Open Control Platform Keeps the Oil Flowing

A network of pipes and pumps at the Cheal oil field in New Zealand extracts oil from nearly a mile beneath the surface and carries it through the production process.

Austral Pacific Energy Ltd. turned to a Rockwell Automation multidiscipline control system to achieve quick time to first oil with their greenfield production station.

A mile beneath the rolling hills of western New Zealand lies a vast reserve of solid, waxy oil. Unlike the familiar smooth, dark liquid that gushes from the ground, this congealed oil can only be extracted after it's heated and softened by high-temperature water.

Austral Pacific Energy Ltd. owns this reserve, called the Cheal oil field, and wanted to build a production station that would accelerate "time to first oil." It needed an automated system that could control and monitor everything from oil temperature to equipment performance while capturing the data necessary to comply with rigid regulatory requirements.

Going with the Flow

Alan Hooker, an instrument and electrical engineer with Independent Technology Ltd. (ITL), the contractor hired to design and build the station, explains that the complex nature of Cheal's production and information needs demanded a reliable system that could maxmise uptime. "The site can only handle around five hours of downtime before it begins to lose heat," says Hooker. If all heat is lost, it takes up to two weeks to heat the wells up to the desired temperature.

Heat begins the complex oil extraction and production process at Cheal. Two centrifugal pumps powered by 350-kilowatt motors inject 115° C water a mile beneath the surface, softening the oil. To prevent the oil from re-solidifying as it ascends, continuous heat is applied. The fluid exits the site's four wells and then travels to a separator drum where the oil, water and natural gas divide as their densities dictate – the gas rises, and the oil floats to the top of the water.

A pump forces the separated water back down the wells, and a pipeline exports the separated gas to another production station for further processing. The oil is exported to Australia for refining and then moves into worldwide distribution channels.

A Multidiscipline Mindset

Austral Pacific wanted to install a control system with distributed control system (DCS) functionality as well as the overall look and feel – one that would provide greater operational flexibility and a global view of their remote sites. Cheal's System Integrator Guy Heaysman, managing director of Engineering Control Limited (ECL), explains that traditional DCS systems can be complicated and inflexible to integrate with other equipment and systems.

Monitoring and tracking information, however, is a crucial part of the Austral Pacific process. The production stations must comply with environmental regulations that require detailed data on greenhouse gas emissions, the amount of water used and other factors. Also, flow rates, pressure, temperature and vibration inside the operation must be constantly monitored and measured. There's also essential proprietary record-keeping on everything from production to revenue.

After assessing the options, a control system based on Rockwell Automation® Integrated Architecture™ was selected to consolidate Cheal's full range of needs. The solution includes Allen-Bradley® ControlLogix® L62 Programmable Automation Controllers (PACs) and FactoryTalk® software to control and gather information about the entire production process.

The ControlLogix PAC provides all of the capabilities of a traditional DCS system in addition to managing Cheal's thousands of discrete, process and safety I/O points using a single platform. A traditional DCS system could only address Cheal's process needs.

ITL's Hooker says, "Using ControlLogix controllers helps lower the cost of ownership, provides better flexibility and offers more scalability than a traditional DCS system. The open architecture of the controllers, software and other automation equipment also helps give Cheal the versatility to integrate field instrumentation and equipment from other vendors."

Heaysman explains that by using the RSLogix™ 5000 configuration tool on

the engineering station, ECL leveraged a library of built-in process control instructions: "The software's neatly laid-out programming code makes it easier for users to diagnose problems and make changes down the road. The system uses tag-based memory, which means that all the physical addresses are in real-world terms like 'Well 3 sensor' that can be understood by people throughout the enterprise."

Visualisation Versatility

The FactoryTalk integrated production and performance suite sits at the core of Cheal's information-handling capabilities. The software provides performance, visibility and data management capabilities to operators at the Cheal production station.

Equipped with FactoryTalk View Site Edition (SE) software, Cheal's industrial computers – used to monitor and trend the control system and devices – provide a complete view of the Cheal oil field. Designed for supervisory-level monitoring and control applications, the software's scalable architecture supports distributed-server/multi-user applications. It also gives pager-toting field operators remote access to the control system, equipment and instrumentation.

To supply operators with the information they need to make business decisions about the site, FactoryTalk Transaction Manager stores data generated by the controller and converts it to a spreadsheet. Every day, Austral Pacific's Wellington, New Zealand, office receives an automatically generated report containing information about how much oil, gas, water and chemicals are being used, produced or exported.

