

Power Quality for Improved Power Delivery Performance - Program 1

Program Overview

Program Description

Electric utilities worldwide consistently report that power quality (PQ) is a fundamental but underutilized component of the three key utility business performance metrics: system performance, economic performance, and customer satisfaction. The Power Quality research program may help to improve these three metrics, allowing PQ managers and transmission and delivery (T&D) asset utilization and system planning professionals to use PQ-related technology, knowledge, and expertise to help improve their organization's bottom-line performance.

Research Value

With the knowledge acquired through this research program, members will have access to information that can help them in the following ways:

- In the future, models and tools may be available to identify the most cost-effective utility-side strategies for improving reliability and power quality, and it could be possible to quantitatively estimate the PQ and reliability improvements provided by any specific improvement project (Project Set 1A). The program is currently addressing this goal by improving models of how electric system investments affect PQ performance.
- In the future, benchmarking of system power quality and reliability performance may be a dynamic, ongoing function, rather than a one-off project (Project Set 1A). This project is addressing this issue by researching the critical gaps that must be overcome to fully integrate disparate but essential utility database and records resources, including weather, maintenance, operations and GSM.
- A world-class power systems monitoring database management and analysis system could be available within a decade. The program is working actively on a universal "next generation" utility data platform and the next generation of PQView software that could take advantage of it.
- In the future, systems may detect and locate faults on a map, preferably from PQ or other readily available data sets (Project Set 1B). Fault location has emerged as one of the early-adopter applications for improved utility performance based on PQ expertise.
- There may be a universal equipment immunity standard for electronic equipment in the next decade. Facilitating creation and adoption of a universal end-use PQ immunity standard could yield an economic and customer satisfaction benefit.
- The means to deliver PQ information to the right audience could be automated over the next decade. Customization of content and delivery is fundamental to increasing the impact of PQ knowledge resources.

Approach

EPRI research in power quality will yield a variety of data and knowledge that will be beneficial to program members. This information will come in a number of forms and is expected to include:

- software updates,
- new and updated information and tools, and
- publications and forums, technical support, and web-based services.

Accomplishments

In the past, the power quality program has delivered valuable information that has helped its members and the industry. Some examples include the following:

- EPRI's Integrated Power Quality Diagnostic System (IPQDS) is a compilation of tools that allows PQ engineers to perform basic power quality analyses such as transient and harmonics analysis, voltage sag simulations, and motor-starting calculations. This report discusses three specific IPQDS modules—the capacitor switching module, flicker analysis module, and motor starting module—as well as the tap fusing worksheet, an Excel spreadsheet.
- The Industrial Design Guide (IDG) enables power quality engineers to understand the processes of industrial customers. The web-based approach provides the investigator with an easy-to-use format that allows known solutions to be applied repeatedly. Each process in the IDG is laid out in a graphically rich format that identifies the sensitive components that make up the process.
- PQView[®] is a multi-component software system developed by EPRI for building and analyzing databases of power quality and energy measurements. Its components build measurement databases, write summary reports, compute power quality indices, view waveforms and rms samples, and trend steady-state quantities. PQView helps build databases with billions of measurements from thousands of monitoring points taken by many different types of meters, including power quality monitors, voltage recorders, in-plant monitors, and digital fault recorders.
- The Power Quality Online Resource Center is a member-focused website with the latest information on events, program deliverables, PQView software downloads, power quality tools, and more.

Current Year Activities

In the coming year, this research program expects to accomplish these objectives:

- Update PQView based on input from the PQView Users Group and members
- Develop new and updated information and tools in the areas of T&D design, maintenance, and planning; power quality and reliability benchmarking and standards; power quality monitoring; fault location; stray and neutral-to-earth voltages; power quality compatibility; and power quality technology assessment
- Delivery mechanisms such as a comprehensive collection of technical and information publications and products, educational forums, technical support, and web-based services

Estimated 2010 Program Funding

\$2.5M

Program Manager

Bill Howe, 303-417-1514, bhowe@epri.com

Summary of Projects

PS01A Improving PQ in Transmission and Distribution (062088)

Project Set Description

This project set provides focuses on understanding, analyzing, and mitigating PQ issues on the T&D system including improved understanding of PQ phenomena, system modeling, development and application of standards and deployment of analysis tools through the PQ Diagnostic System (PQDS).

