

# EPRI PQ WEEK 2014

Power Quality Interest Group, Flicker Interest Group, PQ Investigator Users Group, and Advanced PQ Training

## April 21–25, 2014 • EPRI, Knoxville, Tennessee Program: Power Quality (P1)

EPRI invites you to join us this spring for our annual Power Quality Week! We will be offering a jam-packed week with a unique blend of Power Quality training and collaboration. The week will begin with the Power Quality Interest Group (PQIG) on Monday followed by four days of Advanced Power Quality Training. PQ training will begin with Industrial-side PQ Issues and solutions on Tuesday. In addition, the flicker interest group will be held on Tuesday as well. Wednesday will include a focus on motor drive PQ issues with a new case study session that will include a review of noteworthy PQ Hot Line Call material. Advanced PQ training topics on Thursday will include a special focus on grounding, surge, and protection techniques. In parallel, the Power Quality Investigator Users Group will meet this day as well. Friday's training will be focused on PQ monitoring.

## WEEK OF EVENTS

#### POWER QUALITY INTEREST GROUP MEETING

#### Monday, April 21

Beginning midmorning, EPRI will kick off PQ Week 2014 by hosting the Power Quality Interest Group (PQIG) meeting. In this forum, we have the opportunity to offer rich, interactive presentations and demonstrations in the laboratories of EPRI Knoxville. Topics for PQIG include:

• Overview of EPRI's Harmonic Evaluation Module. The Harmonic Evaluation Module (HEM) application provides a user-friendly interface to drive advanced harmonic analysis including frequency scans and harmonic distortion analysis by allowing the user to select circuit and harmonic models of interest from inbuilt libraries. The HEM provides the means of estimating harmonic impacts at various penetration levels for different harmonic sources on selected distribution circuits as well as evaluating potential filter bank solutions. This session will provide an overview and demonstration of the HEM functionality and will include a discussion of the path forward for this software tool.

- Overview of EPRI's Flicker Evaluation Module. The Flicker Evaluation Module (FEM) provides a user-friendly interface that can be used to perform high-level flicker assessment of an existing or a proposed fluctuating load. The basic functionality of the tool includes the ability to determine the appropriate emission limits of proposed loads that fluctuate by nature, the ability to estimate the flicker contribution of individual fluctuating loads, as well as overall flicker taking into account background flicker. The FEM can evaluate compliance of the loads against the determined flicker limits and estimate the impact of potential mitigation solutions such as adaptive var compensation equipment. This session will provide an overview and demonstration of the FEM functionality and include a discussion of the path forward for this software tool.
- *TPQ/DPQ III Update.* EPRIs TPQ/DPQ III Project is the latest benchmark study examining power quality data from low, distribution, sub-transmission, and transmission circuits from over 1000 sites. In this session, the lessons learned from this important research project and key take-aways will be discussed.

#### ADVANCED PQ TRAINING DAY 1

#### Tuesday, April 22

The first day of the Advanced Power Quality Training will cover enduse industrial power quality topics.

- Review of Common Customer PQ Susceptibilities. In this session, the susceptibilities of various industrial equipment to voltage sags will be discussed and demonstrated. This session will include examples of customer drawings and systems taken from actual sites, supplemented by test results and live demonstrations. EPRI's PQ Investigator software will be used to show PQ issues in various industries, equipment issues, and power quality susceptibilities of devices and components.
  - Performing Voltage-Sag Tests in a Three-Phase World. SEMI F47 and IEC 61000-4-34 have long been used as the benchmark for characterization and compliance testing of equipment against voltage sags. These two standards advocate only single- and twophase testing on three-phase equipment. As many high-tech companies are finding, three-phase voltage sags continue to cause machine or tool downtime. In this session, we will conduct lab testing of a mock three-phase machine and walk through the best way to test the equipment to determine whether it will survive voltage sag events in real-world scenarios. The SEMI F47-0706, IEC 61004-34, and the emerging IEEE P1668 standard will be discussed and demonstrated in this session as well.
- *Mitigating Power Quality Problems at Multiple Levels*. Solving power quality issues requires an understanding of the customer power system infrastructure, process equipment and controls, and economics. Some problems can be solved with small power conditioners or by embedding the solution through a replacement of a vulnerable component with a more robust one. System complexity or economics may require a machine-level or factory-level approach. In this session, we will demonstrate multiple levels of PQ mitigation and discuss the decisions that lead to solving these issues at multiple levels.

