

# Integration of Sustainable Water- and Waste Management into Energy Communities

Topic: (3) Sustainable Energy Communities  
Matthias MALDET<sup>1</sup>(<sup>1</sup>), Georg LETTNER<sup>(1)</sup>, Daniel SCHWABENEDER<sup>(1)</sup>  
<sup>(1)</sup>TU Wien Energy Economics Group

## Motivation and Guiding Question

Waste and water management have been analyzed in different papers, for example in [1], [2], and [3]. Those papers have in common that the concepts are only applied in the respective sector. In energy communities, sector coupling concepts are often examined, while waste and water as an energy sector have barely been considered in such concepts before. The aim of this paper is to investigate how waste and water management concepts can be implemented into energy communities and how they can interact with other energy services.

## Methodical Procedure

In the first step a literature review is done to study existing waste and water management concepts. These conceptions are analyzed more in detail, and possible enhancements of the concepts are considered. The goal thereby is to improve the sustainability of waste and water treatment in the context of end consumer sharing concepts.

Building on the findings it is analyzed how waste and water management approaches can be implemented into energy communities. As sector coupling is a major part in energy communities it is investigated how the energy sectors waste and water can interact with other energy services.

Based on the research results, a sector coupling model conception – beyond the actual discussed energy carriers (electricity, heating, gas) - is developed that considers different energy sectors and the interaction between the sectors. A key aspect of the model concept is that waste and water treatment concepts are included into the interactions between the sectors. Furthermore, conversion technologies between the different sectors are examined. The development of the model is done in such a way that investigations concerning sector coupling with the waste and energy sector, as well as future issues regarding sustainable waste and water treatment in energy communities can be examined. A theoretical use case shows a possible application of the model. As the model is work in progress, the aim of the paper is to describe the model development rather than analyses with the completely finished model.

## Results and Conclusions

For sustainable waste treatment it is necessary to reduce the emerging waste and to feed it to an efficient energy set in a targeted manner with regard to sector coupling. Future developments allow a more sustainable waste treatment, for example the recovery for the production of heat and electricity. To get the full potential out of it, a functioning waste separation is necessary.

Sustainable use and recovery of water, also in higher temporal solution, can be achieved by further treatment of sewage water.

The joint use of conversion technologies in energy communities and the common endeavor to reduce water usage and waste can lead to a more sustainable society. In energy communities with mainly private households, the reduction of waste and water is the major aspect. Communities with partly industrial users that provide waste and water treatment technologies have a higher potential of sustainable treatment of waste and sewage water.

The developed model in Figure 1 shows how the energy service sector can interact with each other, while Table 1 gives an overview on the possible conversion technologies for waste and water.

---

<sup>1</sup> Gusshausstrasse 25-29/370-3, +43 1 58801-370 365, maldet@eeg.tuwien.ac.at, <https://eeg.tuwien.ac.at/>

