

# *tailored collaboration opportunities*

## Power Quality Training Courses and Workshops



EPRI offers training programs designed to answer your customers' power quality concerns and take advantage of business opportunities.

What will it take to succeed in today's competitive energy services market? Technical know-how is essential. New technologies will continue to shape many of tomorrow's competitive opportunities. But having an insider's knowledge of advanced and emerging technologies is just the beginning. These days you need broad experience in the industry to know exactly how to best capitalize on new technologies, trends, and market intelligence.

You can obtain this knowledge and experience by sponsoring training courses for your employees and customers through the EPRI *Power Quality Training Courses and Workshops Tailored Collaboration* opportunity. This opportunity leverages resources from an EPRI matching fund, while providing you with the capability to train large numbers of employees or customers at your facility or customer site. It also offers the flexibility to combine any of the classes and custom-design a curriculum that meets your specific needs.

Today's commercial, industrial, and residential customers have greater power quality concerns than ever before. Minor power disturbances that would have gone unnoticed

### Helps You Build Partnerships With Premium Power Customers

a few years ago can now damage sensitive computer-controlled machinery, impact productivity and worker safety, and shut down ordinary household appliances. You can best serve your customers by keeping up-to-date and gaining hands-on experience through EPRI's training courses and workshops. These classes provide information on building an effective power quality program, creating partnerships with customers, and troubleshooting and resolving power quality problems.

**PROJECT SUMMARY** To meet the unique needs of your own business as well as the customers you serve, you can choose from any of the 33 EPRI training courses and workshops described on the attached listing. These classes are designed to help you establish the best power quality program and select the most suitable technologies for your system and customers. Each course can be provided for groups of approximately 10 to 25 participants. The courses can also be hosted for groups at the EPRI Power Electronics Applications Center (PEAC) in Knoxville, Tennessee, and the EPRI Nondestructive Evaluation (NDE) Center in Charlotte, North Carolina.

EPRI's training courses and workshops target three distinct areas: technical expertise, business and marketing development, and specific customer segments. You can mix and match as many of these courses as you choose to suit your particular needs. You can also select from a variety of topics to develop a program that may consist of one customized course, a series of courses, or one or more large training sessions.

Examples of technical training courses are “State-of-the-Art Power Quality Monitoring,” “Contemporary Topics in Power System Harmonics,” and “Analyzing Power Quality Problems Using Simulation Analysis.”

Business- and marketing-oriented courses include “Using *PQWeb* to Provide Power Quality Information Over the Internet,” “Analyzing the Economics of Improving Power Quality,” and “What Electric Utility Executives Should Know About Power Quality.”

Customer-related courses include “Power Quality in the Industrial Environment,” “Power Quality Training for Commercial Customers,” and “Industry-Specific Power Quality Training.”

**DELIVERABLES** Program content differs from course to course. Please consult the attached listing for a description of each class. The programs are held on-site at your or your customer's facility unless otherwise indicated.

**RETURN ON INVESTMENT** You can build revenue and enhance customer satisfaction by providing innovative and targeted training as part of your power quality program. EPRI can help your staff become experts in power quality variations as well as their causes, possible impacts, and best mitigation measures. From basic training information on power quality technologies to contracting guidelines and sophisticated marketing techniques, you can take advantage of a complete package of state-of-the-art knowledge and customer service tools to put your successful program in place. Through EPRI you also have access to emerging power quality business opportunities, products, and services that will help you gain and maintain competitive advantage.

**DEMONSTRATED VALUE** Only EPRI has the diverse resources necessary to position your company to win customer loyalty in today's increasingly competitive energy services market. EPRI's broad knowledge of energy customers, changing markets, and international developments can help you anticipate and shape the changes that are transforming the energy industry along

with the needs of your customers. For nearly 30 years, EPRI has been at the leading edge of market insights and technology development, delivering a wide range of products, support, and services. In 1997, the company managed \$428 million in collaborative technology development and demonstration projects. EPRI has created an unparalleled network of technical experts, research allies, manufacturers, industry representatives, and marketing specialists from around the world. As an objective source, EPRI can seek the best technology, vendor, and fit for your particular needs.

**PRICE OF PARTICIPATION** Courses can be priced individually or as a series of any combination of classes. Costs generally range from \$650 to \$2500, depending on the course selected.

