



APPLICATION

# Global District Energy Climate Awards 2011



Name of system:  
Location:  
Owner:  
Type of ownership:  
Submitted by:  
Phone:  
E-mail:

Västermalmsverket  
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# Summary

## History

Falu Energi & Vatten is taking responsibility by developing the community of Falun, Dalarna. Our Cooling & Heating plant is situated on the brink of the world heritage, Falu copper mine, which for many centuries was one of Sweden's foremost business activities. That is a tradition we are carrying on.

## Climate impact

Falun's, investment in climate neutral production of heating, cooling and electricity has globally reduced CO2 emissions by 145 000 tonnes / year. This is equal to 47 000 cars!

There have been large ventures within renewable power production. Since 2007 the annual production has doubled.

The mix of different renewable power production in Falun municipality replaces fossil energy and reduces the global CO2 emissions.

## The system

Västermalmsverket is a combined heat and power generation plant, which makes it unique due to simultaneous production of heat and electricity. By investing in an absorption cooling machine we have reduced the use of electricity for conventional cooling installations at the same time as we are able to increase the production of electricity at Västermalmsverket.

We are building a wood pellet factory which helps us to produce more renewable electricity in summer when the heat needs is at its lowest. At the same time we have increased our electricity production and we get wood pellets to use in our district heating production during the winter.

## Opportunities for the future

In order to develop a sustainable district heating industry there is a need to spread knowledge about district heating's minimal environmental impact. This knowledge needs to be transferred not only to customers and the public. It is also important that politicians, policy makers, officials and industry understand total systems and the large picture.

"To create a sustainable society we need take a holistic approach - what is good for society is also good for the district heating industry"



## Falun - our place on earth

Falun is Dalarna's largest municipality with 55,000 inhabitants. The County town and the center of culture and sports in Dalarna.

Faluån (a river) runs right through the town and cuts it into two parts. On one side lies Falun copper mine, which for many centuries was one of Sweden's foremost business activities. The place is called, therefore, in vernacular for the gruesome side, not a lot of plants lived in the rust of the smoke poisoned soil. On the other side of the river, where rust smoke is not reached, there are a number of large and beautiful old houses and neighborhoods that therefore called the sweet side.

This is in part all history. For the last century the community and Falu Energi & Vatten has together with industry worked hard and purposefully to develop the community into a



successful place to live in and a flourishing place of business. This, with a focus on next generation and with a responsibility for the climate and environment

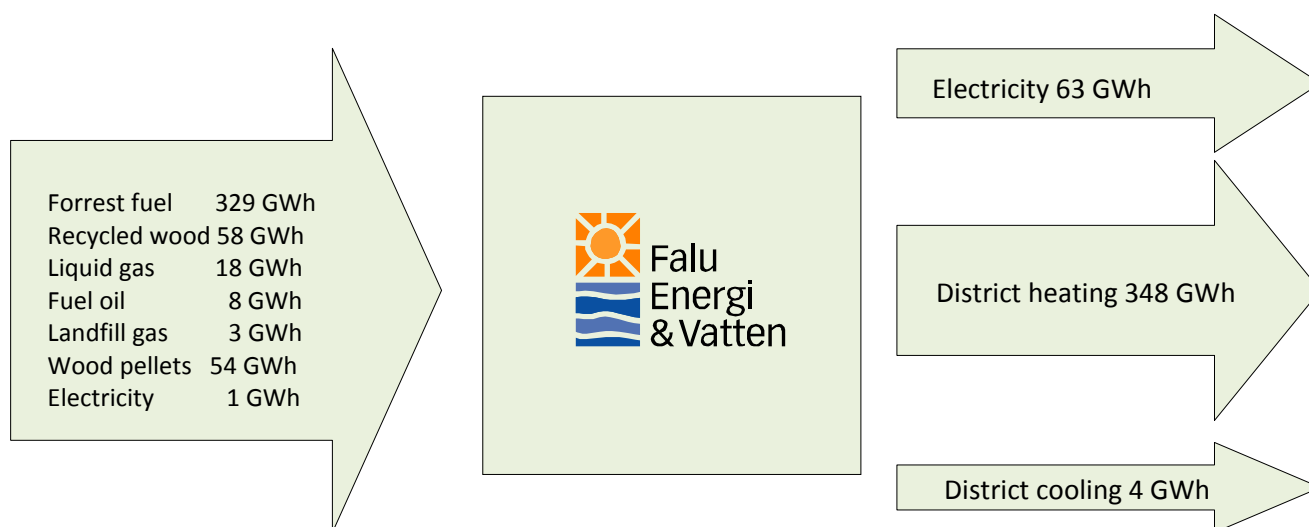


Figure 1 Energy input and output to/from Falu Energi & Vatten AB, 2010

## Falu Energi & Vatten

Our part in the development of Falun is to take a holistic approach to energy production in the region. We have the past decade invested heavily not only on district heating

