



Managed Services— The Future in Building Automation

WHITE PAPER

Executive Summary

BuildingIQ's business model is evolving to include offering a package of *Managed Services* that further leverages its core strength in heating, ventilation and cooling (HVAC) system optimization. *Managed Services* will ensure that a building's operations would be overseen 24/7 by a highly trained and skilled operations team, responsible for ensuring the HVAC system delivers on guaranteed comfort and savings. Through cloud-based remote access, it would continuously monitor performance at every level—from whole building to individual controls—looking for inefficiencies that degrade performance. BuildingIQ's overriding objective is to optimize HVAC performance in order to achieve the greatest possible energy and monetary savings for the customer.

1.0 Introduction

Operators of large commercial buildings understand that their buildings are more than static structures. They are entities that live and breathe thermodynamically, and must be managed to a narrow temperature band of tenant comfort while everything around them is changing continuously. Outside temperatures rise and fall, occupancy patterns fluctuate, usage changes, interior configurations are revised, equipment, electronics, and components are changed out as a matter of routine, and HVAC systems are prone to a host of problems.

Whole-building HVAC performance can be affected by any sensor that fails, every control loop that goes out of tune, every damper that jams, and by the continuous patchwork cycles of repair, adjustment, resets, and old-fashioned tinkering. More often than not a local zone problem fixed by maintenance staff or subcontractors is done without knowledge of its impact on the overall system; the data and tools for integrated analysis have not been available.

Maintaining peak performance of an HVAC system requires a more comprehensive approach to building intelligence, combining personnel with technology capable of whole-building awareness around the clock, one that can identify small problems and larger systemic issues simultaneously, the moment they arise. And one that can identify problems with enough precision to help direct effective solutions, ranging from component repair/replacement to fine-tuning control loops to software refinement.

It calls for a higher level of service that can augment traditional, warranty-based approaches used today in most large commercial buildings. The broader approach is not so much a replacement service as a natural adjunct to the current practice of BMS providers. The incentive for building owners and operators alike is to save energy and money by taking the building to its fullest potential in terms of energy

efficiency. And with advanced management tools energy efficiency potential is growing.

BuildingIQ's *Managed Services* reinforce its core strength in HVAC system optimization. Through cloud-based remote access, our team continuously monitors performance, 24/7, at every level—from whole building to individual controls—looking for inefficiencies that degrade performance. BuildingIQ's overriding objective is to optimize HVAC performance in order to achieve the greatest possible energy and monetary savings for the customer.

2.0 Trends in the Building Automation Industry

A number of trends point toward a more service-oriented approach to building automation in the future. Continuous monitoring and real-time servicing is the best way to keep a BMS properly tuned for high-level performance.

The “product-side” of a BMS installation is never a once-and-done affair. Too many things in the building's environment remain in flux, too many aspects of the building's thermodynamic behavior can remain elusive, and too many subsystems and components can be improperly calibrated. As a result, commissioning is typically advised after BMS installation.

Commissioning is the process of evaluating the success of the BMS installation. An independent third-party contractor is generally brought in by the building owner or operator to answer key questions. Was the system installed properly and does it operate according to design specifications? Can it achieve the operating efficiencies promised? Does it live up to its full potential? The BMS is adjusted accordingly. Clients and partners are recognizing that BuildingIQ's *Managed Services* is a very effective and cost-efficient way of achieving this commissioning.

Increasingly, owners and operators are looking for ways to keep their buildings at high-performance levels at all times. Some seek full-scale “re-commissioning” of their buildings as data reveals that HVAC performance is beginning to decline. This requires the right diagnostic software that can detect imbalances, inefficiencies in subsystems, broken components and sensors, and improperly tuned control loops. Most software only goes part way—that is, it detects problems and makes recommendations but doesn't actively make the necessary adjustments. One of the strengths of BuildingIQ's software platform is that it takes active control to optimize system performance.

A similar trend driving the software/service-oriented approach to building automation is the desire of building owners to upgrade their existing BMS without incurring large capital expense. Rather than hardware replacement they are looking for service enhancements to accomplish the same end.

Some in the industry refer to an adjunct service called “continuous commissioning,” as the logical extension of initial commissioning and re-commissioning. However, most often this is not so much continuous as episodic. BMS inspection, testing, and evaluation are done periodically, generally at defined intervals, but often by firms that have no long-term, continuing commitment to the building's performance. There is growing appreciation by owners of the benefits of having 24/7 continuous monitoring of performance.

