Power Quality Business Analyzer Meeting Minutes & Presentation Notes

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Meeting Minutes, November 2000

EPRI Project Manager

S. Bhatt

EPRI • 3412 Hillview Avenue, Palo Alto, California 94304 • PO Box 10412, Palo Alto, California 94303 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com

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Principal Investigator
P. Nelsen

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ABSTRACT

The aim of the Power Quality Business Analyzer (PQBA) Project is to develop software tools that assist power quality engineers in determining and communicating the costs of power quality to utility customers, and developing business cases for the implementation of power-conditioning strategies. In order to develop tools that communicate the business effects of power quality to end-use customers, it was necessary first to understand how end-use customers make decisions about power quality and power-conditioning solutions, and then to understand the importance of power quality to those end users. To that end, two stakeholders meetings were held to discuss power quality business issues with representatives of a variety of industries, including textiles, plastics, healthcare, hospitality, and power electronics. This report presents the minutes of those two meetings.

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INTRODUCTION

The business effects of power quality are becoming increasingly visible and important to suppliers and consumers of electricity as modern industry becomes reliant on sophisticated machinery for efficient operation. Utility customers are affected by power quality without knowing specifically what power quality is, or how it affects their operations.

The aim of the Power Quality Business Analyzer (PQBA) Project is to develop software tools that assist power quality engineers in determining and communicating the costs of power quality to utility customers, and developing business cases for the implementation of power-conditioning strategies. In order to develop tools that communicate the business effects of power quality to end-use customers, it was necessary first to understand how end-use customers make decisions about power quality and power-conditioning solutions, and then to understand the importance of power quality to those end users. To that end, two stakeholders meetings were held to discuss power quality business issues with representatives of a variety of industries, including textiles, plastics, healthcare, hospitality, and power electronics.

The two stakeholder meetings revealed that, despite progress made in the identification and solution of power quality problems, power quality remains a mystery to many engineers and most decision makers within industrial customers. In fact, some meeting participants went so far as to suggest attempting to educate customers about power quality by using the term “mysterious events.” Decision makers within end-use customers aren’t particularly interested in the technical details, but rather in the business effect of the interruptions caused by power quality disturbances and in any proposed solution to a known problem for the facility. Most industries require payback on process improvements of between 12 and 24 months.

Overall, meeting attendees felt that power conditioning should not be sold to customers as a solution to power quality problems. They felt that customers would respond more positively to business cases based entirely on solving known business or manufacturing problems such as mysterious shutdowns, missed loom picks, or extruder problems. Anyone wishing to assist an industrial customer must first understand the customer’s process and how power quality disturbances are affecting a particular facility. Knowledge of power quality must be used to present and justify a solution to a problem that industrial customers know that they have. As one participant so eloquently said, “You can’t sell me a solution to a problem I don’t know I have, so don’t try to sell me power quality.”

The end result of these discussions was to focus development efforts of the PQBA on assisting users to determine the appropriate language to use when developing business cases for a particular type of customer, and assisting users in understanding the cost structure of a business to identify the business effect of power quality to which decision-making executives will respond.

The following two chapters contain the meeting minutes from the two stakeholders meetings held as part of the PQBA Project in 2000.

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POWER QUALITY BUSINESS ANALYZER STAKEHOLDERS MEETING – APRIL 18, 2000, CHARLOTTE, NORTH CAROLINA

On April 18, 2000, the first in a series of stakeholder meetings was held at Duke Energy in Charlotte, North Carolina, to discuss the business implications of power quality (PQ) on a variety of industries. Representatives from the plastics, textile, healthcare, chemical, and utility industries spent the day discussing the business impacts of power quality with EPRI and EPRI PEAC.

Meeting Objective

One of the objectives of the meeting was to discuss the value of power quality to the healthcare, textile, plastics, and process industries, and to understand how decisions about capital expenditure for PQ solutions are made in these industries. A secondary objective was to determine how best to analyze and present the business implications of power quality solutions to industry in an effort to improve the adoption rate of power quality solutions for customers.

At the beginning of the meeting, some more specific objectives were laid out by attendees. These included:

1. Determine industry specific and common views of PQ.
2. Determine the value of PQ to industries.
3. Translate PQ from a technological to a business perspective.
4. Determine how decisions are made in industry, and who makes those decisions.
5. Explore the economics of power quality solutions.
6. Explore the possibility of developing equipment standards for power quality.
7. Determine how power can be delivered differently to better meet the needs of end-users.
8. Determine the effects of deregulation on the PQ market.

