

# The 12 Things You Need to Know about Monitoring-Based Commissioning (MBCx)

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From the moment a building is constructed and starts consuming resources, it starts deteriorating. Mechanical, electrical, automation, and all building systems naturally decline over time in terms of both performance and efficiency. The results can be the same; operations and maintenance costs rise, energy consumption rises, and occupant comfort may decline.

Building owners and managers know they have options to prevent this natural progression, but are often overwhelmed by a glut of contradicting information, misinformation, and misconceptions in the marketplace. Different vendors different use terms like commissioning, existing building commissioning, fault detection and diagnostics, smart buildings . . . the list is nearly endless.

Although the terms are different, the message is the same: “Let us analyze and optimize your building and we’ll save you money.” It’s certainly an attractive proposition—spend a little money now, save a lot of money later. But because of the terminology confusion, abundance of market options, and lack of standardization in approaches to dealing with this issue, building owners and managers have become understandably leery of sales pitches. In the midst of the confusion, though, lies a truth; what the industry calls continuous or monitoring-based commissioning does, in fact, deliver improved building performance and energy efficiency.

1. It goes beyond energy savings.
2. It’s a team effort.
3. Process, process, process.
4. Implementation requires full buy-in.
5. It’s more than just a rule developed in a lab.
6. You might not have all the data you want and need.
7. When it comes to data, it’s all hands on deck.
8. MBCx doesn’t work on its own.
9. The software doesn’t “drop in” and get to work.
10. Don’t turn it on all at once.
11. If you’re not committed to fixing issues, don’t waste your money on MBCx.
12. Optimization strategies go hand-in-hand with analytics.



The real long-term value of commissioning is in the building performance improvements and compliance efforts. That value is possible through a comprehensive combination of the right people, processes, and technologies.

## Defining Monitoring-Based Commissioning

According to a report by the Lawrence-Berkeley National Laboratory, "Monitoring based commissioning (MBCx) combines ongoing building energy system monitoring with standard retro-commissioning (RCx) practices with the aim of providing substantial, persistent, energy savings\*." What we are really talking about is a sophisticated package of software applications that combines building data from a wide variety of sources to better manage building performance and efficiency. MBCx involves the implementation of improvement measures along with ongoing service and insights necessary for full transparency, measurement, and reporting. That is, what facility engineers have done manually for decades can now be completed more efficiently, more comprehensively, and more accurately by combining building and energy system data with an engineering team's expertise through the MBCx process.

When MBCx is built into a continuous building improvement process, it allows combined technologies involved in data mining to identify faults or issues in building systems with the necessary human analysis to determine how to address those faults or issues. Truly advanced MBCx solutions will also help identify and prioritize resolution paths; for example, if there is simultaneous heating and cooling in air handler 5, facility engineers should investigate a leaking chilled water valve to avoid a potential costly expenditure.

Defining MBCx is the first step toward understanding it; we will now review the 12 things you need to know about monitoring-based commissioning.

### 1. It's not just about the energy savings.

The same Lawrence-Berkeley National Laboratory report asserts that MBCx is a highly cost-effective strategy. The buildings involved in this benchmarking analysis realized average energy savings of 10%, with some ranging as high as 25%; and the investment had a simple payback period of 2.5 years, according to the report. Those are impressive results to be sure.

Many vendors today offer metering and commissioning services and promise energy cost savings. While that's an important goal that often gets building owners interested in a service package, what's equally as important is the improved building performance and compliance that can result from a truly comprehensive MBCx strategy.

Through our experience over the years, we have come to understand that building maintenance is not always thoroughly completed for a variety of reasons, including, without limitation: the mechanical, electrical, and HVAC systems are considerably more complex than they once were; maintenance issues are resolved when the building is no longer comfortable and a tenant complains, or when a piece of equipment breaks and must be repaired or replaced; and because regular maintenance schedules (for example, filter replacements every six months) are not sufficient to support the building's most effective performance. MBCx is a comprehensive business process to improve the way buildings are maintained by using technology as an enabler.

