

CIRCULAR ECONOMY OF WATER - WASTE WATER TREATMENT

WHITE PAPER: CIRCULAR ECONOMY OF MUNICIPAL
WASTEWATER TREATMENT PLANTS IN EUROPE

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We combine our vast international experience with local know-how

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INTRODUCTION OF THE WHITE PAPER AND CIRCULAR ECONOMY

Introduction – the whitepaper

The whitepaper...

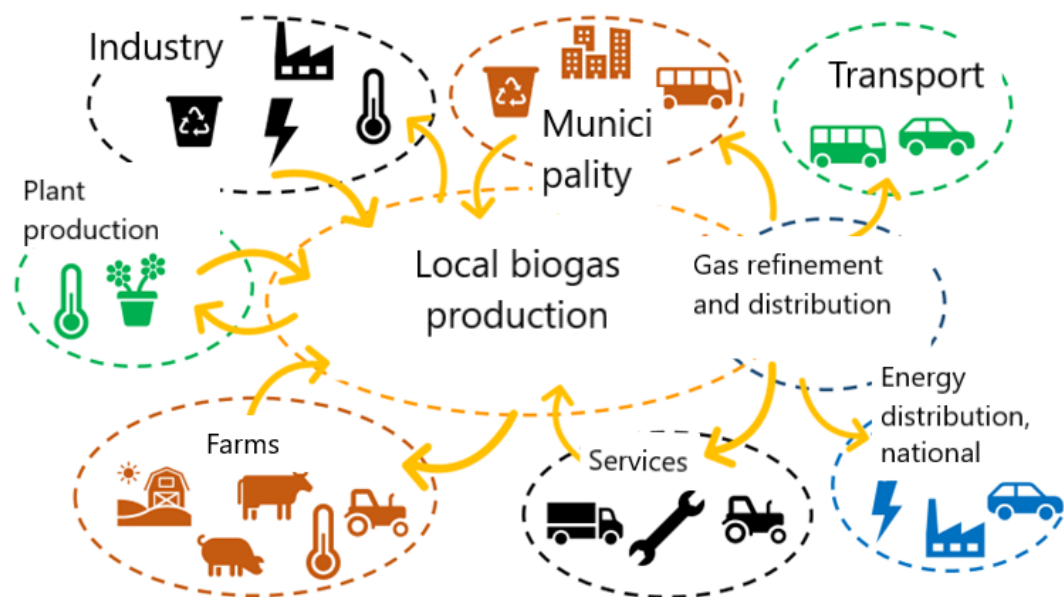
- discusses circular economy of municipal wastewater treatment plants (WWTPs) in Europe.
- is part of China Europe Water Platform (CEWP) plans create a base for discussion on the future of circular economy of water - wastewater treatment.
- includes a short overview of past developments and current situation, with a focus on innovations and technologies which are likely to be widely applied in the future.
- concentrates on technologies in order to benefit both private and public actors interested in the topic.
- covers only Europe and consider the general situation on the continent. It includes examples from European countries and examples of possible emerging technologies.

Introduction – circular economy

- In general, circular economy is a systemic approach in which the waste is minimized, and life-cycle value of natural resources and products is maximized.
- On contrary to linear “take-make-waste” model, circular economy approach is based on principle of “Reduce-Reuse-Recycle-Restore-Recover, (5R)”.
- Many resources like energy, water, materials, data, knowhow and value creation could be circular.
- Water has a global natural hydrological cycle. The circular economy of wastewater is in fact circular economy of water.
 - Water efficiency
 - Substances and bound energy are recovered
 - After collecting the valuables from the wastewater, it can be reused as industrial or even drinking water.

EXAMPLES FROM EUROPE

Ecosystems and business models in Europe



Circular economy is built on business models and ecosystems where operators are interlinked.

