Clean Energy in Azerbaigian

TecnoQuadri has installed a supervision system that manages an impressive photovoltaic park in Azerbaigian.

Eight thousand solar panels, located in the Naxçıvan Automonomous Republic in Azerbaigian, for a photovoltaic park of twenty-two megawatts that produce 30 million KiloWatt-hours a year at full capacity with a CO2 emission savings of about 18,000 per year.

The photovoltaic park, which contains eighty-one thousand photovoltaic panels, has been installed over twenty hectors of land. Just to give a clearer picture of the immensity of the site, try to imagine the panels placed horizontally next to each other for a distance of around a hundred and forty-seven thousand square meters.

The Naxçıvan Automonomous Republic is a landlocked exclave of the Repubic of Azerbaigian. The region covers 5,500 km² (2,100 sq miles) and borders with Armenia, Turkey and Iran. It is an extremely arid and mountainous region with great salt deposits. However, with the implementation of irrigation systems, its agriculture is able to include cotton, tobacco and grains such as barley and wheat as well as floriculture products. Sheep breeding and rearing prevails in the driest areas.

Their major industries include the mining of minerals such as salt, molybdenum and lead. Other industries include cotton ginning, silk spinning, fruit canning and tobacco products. TecnoQuadri started up in 1989 as a company dedicated to building electric switchboards for distribution, automation, customer service and maintenance.

It subsequently branched out to specialize in

realizing systems for industries and automatic machines. TQ is distinguished by its versatility and availability towards customers to solve their problems.
Their natural growth and development has enabled them to complete its product offerings with the management and programming of PLCs and supervision systems for machines and production sites as well. With the advent of renewable energy, TQ specializes in design engineering, building and installing field and interface electric boards for the photovoltaic sector.

LTQ can create data acquisition and monitoring systems on SCADA platforms mainly for production plants and any other application that needs it. With regard to waterworks and purification systems and plants, TQ design engineers and create telemetry systems for remote control and monitoring, data storage and remote alarming:
TQ is the Lacrois Sofrel System Integrator for whom Progea has developed a specific communication protocol.

TecnoQuadri's main activities are electro-technical and electronic design engineering, electric panel engineering, machine cabling, industrial plant engineering, PLC and Supervision software design engineering. The sector in which TQ are particularly active are: the Energy, Packaging, Chemical-Pharmaceutical,

"Thanks to the OPC UA communication protocol developed by Progea especially for the SOFREL devices and available on the Movicon.NExT platform, it was easy to exchange information between the field and the supervisory application."

Gianni Poggialini
Software manager TecnoQuadri SNC di Donati F. & C.

Building Automation, Water Treatment and Purification, Food & Beverage, Wood, Wine Cellars and Brick manufacturing.

Project Objectives

The projects has been designed and developed to allow the site's operators to interact in a simple and quick way.
The project also caters for the less experienced operator in both supervision software and in managing production sites of this size.

With this in mind the basic idea of this project was to permit operators, including those with less experience, to become familiar with the process and gain easy control of the site to make it more productive by means of using a simple supervision system.

Handling Big Data

The most important function of this project is without doubt managing enormous quantities of data collected from field devices. In fact, about 1700 pieces of data are received from the Sofrel electric panels for each inverter daily.

Overall around 230 thousand pieces of information transit daily from RTUs to NExT's Historian database for a total of about 7 million a month.

Information is reprocessed at regular intervals by means of the SCADA's scripts and MySQL procedures and centralized in optimized database tables. These tables are then used to manage data analysis and reports which are needed by operators to understand the site's running status.

The application

- The application is installed in a control room and has the following fundamental features:
- One unique interface to control the running status of entire photovoltaic site. This site has expanded with time and consists of inverters, network analyzers, protection and sensors to detect environmental conditions, such as irradiation, temperature, wind speed and direction, of various brand names.
- Round the clock control of the entire photovoltaic site with the immediate interception in the event of malfunctioning

"One of the main reasons that drove us to choose Progea's Platform was its versatility. I would also like to point out the importance of Progea's technical support services. I found them to be always quick to respond and ready to solve problems encountered during the project development stage."