The results can include a lower likelihood of premature equipment failure; assistance with federal, state, local, and corporate requirements and regulations; energy and operational cost savings; and, finally, sustaining and perpetuating the improvements you have made.

**2. It's a team effort.**

While MBCx involves highly sophisticated technologies, even the best software applications do not always perform exactly as you need or want them to without the right people working with them. Monitoring-based commissioning means assembling a high performance team comprised of building engineers, controls contractors, mechanical contractors, commissioning resources, and others. The objective is to assemble subject matter experts from every aspect of the building's performance to most effectively review and analyze the mined data. This team will understand the building's unique operations and how to interpret the issues that might arise on a dashboard.

**3. Process, process, process.**

The technology and the people are there. Having the right processes to support their efforts is critical to maximizing their effectiveness.

Fault detection and diagnostics (FDD) and similar solutions identify out-of-range states for various systems or equipment within a building. A fault is not an alarm; a fault indicates that the system is not running optimally. FDD analysis continually monitors building performance and can identify many faults each month, depending on the complexity of the systems and the size of the building. The technology can give you great insight and information, but you need the people available to finish the interpretation and analysis. Those teams require effective processes to facilitate that regular analysis and proactively optimize building performance and efficiency. Building owners who engage in MBCx may need to develop new business processes to support the teams and technologies in new ways.

It requires a new approach that is no longer simply reactive to break/fix scenarios but now can be proactive based on data, analysis, and operational processes built into the business. The upfront investment in proactive services will ultimately reduce operating costs by enabling your team to work more efficiently and, more importantly, improve building performance.

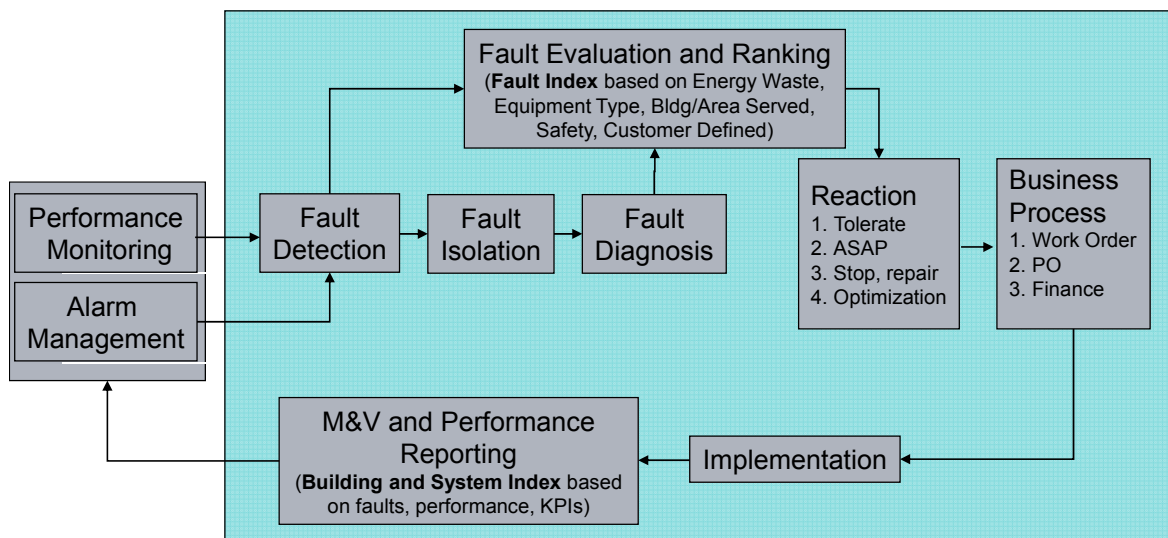
**4. Implementation requires full buy-in.**

The term "building owner" refers to more than a single person or entity who owns the building. "Building owner buy-in" means getting all facility engineers, technicians, and information technology specialists on board to plan for and participate in an MBCx implementation. And because it requires continued, long-term engagement and participation, all stakeholders should be aware of and committed to implementing and sustaining the process.

