

Market Transformation the *Right Way*: Innovative Programs Deliver Buildings that Work

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1. SYNOPSIS:

Opportunities exist for utilities to provide quality assurance whether they are promoting DSM in a regulated market, or selling energy services in a competitive market, through building commissioning.

2. ABSTRACT:

A key concern for future global economic growth is the construction of environmentally sustainable commercial buildings that promote productivity. In the U.S., utilities have operated energy efficiency programs aimed at installing energy conservation measures (ECMs) for over ten years. Problems with the reliability and persistence of energy savings from those efforts, coupled with competitive pressures in energy markets, are causing utilities to develop more thorough, marketable approaches for their customers.

Buildings that operate reliably, and ensure sustainable energy efficiency performance, result from a quality assurance process that begins at the building or system design phase, and continues through the life of a building. This paper relates results of:

- Studies performed in cooperation with government agencies and national conferences on building commissioning (quality assurance processes) that examine both baseline and best practices to achieve buildings that work
- Characteristics of building performance and operation in a changing environment: products and services that are attractive to customers
- Experience of five utilities in designing, implementing and revising programs that include commissioning and building operation, and how these programs have been affected by the shift to a competitive marketplace
- A five-stage Federal 250-building energy systems tune-up program that offers comprehensive upgrades, preventive maintenance and staff training for sustained improvements in comfort and indoor environmental quality

Opportunities exist for utilities to guide this process, whether they are promoting DSM in a regulated market or selling energy services in a competitive market atmosphere.

3. INTRODUCTION

3.1. Scope

This paper is a discussion of building commissioning as a means for utilities to enter the newly competitive market by ensuring reliable, long term building productivity for utility customers. The authors present applications currently under consideration or in use, and examples of market approaches that five U.S. utilities and one federal agency use to apply commissioning to transform their markets in a competitive environment.

3.2. Background

The U.S. electric utility industry is facing a tough competitive transition at the same time that its target market is undergoing transformation to increase energy efficiency. The prospect that customers may change utility partners at will is causing the traditional role of utilities in providing energy conservation services to be challenged.

A prevailing question among U.S. electric utilities is how to compete in a market where power at lowest price is perceived to be the criterion for success. But when the dust from competitive pricing settles, what can utilities offer customers to distinguish their low-priced electricity from another utility's identical product?

After electricity customers have reaped the benefits of a new pricing structure, they will return to long-range concerns such as performance quality and sustainability. Utilities should expect to participate in securing a high-performance workplace that is designed around human comfort, long term health and safety, and reliable energy efficiency.

Transforming the market to one that consistently self-selects energy efficiency to achieve such workplaces will be tricky in a competitive environment--at least as far as utility involvement is concerned--but requires very little magic. The key to both transformation and the competitive edge in the looming market climate is, of course, customer services, the traditional bond between sellers and loyal buyers. The rabbit-in-the-hat is simply providing desirable services better, and sooner, than everyone else to achieve high market penetration.

In many cases, particularly for complex commercial and industrial buildings, owners are paying for an independent third party to assure the quality and efficiency of design and construction. This service, "building commissioning", is defined as:

a systematic process of assuring by verification and documentation, from the design phase until after construction, that all facility systems perform interactively in accordance with the design documentation and intent, and in accordance with the owner's operational needs, including preparation of operation personnel.

Commissioning directly addresses systems reliability and persistence of energy using systems, which are issues for both the utility and the building owner. A few observant electric utilities have discovered that building commissioning is a service they are well-prepared to provide, and have begun to do so. Furthermore, they are finding that commissioning does not need to be offered in partnership with demand-side management (DSM) programs. Whether they have offered the service in conjunction with a DSM program or not, they have begun to disaggregate the costs, benefits, and savings available from commissioning. Utilities have also discovered that commissioning is a means of satisfying regulatory requirements for measured long-term savings, while providing customers with the quality assurance they want.

Moreover, commissioning is a service that customers need and have demonstrated they will pay for. As a *specialized* service commissioning is new enough that utilities face minimal competition outside the utility industry, and old enough to be recognized as a real service. Certain commissioning services are provided by engineers, test and balance professionals, and some trade allies, such as HVAC installers, but the process of commissioning whole building systems from the design phase to the delivery of trained operations staff is rarely done. It is also increasingly necessary. Surveys and reports from building owners, insurers, and attorneys handling increasing numbers of multimillion dollar lawsuits indicate that the price tag for poor building performance is exorbitant (Brady 1994). These costs far exceed the cost of creating systems that work right the first time, and for a long time.

