

## Project Information

**Subject:** Energetic optimisation of a waste water treatment plant under special consideration of the energy carriers natural gas and hydrogen (EuWaK)



**Project Partners:** Emschergenossenschaft, Essen  
Tuttahs & Meyer Engineering Society, Aachen  
Engineering Society Redlich und Partner, Aachen  
Research Institute for Water and Waste Management, Aachen  
City of Bottrop

**Project Duration:** 01.06.2005 – 30.06.2008

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### Project Description:

The utilisation of digester gas is limited even today to few paths. It is limited in the sewage plant operational practise to the classic use in boilers, CHP units or for direct drives. However, in the near future much more possibilities a sewage plant operator can take into his consideration in the area of construction and operation. By processing of digester gas to natural gas quality (in the following called "natural gas") and/or hydrogen sewage plants are able to develop from pure disposal sites to production sites for high-quality energy carriers.



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Hydrogen is an essential component of sustainable energy concepts, for mobile as well as stationary energy supply.

- Natural gas is seen as an approved bridge technology towards the hydrogen energy age.
- The present hydrogen production is based on fossil fuels; so sustainability is not guaranteed.
- Digester gas offers a big and economically developable potential to regenerative hydrogen production:
  - about 10 mN<sup>3</sup>/a hydrogen per treated inhabitant value
  - hydrogen capacity in North Rhine-Westphalia: ~ 1 billion kWh/a of digester gas
- By cofermentation this potential can be developed even further
- Sewage plants form an exhaustive net, feature certified staff and are suited as an important first stone for the construction and the decentralisation of the necessary future hydrogen infrastructure.

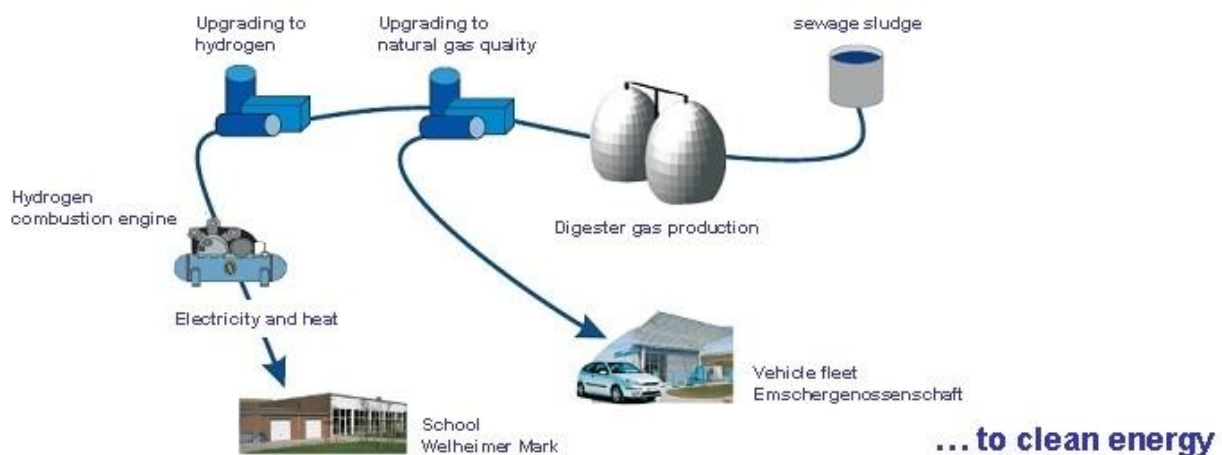
To secure the sewage-technical demands for water pollution control sewage plants are not only marked by a very high power and heat consumption. Another important part is the fuel consumption. For journeys in the area of the company`s sewage net incl. cleaning of canals and rest material disposal about 8.5 kWh / (E a) in mobile energy are to be considered; this corresponds to about one third of the power consumption for the sewage cleaning.

About the large-scale technical processing of digester gas to hydrogen quality, that leaves open all options of utilisation, no practise experiences are present up to now. This knowledge gap is to be closed with that Emschergenossenschaft plans.

### Objective

For the first time the large-scale technical conversion of a plant for processing of digester gas to gaseous hydrogen (GH<sub>2</sub>) for future comprehensive purposes (PEM fuel cells) with integration of the bridge technology natural gas is carried out. So, the development of the H<sub>2</sub> infrastructure shall be speeded up and the market launch accelerated...

### From sewage sludge ...



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Location of the intended pilot plant is the sewage plant Bottrop of the Emschergenossenschaft (EG), with a removal size of about 1.34 million IV one of the country's biggest sludge treatment facility. A partial stream of the digester gas, which is currently utilised in 3 gas engines of same construction which serve as CHP units, is processed to natural gas as well as in a possible further step to hydrogen.

The city of Bottrop pursues the town planning aim, to make the energy supply more efficient and ecologically more acceptable with different projects from housing developments by the application of hydrogen technologies. The activities of the "Hydrogen City" of Bottrop are connect in ideal manner with the planned project of the Emschergenossenschaft: the hydrogen generated from digester gas is used to supply a close to the Bottrop sewage plant situated school centre incl. swimming-pool with electricity and heat.

### Approach and draught

Within the scope of the first project phase are for the comprehensive practise test of a complete system the following investment developments and activities intended:

- Gas processing arrangement for the production of "natural gas" from digester gas with a digester gas treatment capacity of 120 m<sup>3</sup>/h (active coal filter and pressure swing adsorption)
- Reformer + further gas processing (pressure swing adsorption) for the production of about 100 m<sup>3</sup>/h GH<sub>2</sub>
- Stationary, non-fossil electricity and heat supply of the school Welheimer Mark with swimming pool (City of Bottrop) by means of a hydrogen CHP unit
- Operation of own natural gas passenger cars with processed digester gas by the EG

The project contains project development, planning and accompanying research for these arrangements. From reasons of a more flexible availability and higher robustness compared with fluctuating GH<sub>2</sub> qualities in the development stage a ICE CHP unit is used in the first step as a stationary hydrogen consumer.

After comprehensive optimisation of the gas processing one is able in the second phase to include a fuel cell and a filling station for the delivery of GH<sub>2</sub>.



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