



CUSTOMER CASE STUDY

Enbridge uses AVEVA pipeline solutions to operate one of the world's largest SCADA systems

Goals

- Replace 37 proprietary SCADA systems with one safe, high-availability commercial off-the-shelf (COTS) pipeline SCADA solution
- Modernize aging SCADA infrastructure to be up to date with the latest hardware and software operating systems to facilitate more secure and efficient maintenance programs
- Comply with API RP 1165, an industry standard for HMI pipeline management displays, for safer and more sustainable midstream operations

Challenges

- It was difficult to manage multiple disparate legacy systems as they aged and diverged from one another
- Maintaining proprietary systems required a diverse skill set and experience with the legacy systems
- Operations were inconsistent, and operators reported strain when using legacy consoles

Results

- **Human factors**—The new system improves operator wellness by reducing fatigue and increasing situational awareness
- **Safety**—HMI systems are API RP 1165 compliant, meaning they better support safe and reliable operation
- **Continuous improvement to operations**—Real-time decision support improves responsiveness and maintains safe operations

Solutions

- AVEVA™ Enterprise SCADA
- AVEVA™ Pipeline Operations for Liquids
- AVEVA™ PI Server

Monitoring the world's longest and most complex crude oil and liquids transportation system is challenging. With geographically dispersed and disparate operational control systems, managing the entire pipeline system holistically is a formidable challenge. That's why Enbridge decided that it needed the world's most trusted operations control solution to manage one of the largest pipeline networks in the world.

Enbridge Inc., a multinational pipeline and energy company headquartered in Canada, transports crude oil, natural gas, and natural gas liquids. Enbridge transports 30% of the crude oil produced in North America and nearly 20% of the natural gas consumed in the United States. To manage the liquids pipeline system more safely and sustainably, Enbridge wanted to digitally transform its monitoring and control system. Scaling monitoring and control capabilities across thousands of miles of pipelines and terminals, however, required replacing multiple proprietary legacy SCADA systems with one safe, high-availability commercial off-the-shelf (COTS) pipeline SCADA solution.

The primary challenge Enbridge faced was maintaining and supporting proprietary SCADA systems and accessing real-time data to make informed decisions. The scope of its project is incredibly ambitious: Enbridge is looking to merge several disparate SCADA systems and their supporting technology into one while the pipelines remain operational and without incident or interruption.

“We haven’t undertaken an initiative this ambitious in over 30 years. Back then, we had far fewer assets than we do today. We’re taking the right steps to improve our digital toolkit and lead the way in our industry.”

Scott Arndt

VP, Pipeline Control & Integrity, Enbridge

Rethinking SCADA for North America’s largest pipeline network

Enbridge had several goals for its SCADA Replacement Program (SRP). The first was creating a single SCADA system to replace disparate legacy systems. Enbridge’s existing HMI/SCADA solutions required diverse skill sets and experience to maintain, becoming more inefficient as they aged. Modernizing its HMI/SCADA solutions with one best-in-class solution not only addressed these technological obsolescence issues but also helped Enbridge to ensure its operations continued to run smoothly.

The second goal was to enable operators to perform abnormal situational management (ASM) by improving HMIs and increasing operator awareness. More intuitive HMIs reduce operator fatigue and improve decision-making, enabling operators to make smarter, faster decisions. The company remains committed to maintaining compliance with API RP 1165, a recommended practice for the design and implementation of pipeline SCADA displays.

Maintaining safety was a key requirement when selecting an off-the-shelf pipeline SCADA software. Enbridge needed to maintain built-in critical safety functionality, such as line blockage, to maintain safe and sustainable pipeline operations. The company also needed a scalable solution capable of integrating systems and equipment across the enterprise. The new system Enbridge deployed integrates more than 350,000 tags.

This multi-year project celebrated 50% completion in 2024. Enbridge is using AVEVA solutions to modernize 37 operator consoles. Enbridge used a phased approach, starting with a proof-of-concept phase, followed by a one-year front-end engineering design (FEED) study to gather requirements and design the system for the pilot phase. The successful pilot project convinced Enbridge that AVEVA solutions best met their challenging objectives to most safely and efficiently operate one of the largest pipeline SCADA systems in the world.

“I believe it’s important to establish shared interests and aligned goals when undertaking such a large, ambitious, and complex transformation in our mission-critical business operations. We selected AVEVA as our partner because they not only demonstrated this commitment but also showcased their industry leadership in SCADA solutions, which support over 70% of the U.S. oil and gas transportation sector.”

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Bhushan Ivaturi

SVP and Chief Information Officer, Enbridge

Operator awareness leads to safer, more sustainable pipelines

Enbridge’s colossal SCADA replacement project relies on AVEVA Enterprise SCADA for liquids pipeline operations. The system architecture is hardware agnostic, which makes it easier to update and maintain as pipeline assets change. The ‘intelligent midstream’ solution is robust, with built-in redundancy and high availability to ensure continuous operations.

API RP 1165-compliant HMIs and ASM implementations help improve pipeline operator awareness to stay vigilant in meeting operational and efficiency goals. The AVEVA Enterprise SCADA system is a key data source for real-time situation insights.

