The ROI of Monitoring Based Commissioning:
Automating Continuous Commissioning for Energy Efficient Buildings
Executive Summary

Facilities managers understand that wasted energy will increase over time unless there is some intervention. When do you have time to analyze your equipment data when most of your time is spent reacting to everyday comfort complaints and maintaining current project schedules? Commissioning services are a best practice in energy management, but recommissioning or retrocommissioning are done at most every three to five years. Thus, wasted energy compounds and potential savings are deferred for years.

Continuous commissioningSM introduced the idea that commissioning and energy management work should be ongoing to drive greater savings. However, the volume of information, the complexity of equipment and ongoing operational demands make this difficult to do. Monitoring based Commissioning (MBCx) builds off the concept of continuous commissioning, but uses automation to deal with the complexity. MBCx combines continuous monitoring, fault detection and diagnostics and building performance dashboards based on predictive analytics to provide persistent and continuous energy savings with full mobile visualization.

To assess the ROI of monitoring based commissioning, this paper reviews the following benefits:

- **Reduced operating expenses** are perhaps the most important benefit associated with commissioning with building efficiency improved 5%–20% through retrocommissioning. By accelerating energy saving projects, MBCx allows you to realize these savings in months rather than years.

- Your utility company has **incentive and rebate programs** that you qualify to use and you can drive incentives with a monitoring based system.

- A continuous monitoring system gives you this **visibility in hidden assets** and their effect upstream and downstream in the context of your system as a whole. The analytics in MBCx make it much easier to maintain peak performance of these assets.

- Many facilities management teams spend much of their time reacting to disruptions in building performance. MBCx helps **staff become more efficient and proactive** in building energy efficiency.

- To address improperly operating equipment, monitoring-based commissioning supports **Fault Detection and Diagnostics** (FDD) to identify future problems in equipment before they become disruptive. Through the continuous monitoring of energy consumption and equipment operation, faults can be detected and maintenance can be performed.

- Most organizations have made commitments to **sustainability and green initiatives**. MBCx can play an important role in helping meet your energy efficiency benchmarks and getting points for programs like LEED certification.
The Time Challenge

The demands on today’s facility management teams continue to grow; save money on energy and utility usage, reduce maintenance and labor costs, speed up troubleshooting time, maintain occupant comfort, and the list goes on and on. Yet the key challenge in accomplishing all this remains the same… and that is time.

When do you have time to analyze your equipment data when most of your time is spent reacting to everyday comfort complaints and maintaining current project schedules? And how can you truly optimize your efficiency when the use of multiple disparate systems just adds more complexity, more interfaces to manage, more maintenance, and causes more “disconnect” than ever before. How do you manage the continued pressures of costs and budgets, and decide which initiatives will have the greatest positive impact on equipment performance and energy reduction with the limited time and resources you have today?

The bottom line is, you want systems that reduce cost, accelerate the decision making process, deliver real time visibility into when and where problems occur, and ultimately guide you toward tasks that provide the most value to be realized during your limited amount of time.

In this white paper we address the benefits of implementing a smart continuous commissioning system for your facilities. We show you how implementing Monitoring Based Commissioning (MBCx) actually reduces your reliance on other systems and how it can improve your real time operational visibility into the right set of programs, all without requiring additional IT support, time, infrastructure, and maintenance costs.

Facilities Management and Energy Efficiency

Building optimization and commissioning are a best practice to ensure energy efficient buildings. This is driven by both recent regulations requiring commissioning of new construction and existing buildings combined with the savings building owners have gained through the commissioning process.

Facilities managers recognize that wasted energy increases over time. Buildings experience degradation caused by malfunctioning equipment and changes in building occupancy. As facilities managers respond to occupant complaints and perform routine maintenance, systems stray from how they were designed. This results in lower building efficiency that gets compounded over time.

In response to this trend, facilities managers will periodically return to the concept of commissioning. Recommissioning or Retrocommissioning optimizes the mechanical or electrical systems in an existing building to tune the building’s systems to new set points based on its actual operations.
According to a study by Navigant\(^1\), recommissioning is performed at most every three to 5 years and more typically once every 5–10 years. This is understandable because the process can be expensive. However, retrocommissioning can reduce a building’s energy consumption by up to 10%–20% in particularly out-of-tune buildings, though a majority of buildings can achieve savings in the 5%–10%.

