

DECARBONIZING VIENNA'S HEATING SECTOR: THE ROLE OF LARGE-SCALE HEAT PUMPS AND DISTRICT HEATING*

To ensure Vienna becomes climate-neutral and independent from fossil fuels in the future, sustainable energy sources are essential. Among all the analyzed sectors, the heating sector (low-temperature heat, i.e., space heating and domestic hot water) demands the largest investments within the city to meet its decarbonization targets. In particular, the widespread use of individual gas boilers in residential units is planned to be phased out by 2040. Decarbonization will therefore require a comprehensive systemic shift in heating and hot water supply, with district heating playing a central role in this transition.

District Heating Production in Vienna

By 2040, 56% of Vienna's heat demand is to be supplied via district heating.

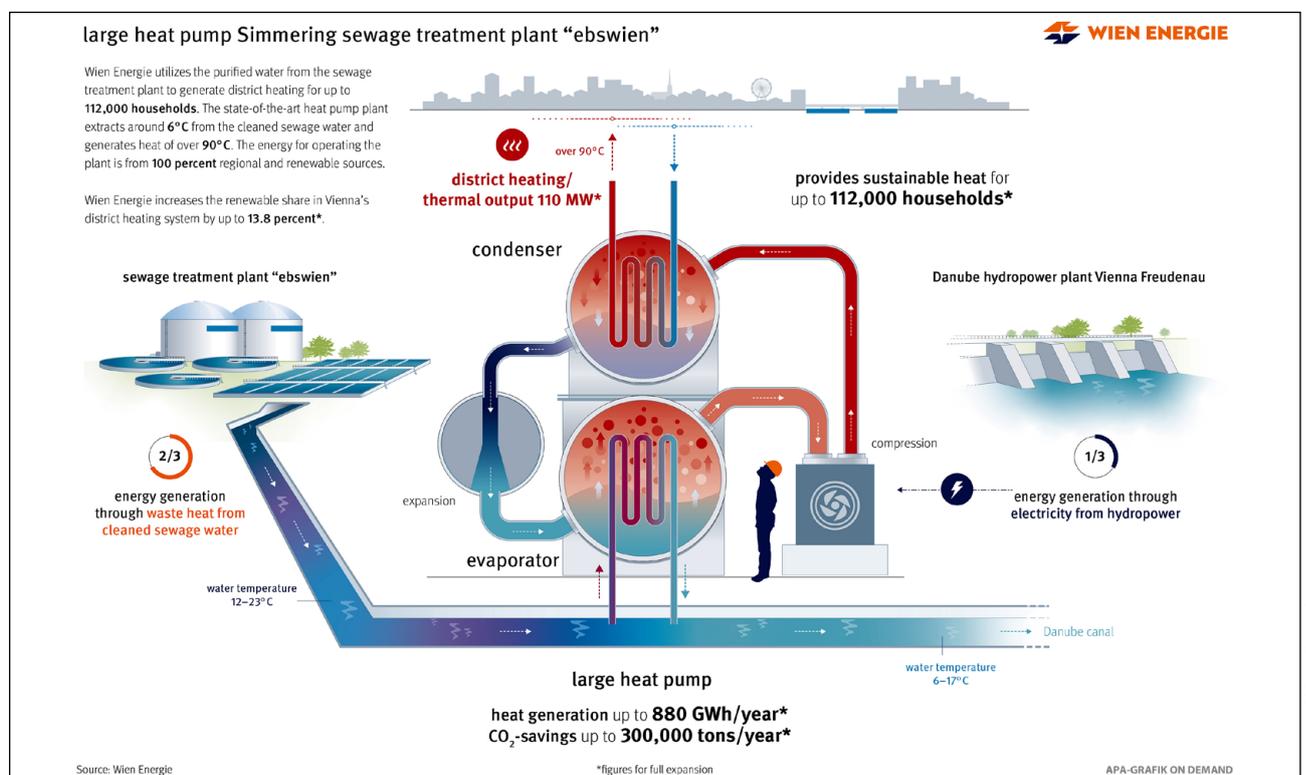
Currently, combined heat and power (CHP) plants account for around 52% of district heating production; however, their share is expected to drop to around 13% by 2040. Starting in the 2030s, these plants will increasingly operate on green gas, thereby achieving net-zero emissions by 2040. The share of conventional heating plants will decline significantly, while the share from waste incineration plants will remain constant. To replace the heat generated by CHP and heating plants, geothermal energy and large-scale heat pump technology will play a key role. With these two technologies combined, Wien Energie will be able to produce more than half of Vienna's district heating.

Large-scale heat pumps make it possible to utilize waste heat from various sources, such as commercial and industrial operations, sewer systems, and wastewater treatment plants. These renewable sources provide low-temperature heat, which is extracted using electricity and then upgraded to the temperature level required by the district heating network.

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Large-Scale Heat Pump Facility at Vienna's Wastewater Treatment Plant

Vienna, as a city of about two million residents, operates a single wastewater treatment plant—Ebswien in Simmering. This facility treats the entire city's wastewater, as well as that of surrounding municipalities and industrial sites. Due to Vienna's combined sewer system, a substantial portion of rainwater also flows into the plant, resulting in the purification of



* Český překlad článku je uveřejněn na webových stránkách časopisu.



One of the three heat pumps next to the waste-water treatment plant that is now already producing climate neutral heat for Vienna's households

around 200 billion liters of water per year—equivalent to over 21.6 million liters per hour or 144,000 full bathtubs. The temperature of the treated effluent fluctuates between 12°C and 25°C throughout the year.

To harness the residual heat in this treated wastewater year-round, Wien Energie is currently building one of Europe's most powerful large-scale heat pump systems next to the ebswien plant. In early 2023, three heat pumps for the first phase of the project were

delivered. These pumps extract approximately 6°C from the treated water. This extracted waste heat is passed through evaporators (heat exchangers), where it is cooled further. A compressor then raises the temperature to the required level for producing hot water. The heat is then transferred to the district heating water via condensers (heat exchangers).

Since the end of 2023, the system supplies climate-neutral district heating to up to 56,000 Viennese hou-

seholds resulting in CO₂ savings of 150,000 tons per year. Once fully completed, it will be able to serve up to 112,000 households, resulting in CO₂ savings of up to 300,000 tons annually. To ensure the electricity for the heat pumps is also climate-friendly, it is sourced directly from the nearby Freudenuh hydropower plant, allowing for fully renewable operation. The first expansion stage increased the share of renewable district heating in Wien Energie's generation park by approximately 7%, with another 7% expected upon completion of the second expansion stage.

Wien Energie is investing around €70 million in this major climate protection project. It is supported by funding from the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, with additional EU funding (IWB/EFRE) being sought.

Technical Implementation and Expansion

Upon completion, the heat pump facility will consist of six heat pumps, each with a thermal output of around 18 megawatts. The three units already installed in Simmering were transported from France and each measures roughly 12 meters in length, 9 meters in width, and 7 meters in height, weighing approximately 205 tons. In January 2023, the units were installed over a 14-day period, with individual components of up to 47 tons carefully positioned at their final location. Additionally, a photovoltaic system has been installed on the roof of the dedicated building constructed for the heat pump facility. Over the coming years, the remaining heat pumps will be added, doubling the total thermal output from 55 to 110 megawatts. This will mark another significant milestone in the decarbonization of Vienna's district heating system.



At the beginning of 2023 Wien Energie started installing the first three out of six planned heat pumps

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