Project Number	Project Title	Description
P001.001	PQ Issues and Solutions for Transmission and Distribution	This ongoing project builds on years of research and application guide development and uses the PQ expertise at EPRI and that of project funders. The project develops methods for improved analysis of electrical T&D power quality performance issues, thereby creating a standard procedure for assessment of PQ performance, improvement opportunities, and mitigation strategies. The project also focuses on practical assessment of the effectiveness of in-field PQ improvement and mitigation strategies and techniques.
P001.002	PQ Benchmarking and Standards	Work planned for 2010 includes continued data collection for and leveraging of the a TPQ/DPQ III project—a combined distribution and transmission power quality benchmarking study. This study will move beyond EPRI's previous benchmarking studies by developing the infrastructure to automatically collect and benchmark data. This work will begin to inform future standards that presently utilize PQ and reliability metrics and provide more useful and precise information for the various T&D voltage classifications for those standards and for comparative benchmark efforts.
P001.003	Support and Development of PQ Analysis Tools	Expert PQ analysis tools for T&D including enhancements to the PQDS as prioritized by the project participants.

P001.001 PQ Issues and Solutions for Transmission and Distribution (055700)

Key Research Question

Management of power quality is a key core competency for electrical transmission and distribution systems around the world. Power quality issues on the T&D system are often complex, wide-reaching, and expensive to mitigate. Through collaborative research, however, funders of this project will gain valuable insights on the effectiveness of PQ mitigation measures on the grid and analysis techniques to speed understanding, diagnosis, and mitigation of PQ issues.

Approach

This project develops methods for improved analysis of electrical T&D power quality performance issues,, thereby creating a standard procedure for assessment of PQ performance, improvement opportunities and mitigation strategies. The project also focuses on practical assessment of the effectiveness of in-field PQ improvement and mitigation strategies and techniques. This is an ongoing project that builds on years of research and application guide development and uses the PQ expertise at EPRI and that of project funders.

Work in 2010 will focus on:

- T&D PQ assessment methodologies
- Analysis of the effectiveness of PQ improvement and mitigation technologies and techniques

Impact

Standardized approaches to assessment and evaluation of PQ performance and mitigation approaches may facilitate more efficient assessments and increase the impact of those assessments once they are complete.

Impact assessment of different improvement and mitigation technologies and techniques reduces trial-and-error methods and increases the likelihood of PQ issues being properly diagnosed and solved the first time.

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can best apply the results of this research by assimilating them prior to undertaking investigation or mitigation of a PQ issue on the T&D system.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
PQ Issues and Solutions for T&D: Lessons learned from example applications will be used to improve algorithms and methods for cost/benefit assessments of PQ/reliability improvement approaches.	12/31/10	Technical Update

P001.002 PQ Benchmarking and Standards (058585)

Key Research Question

Reporting of PQ performance is a critical requirement for electric utilities; informing internal planning processes, enabling performance benchmarking, and accommodating external reviews required by regulators. Benchmarking of existing PQ standards offer opportunities for improved system performance at reduced capital cost.

Approach

This project area provides tools and guidelines for effective performance assessment and reporting methods. It helps members better understand and adopt industry standard approaches for performance assessment and provides coordination with new industry standards development. The project will track and contribute to industry standards development related to power quality and reliability indices and reporting methods. It will also develop tools and advanced methods for analyzing system performance as a means to help improve performance. These tools and methods include advanced approaches such as the service quality index pioneered in this program; statistical characterization methods; and methods for normalizing performance according to system characteristics (e.g., lightning).

The project will also track regulatory issues and standards development around the world to understand priorities for benchmarking and characterizing performance. New methods for applying statistical characterization methods and normalizing results will be documented and addressed in an annual workshop on reliability and PQ benchmarking developments.

