Increase of energy efficiency of wastewater treatment plants (WWTP)

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Energy demand of ca. 10,000 municipal WWTP

- Energy consumption of 4,400 GWh (causing 2.5 Mio. t CO$_2$ emissions)
- This is equivalent to energy consumption of about 900,000 4-person-households
- Typically, WWTP are with 20% largest communal electricity consumer
Energy Transition – Relevance for Sewage Management

Percentage of energy demand per process step

- Biological treatment: aeration (67%)
- Flocculation filtration (8%)
- Sludge treatment (11%)
- Others (6%)
- Sewage lift station (5%)
- Mechanical treatment (3%)
Measures for increasing energy efficiency

Energy saving

• Ca. 20 – 30 % by short- and mid-term measures:
  – Installation of energy efficient aeration systems (e.g. membrane systems)
  – Modified design of stirring devices
  – Anaerobic systems
Measures for increasing energy efficiency

Energy production

• Currently, WWTP produce 1.100 GWh per year (doubling is possible through increase of efficiency)
• Advantage of sludge gas production: storable renewable energy
• Use of thermal energy of wastewater by heat exchangers:
  5-10 % of buildings in Germany could be heated
  – Heat customers need to be situated nearby (400 meters)
  – New buildings and public swimming pools
  – Industries
Current activities

• Implementation of 14 demonstration projects as part of the environmental innovation program funded by FMoE
• Goals:
  – Energetically self-sustaining WWTP
  – Advanced approaches of thermal energy use of wastewater: on-site and decentralized solutions (e.g. in housing complexes)
  – Conversion of heat to electrical energy (ORC processes)
  – Pilots on recycling of phosphorus
  – Use of regenerative energy on-site
• Research on options for reducing water infiltrating sewers: external water increases energy demand of WWTP up to 15 %
Current activities

- Guiding principles on energy efficiency of WWTP are planned to be anchored in the national Wastewater Ordinance

- Technical rule DWA-A 216 „Energy analysis of WWTP“:
  - Key instrument for WWTP operators
  - Worthwhile for large plants (> 10,000) which amount for 87% of total energy demand