

Pohokura sets the standard for remote operation and sustainability

Located off the Northern Taranaki coast, the Pohokura field is New Zealand's largest natural gas resource. To achieve zero normal operational presence (ZNOP), the Pohokura production station implemented a new integrated automation control system from Rockwell Automation.

Natural gas is a very valuable resource. It is an environmentally friendly, clean fuel when compared to other fossil fuels. Natural gas is more efficient with 90 per cent of production reaching the point of consumption. The efficiency is constantly improving with technological advances in extraction, transportation and storage techniques. The transportation system for natural gas consists of a complex network of pipelines, designed to quickly and efficiently transport natural gas from its origin to areas of high demand.

The Pohokura field, offshore from Taranaki, is the country's largest natural gas resource, owned by a joint venture between Shell, Todd Pohokura, and OMV New Zealand. The production station is operated by Shell Exploration NZ which uses the services of Shell Todd Oil Services (STOS). The Pohokura field natural gas is fed into the national grid network. The first commercial gas flowed from three onshore 'extended reach' drilling wells in the Southern part of the field in September 2006. In March 2007, gas and condensate began to flow from the first of five offshore wells via an undersea pipeline back to an onshore production station at Motunui.

Developing an unmanned site—where operations are monitored from a control room in New Plymouth—required the combined expertise of engineers, consultants and systems integrators. The Pohokura design contractor, Transfield Worley, appointed long-standing systems integrator partner Engineering Control Limited (ECL). One of the requirements for remote operation was that the motor control centres

(MCCs) be integrated into the main plant control system on an intelligent network so that the information from the gas station could be fed back to the control room. Transfield Worley based the new system on the DeviceNet

to deliver the project on time, on budget and safely, with no harm to personnel or any adverse effects to the neighbours or the environment."

The operational philosophy for the Pohokura production facility

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network together with the Allen-Bradley® ControlLogix® platform from Rockwell Automation®.

Another requirement was that the status of power switchgear at the 400V MCCs and the plant 11kV main switchboard had to be available in the control room and this switchgear had to be operable from the control room as well. This was achieved by hardwiring the switchgear to discrete I/O in the ControlLogix. Being able to operate the switchgear from remote is also a welcome safety feature as it removes the need for local operation and so does not expose operators to possible harm from such things as arc flash as may occur if there is a switchgear fault or failure whilst it is being operated.

Establishing a remote operation

Pohokura produces over 45 per cent of New Zealand's natural gas which is reticulated around the North Island to industry and domestic consumption. "By using Shell's technical expertise we set out to deliver a highly reliable unmanned gas production station with a small environmental footprint," said Paul Brown, Pohokura Operations Engineer. "A priority for us was

to establish an unmanned site with zero normal operating presence (ZNOP); plant operation would be performed off-site from a remote control room in New Plymouth using a Distributed Control System (DCS). Remote operation is an ideal way to help keep personnel safe and away from potentially hazardous equipment, but its operational success relies on excellent control, fault diagnostics and network capabilities.

"DeviceNet provided a network solution that could help provide reliable communication and also had the added feature of Automatic Device Replacement (ADR), allowing for reduced downtime with automatic download of device parameters," said Prasad Nory, Industry Manager, Rockwell Automation. ADR consists of configuration and auto-address recovery which effectively lowers maintenance requirements. Operating 24 hours a day, 7 days a week, Pohokura has a scheduled proactive maintenance day every month to identify and deal with potential problems..

The Pohokura blueprint

The Transfield Worley electrically engineered design was the basis for

a completely integrated solution that required the capabilities of leading board builders, Switchbuild Ltd. The Pohokura solution evolved around the development of two low-voltage MCCs. Two 2.5MVA transformers feed into the first low-voltage MCC via 4000A Air Circuit Breakers (ACBs). Power from the first MCC is then fed through to the second low voltage MCC. The intelligent MCC design utilised the DeviceNet network, communicating to the DOL start motor starters for control and monitoring. The E3 plus smart overloads provided motor protection that very closely matched the motor operating characteristics with the enhanced protection capabilities such as earth fault, stall, thermistor and loss of load that are normally provided by much more expensive motor protective relays.

An Allen Bradley ControlLogix Programmable Automation Controller is used to provide the comprehensive monitoring and control of the MCCs and feeds back information to the distributed control system. "The Allen Bradley solution provides advance load protection. The client has the ability to analyse the performance of their motors and view faults, all in an integral unit that is visible from the distributed control system," said Donald Liddell, Manager, Switchbuild.

To avoid costly downtime at Pohokura, ECL developed and incorporated switching Controls in the PAC in the event that power is lost from one of the two 11kV incomers. According to Peter Huitema, Engineer ECL, "Normally when supplies switch over you lose power, even if it's just a few milliseconds, the motors will shutdown. To avoid this, we determined how many seconds the motor can be with no power without causing any damage. We used inertia to keep motors running for up to 1.5 seconds, to allow time for the other supply to switch over. By programming this information into the Control System we were able to avoid costly shutdowns."



Pohokura field is New Zealand's largest natural gas resource

Environmental excellence

The implementation of state-of-the-art engineering has enabled the Pohokura plant to be operated remotely. "Safety to personnel and the environment take an even higher priority in a remote operation so plant and components must work reliably with minimal maintenance. All components chosen for the Pohokura project had to have proven reliability," said Paul Brown, Pohokura Operations Engineer.

To achieve environmental excellence, modifications were made to the original design of the field. Horizontal directional drilling technology was used to eliminate the need to have a pipeline from the onshore production station out to the offshore platform that would have run over the cliff face and across the foreshore. Instead—and as a first for New Zealand—a pipeline was inserted behind the cliff face and underneath the foreshore, so there was no visible or physical intrusion and the local coastal environment was preserved.

The plant's processing areas are built in concrete bunds. Before the water is drained into the stormwater

treatment systems, an absorbent skimmer removes residual floating hydrocarbons. Stormwater is further processed via a specially designed "wetland" where plants are utilised as a natural bio-filter. Filtration through the wetlands removes any residual hydrocarbons. These environmental features resulted in Shell Pohokura receiving a sustainable development and technical innovation award from the Taranaki Regional Council in 2010.

Reaction to the integrated automation control solution from Rockwell Automation has been positive. "There have been no problems with the PACs from Rockwell Automation in the five years of Pohokura operation—our objectives have been fully satisfied in terms of budget, timing, personnel safety and environmental sustainability," concludes Brown. The value of the successfully operating remote control operation at Pohokura has been realised and as such, is currently undergoing an expansion to create another plant using the same easily extendable solution provided by the Rockwell Automation Integrated Architecture® system.