Energy efficient wastewater treatment in Szczecin

Solutions proposed for WWTP „Pomorzany”

Piotr Miakoto and Jacek Jasiulewicz,
Water And Sewage Company Ltd. of Szczecin, Poland

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Basic information about WWTP „Pomorzany”.

- WWTP "POMORZANY" receives sewage from the catchment area located in the left bank of Szczecin City. Due to the combined sewerage system, the inflow to the WWTP during the rain can reach 7.68 m³/s. Dry flow capacity for dry weather was designed for flows up to 66,000 m³/d and 418 000 RLM (equivalent inhabitant)
General overview of WWTP „Pomorzany”
## WWTP Pomorzany

Current consumption and production of electrical energy in kWh

<table>
<thead>
<tr>
<th>Year</th>
<th>Produced energy</th>
<th>Energy used for blowers</th>
<th>Energy used by incineration plant</th>
<th>Energy for remaining facilities</th>
<th>Total energy</th>
<th>Bought energy</th>
<th>Percentage share of produced energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>3606147</td>
<td>4400408</td>
<td>965400</td>
<td>3890365</td>
<td>9256173</td>
<td>5649026</td>
<td>39%</td>
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<td>2015</td>
<td>4230048</td>
<td>3965955</td>
<td>1065141</td>
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<td>8869081</td>
<td>4639033</td>
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<tr>
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<td>4045059</td>
<td>3756433</td>
<td>1090205</td>
<td>3961195</td>
<td>8807833</td>
<td>4762774</td>
<td>46%</td>
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**WWTP Pomorzany**

Actions related to reduction of requirement for electrical energy

- Replacement of the existing aeration system with a new more efficient one
- Improvement of mixing in oxidation zones
- Application of a new air delivery control system for biological chambers
- Power reduction for individual pumps, mixers, etc., within the planned replacement of equipment
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Aeration system – current state

- Inefficient air delivery control system
- Insufficient oxygenation capacity
- Very high pressure losses on the air distribution system
- Too slow circulation speed
- Operation of the aeration system - on / off
- No spare blower
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Aeration – system modernization

- Performing off-gas oxygen utilization tests
- Determining the maximum and minimum air / oxygen requirements
- Getting familiar with the type of diffuser offered
- Determining the operation mode of the system by division into sections
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Aeration – mixing modification

- Adaptation of mixing force to new conditions.
- Use of mixers for more efficient aeration
- Combination of mixers work with oxygenation cycles on / off
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Aeration – existing control

• Existing air supply control is performed using oxygen probes
• Interruptions on the on / off system are regulated each time
• Automation does not manage the exclusion of unnecessary mixers
• The system does not follow the changing conditions
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Aeration – modification of control

- The new control system shall adjusts the amount of oxygen and mixer operation to varying conditions over time
- Connection of air supply to biological chambers with nitrogen processes
- Application of electrodes for measuring ammonia and nitrates
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Aeration- expected results

• The new aeration system can reduce energy consumption by **up to 20%**
• Changing the control system can reduce power consumption by **up to 10%**
• Assuming the most unfavorable variant of overlapping savings from the modernization, the final effect shall result in **at least 20%** of electricity savings.
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Reduction of equipment power consumption

- Matching new pumps and mixers with maximum efficiency
- Use of new technical solutions:
  
Example: 4 pumps with a power consumption of 20 kW each were replaced by four 7.5 kW pumps

- The estimated reduction will be about 5%
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Measures to increase the amount of produced electricity

- Performance improvement of sludge line
- Construction of photovoltaic farm
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Performance improvement of sludge line - actions

- Collecting higher amount of primary sludge
- Additional thickening of primary sludge
- Utilization of full volume and capacity of mixed sludge tank
- Improvement of the circulation system and stabilization of the sludge heating process in fermentation chambers
- Elongation of sludge fermentation time in fermentation chambers
- Use of fats in biogas production
- Improvement of the way of collecting fermented sludge from fermentation chambers
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Performance improvement of sludge line - effect

- Increasing the production of biogas by at least 15%
- Higher content of dry mass in sludge after presses
- Reducing the amount of polymers for dewatering
- Lower demand for thermal energy in the sludge drying process
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Construction of a photovoltaic farm

- Utilization of the experience of already built facilities
- Free land for investment of 3 hectares at the WWTP „Pomorzany”
- ZWiK Szczecin, with 6,300 panels located on 3 hectares, currently generates about 1,400,000 kWh of energy
## WWTP Pomorzany

Predicted consumption and energy production in kWh

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<tr>
<td>20...</td>
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<td>3005150</td>
<td>1035700</td>
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<td>7803990</td>
<td>1752170</td>
<td>78 %</td>
</tr>
<tr>
<td></td>
<td>15% increase</td>
<td>20% decrease</td>
<td>5% decrease</td>
<td>5% decrease</td>
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<tr>
<td></td>
<td>+ solar energy</td>
<td>1400000</td>
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WWTP Pomorzany
Estimated savings on electricity alone will amount to \(1,2 \text{ mln zł. (290 000 EUR)}\) per year
Thank for your attention

Piotr Miakoto
Senior Master for Exploitation at WWTP „Pomorzany”
Water And Sewage Company Ltd. of Szczecin, Poland

Jacek Jasiulewicz
Manager of WWTP „Pomorzany”
Water And Sewage Company Ltd. of Szczecin, Poland