but also electricity generation with a single goal: Create wealth for the next generation and reduce emissions of greenhouse gas.



# Description of the system

## District heating

25 years ago Falun municipality started to extend its district heating, using waste heat from an acid plant. The politicians were at the beginning difficult to convince, but with a grant from the local council and inexpensive waste heat the project could get underway. 1993 marked the closure of the acid plant and investments had to be made in new bio fuel-based Combined Heat and Power plant (CHP).

Expansion continued with more customers and boiler plants and in 2006 the CHP plant in Falun was supplemented with an additional bio fuel-based CHP block.

Nowadays it is stated in the municipality's energy goals that district heating is preferable as a heating source and that energy production shall be based on renewable fuel, which is also in line with the EU's climate strategy.

## The grid

Falu Energi & Vatten has extended its district heating throughout the energy-densest areas of Falun's urban areas and in a small scale to houses. Over 90 % of the customers are homeowners, yet they represent barely 10 % of energy sales.

In addition to the large district-heating grid in the urban areas of Falun there are smaller grids in the small communities of Bjursås, Grycksbo and Svärdsjö (located in the radius of 20 km of Falun). The district heating in these grids is produced by wood pellets in boilers.

An increasing number of direct electric heating properties are being converted and connected, which has allowed an increased opportunity to produce more "green" electricity in the CHP.



## District cooling

In mid 2000 customers started requesting comfort cooling. Due to an absence of district cooling, it had been based on compressor technology with heat recycling. In 2008 Falun took the forward-looking decision to invest in district cooling.

By investing in the project "Natural power, heating and cooling in Falun" and using absorption cooling machines we would be able to produce cooling from district heating and create a larger heating basis for the production of electricity during the summer and to be in a position to offer property owners problem-free and cost-efficient cooling. Environmental and climate consequences were also regarded as important, a reduction in the use of electricity for cooling in properties by approximately 1 500 MWh electricity per year when all investments have been made, increased the production of electricity by 500 MWh per year. In global terms there is a reduction in emissions due to a reduction in the use of electricity.

## Facts and figures:

- The district-heating network is 145 km long
- Approximately 2 200 properties are connected
- More than 90 % in the urban areas and more than 50 % of all households in the municipality get their heating from us
- Approximately 2,5 million square meter of buildings/customer facilities served
- Sales 348 GWh heating, 63 GWh electricity and 4 GWh cooling
- Turnover 220 million SEK
- Number of employees 25
- Primary energy factor 1,01
- Bio fuel share 98 % (chippings, bark, sawdust, slash & burn and wood pellets), 2 % landfill gas and liquefied gas

## Electricity

The last couple of years we have made some large ventures within renewable power production. Since 2007 we have doubled the annual production from 50 to 100 GWh.

The mix of different renewable power production in Falun municipality replaces fossil energy and reduces the global CO2 emissions.