Finally, a marketing advantage to utilities in providing this service is that, apart from a dozen or so pioneering utilities, commissioning has not already been extensively offered. It is, from a marketing perspective, new.

The experiences of utilities that have supported commissioning services thus far differ. They range from providing information only to paying full (100 percent) incentives for commissioning entire shell and mechanical systems, whether or not the equipment was installed as an energy-efficiency measure. A few utilities have planned commissioning programs that were not implemented because they were sabotaged by the threat of competition. Most of these enlightened utilities were either under way or have gone ahead in spite of (or perhaps to explore) market risks. Five utility commissioning experiences are described below. The following outline of building commissioning tasks will provide a framework for reviewing the utility programs.

The commissioning agent's job is to ensure that efficient and reliable building systems are designed, installed, integrated, and tested, and that the outcome is a completely productive building system with trained operating personnel. Related tasks include coordinating with building designers and contractors to gather information including description of energy efficiency measures, make recommendations with regard to equipment that can increase efficiency, develop a commissioning outline for the building, observe and obtain documentation from each installer on the start-up tests. Comprehensive functional performance testing and documentation follows, which may include post-occupancy end-use monitoring or seasonal testing. Repairs and adjustments are usually the responsibility of the building owner. The O&M component of the commissioning process is very important for sustaining energy savings and high performance levels over time. It includes summarizing equipment manual information, and verifying that building personnel are adequately trained in daily operation and periodic maintenance.

4. INVESTIGATION OF COMMISSIONING PROGRAMS

Federal, state and local government agencies, and a handful of utilities, have pursued programs that help their customers acquire reliable, profitable buildings. Through an annual national conference, the methods of professionals, the measured results of commissioning programs, and the lessons learned about application, are shared, including costs, benefits, barriers to implementation, and successes¹. Five utilities, discussed in a section below, are representative of the programs' designs, products and services, and market-related changes that have occurred.

4.1. Examining quality assurance baseline and best practices

Research indicates that substantial energy-saving opportunities are available from existing systems over time in commercial buildings (Herzog and Lavine 1992). If mechanical and electrical systems control strategies or operating mechanisms do not perform as specified, revised operating procedures can produce savings that would never be achieved without such a long-term quality assurance approach.

A study is presently under way to identify the O&M practices routinely performed in representative buildings throughout the United States. The results from this study will be used to design useful, practical approaches to raising the level of current practice, and to "benchmark" and disseminate current best practice strategies. The study is being conducted on the largest market sectors in four diverse geographical regions of the United States. The study is built upon the following objectives:

- Identify the current range of commercial building operation and maintenance practices in the target markets
- Identify and define best practices in these same markets
- Identify and recommend ways to overcome barriers to achieve best practices

The project assesses baseline O&M practices in approximately 200 buildings through a two-part mail survey directed to those responsible for operating and maintaining the mechanical and electrical systems and to the person most familiar with organization and budget issues affecting O&M practices.

On-site visits to verify O&M practices reported on the survey forms will be performed at a selected number of sites in each region. Analysis of all collected data will result in summary tables of O&M practices, listed by selected technologies for each target market group. Also, survey findings will be assessed using interviews with regional real-estate management and building maintenance firms and regional focus groups with building operators, facility managers and the building owners. A second result of these interviews and focus groups will be to identify barriers to achieving better O&M practices.²

4.2. Experience of Five U.S. Utilities

The five programs described below exemplify the experience of utilities in designing, implementing and revising programs that include commissioning, and how these programs have been affected by the shift to a competitive marketplace.

4.2.1. Los Angeles Department of Water and Power

The Los Angeles Department of Water and Power (LADWP), a public utility serving a major urban area of southern California, offers commissioning services through its new construction and existing building programs. The commissioning component was added to these programs in 1992, with a 100% incentive payable to the building owner to cover the commissioning agent's work. The programs integrate commissioning with operation and maintenance requirements to increase achievable energy savings over the life of the building systems. Costs associated with these requirements are included in the incentive payment and identified as part of the bid process and commissioning process.

