

A POWER QUALITY MANAGEMENT AND TECHNICAL GUIDE: *Techniques, Applications and Case Studies*

September 27 – 28, 2017
Sheraton Denver Tech Center
Denver, CO

POST-COURSE WORKSHOP

**Monetizing the Cost
Impacts of Power Quality
Weaknesses and Remedies**

THURSDAY, SEPTEMBER 28, 2017



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IACET to offer 1.0 CEUs
for the course and 0.3
for the workshop

OVERVIEW

Power quality is re-emerging as an important topic in the electric utility industry. Driving this phenomenon are constrained budgets that bite into system management resources, new “smart” technologies that may have unintended consequences, and higher penetration of intermittent and variable energy resources on utility transmission and distribution grids. These dynamic conditions introduce new sources of flicker, harmonics, reactive power and other power quality problems for the grid. Utilities, balancing authorities and system operators – confronting changes in the knowledge and experience of the workforce – must ensure that staff renew their familiarity with such power quality issues, as well as software models and needed instrumentation to effectively deal with these challenges. This is especially important given recent changes in power quality-related codes and standards, which put far more burden on these grid-interfacing entities to understand the state of their own vulnerabilities prior to implementing these new technologies and absorbing non-baseload energy resources on their systems.

This one-and-a-half-day course provides an introduction to power quality – from both sides of the meter — and provides understanding, toolkits and practical application measures to ensure that attendees have a grasp of contemporary power quality issues and their appropriate mitigations. Through multiple case studies and illustrations, attendees will gain a fundamental understanding of how to apply power quality mitigation solutions. The optional workshop will explore their magnitude of cost, and the costs associated with not addressing these challenges and the financial benefits associated with proactively tackling these power quality issues.

LEARNING OUTCOMES

- Define the basic types of power quality problems and issues
- Identify measurement and analysis tools needed to determine power quality problems
- Consider the smart technologies, renewable energy resource and other triggers that diminish power quality
- Review the codes and standards that apply to system power quality
- Explore power quality problem mitigations and solutions
- Review case studies of real-life power quality problems

WHO SHOULD ATTEND

Staff with these functions

- New to the power industry
- T & D engineering and operations
- Design engineering
- Field assessment and audit skills
- Project management
- Financial analysis
- Enterprise, long-term and resource planning
- Legal, regulatory and government affairs
- Key accounts
- Sales and marketing

AGENDA

WEDNESDAY, SEPTEMBER 27, 2017

- 8:00 – 8:30 am Registration and Continental Breakfast**
- 8:30 – 8:45 am Overview and Introductions**
- 8:45 – 9:15 am Ways to Think About Power Quality**
- Overview
 - Myths — what power quality is not
 - What is free power quality?
- 9:15 – 10:30 am Power Quality Concerns for the 21st Century**
- Voltage imbalance
 - Sag, swell, transients, etc.
 - Volt-VAR and reactive power
 - Harmonics and waveform distortion
 - Flicker
 - Power factor
- 10:30 – 10:45 am Morning Break**
- 10:45 am – 12:15 pm Implications for Bi-directional Power Flow Problems**
- Utility generated PQ problems — case studies
 - o Flicker from other customers
 - o Reactive power problems
 - o Harmonics from other customers
 - Renewable generated PQ problems — case studies
 - o Flicker from PV sources
 - o Reactive power problems
 - o Harmonics from renewable sources
- 12:15 – 1:30 pm Group Luncheon**
- 1:30 – 2:00 pm Implications for Bi-directional Power Flow Problems (cont'd)**
- Smart-technology and unintended PQ consequences — case studies
 - o Inverters
 - o AMI
 - o Controllers/communications protocols
 - o Software and other grid “self-healing” measures
- 2:00 – 3:15 pm Power Quality Measurement, Installation and Analysis**
- Measurement techniques
 - o Equipment
 - o Costs
- 3:15 – 3:30 pm Afternoon Break**

AGENDA

WEDNESDAY, SEPTEMBER 27, 2017 (CONTINUED)

3:30 – 4:00 pm

Power Quality Measurement, Installation and Analysis (cont'd)

- Measurement techniques
 - o Equipment
 - o Costs

4:00 – 5:30 pm

Differences in Transmission and Distribution Power Quality Awareness and Mitigation

