Conducting a Power Quality Analysis

The goal of a power quality analysis is to identify sources of electrical transients to improve the operation and reliability of the electrical system. Specific scenarios that may lead to a power quality analysis include:

- Resolving ongoing equipment issues
- Investigating the root cause of equipment failure
- Trend monitoring of RMS voltages and currents
- Measuring total harmonic distortion (THD) in voltage and current

Capturing electrical power transients is challenging. Severe voltage spikes may occur only a few times per year, and may last only one millisecond. A good power quality meter (PQM) includes event triggering logic and large memory storage to help capture and record these events. The most important part of conducting a power quality analysis is knowing what transient types to look for and where to find them. The following is preparation work that will improve the outcome of this analysis:

1. Gather electrical system diagrams and identify problematic equipment. This will be used to determine where to hook up the power quality meter(s).
2. Collect fault logs and operator manuals for problematic equipment. If possible, involve the equipment manufacturer to better understand which types of electrical events may cause the recorded faults. This will be used in setting the event trigger types and thresholds.
3. Understand that power quality events do not happen every day; it may take weeks or months to gather the appropriate amount of data. Consider a multi-phase approach, such as a one-month initial monitoring period with a six-month follow-up monitoring period. This allows an initial report to be generated while additional data is being collected.

Some owners/operators may not be comfortable conducting a power quality analysis on their own. When hiring third party consultants, be sure to have thorough discussions about the desired outcome. A good power quality report will not only include data, but also conclusions and recommended actions to improve the reliability of the electrical system.

Owners/operators that wish to conduct a power quality analysis "in-house" need a high-quality power quality meter. The Dranetz *Handbook of Power Signatures* is a good reference when interpreting the data.

Installing permanent power quality monitoring equipment is another great option. Long term monitoring of power quality ensures that intermittent faults and one-time events are captured and recorded. This improves the ability to resolve electrical related problems that may happen on-site.

Electrical Safety Warning

High voltages pose significant risk of electrical shock. Only qualified individuals should access or work on high voltage circuits. De-energize equipment, follow lock-out / tag-out (LOTO) procedures, and use appropriate personal protective equipment (PPE).

A common mistake in power quality analysis is using root mean squared (RMS) trend data as "proof" that voltage transients do or do not happen. Keep in mind that RMS values are calculated over a time of approximately one second. This means that any transients faster than 1 second will not show up in the data. For example, a 2000V spike may show up as less than a 1Vrms increase in the RMS trend data. Fast electrical transients require high-speed data acquisition with sophisticated event triggers and thresholds.

Figure 7 illustrates which transient types can be captured with RMS trend data and which require a power quality meter to capture.

Figure 7. Capturing electrical power transients