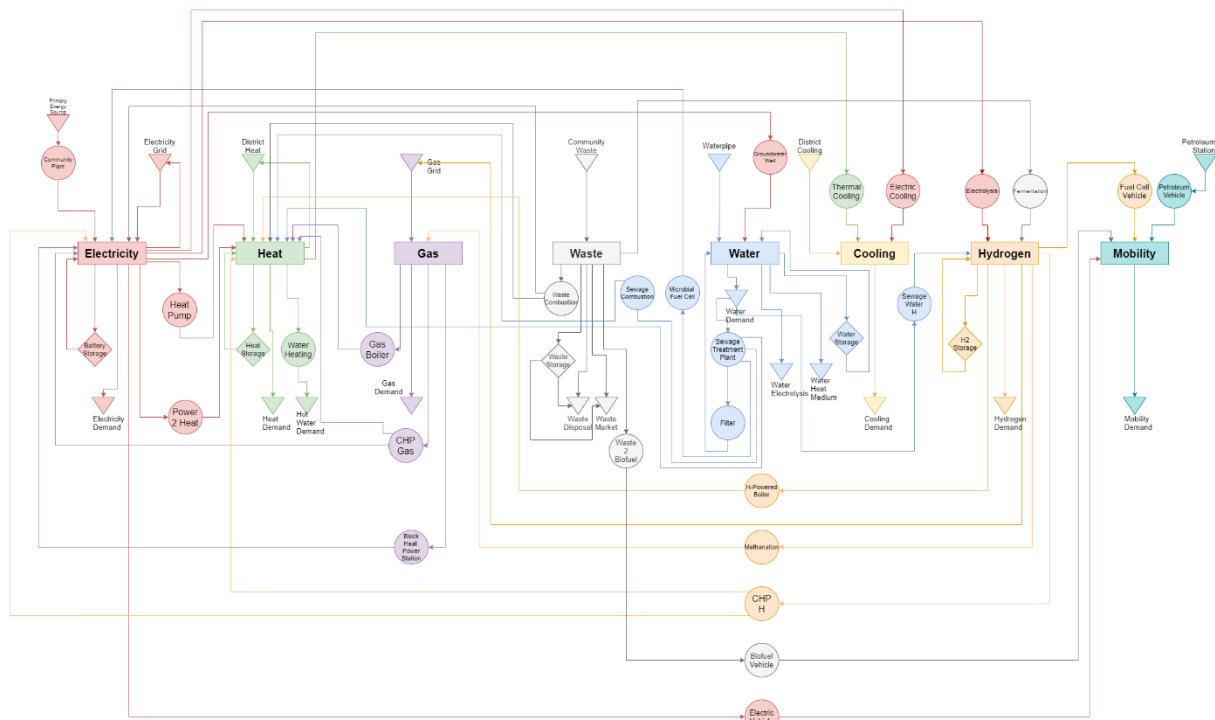


Figure 1 Sector Coupling Model

Table 1 Water and Waste Conversion Technologies

Technology	Input	Output	Description
Waste Combustion	Waste	Electricity, Heat	Using waste instead of coal for incineration
Waste to Biogas	Waste	Gas	Anaerobic Digestion of Biowaste
Waste to Biofuel	Waste	Car Fuel	Biofuel out of waste for car powering
Fermentation	Waste	Hydrogen	Biological treatment of waste for hydrogen production
Sewage Treatment Plant	Wastewater	Clean Water, Sludge, Heat	Recovery of water with additional exhaust heat an by-products
Sewage Combustion	Sludge	Electricity, Heat	Using sludge instead of coal for incineration
Anaerobic Digestion	Sludge	Gas	Sludge as source for anaerobic digestion
Microbial Fuel Cell	Sludge	Electricity	Innovative Technology for electricity generation from sewage sludge
Sewage Water to Hydrogen	Wastewater	Hydrogen	Hydrogen recovery of wastewater by fermentation

The aim of the work is, to analyze how the implementation of sharing concepts of waste and water treatment into energy communities can have positive influence on the usage of other energy services.

Acknowledgement: This work is done in the “Hybrid Local Sustainable Communities” project [4] and is supported with the funds from the Climate and Energy Fund and implemented in the framework of the RTI-initiative “Flagship region Energy” within Green Energy Lab.

## Literature

- [1] J. K. Seadon, "Sustainable waste management systems," *ELSEVIER*, pp. 1639-1651, 11 2010.
- [2] A. J. Morrissey and J. Browne, "Waste management models and their application to sustainable waste management," *ELSEVIER*, pp. 297-308, 2004.
- [3] T. Russo, K. Alfredo and J. Fisher, "Sustainable Water Management in Urban, Agricultural,," *MDPI*, 12 12 2014.
- [4] Green Energy Lab, "Hybrid LSC," [Online]. Available: <https://greenenergylab.at/projects/hybrid-lsc/>. [Accessed 26 May 2021].