- Transmission-associated quality problems
- Distribution-associated quality problems
- Equipment misapplication
- Case studies

THURSDAY, SEPTEMBER 28, 2017

8:00 – 8:30 am

Continental Breakfast

8:30 – 10:15 am

Mitigation of Power Quality Disturbances

- Methodologies
 - o Grounding
 - o Voltage ride-through
 - o Redundant systems
- Products
 - o Inverters
 - o STATCOM
 - o SMES
 - o Hi-Speed Power Electronic switches
 - o Controllers - various kinds
 - o Others

10:15 – 10:30 am

Morning Break

10:30 – 11:15 am

Review of Power Quality Related Codes and Standards that Define and Resolve Renewable Power Quality Problems

- IEEE C2 – 2012
- IEEE 519
- IEEE 1458
- IEEE 1547
- NESC
- NFPA 70 – NEC
- UL 1741

11:15 – 11:45 am

Open Forum on Power Quality Issues and Scenarios

11:45 am

Program Concludes

POST-COURSE WORKSHOP

Monetizing the Cost Impacts of Power Quality Weaknesses and Remedies

THURSDAY, SEPTEMBER 28, 2017

OVERVIEW

Power quality is not an optional element of large power system operations – it is essential to the proper physical and economic function of the grid. This workshop will explore the relationship of many types of power quality issues to their magnitude of cost, the costs associated with not addressing these challenges and the financial benefits associated with proactively tackling these power quality issues.

LEARNING OUTCOMES

- Assess real costs associated with power quality problems
- Demonstrate the financial modeling and analysis that quantifies the financial benefits of remediating power quality problems
- Case studies illustrating cost-benefit correlations of power quality correction

WORKSHOP AGENDA

| | |
|------------------------|--|
| 12:30 – 1:00 pm | Registration |
| 1:00 – 1:15 pm | Overview and Introductions |
| 1:15 – 2:45 pm | Monetizing the Cost Impacts of Degraded Power Quality <ul style="list-style-type: none">• Customer complaints• Financial threats and/or liquidated damages• System performance reductions• Unanticipated and/or unplanned O&M• Regulatory appeal and tariff relief consequences• Erosion in ratepayer sentiment and public affairs reputation |
| 2:45 – 3:00 pm | Afternoon Break |
| 3:00 – 4:30 pm | Monetizing the Benefits, Avoided Costs and other Financial Impacts Resulting from Power Quality Improvement Measures <ul style="list-style-type: none">• Cost-benefit ratio of power quality solutions• Conditions that allow favorable economics• Collecting costs• Mitigation equipment categories and costs• Case study: Formulation of settings, instrumentation and controls• Case study: Maintaining the correct power and reactive factors<ul style="list-style-type: none">o Automated, system-administered mitigation methodso Customer-provided, but system-enforced mitigation methods |
| 4:30 pm | Workshop Adjourns |

INSTRUCTORS



Mike Coddington

Principal Engineer, National Renewable Energy Laboratory (NREL)

Michael Coddington is a Principal Engineer with the Integrated Devices and Systems Group at the National Renewable Energy Laboratory (NREL) - a Department of Energy owned laboratory in Colorado. Before coming to NREL nearly 10 years ago, he worked as a Distribution Planning and network Engineer, System Planning Engineer, Key Account Executive, and numerous other roles at two electric utility companies. His work at NREL focuses on the integration of photovoltaic systems (and other distributed generation systems) to the electric distribution system, with a focus on high penetration PV concerns and solutions. Mr. Coddington has authored and collaborated on dozens of technical reports and papers focusing on integrating distributed generation systems onto the grid in a safe, reliable and cost-effective manner. He is active in standards and codes development, is a Senior Member of the IEEE, was Secretary of IEEE 1547.6, and is a voting member of the UL1741 Standards Technical Panel (STP). He received his electrical engineering degree from Colorado State University, is a licensed Master Electrician and licensed Electrical Contractor in the State of Colorado, and is a licensed commercial electrical inspector.

