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Measurement & Analytics
Remote communications

Remote communications for upstream oil and gas operations

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Introduction

Oil and gas fields often span numerous square miles across remote areas that often lack cellular coverage. Extreme outdoor conditions are typical--intense cold, ice and snow, searing heat, heavy dust, high humidity, strong wind, torrential rain and salt fog. Data communications for oil and gas fields require reliable and resilient, high capacity wireless networks that operate over large areas under these extreme conditions.

Data from instrumentation and controls plays important roles in today's upstream oil and gas operations. Remote terminal units (RTUs), controllers, and measurement devices regulate and optimize well pad operations throughout widespread fields, creating efficiencies that save millions of dollars. Local and remote access to data and controls reduces costs for vehicle upkeep, gas, insurance and maintenance. Operators can handle more wells while driving less.

Well pads and fields have become production facilities necessitating centralized data transmission to and from remote locations in real time. These systems provide management the opportunity to supervise and control production from afar, while enhancing compliance with environmental regulations and improving operator productivity and safety.

Measurement and automation

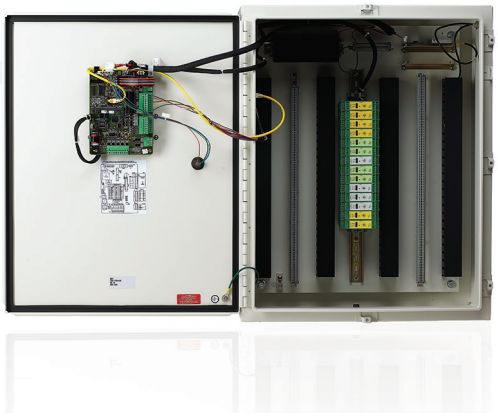
Horizontal drilling and fracture techniques have resulted in smaller environmental footprints for oil and natural gas production. Multiple wellheads can be consolidated in a small area. Sensors and instruments provide data for pressures, temperatures, flowrates, and level for wellheads, separation equipment and tank storage. One RTU can often automate and control the entire well pad with multiple wellheads while communicating with a remote central control room linked to multiple well pads in the field.

As wellheads age, production slows. Backpressure resulting from the buildup of oil and water halts flow from the well. Companies employ enhancement techniques to improve production. Techniques such as intermittent lift, plunger lift, gas injection, surfactant injection, and submersible pumps can restore well production to optimum levels.

Aside from optimizing production from individual wellheads, an RTU can be configured to measure and control nearly all the well pad functions. It can turn wells on and shut them off based on simple or complex algorithms to optimize production. Connected to appropriate sensors, it can measure the water, oil, and gas produced. It can also measure and control separator temperatures and monitor oil and water tank levels. It can shut down individual wells or the entire well pad in emergencies.

Control routines within RTUs for pumps that provide artificial lift can handle basic and on-off operations, and perhaps a drive to regulate operating speed for better energy management and improved production. Measurements from these devices include load, position and torque. Modern RTUs monitor measurements from each wellhead to automate these operations, removing some burden from operators.

Flowmeters in piping from chemical tanks measure and totalize the amount of fluid pumped into a well versus planned amounts. Flowmeters also totalize volumes of wastewater pumped into disposal wells. Pump drives control fluid flows while sensors avoid overfilling and spills.



Other equipment on the pad performs primary separation of oil, water and gas coming from the individual or multiple well heads. Instrumentation for measuring pressure and temperature control the separation process. Flowmeters measure the outputs from the separator--perhaps a Coriolis flowmeter for the oil, a magnetic flowmeter for water, and an orifice element coupled with a DP transmitter on the gas. The RTU looks at all these flow measurements and calculates the production amounts attributed to the wells and the water collected for disposal.

Custody transfer measurements come into play, whether for production piped offsite, or for tank truck loading and unloading. Systems record data such as truck number, driver name, and volume of product. Producers use the data to account, reconcile, and invoice. The records go to a central oil battery where the product goes into the piping system for transmission.

Communications for measurement and control operations on a well pad are usually direct wired and powered by solar charging and batteries. This permits well pad operations to continue autonomously for many days. Solar powered wireless communications provide key data that can be accessed centrally via a supervisory control an data acquisition (SCADA) system. In addition, data, control and optimization routines may be available for the operator to execute locally or remotely, as necessary.

Wireless transmission systems

Networking infrastructures for collecting and transmitting data from the field to centralized remote locations are evolving. Traditional unlicensed radio systems limit bandwidth. Wireless signals in fields with high-density drilling tend to compete, creating interference and signal drop offs. To support growing data demands, companies are transitioning from traditional radio networks toward meshing systems. Meshing networks boost bandwidth communications and the capabilities of remote routers.

Meshing networks contain multiple nodes and can self-correct. If a node fails, the network will search for alternate nodes and paths to transfer data. These networks connect to SCADA systems that deliver widespread data in specialized formats to central locations.

The volume of data generated in the upstream oil and gas fields is growing exponentially. At one time there may have been only a valve, one primary measurement device, and a wireless connection. Now there are multiple sensors for pressures, temperatures, flow rates, tank levels, valve positions, alarms, and other variables associated with safety and optimization.

The wealth of information available allows operators to reduce site visits and work safely during any necessary visits. At remote locations, the data becomes meaningful information for analysis and production oversight by management and a variety of users.

Additional functions provided by high bandwidth wireless network systems include:

Real-time video feeds and surveillance

Providing operations with remote situational awareness and information that can facilitate decisions, improve safety, and deliver early visibility into critical unfolding situations.

Security and surveillance systems

Enhancing facility security with electronic access control at entry points or secure locations in the facility; video security at gates or around the site perimeter

Asset tracking

Tracking and updating the location of fixed and mobile assets in the field improves operations and contributes to safety and security.

Mobile field workforce connectivity

Keeping workers in the field connected with access to SCADA data, instant messaging, email, and voice at remote sites even if they lack cell service is important for operations and worker safety.

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