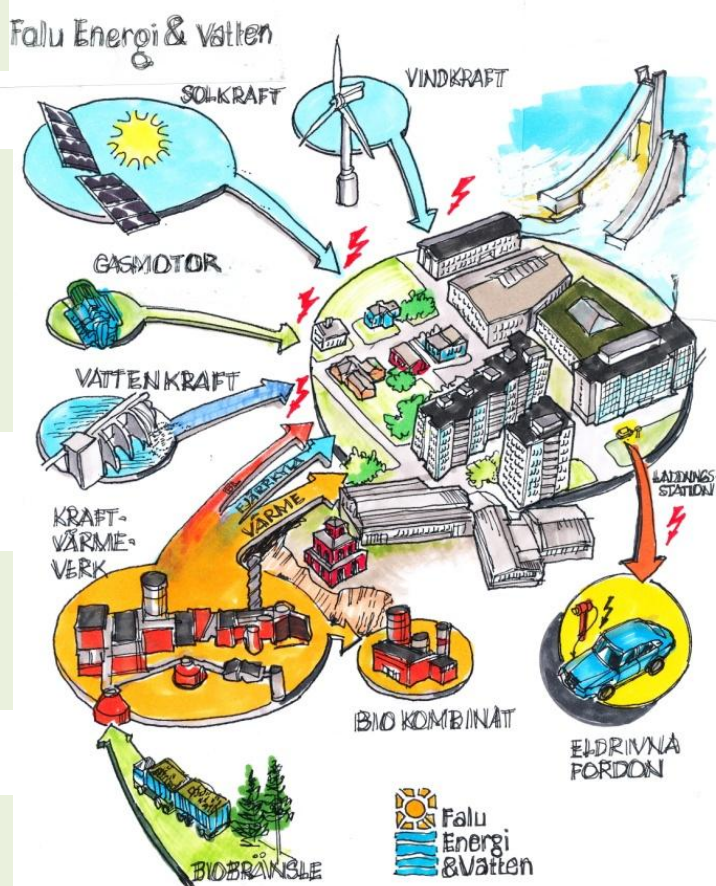
The production is sustainable and makes both the power system and community less sensitive to disturbances and price peaks. Through our power lines we deliver a high quality renewable product to the citizens of Falun 24/7/365.

We have one of the largest solar panel systems in Sweden on top of the fire department in Falun.

At the sewage treatment plant in Främby we use an intelligent way to take care of biogas from the sewage. The gas is burned in a gas-powered engine that generates both electricity and heat.

Water is essential in our green energy mix. We own four hydro power plants in the municipality.

There is now extensive production of electricity from local bio fuels in our two CHP plants.



We are investing in infrastructure of the future – charging stations for electric vehicles

Wind power plays an important role in our green energy mix. We own wind turbines in the municipality. The local wind power production corresponds to 10% of the annual electricity demand in Falun.

We deliver free wind power to our charging stations for electric vehicles.

To increase our renewable electricity production, we are investing in a wood pellets factory. The pellets will be used in our own production during the winter.

# Saving the climate - the facts to back it up

## Emissions

District heating & cooling is a wise choice for the environment when it is produced from environmentally friendly bio fuel. The combustion of fossil fuels leads to emissions of fossil CO<sub>2</sub>. By choosing bio fuel the direct emissions of fossil CO<sub>2</sub> are reduced to zero. In Falun we our production are based on fuel from the forest. The work on returning the ash to the forest has been going on since 1998. We work hard to find good areas of usage for our waste products.

Steering and regulating principles for the injection of ammonia in the bio fuel pump at Västermalmsverket have resulted in the reduction of CO<sub>2</sub> emissions and a reduction in usage of commodity chemicals (ammonia).

During the period of time that emission rights, the so-called black certificates, have existed we have reduced the use of and need for those from 8000 to 300.

If you choose district heating instead of oil the primary energy consumption is reduced by 54%.

The overall operations lead to a net reduction in emissions. The figure shows how Falu Energi & Water have reduce the CO<sub>2</sub> emissions globally.

Figure 2 shows the trends toward more eco-friendly fuel in the plant.

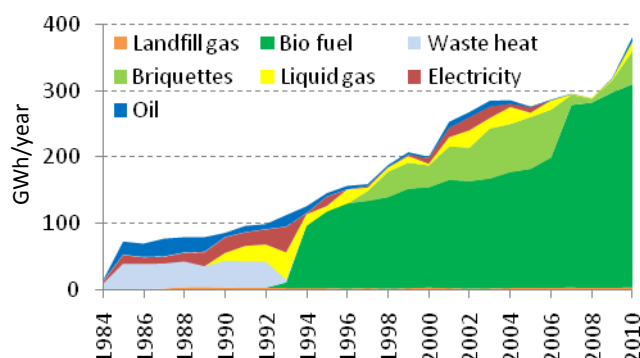


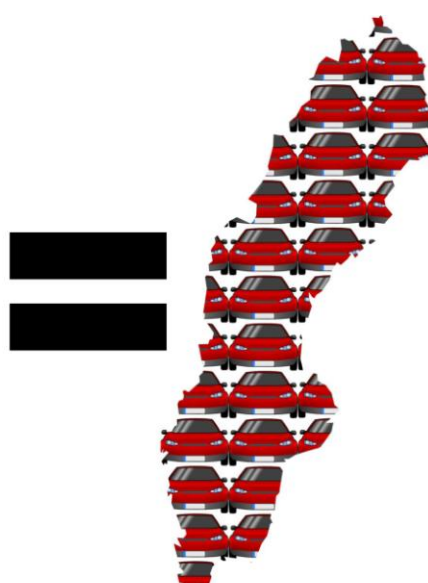
Figure 2 The proportions of fuels used to generate district heating, cooling and electricity.