Antonio Savelli Business owner of TecnoQuadri SNC di Donati F. & C.

Movicon.NExT

A flexible and modular solution for any type of application

in order to restore the site back to normal working order without causing any production downtimes.
- A data archiving system which stores all data relating to electric quantities of the site's inverters and environmental conditions so that subsequent analysis can be run on the efficiency status of each inverter.
- An analysis of historical data represented on graphs and tables to help operators verify whether all the site's devices are working properly and efficiently.

System scope

The scope of the system is to monitor and control the 22MW photovoltaic site composed of a 20MW system and a 2MW system. The 20MW system consists of 80 250kW Ingeteam inverters. The 2MW consists of 41 50kW ABB inverters. The Sofrel S55O remote terminal units have been installed in each substation on the field with a grand total of 14 altogether. Each S550 RTU collects:

- In 485, by means of Modbus, data deriving from neighboring inverters and network analyzers.
- In digital, the status of the electrical panel's switchgear.
- In analogic, the data from temperature, irradation, wind speed and direction sensors.

Each RTU, in Ethernet with TCP Modbus protocol, makes its data available to the SCADA by means of the FR1000 (Front end). The backbone of Ethernet network is made up of optic fibers and a switch has been installed in each location where a RTU resides. The network branches off to the various devices in copper from each switch.

The architecture

The site is managed by a supervisory PC installed in an air conditioned Control Room in which runs an application developed with Movicon.NeXT using a SCADA PRO 10K tag runtime license with the Driver Pack Telemetry option. Movicon.NeXT uses SQL Express for default but you can use other databased by simply changing the connection strings. In this case, data read from the field are stored in a MySQL database.

Softrel's FR1000 front-end and OPC server, guarantees connections between the 14 Sofrel S550 RTUs and the supervisory system. As already mentioned, Progea and Sofrel worked together to implement the communication protocol with tools on the SCADA. The FR1000 is a remote management software interface with Ethernet communication and is open to industrial supervisory systems. Thanks to exchanging data through a dedicated communication driver, information quickly reaches the supervision system and, as a consequence, is immediately available to the operator.

Results

Once the application had been installed the results were soon evident both in security and management efficiency. The installed system performs well in managing alarms and helps resolve malfunctions efficiently and effectively, as alarms are immediately sent to the SCADA which displays them.
In the event of an inverter malfunction, the operator can navigate the screens until reaching the page relating to the inverter in question in order to find all details on the anomaly. Therefore, and in the major part of the cases, the operator is able to have all the information that they need straightaway in order to know how to react and solve the detected problem before physically attending to the inverter.
In addition, the comparison graphs show real-time electric data of several inverters which make it possible for operators to intercept visually malfunctions of an inverter that otherwise would only be detected afterwards when analyzing Energy/Irradiation data stored in the database.

Another very important function is the Derating management. The thermal derating reduces the power of inverters to prevent components from overheating. The inverters work at Maximum Power Point level when running normally. This operation point is set in such a way that the power resulting from the ratio between the voltage rate and the PV current is equal to the maximum power rate. The position of the Maximum Power Point changes continually according to the irradiation and temperature of the PV modules. The temperature derating is needed to protect the inverter's sensitive semiconductor components from overheating. When the monitored components reach the maximum temperature point, the apparatus switches over to run at lower power point. This is done by gradually lowering the power. In exceptional cases, the inverter turns off completely. Once the temperature of the components in question goes below the critical value, the inverter restores the optimal working point. The real time visual signaling of the Derating status of each of the site's inverters and its cause permit prompt intervention by operators without disturbing its production efficiency.

Conclusion

Our choice fell on the Progea software, as our search for a supervision platform was aimed at systems that we already knew about and had developed drivers for the Sofrel remote terminal units for remote control and management. These Drivers had to permit the RTU variables to be imported by the SCADA to collect real-time and historical data. In addition, the supervision software had to be easy to manage and visualize as well as archive the vast amounts of data which is collected and logged daily by the Sofrel remote control systems. Progea met all our demands.
The project stared in August 2017 and finished in June 2018.

Antonio Savelli
Owner of TecnoQuadri SNC of Donati F. & C.

Gianni Poggiolini
Software Project Manager