

CHAPTER 18:

Flue gas scrubber and heat pump, Caligo innovation, were taken into use in late September 2014 and the operation performance will still be improved when e.g. with new fuel contracts the lower quality (more wet) fuel will be fed into the system.

In Caligo innovation, part of the district heating return flow is forwarded through an ammonium heat pump application. The heat pump cools down the condensing circulation in order for the condensing unit to recover the heat from the flue gases efficiently in all plant operational conditions. Temperature conditions in the condensing unit remain enough below the dew point even when the district heating return flow temperatures are high. Typically, heat recovery performance in a traditional condensing unit fail down to 0-7% (heat recovery in kW / boiler capacity in kW) when DH return flow temperature increases to 55-60C. By Caligo application the heat recovery performance remains still at 17-22% level in the same corresponding conditions. By Caligo's latest experiences, the maximum heat recovery performance is even on 35%-38% level when the system is used by a wooden chip plant in wet fuel conditions.

The high performance of the Caligo innovation can be proofed also by comparing the flue gas inlet temperature against the outlet temperature. Flue gas inlet temperature varies typically between 130-200C. After the Caligo solution, the respective temperature is only 30-45C. In practice, the temperature difference between inlet and outlet is recovered heat. Even more importantly, the outlet temperature is always well below the respective dew point, which ensures extremely high heat transfer from the flue gases to the condense circulation and back to the DH network.

Caligo innovation utilizes high performance heat pumps only. Ammonium is used as heat transfer media inside the heat pump due to it's excellent COPh value. COPh value varies typically between 8-12 ensuring low consumption of electricity. System thermodynamics and it's optimization is based on a dynamic adjustment and control of the heat pump together with two condense circulation flows and respective heat transfer units. In total, Caligo application consists of over 10.000 rows of software code.