## Positive impacts with CHP

There are many benefits from district heating compared to individual heating, both for the environment and the consumer. By replacing a number of individual heating systems, all emissions are concentrated in one place for treatment by organizations with the necessary expertise and equipment.

Västermalmsverket is a combined heat and power generation plant, which makes it unique due to simultaneous production of heat and electricity.

By investing in an absorption cooling machine we have reduced the use of electricity for conventional cooling installations at the same time as we are able to increase the production of electricity at Västermalmsverket.



Falun's investment in climate neutral production of heating, cooling and electricity, have globally reduced CO<sub>2</sub> emissions by 145 000 tonnes / year. That is equal to 47 000 cars! That is as many cars that will fit on Sweden's land area!



### Innovative solutions and strategies

We have built cleaning equipment for the flu gas condenser. The waste heat in the condenser is used for heating Falu Energi & Vatten's head office before it is released to the container so as to reduce the environmental impact on discharge to lakes and watercourses.

We actively work to improve combustion in the bio fuel boiler at Västermalmsverket. This work has, among other things, led to more stable combustion and lower emissions of CO<sub>2</sub> and NO<sub>2</sub>.

The incineration of local demolition wood waste in Falun, through co-incineration with bio fuel from the forest is a good example on how we try to improve and give customers incentives to sort out their waste.

Production and maintenance planning have led to increased accessibility (currently over 99 %), which has resulted in almost no use of fossil based reserve capacity.

We regularly participate in local energy and environment fairs in order to inform people about district heating and the saving of energy.

One off the key elements are our activities to be involved in Falun municipality's energy and climate program.

### Support from the authorities and NGO:s

Falun Energi & Vatten is the first company in the world to deliver district heating, district cooling and electricity with Good Environmental Choice labeling to all its customers.

The Swedish Environmental Protection Agency has chosen to support us and nominated our district cooling efforts as particularly good and effective measures for limiting greenhouse gas emissions.

### Financing

In the early development of district heating, there was an opportunity to develop with public funds and this was utilized by Falun. In the following years, most investments have been made through own resources. Now and then the government issues programs that eg. Reduce emissions of CO<sub>2</sub>. We have got some funds from these kinds of programs including our investment in district cooling.



Bird Phoenix made off bio fuel.

# Customers – together we can develop the community and reach the goals

## Customer Responsibility

Falu Energi & Vatten AB is in the forefront of putting the customer at the center of business and at the same time develop the community. All the inhabitants in Falun community is at customer to Falu Energi & Vatten or a customer to our customer.

We work in close collaboration with our customers, to try to find new ways to make life easier for the consumers on a commercial basis. Our flexibility gives us an advantage to find ways for satisfying customer needs. We give special focus on our larger customers, by partnering with them. In this way, we build long-term cooperation and relationship. We are the customers 'good neighbors'!

Every second year we carry out customer surveys, measure the satisfied customer index and create plans of action based on these.

## Energy conservation and energy services

It is central to us that our customers are satisfied with district heating, both in terms of comfort, but also the price. Therefore, we have abandoned the fixed charges completely (fixed charge 0 SEK). This in turn leads to good energy conservation, which in turn leads to reduced CO2 emissions.

The standard price list for larger customers has been adapted so that high levels of cooling lead to lower costs which reflect the actual reduction of production costs.

Yet another step towards customer satisfaction is our customer visits where we together with the customer inspects the property and household and develops proposals on energy efficiency, all free of charge.

We also offer all our customers free web-based monthly energy statistics to make the customer become more aware of their consumption, which we see as a door opener for energy conservation and energy efficiency. We distribute information on energy-saving tips to our customers to make more them mote conscious when it comes to energy matters. We see our customers' needs

from their side and therefore do everything to meet their demands and desires.

