. The fictive scenario below shows what could be the way to proceed.

Starting point

This rural municipality is surrounded by forests. Several local players are already using the forestry resource. There is a huge quantity of unused residue resulting from those industries, most of the time simply left on the forest floor to decompose or burnt on slash piles (branches, treetops, non-commercial species).

No biomass boilers are installed in the municipality, no one produces woodchips.

Year 1

The municipality decides to take advantage of the unused biomass resource and invests in the first containerized biomass boiler. A small heat network is created to connect the town hall, the boiler and the nearby commercial building.

The construction of that first boiler plant is seen as an opportunity by a local businessman who invests in a small chipper to provide fuel for the biomass plant.

Year 3

The first biomass plant has now been used for two heating seasons. It has proven to the inhabitants that it does not generate any trouble to their environment and well-being, and that it allows the municipality to save on heating costs.

The municipality decides to build a second heat network with a modular biomass plant to heat the high school, library and school board buildings.

Years 4-6

A new heat network is built to provide cheap green energy for an industrial zone. With the cheap price and goof availability of residual woodchips, a first private heat network for an office and residential complex is built.

The woodchip provider sees his turnover grow and has to invest in an additional chipper and hire more staff.

Years 6-9

Small heat networks connected to pre-assembled heat plants multiply around the town. The woodchip provider increases his production capabilities according to the demand.

The town has now a great number of biomass heated buildings and a strong and skilled local biomass fuel provider. Instead of a huge initial investment, all small heat networks have required a small investment. At this stage, the return on investment of the first networks has already been completed.

Year 10

The combined power need of the heat networks and the presence of a local strong biomass supplier allows the municipality to build a big biomass heating plant. All the smaller networks are connected to the new main network heated by this big heating plant.

One of the containerized biomass plants is kept in place. It will be used for peak energy on the coldest days, as well as main power in summer time when the big boiler plant is serviced.

The other containerized biomass plants can be either relocated to initiate heat network development in other parts of the town or sold as used units. Säätötuli's pre-assembled biomass heating plants are manufactured to have a life span exceeding 20 years. In Finland, Säätötuli modular bioheat containers depreciate only a few of their value each year (first unit was commissioned in 2003).

Pictures of the municipal biomass heating plants of the Finnish towns of Vimpeli (population 2900) and Halsua (population 1160). Commissioned by Säätötuli in 2008 and 2011.

You will find more information about our products and services on our website:

www.saatotuli.ca

Please visit also our other websites:

www.wood-chippers.ca

Chippers able to produce biomass-fuel grade wood-energy chips even with branches, hog piles and leftovers

www.firewoodprocessors.ca

Modern wood heating is made with woodchips, but you will always need firewood for your grill, BBQ and camping needs

www.woodprocessors.ca

Transform easily your tractor into a processor with winch, delimb and cut-to-length functions

Woodchips vs. wood-energy chips – what is the difference?

The word woodchip is commonly used for the pulp and paper woodchips that are made with only the best parts of the wood and screened to have a constant particle size. Säätötuli's biomass boilers do not need such a high-quality woodchip and it makes no sense to start competing with the pulp & paper industry for the same supply. Wood-energy chips are the best possible fuel to feed your boiler. Wood-energy chips are woodchips made from hog, branches, treetops, sawmill leftovers, etc. When made with a good chipper, no screening process is necessary as it would eliminate a part of the biomass.

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