FIELDCOMM GROUP™ PLANT OF THE YEAR 2007

StatoilHydro

StatoilHydro Ormen Lange, Aukra, Norway
Plant of the Year 2007 Award Winner

By designing in the advanced communication and self-diagnostics capabilities of HART technology, Norway's StatoilHydro and its partners started efficiently delivering natural gas to the U.K. in 2007.

PROJECT OBJECTIVES

- Very reliable and efficient operation because of the size and remote location of the facility
- Harsh weather was very possible, extreme temperatures and challenging waves and winds would cause access problems
- The size of the facility, the on-shore plant is one square km, with a main control room and 10 substations.
- Create user friendly presentation of smart field devices to the operators
- Integration and data exchange between asset management and control systems

SOLUTION

- Added an asset management system to their control system to improve reliability during start-up and operation
- Engineered and built-in an infrastructure to take advantage of smart device information for predictive diagnostics
- HART-enabled instrumentation and valves communicate intelligent device diagnostics to the system
- Instrumentation performance and configuration problems were identified, investigated and corrected before the plant start-up
- Transition to a predictive maintenance strategy to lower costs and improve reliability

RESULTS

- Transitioned to a more predictive maintenance strategy saving time and money
- Now able to determine the root cause of problems

- Remote access to device information allowed some problems to be corrected from a safe location
- Created a robust video conferencing capability so that experts from around the world can meet virtually to help diagnose problems and propose solutions.
- They now have a much better overall view of the plant asset condition
- With alert reporting activated, work can be prioritized, scheduled, and tracked. Baird notes that so far fault diagnosis has been made very quickly, thereby enabling corrective action to be taken in a controlled manner. Often, this has allowed fixes to be made directly to the root cause of the problem.

When winter strikes, you need heat to beat back the cold. It would be best if the fuel were reliable, plentiful, and relatively clean burning. This year, consumers in the U.K. have a new source for that heat, natural gas and condensate pumped across the ocean from Norway's subsea Ormen Lange gas field. They'll warm water for tea, cook food, heat homes, generate power and otherwise use the fuel for years to come.

They're able to do so, in part, because of HART technology. Erling Ramberg is an automation lead engineer at the Norwegian oil company StatoilHydro. The firm designed the onshore processing facility that produces the natural gas and condensate shipped to the U.K. He notes that the goal was to be as efficient as possible and that HART-capable transmitters and valves were chosen for this and other factors.

"It has to do with size of the plant, of course, and the location out on the island. Also, we do not want to bring in more people than required," he says.

Because of its use of the advanced capabilities of HART technology, the Ormen Lange onshore facility has been named the 2007 HART Plant of the Year. This international award is presented to end user companies in recognition of their ingenuity in the application of HART technology. Recipients are plants that have taken the capabilities of HART instruments beyond configuration and calibration or are using the real-time diagnostics and process variables of HART-enabled devices to improve operations, lower costs and increase plant availability.

This plant was selected for their foresight and their ability to build the infrastructure to take advantage of HART capabilities in their intelligent field devices. They are very forward thinking and pro-active when it comes to moving to a predictive maintenance strategy that will lower maintenance costs and improve plant reliability.

Up from the Cold, Dark Sea

Discovered a decade ago by one of StatoilHydro's parent companies, Ormen Lange is a natural gas field off the Norwegian coast. It's large in more ways than one. It measures 40 kilometers long and eight wide. It also has proven gas reserves total nearly 400 billion cubic meters, an amount projected to be able to supply up to 20 percent of the natural gas needs of the U.K. for the next forty years.

But Ormen Lange is not easy to exploit. The gas field itself lies roughly 3000 meters below sea level, buried beneath an uneven seabed and sitting under 800 to 1100 meters of water. Situated 120 km off the coast of Norway, the site experiences some extreme natural conditions. There are subzero temperatures, whether measured in Fahrenheit or Centigrade, most of the year. The seas are stormy, with strong underwater currents.

Four companies are partners in the project that brought this fuel up from the bottom of the sea and into British homes: StatoilHydro, Shell, ExxonMobil, Petoro, and Dong. No one partner owns more than about a third of the project, with StatoilHydro in charge of development and Shell operation of the onshore processing facility.

As for project itself, it consists of a 24 subsea wells in four seabed templates. The output of the wells is sent in pipes 120 km to Nyhamna on the island of Aukra on the west coast of Norway. There the fuel is processed and readied for shipment to the U.K. via a 1200 km long undersea pipeline.