A signed agreement between the utility and the building owner ensures that both parties are committed to fulfill the program requirements of the commissioning process. In return for the incentive payment, the building owner agrees to:

- Cooperate with the utility's requirements and procedures
- Enter into an approved contract with a utility-prequalified commissioning agent
- Provide all necessary construction documentation
- Ensure the cooperation of the design team, contractors, and O&M staff
- Ensure that recommendations of the commissioning agent are implemented on time

LADWP prequalifies commissioning agents and trains them to perform services in accordance with the program requirements. As long as agents meet the utility's criteria, the owner may select the commissioning agent. The agents are responsible for ensuring that commissioning and O&M program requirements are met, and transferring O&M to the building owner at occupancy. As part of the commissioning process, O&M manuals and operator training are provided by the equipment manufacturer.

Initially, commissioning was to be offered to all construction projects. The program has undergone some revision over time. Instead of offering identical commissioning services to all customers, cost-effectiveness categories were developed. Five project categories were defined as guidelines, using building size and system complexity as cost criteria. The categories range from small, simple buildings (no incentive cost to the utility because commissioning is performed by in-house utility staff) to new construction of campus-type central plants or similar major facilities (US\$20,000+).

One issue that must be addressed by this and other public utilities is that it cannot market beyond the municipality. Their territory is therefore vulnerable to investor-owned utilities, "without boundaries" in a competitive market, that may want to cream-skim. While this utility's rates are presently lower than other utilities in the region, competition may change their advantageous pricing position. Long-term contracts to retain customers are vitally important, and customer services are part of the answer.

According to LADWP representatives, among the strongest customer services this utility provides is commissioning. As part of their strategic plan for future services, the utility is considering providing commissioning agents free of charge to building owners for small projects, or oversee the work of an owner-retained commissioning agent for larger projects. In the latter case, the utility could manage and direct the commissioning process, working with manufacturing representatives and other trade allies.

The utility can act as a neutral third party that can provide commissioning services at no cost to the building owner. This, of course, puts them into competition with independent commissioning service providers. If the utility offers commissioning, the service will likely be disaggregated from energy efficiency measures and offered as a stand-alone service.

4.2.2. Clark Public Utilities

As part of a regional conservation resource acquisition plan, Clark Public Utilities offers design assistance and building commissioning in the form of measure performance verification. The program is an effort to capture lost opportunities in the region by offering services to help building design teams build or retrofit more energy-efficient buildings. The goal is to raise the efficiency level of buildings above the Model Conservation Standards developed by the Northwest Power Planning Council.

The regional power administration that offers the plan to participating public utilities does not assign a measurable benefit to commissioning on the basis that no firm methods have been developed to measure costs and savings. As a result, this aspect of the program cannot be disaggregated, but it is recognized that the service directly impacts the quality of the program. It is considered a legitimate program service, and is treated as an overhead cost (technical assistance that enhances the quality of the product and the customer relationship, but does not provide savings). The expense allowed for commissioning is determined by individual utilities participating in the plan, since the program objective is to remain within precalculated overall cost limitations.

Although the program has not changed since commissioning was first offered in this program two years ago, the commissioning practices have been refined. Procedures and specifications have been developed to expedite the process, but no actual revisions have taken place. Clark has begun to eliminate incentives--and therefore commissioning--for measures with a payback of less than two years. Experience in this program has also demonstrated that some measures are not cost-effective to commission. The utility commissions on a selective basis now, rolling commissioning into the package on a case-by-case basis.

No other changes in the program or the commissioning component are anticipated as a result of market pressures at this time.

4.2.3. PacifiCorp (Pacific Power/Utah Power)

PacifiCorp, an investor-owned utility that serves large segments of the northwestern states, has offered a commissioning program for new commercial construction since 1991. The program is directed primarily at buildings larger than 12,000 square feet. For the utility, the purpose of requiring fully funded commissioning has been to ensure acquisition of energy savings and protect its investment. The program was designed to:

- finance purchase and installation of energy-efficient measures (including both the building shell and mechanical measures)
- buy down the lending interest rate (from the building owner's point of view, essentially netting the incremental cost of the measures)
- pay in full for commissioning services

The utility's initial investment in efficiency improvements is recovered directly through an energy service charge. A unique aspect of this program is that PacifiCorp trained and certified its own pool of commissioning agents, then hired on an on-call basis from the pool. The agent is responsible exclusively to the utility. The agent becomes involved in projects as early as possible, and remains involved until functional performance testing and O&M training have been completed.

