Maintaining High-Performance Schools after Construction or Renovation

By Gary Luepke and Louis J. Ronsivalli Jr.

With taxpayers' considerable investment in schools, it is critical for school districts to preserve their community's assets with new construction or renovation and effective facility maintenance programs. But how do you keep your new or newly renovated high-performance schools performing at optimal levels after the last construction truck has left the parking lot?

"High-performance" school buildings are designed to link the physical environment to positive student achievement while providing such benefits as sustainability and energy efficiency. A critical element of a high-performance school is energy-efficient heating, ventilating, and air-conditioning (HVAC) and control systems that allow schools to maintain a comfortable environment while reducing energy consumption, saving money, and improving the school's indoor air quality.

Properly designed, installed, and maintained energy-efficient HVAC systems keep operating costs low and offer an environmentally responsible solution. Web-based facility management systems connect building systems and provide a common view of energy-use patterns in multiple schools across a district. These systems enable better access to information that leads to better decision making, superior performance, and a more sound investment for a school district.

Approaches to Maintenance

Preventive and predictive maintenance programs allow school administrators to understand system performance and anticipate and plan for possible system failure, ultimately helping to protect the school's investment and ensuring that the HVAC and control systems offer maximum energy efficiency.

According to the Federal Energy Management Program's *Operations and Maintenance Best Practices: A Guide to Achieving Operational Efficiency, Release 2.0*, maintenance programs can save 5% to 20% on energy bills without significant capital investment. Although maintenance will not improve system efficiency above and beyond its original design performance, a structured maintenance program can help prevent the deterioration of system or component efficiency over time or help restore efficiency to original design performance levels.

Today's robust and affordable technology has spurred a conscious movement toward more "need-based" service in which regular maintenance procedures are performed only when testing or documentation indicates they are necessary, rather than when the calendar indicates it's time for maintenance. A maintenance program based on the performance "outcomes" of equipment and systems is referred to as performance-based maintenance. The goal of performance-based maintenance is to sustain original design performance outcomes (capacity, efficiency, and reliability).

Three other approaches to maintenance help ensure a healthy and energy-efficient learning environment:

- **Deferred maintenance**, also known as reactive maintenance, refers to the absence of a formal maintenance program. This approach appears to be a short-term cost-saving bridge, but in reality, it quickly becomes the most-expensive cost-of-ownership option.
- **Preventive maintenance** refers to the traditional practice of scheduling maintenance tasks at predefined frequency intervals and then performing those tasks per prescribed dates, whether or not they are needed. This practice also implies that the date-based task schedule will ensure performance outcomes, but the completion of tasks and performance outcomes are rarely related.
- **Predictive maintenance** refers to the use of nondestructive testing, predictive technologies, and diagnostics to determine operational readiness and projected performance and actual maintenance needs. Predictive maintenance technologies include the use of ultrasonic testing, digital infrared thermography, vibration analysis, electromagnetic eddy current tube testing, oil spectroanalysis, refrigerant analysis, and other nondestructive testing–based applications.

High Performance Buildings for Life™ Action Plan

How do you know what high-performance systems are right for your facility? A basic audit and analysis should help determine the answers to the following questions:

- What are the critical systems in the facility for which performance criteria have been or should be established?
- What are performance criteria for the equipment (efficiency, capacity, control, etc.) and what can be used as a baseline against which you can compare future performance?
- Are there more urgent issues that should be considered in your systems analysis?
- Do you have adequate redundancy for critical systems?
- Do you have a contingency plan to manage incidents?
- What does the current maintenance program look like and can you identify "gaps" that could cause concerns about performance degradation?
- Do you have manufacturer-recommended maintenance practices that can enhance the current program?
- Can you identify testing and diagnosis procedures to help you move toward a more proactive maintenance future.

A fourth level of maintenance, **reliability-centered maintenance**, features a more formal approach to random system testing, continuous monitoring, and documented remedial measures for out-of-tolerance metrics. It is the basis for sustaining a High Performance Building for Life™.

Cost Benefits to Communities

According to the U.S. Environmental Protection Agency, high-performance schools promote higher student achievement, increased average daily attendance, increased teacher satisfaction and retention, reduced liability exposure, and reduced environmental impact.

High-performance schools also have decreased operating costs, limited liability, and reduced environmental impact. In the face of those results, it's hard to argue against them. Don't our children, educators, and communities deserve the opportunities these schools afford?

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