**5. It's more than just a rule developed in a lab.**

MBCx is no off-the-shelf, lab-developed process. That is, every building has unique controls, unique configurations, and unique data. The many diagnostic algorithms must be continually tested and improved upon, rather than developed and tested in sterile lab environments. Preparing these algorithms means getting a picture of the building's systems and creating a model that considers the original control drawings and design intent. No rules can come out of the box and apply to every building, every climate, every situation.

MBCx can provide a series of tried-and-true algorithms that support the rule development process in the field. The mechanical, electrical, and energy systems produce vast amounts of data that can be measured and compared against a set of expected values. When the actual values do not match the expected values, the algorithms will generate a fault, and in the cases of evolved MBCx, a root cause. Engineers get a wide-ranging picture of what is going on in the building, and MBCx can be customized to the characteristics of a particular building.



\* Mills, Evan, and Paul Mathew. Monitoring-Based Commissioning: Benchmarking Analysis of 24 UC/CSUI/IOU Projects. Rep. Berkeley, California: Lawrence Berkeley National Laboratory, 2009.



**6. You might not have all the data you want and need.**

Most of today's building automation systems are designed specifically to control the building's systems; not as tools to analyze and trend data. IT professionals can extract data, but it is not necessarily going to be comprehensive enough to provide the analysis you want as quickly as you need it. Insufficient data leads to fewer insights and more tentative conclusions, and so effective commissioning may require a building automation system upgrade or hardware improvements, for example, in order to uncover and leverage the trending data that's buried in the building automation system.

**7. When it comes to data, it's all hands on deck.**

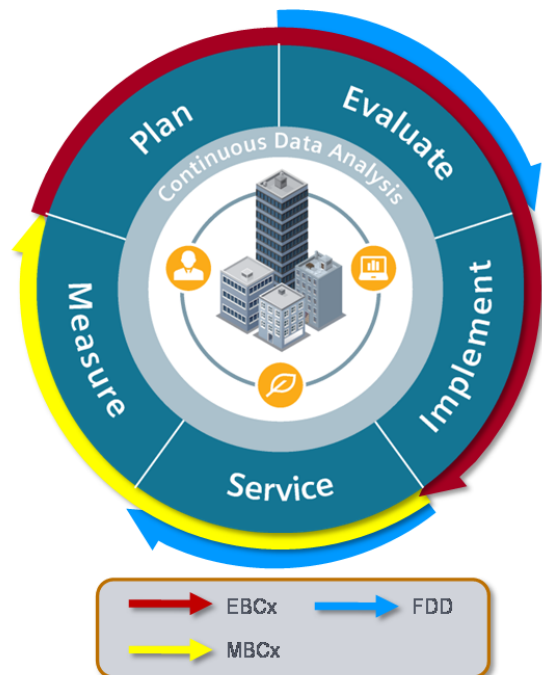
A complete picture of building performance is only available when you have all data hands on deck. Automation system data, energy data, equipment data, service work orders—all of it must work together. Each set of data provides valuable information, but is not effective as a comprehensive strategy on its own. Looking at utility usage as an MBCx strategy is akin to diagnosing cancer by listening to a stethoscope. Many of today's "commissioning" vendors may position their work as comprehensive, but if they're examining just one set of data, you're getting a partial picture at best.