Sam Wheeler

President, Power Quality Advisors

Sam Wheeler is a consultant to the electric power industry. He specializes in the areas of power quality, ARC flash, hazardous location evaluations, renewables integration, and industrial troubleshooting. Before starting Energy Services, he created and ran for-profit power quality service business-units at Public Service of Colorado, and at UtiliCorp –United. He was also a distribution engineer for Utilicorp-United, City of Longmont (CO) and a transmission engineer at Tri-State G&T. Mr. Wheeler has worked as a consultant to DOE and the World Bank on advanced grid technology evaluation projects. He was the Chairman of the Advisory Board, and a contributor to, both Power Quality Assurance & Reliability and PowerValue magazines. He has published a number of technical papers, technical magazine articles and educational publications. He has acted as an Independent Engineer on several utility /PV developer disputes. Mr. Wheeler has a BSEE from the University of Colorado and is a member of the National Fire Protection Association (NFPA).

REQUIREMENTS FOR SUCCESSFUL COMPLETION

Participants must sign in/out each day and be in attendance for the entirety of the course to be eligible for continuing education credit.

INSTRUCTIONAL METHODS

PowerPoint presentations and case studies will be used in this course.

PROCEEDINGS

The proceedings of the course will be published, and one copy will be distributed to each registrant at the course.

EVENT LOCATION

A room block has been reserved at the Sheraton Denver Tech Center, 7007 S Clinton St, Greenwood Village, CO 80112, for the nights of September 26 – 28, 2017. Room rates are \$149 plus applicable tax. Call **1-303-799-6200** for reservations and mention the EUCI event to get the group rate. The cutoff date to receive the group rate is September 5, 2017 but as there are a limited number of rooms available at this rate, the room block may close sooner. ***Please make your reservations early.***

IACET CREDITS



EUCI has been accredited as an Authorized Provider by the International Association for Continuing Education and Training (IACET). In obtaining this accreditation, EUCI has demonstrated that it complies with the ANSI/IACET Standard which is recognized internationally as a standard of good practice. As a result of their Authorized Provider status, EUCI is authorized to offer IACET CEUs for its programs that qualify under the ANSI/IACET Standard.

EUCI is authorized by IACET to offer 1.0 CEUs for this course and 0.3 CEUS for the course.

REGISTER 3, SEND THE 4TH FREE

Any organization wishing to send multiple attendees to this course may send 1 FREE for every 3 delegates registered. Please note that all registrations must be made at the same time to qualify.

REGISTRATION
to register [CLICK HERE](#) or

Call: 201 871 0474
fax: 253 663 7224
email: [register@pmaconference.com/](mailto:register@pmaconference.com)
web: <http://pmaconference.com/>
Mail: POB 2303 Falls Church Va 22042

Please make checks payable to: "PMA"

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PLEASE REGISTER

A POWER QUALITY MANAGEMENT AND TECHNICAL GUIDE COURSE AND WORKSHOP: SEPTEMBER 27 – 28, 2017: US \$1895,
 Early bird on or before September 8, 2017: US \$1695
Utilities, System Operators, Balancing Authorities, Government, Munis and Coops: US \$1495, Early Bird Rate US \$1295

A POWER QUALITY MANAGEMENT AND TECHNICAL GUIDE COURSE ONLY: SEPTEMBER 27 – 28, 2017: US \$1495,
 Early bird on or before September 8, 2017: US \$1295
Utilities, System Operators, Balancing Authorities, Government, Munis and Coops: US \$1195, Early Bird Rate US \$995

How did you hear about this event? (direct e-mail, colleague, speaker(s), etc.)

Print Name Job Title

Company

What name do you prefer on your name badge?

Address

City State/Province Zip/Postal Code Country

Phone Email

List any dietary or accessibility needs here

CREDIT CARD INFORMATION

Name on Card Billing Address

Account Number Billing City Billing State

Exp. Date Security Code (last 3 digits on the back of Visa and MC or 4 digits on front of AmEx) Billing Zip Code/Postal Code

OR Enclosed is a check for \$ _____ to cover _____ registrations.

Substitutions & Cancellations

Your registration may be transferred to a member of your organization up to 24 hours in advance of the event. Cancellations must be received on or before August 25, 2017 in order to be refunded and will be subject to a US \$195.00 processing fee per registrant. No refunds will be made after this date. Cancellations received after this date will create a credit of the tuition (less processing fee) good toward any other EUCI event. This credit will be good for six months from the cancellation date. In the event of non-attendance, all registration fees will be forfeited. In case of course cancellation, EUCI's liability is limited to refund of the event registration fee only. For more information regarding administrative policies, such as complaints and refunds, please contact our offices at (201) 871-0474.