Work planned for 2010 includes continued data collection for and utilization of the TPQ/DPQ III project—a combined distribution and transmission power quality benchmarking study. This study will move beyond EPRI's previous benchmarking studies by developing the infrastructure to automatically collect and benchmark data.

Impact

- Helps utilities effectively apply industry standard methods for characterizing performance, which can significantly reduce the cost of these activities.

- Provides advanced system performance measures to help provide a better basis for making system performance improvement investment decisions, thereby improving the cost-benefit ratio of these activities.

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can best apply the results of this research by assimilating them and applying them to recommended power quality and reliability characterization and reporting methods in their external reviews of—and internal planning on—reliability and power quality performance.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
PQ Benchmarking and Standards: Technical report on PQ benchmarking and standards	12/31/10	Technical Report

P001.003 Support and Development of PQ Analysis Tools (048303)

Key Research Question

Expert software resources for PQ are difficult to find in industry, but they are essential for understanding of complex phenomena and for cost-effective problem solving. The time and cost of developing these tools is prohibitive and the technical expertise required to create them can be very difficult to find.

Approach

This project will continue to provide special-purpose tools to improve the accuracy and efficiency of power quality analyses. The project will provide development and support for the EPRI Power Quality Diagnostic System (PQDS) as well as development and support for commercially available tools that analyze reliability and quality issues. Utilities typically need to perform specific analyses to evaluate the reliability and PQ characteristics of specific power systems. The simulations may evaluate specific problems (e.g., transients, harmonics, voltage regulation, and flicker) or they may evaluate system designs to improve reliability and quality.

New tools will be developed as modules of commercial software packages such as EMTP-RV, and new approaches will be implemented in advanced tools like the Distribution System Simulator. Real-world problems and objectives will be identified and used as the basis for developing new evaluation approaches and tools.

Members identify priorities each year. Recent years have focused on analysis tools for capacitor switching transients, lightning protection for customer systems and transformers, flicker evaluations, motor starting in-rush, flicker, capacitor switching, and ferroresonance. New developments in 2010 focus on additional EMTP-RV modules as well as overall enhancements to the PQDS platform.

Impact

- Improves the accuracy and efficiency of PQ and reliability evaluations through application of special-purpose tools and methods
- Improves characterization of power quality phenomena
- Speeds solution identification and results quantification
- Supports response to regulatory inquiries and response to customer PQ and reliability issues

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can best apply the results of this research by assimilating the results and applying the newly developed software tools along with application information and support. An annual workshop provides training and updates in the latest capabilities in EPRI tools and commercial simulation tools.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Support and Development of PQ and Reliability Analysis Tools: This tool implements advanced weather normalization features for evaluating reliability performance from outage databases and weather databases (based on technology developed in industry standards groups and EPRI research).	12/31/10	Software

PS01B Integrating PQ Monitoring and Intelligent Applications to Maximize System Performance (062089)

Project Set Description

The objective of this project set is to implement monitoring system advancements that will not only enhance the benchmarking and reporting functions of monitoring systems but also provide the basis for advanced applications that can improve equipment and system reliability. This project set works to enhance distribution reliability to meet the increasingly diversified requirements of a competitive energy marketplace, including changing regulations and open-access requirements.

Project Number	Project Title	Description
P001.004	Integration of Data from Multiple Sources	This project integrates PQ and system data from multiple sources to enable improved decisionmaking.
P001.005	Advanced Applications for Monitoring Systems	Advanced Applications for Monitoring Systems
P001.006	Monitoring System Development and Management	Updated PQView Data Visualization and Analysis Software

P001.004 Integration of Data from Multiple Sources (060443)

Key Research Question

The EPRI PQ Program has identified issues relating to PQ data and monitoring as important to the success of electric utilities in the coming years. One challenge is to take data from many different sources and integrate it into common resources that can be used to inform decision-making and offer close support for operation of modern utility T&D systems.

