ACHIEVING ENERGY NEUTRALITY IN WASTEWATER TREATMENT THROUGH ENERGY EFFICIENCY AND ENHANCING RENEWABLE ENERGY PRODUCTION

BSR WATER Platform Project Meeting
18.2.2021

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Interreg Baltic Sea Region

EUROPEAN REGIONAL DEVELOPMENT FUND

EUROPEAN UNION

INTRODUCTION

Themes of the presentation

- What are Turku Region Wastewater Ltd and Kakolanmäki WWTP
- WWTP's energy consumption and energy efficiency projects
- Co-operation with local energy company and biogas station
- WWTP's energy balance and climate impact of WWTP as entirety

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TURKU REGION WASTEWATER LTD

- Wholesale company owned by 14 municipalities in Turku region in South-Western Finland
- Centralized wastewater treatment in the area
- Turku Region Wastewater Ltd produces good quality and cost-effective wastewater treatment services to its owner municipalities

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KAKOLANMÄKI WWTP

- WWTP is located in the solid rock of Kakolanmäki hill in the middle of Turku city
- WWTP treats 300.000 resident's wastewater and industrial wastewater of the area
- Average inflow is 90 000 m3/d
- The treated wastewater is discharged into the harbor basin

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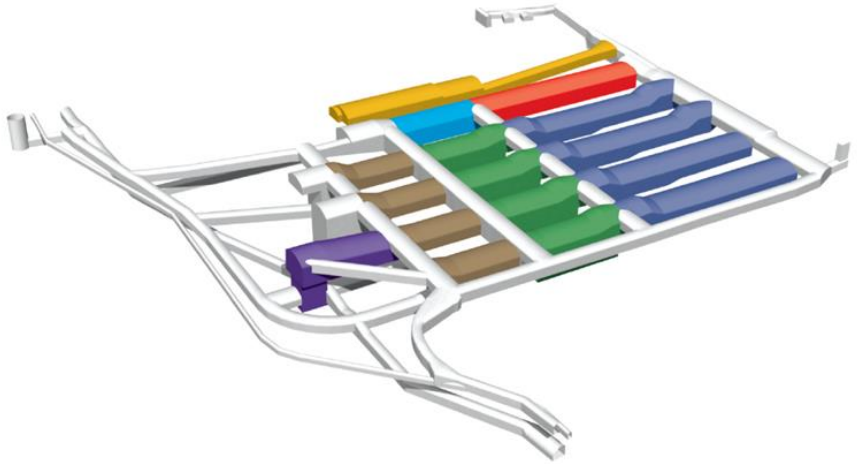
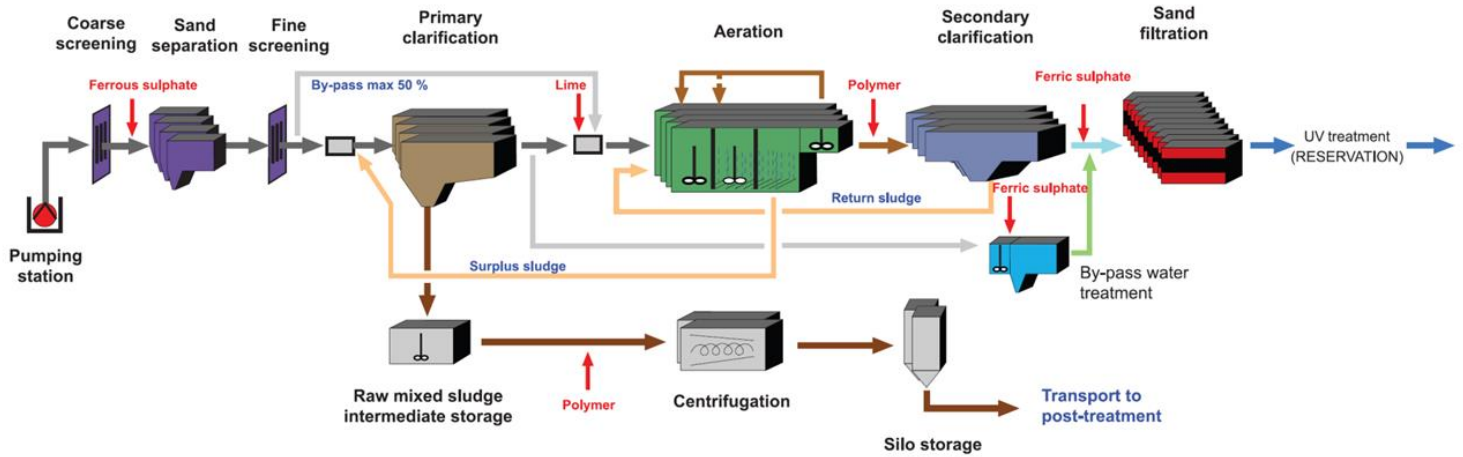
PROCESS



