GASCADE Gastransport GmbH

mP Energy®

Case Study

GASCADE

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Gas Flow Management at GASCADE

Reliable Forecasts ensure consistently Stable Transport Services

With its own company pipeline network, approximately 2,400 kilometres in length, and an annual natural gas transport volume of 411 TWh (37 BCM); GASCADE Gastransport GmbH is one of the leading TSO network operators in Germany and Europe. The joint venture between the BASF subsidiary Wintershall and the Russian Gazprom with around 350 employees ensure that natural gas from fields in North-West Europe and Russia reliably reaches consumers in Central Europe. The network consists mainly of the five GASCADE pipelines MIDAL, STEGAL, JAGAL, WEDAL and RHG as well as the connected TSO partner lines NORD STREAM, OPAL and NEL. Nine compressor stations with a total output of around 553 MW maintain stable pressure in the network.

Central Dispatching – 24 x 7

All facilities and systems are operated and monitored around the clock by GASCADE Central Dispatching in Kassel, which is responsible for operations management of the transport processes. Information from some 100,000 data points is continuously supplied to the gas flow management control system over fibre optics cables installed along the pipelines. Over 30,000 datasets are processed every three minutes.
To guarantee stable, reliable transport capacity for all customers, Central Dispatching depends on identifying pressure changes in the pipelines in advance through forecasts aimed at predicting the feed and discharge volumes. This gives GASCADE the flexibility to respond by adjusting gas volumes and pressures in a timely manner, prior to more elaborate intervention into network control becomes necessary.

Simulation for 48 hours in Advance

In practical terms, this planning is carried out on the basis of simulations for a period from 24 to 48 hours in advance, generated based on forecast data. A forecasting solution formerly used until October of 2014, as an integrated feature in the PSIgamos control system, supplied satisfactory results. However, the forecasting functionality in the new control system was in terms of flexibility very restrictive and its regression calculation method was limited to a maximum of two prediction factors (predictors).

Because of these constraints GASCADE decided to implement a new separate forecasting solution in conjunction with the upgrade to a new control system.

As reported by Frank Rosskopf, from network dispatching at GASCADE Gastransport GmbH, the forecast quality as such was actually not the number one issue:

"When it comes to forecasting, the key factors for us are: its ability to be readily adapted to changing requirements through the use various forecast methods, reliability, system stability and error tolerance. The objective is less focused on achieving an improvement of half a percentage point, which often plays a significant role for example in gas trading. Our primary goal is to achieve a stable functioning process. We must be able to produce applicable useable results even if, for example, certain measurements are missing due to a technical failure and we have to work with corresponding substitute values."

Frank Rosskopf, GASCADE

Thanks to positive experiences in a previous project, the forecasting software **mP Energy** from the Munich software firm metalogic and the Vienna software company HAKOM as the integration partner had a huge head start in the selection process from the outset. The flexibility of this solution was a convincing argument for those in charge at GASCADE in addition to being able to handle an unlimited number of predictors in the forecasts. Other important prerequisites, which were also decisive for the decision for mP Energy, were its interfaces that enabled a seamless integration to the control system plus the extensive filter options and capabilities that support the pre-processing of measured values.

Following the project launch in the spring of 2014, both control systems and forecasting solutions were operated in parallel during a transition phase in order to determine whether the results achieved were (as a minimum) equivalent to the former results. The quality of the forecasts was in fact somewhat better.

Pressure Changes and Balancing

GASCADE primarily uses forecasts for two purposes: For one, they constitute an important basis for predicting the changes of pressure in the distribution network in the next 48 hours. For another, the forecasts allow conclusions to be drawn regarding possible physical differences between input and output necessary for estimating the balancing energy requirements.

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

For the upstream processes to manage the measurements and reference data, **mP Energy** is front ended by the Time Series Manager (TSM) of HAKOM Solutions GmbH which processes all temperature data. This tool also generates replacement values when current weather data for example is missing. The TSM is responsible for the allocation forecasts as well, which are required for example when total consumption forecasts supply better results than individual station forecasts.

Cyclical Projection with Time Constraints

Reflecting upon the tight time constraints reveals how important the smooth interaction of individual processes within the forecasting and simulation process chain really is. Within the scope of the cyclical projection, the latest measurements are available in the control system at Central Dispatching in Kassel following the previous hour and are then immediately checked for plausibility. The forecast is then processed and the results are accessed exactly twelve minutes after the hour. Having the forecast available precisely at this time is absolutely essential; otherwise forward simulations that always start 25 and 55 minutes after the full hour would be affected.

mP Energy® – Better Results Quicker.

Mastering Complex Forecast Scenarios

For about half of all forecasts, GASCADE achieves a sufficient forecast quality applying the standard metalogic regression methods. However, this approach is often not sufficient for forecasts that do not primarily depend on temperature as a predictor – for example in the case of the consumption values of industrial enterprises that often contain significant deviations due to factors such as special production processes or plant holiday shutdowns. This is where the **metaScript Master** module comes in. As an option for **mP Energy,** it can model even highly complex forecasting scenarios with its integrated scripting engine. This for example includes 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" using standard means.

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

"The closer the forecasts and our simulations are to the actual values, the less effort is needed for our network monitoring and network control," Frank Rosskopf explains. "As a concrete example, this means lower machine wear and lower costs since the compressors do not have to be started up and shut down, at the cost of very high energy consumption, more than necessary."

Coping with Network Changes

Due to ongoing changes and growth the GASCADE gas pipeline network is expanded by five to ten new discharge stations each year. These stations have to be integrated in the forecasting process in a timely manner. This is very straightforward and efficient with the new system. First the new measuring station is set up in the control system. Then the mapping is expanded accordingly for the interfaces between **mP Energy** and the control system. The measured data from the new stations is then fed into TSM thus providing a basis for the forecasting.

"By implementing the forecasting solution from metalogic, we have accomplished our key objective: Creating a future-proof, open platform that gives us sufficient scalability and flexibility for future expansion and individual adaptations,"

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