How Wrompa works

Question: What is Wrompa and how does it work?

Krzysztof Lenart: The Wrocław wastewater heat recovery installation – Wrompa – is a complex system. It includes the heat pump itself, the wastewater pre-treatment technological line, various auxiliary devices and installations, as well as one-kilometre section of district heating pipeline (2xDN500) that transports heated network water from the installation to the city's main heating pipeline.

Wrompa is located at Port Południe – the largest wastewater pumping station in Wrocław.

From a technological perspective, the entire system can be divided into five main elements: 1) the external sewer network supplying wastewater to the installation, 2) the mechanical wastewater pre-treatment system – essentially a small wastewater treatment plant without the biological stage, 3) the heat pump (one large unit), 4) auxiliary equipment and installations, and 5) the district heating network.

Wastewater flowing into the facility through a specially built gravity sewer is first subjected to mechanical removal of solid contaminants. The first element of the pre-treatment system consists of fine screens with a spacing of 6 mm, which retain larger elements such as food residues or hygiene materials, referred to as screenings. The separated solid waste is transported by screw conveyors to containers located outside.

The wastewater is then directed to a grit chamber where mineral and organic fractions are separated and transported to appropriate containers outside the building. The grit chamber also separates and removes floating fractions, mainly grease, which is likewise collected in a dedicated container.

The prepared wastewater is then pumped to the evaporator of the heat pump. The evaporator is a shell-and-tube heat exchanger in which wastewater flowing through the tubes transfers heat to a special working fluid (R1234ze) located in the shell of the exchanger. In this process the working fluid evaporates. The cooled wastewater returns to the sewer network, and the nominal flow through the evaporator is 1600 m^3/h (with an operating range of 1200–2200 m^3/h).

Next, compressors increase the pressure of the working fluid, which is then directed to the condenser – another exchanger of similar construction to the evaporator. In the condenser tubes flows water taken from the return pipeline of the district heating network, which absorbs heat from the working fluid

and causes it to condense. The water heated to as much as 85°C is then supplied to the district heating network, while the condensed working fluid returns to the evaporator where the cycle begins again.

The entire process is controlled and monitored remotely in real time.

The role of Wrompa in Wrocław's district heating system

Question: What role does the Wrompa installation play in Wrocław's district heating system? Is it a central source? What is its scale and what share of heat demand does it cover?

Krzysztof Lenart: The heat pump operates within the centralised district heating system of the city of Wrocław. It usually operates at a nominal wastewater flow of 1600 m^3/h and can cover up to 5% of the heat demand of customers supplied by the district heating network. Another heat pump using waste heat from a data centre also operates within the system, but its capacity is relatively small – about 1.6 MW.

Question: What specific results – numerical or operational – show that the project actually delivers results and has potential for further development? What is the capacity of the installation and what share of heat demand does it actually cover?

Krzysztof Lenart: The nominal capacity of the installation is 12.5 MW, but operational experience shows that it can operate without difficulty at capacities exceeding 14 MW. As I mentioned earlier, under favourable conditions it can supply up to 5% of the heat demand of customers connected to the district heating network, while under average conditions this share is around 3%.

Daily operation

Question: What level of maintenance does the system require? Are there any recurring operational issues? How do impurities in wastewater affect the efficiency and operation of the system, and what solutions are used to mitigate their negative impact?

Krzysztof Lenart: At present it is difficult to clearly determine typical average operating costs, because the installation is still in its infancy, especially since it is a pioneering installation in Poland. According to the manufacturer's guidelines, the evaporator tubes should be cleaned once a year, but so far operational experience shows no noticeable decrease in heat exchange efficiency between the wastewater and the working fluid.

To limit the negative impact of impurities depositing inside the evaporator tubes, a system with a 4-way direction valve has been implemented. This valve cyclically changes the direction of wastewater flow through the evaporator tubes, preventing permanent accumulation of impurities.

Question: Do wastewater flows provide a stable heat source throughout the year?