Ramberg notes that direct pumping of the fuel to shore-based processing won't be problematic because special steps are taken to prevent pipe-clogging due to freezing of the liquid. That's done with an on-shore monoethylene glycol (MEG) plant. They pump the MEG liquid out to the wells, inject it in the pipelines and transport it with the gas to shore to prevent freezing.

Meeting the Challenge for Less

Once onshore, the MEG is removed and reused. The fuel then has to be processed and readied for shipment to the U.K.

When designing the plant, StatoilHydro faced several constraints. One was the remote location, another was the sometimes harsh weather, and a third was the size of the facility. As finally built, the on-shore plant is one square km, with a main control room and 10 substations.

An overriding concern in the design was the need for absolutely reliable operation. No one, after all, wanted a consumer in the U.K. to turn on a burner and get nothing out because of a problem with a plant across the sea. The company, quite naturally, also wanted to accomplish all of its goals as efficiently and with as little onsite manpower as possible.

Ramberg recalls the technology selection process. Given the constraints, the ability to do predictive diagnostics was particularly important. With that capability, the health of a valve or other component could be gauged and maintenance could be done as needed. Valves wouldn't be changed out too soon, which would waste money. They also wouldn't be changed out too late, which could potentially jeopardize operations.

There were other benefits to having a wealth of diagnostic information. With the right data, it should be possible to identify the root cause of a problem. It might then be possible to correct the issue remotely, meaning fewer personnel would be exposed to harsh weather and possibly dangerous conditions. What's more the collection of data could, over time, lead to the elimination of some problems as root causes were identified and fixes implemented.

Because of the advantages of a communication rich approach, the company selected HART Communication technology to deliver the device diagnostic information they were seeking. The finished plant has about 1400 separate HART-enabled field devices connected on-line—full time. Of these, about 350 are valve positioners, with most of the rest transmitters. A handful of traditional 4-20 mA anti-surge valves are connected to HART multiplexers so that their data can be converted for communication.

Control is handled by an ABB system, with secondary controllers in the substations handling the interface between local devices and the plant-wide controller. As might be expected given the need for reliability, there are redundancies and intelligent approaches built into the setup. Some of these aren't those typically thought of or used. For example, there's a robust video conferencing capability so that experts from around the world can meet virtually to help diagnose problems and propose solutions.

After processing at the plant, the fuel begins a trek to the U.K., traveling 1200 km before arriving at a terminal at Easington at the other end. Ramberg said that it is a very long pipeline and thinks it is the longest subsea pipeline so far.

Operations Begin

With an eye toward full production over a span of months, the startup was an activity going on for weeks, but the actual startup was when they opened the valve to the well. That happened the 13th of September.

Ramberg adds that HART technology helped the plant meet its commissioning schedule. However, in some sense, his job is done. Starting in December, operation of the plant was taken over by project partner A/S Norske Shell, the Norwegian member of the Shell family.

Graham Baird, a condition monitoring engineer for A/S Norske Shell, will be one of those responsible for monitoring of the plant's day-to-day operations and health. He's had input in the design phase, particularly with regard to what's needed for operational monitoring of intelligent field equipment condition.

While there hasn't been a lot of operational data so far, what the HART-enabled technology has delivered is promising referring to the control system's asset optimizing package and device manager. Early indications are that they will have a lot of useful actionable data, as they are online continuously scanning the HART-enabled instrumentation.

With alert reporting activated, work can be prioritized, scheduled, and tracked. Baird notes that so far fault diagnosis has been made very quickly, thereby enabling corrective action to be taken in a controlled manner. Often, this has allowed fixes to be made directly to the root cause of the problem.

There also can be synergies with other non-HART condition monitoring systems. For example, compressor performance can be influenced by surge valve conditions, instrumentation calibrations, and so on. With more diagnostics data available, it's possible to cross reference between systems to establish why equipment may not appear to be performing according to design.

All in all, they get a much better overall view of the plant asset condition right now sums up Baird.

Baird explains that the use of HART technology and the wealth of diagnostic information it provides aligns with Shell's Total Reliability Initiative. Getting that more informative picture also helps plant operators rest easier at night. Having a large number of instruments and valves connected to the HART-based systems for diagnostics can help achieve a high availability for safety related instruments, critical process instruments and control valves. This gives plant operators the confidence that they have properly operating control equipment.

Thus, an intelligent application of HART technology helps keep the U.K warm. With the predictive diagnostic capabilities built into the system, the Ormen Lange plant should be able to do so in a cost-effective manner for years to come.