If an emergency situation arises, controllers at the Cheal oil field can automatically send out an analog or digital alarm to pagers in user-defined situations. The software manages and tracks alarm states, as well as automatically stores timestamp information.

Tying the Rockwell Automation system to Cheal's KEPserverEX server technology helps field instrumentation send information back to the ControlLogix controllers. These field devices measure flow, temperature and other process metrics, then send data to the controller through a 4-20 mA connection.

To ease on-site system monitoring, an EtherNet/IP network transfers information from five remote-site pipelines to an Allen-Bradley PanelView™ HMI, providing users with a window to the entire site. Cheal's three networks support the Common Industrial Protocol (CIP), a common language that provides the interoperability and interchangeability engineers need to seamlessly connect production devices to the rest of the enterprise.

Time to First Oil

Despite the Cheal oil field's complex production process, it achieved quick time to first oil – production began 10 months after the company signed on with Rockwell Automation versus the typical 12 months.

Configuring the system to Cheal's specifications went just as smoothly. With the common engineering environment of Integrated Architecture, Austral Pacific simplified its configuration process by simultaneously addressing safety, process and control disciplines.

Now that oil production is under way, the fully automated system requires only one or two on-site operators. The reliable production station helped reduce downtime, a critical outcome for a process so dependent on keeping the site heated at all times.

Austral Pacific achieved a lower cost of ownership than a traditional DCS system could offer because of the seamless interaction between controllers, engineering and visualisation tools, networking capabilities and field instrumentation. Austral Pacific immediately benefited from its system's inherent flexibility when geologists discovered a nearby oil field shortly after the control system was programmed.

Due to the scalability of Integrated Architecture, Austral Pacific quickly incorporated the "Cheal B" site into its existing control system. The Cheal B site works seamlessly with the Cheal A control system because of the Ethernet connection between each site's controllers and the ability for devices from various vendors to communicate over DeviceNet.

"As Cheal expands its operations by developing new oil fields, we plan on continuing our use of Rockwell Automation products and services," Hooker said. "Based on the success we've had in terms of reliability, flexibility and support, the benefits are undeniable." AT

An oil tanker pulls up to the Cheal production station to transport the oil to a nearby port.

APPLICATION STORY

Loy Yang Power Drives Long-Term Success

An innovative drive solution – founded on Rockwell Automation's PowerFlex 7000 medium voltage drive – helps streamline Loy Yang Power's mine conveyor system upgrade.

Keeping Australia's coal-fired power generation infrastructure online – from the coal mine through to the generating plant and distribution grid – goes some way to ensuring the nation's industrial wheels remain turning. Stoppages, breakdowns and unscheduled downtime can be crippling to the power generating process, and can impact both the energy producer's and end-users' bottom lines in a matter of minutes.

One energy industry stakeholder leading the way in providing an uninterrupted supply of electricity is Victoria's largest energy producer, Loy Yang Power. Located within the heart of the Latrobe Valley, 165 kilometres east of Melbourne, Loy Yang Power provides reliable and efficient energy for industry and consumers right across south-eastern Australia.

Loy Yang Power recently embarked on an upgrade of its four-level open-cut coal mine facility, Loy Yang Mine. The "in progress" upgrade includes the redesign and progressive changeover of the mine's existing coal transfer conveyor drive systems. To obtain a drive solution capable of withstanding the rugged mine environment while delivering premium around-the-clock performance, Loy Yang Power enlisted the engineering experience of Rockwell Automation®.

Coal to Kilowatts

With an annual output of approximately 30 million tonnes of brown coal and four million cubic metres of overburden (soil that overlays the coal seams), Loy Yang Mine is the largest coal-producing mine in the southern hemisphere.

Huge electric-powered bucket-wheel dredgers patrol the open-cut mine "benches", each excavating up to 4,000 tonnes of coal per hour on average. The bucket wheel of each dredger feeds on-board dredger conveyors, which in turn deposit the coal onto main transfer conveyor systems on each level of the mine. With a combined length in excess of 25km, the mine's conveying system transfers the freshly mined coal from the mine floor to a raw coal bunker on the surface.

According to Loy Yang Mine senior electrical engineer, Steve Cleaver, providing a steady flow of coal feedstock to the coal bunker is essential to keeping the power generation process online and producing cost-effective electricity. "The coal bunker only has enough capacity to fuel 20

◄ *Bucket-wheel dredgers feed on-board dredger conveyors, which in turn deposit the coal onto main transfer conveyor systems on each level of the mine.*

hours of power generation. Therefore, the pressure on the conveying system to perform is relentless," he says.

