From High Performance Design to High Performance Operation: The Intelligent Lab Building Leap

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Stringent energy goals reflected in new codes, standards, rating systems, and institutional priorities continue to raise the bar for performance, prompting creative solutions that result in complicated building system designs with complex operational strategies. In many cases these complex high performance designs do not translate into sustained, high performance operations. The multiple reasons for this include reductions in operational staff and skills and, above all, use of technology.

Technology by definition solves problems and makes work easier. It is indeed surprising that technology is a reason why high performance design does not translate into high performance operation. The real problem is that technology is often equated to a software or a product when it should be looked at as a process. The intelligent building approach follows a holistic step-by-step process that includes systems, people, and technology.

Today, enhancement in building systems have resulted in high efficiency systems, such as chilled beams, heat recovery chillers, enhance run around loops, energy wheels, and water reclaim systems. A combination of these high efficiency systems are typically utilized on new laboratory projects to meet and exceed code and institutional requirements. Once the right combination of systems is selected, the focus should be on designing them from an operational perspective.

Minor modifications can be made to the configuration of Building Automation Systems, Computerized Maintenance Management System, Operational Training Requirements and Preventative Maintenance Procedures to help in this transition.

Building Automation System represents millions of dollars of investment on campuses and buildings. It's typically configured to provide the operators with lots of data. However when operators are constantly trying to solve problems with limited time, this approach becomes ineffective. However, building automation systems can be configured to provide information rather than data. For example, use of key performance indicators can provide operational staff with vital information on the health of their facilities and can be an indicator of successful operations. Examples include occupant comfort, energy use, and sash positions. Advanced alarm management strategies can be configured to lead operators to the root cause of problems, rather than inundating them with hundreds and thousands of alarms that are a result of the root cause. Furthermore today's building automation systems are increasingly equipped with fault detection and diagnostics technology that use algorithms to determine solutions. By utilizing these functionalities in the building automation systems it is now possible to provide building system operators with solutions enabling them to do more with less.

Computerized Maintenance Management Systems are typically configured to include preventative maintenance strategies and work orders. Operations staff add these work orders and their resolution in a free text format. This makes data entered into the software difficult to analyze. If we start by understanding the questions we need answered from the Computerized Maintenance Management Systems, standardized sets of data entry procedures can be developed to streamline data for analytics. Questions could include: which air handler or fan coil unit type has the fewest work orders; which brand of UV lights lasted the longest; and, which sensors required the most frequent calibration. Answers to such questions can be utilized to write facility operations standards from a life cycle perspective.

Operational training is specified on most projects and includes educating operators on how a particular software or system works. Such training has its purpose in basic systems understanding. However "performance"-type training appears to be a missing piece of the puzzle. Educating facility management staff on how a building should perform (measured through its key performance indicators) and what to do if performance metrics are not within range (derived through building automation system and computerized maintenance management system) will further aid the translation of high performance design into high performance operations.

It is important to note that there is no silver bullet to transition a high performance design into a high performance operation. By addressing building systems, people and technology together as part of a holistic intelligent building process, the means for successful translation can be provided. University of Florida Health has accomplished such a transition for its Cancer Tower. During its eight years of operations energy consumption has met predicted values, patient comfort is tracking highly and overall alarms compared to other similar buildings are significantly fewer.