



Case Study: Ecopetrol

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Opto 22 SNAP PACs to help
Colombia's National Oil Company
maximize output, securely monitor
and control pump sites*

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CASE STUDY: ECOPETROL

Systems Integrator SINCRON uses Opto 22 SNAP PACs to help Colombia's National Oil Company maximize output, securely monitor and control pump sites

THE CHALLENGE

Bogota-based Ecopetrol S.A. is Colombia's national oil company and one of the four largest petroleum companies in Latin America. With a rich history of oil exploration, research, production, and transportation, Ecopetrol owns and operates a vast network of pumping, refining, processing, and transportation facilities and equipment all over Colombia.

This extensive infrastructure includes oil fields, oil wells, refineries, ports, and almost 5000 miles of pipeline throughout the country. It also includes a multitude of pumpjacks, drilling equipment, and other oil pumping-related systems.

SINCRON Diseño Electrónico Ltda, founded in 1978, specializes in the distribution of industrial automation and control products for applications in oil, food, tobacco, publishing, dairy, and many other industries. Located in Cali near the Pacific coast, SINCRON has distinguished itself by extending its offerings beyond simply reselling automation and control hardware, and forming an independent systems integration division.

In this regard, SINCRON is well-known in South America for the talent and knowledge of its personnel, particularly in

keeping pace with the newest technologies and adapting to the constant changes of the automation industry. This has been most recently evidenced by SINCRON General Manager Gustavo Saa's introduction of the programmable automation controllers (PACs) to Colombia.

"SINCRON distributes and resells products from General Electric, DVT, and many other vendors. After evaluating competing technologies, we chose Opto 22's SNAP PAC family of programmable automation controllers to form the core of many new control systems we are deploying in applications throughout Colombia. These PACs are among the very first used in our country," notes Saa.

For many years, SINCRON has been the exclusive hardware distributor and integrator for Ecopetrol's pump-site monitoring operations. These projects have primarily involved proactive monitoring of pumpjacks, the motors or engines used to drive them, and the submersible pumps used to extract the oil.

In the past, this monitoring was accomplished using Opto 22 SNAP Ultimate I/O systems—an intelligent I/O processor and an assortment of analog and digital I/O modules programmed to track the status of the aforementioned equipment. Matters were slightly



Ecopetrol pumping site



An Ecopetrol pumpjack

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complicated by the fact that temperatures at these pumping sites often reached 95 °F with 95% humidity, which caused equipment temperatures to sometimes reach 130° or more.

Many of the pumping locations are also very close to the ocean, thereby exposing the pumping and control equipment to moist air and saltwater. The industrially hardened Opto 22 hardware, however, well known in the industry for its durability, was able to withstand these harsh conditions, as was the NEMA-4 certified OptoTerminal-G70, a mountable operator interface terminal Ecopetrol operators used to monitor and acquire data from the systems connected to the Opto 22 hardware.

But as successful as these Ecopetrol monitoring projects were, Saa knew that they barely scratched the surface of what SINCRON and Opto 22 were capable of providing. So when requests for proposals went out from Ecopetrol for not just monitoring, but also extensive control of 35 new pumping sites, Saa made sure his company won the bid.

A project team was quickly assembled and requirements were assessed. Among these were the fact that all of these sites were equipped with power but no Ethernet or internet access (wired or otherwise) was available—making data transmission a bit of a challenge.

Also, there was no consistency in the types of pumps and equipment used at each site. For example, the variable frequency drives (VFDs)—devices that control the rotational speed of the pumpjack motors by controlling the frequency of the electrical power supplied to them—at the pumping sites were provided by three different

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hardware manufacturers. Moreover, each of the three communicated using a different industrial protocol—HART, Modbus, and Profibus.

“SINCRON aimed to provide some level of uniformity for Ecopetrol and that began with our choice of Opto’s SNAP PAC,” says Saa. “We proposed the SNAP PACs because we knew that with them, we could design a system that could perform Ecopetrol’s required monitoring and control functions using the same configuration at each site.”

This configuration consists of a SNAP PAC stand alone controller and a SNAP I/O rack, on which reside a SNAP Simple I/O processor and assorted digital I/O modules (used for on/off and toggling control functions) and analog I/O modules (used to monitor and regulate devices that have a range of possible states or values.)