## ADVANCED PQ TRAINING DAY 2

#### Wednesday, April 23

Day 2 of the Advanced Power Quality Training will cover additional end-use industrial power quality topics.

- *Improving the PQ Performance of ASDs.* Adjustable-speed drives (ASDs) are particularly vulnerable to two major types of power quality events: voltage sags and capacitor-switching transients. Additionally, ASDs themselves can be a source of harmonics on the electrical grid. In this session, we will review ASD performance problems and solutions and see lab demonstrations of solutions in action. You will also receive PQ setting options for 74 different drive models.
- Select PQ Hot-Line Calls and Case Studies. Storytelling is one of the best ways to learn about PQ issues and solutions. In this session,

we will review selected PQ hot-line calls and case studies from our archives covering various relevant topics.

• *Mock Class PQ Problem Session*. In this session you will be presented with mock power quality problem, enabling you to apply the knowledge learned during previous sessions

## ADVANCED PQ TRAINING DAY 3

#### Thursday, April 24

Picking up on Thursday, Advanced Power Quality Training will focus heavily on wiring and grounding issues:

- *Facility Grounding*. This session provides the baseline for the course material to be explored throughout the rest of the day. An overall low-voltage system one-line diagram will be presented showing the utility system medium voltage system through the distribution transformer, main service panel, subpanels, loads, and customer internal transformation. Individual points along the one-line will be expanded and discussed in further detail regarding grounding applications.
- *Establishing a New N-G Bond.* This session answers the Where's, Why's, and How's associated with the establishment of a new neutralground bond within a LV distribution system. The need to establish a new neutral (grounded current carrying conductor) may stem from the need to assure NG voltage is minimized, applied where sensitive electronic loads are planned, or perhaps to prevent nuisance tripping of residual current devices. Grounding issues associated with transformation will be discussed along with transformer overcurrent protection device (OCP) selection. Transformer energizing inrush issues and effects on OCP selection will be presented.
- Automatic Transfer Switch Neutral Considerations. Facilities using residual current sensing for power distribution protection in conjunction with standby generation systems can develop problems without the proper transfer switch installed. This section considers the genesis of the 4-pole transfer switch and how its utilization avoids possible problems.
- *Transient Voltage Surge Suppression Application*. If a Transient Voltage Surge Suppression (TVSS) system is desired, the National Electric Code requires specific types of TVSS devices to be used depending on their location in a facility. This brief discussion reviews the types and application of TVSS systems and some practical installation practices to assure the best performance of a TVSS system.
- *Facility Lightning Protection*. This presentation references the NFPA780 to review the basic components of a facility lighting protection system, how to assure its best performance, a recommended grounding system, and considerations for a TVSS system.
  - Neutral-Earth Voltage Simulation and Modeling. This module will focus on simulation and modeling to better understand neutral-earth voltages in practical distribution systems. We will look at a couple of case studies where elevated neutral-earth

voltages have occurred due to certain types of non-linear loads, soil conditions, and other distribution circuit characteristics. We will explore using the open-source tool, the "OpenDSS", to analyze these problems. We will discuss different types of solutions, and also potential issues that may arise from implementations of some of these solution types.

#### ADVANCED PQ TRAINING DAY 4

#### Friday, April 25

Rounding out the week, Day 4 of the Advanced Power Quality Training will cover important topics in power quality monitoring:

- Overview of PQ Measurements and Data. In this session, relevant PQ monitoring standards and various anomalies will be explored.
- *The "ABCs" of PQ Monitoring.* You are looking to implement a PQ monitoring system, but how do you get started? In this session, we will discuss the objectives of PQ monitoring, the plethora of monitoring equipment available, issues with data collection and management, and meaningful reporting.
- *Recommendations for Monitoring Site Management*. In this session, the basics of organizing teams and the Where, What, and How of managing PQ monitor sites will be discussed.
- *Identifying Disturbance Waveforms*. You have recorded a lot of PQ data, but do you really know what the waveform is telling you? In this session, we will review example waveforms and indentify their true cause.
- *Introduction to PQView*. One of EPRI's flagship products, PQ View is a powerful tool for power quality data and analysis. In this session, you will learn the basic features of PQ View and cover example advanced features such as fault location.