**8. MBCx doesn't work on its own.**

MBCx can provide persistent performance improvements and operational savings, but without a comprehensive commissioning strategy, it's not going to deliver all the results building owners want, need, and demand from commissioning vendors and partners. A comprehensive commissioning strategy must include existing building commissioning (EBCx) to help ensure that a building is performing optimally according to current needs, while MBCx can not only ensure savings, but also identify advanced measures for performance improvement. This comprehensive commissioning strategy is only effective when combined with the traditional diagnostic

activities of skilled personnel in the building. Consider one example where a building's HVAC system was overtaxed in trying to cool a building. Engineers could determine, through MBCx, that one of the temperature sensors was reading temperatures significantly higher than in other areas of the building; but it took the intervention of a person walking the building to realize that the sensor was located behind the soda machine to realize the full value of that data. The EBCx was a critical aspect of that full diagnosis and correction.

For further reading on a comprehensive commissioning strategy, please read *Commissioning: An Essential Part of a Comprehensive Energy Strategy*, by Michael Chimack.



**9. The software doesn't "drop in" and get to work.**

In our fifth point, we learned that no off-the-shelf MBCx package is available to work in any building in any situation. Likewise, no software package can simply be "dropped in" and get to work for the building. Configuration requires a team-wide effort to gather data, configure rules, and generate usable information. Regardless of what commissioning vendors' marketing departments might promote, no solution can be turned on and immediately generate savings. Often, because not all data is available and because of a building's preexisting conditions, engineers will have to rely on imperfect data in order to arrive at solutions. Again, MBCx is one part of a comprehensive energy strategy that involves the right people, processes, and technologies to be effective.

**10. Don't turn it on all at once.**

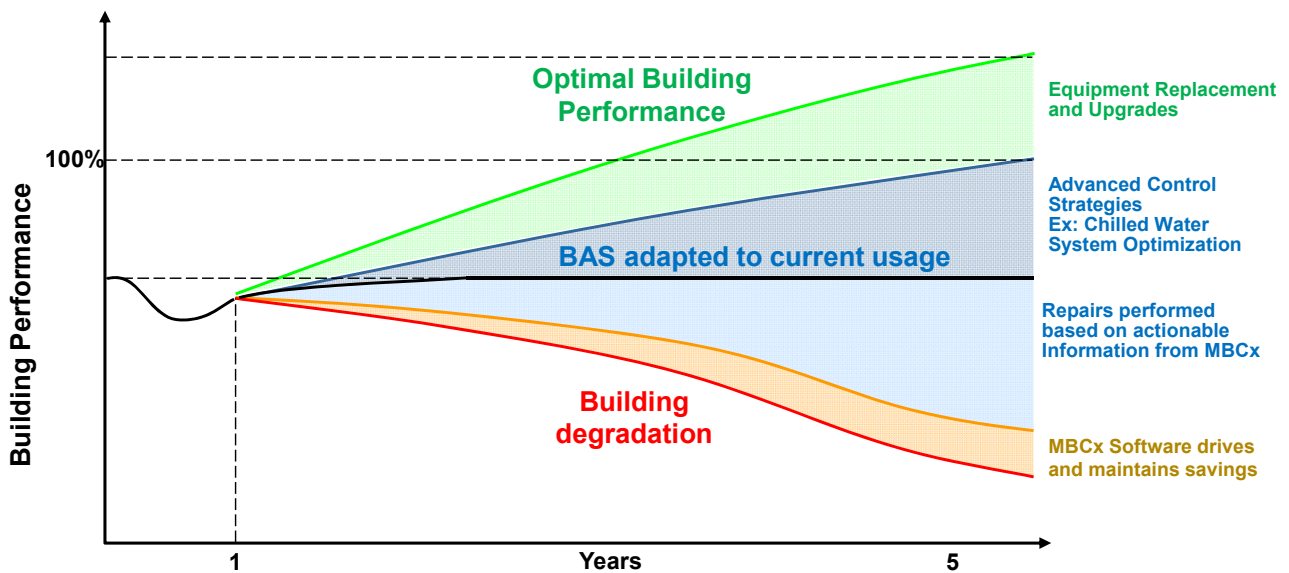
Most organizations don't have business processes built around ongoing building commissioning. If you turn on MBCx across an entire portfolio of buildings, you may identify so many issues that building engineers will become overwhelmed. It can be difficult to establish effective and reliable response processes. Rather, it's best to start slow and with a smaller workload so you can develop a process that will allow you to be successful. As you get more comfortable with your strategy, then it's possible to take on more and more responsibility and to bring data into the process as it's refined.

