

Case Study

GASCADE - Gas flow management

With its own pipeline network of around 3,200 kilometres in length and an annual transport volume of over 433 TWh or approx. 39 billion m³ of natural gas: GASCADE Gastransport GmbH is one of the leading pipeline system operators in Germany and Europe. The joint venture of Secure Energy for Europe (SEFE) and Wintershall Dea AG employs around 450 people and ensures that natural gas from the sources in Northwest Europe and the LNG terminal in the Baltic Sea reaches consumers in Central and Eastern Europe reliably.

Central dispatching around the clock

All facilities and systems are monitored and controlled around the clock from the GASCADE dispatching centre in Kassel, which is responsible for the operational handling of the transport processes. Information from around 81,000 signals is continuously transmitted to the gas flow management system via fibre optic cables installed along the pipelines. To guarantee a stable, reliable transport service for all customers, the dispatching centre relies on detecting pressure changes in the pipelines in advance through forecasts aimed at predicting the feed and discharge volumes. This gives GASCADE the flexibility to respond to adjusting gas volumes and pressures in a timely manner prior to more elaborate intervention in the network control becomes necessary.

Simulation for 48 hours in advance

Specifically, transport planning is based on simulations for a period of 24 to 48 hours in advance, which are generated based on forecast data. The actual quality of the forecasts was not the top priority, as Daniel Zimmer, from GASCADE Gastransport GmbH, reports:

GASCADE

"For us the key factors for forecasts are its ability to readily adopt to changing requirements through the of various forecast methods, reliability, system stability and fault tolerance. The objective is less focused on achieving an improvement of half a percentage point better, which often plays an important role in gas trading, for example. For us, on the other hand, the main focus is on stable, functioning processes. We must be able to achieve useful results even if, for example, certain measured values are missing due to a technical failure, and we have to work with corresponding substitute values. This continues to be valid."

Daniel Zimmer, GASCADE Gastransport GmbH

In addition to being able to apply unlimited predictors to the forecast, those responsible at GASCADE were also



convinced by the flexibility of the solution. The software can be easily integrated into the new control system via interfaces and offers a wide range of filter options for the pre-processing of measured values - an important prerequisite that contributed significantly to the decision in favour of metalogic.

Forecasts for pressure changes and balancing

The forecasts serve two main purposes at GASCADE: On the one hand, they form an important basis for forecasting the pressure changes in the distribution network over the next 48 hours. On the other hand, the forecasts provide information about possible physical differences between input and output and are used to estimate the demand for balancing energy.

A temperature-dependent model with currently 14 predictors is now applied to the general processing of forecasts at GASCADE. These include the average daily temperatures, the minimum/maximum values (daily lows and highs) and current wind data. Global radiation as well as consumption, weekly profiles and average values of the last few weeks are also included, which are calculated by default based on the day block period Tuesday to Thursday.

Cyclical projection with Time Constraints

The importance of a smooth interaction of the individual processes within the forecasting and simulation process chain becomes clear when reflecting upon the tight time constraints. Within the scope of the cyclical predictions, the latest measured values are available in the control system in the dispatching centre in Kassel directly after the hour change and are then immediately checked for plausibility. The forecast is then processed, and the results are accessed exactly eleven minutes after the hour change. The forecast must be available precisely at this time, otherwise the forward simulations, which always start at 13 and 43 minutes after the hour, would be affected.

Mastering complex forecast scenarios

GASCADE achieves sufficient forecast quality for around half of the forecasts produced using standard regression methods. However, this approach is often not sufficient for forecasts that are not primarily temperature-dependent - for example in the case of consumption values of industrial companies, that often contain significant deviations due to factors such as special production processes or plant holidays. This is where the metaScript Master module comes in. As an option for mP Energy even very complex forecast scenarios can be mapped via an integrated scripting engine. This includes, for example, special interactions with specific parameters, synthetic load profiles or adopting and updating certain hourly values for the future. Viable forecasts can be created and processed for situations that are practically "not forecastable" applying standard means.



"The closer the forecast or our simulation is to the actual values, the less effort we have to invest in network monitoring and control," explains Daniel Zimmer. "In practice, this means, for example, lower machine wear and lower costs, since the compressors do not have to be started up and shut down unnecessarily at the cost of very high energy consumption".

Dispatching Specialist Daniel Zimmer.



Even though improving forecast quality was not the primary reason for GASCADE to adopt mP Energy, acquiring accurate forecast results provides clear advantages for the TSO network operator.

Adopting the grid for Hydrogen

Today, GASCADE is a supporting pillar in the development of an infrastructure for the transport of climate-neutral hydrogen. In line with the climate goals, we are already developing solutions to rapidly realise the energy transition - with the transport of hydrogen.

The integration of hydrogen into the already existing grid infrastructure and its further development is the path GASCADE will follow.

In this process, we expect a change and expansion of the gas pipeline network at GASCADE. Both producers and consumers of hydrogen will be added in the future. These stations will be integrated into the forecasting processes in a timely manner. With our system, this can be done very easily and efficiently. The new station is first set up in the control system. Then the corresponding extension of the mapping takes place at the interfaces between mP Energy and the control system. The measurement data of the new station runs via the time series manager and then serves as a basis for the forecast.

"With the forecasting solution from metalogic, we have been able to create a future-proof, open platform that gives us sufficient room for future expansions and individual adjustments," comments Dispatching Specialist - Daniel Zimmer.