The concept of **continuous commissioning**, first developed by the Energy Systems Laboratory at Texas A&M University, introduced the idea that the analysis and remediation of problems should be ongoing. Thus, the building owner benefits from more manageable ongoing investments that yield saving much sooner which also eliminates the compounding of costly energy waste over time.

While the concept of continuous commissioning is appealing, it can be very challenging to implement. First, facility managers need to devote time and resources to the process, resources that are responding to ongoing operational needs and issues. Second, the amount of information from building management systems, devices under management and their subsystem components can be staggering with a massive number of control points to consider.

Automation is the logical approach to dealing with these issues. **Monitoring based Commissioning (MBCx)** builds off the concept of continuous commissioning, but uses automation to deal with the complexity and volume of information. *MBCx combines continuous monitoring, fault detection and diagnostics and building performance dashboards based on predictive analytics to provide persistent and continuous energy savings.*

MBCx can be used in several ways. For existing buildings, it can be introduced at any time as a way to use retrocommissioning concepts in a more gradual way. This allows saving to build over time rather than allowing wasted energy to grow. It can also be used in the new building commissioning process to automate and validate the process. This allows facilities managers to maintain the design performance from the very beginning. Applying analytics to the large amount of building data ensures that the facility manager has full visibility and can readily prioritize activities, ensuring much greater efficiency. This allows the right information to be delivered to the right person at the right time.

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\(^1\) “Building Optimization and Commissioning Services” Navigant Research Q1 2015
Identifying the Savings Opportunity Gap

The “Savings Opportunity Gap” is the dollars that are wasted due to equipment inefficiencies and misconfigurations, lost utility incentives and rebates, and unplanned process failures. Traditionally these savings are hard to calculate, let alone spot; particularly without a sophisticated system that is designed to bring these savings opportunities to the forefront.

Engaging in periodic retro-commissioning studies and services closes the gap, but without further re-commissioning, energy and operational costs will continue to build up again. A better alternative is to use a monitoring based commissioning system to implement continuous commissioning. Unlike retrocommissioning projects done every few years, you can eliminate savings degradation over time and provide an actual increase in total savings through the real time visibility and on-going fault detection across your facilities. These systems have a payback in months versus years, and can often pay for themselves through utility incentives and greater operational efficiencies (See figure 1 below).

Figure 1: In a new building, commissioning services are critical to ensuring the building meets its design goals. Without any intervention, the amount of energy wasted will increase and compound over time. Retrocommissioning (RCx) can provide periodic saving, but Monitoring Based commissioning (MBCx) helps deliver greater saving more quickly as shown by the green shaded area.
MBCx requires an incremental investment in software to correlate the data, perform the analytics and help with visualization through reports and dashboards. This empowers the people making decisions about remediations to be much more efficient and effective. However, it should be noted that the actual work on the equipment is the same under both MBCx and retrocommissioning. The difference is that MBCx allows this expense to be spread out over time as a series of smaller projects (as shown below) rather than as a very large project every three to five years.

![Figure 2: By embracing continuous improvement, facilities managers benefit from a continuous ROI.](image)

Facilities management has to be concerned with costs as well as benefits. What are the tangible benefits from the investment in MBCx? Do they present a compelling Return on Investment (ROI)?

**Reduced Operating Expenses**

Reduced operating expenses are perhaps the most important benefit associated with commissioning, particularly for retrocommissioning of existing buildings. Many building owners report that their building became 5%–10% more efficient through retrocommissioning, though some poorly performing buildings have enjoyed even greater levels of energy efficiency.