Approach

In this project, EPRI will expand the ability to integrate data sets to enable informed decision-making. This effort includes not only data acquired from PQ monitors, but also other data sets, including reliability, maintenance, recloser and switchgear operations, and lightning and weather, to name a few. As part of this project, EPRI will work closely with the IEEE Power Quality Subcommittee to transfer EPRI's specification for storing PQDIF records in a database format. EPRI also plans to work with the IEEE Task Force by authoring

chapters of the IEEE application guide and XML specification annex. The project will develop a new data handler for PQView that can read PQDIF files in binary, XML, or database format, based on EPRI work with IEEE's P1159.3 Task Force and with instrument vendors. The resulting new data handler will include a logging function that provides feedback to PQView users on problems with noncompliant PQDIF files.

The IEEE 1159.3-2003 PQDIF standard provides a file format for exchanging measurements between power quality systems. To increase its adoption, IEEE is writing annexes on the PQDIF application and extending its file format to XML. In 2007, EPRI wrote a PQDIF application guide with examples containing measurements in PQDIF structure in binary, XML, and database format. The database format is an innovative means of storing PQDIF definitions, observations, and instances. It includes updated code examples to illustrate how to write files in this format. The new XML version of PQDIF is not supported by PQView's PQDIF data handler. The IEEE Task Force needs help to write its PQDIF application guide and XML format annex.

Impact

- Integration of data from multiple resources is of great value to utilities.
- The analysis and decision-making enabled through data integration can improve operational efficiency significantly.

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can best apply the results of this research by assimilating them and applying the ability to capture the added monitoring value that is routinely being integrated into such non-monitoring components as relays, meters, switches, reclosers, circuit breakers, and regulators. Such integrated devices are often referred to as "intelligent electronic devices."

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Integration of Data from Multiple Sources: Integration of PQ and system data from multiple sources to enable improved decision-making	12/31/10	Software

P001.005 Advanced Applications for Monitoring Systems (062153)

Key Research Question

The EPRI PQ Program has identified issues relating to PQ data and monitoring as fundamentally important to the success of electric utilities in the coming years. Power quality monitoring systems have significant amounts of data describing the performance of the power system and the condition of power system equipment. These data have traditionally been available only for historical analysis and reporting. However, advances in communications systems are making these data available in near real-time and integration of data from additional intelligent devices in the system is resulting in the capability to collect data from throughout the system. However, considerable barriers remain to realizing the benefits from these advances.

Approach

This research may increase the value of PQ monitoring systems through the development of advanced applications that can directly benefit system operation and maintenance. The applications build on existing monitoring system platforms to minimize the additional investment required to achieve these benefits. They also take advantage of the data available in power quality monitoring systems that can be used to assess equipment and system condition with appropriate analytical methods and system interfaces.

This project expands the value of PQ monitoring systems by using the data to develop important information about the health of the overall system and individual components. Alarms and reports can then be integrated

with system maintenance procedures and operations to more efficiently resolve problems and improve equipment reliability. The net effect can be a dramatic improvement in system reliability and a reduction in maintenance and operation expenses—the most important justifications for monitoring systems in the future.

Work will focus on the following:

- General processor for trended PQ data to identify abnormal conditions based on control chart theory
- Methods for resampling voltage and current waveforms for facilitating Fourier analysis or for long-term storage in databases
- Voltage regulator performance module
- Fault protection and coordination assessment module
- Circuit breaker performance assessment module
- Transformer loading and lifetime assessment, including harmonics
- Arrester performance for transient events
- Advanced fault analysis and incipient fault identification
- Harmonic resonance assessment for capacitor banks
- Capacitor bank switching performance assessment
- Customer PQ interface assessments (implementation of limits for harmonics and flicker)
- Customer equipment performance assessments based on monitoring information from intelligent meters

Impact

- Application of PQView continues to be of great value to modern utilities.
- The value of the analysis and decision-making enabled through application of PQView can improve operational efficiency.