Krzysztof Lenart: Yes, wastewater provides a stable source of thermal energy throughout the year. This is because Wrompa was designed taking into account variability both in the volume and temperature of wastewater. Even in winter, wastewater still contains thermal energy that can be recovered by the heat pump.

As a result, the Wrompa installation can operate almost continuously (with only minor interruptions) and supply heat to the city's district heating network, ensuring heating for homes and domestic hot water regardless of the season.

Question: How does the system deal with temperature fluctuations – both during the day and throughout the year, particularly in winter when melted snow enters the sewer system? Does the installation include a heat storage tank or another heat storage system?

Krzysztof Lenart: The installation does not include a storage tank or any other type of heat storage component. The heat pump was selected in such a way that it can operate during most of the year. When determining its size, capacity and operating parameters, variability in both the volume and temperature of wastewater was taken into account.

In extreme conditions, for example during significant snowmelt or very low wastewater inflow, operation may be temporarily suspended. However, experience so far shows that such situations are rare.

Creation and development of the project

Question: Where did the idea of using heat from wastewater come from and who initiated the project?

Krzysztof Lenart: The idea was inspired by a similar installation built in Oslo before 2010. At that time the installation also belonged to Fortum.

The Wrompa project was initiated by Fortum, which invited MPWiK Wrocław as the main partner, with the support of the municipal authorities.

Question: How long did the preparatory process take – from the initial idea to commissioning? What was the most difficult aspect during the decision-making stage: technology, finances or risk?

Krzysztof Lenart: The idea emerged in 2017 and the entire preparatory process lasted many years. Construction only began in 2023 and was completed in 2024. Because the project was absolutely pioneering on a national scale and at the same time intended to be a commercial project rather than a research one, it involved many uncertainties. As a result, risks related to implementation and later commercial aspects significantly influenced the decision-making process.

Question: What was the cost of the investment and what financing model was used – public, private or mixed?

Krzysztof Lenart: The Wrompa project in Wrocław was financed primarily from Fortum's own resources with support from European and national funds, including the European Economic Area (EEA) Mechanisms and the state budget. The total cost exceeded EUR 24 million (PLN 100 million), while the funding support amounted to around EUR 4.8 million (PLN 21 million).

Question: How was the investment risk divided?

Krzysztof Lenart: Fortum bore the entire investment risk.

Cooperation model and barriers

Question: How were the roles divided between MPWiK and the district heating operator during the investment phase, and how does it look now during daily operation?

Krzysztof Lenart: Fortum was the sole investor, although the installation was built on the premises of MPWiK, with which all technical and formal issues related to the use of wastewater had to be agreed. Fortum is responsible for operating the installation and supplying heat to the district heating system, without the involvement of the city.

Question: Could this cooperation model between Fortum and MPWiK Wrocław be easily replicated in other cities, or does it require specific conditions?

Krzysztof Lenart: In principle, the cooperation model could be replicated in other locations, but each case would require adaptation to local conditions and administrative constraints.

Question: What barriers – administrative, legal, financial or others – currently limit the development of similar projects? Are regulatory changes needed or rather a change in planning approaches?

Krzysztof Lenart: The biggest barriers currently limiting the development of projects similar to Wrompa are administrative, legal and financial. Administratively, the problem lies in long and complex procedures for obtaining environmental, construction and connection permits, which extend the time required to complete investments.

Legally, development is limited by the unclear classification of fuels and energy sources – including waste heat – as renewable in efficient energy systems, as well as by the obligation to apply cost-based tariffs, which limits the profitability of new solutions.

Financially, the barrier consists of high investment costs combined with limited access to preferential financing and support schemes that fully recognise innovative heat sources and energy storage.

In practice, accelerating the development of such projects requires both regulatory changes – including simplified procedures, clear definitions recognising waste heat and new investment tariffs – and a change in planning approaches, including greater flexibility and long-term strategies for district heating networks.

Potential of waste heat in district heating systems

Question: How does the network operator assess the potential for further use of waste heat?

Krzysztof Lenart: Fortum sees waste heat as an important element of the transformation of district heating, enabling reduced consumption of primary fuels, increasing the share of renewable heat in energy-efficient systems and improving the overall efficiency of the network.