The following is a short recap of the meeting proceedings and the opinions expressed by the attendees.

Industry Specific Recommendations/Observations

Healthcare

- The healthcare industry does not understand downtime costs.
- Decisions are based on collegial recommendations/physician demands.

- Education of physicians as to the effects of PQ is key.
- Industry personnel never think to blame the power, unless there is an interruption.
- Facilities do not have engineers familiar with PQ issues.
- Physicians and, to a lesser extent, nurses drive the purchasing and "solution" efforts in the industry.
- CEOs and hospital directors have final say, but physicians drive the decisions.
- The main constraint on equipment decisions is purchasing agreements.

Textiles

- PQ is not on the "radar screen" of decision makers or plant managers.
- Textiles industry does not see tie-ins between power quality and production goals.
- If PQ solutions are tied to improvements in productivity, selling solutions will not be difficult.
    - Ideally, identifying a productivity improvement in a known problem area or major cost driver is the best way to communicate the benefits of a PQ solution.
- Overall, electricity is a small fraction of the production cost of textiles.
    - Labor and raw materials are the largest costs.
- Life cycle costing is important in the textile industry.
- Eventually, all cost and benefit calculations MUST be reduced into terms of $/lb of product.
- If not identified specifically, generally, PQ problems are simply "lived with." Many unidentified PQ problems have existed long term, and workaround solutions have become standard operating procedure. This creates difficulties in justifying additional cost for a solution that has minor perceived benefit.
- Operational concerns make investigating minor events a non-priority.
- Lead engineers and plant managers champion and push capital expenditures on process fixes.
- Central office personnel (senior executives, CFOs) make final decisions about capital expenditures.
- Selling PQ in the textile industry will be analogous to selling "education"--executives were not willing to pay for education, but would buy performance improving skills certification. Similarly, PQ solutions should be "marketed" as power conditioning that improves productivity.

Plastics

- Very similar to textile industry in operations, but plastics processors are often smaller businesses, so decision makers and operational managers are tied more closely.
- Single largest concern to plastics processors is unplanned interruptions.

Understanding the Value of PQ

A PQ problem is a spontaneous event that affects production making it a headache for the plant manager. This is decoupled significantly from the capital request process. This leads to a discussion of why even very small expenditures are not championed, even given the prospects of significant cost savings. The agreed upon reasons were:

- It is difficult to get unbudgeted capital expenditures to fix a minor operational problem.
  - Presenting a "savings" solution to a problem that can be dealt with using current resources (labor), even imperfectly, is difficult to justify despite significant possible savings.
  - Plant managers may be unwilling to champion the project because PQ problems are seen as someone else's fault.
  - PQ is nowhere near the radar screens of senior executives who have not experienced the problem directly as have operating personnel. So, solving a PQ problem or gaining a PQ improvement is not something for which they are interested in spending money.
- The value of improved PQ is improved process performance, improved product quality, and reduced costs.
  - PQ itself has no inherent value.
  - Utilities and PQ service providers must provide services and products that improve end-user processes.
  - This improvement must be communicated properly.

Translating Solution Benefits from Technical to Business Perspective and Understanding the Decision Process

- Industrial decision makers, plant managers, and senior executives have no visibility of what "Power Quality" is or does.
- To begin discussing PQ with a non-utility person, the effects on their industry must be communicated effectively, preferably from the angle of increasing productivity or reducing costs.
- Different tactics must be taken when communicating with technical personnel than those taken with executive personnel.
  - Tying PQ solution benefits to identified industry cost drivers will work with all industries.
- Different approaches to dealing with PQ effects must be taken depending upon the industry.
  - Understanding of industry cost drivers and how PQ solutions can help to improve performance in those areas.
  - Commodity-based industries (like textiles) will prefer a cost reduction approach.
  - Value-added, specialty, and cost-plus industries will prefer a revenue improvement approach.
  - The healthcare industry prefers a revenue generation approach (i.e., less interference from transients will allow more billable X-rays, etc.).

