INP Reference

Feasibility study large-scale heat pump

LOCATION: Karlsruhe, Germany

SYSTEM/TECHNOLOGY: District heat supply

SERVICES: Solution development / Feasibility studies

INDUSTRY BRANCH/TYPE OF PLANT: Green Energy, Power Generation

CLIENT: Stadtwerke Karlsruhe GmbH (local utility operator)

ACTIVITY PERIOD: 2021-2022

Project description

The goal of the climate protection concept of the city of Karlsruhe is that municipal companies will become climate-neutral by 2040. One of the aims of Stadtwerke Karlsruhe GmbH, the local utility operator, is to make the heat supply of the district heating network CO2-neutral. One measure to achieve this target is to increase the renewable share of heat generation in the district heating network. The purpose of the present study is to examine the feasibility of using large heat pumps to generate heat for the district heating network. The integration of a large heat pump system can help reduce CO2 emissions while increasing supply security through redundancy. A heat pump produces electricity-related CO2 emissions depending on the performance number of the heat pump or compressor.

Large heat pumps are only operated as far as possible when the power grid contains a high proportion of renewable energy and conventional power plants are not running due to market conditions. The operation of the large heat pump thus takes place at times when the CO2 emissions in the grid-related electricity are low. The decisive factor here is the advantageousness of the large heat pump over the existing natural gas operation heating plants.

The economic viability was investigated by means of a sensitivity analysis for two heat generation scenarios and for different electricity and natural gas prices in order to find a decision even if the data situation changed in the volatile energy market.

INP Services

- Recording of the as-is state of the district heating supply
- Preparation of a technical feasibility study on the use of large-scale heat pumps to support the heat demand coverage of the district heating network
- Elaboration of the technical system concept taking into account partial-load operation and dynamics of the large-scale heat pump
- Assessment of possible CO2 savings
- Preparation of an economic feasibility analysis with investment costs, heat production costs, economic key figures, the calculation of the

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