



Vector Gas: control under pressure

New Zealand gas transporter and technical operator for the Maui Pipeline, Vector Gas, upgrades the Mokau Compressor Station using advanced process and safety control solutions from Rockwell Automation.

Natural gas is the most versatile of all the fossil fuels, although industrial, commercial and residential users alike tend to take its benefits and its supply infrastructure for granted. The transportation structure alone comprises a complex network of pipelines, valves and compressor stations, which require skilled management and maintenance to ensure end-users receive an adequate supply of natural gas at the correct pressure to meet their needs.

A major player in New Zealand's high-pressure gas transmission industry is Vector Gas Limited. With a network over 2,500km in length, Vector Gas annually delivers 100PJ of gas to industrial, commercial and residential consumers across New Zealand's North Island. Vector Gas also operates and maintains third-party-owned pipelines such as the Maui Pipeline. The 307km-long Maui Pipeline is the largest-capacity high-pressure gas transmission line in New Zealand, and this is pressurised by a single compressor station—the Mokau Compressor Station.

When the station controls required upgrading in the Mokau Compressor Station, Vector Gas turned to long-

standing systems integrator partner, Engineering Control Limited (ECL). In keeping with Vector Gas's decision to standardise control across its compressor stations, ECL founded the new system on the powerful Allen-Bradley ControlLogix platform from Rockwell Automation.

Safety is everything

The primary function of the Mokau Compressor Station is to receive gas from the south and 'line-pack' it to the north. Line-packing involves pressurising the gas to allow a greater quantity to be 'packed-in' to the pipe, effectively utilising the pipeline itself as a large pressurised gas reservoir.

The Mokau Station comprises two centrifugal compressor-sets, each powered by a gas turbine engine. "The compressors are designed to increase the gas pressure—in excess of 50bar, if required," says Vector Gas Instrument and Electrical Engineer, Alan Taylor. "This enables it to flow north by pressure differential alone, without need for additional pumping stations."

The station has five operating modes—



Vector Gas Instrument and Electrical Engineer, Alan Taylor —“ControlLogix enhances the automation control functionality and improves the communications between controllers.”

Run; Ready; Inhibit; Emergency Shut Down (ESD) and Backflow, and is designed to operate in Run mode for extended periods. ESD mode is activated in the event of an emergency, to put the station into a safe condition—stopping the compressors, depressurising the station pipework through emergency venting, and allowing the gas in the Maui

Pipeline to bypass the station.

Three controllers are needed to operate the station—one each for the gas turbines, and one known as the ‘station controller’. The station controller supervises the entire station, communicating with the gas turbine controllers, safely administering the valves of the compressor station, and managing the operating modes. In the event of an incident, the station controller initiates ESD mode in order to mitigate damage to the Mokau Station and the Maui Pipeline.