## Service and maintenance

We offer our customers maintenance guarantee which means that qualified staff visits the property every third year for an inspection. Customers with a maintenance warranty can at any time for any problem contact our service technicians for a visit at no extra cost.

Falu Energi & Vatten also offers a concept called Färdig Fjärrvärme™ (eng. Easy district heating), which makes district heating even easier.

## Annual meetings

Falu Energi & Vatten was one of the first ever companies to be certified with Reko certification. Every year we send out invitations to information meetings where we discuss energy, prices and how we set prices and listen to guest lecturers. About 1 000 people have attended these meetings so far, which is quite good considering we have about 1 500 customers.

The quality-assurance system Reko District Heating has been developed by the branch organization Svensk Fjärrvärme (Swedish District Heating Association) based on the needs and expectations of the customers. Reko District heating means that we live up to high expectations on openness, comparability and trust, which provide our customers with security.

## Good Environmental Choice

Falu Energi & Vatten is the first company in the world to deliver district heating, district cooling and electricity with Good Environmental Choice labeling to all its customers. This labeling places extremely high demands on the products, which are approved and is often called "the world's toughest environmental labeling". At Falu Energi & Vatten this is part of our climate work and we are happy to be able to give our customers proof that our district heating, electricity and district cooling have very little impact on the environment and the climate.



# Renewable energy – replacing fossil fuels

Electricity can be produced close to the end user of renewable and non-emitting resources, e.g. from the CHP. Each revolution on one of our wind turbines is spinning provides enough electricity to power an electric car 10 km onwards.

The transport sector is almost entirely dependent on fossil fuels and contributes to a significant part of the climate-damaging emissions of CO<sub>2</sub> and particulates. We face a big challenge when it comes to making us independent of oil and an important part is to revolutionize our vehicles. But all technology shifts take time and require dedicated pioneers who are willing to take the costs and risks of unproven technology.

In 2009 Falu Energi & Vatten started an electric car project. We aim to take a leading role in the introduction of new and eco-friendly vehicles. Driving future vehicles with renewable electricity from our CHP plants, wind turbines and hydro power plants is a natural and intelligent part in Falun's future energy systems.

As the first company in Sweden Falu Energi & Vatten introduced the new electric car Mitsubishi i-MiEV. Today, we own six electric cars. Three of them are used in our own activities to reduce overall emissions from our operations. The other cars are outsourced to the community to let more inhabitants try the electric car for their needs and in their everyday lives. The home care services of

Falun municipality use one of our electric cars in their daily activities to visits to elderly and sick at their homes. Another of our electric cars is



*One pine can take you from Falun to Paris and back in an electric car and heat a household for two months*

used by the organization behind the Ski World Championships 2015 in Falun, to give the event an environment and climate-aware character. The sixth electric car we rent out as demo car so that individuals, companies and organizations in Falun to have the opportunity to test drive an electric car.

## Infrastructure for charging

In the center of Falun we have provided some of the most attractive parking lots with charging stations for electric vehicles. The electricity that comes from the charging stations is free for all electric vehicles and is origin marked with wind power.

Since our community contains rural areas, we have also made sure to install charging stations outside the central of Falun. Today we offer the opportunity for visitors at the famous tourist destination of artist Carl Larsson in Sundborn to refuel their electric cars with fresh hydro power from Sundborns hydro power plant. In the village Linghed one can fill his/her electric car with wind power directly from a new wind farm in the vicinity.

We believe that electricity will play an important role in the future supply of fuel for cars. It is simply impossible to ignore all the benefits of electric motors in front of fossil fuels.



*Six pines can take you from Falun to Paris and back and down to Paris again, while it provides a household with heat and electricity for one year!!*

# Improving life in Falun community

## An Italian meets Swedish CHP

One of Erik Westholms, Professor in cultural geography, friends, from a research project that the EU funded, is named Ada Cavazzani. She is a professor of sociology at the University of Cosenza in the wonderful Calabria in southern Italy. Ada was in Falun for a project meeting and immediately took the forests and lakes to their hearts. When she got home she took with her a dream to come back and skate on large, frozen lakes. A few weeks ago, just before Christmas, the professor sent an e-mail, Ada, the ice is shiny like a mirror, and it's time to skate. She responded with her Italian directness, I come to New Years, I fly with KLM out of Amsterdam. Then it started snowing.