- SCREENING AND SAND SEPARATION
- PRIMARY CLARIFICATION
- AERATION
- SECONDARY CLARIFICATION
- TERTIARY TREATMENT (SAND FILTERS)
- BY-PASS WATER TREATMENT
- HEAT PUMP FACILITY



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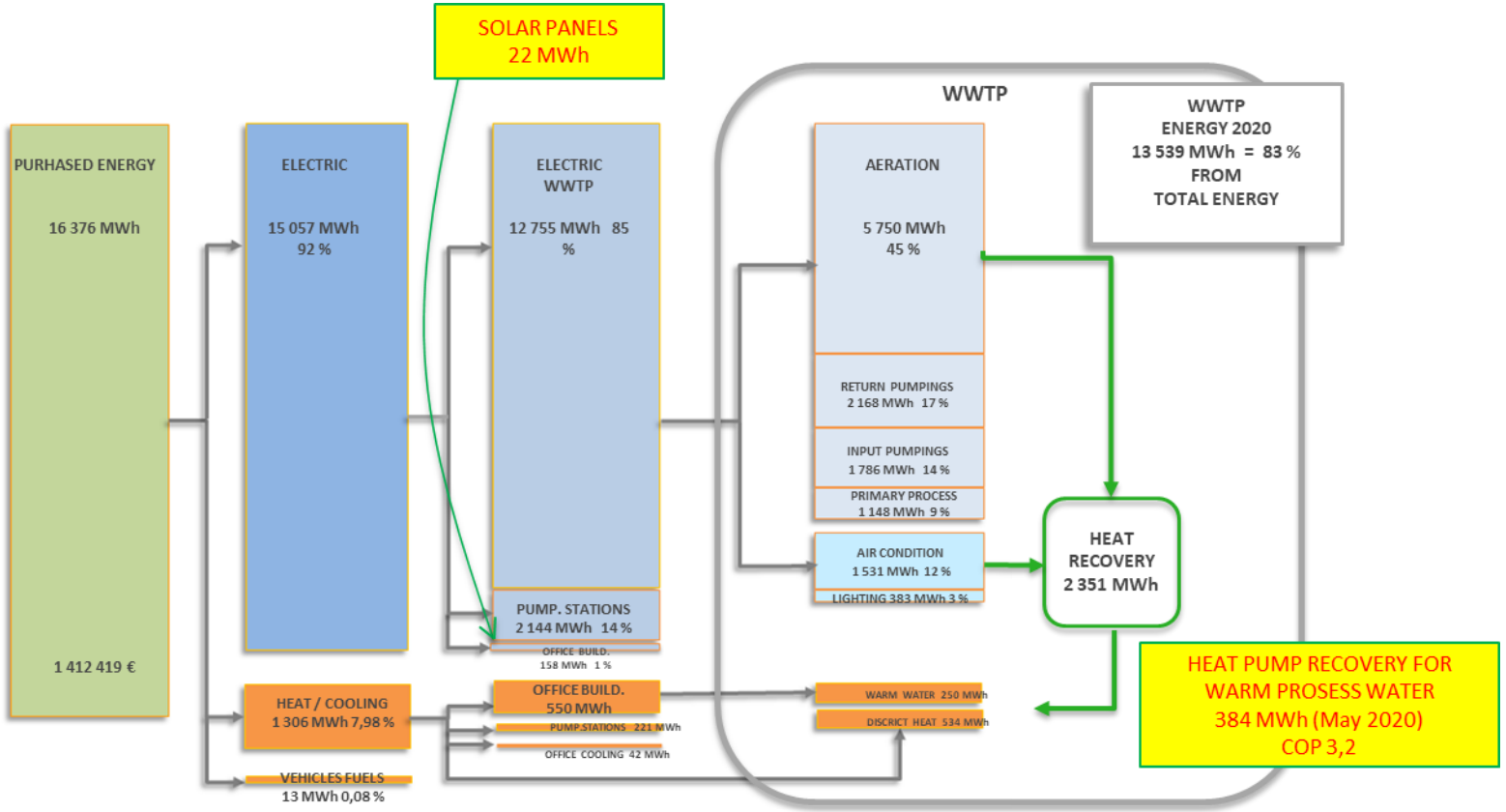
ENERGY CONSUMPTION 2020



