TRIGENERATION INCREASING THE ELECTRICITY PRODUCTION

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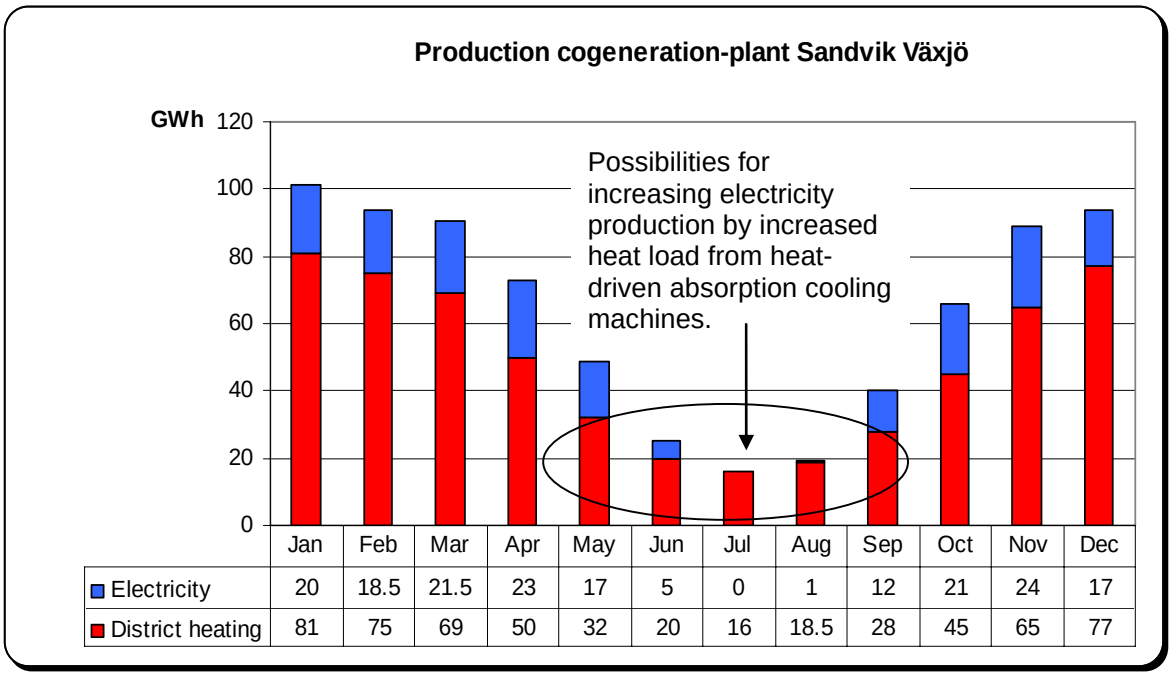
There is a great challenge for creating sustainable energy systems for the future, but the work began long time ago. Sweden´s first municipal power station for street lightning and general distribution was opened in Växjö in 1887- only five years after the first two power stations in the world had been brought into operation, one in London the other in New York.

120 years later the municipality of Växjö received the price Sustainable energy Europe 2007, which proves the city to be on the right way for creating a sustainable energy system. The city has a vision of a fossil fuel free Växjö, where our energy consumption does not lead to any climate change. So far the work has turned out well, and the emissions of fossil carbon dioxide have decreased by 30 % per inhabitant since 1993. At the Sandvik plant in Växjö VEAB produce district heating and electricity from two biofuel-fired cogeneration blocks. This has created the largest benefits for the decreasing of fossil carbon dioxide emissions from the inhabitants in Växjö.

The demand for cooling is growing which would result in an increased consumption of electricity if the cooing demand was to be fulfilled by electrical driven cooling technology. A more sustainable solution can be to use heat-driven absorption cooling where heat from renewable energy sources may be used as driving energy instead of electricity. The next step for VEAB to create the sustainable

energy system for Växjö can be the erection of a district cooling network. This will make the cogeneration plant to be a part of the trigeneration energy system by producing cooling in heat driven absorption cooling machines, se figure 1. At this time a first cooling plant has been erected and is now under evaluation. At the same time there have been made a study about the possibilities for district cooling in Växjö.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Electricity	20	18.5	21.5	23	17	5	0	1	12	21	24	17
District heating	81	75	69	50	32	20	16	18.5	28	45	65	77

Figure 1. Production of heat for district heating and electricity. In the months of low load in the district heating network is there almost none electricity produced. This is due to small loads in the district heating network, by increasing the heat load by heat driven absorption cooling machine can electricity also be produced in this period.

By increasing the load at the district heating system from May to September can the electricity production increase. At this time this is not possible due to two different matters. At first the load in the district heating system need to be greater than today, this can be made through the increased load from heat driven absorption cooling machines. The second matter is the overhaul period which needs to be done when heat load is as smallest. Investigation is now being made about building also

another cogeneration plant, which would create the possibilities for producing electricity all year around. If/When the new cogeneration plant is built the possibilities for the district cooling system can be seen as really good. The heat load would increase and electricity would be produced, se figure 2.

