

Without going into the long list of accomplishments, a refinery in Southwestern Ontario has demonstrated repeatedly its ability not only to remain on the forefront of technology but to successfully integrate existing non state-of-the-art processes with the newest the industry has to offer.

So when the Sarnia refinery chose to become a market participant with the Independent Electricity System Operator (IESO), and have the ability to sell electricity onto the grid, they understood the advantages of leveraging some of their existing equipment when integrating it into a new required metering system.

The facility approached Rodan Energy and Metering Solutions Inc. to be their service provider for the upgrading that included establishing a wholesale revenue meter point and power monitoring system. The system would need to maintain as much of the existing metering as possible while upgrading to an Ethernet network that would provide data electronically to the IESO, the refinery SCADA system and to Hydro One in the future.

What they found

The initial audit of the distribution system performed by Rodan found two parallel feeds (20 MW and 15 MW respectively) to the plant with a normally closed inter-tie connecting the two. Two existing meters monitored the primary side of the main customer-owned transformers, as well as four ION 7650 power quality meters on the distribution feeders.

Included in the audit findings was an existing non-blondel metering installation on the primary side of the zig zag transformer that would need to be upgraded to the IESO standards.

Metering solutions

As a market participant, the refinery needed to supply the IESO with data from both a wholesale metering point on the incoming service and the operational data available from the distribution metering system on the secondary side of the transformers.

Historically, they had monitored their main incoming feeders with Power Measurement first generation power meters. When they needed to upgrade to meet the IESO standard, a continuation with the ION meters was a natural choice. For the two wholesale metering points, Rodan standardized on the ION 8600 meters for their ability to provide revenue data, their power monitoring functions, and for their compatibility with multiple systems including both the IESO and SCADA systems and the future Hydro One SCADA system. On the distribution side, Rodan selected the 7650 ION meter because of its similarity to the ION 8600.

Due to the large amounts of data being collected from the system, Rodan recommended the inclusion of the ION Enterprise power monitoring software in the project for its ability to access both revenue and power quality information in real time and for the easy integration of the existing meters into the new system. By installing the power monitoring software the facility gained the ability to monitor in real-time their

power quality up time which for a facility that produces 72,000 barrels of oil a day using a power sensitive process was an important consideration.

At the Sarnia refinery, where the main refining processes are being fed on the same system as the support services, including product quality monitoring, water treatment, emissions monitoring, and pipelines; the pumps, motors, variable speed drives and computers associated with these services often create higher order harmonics that can severely handicap the power quality of the system. By having the ability to monitor the effects of the harmonics, operations staff could install the necessary mitigating equipment to protect the process.

In addition to the metering upgrade to conform to the IESO standards the instrument transformer configuration for the non-blondel installation required reworking that included six new current and voltage transformers.

Monitoring

The meters are equipped with additional inputs and outputs that make provisions for monitoring the status of breakers through an expansion block that connects directly to the meters. In this case, rather than using the Power Measurement expansion block Rodan tied a standard Modbus PLC to one of the communications ports and used it to monitor the input/output that was required by the IESO: the breaker status on the mains and tie-breaker status. These statuses are monitored by both the SCADA system and the IESO operational SCADA system.

The network

Much of the strength of a power monitoring system and its meters is its ability to communicate over the Ethernet network and provide data to multiple parties at multiple levels: to the IESO MV90 system, both revenue settlement data and operational data; the facility SCADA system, and the future connection to Hydro One's province wide SCADA system. Unfortunately for many metering systems, and this is no exception, the ability to tie a device into an Ethernet network was not foremost in the designer's mind at the time of installation. As a result, special consideration needed to be given to integrate the legacy equipment into the upgraded monitoring software.

Both the revenue and distribution meters are connected to the ION power monitoring software using Ethernet communications and the information is brought in to the power monitoring system and stored locally on an SQL database where it can be analyzed by engineering, operations, and accounting staff before being archived. The legacy meters that are not equipped with Ethernet communications are tied in using a RS485 network and the information is brought back using the Ethernet meter as a gateway to the power monitoring software.

Through the Ethernet network and the modem connection the interval data is uploaded to the IESO daily to facilitate a timely and accurate settlement by the regulator. The operational data that is supplied to the refinery SCADA system is also provided in real time and allows for quick recognition and action on problems or peaks that arise.

Future Network Considerations

In the future, when Hydro One requests the operational data from the main feeders of the network so as to complete their knowledge of the distribution system, a connection is available through a serial connection using either the ION native protocol or the modbus protocol. The final port is currently not configured but has the option of being configured with a utility monitoring protocol DNP to serve up information to a local or province wide SCADA.

Conclusion

In the course of becoming a market participant, the refinery has not only gained the advantages of participating in the Ontario electricity market but has gained a power monitoring system that enables them to establish a complete picture of their electricity usage and provides real-time analysis of power quality and demand. With an established baseline of electricity usage, the refinery is in an excellent position for assessing current electricity needs at the plant and being able to accurately evaluate the electricity costs for planned expansions or ones that are not yet on the drawing board. With the capacity existing for the connection to Hydro One with room left over for the possibility of future Demand Side Management or Generation the facility is set for anything the future brings.