Bakersfield Refining Company Ensures Productive Operations with Advanced Power Monitoring

EQUILON ENTERPRISES LLC

Bakersfield Refining Company is part of Equilon Enterprises LLC, a partnership between Shell and Texaco. Their Bakersfield, California refinery has a capacity of 70,000 barrels a day. But without reliable electric power the refinery stops operation. Restarting a refinery after an unplanned outage is extremely difficult and expensive.
 The Bakersfield site had experienced unplanned power interruptions. But a lack of reliable electrical information had prevented engineers from determining the causes and making appropriate corrections. The production disruption and cost associated with electrical problems prompted refinery personnel to begin a search for a complete power-monitoring package that would capture plant electrical conditions and events. Such a system was expected to enable system analysis and outage cause determination so that appropriate corrective actions could be taken to eliminate continuing outage problems.

EIG's Total System Solution

The Bakersfield Refining Company had experienced several disruptions to operations related to their electric supply. They expected that most disruptions were due to the electric power supply. They also recognized the possibility that some problems could result from refinery operations. Without adequate monitoring it was difficult or impossible to determine the causes conclusively. After a review of what they did know, plant management decided to investigate a plant-wide power monitoring system. Electrical Reliability Engineer Chuck Soderstrom and consulting engineer P.R. Calkins were assigned to identify the system key requirements and select a vendor. They decided to monitor all medium voltage feeder circuit breakers feeding the plant. The ability to do event reconstruction after a power supply or power quality event was deemed a critical requirement.

project thumbnail

Application

Oil Refinery

System

Nexus 1250 Monitors

Power System Supervisor power monitoring software

Plant Ethernet LAN

Benefits

Improved plant electrical monitoring

Instantaneous alarm reporting (local and remote)

True sequence of events recording for outage reconstruction

Electrical equipment loading history

Scalable architecture for simple expansion

Electro Industries GaugeTech

The key elements of the monitoring system are listed in Table 1.

Chuck and P.R. instigated a search for power monitors and a monitoring system that would meet their requirements. Initially, they considered three different systems. Ultimately, they chose a total system solution from Electro Industries/GaugeTech. The EIG system consisted of the Nexus 1250 power monitor for each of Bakersfield's 14 feeders and the Power System Supervisor 3.0 system monitoring software.
The Nexus power monitors coupled with the Power System Supervisor system provided a total system solution that matched Bakersfield's
The Nexus 1250 power monitor

provided high accuracy measurements of all electrical parameters. It included connection to the plant's Ethernet LAN for easy data collection. The meter's high-speed status inputs monitored circuit breaker status to provide immediate notification of breaker operation. But the high-speed monitoring also provided a one millisecond resolution event recorder to track events exactly. The Nexus' IRIG-B input for time synchronizing was connected to a standard GPS clock output. The IRIG-B time signal is commonly used in electric utility protection systems to achieve exact time synchronization across large systems.

Table 1:

system requirements

- Monitor volts, amps, and power values for each feeder circuit breaker.

- Record Voltage transients to capture sags and surges

- Record waveforms during voltage transients or fault conditions.

- Record voltage and power values for load analysis

- Provide event recording with mill resolution on events.

- Provide time synchronizing a the entire plant to aevent analysis

- Install monitors on existing plant Ethernet LAN

- Provide System Information at central location and in plant

The Nexus 1250 monitor includes extensive historical, power quality and waveform logging. The waveform recording capability provides precise and accurate waveform recordings of up to 64 events.
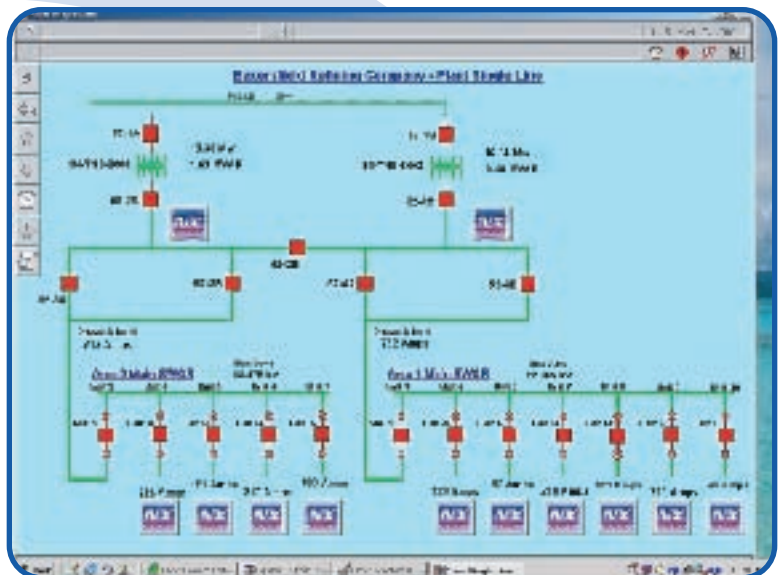
The Power System Supervisor system is a full-featured, open protocol monitoring and control system. It provides complete monitoring and control functionality with the inherent power of open communications design. It typically communicates using Modbus protocol but can be configured for DNP3.0 and numerous other protocols. It can communicate with devices from dozens of manufacturers using the device protocol.