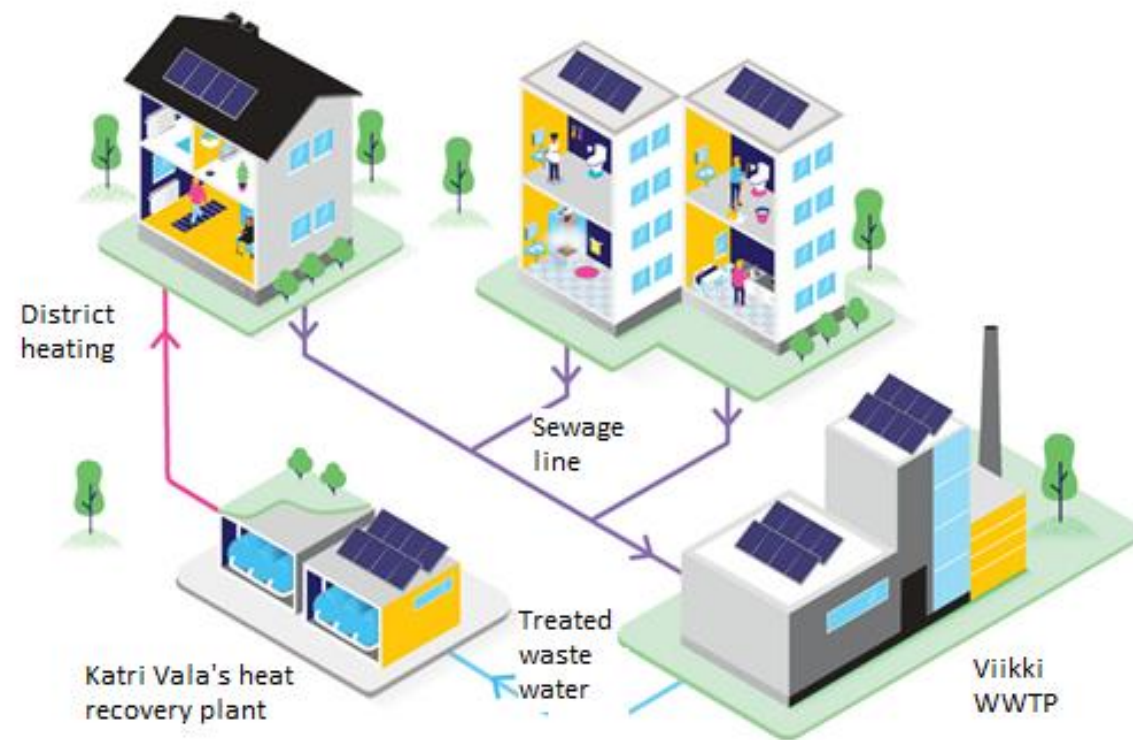
Examples from Europe:

- Most of the WWTPs are owned by municipalities or public actors in Europe.
- In Sweden, there is a low-hierarchy model in which an individual becomes a member of the company, when the individual joins the water supply network.
- In the Netherlands WWTPs are seen as energy and resource factories.
- The Dutch model joins the forces of the 21 water authorities with their umbrella organization and the Foundation for Applied Water Research (STOWA), several knowledge institutes and many other organizations.
- In the Nordics, municipalities have utilized a model of industrial and urban symbiosis.
- Also, a model where multiple municipal WWTPs' sludges are collected and processed by a private company is an option.
- A sponge city aspect developed and widely applied in China has become popular in Europe.

Reference: Sweco, Writer, *Pirkanmaan biokaasuekosysteemi -raportin tulokset*. [Performance]. Sweco, 2020.

Energy recovery in Europe

- WWTPs should be viewed as energy factories
- Energy capturing methods include i.e.
 - biogas plants
 - heat recovery
 - coupling of district heating or cooling from the water and wastewater networks.
- Anaerobic digestion as an energy source at WWTP is getting more common every day in the Nordic countries.
- Heat recovery from wastewater is applied in Central Europe.
- In Germany solar drying, low thermal drying and hybrid systems are used for sludge drying
- Netherlands' specialty is decentralized heat recovery, riothermy (gasless energy). Riothermy is a technique for recovering energy from wastewater from the sewage system via heat exchangers.



Resource recovery and efficiency in Europe



- Resources recovered from European wastewaters are for example
 - nutrients such as phosphorus and nitrogen for agricultural use
 - Metals
 - CO_2
 - Alginate (see the picture)
 - Proteins
 - Cellulose
- Also, water can be reused.

THE FUTURE

Future scenarios



- A workshop was arranged for discussion for the paper that included Sweco's European specialists.
- During discussion about what kind of future technologies do you know of in municipal wastewater treatment several subgroups were identified:
 - reuse of water
 - new power solutions
 - nutrients
 - new treatment goals
 - integrated/new approaches and climate change
 - advanced wastewater treatment
 - resource recovery
 - Decentralization
 - Modeling
 - source separation
 - new ecosystems
 - process optimization
 - scalable technology

Conclusions

- There are currently several projects in Europe that seek to develop the circular economy through holistic ecosystem thinking and cooperation
- As primary sources become scarcer, resource utilization from wastewater has become an increasingly profitable option.
- Water reuse and recycling are important, especially in countries where fresh water sources are scarce.
- In Europe, developments will continue in the future.
 - New holistic communities will be formed to recycle energy and resources – instead of wastewater treatment the WWTP's are seen as energy and resource factories.
 - Technologies for implementing these exist in Europe already, and now mind change and holistic concepts for their management and best use will be required.
- The future of the circular economy in Europe is not possible without digitalization and AI.
 - In the future, artificial intelligence will use the process and environmental parameters to predict how the processes of a WWTP should be run in order to control the predicted event in the coming days.
- In the future, Europe can offer China concept and package solutions focused on holistic management, where the result is better than the sum of its parts. The new big cities offer huge opportunities for the introduction of a holistic and controlled circular economy system.

[Please see the white paper for references.](#)