#### FLICKER INTEREST GROUP MEETING

#### Tuesday, Aprill 22

Industrial customers can create problems for the electricity supply system when they have nonlinear loads or loads that vary significantly over time resulting in system voltage fluctuations.

The Flicker Interest Group will hold a meeting to discuss the latest findings in this important research area. If you are not a member of the Flicker Interest Group but would like to attend this meeting, please contact Carl Miller of EPRI at 865.218.8027 or cemiller@epri.com.

#### PQ INVESTIGATORS USERS GROUP MEETING

#### Thursday, April 24

Based on over 500 person-years and hundreds of tests and facility audits, the PQ Investigator is an expert system for investigating and solving end-user PQ issues. This Users group meeting will include an in-depth look at the new features of Version 2.2 and a review of case studies from utilities and EPRI. Furthermore, this forum will provide the users an opportunity to provide specific input, guidance, and prioritization for the ongoing and future development of this tool. If you are not a member of the PQ Investigators Users Group or not a base funder of the development of the PQ Investigator and would like to attend this meeting, please contact Mark Stephens of EPRI at 865.218.8022 or mstephens@epri.com.

## PQ WEEK REGISTRATION AND LOGISTICS

For more information and to register for the PQ Week events, please go to *www.epri.com* and select the Events tab at the top of the menu. Click on the "Main Calendar" link, and then select the month (November) and year (2014) to locate this event by date. Click on the link in the calendar and follow the simple and easy registration instructions.

## CONTACTS

In case you experience difficulties or have questions, please go to the home page of MyPQ.epri.com or contact the meeting planner referenced below:

#### Angie Henegar, Administrative Assistant Phone: 865.218.8111

Fax: 865.218.8001 Email: ahenegar@epri.com

#### TECHNICAL CONTACT

Mark Stephens, Senior Project Manager Phone: 865.218.8022 Email: mstephens@epri.com

## ACCOMMODATIONS

There are several great hotels within a few miles of the EPRI Knoxville office (942 Corridor Park Blvd.). Search for hotels near Turkey Creek or Cedar Bluff in West Knoxville.

## PQ WEEK AGENDA AND COSTS

The Power Quality Interest Group meeting is sponsored by Program 1 and is offered at no charge. The Flicker Interest Group and PQ Investigator Users group meetings require prior membership, sponsorship or special invitation. The remaining training days are offered at \$450/day.

#### Monday, April 21

#### 10:00 a.m. to 5:00 p.m.

- Power Quality Interest Group Meeting:
- Overview of EPRI's Harmonic Evaluation Module
- Overview of EPRI's Flicker Evaluation Module
- TPQ/DPQ III Update

#### **Tuesday April 22**

#### 8:00 a.m. to 5:00 p.m.

Advanced PQ Training Day 1:

- Review of Common Customer PQ Susceptibilities
- · Performing Voltage-Sag Tests in a Three-Phase World
- Mitigating Power Quality Problems at Multiple Levels

Concurrent: Flicker Interest Group Meeting

## Wednesday, April 23

8:00 a.m. to 5:00 p.m.

Advanced PQ Training Day 2:

- Improving the PQ Performance of ASDs
- PQ Case Studies
- Effectively Performing Power Quality Audits

#### Thursday, April 24 8:00 a.m. to 5:00 p.m.

Advanced PQ Training Day 3:

- Facility Grounding
- Establishing a New N-G Bond
- Automatic Transfer Switch Neutral Considerations
- Transient Voltage Surge Suppression Application
- Facility Lighting Protection
- Neutral to Earth Voltage Simulation and Modeling

Concurrent: PQ Investigator Users Group Meeting

#### Friday, April 25 8:00 a.m. to 4:00 p.m.

Advanced PQ Training Day 4:

- Overview of PQ Measurements and Data
- Identifying Disturbance Waveforms
- Recommendations for Monitoring Site Management

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- ABCs of PQ Monitoring
- Overview of PQView

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