

Energy from the urban water cycle

The urban water cycle as an energy supplier

The urban water cycle is designed for the transport of water and wastewater.

Drinking water is used by consumers – households, and industry – and is then transported as wastewater to the wastewater treatment plants (WWTP). There, it is purified and returned to the water cycle.

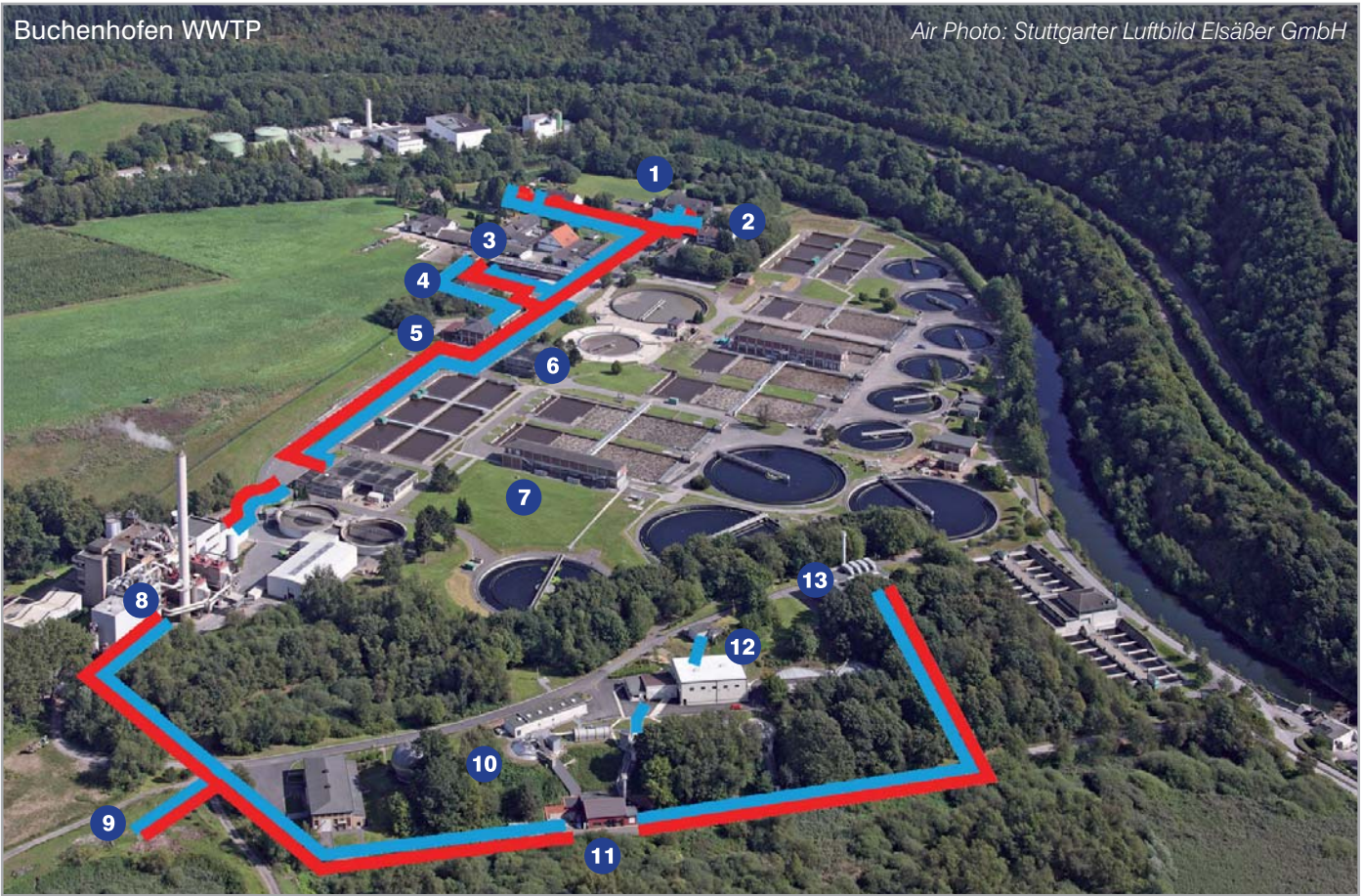
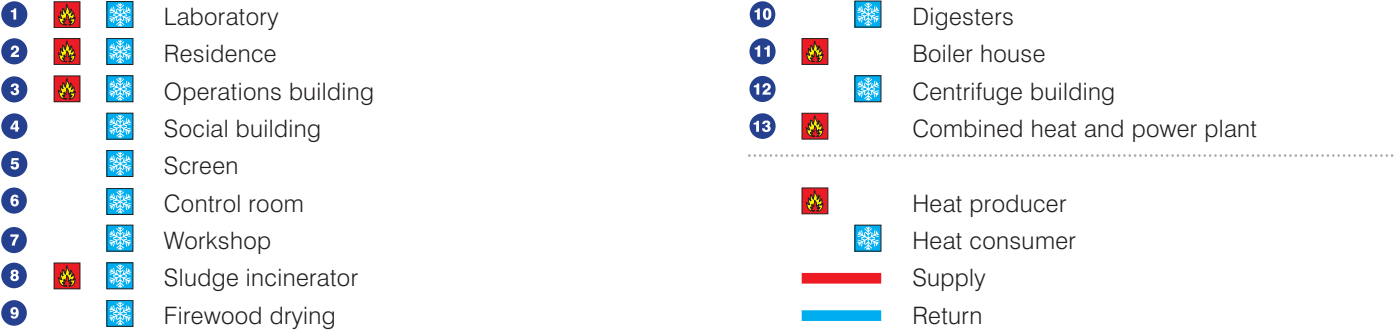
There is a large amount of energy stored in the water cycle, especially thermal energy as confirmed by recent studies. A large part of this energy remains unused and is released into the environment. Additionally, a great deal of energy is required for transport and purification of wastewater.



