What Is All the Fuss about Interoperability? BACnet from an End User's Perspective

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INTRODUCTION

This article gives the end user guidance on the benefits and issues surrounding interoperability, and a brief review of the history and the current state of technology for energy management systems. Emphasis is placed on how to go about getting the right system that will generate savings and reduce installation and maintenance costs.

The BACnet™ standard is relatively new and just now beginning to be specified and installed. This article is written at a time before BACnet has been fully integrated into the industry and extensively field proven, although major installations[1] have been successfully demonstrated.

Since an energy management decision is a long-term commitment, it is important for the end user to understand the impact of BACnet on their current and future purchases. Otherwise, you may be specifying and installing an energy management system destined for premature obsolescence.

WHY SHOULD USERS CARE?

Cost and flexibility is why. Up until recently, every supplier of energy management systems had only proprietary designs. If you wanted modifications or additions, you would generally only have one

choice, to go back to the original supplier and pay their prices. Fortunately, efforts have been underway to allow one supplier's equipment to "talk" to another's via the BACnet standard. This will allow end users the flexibility to purchase equipment from different suppliers to get an optimum system at the least cost.

A BRIEF HISTORY OF ENERGY MANAGEMENT SYSTEMS

Automatic controls were developed in the late 1800's and a workable night thermostat was developed in the very early 1900's.

Not until the 1970's, with multiple energy crises, and increasing costs, did the idea of conserving energy become really important to building owners. The most important new technology was the advent of the computerized energy management system (EMS). These early systems provided centralized control, unattended, with electronic accuracy. However, early systems tended to be bulky, not user friendly, unreliable and very expensive to install and upgrade.

During the late 1980's and early 1990's the personal computer introduced an easy-to-use graphical interface to energy management systems, and improved the effectiveness of operator interface. The next major technology shift for the industry, which has evolved from EMS to distributed direct digital control, is occurring now. We are moving toward the beginning stages of pure interoperability between systems and components. There are more than 30 suppliers of controls and manufacturers of HVAC, lighting, fire alarm, security and electrical systems that have or are developing capabilities for interoperability using BACnet standards.

Echelon's LonWorks®, LonTalk® is a subset of the BACnet standard. LonWorks is often implemented in either a stand-alone fashion for small systems or as the preferred communications method for unitary controllers as a subset of a BACnet installation. Readers should also see Mike Tennefoss's article is this feature issue for another perspective on the application of this technology.

You might think of BACnet as a standard language for passing information back and forth amongst various suppliers' devices. For example, this could be a command to turn on a fan or an outside temperature reading being shared with multiple controllers.

BACNET ADVANTAGES FOR THE END USER

Capital Cost Reductions-Initial Installation

The biggest advantage for the end user will be lower prices due to competition from multiple vendors. BACnet also allows equipment suppliers to design dedicated controls into their equipment at the factory. Then, when the equipment arrives in the field, it's a simple matter of connecting a control cable and the energy management system will be able to talk to the equipment and vice versa. The labor costs of a field installed energy management system are normally more than 50% of the total cost. The efficiency of factory-installed controllers provides for a lower total cost.

Capital Cost Reductions-Modifications, Upgrades and Expansions

An even greater reduction in cost will occur whenever an existing system is modified, upgraded or expanded. Until BACnet, I often referred to the relationship between the energy management system supplier and the owner as a marriage. Like a marriage, one has to choose one's partner with care because a divorce is painful and expensive. With the suppliers each having different protocols, the ability to change or upgrade the system was nearly impossible except from the original supplier. The only other alternative was to get a divorce—remove and replace the original supplier with a new one. Under this scenario, the cost for a divorce would be prohibitive and the original supplier has little incentive to be cost competitive.

Operating Cost Reductions

Besides the cost of any major modification, upgrade or expansion, the cost for maintenance and repair (M&R) services on a BACnet energy management system will be less. Maintenance costs typically range from as low as 5% of the original installed cost per year up to as high as 15%. The cost varies widely depending upon the local market and the extent of services contracted. Over the life of the system M&R costs could exceed the installed cost. With BACnet implemented, more suppliers could provide M&R services on the energy management system and use their own or other's parts for replacement. This will result in lower costs for M&R services.

The Best Technology

In my experience, all of the energy management system suppliers have strengths and weaknesses. One vendor may make a great humidity sensor and another might have the best VAV controller in the world. With BACnet, the system installer has the flexibility to pick and choose the components that are optimum for the job.

HOW TO BUY COST EFFECTIVE ENERGY MANAGEMENT SYSTEMS

In my experience, energy management systems continue to be one of the best investments in energy management (after lighting) for controlling operating costs and improving comfort and reliability. However, unless the system is designed, installed, programmed and operated correctly, the results will be less than desired. This is true for all energy management systems and even more so for future systems if they are to take advantage of the move to more open architectures.