**PROJECT STATUS AND SCHEDULE** Thirty-three EPRI training courses and workshops are being offered for 1999. Four of these courses will be held at EPRI PEAC in Knoxville, Tennessee, and three at the EPRI NDE Center in Charlotte, North Carolina. The remaining 26 courses can be held at the location of your choice.

**WHO SHOULD JOIN** This Tailored Collaboration opportunity is available to all funders of EPRI Power Quality activities.

**CONTACT INFORMATION** For more information, contact the EPRI Customer Assistance Center at 800-313-3774 or [askepri@epri.com](mailto:askepri@epri.com).

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## 1999 EPRI POWER QUALITY TRAINING COURSES AND WORKSHOPS

**1. *Analyzing Power Quality Problems Using Simulation Analysis.*** In this course, participants gain hands-on experience using the Analysis and Simulation Modules of the EPRI Power Quality Diagnostic System. To establish a clear understanding of the underlying principles of the modules, the course includes basic training in power quality phenomena. Case studies illustrate a variety of problems and available solutions. For energy company transmission, distribution power quality, and customer relations engineers and key account executives.

**2. *Analyzing the Economics of Improving Power Quality.*** This course provides hands-on experience using the Economic Assessment Module of the EPRI Power Quality Diagnostic System. It shows how to maximize analytical value by customizing the databases of the module. Through case studies, it also teaches how to calculate and apply information describing power quality levels (especially voltage sag performance), and how to develop an optimum strategy by evaluating solutions at each level. For energy company power quality and customer service engineers.

**3. *Calculating System Performance Using Reliability Benchmarking Methodology (RBM) Indices.*** In this hands-on workshop, participants learn to calculate RBM indices to track power quality performance at customer sites and at the system level. The workshop introduces the RBM indices as well as calculation tools and power quality state estimators, which are add-on modules to the EPRI Power Quality Diagnostic System Measurement Module. For energy company engineers whose responsibilities include system reliability characterization and performance, or customer power quality investigations and reporting.

**4. *Contemporary Topics in Power System Harmonics.*** This is a seminar for anyone who has an interest in the latest topics of harmonics. It examines the effects of harmonics on equipment, discusses harmonic analysis, describes methods for reducing harmonics, and addresses the application of Institute of Electrical and Electronics Engineers (IEEE) Recommended Practice 519-1992 and various European standards for harmonics.

**5. *Designing a Power Quality Monitoring System.*** This workshop delves into the objectives of a monitoring system: solving power quality problems, characterizing system performance, verifying solutions, complying with power quality contracts, developing a customer information

system, performing equipment diagnostics, and prioritizing the monitoring system. It discusses the components of a monitoring system, types of monitoring equipment, where to monitor, transducer considerations, data processing and data analysis, access to the system, and example systems. Participants develop specifications for their own systems. Those with monitoring systems already in place evaluate alternatives for expansion. For energy company transmission, distribution power quality, and customer relations engineers and key account executives.

**6. *Developing a Power Quality Program.*** This seminar addresses key questions relating to power quality program options, types of services, organizational structure, market needs, program costs, staffing, training needs, equipment requirements, and measuring performance—all of which must be answered before an effective power quality program can be put in place. The seminar also covers market analysis, customer surveys, evaluation of technical and training requirements, assessment of existing organizational structure, and company preferences. For supervisor- or managerial-level energy company personnel responsible for directing and implementing efforts to develop or modify a power quality program.

**7. *Distribution Power Quality.*** In this seminar, energy company personnel dealing with distribution system design and power quality evaluations develop an understanding of how distribution system problems can impact customer operations. They learn about the different types of customer power quality problems that can result from capacitor switching transients, distribution system harmonic levels, remote faults on the power system, and lightning transients. The seminar also presents methods of analyzing these problems and possible solutions, along with an overview of important standards relating to power quality.

**8. *Delta-Connected Industrial Distribution Systems.*** This one-day seminar explains the benefits and drawbacks of ungrounded delta distribution and some options for improving the performance of the system and equipment. The seminar features demonstrations using a large, active demonstration board. Attendees will see firsthand the operation of an ungrounded system and the different problems and solutions. For energy company power quality engineers and industrial customers.

**9. *Efficient Motor and Drive Application Considerations.***

This seminar provides an overview of the types of motor and drive technologies that can be used to increase energy efficiency and improve manufacturing process performance. It describes the characteristics and application considerations of each technology, and places particular emphasis on economic evaluations and power quality enhancements. For energy company engineers and marketing representatives, building and industrial designers, plant utility and production personnel, commercial customers, electrical contractors, motor and drive vendors, and manufacturers.