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ENERGY EFFICIENCY PROJECTS

Accomplished

- Aeration compressors efficiency
- Aeration measuring and adjustments
- Air condition optimizing
- Heat pump for warm process water
- Lightning optimization and efficiency
- Several pumping efficiency projects on the plant and network
- Solar panels

Examination in progress

- Air condition impeller to direct drives and permanent magnet motors
- Heat recovery pumps to pumping stations
- Inflow pumping update
- LED-lightning
- Outlet air heat recovery
- Solar cells and panels to pumping stations
- Specific sand filter compressors

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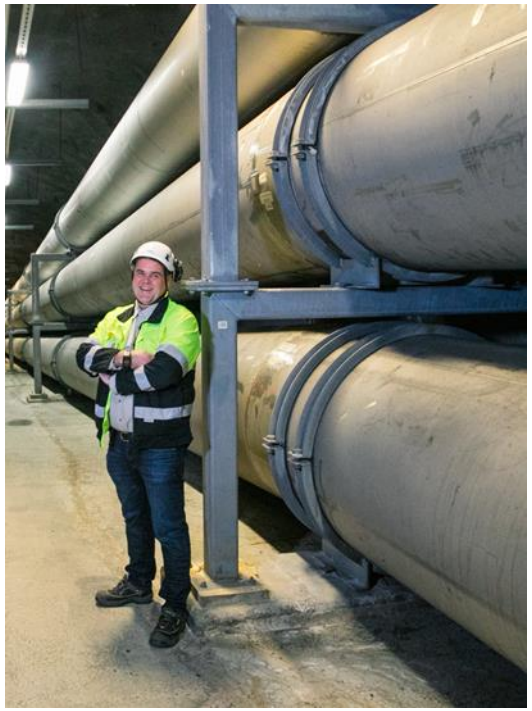
COOPERATION

Energy efficiency by optimizing and developing energy consumption

- Cooperation with local energy companies on heat recovery from wastewater
  - Heat for 15 000 households and almost all district cooling in Turku region
- Cooperation with Gasum on sludge recovery
  - Biogas, nutrients and heat



Own power generation

- Heat recovery from ventilation and compressors
  - Equivalent to 300 household's energy consumption
- Solar panels
- Heat Recovery to produce warm process water
- Future Energy Efficiency Measures
  - Turbine before the Outlet Pipe
  - Enhanced heat recovery from the aeration compressors

Commitment for the better Baltic Sea

- The Baltic Sea Challenge (http://www.itamerihaaste.net/en)

SUSTAINABLE DEVELOPMENT GOALS

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HEAT PUMP STATION

- The heat of treated wastewater is used as renewable energy
- Energy company is producing district heating and district cooling from the wastewater
- The capacity of the heat pump station is 40 MW district heating and 26 MW district cooling
- Turku region carbon emissions are 80 000 tons lower per year because of the use of the heat pump station