Ada is a curious person. She wants to know everything and she is in search of the good things in life and society. She is also quite critical of what is not sensible. When she pointed to the CHP plant's fuming chimney, the professor smelled a rat. Well, he tried to appease her, that plant heats the entire city, it is based on renewable fuels and produce electricity as well.

Hm, "said Ada, who owns it? The ones who live in this town, the professor replied. Ada bobbed her head, almost offended. It can't be that good. Take me there; said Ada, I want to see that place immediately.

They drove up to the entrance and were well received. They got to see the big screw that enters the sawdust, bark and wood chips in the boiler where it swirls around and is evaporated in the fluid bed. The CHP plant in Falun provides 315 GWh heat and 63 GWh of electricity. Renewable fuels, most modern treatment technology. The fuel comes from forests around Falun, about a 100 km radius and the ashes are returned as nutrients to the forest. The smoking chimneys emit mostly water vapor. Ada Cavazzani was speechless before this demonstration of how to build environmentally friendly technology systems with local resources: this is very clever.

The professor painted a picture of how it looked 25 years ago when he and his family moved to Falun; Thousands of chimneys where emitting disgusting sulfurous smoke that lay like a heavy lid over the city. Now the only chimney is the CHP that smokes and it release just water vapor. When Ada comes back from yet another cross-country skiing on the lake she asks: how the snow can be so white, day after day? Doesn't the snow get dark and dirty when it lies on the ground? No, not if you do not pollute it.

But Ada would like to know more. What happened when you went from oil to bio fuel? Was it a strong social movement that demanded this? Yes, the environment was a major political issue. Is it really true that this is in municipal ownership, it is people's own facility? Are people proud of an energy system as well take advantage of natural resources? Here the professor had to answer: no, not really. Most probably the majority of people don't even know it.

Ada stares at him with a challenging gaze. Don't you Swedes see that your society is very well organized? No, he replies. People will be furious if it is busy when they call the health center. The welfare state gave birth to the expectations that will never be met. Our public debate is critical on the verge of self-whipping. How we got to us that our society is so bad? Let's talk about it next time Ada visits.

# Challenges and opportunities for the future

## Challenges

The district heating industry faces no immediate crisis, but must prepare themselves for new marketing opportunities in the future. District heating is going through a depression of confidence which is about price, environment and no possibility to choose supplier

The District heating sector is facing a crossroads where market conditions are changing, but there is no doubt that the industry is important for the future society.

District heating is done today for the most part with renewable or recycled energy and has over the past 25 years reduced the Swedish CO2 emissions by 11 million tones. Excess heat from power plants and waste incineration is used in heating networks so that we get more out of the energy supplied. All of Europe could be heated only by making use of waste heat from the condensing power plants that are there.

In order to develop a sustainable district heating industry there is a need to spread knowledge about district heating's minimal environmental impact. This knowledge needs to be transferred not only to customers and the public. It is also important that politicians, policy makers, officials and industry understand total systems and the large picture.

We can't just look at the building and its energy efficiency (kWh / Sqm) as part of the EU directive says. We can see the big picture and commit to what's most resource-effective and right for the climate and Mother Earth.

To make use of energy more efficient is necessary for a future sustainable society, and what is good for society is also good for the district heating industry but energy efficiency will ultimately result in decreased supplies of heating

## Opportunities

To adjust pricing and termination terms for the customer is a way to gain trust and is an opportunity that Falu Energi & Vatten have utilized. We have abandoned the fixed charges completely (fixed charge 0 SEK) this provides a lower degree of sensation of locking in to a monopoly system. We have also introduced short notice periods so that the customers have a clear idea about that they can choose the supplier of its heat as they prefer.

By working together with industry, politicians, construction and building industry, are we able to change the perception of district heating. We have therefore begun having active and regular meeting with those in power, key individuals and organizations to take social responsibility and thereby start the journey to improve the climate.

Through the energy efficiency that customers are undertaking, we notice the lower heating needs. It has made us the whole time trying to find new ways to get rid of heat.

First, we built absorptions cooling which enabled a continuation and expansion of electricity generation. Now we build a wood pellet factory which helps us to produce more renewable electricity in summer when the heat needs is at its lowest. At the same time we have increased our electricity production, we get wood pellets to use in our district heat production during the winter.

Now that's a smart energy system!