What's The Role For Advanced Technologies In Green Building Design?

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The latest innovations will disappoint unless the entire project team adapts to work together in a new way that will embrace new technology and help the owner make the most of a system's potential.

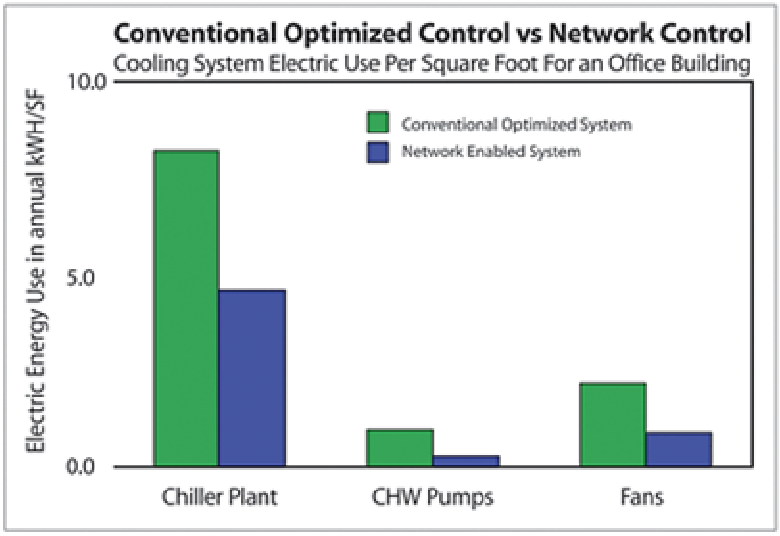

FIGURE 1. A comparison between the energy usage of a cooling system in with coventional optimized control (green bars) vs. network control (blue bars) in a Southwestern U.S. office building.

The history of the green building movement to date shows a subtle but persistent bias by architects away from the application of more advanced technologies in the comfort systems that serve these buildings. There are rational and valid historical reasons behind such a bias. At times, more advanced comfort system designs have tended to preclude the use of simple "green" elements. For example, a perceived incompatibility between the use of operable windows and more advanced climate control systems has led architects to seek lower technology comfort systems in order to keep operable windows.

However, the design community as a whole appears to be awakening to the reality that simple, occupant- and resource-friendly building elements can be entirely compatible and even synergistic with the application of more

advanced technologies in comfort system elements. It is also becoming apparent that the application of advanced technologies has the capacity to significantly improve the sustainability of building projects. As a result of this progress, it is now becoming essential that designers consider advanced technologies in their green building comfort system designs.

Evaluating the Potential Benefits of Advanced Technologies

The first step in considering advanced technologies for a green building project is to determine what benefits these technologies can bring to a design. The answer for many projects is that advanced technologies offer large potential reductions in comfort system energy use. New network enabled system configuration and control technologies that are made possible with the Equal Marginal Performance Principle[1] have the capacity to achieve significant reductions in electric energy for the fans, pumps, and compressors that are fundamental components of many building comfort systems. Use of these technologies makes it possible to configure integrated building comfort systems that can generate and deliver comfort with considerable reductions in electric energy use.

Figure 1 shows a comparison between cooling system electric energy usage for an office building in the Southwestern U.S. when an optimized conventional system (green bars) is reconfigured to a network-based system of the same first cost (blue bars). It is important to note that the comparative (percentage) reductions shown in Figure 1 remain essentially the same as the building envelope and other aspects of the building are designed for improved efficiency. This means that the electric energy budget for cooling in many buildings can be expected to be cut about in half when the conventionally optimized cooling system is reconfigured for network controls. And these savings can be achieved without increasing the cost of the system.

Making Advanced Technology Systems Work

Reducing building comfort system electrical energy use by half without adding to the construction budget is certainly an attractive design option, especially for green buildings, but achieving this level of reduction is not as simple as merely adjusting the project drawings and specifications to incorporate newer network-based technologies and control concepts. Designers must also recognize that the current processes by which building systems are designed, constructed, and turned over for operation are not usually effective in supporting the application of newer technologies. So, to achieve success with advanced technologies, the design team must be ready to change the project process as well as the technologies that will be applied.

The root of the “process” problem in applying more advanced technologies to building comfort systems is the disconnect, or lack of effective communication, between the various entities in a building construction

project. The designer, individual contractors, equipment suppliers, commissioning agent, and system operators are the key players in achieving a successfully operating building comfort system. But in many projects, there is little or no opportunity for all to sit together and discuss freely how the basic elements of the design intent will be provided in the equipment, installed, verified, and supported in operation. As a result, building systems that employ even a small variance from conventional comfort system technologies run a high risk of underachieving their performance goals.

There are then two elements upon which designers must focus to apply advanced technologies effectively in their green building projects if they wish to maximize the performance of these projects. First, designers need to assemble a team that truly understands and is ready to support all the technologies that are desired for the project. Second, designers need to work with the architect and owner to ensure the process empowers the design team with the ability to ensure the technologies are properly applied in order that the performance expectations of the design are achieved.

Verification of System Performance

One of the most important aspects of adjusting the conventional building design and construction process to support the application of more advanced technologies is to incorporate a simple and effective ongoing system performance verification process within the system design. Such a performance verification process need not be expensive nor cumbersome when it is applied into the same intelligent Web-based network system that is incorporated as the platform for the advanced controls employed to achieve the higher level of building energy performance. Such Web-based systems permit contractors, the commissioning agent, and later the operations and maintenance staff or contractors, to collect real-time information on operational anomalies that can be quickly diagnosed and remedied with oversight from the designers — simply and inexpensively.

To be successful, such a performance verification process must be a central element of the project design. It must be simple to use, and it must provide useful performance information and make available more detailed information, both real-time and historical. With this information, any operational anomaly or performance shortcoming can be quickly and easily diagnosed remotely and corrective actions coordinated for effective and prompt resolution.

Summary and Conclusion

The application of advanced network-based technologies in cooling system designs offers a reduction in energy use of about one-half of the electrical use of more conventional optimized system designs. But to ensure the success of these advanced technologies in green buildings, design engineers need to focus on a role of making the system work. Certainly this includes

establishing a realistic system design intent, developing drawings, and specifying equipment and processes. But these traditional engineering functions are not sufficient to ensure success when more advanced technologies are being applied. For these, the designer must also work closely with the equipment suppliers, contractors, commissioning agent, and system operators to ensure the design intent is adequately supported throughout the implementation, startup, and initial building operation. This increased role is absolutely essential in realizing the full potential of advanced technologies in green building projects. **IBT**

Wrks Cited

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About the Author: Hartman is principal of The Hartman Company, which was founded in 1972 as a high technology engineering firm, specializing in applying computer technology to commercial and industrial building control and energy management. Hartman has played an important role in pioneering the use of advanced computer-based energy management control strategies. He continues to place a strong emphasis on the use of modeling for evaluating potential improvements, and has developed a number of in-house programs to model a variety of energy and financial improvement scenarios. E-mail him at tomh@hartmanco.com

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