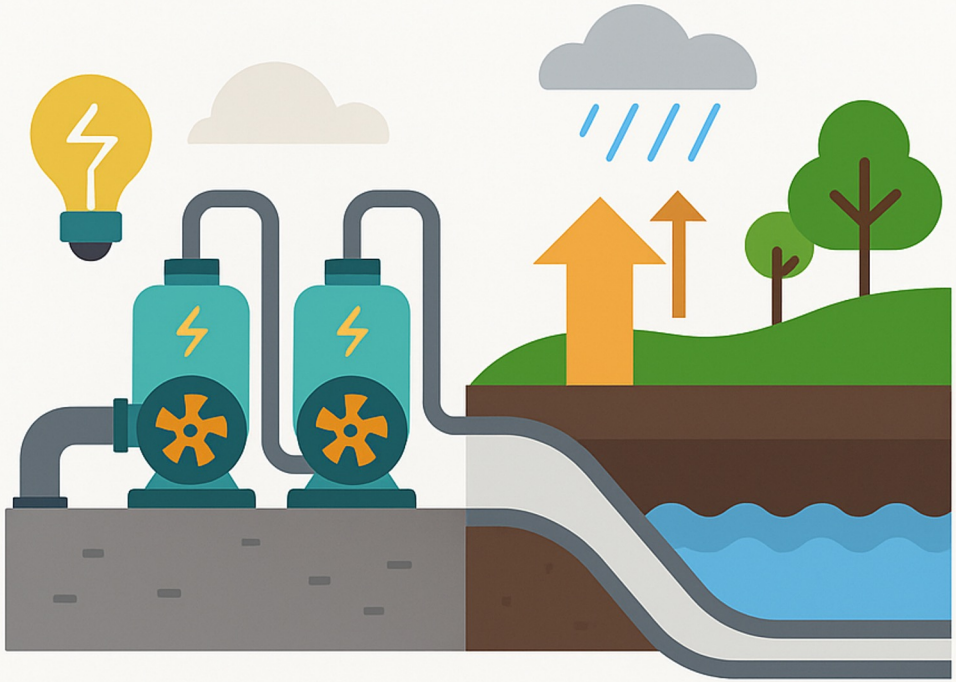

ENERGY OPTIMIZATION TASK FOR THE BLOMINMÄKI WASTEWATER PUMPING

CHALLENGE BRIEF • JUNCTION X HSY X VALMET

Core of the Challenge

- Objective: Develop an energy-efficient control solution for the Blominmäki waste water pumping
- Context: Tunnel water level varies; water is pumped to a high elevation → high energy consumption
- Data & model: Simulated or recorded dataset + simple simulation model

Available Data

- Pump-specific power consumption (electricity)
- Pump-specific flow rate
- Tunnel water level
- Discharge elevation (constant)
- Suction height (varies with tunnel level)
- Topography + elevation differences

Phenomena & Dynamics

- Large tunnel volume = delay between pump activation and impact
- Seasonality, daily usage cycle: morning & evening peaks, low night consumption
- Forecast, storm rain effect: rapid, episodic increase in inflow

Optimization Constraints

- Pumps must not start and stop frequently
- Operation near optimal efficiency: minimize kWh/m³
- A smooth outflow is desirable
- Tunnel bottom must be flushed at least once daily
- Pumps must not be stopped entirely
- Clear min/max tunnel level boundaries required

Technical Setup & Limitations

- Dataset: approx. 1 month including rain events
- Data format: CSV / Excel
- Simulation: Offline Python-based model
- Optional: Feedforward control or multi-agent AI-based logic
- Visualization: Cross-sectional view with topography, tanks, and pumps

Targeted Outcome

- Data-driven, intelligent pump control algorithm
- Accounts for delay, demand peaks, rainfall, and energy efficiency
- Allows scenario testing in a simulation environment

Further Development Potential

- Generic solution applicable to other waste water plants e.g. Viikinmäki (HSY), Sulkavuori (Tampereen keskuspuhdistamo), Kakola (Turun vesi) and others in Finland / globally

- Potential for productization through collaboration

- Possible integration with OPC UA/Digital Twin architecture