

TGI Minimizes Operational Outages by Improving Decision Support with Digital Twin

RESULTS

- Increased maintenance efficiency with defined shutdown windows for gas pipeline network
- Minimized impact of maintenance on operations and customer deliveries
- Improved ability to meet regulatory requirements
- Improved performance prediction for increased efficiency and safety



APPLICATION

Real-time simulation and forecasting of the pipeline network of a natural gas transporter to predict what will happen in the future based on current operational conditions or anticipated changes.

CUSTOMER

Transportadora de Gas Internacional (TGI), the largest natural gas transporter in Colombia, safely maintains an extensive network of 4,000 kilometers of gas pipelines with a compression capacity of over 193 horsepower. TGI delivers gas to many sectors of the economy including residential, commercial, industrial, and power generation.

CHALLENGE

Maintenance activities, plant and pipeline shutdowns, and variation in client consumption all mean that TGI personnel must be able to handle daily planned and unplanned operational conditions. Because it was becoming increasingly difficult to manage these fluctuations on paper or spreadsheets, the reliability team chose to drive improved decision support through digitalization across the organization.

“The digital twin simulation helps our operators predict how the changes they make will impact processes today and far down the line. That foreknowledge leads to easier, better decisions and drives more efficient operations.”

Jesus Vargas Torres

Advisor to the Operations Management at TGI

SOLUTION

TGI's operators must constantly adapt to change caused by variation in customer needs, suppliers' issues, and maintenance-related adjustments. For years, TGI engineers used manual documentation to handle both daily changes and disaster planning. Impacts of field or compressor plant shutdowns, pipeline maintenance, and leaks or ruptures were calculated on large, complex spreadsheets. Managing these spreadsheets was difficult and cumbersome for even the most experienced technicians—many of whom are beginning to retire, leaving their responsibilities to newer employees.

To improve decision support, TGI's reliability team implemented a real-time digital twin simulation of the organization's pipeline network. The team linked Emerson's OpenEnterprise™ supervisory control and data acquisition (SCADA) system to PipelineManager™ simulation software to create the digital twin.

The real-time digital twin data can be sped up to allow operators to see the future state of their processes. Predictive models run automatically at ten to fifty times normal speed. These models use the current state operating conditions to allow operators to witness what conditions will be like in six hours. Operators have a clear indication of how the actions they perform now will resonate across the pipeline network and impact future operations.

This same predictive model can be run on demand whenever necessary, allowing easier testing of operations changes. If the team wants to push the boundaries of the system for any reason, pre-configured conditional alerts will tell operators how many hours it will take before problems occur, such as losing a compressor, compressor plant or injection plant, or other conditions that may lead to an imbalance somewhere in the network.

The reliability team was able to use the new digital twin to predict the consequences to downstream plants and stations when a single production site is

“The digital twin’s ability to calculate exactly how long a maintenance window can last before it impacts our customers is invaluable in helping technicians schedule upgrades, installations, or emergency service without interrupting production.”

Omar Caro Vargas
Control Room Lead Engineer for TGI

shut down. The look-ahead model allowed the team to determine the actual time it would take to reach minimal suction pressure at the compressor stations and the time it would take to reach minimal arrival pressure at a site. Using this data, TGI could identify an exact window of opportunity for any shutdowns to the production site. Armed with this information, maintenance crews can approach all future activities knowing exactly how much time they have available to perform their tasks, making it easier to plan and schedule.

When the maintenance team needed to bring a compressor station down for repairs, the reliability team was able to use the digital twin to identify the time it would take to reach minimal arrival pressure at two customer sites. This allowed TGI to know exactly how long technicians had to complete the repair without any risk of breaching contract obligations with those customers.

The team also uses the digital twin to test hypothetical scenarios, which are particularly effective for process improvement and disaster preparedness. Before installing new pieces of equipment or making changes to pressure and flow, engineers can simulate the adjustments in the digital twin to see in real time exactly how the impacts of those changes will cascade across the pipeline. The digital twin also allows the

team to simulate emergency shutdowns. TGI can test responses to these emergencies in the simulation — including rerouting without breaking contracts and activating the proper response teams — without any risk to safety or operations.

Simulation has also enabled TGI to better meet government and customer regulations. The Colombian Regulatory Entity (CREG) requires that pipeline operators must communicate with customers in advance of any planned shutdowns or restrictions. TGI can now more accurately make these reports with el Consejo Nacional de Operación de Gas Natural (CNOGAS), as the operations team can simulate the scenarios in advance using estimated conditions and confirm them later in the same day when they have actual condition data. Moreover, for customers that have variance in daily delivery, TGI can use the digital twin to determine whether the network can withstand required changes and renegotiate daily requirements whenever necessary.

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“The cutting-edge technology we are incorporating into TGI operations opens a world of opportunities to improve our business and competitiveness.”

Luis Casallas Bello
PM / Contract Controller and Procurement for
Technology Projects inside TGI

networks that include a diverse range of field hardware and equipment.

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A field-proven online simulation and modeling tool that provides pipeline leak detection, leak localization, batch tracking, automated forecasting, facility planning, and operator training and support.



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