

## SUSTAINABLE DESIGN OF BUILDING AUTOMATION SYSTEMS

In the past sustainability has not really been applied to Building Automation Systems. We thought of life cycle costs of a BAS with the acceptance that a system had a fixed life to it due to a number of factors. Those factors that have applied to limit sustainability include: short life of availability of key components (chips), proprietary software and hardware components and available knowledge to continue to service the aged equipment.

As the BAS continues to age and the factors take hold, a Building Owner is typically left to resort to a complete BAS retrofit. While this is a reflection of what has been the history of the industry, it certainly does not have to be the future. With increasing demands to reduce, recycle and reuse, such limitations will not be accepted.

The good news is that sustainability can be achieved in the BAS, providing substantial value to the owner and reducing the impact on the environment. A sustainable BAS can be achieved without increasing first cost, and will deliver substantial reduction in life cycle costs, improved serviceability, reduced energy consumption and improved user satisfaction. A tall order but very capable of being delivered with current technologies.

Let's first establish the requirements for a sustainable BAS:

- Continuous availability of the majority of system components (hardware and software) that is compatible with the original system. These components are not necessarily from the same original manufacturer, but ideally from multiple manufacturers. This would allow the building owner to have brand "A" VAV replaced with brand "B" VAV on the same network communicating with the other controllers seamlessly. This needs to be no more complicated than replacing one brand of tire on your car with another. Those components that cannot be seamlessly replaced must have replacement solutions whose cost is minor in relation to the alternative cost of replacing the entire system. An example would be the graphical user interface whose operating system has become obsolete. The personal computer (PC) has failed and the new PC operating system is not compatible with the original Graphical User interface. A new graphical user interface (software and associated hardware) is installed with recreated graphics communicating to the existing controllers
- Availability of information. In order for the BAS to be sustainable there have to be trained Controls technicians available to maintain the system. As such training and supporting documentation needs to be available to all qualified parties. It is not just the manufacturer providing training on its legacy components but more importantly standardization of communication languages and network management tools. This standardization helps insure that there are many sources of training and knowledge to maintain and expand the system.
- Expansion of the BAS. The newer BAS components need to be compatible with the older system components so that the system can be seamlessly expanded. While Gateways have been available for many years they are not always a "best practices" solution as they require specialized knowledge, involve proprietary software tools and generally offer limited support.
- BAS enhancements. The BAS needs to allow for enhancement that capitalizes on the latest technology improvements. A good example of this is the replacement of the PC based graphics with a Web Browser based graphical user interface.

One viable solution to sustainable design of BAS is “Open Systems”. Not the open system hype that has worn out our ears (and wallets) over the years, but Truly Open systems. Lets look at some examples that address the requirement above

- Continuous availability of the majority of system components – Since one cannot reasonably expect to depend on any one manufacturer to continue to develop a product indefinitely, the next best solution is to have compatible products provided by multiple manufactures. The only way to accomplish this is to have standards in communications, applications and software management tools along with an industry based association to support the creation and verification of compliance of the standards. This way there is a reasonable level of assurance that the resulting products produced will interoperate with each other. This is currently accomplished at the controller level through the LonTalk protocol and certified by the LonMark Association and by ASHRAE's BACnet protocol that is more recently certified by the BACnet Testing Labs. At the network level there are three defacto standards helping to insure a continuous availability of network management tools, user interfaces and components. These are the Lon Network Services (LNS) supported by Echelon, BACnet and the Niagara Framework supported by Tridium.
- Availability of information – All related information and associated training for the standards created for the BAS – Protocols, Network Management tools, controller programming tools, documentation, etc. need to be available to all. This is currently available in varying degrees, depending on the manufacturer and standard. For the network management and graphical user interface tools based on Echelon's LNS, BACnet and Tridium's Niagara Framework, the training is available from many sources and is interchangeable. Students are given a standard training course and tested to receive certification and ensure consistency of implementation. For the controller programming tools, more and more manufacturers are making their tools available as freeware on the public side of their web site along with related audio visual tutorials for training along with related supporting documentation.

- Expansion of the BAS – If the aforementioned practices are met, then expansion of the BAS becomes much easier for the Building Owner. If the BAS is designed around open standards, then expansion is straight forward. In such a scenario the original network management and user interface are used to manage and communicate to the new components. This can be accomplished with either the LNS or Niagara Framework based systems.
- BAS enhancements – The BAS industry is rapidly implementing new features that enhance the user experience and improve the operation and efficiency of the building. At the field level controller, these enhancements can easily be incorporated on the existing network by using LonWorks and BACnet based devices. At the user interface the enhancements to graphics can be easily achieved through the LNS, BACnet and Niagara Framework based systems.

Taking into consideration all of these factors in the selection and design of a BAS can provide significant increases in the sustainability of the system. This increase in sustainability of the BAS, while not indefinite, can reasonably be expected to match the life of the mechanical systems that they control. Some recent examples substantiate that improved sustainability is a reality. As an example, some of the earliest Circon Systems (now owned by Distech Controls) installations of LonWorks technology, that are over 12 years old, are being expanded using LNS or Niagara Framework based network management tools and graphical user interfaces and new Lonwork controllers thereby extending the life of the original building automation system.

In conclusion, a sustainable BAS is achievable with proper initial design considerations that include the use of open protocols, standardized Network Management tools and open access to product and training. These properly implemented sustainable design practices will allow for the implementation of technology enhancements, expansion and maintenance of the existing system without the need of a complete retrofit.

**FOR MORE INFORMATION ON OPEN SYSTEMS AS A SOLUTION TO SUSTAINABILITY PLEASE FEEL FREE TO CALL US AT (212) 924-2044**