**11. If you're not committed to fixing issues, don't waste your money on MBCx.**

MBCx will undoubtedly identify issues in a building to be resolved. And though you may have dedicated budget to the MBCx implementation, if you're not prepared to dedicate an ongoing operational budget to correct faults or implement facility improvement measures, you're wasting your money. Monitoring-based commissioning is a comprehensive process that involves the right people and technologies; use the technologies to change your processes and the way you manage a building

**12. Optimization strategies go hand-in-hand with analytics.**

Optimization strategies can work well on their own, but buildings need to combine those strategies with fault detection and diagnostics and building analytics. Chilled water optimization solutions like Siemens Demand Flow™, demand response for load optimization, and Aircuity with demand based ventilation all provide automated optimization but make sure proper fault detection rules are implemented to support and keep the optimization strategy on track.



# Successful MBCx Delivers Value

As the Lawrence-Berkeley National Laboratory report confirmed, MBCx does deliver energy savings and a return on investment, but the real long-term value of commissioning is in the building performance improvements and compliance efforts. That value, however, is only possible through a comprehensive combination of the right people, processes, and technologies to continuously optimize a building's performance and efficiency.

## Abbreviations

<b>EBCx</b>	Existing Building Commissioning
<b>FDD</b>	Fault Detection and Diagnostics
<b>MBCx</b>	Monitoring-based Commissioning
<b>RCx</b>	Retro Commissioning

## About the authors

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Mr. Butler provides technical oversight of Cimetrics' R&D activities and consulting services. He began his career at Cimetrics in 1990 as a contractor, later joining the company as Director of Software Engineering. Mr. Butler has been actively involved in the development of the BACnet® network protocol for more than 15 years. He organized the BACnet Testing Laboratories and served as its manager for 6 years.

Mr. Butler earned his B.S. and M.S. degrees in Aeronautics and Astronautics from MIT. His thesis described the development of a software-based simulator for evaluating air traffic flow management strategies. After graduation, Butler worked as a contract software developer for several small companies and taught in the math and computer science department at Ithaca College. He is a member of ASHRAE and the IEEE Computer Society.

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Craig Engelbrecht has over 12 years of entrepreneurial experience within the building automation industries and pioneered energy information software products and solutions that span commercial, government and education markets. For Siemens Infrastructure and Cities, Building Technologies Division, Craig is the Director of Remote Services and Technology working to identify market trends in remote services, energy efficiency and enterprise information management, while developing the vision and employing commercialization strategies to the future roadmap, and overseeing strategic business development that supports the business needs in the marketplace.

### Jim Lee – CEO, Founder – Cimetrics

Mr. Lee is the founder of Cimetrics and has acted as its CEO since its formation. Mr. Lee has been a leader in the embedded control networking and building automation community for over 20 years. As founder and former President of the BACnet Manufacturers Association (now BACnet International), the leading open systems networking consortium in the building automation industry, Mr. Lee's aggressive promotion of the BACnet open protocol standard has helped make Cimetrics a high-profile player in the arena. Mr. Lee has an earned B.A. in Physics from Cornell University.

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Mr. Sinopoli is an innovator in the high performance building industry. For over 30 years, he has designed and engineered operationally efficient, intuitive and sustainable buildings through an integrated design matrix of building systems and technology. His design work can be found in many building types and uses throughout the US, Asia, Europe, the Middle East, South America and Africa. He has consulted and lectured government organizations, industry associations and Fortune 500 companies.

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