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can apply the results of this research by assimilating them and applying them to existing and future PQ data resources.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Advanced Applications for Monitoring Systems	12/31/10	Assembled Package

P001.006 Monitoring System Development and Management (058586)

Key Research Question

Acquiring, storing, and analyzing PQ data is an increasingly important but daunting task for modern electric utilities. The challenges of this process are many, including dealing with massive amounts of data in varying formats and quickly analyzing these data to acquire the knowledge necessary to make informed decisions that can save utilities many millions of dollars in expenses, troubleshooting, and reduced downtime.

Approach

PQView® is a multi-component software system developed by EPRI and Electrotek Concepts for building and analyzing databases of power quality and energy measurements. Its components build measurement databases, write summary reports, compute power quality indices, view waveforms and rms samples, and trend steady-state quantities via workstations and web browsers.

This project provides ongoing development of new, advanced features and capabilities for managing and analyzing large power quality monitoring databases with the goal of enabling quick and expert decisionmaking. This project's developments will be implemented in the PQView software for managing power quality monitoring systems; they are also implemented for convenient interface to other PQ management systems.

PQView is the premier power quality data visualization and analysis tool in the world, enabling participants not only to better detect and diagnose PQ issues, but also to improve the speed of fault location and to better communicate the grid impact of voltage sags. The software is in use by more than 50 utilities around the world, and the research effort is coordinated closely with the PQView User Group to help prioritize development efforts.

Members help prioritize important functions to be included in the power quality monitoring system, including the following:

- Easier data importing into PQView with new PQDIF-format data handlers
- Voltage regulator performance module
- Fault protection and coordination assessment module
- Automated power quality and reliability reporting methods
- Transformer loading and lifetime assessment, including harmonics
- Arrester performance for transient events

Impact

- Utilities implementing preliminary fault location algorithms using PQView have reduced average feeder downtime by approximately one hour per fault event.

How to Apply Results

Power quality managers, engineers, and technicians receive software updates through the PQView Users Group. Software updates based on the research also undergo EPRI SQA testing. The products also include updated software documentation and annual workshops for tech transfer of new developments.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Updated PQView Software: This work will update the world-class PQView data visualization and analysis software package—the best-in-class solution for data handling, visualization, and analysis.	12/31/10	Software

PS01C Achieving Cost Effective PQ Compatibility Between the Electrical System and Loads (062092)

Project Set Description

This project set will help EPRI members ensure electrical compatibility between the power system and the end-use customer's equipment. Power quality mitigation solutions significantly reduce electrical disturbances at the transmission, distribution, and end-use level by integrating advanced energy storage technologies with power electronics. By enabling members to provide high-quality and highly reliable power to their end-use customers, the project set enables power quality to serve as a strategic value creator for the utility industry—and specifically program members—in a highly competitive energy market.

Project Number	Project Title	Description
P001.007	System Compatibility Research	This project involves the development and promotion of PQ compatibility standards.
P001.008	Emerging PQ Technology Assessment (Energy Efficient Technologies)	Technology Assessment and Application Guide for PQ Mitigation Technologies
P001.009	System Compatibility Resource Tools	Updated System Compatibility Resource Tools

P001.007 System Compatibility Research (062349)

Key Research Question

The EPRI PQ Program has identified a number of objectives relating to understanding and improving the compatibility between electric power supply and end-use loads. A key barrier to achieving these successes is understanding the sensitivity of both today's end-use loads and new and emerging end-use loads.

Approach

This research area characterizes compatibility issues between end-use equipment, power conditioning technologies, and power system performance. Activities include establishing evaluation criteria (e.g., testing protocols), evaluating failure mechanisms, and identifying solutions. This research will acquire and distribute seminal compatibility information and knowledge. As issues are studied and uncovered, solutions will be developed and applied by the other projects in this project set.

