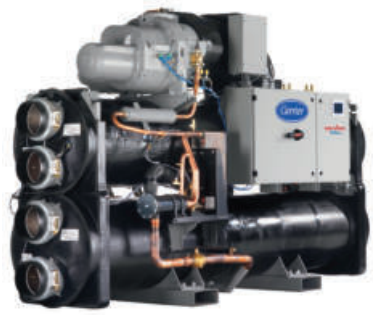
CASE STUDY

TWS - THÜRINGER WÄRME SERVICE, WEIDA

Carrier heat pump providing a residential neighbourhood with an innovative heat and power supply



Project description

Thüringer Wärme Service

Project developer and contractor TWS (Thüringer Wärme Service GmbH) has delivered an innovative heat and electricity supply concept to a whole neighbourhood in Weida, in the state of Thuringia. It supplies the Allgemeine Wohnungsbaugenossenschaft eG (AWG) housing cooperative in Weida, which manages a neighbourhood with around 1100 residential units.

To permanently reduce both energy costs and the carbon footprint, the existing heating systems are to be replaced by a district heating supply, at least 35% of which comes from renewable energy sources.

The concept consists of three core components: a CHP (combined heat and power unit), a power-to-heat system and a heat pump that uses either air or geothermal energy to provide heating, depending on the weather. The heat pump used is a custom pump from Carrier with an output of 1100 kW. The sophisticated control technology for integrating the heat pump into the overall concept also comes from Carrier.

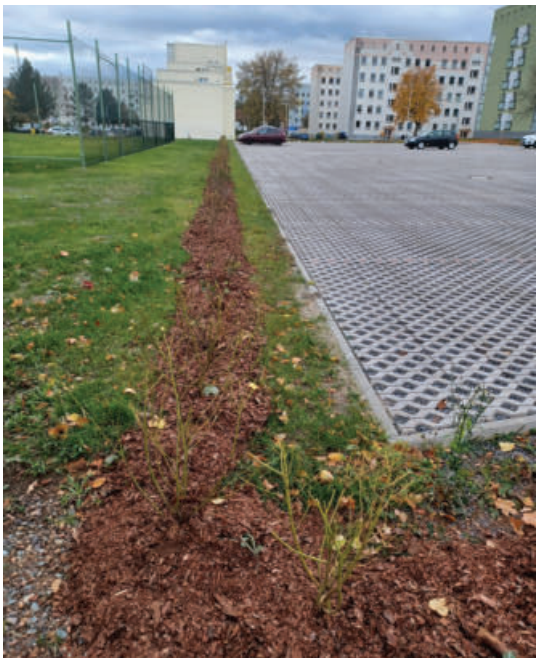
MAIN ADVANTAGES

- High proportion of renewable energy sources (almost 40%)
- Innovative concept with tried-and-tested components
- Consistent heat supply from geothermal energy (winter) and air (summer)
- No investment funds required (contracting)

TECHNOLOGY

Two 61XWH-ZE (water-to-water) high-temperature industrial heat pumps with custom control concept from Carrier

Background



A CHP unit with an output of 1.6 MW_{el} and 500 kW_{th} (electric boiler) ensures highly efficient generation of heat and electricity to provide the basic supply for the neighbourhood.

Energy production is supplemented by a heat pump with an output of 1.1 MW_{th}, which utilises two different primary sources for heating depending on the season and outdoor temperature. Air serves as a heat source in summer, while geothermal energy is used in winter. To facilitate this, 48 geothermal probes were laid at a depth of 180 metres.

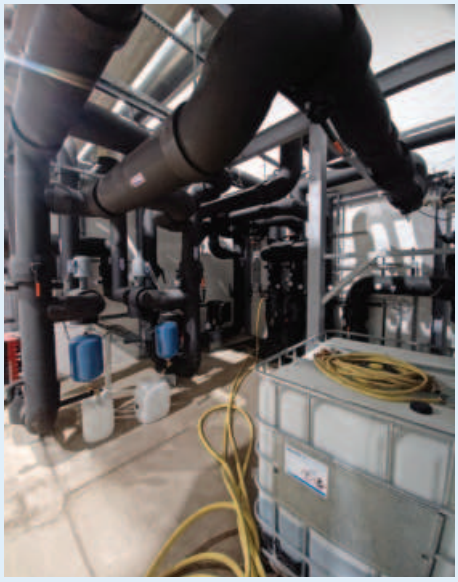
An additional electrical heat generator (power-to-heat) converts the electricity generated from renewable sources into heat for heating purposes when required. A buffer system with 2 x 85 m^3 accumulators and a gas boiler (2 x 2 MWth) complete the project.
The share of renewable energy sources achieved is at least 35%, making the project eligible for iKWK funding.

Challenges and solutions

TWS opted for two 61XWH-ZE-05 pumps in consultation with Carrier. When designing the heat pump, TWS first planned and calculated the hydraulics, followed by the air and geothermal heat supply, and then created the control tree from which the design parameters could be derived. Simulation software was also used in this process. Tim Hirth, the TWS project manager responsible for the hydraulics and control technology in this project, explains: "We optimised the heat and energy flows via a 'virtual power plant'. We also used this CAx tool to design the heat pump."

This required intensive collaboration between TWS and Carrier. He continues: "Carrier not only provided us with the data we needed to calculate the COP and other values, for example, but also supported us with its expertise in the integration of heat pumps."

The i-VU control and visualisation tool developed by Carrier, which actually originates from building automation and offers numerous intelligent control functions, also proved very useful.



An exemplary concept

With the iKWK project in Weida, TWS has successfully implemented a concept that is currently unique in Thuringia, and which, according to the planners, can be easily transferred to other towns and neighbourhoods with a district or local heating network. The AWG and its tenants benefit from a future-proof, energy-efficient and climate-friendly heat and power supply, while the AWG also benefits from the fact that it has not incurred any investment costs.

Good start for the new energy and heat supply

The first components of the iKWK plant went into operation in the autumn of 2023. An existing smaller CHP unit (0.4 MWel) and around 50 individual gas boiler systems were replaced. The new plant is designed for a heat output of around 8.5 GWh/a and an electricity output of around 6 million kWh/a. The plant has been fully operational since February 2024, supplying heat and electricity reliably and efficiently. The local gas supplier TEAG is currently asking private households in the neighbourhood whether they would like to benefit from the new heat supply.

Perspective: The path to transformation

From the AWG's point of view, the iKWK project is the first step on the path towards the heat transition. While the current share of renewable energy sources is around 40%, this could rise to 80% in the future. There are several ways of achieving this: the CHP unit can be fuelled with biogas and/or hydrogen, or TWS can integrate an additional heat pump into the neighbourhood heat and power supply. The implemented solution can even be expanded to achieve complete climate neutrality.