By doing energy savings projects on an ongoing basis, MBCx allows you to realize these savings much sooner – in months rather than years. In a study\(^\text{2}\) done by Lawrence Berkeley National Laboratory, the authors benchmarked a portfolio of MBCx energy savings for 24 buildings located throughout the University of California and California State University systems:

\(^{2}\) “Monitoring-Based Commissioning: Benchmarking Analysis of 24 UC/CSU/IOU Projects” by Evan Mills, Ph.D and Paul Mathew, Ph.D, Lawrence Berkeley National Laboratory June 2009
“A total of 1120 deficiency-intervention combinations were identified in the course of commissioning the projects described in this report...From these interventions flowed significant and highly cost-effective energy savings. For the MBCx cohort, source energy savings of 22 kBTU/sf-year (10%) were achieved, with a range of 2% to 25%. Median electricity savings were 1.9 kWh/sf-year (9%), with a range of 1% to 17%. Peak electrical demand savings were 0.2 W/sf-year (4%), with a range of 3% to 11%.

Median energy cost savings were $0.25/sf-year, for a median simple payback time of 2.5 years... Energy savings are expected to be more robust and persistent for MBCx projects than for conventionally commissioned ones.”

Clearly there are significant energy savings for most buildings and MBCx allows facilities managers to realize them sooner and benefit from them for a longer period of time.

Utility Incentives and Rebates

More than likely, your utility company has incentive and rebate programs that you have contributed to and you qualify to use. The challenge is identifying exactly what those are and working to get them done. This process starts with an evaluation of the top energy saving programs that will give you the biggest bang for the buck in both maintenance and incentives. By doing this you can submit these programs into your utility provider (depending on their process), and receive a pre-approval or Memo of Understanding prior to starting an energy saving program to maximize future incentives and return on investment.

On a capital program where equipment is replaced, it is easy to get the approved incentive once the equipment is installed and verified. But did you know that you can drive continuous incentives with a monitoring based system? This approach pays off two fold by reducing your monthly bill and by increasing reliability and performance of all your equipment.

Figure 3: Monitoring Based Commissioning drives and sustains a process that allows you to identify the best options for getting utility incentives on a ongoing basis.
Improved Effectiveness of Maintenance Staff

Currently, many building maintenance teams react ad hoc to disruptions in building performance, thereby missing many opportunities to realize latent energy efficiency potential or optimize occupant comfort, one of the other key benefits of commissioning.

Essential to every organization is prioritizing the right programs to work on first. Everyone has a budget, goals, and cost targets to meet with limited time; so picking the right programs to go after is essential.

So, how do you do it? We talked about utility incentives and monitoring earlier, but how do you leverage all the information from every system to develop an on-going strategy toward energy conservation that drives results every day? MBCx software helps you tie those programs to real dollars, tying those programs down to the equipment level, and to the specific corrective actions that drive your ROI.

Figure 4: Analytics power the visualization tools that help managers make better decisions.
Visibility into Your Hidden Equipment

What are your Top Cost Offenders...right now? If you are not aware of the cost issues across your facilities, or if you do not know right now if your equipment is performing at its peak, you are probably wasting energy. Peak performance optimization is all about knowing in real time when something starts to go wrong, and understanding what to do to correct it.

How many hidden assets do you have? How many times do you check on those assets – once a year, once every two years? Now compound that with potential energy waste that might be going on for a few days, weeks, or even months!

A typical air handling unit has twenty to thirty subsystem components, each of which, if monitored properly, can provide indicators into the health and performance of that asset and system as a whole. For example, what if fifty (50) VAV boxes (in a building that was not being continuously monitoring) was found to have a faulty air damper that remained 100% open over the course of six months. How much energy was wasted during that time? Our estimate is over 100,000 kWh per year. Can you afford that?

A continuous monitoring system gives you this visibility of hidden assets and their effect upstream and downstream in the context of your system as a whole... and it can do this in seconds! A continuous monitoring system not only alerts you, but it arms you with the key insight into the overall system effect of the critical situations – as they relate to energy costs, comfort loss, or costs savings – and it delivers you the potential causes for these events so that you can bring them to a rapid resolution.
Fault Detection and Diagnostics

While traditional commissioning identifies improperly operating equipment, monitoring-based commissioning has the ability to identify future problems in equipment before they become disruptive. Through the continuous tracking of energy consumption and equipment operation, faults can be detected and maintenance can be performed.