Also included in SINCRON’s standard configuration is an RS-485 serial module for communicating with Profibus or Modbus-based VFDs. The SNAP PAC controls the system, sending commands to the nearby Simple I/O units to operate motors that turn a pair of cranks, which in turn, raise and lower the pumpjack. The pumpjack bobs up and



Opto 22’s SNAP Simple I/O System connects to Ecopetrol’s oil pumping equipment. The SNAP PAC (top right) controls the system.

“Network segmenting ensures that the two Ethernet ports function independently... critical control functions remain up and running even if the wireless data transmission gets disrupted due to storms, antenna failure, etc.”

- Gustavo Saa, SINCRON General Manager

down repeatedly, causing the connected submersible pump to draw oil from the reservoir at the bottom of the borehole.

The SNAP PAC also captures viscosity readings and flowrates measured by analog modules that are connected to viscosity meters and flowmeters throughout Ecopetrol's pipeline. The SNAP PAC then uses these measurements to regulate the VFDs, increasing and decreasing their speed as needed to regulate how hard the pumps work and thereby maintain the desired preprogrammed flowrate.

Not to be overlooked in SINCRON's solution for Ecopetrol is the remote monitoring and data acquisition being performed.

“Communication between the SNAP PAC controller and the field I/O units is accomplished using a wired serial connection,” says Saa. “But Ecopetrol was very specific in stating that it needed flowrates, pump statuses, and other data from its sites communicated to Ecopetrol headquarters. Because the pump sites are up to 30 miles away from the headquarters, this communication had to be wireless.”

SINCRON used Ethernet radios to set up a wireless Ethernet network at each pumping location, and then established connectivity with the corporate network using a directional antenna permanently installed at Ecopetrol headquarters. No wireless repeaters were needed, as the size and power of the antenna is large enough to extend across the Colombian landscape and receive signals from all the pumping sites.

SINCRON's expertise with Opto 22 technologies also helped them design Ecopetrol's system to take advantage of the SNAP PAC's network segmenting features.

Saa and his project team used ioProject Professional—advanced software used to program, develop HMI screens for, and establish communication to Opto 22 SNAP PAC

systems—to create a data acquisition strategy that utilized the SNAP PAC S controller's dual Ethernet ports. At each pumping location, one port is used to communicate with and command the SNAP Simple I/O units, and the other port is used to send the flow rates, on/off status and other operational data back to headquarters.

“ioProject Professional has highly sophisticated programming features,” adds Saa. “Network segmenting ensures that the two Ethernet ports function independently, not slowing each other down, and more importantly, existing as two completely different network applications. This ensures that the more critical control functions remain up and running even if the wireless data transmission gets disrupted due to storms, antenna failure, etc.”

Network segmenting also protects Ecopetrol from those who might have access to the corporate network—authorized individuals or hackers who might gain access illegally—from infiltrating and either purposefully or accidentally altering or disrupting the pumping operations.

To date, SINCRON has installed Opto 22 SNAP PAC systems at 35 Ecopetrol locations throughout Colombia. The application has been so successful and become so well-known that other oil companies in the country have



SINCRON established a wireless Ethernet network at each pumping location for transmitting operational data back to Ecopetrol headquarters.

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approached SINCRON about setting up similar projects at their pumping sites.

Case study originally written in 2006.

ABOUT OPTO 22

Opto 22 was started in 1974 by a co-inventor of the solid-state relay (SSR), who discovered a way to make SSRs more reliable.

Opto 22 has consistently built products on open standards rather than on proprietary technologies. The company developed the red-white-yellow-black color-coding system for input/output (I/O) modules and the open Optomux® protocol, and pioneered Ethernet-based I/O.

In early 2013 Opto 22 introduced *groov* View, an easy-to-use IoT tool for developing and viewing mobile operator interfaces—mobile apps to securely monitor and control virtually any automation system or equipment.

Famous worldwide for its reliable industrial I/O, the company in 2018 introduced *groov* EPIC® (edge programmable industrial controller). EPIC has an open-source Linux® OS and provides connectivity to PLCs, software, and online services, plus data handling and visualization, in addition to real-time control.

All Opto 22 products are manufactured and supported in the U.S.A. Most solid-state SSRs and I/O modules are guaranteed for life.



The company is especially trusted for its continuing policy of providing free product support, free training, and free pre-sales engineering assistance.

For more information, visit opto22.com or contact

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