ELECTRICAL

By Mo Rousso

Going beyond basic power monitoring to prevent system failure

Many large electric power consumers feel secure in owning and maintaining their own high- and medium-voltage transformers and power-switching equipment. Once installed, there generally is little maintenance required, and the system goes largely unnoticed and is essentially forgotten.

But there are risks, and the consequences can be severe. Water and wastewater treatment facilities are particularly sensitive to unplanned power interruptions that can result in serious damage to the transformer itself. Without power, these facilities are unable to deliver the services the public expects.

Power monitoring can help. Real-time monitoring and alerts of critical power distribution irregularities can provide early notifications of potential failure, indicate where preventive measures could be taken and prevent serious damage to the system.

Case in Point

Basic monitoring systems alone quite often are not enough. Sometimes, that lesson is learned the hard way.

In July 2009, Helio Energy Solutions installed basic energy and power monitoring at a large commercial facility. The basic monitoring system captured the utility meter pulse data and recorded it at 15-minute intervals. Pulse data provides only kilowatt-hour energy consumption information (as opposed to all three power phases), and, when integrated over time, can provide gross power in kilowatts.

In September 2011, a power system failure of one of two high-voltage power transformers resulted in complete power interruption to the facility and subsequent destruction of the transformer. The power transformer was one of two original units installed during the original construction 20 years earlier. Post-failure analysis identified, among other things, the absence of detailed energy and power monitoring as a potential contributor to the failure. Pulse data from the utility meter is quite limited and could not provide any foresight about the pending failure of the system.

As a result of the catastrophic failure, power monitoring was identified as a requirement for transformer recommissioning. In early 2012, a replacement high-voltage power transformer was installed. Helio Energy Solutions installed advanced monitoring, PredictEnergy Software, at each of the two power transformers with detailed one-minute sampling and a comprehensive list of data monitoring parameters. The advanced monitoring is performed by inductive meters capturing a wide range of electrical, energy and power parameters on all three power phases. These parameters—including voltage and current by phase, along with power factor and phase angle—give great insight into the health and function of the transformer when evaluated on an ongoing basis.

A Hidden Risk

The aforementioned example of power distribution failure represents a hidden risk known to the many large electrical power consumers who own and maintain their own high- and medium-voltage transformers and power-switching equipment. This type of equipment often is overlooked in the risk mitigation process due to its low or nonexistent maintenance requirements and lack of visible interaction with facility personnel and site process.

Water and wastewater treatment facilities have a continuous need for a large power draw to provide service to the community uninterrupted. Monitoring the output of these large, expensive assets with inductive meters can mitigate substantial risks by showing the need for preventive maintenance and insight into pending equipment failure.

Operational Load Parameters

Inductive meters are capable of providing continuous data monitoring of fundamental power quality information. Real-time monitoring and alerts of critical transformer operational parameters are key to protecting these large electrical assets. PredictEnergy's advanced monitoring and analytics demonstrate accuracy over a wide range of parameters to provide conditioned observations of these critical electrical components. The most important parameters to observe are line and phase parameters for comparison, along with power factor and load condition parameters.

Examples of these categories include:

- Line voltage, power, energy and current;
- Phase level voltage, power and current;
- Power factor;
- Reactive power;
- Apparent power;
- Frequency; and
- Temperatures.

The combination of the level of data granularity and the capability of the software analysis creates a powerful, extendable environment with analytic tools to support electrical distribution asset management and risk management.

Visibility & Early Warning

Beyond the detailed visibility provided by the inductive meter, a complete set of alarms and alerts enhances the facility maintenance team's understanding of the asset's conditions, especially as related to the current energy environment, and in relation to other critical energy components and sources. Alarms identify out-of-tolerance data parameters. The alarm levels and settings are customizable by user, allowing filtering of false indications.

Many sites are fed by some form of onsite distributed energy generation. Depending on the load distribution and number of transformers, it is possible for the generation system to produce more energy than is consumed by the site on a single transformer. This can result in automatic disconnects from the generation system even though the overall facility consumption exceeds total energy production.

Analytics can be created to not only present, but also predict this type of pending loss of distributed generation and subsequent harsh loading of the transformers when large power supplies fall off abruptly. Unique power distribution challenges exist frequently, especially at older facilities.

Many wastewater treatment facilities have non-standard power distribution architecture. This takes many forms, such as multiple transformers feeding imbalanced loads with open or closed ties, older switchgear and mixed-age equipment. Wastewater treatment facilities vary widely in origin, layout, age and utility infrastructure interface. The customizable capability and data acquisition flexibility of PredictEnergy eliminates having to select a prepackaged system that may work well in some applications, but not at all for others.

Extending Current Capabilities

Incorporating detailed level power monitoring to support power distribution risk management efforts can provide significant value to wastewater treatment utilities through early notifications to pending failure and preventive maintenance support and verification.

The PredictEnergy software toolset is a simple solution to electrical power distribution visibility. The trend analysis capability readily supports fault tolerance notification with customized user settings. Basic load analysis monitoring supports planned maintenance and is readily upgraded to provide additional information like transformer temperatures. Alerting and alarming features add a real-time response component, which creates actionable feedback to onsite operators.

The software tracks and provides real-time data on power flow, identifies potential system failure before it happens, and alerts users to the system's overall integrity, or lack thereof.

In short, it tracks what can easily be referred to as a moving target, so that users can keep the bull's-eye within their sights and maintain power to their facilities. WWD

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