Putting PQ on the Radar Screen of Plant Managers and Decision Makers

Operational improvements typically are championed by plant or line managers and approved by senior management. To communicate the value of PQ improvements to these people:

- Discussion on PQ must be couched in ways that lead towards improving the profitability of their processes.
  - Address specific operational costs that are influenced by PQ AND are important cost factors in operating the plant.
  - "Decreasing the number of decreased picks on a loom by conditioning power" is a better way to address a solution than beginning with the words "power quality," which do not strike a chord.
  - Presenting PQ solutions and power conditioning as process improvements rather than cost savings will gain the attention of senior executives who understand where the money is going in their processes.
  - Some efforts, like the ITT study of cost drivers in textile plants, may be required to enlighten industry people and PQ investigators as to the true cost drivers in an industry.
  - The ITT has had significant success by generating capability networks to explode cost drivers in an operation, and putting information gained there into an ROI network, which explodes profitability within an organization.

The Essential Economics of PQ Solutions

Rule of Thumb Payback Periods for Capital Investment, Common to all Process Industries Represented

- 6 months – An absolute go.
- 12 Months – Considered worth doing.
- 18 Months – Will probably be pursued, but may require additional justification.

PQ Rating Systems and Industry Standards

PQ Rating System for Industrial Equipment

PQ is not on the radar screens of most industrial consumers, especially because many PQ events (such as voltage sags) may have minor nagging effects that are not attributed to power. It was suggested by one of the attendees that some sort of a rating system could be developed for the PQ performance of industrial equipment, perhaps one analogous to the E rating that is displayed on refrigerators and other home appliances.

This rating system would serve two main purposes:

1. To identify to the customer the extent to which machinery can be affected by power disturbances.
2. To provide the non-technical or non-PQ savvy purchaser of equipment a basis for comparing the PQ performance of equipment.

Because of the varying nature of PQ from one site to another, one problem to another, and one machine to another, it was the general consensus that a simple stamp of approval would not be sufficient. A numerical rating system would be required that allows customers to compare equipment and match its performance ratings to site problem ratings. A second system rating the power quality of customer sites would be required for comparison to the ratings of equipment. It was agreed that this would be difficult because it would require OEMs and utilities to admit that there were problems with power quality and/or equipment performance.

PQ Hardening Standards for OEMs

Discussion then moved to convincing OEMs to adopt higher standards of PQ performance, or providing boilerplate PQ performance specifications for customers to use when specifying and buying equipment. The specifics of such a standard would require comprehensive studies to document costs of PQ and of hardened equipment before widespread acceptance was possible. These studies should be similar to the study that was conducted in Semiconductor that resulted in industry-wide adoption of PQ equipment standards. A discussion was held as to how such a standard could be propagated in the represented industries.

Textiles:

Convincing a large textile company, like Milliken, Springs, or West Point Stevens, would force the equipment manufacturers (most of whom are offshore--Germany, Japan, etc.) to adopt the standards for the large customer. This would then propagate throughout the industry. Industry groups, like ITT, could help to propagate the specifications to manufacturers. However, to accomplish acceptance would require that a large purchaser of equipment demand compliance with the specifications.

Healthcare

Adherence to PQ standards would have to be forced on the manufacturers by many consumers. However, in the legally charged atmosphere of healthcare, simply advancing a set of specifications would practically force their adoption so that purchasers of equipment would be seen as exercising due diligence in the specification and purchase of equipment.

Plastics Industry

Equipment specifications can be propagated quickly through ANSI and plastics associations.

Who will value this sort of work (PQ investigation and solutions) in a deregulated environment?

- There is an opportunity for utilities and PQ experts to perform services in the certification (PQ9000) of facilities and equipment.
- There is an opportunity in the healthcare industry for some service providers (utilities) to handle both the internal and external power management for the hospital.

Is there any added value ($/kWh) to the user for increased PQ?

- Not to the healthcare industry.
- Tolerant facilities will be more willing to accept lower rates for more PQ events.
- There might be opportunities for service companies to manage power quality (spec, install, operate, and possibly provide the equipment) for businesses so that businesses can buy "dirty," "poor PQ" power from the absolute cheapest supplier and then clean it up on site.

