City of Mississauga
Corporate Report

MISSISSAUGA

Date: September 28, 2020 To: Chair and Members of General Committee From: Gary Kent, CPA, CGA, ICD.D, Commissioner of Corporate Services and Chief Financial Officer	Originator's files: Meeting date: October 21, 2020

Subject

Building Automation Systems (BAS) Standardization Strategy

Recommendation

1 That the Corporate Report entitled, "Building Automation Systems (BAS) Standardization Strategy" dated September 28, 2020 from the Commissioner of Corporate Services and Chief Financial Officer be received.
2. That the Enterprise Server Software (ESS) platform Tridium Niagara Framework be established as a City Standard BAS common front end platform for a period of up to 10 years, ending December 31, 2031.
3. That acceptable BAS products and suppliers be determined through an open prequalification process to be specified in future procurement processes for the supply, installation, programming and commissioning of BAS systems which are compatible with the ESS platform Niagara Framework.

Report Highlights

- The City currently obtains proprietary Building Automation Systems from three suppliers (Siemens Canada Limited, Ainsworth Inc. and Convergint Technologies) who are approved City Standards.

- There is a need to improve Building Automation Systems (BAS) to enable the City of Mississauga to operate its buildings' portfolio in an efficient and cost-effective manner, support the Climate Change Action Plan and be positioned to grow in the smart buildings and Internet of Things (IoT). A comprehensive study was undertaken by Ameresco Canada Inc., an independent consultant. The study recommendations include:
    - Adopting a single Enterprise Server Software platform with a common graphical user interface for all BAS products installed in buildings. The open license model used by Tridium Niagara provides for maximum flexibility to the owner. The

Niagara Framework software is an open source ESS package that can communicate to multiple supplier BAS products.

- Pre-qualifying products and suppliers through a competitive procurement process. This approach will establish a pool of open BAS product lines available from multiple suppliers ensuring cost effectiveness through increased competition. Only the pre-qualified products and suppliers will be named in bid requests for projects requiring BAS.
- This report requests approval to establish Tridium Niagara Framework software as a City Standard on a single source basis. In accordance with the Purchasing By-law #374-2006 “City Standard” means specific Goods approved by Council that best fill a long-term City-wide need or requirement. The Niagara Framework software is unique to Tridium, hence they are a single source as described in the Purchasing By-law under Schedule “A” 1. (a) (iv) “the complete item, service or system is unique to one vendor…”
- The cost of licences for the Niagara Framework software estimated at $20,000 will be included in the cost of individual projects, as approved in the Capital budget.

Background

The City of Mississauga, as the progressive and leading-edge public sector entity in the GTA, is well positioned to grow in the direction of data-driven analytics, Smart Buildings and Internet of Things (IoT). Also, by adopting its own Climate Change Action Plan and Corporate Green Building Standard, energy management and sustainability are of high importance for future city development. Recognizing this direction, the strategy of developing an architecture of Building Automation Systems (BAS), as a crucial tool in controlling building HVAC, lighting, ice-making, pool heating and other systems, is of utmost importance. A BAS standardization strategy should be built to set the way BAS systems should be designed, procured, implemented, integrated, maintained, expanded, and interoperated with other city-wide systems.

Building Automation System (BAS) is a technology solution that controls mechanical (HVAC), ice refrigeration and/or lighting equipment in a building and, similar to any technology or electronic equipment, requires engineering knowledge for its design and implementation. Also, due to the limited life of electronic components and advancing technology, it requires periodic upgrades and renewal.

The City currently has forty-three (43) facilities with BAS which are of different vintage, access level, serviceability, graphical interface and ability to store data and control the equipment. The BAS are from three suppliers: Siemens, Ainsworth Inc. and Convergint Technologies. These BAS suppliers were established through a competitive procurement process and approved by Council as City Standards initially in in 2005, reference GC-0578-2005. Council approved the continued designation of these BAS as City Standards in 2012, reference GC-0507-2012, and again in 2018, reference GC-0154-2018. The current City Standard designation ends in 2023.

Each supplier's BAS is proprietary to them and each supplier provides ongoing maintenance and support for the system they provide on a single source basis. The BAS required for a particular installation is specified in a bid request and carried by the general contractor.

The current BAS systems are inconsistent in their design, implementation process, expected life span and ability to effectively control environmental systems, resulting in inefficient use, increased internal labor requirements and energy wastage. Moreover the communication protocol (LON) originally standardized by the City is no longer supported by many suppliers, limiting competition during procurement processes.

Present Status

Based on the aforementioned shortcomings of the existing BAS, a need for BAS standardization was recognized as a pressing matter for the City as many individual systems are due for renewal.

Through a competitive procurement process, Ameresco Canada Inc., an independent engineering consultant, was retained to conduct a Building Automation Systems (BAS) Standardization Study in order to provide recommendations regarding design, implementation and maintenance of the BAS at the City. Ameresco has over 20 years of experience in the public sector, serving clients such as City of London, City of Barrie, Toronto District Catholic School Board and other large public entities.

Ameresco, in consultation with staff, has engaged in thorough reviews of the existing BAS, evaluating all existing systems, collecting stakeholders input, benchmarking current installations and capabilities against BAS industry trends in order to determine the right approach for BAS moving forward at the City.

Comments

The study conducted by Ameresco had four (4) main deliverables:

1) Review and evaluate current state of City of Mississauga BAS;
2) Evaluate merits of using a unified common front-end BAS solution vs. individual front-end solutions for a multi-building public entity such as the City;
3) Establish corporate BAS guideline/master specification for future BAS projects;
4) Pre-qualify BAS suppliers based on available product lines and suppliers' ability to serve the City in efficient and competitive manner.