Continuous Conveying

The legacy transfer conveyor drive systems at Loy Yang Mine were based on water-cooled eddy-current coupling (ECC) technology. When first installed many years ago, the ECCs were the ideal drive solution for providing high torque over a wide speed range – perfect for hauling enormous quantities of coal from the bottom of the mine to the surface.

However, in recent years, it had become clear to the Loy Yang Power mine engineering team that the legacy drive systems were struggling to move the coal as efficiently as they believed was now possible. Furthermore, the existing drive cooling systems were not coping with the production demand and were frequently overheating. "We can't afford to have a conveyor go off-line," says Cleaver. "When we're off-line we're not selling electricity, so downtime is catastrophic. It was time to make a change."

The mine upgrade provided Loy Yang Power with the opportunity to implement a drive solution incorporating the latest technology. "With so many conveyors on-site, it was important that the new drive technology could be brought online gradually and was able to integrate with our existing drive systems and control architecture," says Cleaver.

Compact, Contained, Cooled

In a collaborative effort, Rockwell Automation and the Loy Yang Power engineering team developed a new drive solution, founded on the Allen-Bradley PowerFlex® 7000 medium voltage (MV) AC drive. Featuring "Direct-to-Drive" technology – a technology that helps eliminate the need for isolation transformers on applications with either new or existing motors – the Allen-Bradley PowerFlex 7000 MV AC drive provides space-efficient speed and torque control across a range of demanding drive applications.

The mine engineering team came up with an idea to equip each conveyor with a fully self-contained, cooled and removable drive package that could be easily installed or uninstalled on any of the mine's conveyors. "This allows us to physically locate the drive package at any of the conveyors on any level of the mine, as conveyor length or lift requirements dictate," says Cleaver.

Cleaver also stipulated that the drive packages be housed in an IP67 stainless steel enclosure equipped with a closed-loop air-conditioning cooling system. According to Rockwell Automation technical consultant, Gary Spotswood, the compact nature of the PowerFlex 7000 drive simplified the development of the portable drive packages. "The transformerless configuration of the PowerFlex 7000 meant we were able to help minimise the footprint of the drive package," he says.

Seamless Integration

Four drive packages have been installed on the Loy Yang Mine site to-date – two on the lower level and one each on the middle and upper levels. One of the challenges here was integrating the new Rockwell Automation drive technology with the mine's existing drive technology and control architecture.

Each of the PowerFlex 7000 drive packages is interfaced with a programmable logic controller (PLC) located in the neighbouring switchroom. Each PLC is, in turn, linked to the mine's supervisory control and data acquisition (SCADA) system, via the mine's existing communications network. Each drive package is equipped with an Allen-Bradley electronic operator interface (EIO) located on the front panel of the drive enclosure. "The locally mounted EOIs make it easier for site personnel to access drive diagnostics without opening the dust-proof enclosures and exposing the drives to the elements," says Spotswood.

The Rockwell Automation/Loy Yang engineering team developed a strategy that allowed the new drive packages to seamlessly synchronise with the existing ECC drives. "All conveyors have been set up to run in sequence. Where appropriate, the drives have been configured to operate in a 'master/slave' configuration," says Cleaver.

Explain and Train

According to Cleaver, Rockwell Automation's support from the project's inception and design phase, through to the first phase of supply and installation was second-to-none. "The mining operation is essentially a 24-hour operation," he says. "It was reassuring to know Rockwell Automation support was available 24/7."

Cleaver was especially impressed with Rockwell Automation's willingness to fully explain the inner workings of its drive solution. "We didn't want any proprietary 'black box' technology," says Cleaver. "We can't afford to wait around for specialised service teams. We need to be familiar with the product and its inner workings so we can set it up, monitor it and troubleshoot it if necessary. Rockwell Automation was excellent in this respect; they were able to 'explain and train'."

Loy Yang Mine senior electrical engineer, Steve Cleaver (left), and Rockwell Automation technical consultant, Gary Spotswood, inspect the inside of one of the portable drive packages.

With the mine upgrade at Loy Yang Mine only partially complete, there is much work ahead. Cleaver and his team are planning to progressively replace many other ECC drives across the mine with PowerFlex 7000 drives. "We have been impressed with the Rockwell Automation drive solution," says Cleaver. "It provides us with the combination of reliability and performance we are looking for." AT