Efficiency is good: One unit of electrical energy produces three units of district heating and two units of district cooling

TSE Turun Seudun Energiantuotanto Oy

TURKU ENERGIA

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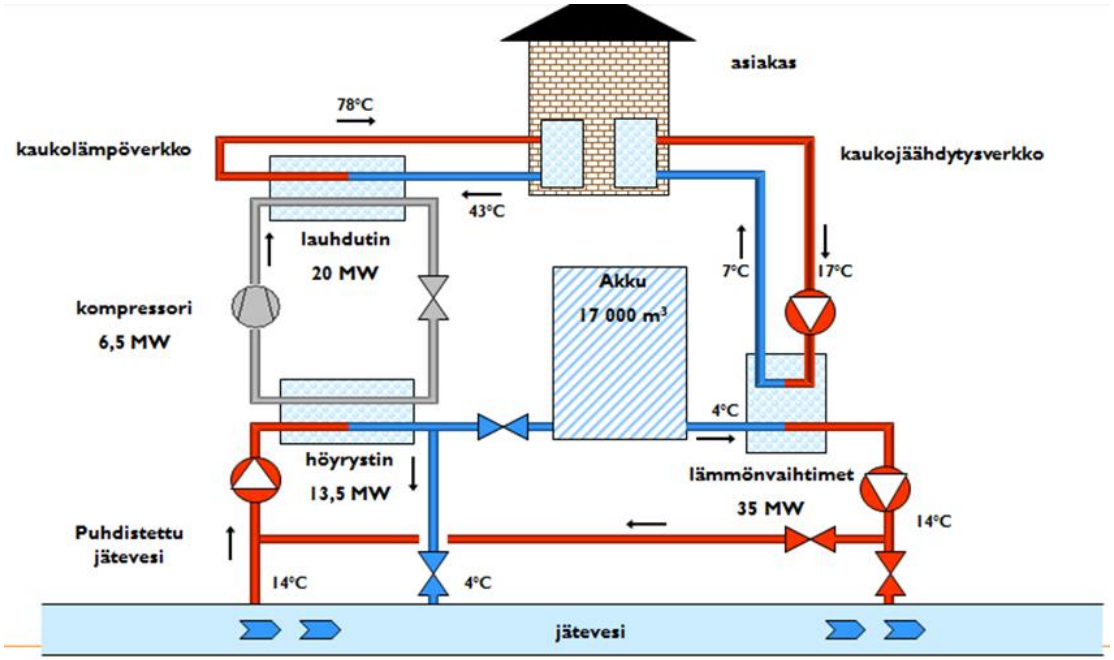
HEAT PUMP STATION



- The Heat pump station takes out the heat from purified wastewater (about 5-10°C)
- The energy output is **300 GWh / year** district heating and **30 GWh / year** district cooling
  - That means 14% of all district heating and almost all district cooling in Turku city

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SLUDGE TREATMENT

- Gasum Oy owns and operates the biogas station
  - 40 000 tn/a sludge from Kakolanmäki WWTP
- Mesophilic Process + Post hygienization (THP removal)
  - **Liquefied Biogas production for traffic**
- Reject Waters treated on site (Evapo-Stripping) (Low loading to WWTP)
  - High quality liquid Nitrogen-product (**with End of Waste -status**)
- The nutrients produced by the community are recycled for utilization (nutrient products for industry and recycling nutrients for landscaping and agriculture)
  - Solid fertilized compost for soil production + Biochar production -piloting

Gasum

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WWTP'S ENERGY BALANCE 2020

WWTP energy consumption	**13 552 MWh**
Electricity	12 755 MWh
District heating	534 MWh
District heating (process water)	250 MWh
Fuels	13 MWh
Administration building	**490 MWh**
Energy consumption of pumping the waste water (sewage network)	**~7 000 MWh**
TOTAL ENERGY CONSUMPTION	**21 042 MWh**
The total energy production from the waste water treatment processes	
WWTP solar cells	22 MWh
WWTP Heat recovery from ventilation and heat pumps	2 735 MWh
TSE heat pump station district heating production (net)	179 014 MWh
TSE heat pump station district cooling production (net)	21 900 MWh
Gasum biogas station (the share of Kakolanmäki WWTP, net)	7 744 MWh
TOTAL ENERGY PRODUCTION	**211 415 MWh**

