

Screen 1 – Intro

The object of this presentation is researches on the operation of Biomass cogeneration power plant in Scharnhauser Park.

Screen 2 – Content

At the beginning of my presentation I will describe the technology that is used for simultaneous heat and electricity generation from biomass on the cogeneration power plant in Scharnhauser Park.

I will also describe the strategy of my researches on the plant operation. I will present the results of my researches and discuss those results.

At the end of my presentation I will resume the results of my researches.

Screen 3 – HKS

As the part of the project POLYCITY, a cogeneration power plant was built in Scharnhauser Park. The area consists mainly of residential buildings. Therefore the energy demand is there primary determined by residential buildings.

The main goal of the project works at Scharnhauser Park was the reduction of the energy demand as well as use of alternative energy sources for the satisfaction of this energy demand. Consequently, the main part of the electricity and heat consumed in the residential area is generated from biomass at the cogeneration power plant.

Screen – 4 – Plan

The combustible

Wood chips are used as combustible at the plant. The main part of those wood chips (seventy percent) stem from natural wood. 30 percent of combusted wood chips are made from forested wood. The wood chips are first stored in the primary wood bunker with a capacity of 1000m³. The wood chips are then carried by a crane to the secondary fuel storage. The secondary wood scraps storage is equipped with a hydraulically floor, which transports the combustible to the burner.

The furnace

The plant is fired by a grate furnace with a capacity of 6,3 megawatt. The thermal energy generated as a result of biomass combustion is released into thermo-oil in the thermo-oil boiler.

Economiser

The furnace is also equipped with an economiser for exhaust heat recovery. Through this exhaust heat recovery the overall efficiency of the plant can be improved.

Cyclone and electric filter

The exhaust fumes stream into the cyclone and electric filter where they are removed from dust. The cleansed exhaust flows then into the smoke stack.

Screen – 5 – ORC

The ORC-System was developed to use of solar, geothermic and biomass for production of electricity. The ORC-process is based on the water-steam-process. The main innovation of the ORC-technology is the use of silicone oil as the working medium. Through the use of silicone oil more favourable conditions can be obtained for the production of electricity meaning that the temperatures and pressures in the ORC circuit are much lower than those of the water-steam-process.

Screen – 6 – Efficiency

According to information given by the manufacturer, the overall efficiency of the plant is 91 percent. The efficiency of the electricity production is given as 15 percent. The efficiency of the electricity production appears at first to be relatively low. The efficiency of the electricity production is however limited by the requirements of the district heat network. The temperature in the ORC-Condenser must be accordingly high in respect to the required temperature in district heat network. The higher temperature in the ORC-Condenser has a negative influence on the electrical efficiency of the ORC-Module.

Screen – 7 – Raw data

The plant operation efficiency has been analyzed on the basis of energy amounts, measured by energy meters. The plant has it own energy meters system for acquisition of produced energy amount. Additionally, the energy meters system provides data of energy demands of the plant. The measured energy amounts are monthly read and archived by plant operator. The archived monthly values serve as a ground stone for the analysis of the plant operation. The raw data includes also the amounts of monthly delivered wood chips. On the basis of those data, the fuel energy at the input of the plant can be calculated.

Screen – 8 – Fuel energy

The chart presents calculation results of monthly amounts of fuel energy. On the basis of the amounts of monthly delivered wood chips, the fuel energy at input of the plant was calculated. The fuel value of combusted wood chips was determined according to the archives of wood supplier. The wood supplier archive contents information about humidity, density and proportions between wood kinds, which were used for production of delivered wood chips. The raw data contains also data about the amounts of monthly ash disposal. On the basis of data about ash disposal the monthly amount of combusted wood chips and the monthly amounts of fuel energy could be calculated.

Screen – 9 – Overall efficiency

The overall efficiency was determined on the basis of the overall degrees of efficiency. The overall degree of efficiency was calculated through comparison between the monthly amounts of generated energy and fuel value. On one hand the overall degree of efficiency was calculated on the basis of wood supply. On the other hand the overall degree of efficiency was calculated based on ash disposal. The final value was calculated as the average value of those two parameters.

One must however be considered. The calculated values represent degrees of efficiency, which were determined using a meter data from a long time span (twelve months). During the daily operation of the plant good working conditions cannot always be achieved, due to the start-up phase, poor weather conditions, variations of the energy demand etc. The calculated values rather enable to determine the quality of the plant while operating in non-stable working conditions.

Screen – 10 – Electrical efficiency

Analogical to the overall degree of efficiency, the efficiency of the generation of electrical power has been calculated. The electrical degree of efficiency is relatively low. On one hand the reason for that low efficiency of electricity generation is the insufficient reliability of the ORC-Module. On the other hand the construction works in the residential area are not yet finished. Due to the insufficient reliability, the ORC-Module was upgraded to guarantee a stabile operation of the plant. The construction work in the residential area should be completed till 2008. Under consideration that the ORC-Module was upgraded and the access of all energy consumers will occur 2008, higher electrical efficiency seems to be attainable.

Screen – 11 – Discussion

The calculated overall degree of efficiency has a normal range in respect to degrees of efficiency of modern cogeneration power plants. The minimal value for degrees of efficiency of cogeneration power plant is set at eighty percent. The calculated degree of efficiency for the cogeneration power plant in Scharnhäuser Park has a value of eighty six percent, which can be evaluate as a normal range.

The calculated electrical degree of efficiency must be appraised as relatively low. However it must be also taken into consideration, that analogical to the overall efficiency, the electrical degree of efficiency was calculated using a meter data from a twelve months long period of time. If the electrical degree of efficiency is calculated as a momentary value, it will have values between eleven and twelve percent. The improvement of the electrical efficiency of the plant is the most important goal for studies on the operation of the plant in Scharnhäuser Park.

Screen – 12 – Outlook

Now a few works about continuation of my researches.

The cogeneration power plant is equipped with measurement instrumentation for acquisition of the main process parameters. The data collected by that instrumentation are archived in the system control module. The evaluation of those data could provide important information for analysis of the power plant operation

Screen – 13 – Conclusion

Despite of the relatively low electrical efficiency, the ORC-Technology has several advantages:

- The temperatures in the ORC circuit are relatively low compared with the temperatures of the water-steam-process.
- Through the use of thermo-oil as a heat transport agent, a steam boiler must not be used to produce electricity.
- The waste heat is released to the district heat network.

According to those advantages, the ORC-Method is the most economical and technical simple method for energy generation from biomass.