Case study

Eneco – ambitious on renewables and low temperatures – saving CO2 with a Digital Twin

Gradyent

Eneco

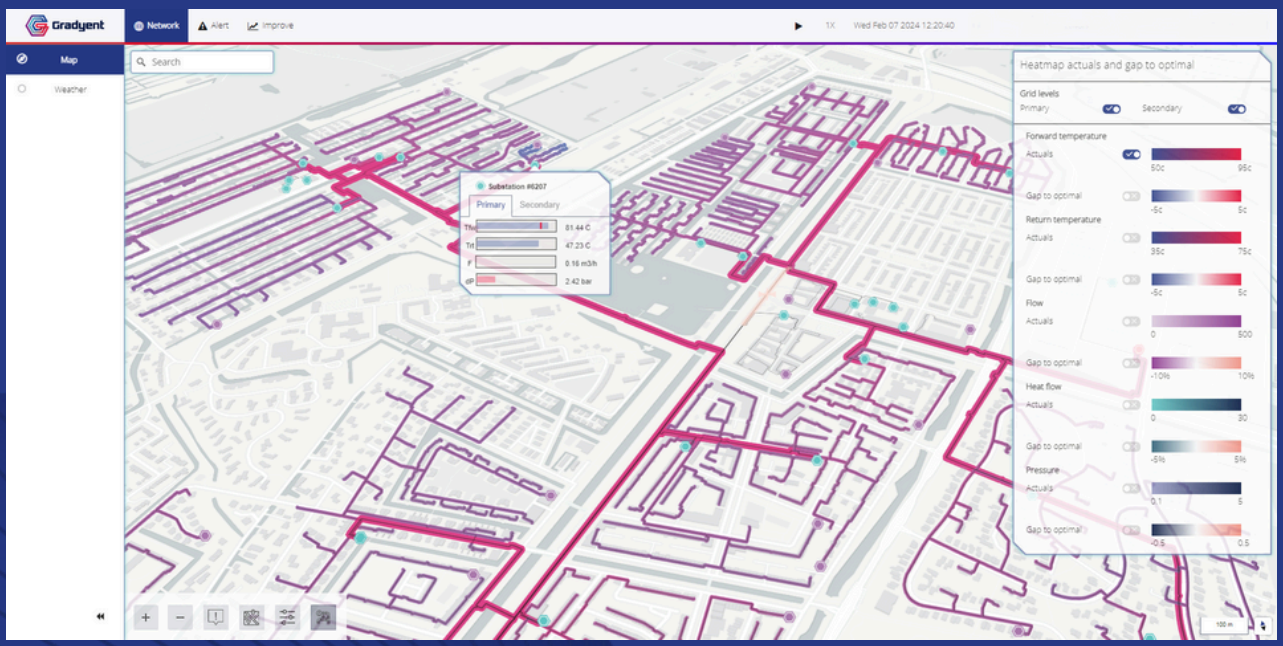
Eneco is the largest district heating operator in the Netherlands and one of the largest energy companies in the country. It delivers district heating to about 140.000 residential and 2.500 commercial customers daily.

One of their networks connecting more than 10.000 homes has a demand of ~150 GWh of heating energy each year. Their ambition is to transition to a fully renewable system in the following years and introduce a smart portfolio of multiple green heat sources. A prominent idea is to use geothermal energy, for which the first soil assessments have already been carried out. This network could be one of the first cities in the Netherlands to use this form of energy on a larger scale for households. For demand peaks, gas-fired sources are already replaced with an e-boiler supplied by renewable wind electricity from the North Sea.

To allow the transition to geothermal, network temperatures should be lowered to ensure the source can operate full-year-round. However, this should be done in a responsible manner – ensuring the 32 substations connecting the secondary networks always have the right temperature levels to deliver the required heat to all the connected homes.

Real-time insight as the basis for temperature reduction

Eneco partnered up with Gradyent to build Digital Twins of their grids. The Digital Twin is a cloud-based representation of the entire heating network, showing the temperatures, flows and pressures in real time. It is trained with data from smart meters and sensor data from sources and substations, taking into account the full network hydraulics, return temperatures and shortcut flows. Also, the Digital Twin uses weather parameters to forecast heat demand and optimal temperatures for the following hours and days. During the day, it balances flow and temperatures dynamically for the next few hours, so a cost-optimal decision can be made on fuel and pumping costs.



A cornerstone of the optimisation is the requirement that end customers still get the heat they need. Instead of creating additional risks, the Digital Twin ensures security in the heat supply. That is why, during the implementation the Digital Twin was first used to run full-year scenarios on lower temperatures, validating that they would not impact customer supply security or contractual obligations.

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To be able to make growth possible, we need to find new sources of heat and the challenge here is that these sources are often at a lower temperature. In trying to find solutions for this challenge we came across Gradyent. The great thing about their team is that they don't only consist of data scientists who are able to process our data in an intelligent manner, but they also really understand the engineering end of our heating system. We learned that we could achieve significant reduction in temperature in both grids that we are operating. In that way, Gradyent has played a pivotal role in reducing our network temperatures, enabling our geothermal plans

Paolo Herdé
Manager Smart Grid & Innovation team at Eneco

Results: Reducing network temperature by 5 -10 °C on average

After implementation and training, the company started using the Digital Twin in daily operations. The setpoints on forward temperature are either taken as recommendations or directly used for temperature control. With the Digital Twin in the control room, Eneco network operators can see the real-time data on sources, substations, and suggested setpoints of the Digital Twin. This is a different approach than the heating curve, which was used before, and creates more flexibility in the daily operation to supply precisely the temperature that is needed.

As a result, the temperatures are reduced over the entire year. In cold winter and hot summer months, temperatures could only be lowered a few degrees. But during spring and autumn, temperature reductions larger than 10°C were often possible compared to the historical situation. On average, the temperature is lowered over a full year, ranging from 5°C to 10°C, depending on the weather conditions during the year. This lowered the overall heat losses, reducing CO2 emissions by more than 600 tons per year. These lower temperatures make the business case for geothermal sources more attractive.

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Using dynamic temperature control, based on all the data from the network in real-time, we were able to lower our temperatures while still ensuring that our end-customers always have the heat they need. Previously, we were using a control curve (stooklijn) in our operations for many years – but this made it hard to see what exactly the impact of changing temperatures in the network was. With the digital twin technology, we are now able to know which low temperature levels are fitting by seeing the impact on all substations and the most critical points in the network in real-time. For renewable sources, like geothermal, this is key to maximize the running hours and business case, keeping our heat affordable for our clients. In that way, we are working towards decarbonization with lower temperatures.

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[Book a meeting with Yvo]

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