Wastewater treatment activities produce energy over ten times more than they consume energy

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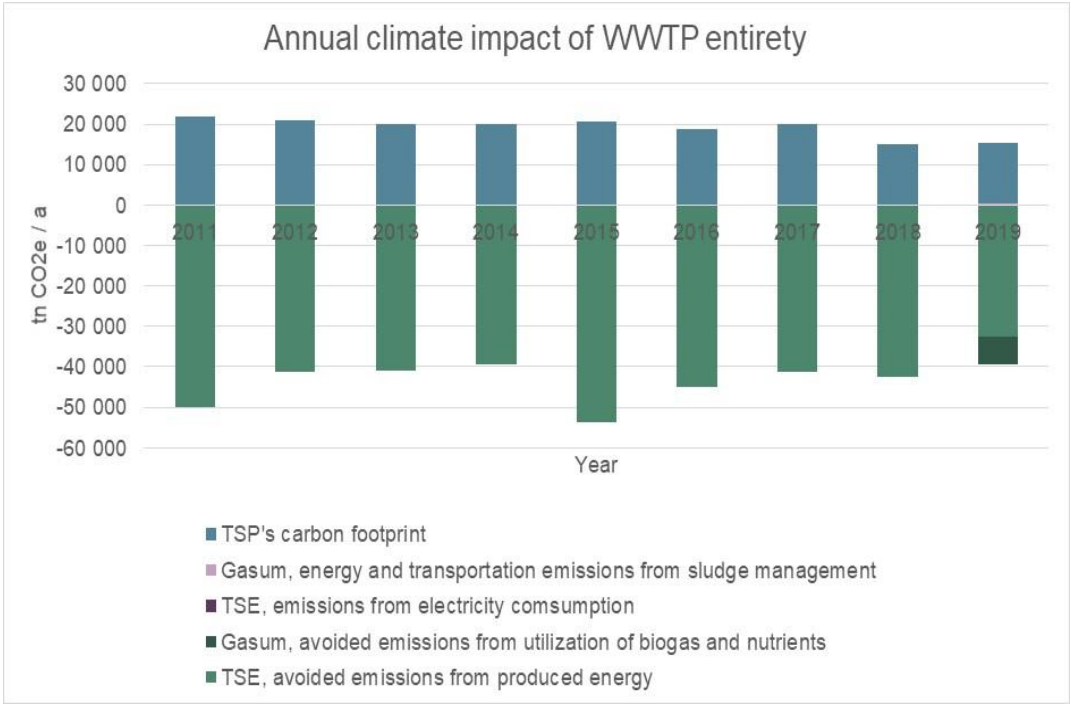
CLIMATE IMPACT OF WWTP AS ENTIRETY

- In the chart emissions of the WWTP operation and the emissions and avoided emissions from operations affiliated with WWTP are presented
  - WWTP operation
  - Sludge treatment at Gasum's biogas plant
  - Waste heat utilization at TSE's heat pumping plant
- Operation enables bio-based energy production in external entities which makes it possible to avoid using fossil energy sources



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FOR THE BETTER FUTURE FOR ALL

- WWTP's operations are based on excellent know-how and optimized operating models. This knowledge can be utilized all over the world.
- Interest in the wastewater expertise has already been considerable, and there are thousands of visitors every year from all over the world.
- The whole process is a great example of the functionality of a circular economy.

Taking into account all factors, the end result is the world's best wastewater treatment.

SUSTAINABLE DEVELOPMENT GOALS

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THANK YOU!
Only the sun may go down to the Baltic Sea without purification.
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