**10. *Electrical Power Systems Quality.*** This seminar explores power quality concepts, problems, causes, solutions, and preventive actions. It provides in-depth information relating to voltage sags and interruptions, transient overvoltages, harmonics, long-duration voltage variations, wiring and grounding, and monitoring power quality. For energy company customer account managers and technical staff, industrial plant engineers, technical personnel with a stake in the energy provider-customer interface, consultants, and university professors.

**11. *Monitoring Power Quality and Solving Problems.*** This seminar offers practical measures for providing power quality services to customers. It includes hands-on use of software and shows how to develop site surveys, monitor power quality, and analyze measurement results. It also addresses wiring and grounding problems and overvoltage transient problems. Case studies illustrate how energy providers and large customers are preventing, identifying, and solving these problems. For energy company management, customer account managers, and technical staff, and large customers.

**12. *Overview of Power Quality.*** This course provides a basic understanding of key power quality concerns at industrial and commercial facilities. It describes the different categories of customer power quality problems, methods of analyzing these problems, and possible solutions. It also provides an overview of important standards relating to power quality. For customers interested in power quality issues, energy company representatives dealing directly with these customers, and distribution engineers.

**13. *Power Quality in the Industrial Environment.*** This seminar describes the key power quality characteristics of industrial loads—sensitivity to power disturbances and harmonic generation. It also addresses the impacts of energy company operations on customer facilities. Topics include harmonic filter design procedures for power factor correction and harmonic control, and methods for controlling transient voltages on the power system and at sensitive loads. For energy company engineers and customer service

representatives working with system compatibility issues, and industrial customers.

**14. *Power Quality Workbook Workshop.*** Easy-to-use worksheets allow workshop participants to evaluate power quality concerns affecting industrial facilities. The workshop describes analytical tools to enable more detailed investigations, and monitoring requirements to characterize power quality problems and system performance. It covers a wide range of solutions and their economics. Participants receive examples of contract agreements and equipment specifications that focus on defining power quality requirements to avoid problems. For energy company power quality engineers and customer service representatives, and industrial facility managers.

**15. *PQ 201: Power Quality Technical Training.*** This three-day course is especially beneficial for technicians and engineers who must troubleshoot power quality problems. It takes a practical look at power quality problems from the customer side of the meter. It presents basic to intermediate-level theory and case studies of power quality problems and solutions. Approximately half of the course is spent in the laboratory, where participants use the latest in commercially available power quality hardware, software, and monitoring equipment to characterize load and power system interactions and incompatibilities. Held at the EPRI Power Electronics Applications Center (PEAC), the course offers Continuing Education Units (CEUs) through the University of Tennessee.

**16. *PQ 203: Tailored Power Quality Training.*** Tailored training courses can be designed to meet the power quality training needs of funding energy service providers. Courses may combine classroom training with real-life, problem-solving exercises in the facilities of customers experiencing problems.

**17. *PQ 213: Power Quality Training for Commercial Customers.*** This course is tailored to meet the power quality training needs of energy company personnel and their commercial customers. Topics include wiring, grounding, harmonics, power conditioning, adjustable speed drives (ASDs), lighting, and case studies.

**18. *PQ 223: Power Quality Training for Industrial Customers.*** This course is tailored to meet the power quality training needs of energy company personnel and their industrial customers. Topics include voltage sags, ASDs, programmable logic controllers, high-intensity discharge lighting, process ride-through, and case studies.

19. **PQ 233: Industry-Specific Power Quality Training.** This course is tailored to meet the power quality training needs of specific industries, such as plastics, healthcare, semiconductor, petrochemical, and textile.

20 and 21. **PQ 301 and 311: Advanced Power Quality Workshops.** Both of these three-day workshops enable energy company personnel to understand advanced power quality issues. Participants have the option to attend from one to all six of the workshop sessions. Each workshop integrates intermediate- to advanced-level classroom theory on various technologies and includes extensive laboratory sessions. *PQ 301* covers transient voltage surge suppressors, uninterruptible power supplies, ASDs, and industrial process controls. *PQ 311* addresses solutions for monitoring equipment, wiring, grounding, and harmonics. Held at EPRI PEAC, both workshops offer CEUs through the University of Tennessee.