However, certain conditions must be met for waste heat to fully play this role. Waste heat must originate from sources legally recognised as renewable and must be used in systems that meet the criteria of an efficient district heating system. This allows it to be classified as renewable energy and access financial support reduce CO_2 emission costs within the EU ETS system.

Ideally, the source should also be stable and predictable (although this is not the most critical requirement), and the transmission and storage infrastructure should enable integration of waste heat with the network, as well as allow its supply to be managed depending on demand, where appropriate. As a general principle, however, waste heat sources should operate in the baseload, maximising their output.

Finally, its use must be economically viable, meaning that the costs of obtaining and integrating waste heat into the system should be lower than those of alternative heat sources.

In practice, this means that waste heat becomes a local, renewable component of the energy mix supporting electrification and decarbonisation of district heating.

Projects of this type are already underway in Wrocław, but due to legal and regulatory barriers they are currently implemented on a small scale. It is also often the case that waste heat is available in locations distant from the district heating network, which effectively prevents its utilisation within the system. In such cases, it is worth considering so-called island district heating systems, provided that local conditions allow for their development.

Question: Is the district heating system ready to integrate more distributed sources, including low-temperature ones?

Krzysztof Lenart: Everything depends on scale. Small distributed heat sources can be integrated into the Wrocław district heating system without major problems, especially if they are located close to large-diameter pipelines.

Integrating larger distributed sources would require expansion of district heating infrastructure and additional investment, but technically it is feasible.

Low-temperature sources are a different issue – at present they would need to operate in dedicated local areas so as not to reduce system parameters.

Energy transition at MPWiK

Question: For MPWiK, Wrompa is more than just a single investment. It signals that water and wastewater infrastructure can become an active participant in the energy transition. Does MPWiK see potential for further heat recovery points?

Jerzy Zarówny, MPWiK S.A. in Wrocław: MPWiK Wrocław already uses heat recovery technologies. One example is the use of waste heat in the sewage sludge drying process. The installation operates with a capacity of 500 kW.

A project closer in scale to the Fortum installation is the heating and cooling system of a new administrative building, based on four heat pumps with a total capacity of 700 kW. In this case, the lower heat source is water from the treatment process.

We see significant potential for further utilisation of waste heat and the implementation of additional projects in this area. The project closest to implementation involves the preheating of sludge prior to the drying process, using waste heat generated within the process itself. This potential is estimated at an additional 500 kW.

Larger installations of around 10 MW could recover heat from treated wastewater. Smaller installations could also be further developed to meet local needs, for example using raw water as a heat source.

These initiatives are important steps towards achieving zero-emission operation of our facilities.

Public acceptance and awareness

Question: As part of the Wrompa project, you decided to create a mural that familiarises residents with the idea of recovering heat from wastewater. Where did this idea come from, what role does it play and how was the concept selected?

Krzysztof Lenart: The idea of creating a mural as part of the Wrompa project came from a desire to familiarise and popularise the concept of recovering heat from wastewater in a way that is accessible and visually appealing.

The technological installation itself may appear difficult for residents to understand, so the mural plays an educational and symbolic role, introducing the topics of ecology, renewable energy and the positive impact of the investment on the city.

The concept for the mural was selected through a competition organised by Fortum for artists, seeking a design combining ecological, social and aesthetic themes.

Among the submitted proposals, the design by Magdalena Osobińska was selected as the one that best reflected the idea of the Wrompa project – integrating motifs of people and nature into the urban space with a positive and optimistic message.

The mural covers approximately 45 m² and is located on the northern façade of the Wrompa building, becoming a visual symbol of Wrocław's innovative energy transformation.

Added value of the DISCO project

Question: What potential do you see in the DISCO project and what concrete benefits can it bring for the green transformation of district heating in Lower Silesia and for the institutions you represent?

Krzysztof Lenart: The main potential lies in the very idea of the project – the exchange of experiences and good practices. Observing successful solutions implemented elsewhere can significantly shorten the path to success within one's own organisation.

Thank you for the interview.