PSS supports communication connections via Ethernet, RS-485, RS-232, and telephone.

The Bakersfield Refining Company system utilized the existing plant Ethernet LAN. This enabled complete power monitoring without the expense of installing a dedicated LAN. PSS' advanced communication management features minimize LAN traffic to allow it to co-exist on existing LANs.

EIG's Nexus Communicator software is seamlessly integrated into the Power System Supervisor software to provide a complete system of reporting with automated downloads and in-depth analysis of present or past electrical power conditions.

Project Results

The PSS software was installed on a dedicated server running Windows NT 4.0. The server was installed on the plant LAN. The Nexus monitors were also connected to the plant LAN using a Modbus gateway. With all devices accessible on the LAN the data can be viewed from many locations throughout the plant.
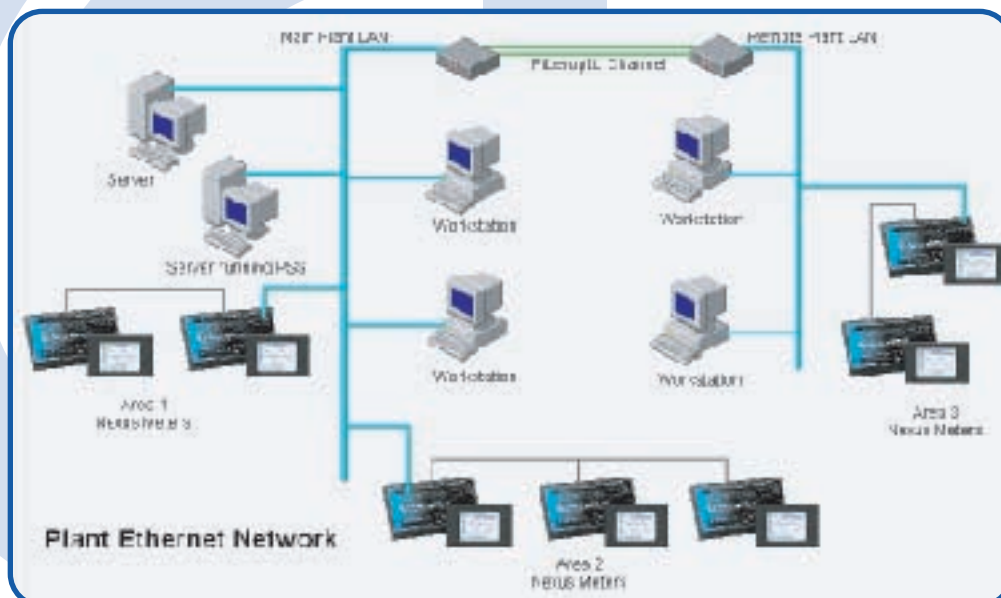
The PSS software includes the ability to allow user logon from any location. The software key tracks simultaneous users so it is not necessary to have a hardware key at each user location. The Bakersfield system included an additional display client to enable operating and engineering personnel to monitor plant conditions from any location.

In addition to real-time data through the PSS system, the total system also automates downloads of stored data from the Nexus monitors. All stored data (historical logs, event logs, PQ logs and waveform logs) are automatically downloaded to the server on a pre-determined schedule. This makes it unnecessary for users to track and perform downloads manually, although they can perform a manual download if needed. The automated download process makes system data available on a common server for convenient viewing through the supplied Log Viewer software.

Since the system has been installed, engineer P.R. Calkins has seen several events that have proven the value of the system. In one case, using the information from the PSS system and the Nexus historical data, plant engineers were able to identify a loading condition that was causing severe overheating in a transformer. Left unchecked the condition would have certainly resulted in premature transformer failure and an extended, unplanned outage. As a result of this single event, P.R. has been able to conclusively demonstrate to management that the system provided the expected payback in ROI.

Project Statistics - Monitoring System

- 14 Nexus 1250 power monitors with 2 MB RAM and LED display

- 4 Ethernet LAN Modbus gateways

- 4 GPS satellite clocks with IRIG-B output

- 1 Power System Supervisor monitoring software package with license for 500 data points and two simultaneous users.

- 1 Pentium III PC with 256 MB RAM running Windows NT 4.0

- Refinery 10 MHz Ethernet LAN with gateway/router between main refinery and satellite facility

Plant Electrical

- Four substations (three serving 12.5 kv feeders and one serving 4 kv feeders.

- 14 electrical feeders

- xx MW total load

System Design

- One control menu screen

- Four plant single screens (one for each station)

- Two trend screens

- Three alarm screens

- One primary server

- One display client