A second area of research will continue previous work with end users, vendors, and energy companies to establish power quality standards in the automotive, machine tool, and food-processing industries. Work has been ongoing in the food processing area, where food-processing groups have already expressed an interest in adopting the SEMI F47 standard as a beginning step. In addition, work is progressing in the automotive industry, where standards are an important platform for their operations. One promising approach is to work toward adoption of a ride-through recommendation, which is used by organizations such as the IEEE. This approach allows the adoption of standards for many industries simultaneously, rather than one industry at a time. These efforts can be coordinated with the International Electrotechnical Commission (IEC) to ensure international acceptance. Another approach is to press for expansion of electrical codes to encompass performance issues. As more industries become willing to adopt the F47 curve, the end result could be a universal, one-size-fits-all type of standard.

A third research area involves development of a guidebook for designing equipment to avoid power quality problems.

Impact

- Improved customer satisfaction among key industrial and commercial customer categories
- Reduced incidence of end-use customer process interruptions
- More efficient and cost-effective development by end-use equipment manufacturers of equipment that meets PQ performance standards using the Equipment Design Guidebook

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can best apply the results of this research by using the results of system compatibility testing and the associated guidelines to help end-use customers solve PQ-related issues and achieve higher productivity.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Development and Promotion of PQ Compatibility Standards	12/31/10	Technical Update

P001.008 Emerging PQ Technology Assessment (Energy Efficient Technologies) (062350)

Key Research Question

A working knowledge of technology solutions as they become available is critical to the overall effort of solving PQ problems. Since power quality mitigation technologies are always evolving, staying abreast of the latest developments is challenging.

Approach

This multiyear project conducts unbiased technical assessments of emerging power quality mitigation hardware in the areas of voltage sags, momentary interruptions, transient protection, and harmonic filtering. The assessments focus on understanding the technologies, reviewing technical specifications, conducting controlled laboratory testing to evaluate performance, and obtaining operational knowledge from field demonstrations. A working knowledge of the latest solutions is critical to the overall effort of overcoming PQ problems. Since PQ mitigation technologies are always evolving, this effort must continue for years.

Impact

- Collaborative research reduces the contributor cost for each PQ mitigation technology tested.
- Identification of effective mitigation technologies prior to installation can result in net savings.
- Improved customer satisfaction can be achieved among key industrial and commercial customer categories.

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can best apply the results of this research by assimilating them to help their end-use customers answer questions on new technologies using unbiased third-party results.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Technology Assessment and Application Guide for PQ Mitigation Technologies	12/31/10	Technical Update

P001.009 System Compatibility Resource Tools (048281)

Key Research Question

Project members will benefit from a centralized set of information that helps them show customers the causes of, and solutions for, the PQ problems they are facing. This challenge is particularly acute in the industrial sector, which consists of a diverse range of processes, equipment, and power quality issues.

Approach

EPRI's system compatibility resource provides a wide range of support to enable detection, mitigation, and prevention of end-user PQ issues. The EPRI Industrial Design Guide (IDG) provides a technical basis for working with industrial end users in power quality, distribution, and economic development activities. This authoritative guide to industrial processes describes in detail such industrial processes as injection-molded plastics and CNC machining, includes electrical diagrams of the processes and sub-processes, and discusses the economics of process-associated downtime. The descriptions and drawings are interactive, leading the user to important power quality considerations such as sensitive components, test protocols, solutions, and applications. The web-based format makes it easy to use. Each year, additional modules describe a specific process in a given industry. As the main repository of power quality site investigation knowledge and lessons learned, this product helps users understand what problems are faced in different industries.

Impact

- Helps members train new power quality engineers, refresh seasoned representatives, and enhance the credibility of all employees in the presence of end users.
- Improves the relationship between the customer and energy company by demonstrating that the company has invested the time and resources needed to research these problems in depth.