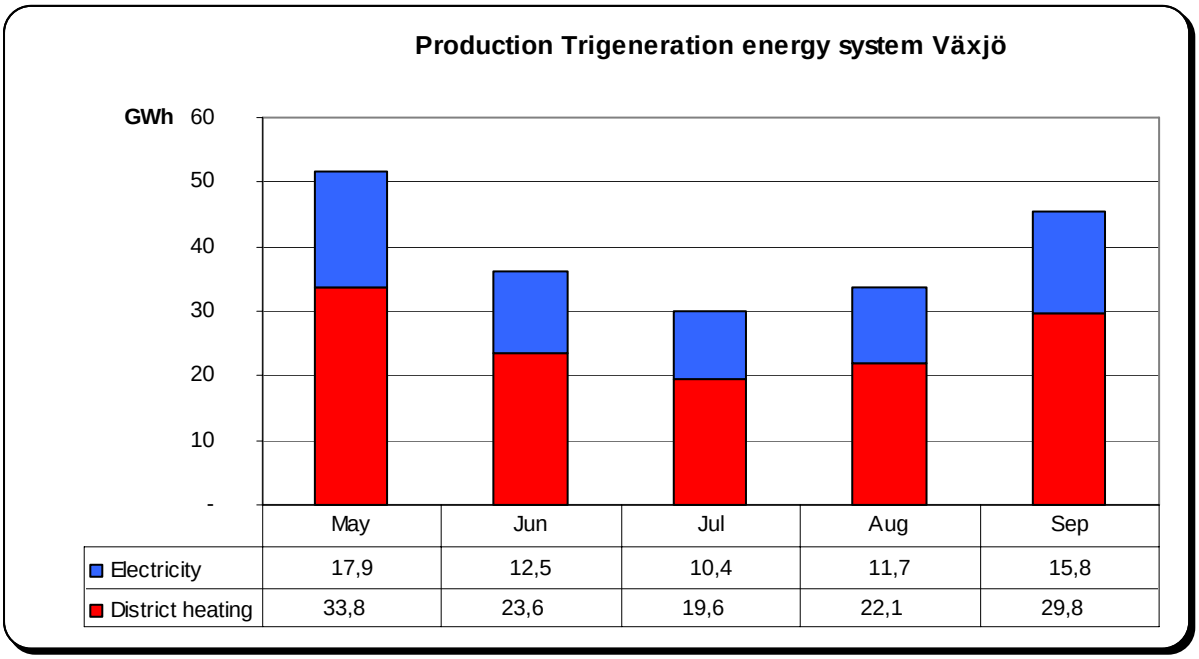


Figure 2. The increased heat load would create the possibilities for producing more electricity.

By increasing the energy system with the third product (cooling) can this create an even more optimized energy system. The environmental earnings by this optimization are great. At this time cooling machines with HCFC is used and will be replaced by district cooling centrals. And the production of cooling for the district cooling system can be optimized together with the existing energy system. The production of cooling will be made by absorption cooling, free cooling and by mechanical chillers. This can be further studied in figure 3.

When studying the decreasing of carbon dioxide emissions is the system border of great interest. The system border for electricity production/consumption is greater than the city of Växjö due to the production of electricity in Växjö will affect the production in Europe. The increased electricity production in Växjö will make the

margin production by the European energy system to be influenced. This can be explained through figure 3. When studying the emissions from carbon dioxide in this system you will se that the total amount of carbon dioxide will be negative. Though it must be taken into consideration that some of the production of electricity has been possible due to specific system limitations, which only take place in Växjö.

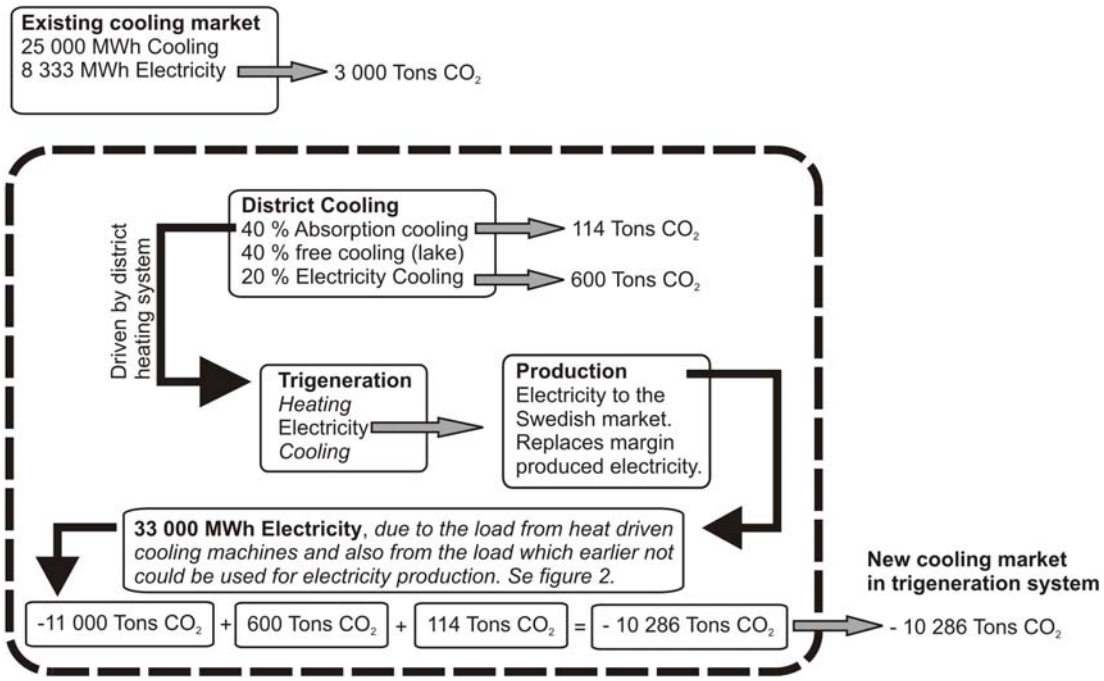


Figure 3. The total energy system is affected when erecting a heat driven district cooling system in Växjö.