A DATA-DRIVEN SEARCH FOR OIL

Integrated systems pump data to feed the search for oil in Alberta.

by Russ Ritchie and Dan Lastiwka

Laricina's pilot facility is a steam-assisted gravity drain plant testing the viability of a new technology for extracting oil from carbonate beds.

To the control room operator, data is a means to an end; it's necessary to keep the process running and productive. To management, data can be the difference between good or bad business decisions.

Unfortunately, getting accurate real-time data to all levels is often difficult at best. Choosing the right field/end devices and an asset management system to ensure their ongoing accuracy and reliability helps, but even then, the flow of information from field instrumentation and other sources too often ends at the DCS, while passing secure operating data into the corporate environment is totally neglected.

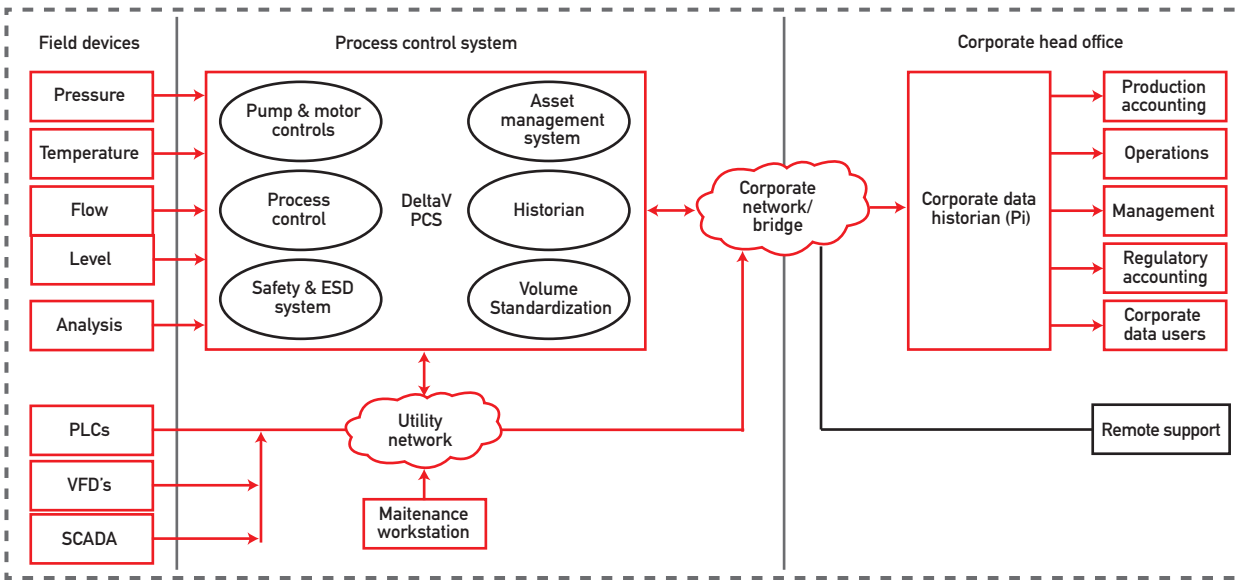
Those who plan and implement automation systems often don't consider the big picture, and look beyond the needs of the control system. Planners should integrate the data acquired from intelligent field measurement devices with the means to convey timely information about operating conditions to those who need it most.

At Laricina Energy Ltd. (www.laricinaenergy.com), data acquisition and management are essential elements in proving the validity of a unique process for extracting crude (bitumen) from a carbonate reservoir in the Alberta oil sands region of Canada. Laricina is a privately held company working to develop drilling technologies for removing heavy oil from vast carbonate reservoirs in northern Alberta. If these reserves are commercially extractable, Canada could become the most oil-rich nation in the world, and Laricina investors would be duly rewarded.

Laricina's first pilot facility is the Saleski steam-assisted gravity drain (SAGD) plant where a project is underway to demonstrate the commercial viability of a new process involving the injection of steam and solvents into wells to recover oil. However, the carbonate bed is neither uniform nor consistent, making economical bitumen recovery a technological challenge. Those who need to know what's happening in the wells must have access to high-quality, reliable data. Their analysis of the geological character of the reservoir and subsequent decisions are essential to the future of the company.

Integrated Data

The system is based on Emerson Process Management's (www.emersonprocess.com) PlantWeb architecture and DeltaV field automation technology with regulatory and supervisory controls, which manage the entire plant. DeltaV also manages all discrete pump and motor controls, safety and ESD controls, and volume standardization according to American Gas Association (AGA) requirements.



BIG DATA FEED

Figure 1 -- The Saleski Pilot Plant system architecture shows all the sources of data at the facility.

The control architecture (Figure 1) incorporates a DeltaV system with about 1200 I/O, half of which are analog, and smart field transmitters or positioners, about 95% of which are HART or WirelessHART. The architecture also includes Emerson's AMS Suite: Intelligent Device Manager asset management software, a utility/SCADA network to gather additional field data, and a data bridge to the corporate Pi Historian (OSIsoft, www.osisoft.com) in Calgary.

The architecture is primarily enet-based, which allows online access—locally or remotely—to nearly the entire process, including end devices, for monitoring, troubleshooting and maintenance. The use of field laptops or handheld devices is unnecessary—a nice benefit in the harsh northern Alberta winter. This system provides close to an online synchronized instrument index for the HART analog devices with no manual intervention, and it is 100% accurate.

The designers wanted to avoid problems observed elsewhere, such as poor tagging. One of the biggest early challenges was establishing a consistent, plant-wide tagging methodology, ensuring reliable instrument recognition for configuration, accurate measurement and reliable documentation. Uniform tagging is also the key to the integration of three separate databases. Tagging must be coordinated right from the start, and it can't be fixed later.