Software as a service combined with *Managed Services* offers the possibility of turning the concept of “continuous commissioning” into reality. The software dimension allows the provider to remotely monitor, thus staying on top of HVAC performance at all times, and at minimal cost. And it offers greater flexibility for expansion and integration of

new services and hardware. For example, it allows building owners to coordinate and fully leverage energy efficiency measures such as variable frequency drives (VFD), rooftop solar, renewable purchased power, battery and thermal storage. As new sustainability opportunities arise, a software/service approach allows building owners to incorporate them at lowest cost.

2.1 The Consequence of Competition in the BMS Marketplace

One of the single greatest factors now restraining the drive toward peak performance in HVAC is the BMS marketplace itself. It is a strong and vibrant business as building automation has come into its own. But the very forces of technological advance that brought a new era of building automation to the forefront has made the business more competitive. Whereas BMS providers once had highly proprietary systems operating with singular and proprietary coding, advances in processing capability and interface technologies, have allowed disparate systems to converge—to be able to talk to one another. As a result, BMS control technology has become more of a commodity in recent years, driving down prices and reducing margins for BMS providers.

Profitability has shifted from the installation side of the business to the servicing side. But most servicing contracts are not unlike automobile warranties. They are there for the time when something fails or falters. If the BMS is still operating, the service function is effectively on hold, even though performance may be slowly degrading over time. Control loops may go out of tune while the system continues. A failing sensor may create a problem that propagates downstream and is difficult to trace. Temperature zone problems can be fixed without understanding the root cause in another part of the system.

BuildingIQ's engineers have found that the majority of BMS systems they encounter have a number of control problems below the surface. Over time settings get overridden, control sequences have to fall out of calibration and are no longer in tune with the larger system, air handling units operate erratically, valves don't operate properly.

Typically, no one goes back into the BMS to correct the problems as they arise. There is little incentive to find the root cause of a problem when symptoms show up somewhere else, and in the hectic building management environment there is little time to focus on these items. Combining this work environment with the fact that it is extraordinarily difficult to dig into a BMS system and the reality that most operators are not trained or properly equipped to do so, it is easy to understand how BMS problems go undetected.

Periodic commissioning may unravel some of the problems, and there are a number of organizations that undertake such work. But overall, they have limited knowledge of the building's thermal dynamics, and limited commitment to the building or the owner. Their job is to fix the problem and move on, not to *perfect* the building, and not to *sustain peak performance* thereafter. Rather they are left to function like an auto dealership; we'll fix it if it's broken, bring it in for scheduled tune-ups.

3.0 The Technological Edge

BuildingIQ has a distinct technological edge in building automation. It stays with a building from the outset, first learning its thermal behavior, then optimizing HVAC performance, and then remotely monitoring 24/7. It searches for inefficiencies continuously, zeros in on problems, and drives the building to its highest energy-efficiency potential. It uses trending tools like many other commissioning vendors but goes beyond the step of making

suggestions and recommendations to the operator. Once fully engaged, it takes active and automatic control of the HVAC system.

BuildingIQ's software continuously asks questions of the building—what is happening right now (good or bad), what is causing it, what will happen in the future, and how can we affect it? It is designed not only to react to changing conditions but also to predict changing conditions by learning the building's occupancy patterns, seasonal flow, and thermal dynamics, then incorporating hourly, daily and weekly weather forecasts into the analysis. As Wayne Gretsky famously said, "I don't skate to where the puck is, but to where it is going to be."

Predictive Energy Optimization™ (PEO) can remain a step ahead of changing conditions by looking at the historical response of the building to temperature variation, and anticipating what will be needed to meet the comfort demands of tenants in the next few hours. By taking advantage of the 2-3 degree temperature band that encapsulates the range of tenant comfort—rather than fixating on a single set point—the PEO software can chart a strategic path to reduce energy consumption and costs. The strategic path is based upon the algorithm's ability to achieve multi-objective optimization (e.g. energy and money).

3.1 Bringing all the Data to Bear

BuildingIQ's technological edge in *Managed Services* draws first and foremost upon its strengths in comprehensive data acquisition and integration. The PEO algorithms are designed to work with a wide variety of data that previously lay separated and hidden away in things such as the BMS, utility bills, meters, third-party data providers, and weather service forecasts. The BMS data feed draws upon the internal network setup to communicate with all

the pieces of equipment that provide the ventilation, heating and cooling. Each piece of equipment in turn provides a stream of information about how fast the equipment is currently running, the temperature and pressure in a certain space, and what temperature set point the operators are trying to maintain. That information, which is constantly flowing across the BMS, is captured and fed into the PEO platform, along with continuously updated weather forecasts from outside services, electric utility interval data, and energy usage data collected by third-party vendors via a separate web service.