The main goal of Wupperverband is to increase the energy production and to produce more energy than required for wastewater treatment by 2020. Already, a large part of the electrical energy for the treatment plants is self-generated and heating requirements for wastewater treatment are largely covered through the conversion of biogas. Furthermore, there is a great potential for heat recovery in WWTPs. In order to harness this potential, the European Union research project INNERS (Innovative Energy Recovery Strategies in the urban water cycle) began in 2011 to investigate both the reduction of energy consumption and how to increase the energy production. The goal of INNERS is an energy neutral or even energy producing urban water cycle.

The project partners of INNERS are universities, research centres, municipalities and water boards in the Netherlands, France, Great Britain, Belgium, Luxembourg and Germany. All individual projects have the objective of saving energy, reducing costs and protecting the environment by reducing CO₂ emissions.

Wupperverband is involved in INNERS with three projects at the sites Buchenhofen, Burg and Kohlfurth.



Using thermal energy for adjacent buildings

At the Buchenhofen plant Wupperverband operates a WWTP and a sludge incineration plant. There, operations buildings are already being heated with the excess heat from the combined heat and power plant (CHP) using an internal heat network.

As a part of the INNERS research project, a local heat network is being built and will be tested. What is new is that the excess thermal energy generated at Buchenhofen through the WWTP and the sewage sludge incineration plant can be used for heating surrounding Wupperverband properties (both laboratory and residential). Furthermore it can be offered to energy providers so that they can provide heat to other adjacent consumers. For this purpose Wuppverband carried out a study in 2011. The results showed that the connection and supply of buildings with heat is cost covering.

In 2012, the implementation phase started with the expansion of the local heat network.





Project Participants:



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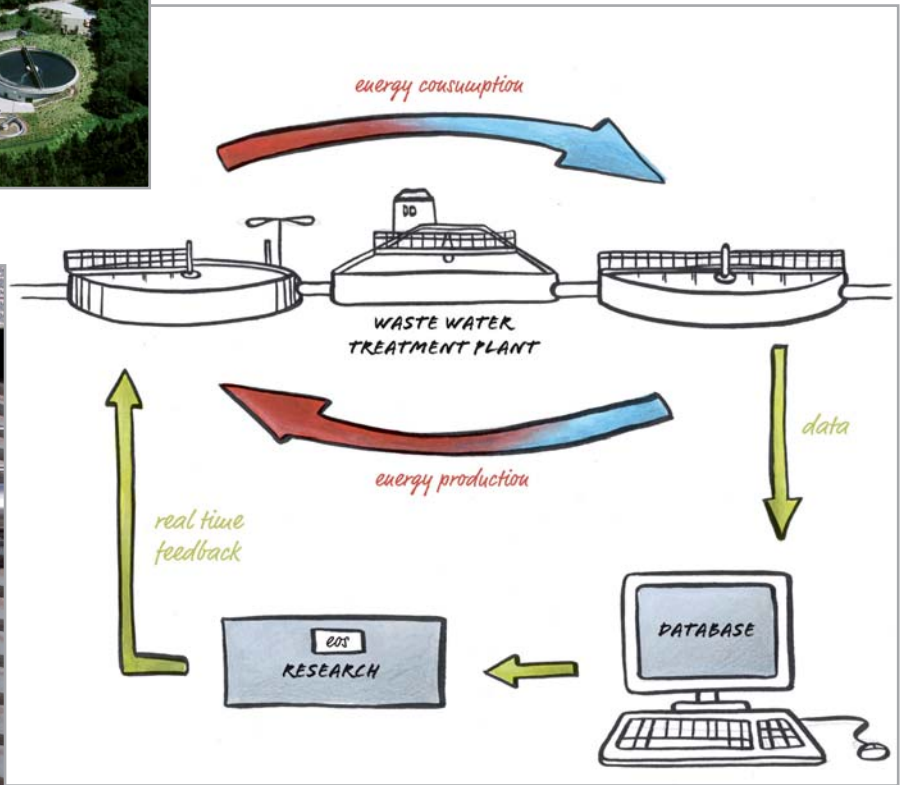
Electricity consumers monitor – saving energy