Remember those hidden equipment issues that can occur for long periods of time... costing significant amounts of money...? Well, continuous monitoring brings these hidden equipment issues into your line of sight, even if it is across thousands of different pieces of equipment, or consolidated into hundreds of systems; each with a multitude of key performance indicators to watch. You cannot expect your BMS or BAS expert to watch them all – but a MBCx system is designed to do just that.

Fulfill Green Initiatives

Increasingly, organizations are making commitments to sustainability. These green initiatives have become very visible with regard to the type, quality and environmental aspects of the buildings they have chosen to occupy. It is a simple and effective way to demonstrate that they are actively engaged in good environmental practices. Many industry reports show that energy efficiency is simply “good business”.

EPA’s ENERGY STAR® program and the U.S. Green Building Council’s LEED® rating system have gained traction as ways to demonstrate energy efficiency. According to a 2014 study\(^3\), there are now more than 26,000 ENERGY STAR-rated buildings, some 3.8 billion square feet, and nearly 23,000 LEED certifications totaling approximately 2.9 billion square feet in the U.S. market.

LEED certification, which includes a commissioning process, allows building owners to take advantage of a growing number of state and local government incentives. An MBCx system can help your building achieve points in LEED v4. LEED also has significant benefits in complying with regulations. For example, buildings are exempted from the NY Local Law 87 requirement for energy audits if they have achieved EPA Energy Star label or U.S. Green Building Council LEED certification for at least two of the three years preceding the filing date.

Thus, the realization of design performance has become an important consideration for facilities managers. Today, many buildings are designed using an energy model to determine the energy savings the building will achieve compared with code or previous performance. Actual performance can vary considerably due to statistical variation, unexpected changes in occupancy patterns, and other factors. MBCx helps facility managers meet these design goals more readily and efficiently as was illustrated in figure 1.

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\(^3\)“National Green Building Adoption Index 2015” by CBRE
Summary

- **Hard dollar cost savings** in the form of **reduced operating expenses** by eliminating wasted energy improves building efficiency 5%–20%. MBCx allows you to realize these savings in months rather than years. MBCx also allows facility managers to take advantage of utility company **incentive and rebate programs**.

- **MBCx helps staff become more efficient and proactive** in building energy efficiency. A continuous monitoring system gives you this **visibility in hidden assets** and the analytics in MBCx make it much easier to maintain peak performance of these assets. **Fault Detection and Diagnostics (FDD)** identify future problems in equipment before they become disruptive.

- Most organizations have made commitments to **sustainability and green initiatives**. MBCx can play an important role in helping meet your energy efficiency benchmarks and getting points for programs like LEED certification.
ABOUT FACILITYCONNEX POWERED BY GE

Powered by GE Proficy software and the Industrial Internet, FacilityConneX is an Enterprise-level intelligent monitoring and knowledge action system designed to bring smart asset monitoring, advanced predictive intelligence, continuous management and energy savings; all available in a secure hosted Cloud environment with online and mobile visibility.

With a cloud based solution you get the lowest TCO (total cost of ownership) while never losing visibility into conditions that matter. Our continuous smart monitoring system – FacilityConneX - provides complete insight into the condition of your equipment in real time. You will get alerted when things are not running at optimal performance levels, and know exactly what needs to be done to resolve the problem quickly. FCX watches not only mechanical fault detection scenarios, but resulting system cost issues as well.

FacilityConneX connects all of your disperse systems and hidden pieces of equipment to give you complete visibility. Remember the number of subsystems of an air handling unit? FacilityConneX does 1000s of checks continuously with advanced fault detection techniques designed to optimize your equipment to the highest performance and with the greatest energy cost awareness in the market.

Our FacilityConneX predictive analytics will do three things for you...

- Watch your equipment and the thousands of fault detection scenarios that can go wrong.

- Classify your findings into your worst offenders to help you focus on the right priorities, at the right time.

- Correlate what is happening overall and connect the savings with the actual correction needed at the equipment level.

FOR MORE INFORMATION VISIT:

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