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Implementation of a local heat grid at Buchenhofen WWTP

Gerd Kolisch*, Inka Hobus*, Dirk Salomon**

*Wupperverbandsgesellschaft für integrale Wasserwirtschaft mbH,
Untere Lichtenplatzer Straße 100, 42289 Wuppertal, Germany, Email: kol@wupperverband.de
**Wupperverband, Untere Lichtenplatzer Straße 100, 42289 Wuppertal, Germany

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Summary

The transition from current energy practices to the sustainable use of energy is essential. Recovering thermal energy is one main key for a sustainable urban water cycle, as it is the energy source with the highest recovery potential. Meda and Cornel (2010), for example, estimate the energy content of wastewater to about 250 kWh/(PE*a) as thermal energy against about 150 kWh/(PE*a) as chemically-bound energy (COD). Currently, thermal heat recovery is discussed a lot, but practical experiences are mostly lacking. Therefore, the advantages of recovering thermal energy from the urban water cycle is investigated in the project INNERS (INNovative Energy Recovery Strategies in the urban water cycle), supported by the European Community within the INTERREG IVB North West. In this project the recovery of thermal energy will be investigated in six demonstration projects with different technological approaches. One project is the implementation of a local heat grid at Buchenhofen WWTP.

The Buchenhofen WWTP with a serving size of about 600,000 PE treats the waste water from the city of Wuppertal. At the site in Buchenhofen there is also located a central sludge incineration plant with a capacity of about 34,000 Mg DS per year. Here the sludge from most of the waste water treatment plants operated by Wupperverband is dried and thermally combusted. The sludge incinerator produces very high thermal energy quantities. In this context, it is interesting to look at the possibility of using thermal energy on site and to examine whether a more energy-efficient operating mode exists for the formation of a heat network connected to external consumers.

Recently, only the heat production of the combined heat and power plants (CHPs) at Buchenhofen WWTP was available via a local heat grid for heating the raw sludge to digesting temperature and to cover the heat demand of the digester itself and of the operational buildings. However, during wintertime fossil fuels were needed in addition to cover the overall heat demand. By an optimisation of the heat supply system and connecting the sludge incineration plant to the existing heat grid, today an additional heat capacity of about 1.5 MW in heat can be provided for internal as well as for external consumers. By this heat capacity theoretically about 450 households could be supplied with heat. Indeed only a portion of this heat is needed for full self-coverage in heat of the plant and external consumers can be connected to the local heat grid (Figure 1). In addition, excess heat can be used during summertime for cooling purposes. In this concern an adsorption chiller was installed which now converts a portion of the heat for cooling the central operational building.

As external consumers the central laboratory building of Wupperverband, some residential buildings and an industrial sewage plant operated by Bayer AG without own heat production are located in an economic distance. These consumers were connected to the heat grid during last winter and start-up of operation was in March 2014.

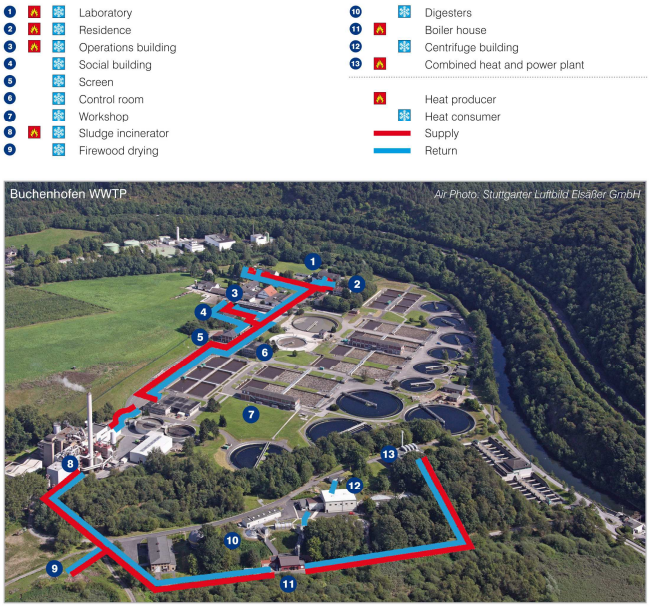

Figure 1. Local heat grid at Buchenhofen WWTP

It is expected that Wupperverband will save on site including the laboratory about 60,000 l fuel oil by the heat grid. Further 60,000 l in fuel oil can be saved by the industrial site and the residential buildings. The CO_2-emission will be reduced by about 350 Mg per year. In a heat balance the additional potential of the heat grid is shown (Figure 2). However, the planned drying of wood ships during summer time by the heat surplus was not proved as economic. Also, the connection of Bayer Sports Park to the heating network is not economically feasible due to a long piping distance of about 2.5 km.

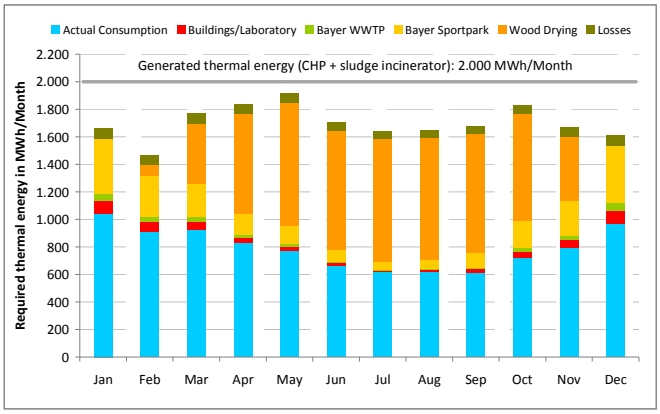

Figure 2. Calculated heat balance for an enlarged heat grid at Buchenhofen WWTP

In the presentation a detailed overview about the heat grid, its elements and the costs will be shown as well as the results of the first half year of operation. In addition, a short overview about the further five demonstration projects of INNERS will be given.

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Investing in Opportunities

This project has received European Regional Development Funding through INTERREG IV B.

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