Summary

- Power Quality is not on the radar screen of most customers. When it rises to their radar screen, it is a problem to be solved immediately that is "someone else's fault" (utility, equipment vendor, etc.). PQ is not assigned a high value or priority.
- It us up to EPRI, utilities, and the rest of the PQ industry to develop products and services and to market them in such a way as to draw end users into the market. This group must help customers understand the value of PQ solutions from the perspective of their business needs.
- Power Quality is not important to end-use customers and, as a concept, never will be. The effects of PQ on that customer's value adding processes are important. Efforts should be made to market reliability enhancements rather than "PQ problem solutions." Reliability enhancements MUST be communicated in language that is meaningful to the industry and deals with its important problems!
- Identifying links between PQ solutions and improved performance in major cost-driving areas of specific industries is of ultimate importance to communicate and justify PQ solutions to those customers. To communicate these links effectively, business cases and solutions will have to be packaged differently for all industries.

The cost of PQ and the value of attendant solutions will be greatest in facilities with the least tolerance for interruption--continuous processes, such as plastics and petrochemical, and other 24/7 operations, such as hospitals.

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POWER QUALITY BUSINESS CASE ANALYZER STAKEHOLDERS' MEETING – AUGUST 10, 2000, NASHVILLE, TN

Attendees

Monte Allbrooks – Opryland Hotels

Bill Berry – EPRI PEAC Corporation

Steve Bethel – Essex Plastics Midwest

Alex Chomicki – TVA

Doug Dorr – EPRI PEAC Corporation

Tom Maddux – NES

Tom Mooreland – Middle Tennessee EMC

Paul Nelsen – EPRI PEAC Corporation

Mike Wheeler – TVA

Background

On August 10, 2000, the stakeholders of the project "Power Quality Business Case Analyzer" met for the third time. The meeting was held at the Holiday Inn Select in Nashville, Tennessee, to discuss the business implications of power quality-related process and production downtime. The Tennessee Valley Authority (TVA) sponsored this event and representatives were on hand from local plastics and hospitality businesses. Several local electric power distributors were also on hand to discuss the business impacts of power quality and the requirements for PQ business-analysis software.

Meeting Objective

Stakeholders gathered to discuss the value of power quality to end-use industries and to understand how decisions about capital expenditure for PQ solutions are made in these industries. A secondary objective was to determine how to best analyze and present the business implications of power quality solutions in a software package.

Overview

Doug Dorr presented an overview of the purpose of the meeting and some of the definitions and concepts associated with power quality. Attendees then introduced themselves by describing what they do and their interest in the meeting. Paul Nelsen then gave a presentation related to the preliminary design philosophy and plans for the PQBA (Power Quality Business Case Analyzer) software. Roundtable discussions were then spurred about the effects of power quality on specific end-use businesses and how the PQBA might best help facilitate resolution to PQ problems.

Plastics Industry

A discussion of the power quality impacts in the plastics industry was initiated. Plastics processes, especially extruded blown film, are continuous and demand constant, consistent operation to produce an appropriate quality of product. Plastics processes are so heavily reliant on continuous operation that the interruption of process machinery often results in thousands of dollars of scrapped product. In addition, plastics processes are very reliant on accurate speed control, necessitating the use of variable-frequency drives (VFDs) and other sensitive electronic controllers, making the processes particularly vulnerable to power quality events. A specific anecdote was recalled in which a plastics manufacturer's VFDs were tripped off line repeatedly due to a capacitor-switching transient. With assistance from the local utility, adding line reactors to all VFDs in the plant solved the problem. The implications of this anecdote were twofold. First, the user was willing to purchase line reactors to solve the problem because the line reactors were a relatively inexpensive solution. Second, had the problem been more costly to fix, however, it is assumed that management would have been quite upset about having to "solve somebody else's problem."

Hospitality Industry

The next discussion topic centered on the hospitality industry, which caters specifically to customers as opposed to the manufacturing of a product. The hospitality industry may or may not be particularly sensitive to "power quality" as it relates to short outages and sags. It depends entirely on the upfront design specification for the facility. Many facilities are equipped with backup generation that is capable of providing power locally if the utility supply is unavailable. Larger hotels often will have dual feeds (when a dual feed is available). Most of the equipment trips due to momentary power quality variations would be considered "nuisance type," which can be reset fairly quickly if there is a maintenance person available (for example, elevators stopping, HVAC tripping off line, and alarm systems sporadically false signaling).

