

Energy efficient wastewater treatment in Szczecin

Solutions proposed for WWTP „Pomorzany”

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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 $7.68 \text{ m}^3/\text{s}$. Dry flow capacity for dry weather was designed for flows up to $66,000 \text{ m}^3/\text{d}$ and 418 000 RLM (equivalent inhabitant)

General overview of WWTP „Pomorzany”



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Current consumption and production of electrical energy in kWh

Year	Produced energy	Energy used for blowers	Energy used by incineration plant	Energy for remaining facilities	Total energy	Bought energy	Percentage share of produced energy
2014	3606147	4400408	965400	3890365	9256173	5649026	39%
2015	4230048	3965955	1065141	3837985	8869081	4639033	47%
2016	4045059	3756433	1090205	3961195	8807833	4762774	46%

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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 adjust 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

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Predicted consumption and energy production in kWh

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2016	4045059	3756433	1090205	3961195	8807833	4762774	46 %
20....	4651820 15% increase + solar energy 1400000	3005150 20% decrease	1035700 5% decrease	3763140 5% decrease	7803990	1752170	78 %

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Estimated savings on electricity alone will amount to **1,2 mln zł. (290 000 EUR)** per year



Thank for your attention

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