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INTEGRATED TECHNOLOGY FOR IMPROVED ENERGY BALANCE AND REDUCED GREENHOUSE GAS EMISSIONS AT MUNICIPAL WASTEWATER TREATMENT PLANTS

“BARITECH”

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Total project costs in EUR 923 485

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Project Promoter

Gdańsk University of Technology



Project Partners

Poznań University of Technology

Silesian University of Technology

Aquateam COWI AS



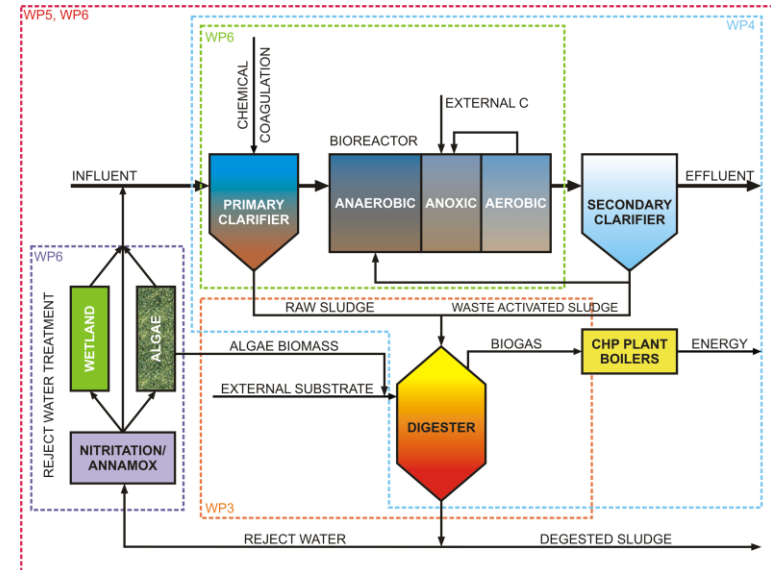
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The aim of the project is to develop a novel sustainable technology that combines increased biogas production, enhanced nutrient removal and reduction of greenhouse gas emissions.

The proposed technology includes treatment of anaerobic sludge digestion liquors by the nitrification/anammox process, algae reactor or wetland system. The increased primary sludge production for digestion is achieved through enhanced primary treatment by coagulation and flocculation.

The technology will lead to energy recovery and savings, greenhouse gases emission reduction, enhanced nutrients removal, sludge minimization and improvement of the economic aspects of WWTPs.



Schematic layout of the proposed technology and scope of seven Work Packages

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EXPECTED RESULTS

1. Reduced load on the biological treatment step of WWTPs by 20 - 30 %

- Implementation of the integrated technology of nitrogen and phosphorus removal from digested sludge liquors (1st step: anammox process, 2nd step: algae growth or wetland treatment system)
- Reduction of suspended solids and organic matter content of primary treated wastewater as a result of enhanced primary treatment by coagulation with organic coagulants

2. Enhancing biogas production (source of renewable energy) in an anaerobic digester by 20 - 40 %

- Increasing the amount of primary sludge.
- Feeding biomass from external (alternative) sources
- Feeding algae biomass from WWTP side stream treatment

3. Improvement of the WWTP energy balance

4. Reduction of GHG emission:

- Reduction of N₂O release as a result of the anammox process
- Reduction of CO₂ due to limitation of energy consumption at WWTP
- CO₂ absorption by algae

5. Higher share of renewable energy originating from biogas in WWTP energy balance

6. Model based optimization of selected treatment processes using a mechanistic approach

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METHODS AND APPROACH

WP. 1. The coagulation/flocculation process in a primary clarifier

- Selection of coagulants/flocculants
- Standard jar-test apparatus by dosing different amounts of various types of organic coagulants to screened raw wastewater

WP. 2.1. Nitrogen removal in the anammox process

- Monitoring of bacteria population dynamics using molecular microbiology techniques (FISH, PCR, DGGE)

WP. 2.2. Nutrients removal by algae/WP. 2.3. Nutrients removal by wetland treatment system

- Nitrogen and phosphorus concentrations will be carried out according to EPA methodology

WP. 3. Biogas generation in the anaerobic digestion process with additional substrates

WP. 4. Model-based optimization of selected treatment processes

- The simulation software GPS-X (Hydromantis, Canada)

WP. 5. Energy balance and greenhouse gases (GHG) emissions estimation

- GHG emission estimation will be carried out according to EPA and WERF methodology for biogenic emissions

WP. 6. Techno-economic analysis

- Flowsheet simulation software (SuperPro Designer, Inteligen, NJ, USA)