Combating Commercial Building Energy Drift

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The insidious but persistent problem of "energy drift," which causes commercial buildings to lose an average of some 20 percent in energy efficiency every one to two years, poses serious financial and operational challenges to building owners and facility managers.[1] With average electricity costs running $2.00 per square foot, this energy leakage is costing billions of dollars in unnecessary spending each year. And with rising energy costs, this problem is only going to intensify.

Even so-called smart buildings and LEED certified buildings drift constantly, organically, due to unforeseen sources of energy leakage that quickly turn these green buildings grey. With buildings that are often millions of square feet, addressing this phenomenon of 24/7 energy drift goes far beyond managing the thermostat and light sensors.

Given the scope of the problem, it's no surprise that the domestic market for energy efficiency software for application in commercial buildings has reached $5 billion annually. Europe and developed Asian markets double this potential.

So, what is the magnitude of this drift and how can its sources be mitigated to reduce operational degradation and loss of energy efficiency? According to the latest data from the Building Owners and Managers Association (BOMA), electricity and maintenance costs account for roughly $3.50 of the almost $8.00 per square foot in annual operating cost of every building area. Control of these costs and the associated risks of operational degradation are paramount to the "best practices" operations of a facility.

Buildings are complex organisms comprised of electrical and mechanical systems tied together by control systems that manage the operations. Those few facility operators fortunate enough to have staff dedicated to viewing and analyzing immense flows of building automation data have had some degree of success in keeping their buildings tuned and operating efficiently. But even if this level of staff was available to each and every building operator—which in this economic climate is a pipedream—erosions in operational efficiency are natural. Some of the causes of such operational degradation are:

1. Dirt

[1] From the exceptional work done at Texas A&M and Lawrence Berkeley National Laboratory, the rate of degradation of system efficiency is well documented at a 10-30 percent rate over a one to two year period.

2. Temperature and time overrides abused
3. Improper control system programming
4. Seasonal changes that stress and disrupt aging mechanical systems
5. Myriad temperature sensor and component failures
6. Malfunctioning of complex electrical, mechanical and HVAC components

The time has come to move building operators away from the business-as-usual approach of "reactive" facilities management services. What is now required is a heuristic and real-time understanding of how buildings truly operate under all conditions. This new approach known as Automated Continuous Commissioning (ACC) proactively identifies pending changes to operational efficiency. By doing so, facilities managers are empowered to sustain maximum operational efficiency while minimizing energy costs.

Historically facilities managers have used a variety of solutions to try to mitigate the risk of system failures, malfunctions or outages. These include

- Time based maintenance management,
- Electrical consumption review as a trigger for reviews of system operations,
- The use of building automation system for graphical representations of system operations
- The use of *periodic* recommissioning and retro-commissioning.

All of these solutions leave a lot to be desired. First off they all are reactive in identifying problems. Second, they are expensive and require a high degree of sophisticated systems understanding. And third and most importantly they don't provide any prioritization of the importance of the problems they uncover.

ACC addresses each of these issues by providing a predictive understanding of systems and the overall network of buildings, while prioritizing when and where to dispatch precious facilities management resources. Understandably, building owners and facilities managers want to know how this is possible and proof of its effectiveness.

Mark Boraski, vice president of property management with Neiman Marcus makes the following observation: "Let's assume you build a facility and it's designed correctly to run at optimal efficiency. It's no different than a new car. As time passes, fuel injectors get clogged, exhaust systems degrade and oil gets dirty. It's inevitable that you move away from that ideal place that you started because of entropy. After you commission a property for optimum efficiency, it immediately starts to degrade day after day, week after week, month after month. There is drift away from the ideal. ACC allows you to always check against that base to see if there is meaningful change. And it allows you to isolate and pinpoint specific systems that have moved beyond acceptable levels so you can assign first line resources to resolve problems well ahead of outright failures."

ACC is comprised of a set of tools that allow the user to achieve a number of goals. Most importantly, it provides for the predictive identification of system and building level anomalies. It

prioritizes these faults in a systemic manner and it tracks the execution of the resolution of these problems.

An ACC platform must consist of a number of components:

1. A mechanism for accessing data from the facility
2. Ancillary collection of data from other sources such as weather, operations and utility data
3. A data warehouse
4. An analysis engine
5. A reporting solution and
6. A process to dispatch and monitor the execution of identified anomalies

All of this is automated to make implementation and use interactive. Figure 1 represents a few of the diagnostics run in a typical automated continuous commissioning analysis.

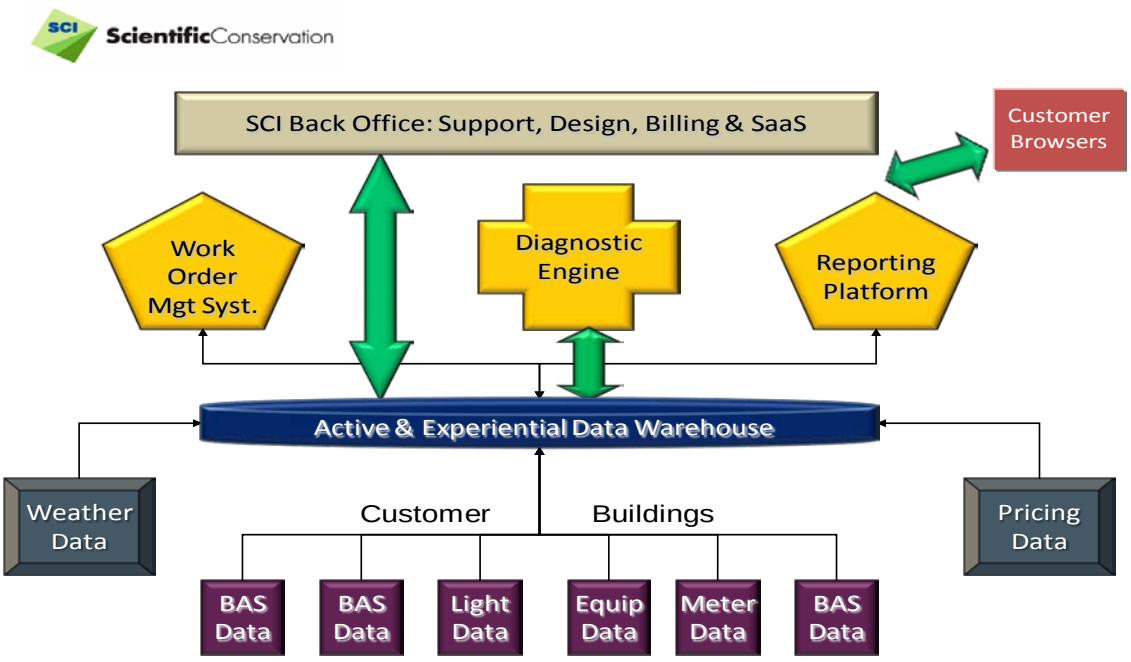

Figure 1: Automated Continuous Commissioning Platform Requirements

In summary, Automated Continuous Commissioning brings facilities operators from the reactive to the proactive world, and by doing so the facilities can be kept at a high level of operational efficiency while minimizing energy consumption.