Energy of a new generation Heat and power plant of Tervola

Kalevi Kaukanen – Entimos Oy

A new high technology power station has been built in Tervola. It uses biomass as its source of fuel, forest shavings, sawdust and bark. The production capacity of the power station is 2 megawatts and it produces 90 % of the district heating and 10 % of the electricity in the Tervola area. Tervola replaces fossil fuels (oil) by renewable biofuels collected from the county area. The success of this project is partly due to a new gasification technology.

The new gasification technology of the Tervola CHP plant raised the city to the rank of the most advanced of the world in the field of biomass.

THE TERVOLA COMMUNITY SWITCHED TO BIOENERGY

The Tervola community district heating has up to now been produced using domestic fuel. When the renewing of the heating station became necessary, Tervola made a decision of principle that the community would start using a domestic energy source instead of oil. At the first stage the community had in mind a classic steam CHP plant. The Tervola decision-makers however had in mind a new product development venture of Entimos Oy led by Kustaa Saares.

To increase its efficiency, the gasifier produces two different gases.

He was known in Tervola to be a renowned and diversified inventor and skilled technician. His workshop is now known as the Tervola technology centre.

The Entimos product development project with the son of Mr. Kustaa Saares, Timo Saares in charge had developed rapidly because of strong financing by Tekes among other things. When the Entimos power station product was completed, Tervola took the opportunity and made a thorough competitivity analysis. The base information used for the analysis was collected from the Entimos test station results. In a impartial comparison the Entimos station was outstanding compared to CHP plant based on traditional technology. The Tervola power plant investment decision was also influenced by the fact that Entimos production methods are strongly based on subcontracting. Up to half of the 1,2 million euros worth station would be subcontracted from the community or the nearby areas. Tervola was also aware that it would receive about 10 - 12 percent more investment subsidies for the Entimos station because of its novelty value. The states investment subsidy covered 27 percent of the overall costs, about 320 000 euros.

The Tervola community made the investment decision clearly based on financial grounds. As this was the first commercial version of the new technology station, a risk analysis was also made. All the studies were in favour of ordering the Entimos station. It was seen that the investments needed to increase the use of bioenergy did not necessarily signify more elevated costs, and that the result might even be financially beneficial. Actually, it was only after the investment decision and construction of the plant had been made that several inhabitants of the area realised that they had made together an energy decision making Tervola one of the internationally most advanced communities in the use of bioenergy.

A GAS POWER STATION PRODUCING ITS OWN GAS

The supplier of the station Entimos Oy has developed this new interesting technology for energy production. The station is a gas power station, in which the gas needed by the plant is produced by the plant itself. The gas generator based on a patented invention produces gas that is suitable for use as fuel from biomass at a very elevated temperature of approximately 1200 0C. Additionally the gas can also be produced from municipal waste suitable for burning. The Entimos gas generator produces two different types of product gases with its dual gas technique. The less pure product gas containing tar is burned as it is in a gas cauldron and is used as district heating. The other product gas is clean and suitable as fuel for the gas engine. The gas engine produces electricity and the heat generated by the pro-

cess is used for district heating. The Tervola power station is an automated, unattended station. In case of a malfunction within the system, an alarm is sent to the mobile phone of the maintenance person or to his computer, and the required control measures can be made from afar.

This technology is suitable for power stations in the range of 2 – 15 megawatts. The station being modular the investment can be made phase by phase. The station can be built at first only as a district heating station, and electricity production can be added to the station later. The station can also be gradually upgraded if more power supply is needed. Several of those power stations can easily be built for a larger community area, thus taking into effect the advantages of dispersed energy production in the form of less fuel transportation and minimised heat transfer loss.

COMBINED ELECTRICITY AND HEAT PRODUCTION

This technology is a combination of electricity and heat production, which in energy production signifies high efficiency. In its own size group, the stations electricity production level is very high, approximately 30 % of all energy produced. Competitive dispersed electricity production is now possible and CHP energy production is economical also in small regions. Also individual production plants that need electricity and heating, eg. sawmills and greenhouses, can make use of this new technology and at the same time use their own leftover biomass as fuel.

The research made concerning the cooperation between the community of Tervola and a local sawmill proved out to be very profitable. The object of the research was a power plant investment, where the sawmills were to use their wastes to produce their own energy and the neighbouring company's electricity as well as district heating for the local community. The leftover heat from the district heating supply was planned to be used for drying sawn wood at the sawmill. The study showed that these arrangements would allow for the power plant to be used at maximum power almost continuously. The investments repayment time was calculated to be less than 4 years when the initial project with classic technology was calculated a to be between 7 and 8 years.

THE ENERGY INDUSTRY IS CHANGING

New energy production techniques have gradually led to smaller production units. In North America the size of the production units in the 1990s has diminished to the levels of the 1940s and the same trend is still continuing. The goal has also been to attain dispersed electricity production. It is also economically sensible to try to achieve relatively small fuel collection areas and short transportation distances. While the size of the units gets smaller the investments become more reasonable, as a result the financial risks are now easier to control.

The importance of bioenergy is going to grow in all the industrialised countries in the near future. The European Union is aiming to double the use of renewable energy sources in its energy program concerning the overall production of energy from the year 1995 (6 %) to the year 2010 (12 %). Up to 80 % of the growth has been estimated to come in the field of bioenergy. Its use would triple and its share from the overall production would rise to 8,5 %. Finland is committed in several international decisions to increase energy efficiency and the use of renewable energy sources. Industry has traditionally used wood waste in energy production. The use of wood waste can however be increased in other energy use. For example the Technology Developement Center´s (Tekes) wood energy technology programme aims to increase fivefold the energy use of forest shavings from the year 1998 to the year 2003.

In the next few years big changes will occur in the processing of municipal waste. In the year 2005, a directive by the European Union will enforce that a considerable part of municipal waste must be recycled, energy being one of the solution.

The Kyoto Protocol (1997) and the Bonn Protocol (2001) which aims to the application of what was agreed upon in Kyoto will cause pressure for changes in energy production processes. The CHP plant solution using renewable bioenergy offers one solution for the international efforts to lower the emission of greenhouse gases and slows down the fast warming of our atmosphere. In Tervola power station there are no greenhouse gas net emissions and no particle emissions.

In the future, environment and energy issues will be paid more attention to. For example in Germany the supply network companies are obliged to purchase electricity from small power stations (less than 5 MW) at a fixed price of about 100,9 euros/MWh. This same type of purchase obligation law is in effect in every other EU country for the exception of Finland and Belgium. A new ecological electricity directive being prepared in the EU will force those countries to enforce a similar purchase obligation. □


ENTIMOS OY

The engine consumes the wood gas, hence producing 2 MW of electric power.

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ENTIMOS OY

The boiler burns the gases with tar and feeds thermal kW to the municipal district heating system.