Asset Management

The AMS Device Manager asset management software offers a number of benefits, including higher plant equipment availability and lower maintenance costs. This application provides constant contact with all 600 smart field devices, enabling Laricina technicians to configure, calibrate and troubleshoot 95% of the plant's analog devices from the control room. Without this tool, technicians would have to go from device to device in the field, inputting data that could not be verified. Field-generated diagnostics identify developing problems online—a significant time and safety benefit.

This plant operates in a hazardous, often cold environment, and trips to the field can require lots of protective gear. Online access to diagnostic data frees plant personnel from handheld devices and reduces the amount of time they must spend in the field. Information about the condition of field equipment is used to determine the most convenient time for repair or replacement. When maintenance is needed, and a technician must go out into the plant, that person knows just where to go and what to take along because an initial evaluation is available right in the control room. This predictive maintenance has eliminated the need for one instrument technician per rotation, saving $400,000 each year, ongoing.

Easy annual verification of Coriolis meters, magmeters and vortex meters is another important benefit of AMS Device Manager. Factory and/or commissioning signatures archived in the AMS Suite database can be compared with current online signatures, eliminating the need to shut down process lines so meters can be visually inspected and/or calibrated. This plant is easily able to meet regulatory requirements for meter verification without losing information or productivity. That alone saves another $400,000 per year by maintaining production uptime, thereby satisfying one of the original design goals.

Using the Valve Link Snap-On application to AMS, one can also view factory and current control valve signatures, enabling plant personnel to determine if a valve requires maintenance during a planned shutdown. In some cases, an unplanned shutdown

can be prevented. Savings here have not yet been realized as the facility is still relatively new.

The AMS Suite database is synchronized and exportable, so all similar devices can be viewed in an Excel table and checked for configuration errors or inconsistencies from anywhere in the world. Laricina's system is all networked through firewalls. Corporate users can gain access from their desktops with user names and passwords. Those away from the corporate center must use a VPN connection. This remote access to field devices allows managers in Calgary to interrogate specific devices in the plant—and reconfigure them if necessary. Limited on-site resources make it important to have this remote assistance available 24/7.

Personnel from Emerson and Spartan Controls (www.spartancontrols.com), Emerson's local business partner in Calgary, also have access to the information for advance diagnostics, and to advise Laricina if and when maintenance is necessary.

All this functionality is available with very little software manipulation. HART Pass-Through, which is incorporated in DeltaV, is the main requirement. Once the system is up and devices attached, the AMS Suite database is automatically populated. The system is intuitive, so no special training has been needed for instrument and control technicians, and they all use it almost daily.

Utility/SCADA Network

A utility network was set up to integrate the 5% of field data that is not HART-enabled into DeltaV and ultimately to the Pi historian. The utility network is integrated via OPC using Kepware (Kepware Technologies, www.kepware.com) on the App station. Information from all SCADA, gas chromatograph, auxiliary PLCs on disposal wells, etc. is included. This network and the associated maintenance computer are also used to configure and troubleshoot the non-HART devices. Radar or other variables on multivariable transmitters are brought directly into DeltaV as secondary variables over HART.

The DeltaV data historian was configured to share information over a bridge to the Pi historian on the corporate network. This enables in-depth analysis of real-time process data by corporate-level users, who work to optimize field operations. It also facilitates reporting and other documentation for management and regulatory purposes. Drivers were chosen to ensure that the AMS Suite, DeltaV and Pi Historian databases are fully synchronized—right down to descriptions, units and instrument ranges. This nearly unified database is one of the top three features of this integrated system, the others being self-diagnostics and predictive maintenance, including meter and valve verification/analysis.

Getting the Job Done

This was a small project carried out by a compact team in a new facility with a relatively low I/O count (1200). It was very important for the IT department to buy into the PlantWeb concept. Without its acceptance and support, the team could not have achieved its goals. At some facilities, IT groups have created many difficulties in the implementation of control systems, especially those that are Windows- and enet-based. This plan and structure made the IT personnel feel that both their system and the operating system were secure. These huge issues were not taken lightly.

Costly manual monitoring and reporting was nearly eliminated with the PlantWeb design. Automatic reporting provides the highest level of data integrity to the management system. Because this information is helping to define an "unproven" reservoir, it is valuable and highly marketable.

Troubleshooting process upsets is much easier with the data synchronization in place. It greatly reduces mistakes and saves time. For example, when steam generators trip, operators are able to see simultaneously what was happening in the boiler's dedicated burner management safety system. The synchronized database enabled engineering to look at all events and process conditions in one timeline, enabling a quick discovery of the root cause of steam generator upsets. Automatic data synchronization alone saved the $150,000 per year that it would have cost to hire a person (at this remote location) to perform this function.

Results Achieved

The biggest benefits of this integrated, software-based system are availability of high-quality data through the corporate historian for efforts at the corporate level to optimize the carbonate bitumen extraction and processing technologies; cost reductions through faster configuration, commissioning and start-up, as well as meter health verification and reduced manpower; easier, error-free documentation based on accurate field-generated information and the synchronized databases.

Since this facility is not yet revenue-generating, it may not be possible to demonstrate return on investment in the traditional sense, but Laricina's automation investment of approximately $2.6 million was easily paid for in just six months. A number of innovative ideas have been brought together to produce better results than is the norm on similar pilot projects. As a result, the company has realized significant profits through the sale of process/reservoir data.

No matter how smart a DCS is, it can't overcome problems at the measurement level, so success often comes down to the management of solid instrumentation generating priceless information. In this case, the related data is more important than the number of barrels produced; Laricina just could not risk leaving data generation, acquisition,and management to chance. ■

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