The utility's program implementers advise that communicating with the building owner *after* commissioning is critical so that recommendations for corrections can be implemented. They also stress the importance of closing the information loop--commissioning experiences should be fed back to the program design modelers so that efficiencies can be incorporated at the front end during building design.

In the last quarter of 1994, major changes to this program were implemented. PacifiCorp is now moving toward the customer covering program costs and custom modeling. While projects "in the pipeline" would continue to receive fully funded commissioning services, commissioning would not be paid by the utility for subsequent projects. The reasons for this change were twofold:

1. The program must become more cost-effective. It has been very successful in penetrating the commercial market, but is inherently costly because the utility paid for commissioning all measures. Some measures have proven unnecessary or unwise, from a cost perspective, to commission.
2. For commissioning to become "business as usual," customers will have to take responsibility for implementing the process. PacifiCorp is beginning to encourage its customers to take on more of this responsibility, while still providing financial incentives as well as instructional and promotional materials.

No projects have yet been contracted under the new concept. The action plan requires utility account representatives to describe commissioning opportunities to their customers, provide how-to information, names of agents, costs, and commissioning specifications so that contractors and subcontractors know what they are taking on.

One issue that arises from this approach is quality control, and reconciling actual energy savings with expectations. If the utility is no longer involved with, or directly paying for, the activities of commissioning agents, then the commissioning rigor achieved previously may also be compromised.

4.2.4. *New England Electric*

New England Electric System (NEES), an investor-owned utility in the northeastern U.S., began offering commissioning to customers with thermal energy storage systems in 1992. Because the program successfully acquired a significant amount of conservation resource, it was expanded to target large commercial construction in the utility's service area, and include a variety of HVAC, controls and lighting measures. Two of this utility's programs (a market-driven new construction program and a utility-driven retrofit program that encourages all energy efficiency opportunities) encourage commissioning by specifying and paying incentives upon completion. The utility finds that design/build projects require the most detailed approach.

NEES hires third party commissioning agents to provide utility-defined services. After completion of performance testing, the utility follows up with an operation and maintenance seminar for industrial customers.

The utility pays 100% of the cost of commissioning projects that qualify for their programs. Because the utility pays an incentive, it specifies at the beginning of a project what commissioning activities are required. The experience gained by design and building professionals raises the recognition of the importance of commissioning, thereby raising the energy efficiency baseline.

Commissioning is treated by the utility as an overhead cost at this time, and is separate from the measure rebate. The regulatory agencies involved have not asked for quantifiable savings data as of May 1994, although there is increasing pressure to do so.

Thus far, no modifications have taken place in the commissioning program as a result of anticipated market changes. Looking to the future, NEES is investigating which services could be available without DSM, or could be offered as a value-added step with one foot in DSM and one foot in other services. From that perspective, commissioning is being regarded as a non- or quasi-DSM service, and could include system audits of mechanical systems (even beyond electric use to the gas heating systems); ascertaining if a building is performing according to the design intent; performing functional tests, and other tasks heretofore performed by independent contractors.

NEES is initiating a pilot to commission a project completed about two years ago. Two buildings (one high energy use new construction and one renovation) will be used as a launching activity to explore costs, savings and marketability. Fee-for-service and shared savings options will be tested. The utility considers this project an experience that can provide customers with a track record and documentation, which will foster credibility in the savings to be gained.

4.2.5. *Potomac Electric Power Company*

Potomac Electric Power Company (PEPCO) planned a commissioning pilot in 1992, intended to become effective in 1993. The utility would pay total costs of building commissioning for nine new commercial buildings. To ensure measure reliability, the utility "put the O from O&M" into the commissioning pilot program.

A one-year delay occurred because the original terms of the contract required designers and building owners to commit to an all-electric commercial building at the predesign phase. They were not willing to do so. At first the utility remained resolved to wait for projects that met the pilot program criteria, believing that their targeted building requirements would be met. Then, acknowledging that the contract terms would prevent the utility from reaching its objectives, the utility rewrote the program eligibility requirements, allowing designers and building owners control over fuel choice. PEPCO has now reviewed applications for forty or more projects and several (one large office building and one college campus building) have completed the screening process. The actual commissioning process is beginning with a new goal of twelve projects, all either complete renovations or new construction. The utility expects the pilot to be completed in two to four years. The spectrum of activities includes commissioning from the predesign phase through training building operators.