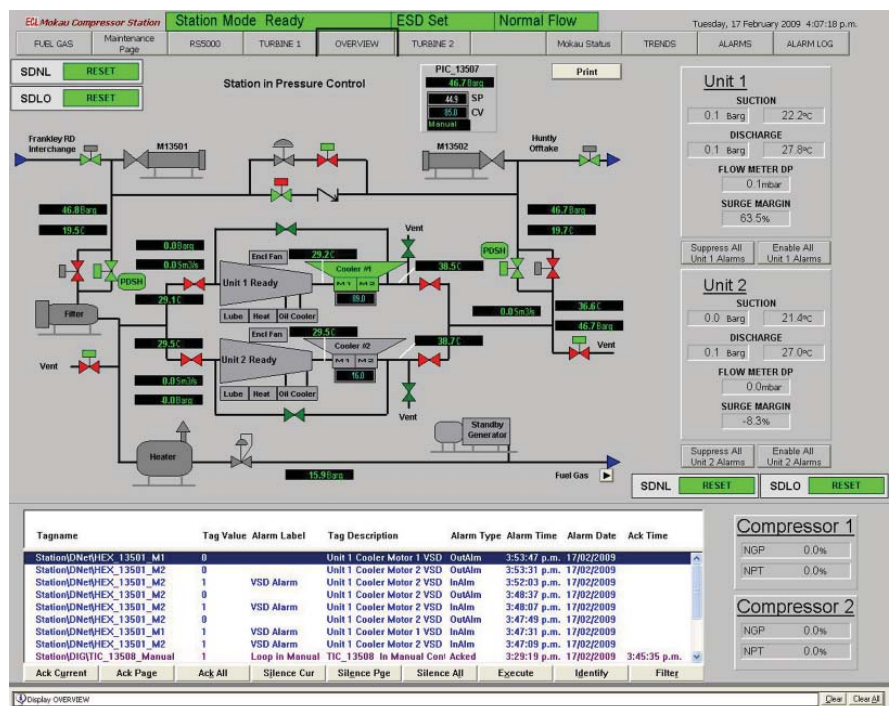
Having previously upgraded the gas turbine controllers to Allen-Bradley ControlLogix, Vector Gas followed suit with the station controller. “Replacing the station controller with a ControlLogix programmable automation controller (PAC) made sense to enhance the automation control functionality and to improve the communications between controllers,” says Taylor. “We have extremely good support for Rockwell Automation solutions, so this was another driver for upgrading the station controller to ControlLogix.”

Enhanced functionality

The primary brief given to ECL from Vector Gas was to replicate the base functionality of the legacy station controller. “The main problem with the legacy station controller was that it had reached the end of its design life,” explains ECL senior control systems engineer, Peter Huitema. “It was tough to get spares, and licensing issues made it difficult to get on-line to diagnose problems.”

In addition to replacing the station controller, the project also entailed upgrades to the onsite Motor Control Centre. This incorporated the replacement of the legacy drives for the gas and oil coolers with six Allen-Bradley PowerFlex 40 variable speed drives. These VSDs increase operational efficiencies through greater refinement of motor speed, and by improving the ability to achieve optimal temperature settings for both the compressor oil and the natural gas under compression.

Allen-Bradley E3 Plus overload relays replaced the legacy overload relays fitted to the turbine enclosure fans.



The implementation of an advanced HMI was a key element for improving the diagnostics capabilities of the system.

These feature advanced protective and control capabilities, and facilitate the transmission of increased operational status information back to the controller.

“The upgrades have provided several additional capabilities over the legacy system,” says Taylor. “The station controller communicates with the gas turbine controllers via ControlNet, and with the VSDs and overload relays over DeviceNet. This unprecedented level of communication enhances both diagnostics capabilities and trend monitoring.”

The implementation of an advanced HMI was key for improving the diagnostics capabilities of the system. “We used FactoryTalk View 5.0 with faceplate-driven control to develop a DCS-type feel,” Huitema explains. “This improves the operator interface and enables personnel relatively unfamiliar with the system to access information far more easily—an important consideration for a station with no full-time staff.”

A safe future

The project also enabled Vector Gas to increase the safety integrity level (SIL) of the control system to SIL2. A SIL study

had found there was a potential for SIL2 events on site, and these needed to be properly addressed to mitigate the risk to site personnel and the station itself.

“The adoption of ControlLogix across the board simplified the implementation of SIL2 for the station controls,” says Huitema. “We used RSLogix 5000 version 16 with function block code for configuring the new ControlLogix station controller and this proved to be a straightforward process. We now have the perfect foundation to bring the whole station to a SIL2 rating in the future.”

The project was completed on time with no operational impact, and has significantly improved the smooth running of the Mokau Compressor Station. “The Integrated Architecture solution from Rockwell Automation has enhanced our levels of communications,” says Taylor. “When a fault occurs now, it is far easier to remotely interrogate the system to pinpoint the cause of the problem. The success of the Mokau Compressor Station project means we are now using this Rockwell Automation solution as a template for future upgrades to numerous other compressor stations across the North Island.” AT