In the case of the Opryland hospitality facility, these problems do not occur because it has enough on-line generation to support its own internal distribution system even when variations do occur on the utility system. Typically, the equipment used for critical operations already are protected with some type of power conditioning. Monte Allbrooks with Opryland described a conscious effort by management during the design stage of the facility to improve facility electrical reliability and PQ performance.

Power Quality

The discussion then turned away from specific power quality experiences and centered on more general end-user perceptions of PQ. Throughout the discussion, there was a clear difference of opinion between customers and utilities about the responsibility for insuring that equipment remains up and running and the general perception of who is responsible for power quality. The meeting attendees seemed to feel that lightning and storm-related outages were more acceptable as unavoidable than other PQ events (for example, tree- or animal-related faults). The idea that power, like any other raw material, might have some quality variations that would have to be dealt with as a matter of course was unacceptable to end-use customers.

PQBA Requirements

A brief discussion regarding the value of PQ business-analysis software and the desired functions of such was initiated. Several questions were asked about the manner in which the PQBA would deal with intangible costs, such as disrupted delivery schedules and the general "annoyance factor." Before closing out the meeting, a PQ business case worksheet was handed out to get input from the group on financial implications and perceptions regarding power quality-related losses. The worksheet also solicited input regarding which parameters are the most important in a software package for PQ business case analysis. Consolidated results from the worksheet are included in these meeting minutes under the section titled "Power-Conditioning Business Case Worksheet Conclusions."

Key Conclusions from the Meeting

- Customers feel that power quality is the responsibility of power companies and that electricity is a product that should be delivered free of imperfections.
- Both customers and utility representatives believe that accurate information on solutions to PQ problems is a significant consideration to be factored into the PQBA software.
- There is an education gap regarding the fact that a solution for problems related to capacitor-switching transients is entirely useless for problems related to voltage sags, harmonics, and so forth.
- There is a need to education utility personnel in the operations of specific industries so that when the utility representative assists an industry in solving a PQ problem, that representative will understand the technical and business issues in that industry.

Power Conditioning Business Case Worksheet Conclusions

- Terminology for PQ is still unclear. "Sags" and "spikes" were specific terms used to describe conditions that make the lights dim or the lights go bright.
- The PQBA software needs to have the capability to historically track and document the costs of process upsets and to provide this information to the financial people for their use in defining their position and in decision making.
- Instead of just recommending a solution (installing a CVT, for example), it would be of value to supply a list of CVT vendors.

- Anything that would help the CFO understand the technical nature of the problem is perceived as beneficial.
- The software should be made available to anyone who might see a benefit (CFO, utility, plant manager, line engineer, and so on).
- Software should address three important issues:
  1. Regardless of cost, what is the payback period?
  2. Will this completely eliminate the problems or what percentage improvement will be expected?
  3. Exactly how will the fix help alleviate the problem?
- For any process upset, it is easier to cost justify the fix if it is an internal facility-induced problem as opposed to being a utility-side problem.
- If the problem is utility side, it is expected that the utility should fix it.
- Multiple options with cost/payback analysis are preferred over a single recommendation.
- It is important to consider budget cycles any time that a proposal for capital investments is made.
- Information on the normal or typical power quality tolerance of various types of equipment would be a valuable tie-in for the information contained in the PQBA.
- Software should be capable of doing a cost-per-unit improvement calculation when trying to justify power-conditioning solutions.
- Would be nice to tie in secondary benefits where applicable, such as “Does the proposed solution improve the life cycle of the protected equipment?”
- For each industry, comparisons in similar process categories and/or other success stories are perceived as helpful in justifying solutions.
- Identifying exactly who the decision maker is can be difficult because it varies by industry type.
- Increased production capacity is a critical element for manufacturing industries and the PQBA software should tie into that theme.
- Acceptable payback requirements vary. The survey range was 18 to 36 months.
- Supporting documentation and/or report output for the PQBA should consider:
  - Cause of the problem.
  - Solution to the problem.
  - Cost of the problem.
  - Exact details on costs and their origination.
  - Cost payback analysis.
  - Comparisons with similar processes.
  - Comparisons with similar plants
  - A listing of specific or expected benefits that will occur if the solution is implemented.
  - The projected improvement in process uptime.
  - A summary of problems that have been documented previously.
  - Ways that the suggested solution can be procured or located.
  - Without being too technical, the exact description of the problem or PQ variation.

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