

# Case Study

## District heating network optimization

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### Challenge

District heating networks constantly transfer huge amounts of energy to supply heat to industrial plants, residential areas, or even entire cities. However, the transfer of energy through kilometer-long pipes also entails heat losses, which can increase significantly if the system is not optimally controlled. In order to ensure optimized operation of the plants, intelligent control systems are required that simulate these complex networks. For this purpose, Gradyent B.V. is developing a cloud-based SaaS solution that can optimize district heating networks in near-real-time with the help of sensor data, a digital twin and AI methods, thus reducing losses and CO2 emissions for the network operator.

### Approach

The successful execution of a feasibility study gave the start of the product development. For the data analysis and optimization, a pipeline was then designed and developed, which sequentially performs the necessary data processing steps and data streaming. Using historical sensor and weather data, as well as parameters of the heating network that is to be optimized, a Digital Twin was physically modeled, simulated and then validated. Subsequent optimization based on AI methods for demand-side forecasting, as well as parameter estimation, enables the calculation of the operating parameters for an optimized control of the heat flows in the network, thereby reducing the overall system heat losses.

The core functionality of the product in the form of the developed data pipeline is deployed in an AWS Kubernetes cluster, while implementing the interfaces for connectivity to the required external data sources and sinks at the system boundaries. The performance requirements are met by ensuring, that the pipeline can

load and process the data from the different sensors in less than a minute. After a successful integration of the individual product components (frontend, backend, AI pipeline) by all project teams, the initial go-live was given in the second half of 2019 with the first pilot customer who uses the product for the near-real-time optimization of the heat transport losses of one of its district heating networks in the Netherlands.

The solution is scalable and parameterizable, which facilitates the commissioning of additional heat networks. Another important feature of the developed pipeline is that the AI models can be refined with new data and redeployed, improving the performance and thus the sustainability of the overall solution over time.

### Result

In close collaboration with Gradyent, Reasonance was able to contribute its expertise in product development in the areas of digital twin modeling, demand forecasting, and optimization, but also in the areas of software architecture, as well as cloud deployment. Gradyent's developed product is a cloud-native scalable SaaS solution that is being deployed for more energy companies and their heating networks, steadily contributing to greater sustainability in the energy sector. The result for the pilot customer was a proven heat loss reduction of 10%, whereas additional potential improvements are being worked on.

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