The result is that the full complement of the building's performance data is finally unlocked and brought together into a single, easily accessible and useful database that in turn supports deeper analysis and broader understanding. The predictive element of the PEO software is particularly robust because it is able to draw upon diverse forms of information that go well beyond the BMS data stream. Furthermore, accessibility to the integrated data and analysis isn't confined to a user located at the building site. The consolidated operational awareness is available to owners and operators from anywhere in the world, via BuildingIQ's cloud-based service.

BuildingIQ brings to the table a technology solution that is not only implemented well the first time, but is continually monitored to make sure those benefits are sustained and ultimately enhanced. Other systems require manual on-site monitoring, whereas BuildingIQ relies upon remote access and control. Automation is taken to its highest level.

3.2 Innovative Display

From the customer's perspective, BuildingIQ's analysis and results are brought to life through innovative display. The design of BuildingIQ's dashboards and

visualizations leverage well-established principles of human perception and data analysis. They avoid the dazzle of many dashboards that use gimmicky gauges and a kaleidoscope of colors but are not particularly useful and can impede rather than enhance communication.

BuildingIQ's interactive visualizations are some of the quickest and most powerful in the business, and readily communicate the building's past, present, and future behavior. They support the user's ability to identify patterns, trends, and exceptions in a building's operations, both for very short and very long periods of time. The approach is based upon the assumption that data is only valuable when it can be understood and leads to action.

4.0 Front-End and Comprehensive Managed Services

Conceptually, *Managed Services* begins with the implementation of the BuildingIQ platform and continues thereafter as PEO takes control of the HVAC system and continuously monitors and adjusts to maintain peak performance. But there is no reason that *Managed Services* could not begin earlier, at the front end of the process when the task at hand is to bring the building up to a level where the building can follow the signals of the PEO system.

Sometimes BuildingIQ has had to exclude buildings from its services, or defer deployment, because the building lacked the basic infrastructure for PEO to interact effectively. They didn't have variable frequency drives (VFD), for example, or didn't have the sensors to provide the necessary feedback. In such cases, BuildingIQ has traditionally made recommendations for the needed upgrades and waited while the building owner contracted the work. And when these upgrades were complete, oftentimes they would need additional refinement or repair, adding to the cycle of contracting delays.

BuildingIQ is in the business of developing and implementing a plan to enable building optimization. We identify the work that needs to be done at the front-end to ensure an efficient and effective pathway to PEO implementation. Then we source any necessary hardware improvements, and integrate them appropriately, all as one package. Taking a comprehensive and ongoing approach from the outset helps ensure a higher-performing building downstream for the owners and operators.

This front-end approach is now under trial development at a major university in California. BuildingIQ and a prominent BMS provider have been asked by the client to join forces to bring an older 200,000 square foot building up to modern automation standards and then take it from there. The building has been operating with older controls and without the benefit of VFDs, a prerequisite of advanced automation. From BuildingIQ's perspective, a building must either be ready, or made ready, before the PEO software can be employed.

The end result will be reported in a case study to show the effectiveness of a more comprehensive approach to *Managed Services*, including both front-end and back-end service. From the customer's point of view, the advantages of a comprehensive approach include finding a single party (or alliance) that accepts full and continued responsibility for delivering the highest in energy efficiency. The process is streamlined; costs are contained, contracting minimized, responsibility centralized, and results enhanced.

5.0 Future Convergence

Managed Services points toward the future convergence of BuildingIQ's strengths and capabilities in software and data infrastructure with the same prowess and experience in hardware of the current fleet of BMS providers. Business realities have shifted the profitability

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of building automation from the hardware installation side of the business to the follow-on services side where each partner, BuildingIQ, and the building management system (BMS) providers, bring strength and capabilities. Together they can drive building automation forward and take the energy efficiency potential of large commercial buildings to new heights. Even the most efficient building designs today can see their energy savings boosted by some 10-25% using Predictive Energy Optimization. This is not so much a ceiling as a starting point for the convergence of the future.

About BuildingIQ

BuildingIQ provides advanced, cloud-based software to reduce HVAC costs in commercial buildings. Customers save 10-25% of HVAC energy and can add 20 points to their LEED score. BuildingIQ software continuously monitors inputs including weather forecast, occupancy, energy prices and demand response events. It makes small changes in HVAC settings that result in large financial gains without impacting occupant comfort.



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