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can best apply the results of this research by assimilating them and applying the Industrial Design Guide with industrial customers to show the causes of, and solutions for, the PQ-related issues they are facing.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Updated System Compatibility Resource Tools: The IDG is the definitive reference to use when designing industrial processes to maximize productivity and minimize production and equipment losses attributable to PQ phenomena. Each year, this project adds modules to this leading tool.	12/31/10	Software

PS01D PQ Technology Transfer and Knowledge Development (063526)

Project Set Description

The EPRI PQ Technology Transfer and Knowledge Development project set has been restructured to deliver increased value for all program contributors. The program provides a wealth of high-impact resources in a well-designed, readable, and accessible format. This includes numerous documents covering a wide range of PQ topics, written not only for use by busy PQ professionals, but also to be shared with important end-use customers and internal utility management. The program's website, www.MyPQ.net, is a comprehensive electronic PQ resource, providing 24/7 access to hundreds of PQ case studies, nearly 300 PQ technical documents, PQ standards references, indexes, conference presentations, and other resources. PQ Technology Transfer and Knowledge Development is one of the most highly used project sets within the EPRI family. The project set is designed to be a valuable part of any PQ program or customer support organization.

Project Number	Project Title	Description
P001.010	PQ Knowledge Development and Transfer	EPRI PQ Knowledge

P001.010 PQ Knowledge Development and Transfer (065541)

Key Research Question

Management of power quality (PQ) issues has never been an easy task, but it has grown even more difficult with deregulation, reregulation, increasingly scarce technical and strategic tools, and a conspicuous lack of unbiased resources for information, collaboration, advice, and problem solving. Moreover, with the ever-increasing use of sensitive digital and electronic equipment in today's economy, end-use customers are not only demanding higher quality power, but also are calling upon utilities to help resolve PQ problems within customer facilities.

Approach

This project provides the knowledge and information electric service providers need to meet these demands cost-effectively. This project leverages EPRI's extensive collaborative research in power quality to provide a wealth of easy-to-use, informative PQ resources for utility staff—as well as materials they can use to inform end-use customers.

This project offers a comprehensive collection of technical and informational publications and products, educational forums, technical support, and web-based services. The project provides information and resource tools needed to help minimize economic losses and more effectively compete in today's marketplace. It also serves to build a knowledge base of the latest power quality products and expert insights into power quality.

Impact

- Provides extremely high value to PQ managers, engineers, and technicians, and utilizes individual participant contributions by at least a 20-to-1 ratio
- Provides the ability to access EPRI experts and network with industry peers both inside and outside the utility industry.

How to Apply Results

Power quality and T&D engineering, design, operations, and maintenance professionals can best apply the results of this research by assimilating them to establish improved relationships with the full range of power quality constituents—utility, vendors, investors, and end users—and improve cost effectiveness by providing

essential information, resource tools, and peer-to-peer knowledge. The PQ Hotline uses the capabilities of existing staff.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
<p>Subscription to EPRI's PQ Knowledge-Transfer Electronic Publications and Resources: This project provides high-impact resources in well-designed, readable, and accessible formats. The project's materials cover topics ranging from PQ basics to cutting-edge mitigation technologies and sophisticated measurement and data analysis methodologies. These documents are written not only for busy PQ professionals, but also are ideal for sharing with important end-use customers and internal utility management.</p>	12/31/10	Technical Resource
<p>PQ Hotline: Members are provided up to 20 hours of hotline access for technical support in the areas of power quality. Access to the PQ Hotline provides best-in-class problem-solving resources, while a PQ Hotline Database provides an unparalleled archive of a range of solutions and industry experience.</p>	12/31/10	Technical Resource
<p>Power Quality Online Resources via MyPQ.epri.com website: Addition and maintenance of online PQ knowledge delivered via the project set's MyPQ.net Web site provides a number of important problem-solving resources for busy power quality professionals. This website is the most comprehensive and unbiased online PQ resource available, providing 24/7 access to hundreds of PQ case studies and over 500 PQ technical documents, case studies, standards references, conference presentations, and a variety of other resources.</p>	12/31/10	Technical Resource
<p>Discounted Registration for PQA/ADA North America Conference and Exhibit: The PQA/ADA North American Conference and Exhibit is the premier international PQ conference.</p>	12/31/10	Workshop, Training, or Conference
<p>North American PQIG Workshop: This utility-sponsored workshop provides end-user focused solutions and insights, making it ideal for education and outreach.</p>	12/31/10	Workshop, Training, or Conference