Reduced operator fatigue across the board

Enbridge’s new SCADA solution has delivered many early successes, including for its team members. Many operators have reported reduced fatigue at the end of their shifts and are enjoying the feeling of greater energy levels. This is due in part to an improved grayscale screen display with fewer flashing elements. The legacy system displayed a lot of information, all of which was relevant but not easily distinguishable for fast decision-making. The new solution uses color to highlight the most important information so that the operators can more easily interpret the details and respond swiftly.

On consoles that have gone live to date, many operators reported that they preferred the new SCADA system and would not want to return to using the older system. The new system’s display— with its design improvements—presents embedded and flexible trends that make operators’ lives easier since they no longer need to perform mental calculations, and the ability to build summary displays has improved worker efficiency and productivity.

There are significant elements of precision in the operators’ work. For instance, they need to pay very close attention to the metrics being displayed to ensure that the correct product is being transferred at the right time to avoid unwanted blending of products, which could result in wastage. Many operators also reported less eye strain at the end of their shift than they did when using the legacy system.

Improved operational control and safety assurance

The tasks that the operators need to undertake during a shift have not changed with the switch to the new SCADA system—they each make hundreds of decisions daily. When assets are operating under normal conditions, the solution ensures operators’ day-to-day tasks are streamlined, allowing them to focus their energy and attention on making the right decision. The solution provides added visibility of asset condition through color-coded display objects that focus on the most important information. This ensures that operators can swiftly respond to an unexpected change, known as an event, to minimize the impact of the event and ensure operational safety—for employees, the infrastructure, and the environment.

“The new system’s trending ability is more informative than the previous system. Generating trends is easy and fast, and the summaries available help to keep important information on one screen rather than being spread out over multiple screens. This helps us find anomalies and act on them much faster.”

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Keltie Pisani

SCADA operator, Enbridge



“The new rate of change graphics instantly tell us what multiple pressure waves are doing at a glance. Before, it took 20-30 seconds to get an idea of pressure waves across the whole pipeline. We can react faster and can keep operations running smoothly.”

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Blake Torok-Both
SCADA Operator, Enbridge

More effective training

Enbridge’s control center training program utilizes a sophisticated trainer/simulator system to evaluate operators’ ability to cope with emergency and abnormal operations. Since the integration of the new SCADA system on a suite of pipeline trainers, operators’ ability to recognize abnormalities quickly has improved significantly.

This improvement to Enbridge’s training program ensures that its operators are better positioned to handle out-of-the-ordinary situations and cope with any emergencies that should arise, thereby ensuring the safety of operations.

“Features like the rate of change bars and real-time, ad hoc, multi-point trending allow operators to identify and investigate anomalies more efficiently than on previous SCADA systems. From a user perspective, we have noticed that as we bring new operators into the control center, there is immediate interest and preference for the new SCADA system over the older systems. It isn’t uncommon for us to hear comments about new operator preference towards the grayscale screens and ease of use of the new AVEVA system.”

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Jeff Amundson
Supervisor, Liquids Control Centre Training, Enbridge

“The new system has had a positive impact on operations, and there has been a reduction in the number of events on the consoles that have transitioned to the new SCADA system. While there were challenges on a few systems as they transitioned, these have mainly been due to the familiarity of the new system, and once the operators became comfortable with the system, there were fewer events.”

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Jeremy Herd
Event Analysis Specialist, Control Centre Operations, Enbridge

“Our new AVEVA SCADA system is delivering increased visibility into historical trends and data, which has greatly improved our operators’ ability to make better, faster decisions. If they encounter abnormal operating conditions, they have the information they need to take swift action to ensure safe operations to employees, the infrastructure, and the environment.”

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Sean Evans

Director, Control Center Operations, Enbridge

Establishing a foundation for long-term intelligent midstream strategy

Enbridge is setting the foundation for a long-term ‘intelligent midstream’ strategy built on real-time data leveraging AVEVA Enterprise SCADA and AVEVA PI Server. Enbridge uses AVEVA PI Server for the calculation, advanced analytics, and reporting of many of Enbridge’s metrics, including its ESG sustainability metrics. For instance, Enbridge can monitor and control energy usage to reduce greenhouse gas emissions and conserve resources.

“We’re now more than a third of the way through this ambitious project, and we’ve faced many interesting and formidable challenges along the way. These will undoubtedly continue as we move forward. The strong foundation that Enbridge is building with its SCADA replacement program will provide us with a trusted data source for safe, reliable, and efficient pipeline operations, now and in the future – no matter what it throws at us.”

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Scott Arndt

VP, Pipeline Control & Integrity, Enbridge

A flexible approach to consuming software

Enbridge is working with AVEVA on several other projects in addition to the Liquids Pipelines SCADA replacement program. These include the modernization of field/station HMIs for the Gas Transmission Business, as well as using AVEVA PI System for the Power Renewables business.

AVEVA’s Flex subscription model provides all business units with uniform and streamlined access to the entire AVEVA industrial software platform. Its single contractual framework provides a cost-effective approach to enabling Enbridge to adopt different operational solutions across its business.