Tips for Buying Cost Effective Energy Management Systems

1. *Educate yourself.* Knowledge is the key to success for effective energy management systems. Sources include ASHRAE, The Association of Energy Engineers, publications like *Energy Users News*, technical conferences, the Internet, energy management system suppliers and consulting engineers.

2. *Talk to other end users about their experiences.* They've been there, done that. Find out what their experiences have been with energy management system suppliers and the energy management strategies that work for your type of operation and buildings. The best bet is to actually go visit the sites and talk to the operators directly.

3. *Interview prospective suppliers.* Here you are not only trying to learn about their technology, but their ability to support your system in the long run.

4. *Prepare a performance-based specification.* This specification should include all the features desired including BACnet compatibility.

The energy management strategies being implemented need to be completely identified if the savings are to accrue. The specification should be specific enough to cover the performance of the system and general enough to allow multiple vendors to present competitive proposals.

5. *Hire a consultant.* If you feel you do not have the time or expertise to design, install, program and operate an energy management system, a consultant might be the right choice for you. However, insist that the consultant has not only experience in designing energy management systems, but also has hands-on field experience in supervising installation, programming and operations. I have seen too many energy management systems that were designed by consultants without field experience that did not meet expectations.

6. *Operations is the key to a successful energy management system.* The designer, installer and programmer of the energy management system get to go home after it is turned over to the owner. The local operator is often left with a complicated system without adequate input and training. From that day on, the operator makes the biggest difference between a "time clock" and an effective energy management system. To achieve the desired savings and in my experience generate even greater savings in the future: 1) Have the operator be involved in the design and selection process, 2) provide training during and after installation and 3) have a program of ongoing support, optimization and training in place.

THE FUTURE

I have been following and writing about the future of energy management systems since 1991 with the papers "Energy Management 2001" and "Energy Management 2005." In 1991, interoperability was just a desire that end users had. With BACnet, that dream has started to come true. In just a few more years, the end user will be able to plug in components just like they can today when matching stereo, computer and telephone components.

UTILITY DEREGULATION AND INTEROPERABILITY

With the passage of the Energy Policy Act of 1992, the process of deregulating the electric industry was begun. Deregulation will bring unprecedented changes to the way that utilities are purchased, used and controlled. The number and complexity of utility bills will multiply. Real time pricing tariffs and other time sensitive rates will challenge the abilities of an energy management system to control loads in an effective manner to reduce costs. In addition, the rate of change in utility metering, billing methods and control is increasing. It is important that any energy management system being specified today have the ability to handle sophisticated energy management strategies and be able to be easily reconfigured to meet changing needs. That is why it is important that any new energy management system be specified with BACnet compatibility.

CONCLUSION

The evolution of the energy management system from the inflexible, proprietary system of the 70s to the easy-to-understand open architecture has occurred over the past 25 years. BACnet's development and further acceptance are allowing end users to obtain better and more cost effective systems. An end user can obtain systems that work and produce the savings desired by following the **Tips for Buying Cost Effective Energy Management Systems** given above and spending some time getting educated on energy management systems in general and BACnet specifically.

Notes and References

[1]"450 Golden Gate Project, BACnet's First Large-Scale Test", Martin A. Applebaum, P.E., and Steven T. Bushby. July, 1998 *ASHRAE Journal*

[2]ASHRAE Standard 135-1995, "BACnet—A Data Communication Protocol for Building Automation and Control Networks"

[3]"Energy Management 2001", "Energy Management 2005" and "The Proper Selection, Care and Feeding of an Energy Management System", George R. Owens, P.E., CEM, Energy and Engineering Solutions, Inc.

These papers can be viewed at
http//www.netcom.com/~view2005/gro.html.

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ABOUT THE AUTHOR

George R. Owens P.E., CEM. Experience includes over 21 years in energy management in the commercial sector with an additional 9 years of electrical engineering in industry. He is a registered professional engineer in five states, certified energy manager, recipient of Energy Awards, publisher and presenter of energy articles, author of book chapters, past seminar instructor with universities' energy programs, has been quoted in newspapers, radio, television and magazines, and has served as an advisor to the utility industry on DSM programs. The subjects of his presentations have covered utility deregulation, energy conservation, O&M, commissioning, and the future of energy technology.

George Owens has membership in several professional organizations (AEE, ASHRAE, IEEE, IES, NETA), where he has held committee and officer positions. He is a recipient of the Association of Energy Engineer's International Energy Manager of the Year and was inducted into the Energy Managers Hall of Fame.

George is president, Energy and Engineering Solutions, Inc., a firm that provides cost-effective solutions to the commercial, real estate, and institutional sectors, with a focus on energy management. Prior to forming his own firm, he was director of engineering for The Rouse Company, involved in over 75 shopping centers and 120 office buildings throughout the United States and Canada, with 57 million square feet portfolio.

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