PEPCO representatives consider commissioning a DSM customer service. Regardless of structural changes in the market, the strategic intent of commissioning remains the same: to get closer to customers from the very beginning. After the pilot is completed, the utility expects to have concrete evidence of the value of commissioning, and to have a clearer idea about the direction its market will take.

4.3. Federal Program

The Energy Star Buildings Program, a federally sponsored energy systems improvement program, offers support for building owners to effect energy efficiency upgrades, preventive maintenance, and staff training for sustained building improvements in comfort and indoor environmental quality. The program is marketed as a partnership between the U.S. Environmental Protection Agency (EPA) and the building owner. Project support does not include financial incentives, but does include technical guidance throughout implementation, performance evaluation after construction is completed, and public recognition. The technical assistance is provided through the program's five stages, which are:

1. Green Lights (lighting system modifications)
2. Building Tune-up, Preventive Maintenance and Training
3. Load Reductions (window and roofing upgrades)
4. HVAC Distribution System upgrades (energy-efficient motors, variable speed drives downsized, building control system installation/calibration)
5. HVAC Plant upgrades (downsized, energy-efficient equipment)

A benefit of this program is that it can demonstrate the value of energy efficiency, reliability and persistence of savings, nationally and outside of the utility market context. It is a window on some of the issues that utilities expect to face in terms of offering energy efficiency or other products and services *for sale*. In fact, the Energy Star Buildings Program actually scouts a path that the transformed utility market could tread: energy efficiency measures are asked for and paid for in full by the building owner; Energy Star provides encouragement and advice, and assists the building owner through the process without large outlays of funds; each stage provides an opportunity to come face to face with program participants; the building owner, having paid for the added value, appreciates and literally can take pride, knowledge, and ownership in the process as well as the product; finally the Energy Star rewards the building owner with information, documentation, savings and recognition for success (benefits s/he would not have if s/he had simply contracted for the same upgrades without the program).

From a conservation perspective, the Energy Star Buildings Program may help to transform the market--happily, without dependence upon current fragile market conditions. But because it is a voluntary program, its advantages are only likely to appeal to building owners who are *already* somewhat committed to energy efficiency.

The EPA is investigating better ways to broaden interest in the program and meet the needs of public and private owners. The baseline information acquired in the project described earlier can help direct their effort. The long-term savings and measure life available from efficiently operating equipment are important to building owners, occupants, and facility managers, whose expenses in this area are traditionally high.

5. CONCLUSIONS

After the rush to provide least-cost electricity is over, utilities that want to retain cost-effective long term contracts in a fluid market will have to market the advantages of the utility/customer relationship. The logic behind this conclusion is as follows:

- Opportunities exist for utilities to build profitable long-term relationships with customers that rely on customer services.
- Customer services add value to the utility's product capabilities, and build loyalty among those served - a critical component of customer retention.
- Building commissioning provides an excellent customer service opportunity that can be offered within the arrangements of DSM programs, as a stand-alone service on the utility's menu, or as an umbrella service that provides quality assurance to a variety of offerings under its rubric.

Building commissioning *can* be justified on the basis of competitive advantage alone. However, its most important societal and economic value is in transforming the market from one that accepts poor performance and inefficiency to one that expects, requests, and pays for reliable performance along with warranties of long-term energy efficiency.

The key attributes of market transformation projects have been defined by an authority who is responsible for such projects at a regional power administration (Keating 1994):

- Based on knowledge, not assumptions about the market
- Strategically targeted to leverage the market toward efficiency
- Embodying measurable goals and an appropriate exit strategy
- Recognition that
 - Long-term intervention may be needed
 - Targeted markets are likely to cross present utility service territory boundaries
 - Market mass, influence, expertise and funding are necessary
 - Collaboration is needed, even in the face of competition, among investor-owned utilities, public utilities, trade allies, manufacturers, and others to change the market

The utilities that are exploring mechanisms to deliver such performance profitably (not just cost-effectively) are including commissioning in strategic plans because the service is both a clear value to their customers, and a means of protecting the investment in energy efficient systems they have already made. Whether or not these utilities offer financial incentives in the future, they have paid out substantial capital already to install conservation technologies. Commissioning and associated O&M services can sustain the performance and savings that utilities and their customers expect to achieve.

6. ENDNOTES

1. National Conference on Building Commissioning. Annual, 1993, 1994, 1995.
2. Project underway at Portland Energy Conservation, Inc.

7. REFERENCES

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