22. **PQ 501: Power Quality Business Opportunities in a Changing End-Use Market.** This two-day course focuses on developing strategic business plans for power quality. It is designed for energy company marketing, operations, and engineering management responsible for power quality activities. The course supplies participants with the knowledge they need to market electricity as a quality product and sell power quality services. Held at EPRI PEAC, participants use the latest in commercially available power conditioning hardware, software, and monitoring equipment. CEUs are available through the University of Tennessee.

23. **PQ 503: Business Opportunities for Power Quality Programs.** This one-day course provides step-by-step instruction and the practical methodology for turning an existing power quality program into a revenue-generating business. It offers a power quality model and marketing data for use in establishing and marketing tailored power quality programs that gain maximum benefits from specific product and service opportunities. For power quality and marketing program managers.

24. **PQC 102: Power Quality Basics.** This one-day course covers basic concepts in power quality, customer electrical systems, proper wiring and grounding, power disturbances, system compatibility, and power conditioning. Held at the EPRI Nondestructive Evaluation Center (NDE), for energy company personnel, facility engineers, and maintenance personnel responsible for, but new to power quality issues.

25. **PQC 103: Wiring and Grounding.** This one-day course offers a practical look at wiring and grounding requirements for safety as required by the National Electrical

Code, versus supplemental wiring and grounding practices for improved performance of sensitive electronic loads. For energy company engineers, customer account managers, and technical staff, and large commercial and industrial customers.

26. **PQC 402: Power Quality for Sales Account Managers.** This one-day course considers the impacts of power quality and power disturbances on the bottom line and addresses cost versus benefits. It also discusses ways to capture the cost of poor power quality, system compatibility issues, and power quality solutions. Held at the EPRI NDE, for power quality account managers and key energy company representatives who interface with business decision-makers responsible for productivity linked to the performance of facility equipment and the electrical system.

27. **State-of-the-Art Power Quality Monitoring.** This seminar is for energy company personnel and customers who have an interest in the latest topics of power quality measurements and site surveys. It addresses the safety concerns of monitoring systems, site survey procedures, and result analysis. It also discusses the various types of monitoring equipment and provides participants with hands-on experience using the equipment.

28. **Using PCs to Solve Power Quality Problems.** This course focuses on using computer simulations to study and understand harmonics and transients. It shows how harmonic loads are represented, how power delivery systems are modeled, and how the computer program can be used for IEEE 519 evaluations. Case studies illustrate harmonic resonance caused by power-factor-correction capacitors, the effect of phase angle cancellation using delta-wye transformers, and the design of harmonic filters. The course also shows how to use the EPRI *Electromagnetic Transients Program* and provides case studies demonstrating the simulation of capacitor bank switching, breaker restriking, and power electronic devices. For energy company power quality engineers.

29. **Using PQWeb to Provide Power Quality Information Over the Internet.** This workshop shows how to set up a power quality monitoring system using EPRI's *PQWeb* software to access monitoring data via the Internet or Intranet. It describes computer system requirements and specifications for interfacing with the rest of the corporate network. It also shows how to customize the system to make it part of an overall Internet presence. For energy company transmission, distribution power quality, and customer relations engineers and key account executives.

30. ***Using the PQ Database in Your Power Quality Program.*** In this hands-on workshop, participants learn to use the EPRI *PQ Database* to improve the quality and efficiency of power quality investigations. The workshop demonstrates how to design *PQ Database* templates to suit a particular customer or investigation. It also shows how to use attachments for documentation and how to link the attachments to applications like Autocad, Excel, EMTP, PowerPoint, Superharm, etc. For energy company power quality and customer service engineers.

31. ***Using the PQDS Measurement Module (PQView).*** This two-day workshop offers an overview of EPRI *PQView* and provides examples of using the module to support monitoring system objectives. Participants learn how to install *PQView* and implement interfaces with different types of monitoring equipment. The workshop describes how to maximize monitoring system value and access to information by integrating the system with the corporate information system. For energy company transmission, distribution power quality, and customer relations engineers and key account executives.

32. ***Utility Capacitor Applications and Concerns.*** This seminar provides a basic understanding of important capacitor protection considerations and power quality concerns. It discusses capacitor bank design and protection considerations, harmonic concerns, and transient disturbances. It also provides an overview of important standards that relate to the application of capacitor banks. For energy company power quality engineers.

33. ***What Electric Utility Executives Should Know About Power Quality.*** This short, nontechnical presentation offers an overview of what electric utilities can do to address power quality issues and concerns. It discusses how power quality problems can affect the energy provider, the economic impacts of solving the problems, and what the competition is doing. For energy company managerial staff.