At the Burg WWTP an energy-online tool will be tested in 2013. It is a computer programme that continuously monitors the main energy consumers in the WWTP (for example, the aerators of the aeration tanks, the transport pumps, the sludge dewatering). The online tool is meant to reduce energy consumption of the WWTP and reduce the proportion of externally purchased energy for operation.



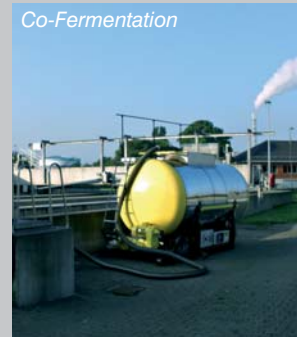
The Centre de Recherche Public Henry Tudor, the University of Luxembourg, the Water Board SIDEN (Luxembourg) and Wupperverband are developing the online tool together. The development of the programme started in 2011 and is expected to go into the testing phase at the Burg WWTP in 2013.

The WiW mbH, the subsidiary of the Wupperverband, is supporting the implementation of this project.

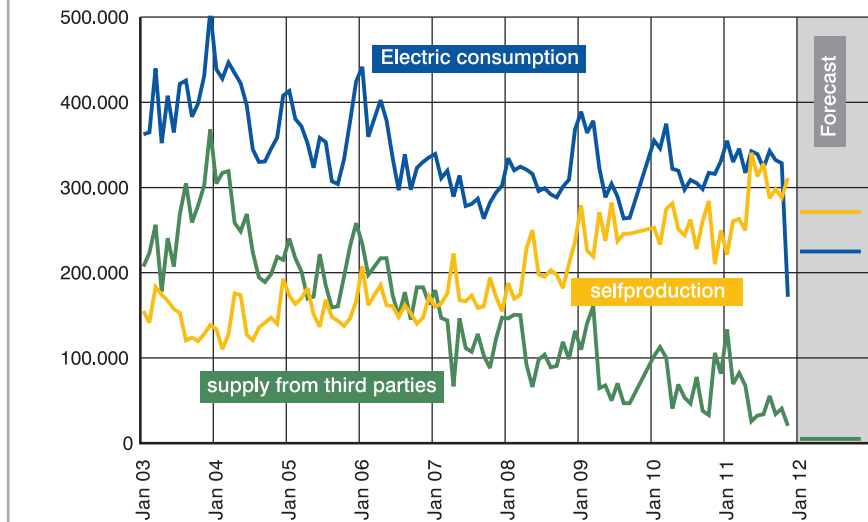


Producing more energy than needed at the WWTP

At the Kohlfurth WWTP Wupperverband analyses how it can produce as much as, or even more energy than needed to operate the plant. There, electricity is generated from digester gas used by the CHP, and from the sun using a photovoltaic system. The CHP also provides heat for the operations buildings. Already, the Kohlfurth WWTP is energy independent at times, i.e. it self-generates enough energy on site to meet the demand.



In the process of wastewater treatment, most energy is consumed in the aeration tank, where microorganisms remove nitrogen among other substances from the wastewater. The research project INNERS is currently investigating the treatment of particularly nitrogen-rich wastewater by special bacteria for deammonification at the Kohlfurth plant. These bacteria require considerably less energy for nitrogen removal.



Electricity use and production [kWh/month]



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