Up to this point, deliverables #1 and #2 as per the above have been completed and the recommendations are presented in this corporate report for Council approval.

Upon Council approval, deliverable #3 will be finalized and deliverable #4 (BAS product lines and suppliers pre-qualification process) will proceed as per required procurement process.

Options

As part of the deliverable #2, multiple options were evaluated, but given the City's multi-building portfolio and buildings systems' complexity, the following two (2) options were included in the final in-depth analysis:

Option A - Common Front End ESS

A common framework BAS utilizes a single Enterpriser Server Software (ESS) package to connect and manage the controls in a portfolio of buildings using an open communication protocol. This allows multiple BAS product lines to operate together with the same graphical interface. This can be accomplished by installing either an ESS package using an open license non-proprietary network, or an ESS with a closed license solution. In the closed license model, only the installing BAS supplier can access and work on that ESS platform. In both cases the ESS can communicate to multiple BAS products in the field using the Open communication protocols such as BACNet, LON or Modbus. In the case of a closed license application the BAS supplier who maintains the ESS would need to be involved in all projects where new BAS are added to the system. With an open license Energy Management Control System (EMCS) ESS, any of the installing BAS suppliers and/or the owner can access the ESS to make necessary changes as new BAS systems are installed.

Presently, there is only one system on the market that provides a fully open licensed common software platform, Tridium Niagara Framework. The Niagara Framework software is an open source ESS package that can communicate to multiple supplier BAS products through its JACE (or similar) line of supervisory controllers. These controllers are available for purchase and installation by many BAS suppliers in conjunction with their own family of BAS products at a given site.

The open license model provides for maximum flexibility to the owner both in terms of service and the installation of new systems. The open license provides access to any of the (pre-qualified) BAS suppliers, a designate specialized system integrator, or direct access by the owner. Once accessed, any individual trained to use Niagara Framework can create graphics, install software updates, set-up and route alarms, program the system and assign user rights, create custom application programming, and perform maintenance of the ESS. This would allow the City an opportunity to receive multiple quotations for the majority of BAS related projects including competitive bidding for new BAS installations and the modification/expansion/service of existing BAS installations. By contrast, a closed license ESS platform is only managed by a single supplier who would need to be involved in every project where access/modification to the ESS is required, creating a competitive advantage over other suppliers bidding for jobs if the supplier of the EMCS ESS package is also a pre-qualified BAS supplier for site installations. Additional advantages of a common front end include:

- One software package to purchase and maintain
- One location for common organizational calendar
- One color scheme and the same visual representation of system within the graphics

- Identical operational BAS functions for all sites (Set-Point Adjustment, Alarms, Trending, Overrides, Scheduling, etc.) regardless of supplier
- Simplified training for end users and the ability for knowledge transfer when moving from site to site (system operates the exact same way)
- One system to learn and be trained on for higher level operators

There are two disadvantages of a common front-end solution:

- Demarcation of responsibility
- Single point for system failure

However, they can be easily addressed as per the following:

Demarcation of responsibility is present as the software is not licensed to one specific supplier. This issue is mostly addressed by the open license model allowing any number of qualified companies (or the owner) to work on the system and contact Tridium directly for product support. The owner should have trained staff members who are familiar with the Niagara Framework product sufficiently to begin the troubleshooting process.

The other disadvantage of a common front end is that it represents a single point of potential failure in the system should there be a loss of server or server software. Please note that such a failure does not impact overall systems operation (it impacts visualization) as the local controllers work independently on the front end. This risk can be mitigated by proper planning for redundancy and maintaining back-up copies of all programming, databases, and system graphics.

Option B - Individual Front End Solution

The alternate to a common front end is to follow the same path as the City's existing BAS design, each pre-qualified BAS supplier to be given a space on a City server to install their own branded ESS package. The primary advantage of this approach is that each supplier will have full responsibility for every component of the BAS system from the building BAS installations to Server software (no demarcation of responsibility). Another advantage is that by having multiple ESS, it means that there is less impact in the event of a failure at the server/server software level or when the software package reaches the end of its service life.

Each of these ESS products have similar alarming, 3rd party integration, scheduling and trending capabilities as compared Tridium Niagara Framework, though some have restricted access (depending on the supplier) to the front end programming, set-up of alarms, trends, access levels, graphics, etc.

As presented below, there are many disadvantages of this option, a major one being the lack of standardization across all sites. As it currently is at City's sites today, each supplier creates their own graphic template using their own software system which typically will have a completely different look, color scheme and functionality when compare to another supplier. The access levels and ability to set up trends, settings, and control variables will vary from supplier to supplier. Some bury the control parameters within the programming and do not expose them to

the graphics making it difficult for City operations staff to troubleshoot or make changes without first contacting the BAS supplier (and incurring a charge for a service call). Additionally, if a City employee is relocated to another building, they may need to be trained on a different system rather than having the graphics, programming, operational BAS functions and access control remain consistent. The EMCS software packages will also need to be renewed at different times for different suppliers, making it more difficult for facilities to maintain constant updates. As is currently the situation, Facility Operations will need to update multiple calendars and schedules each year.

The study document explains in details the advantages and disadvantages of each option; below is a high level summary of the pros and cons of Option B:

Advantages:

- Demarcation of responsibility. Each supplier has full responsibility for the entire BAS system from the building to Server software.
- Supplier access to a higher level of technical support for software.

Disadvantages:

- Lack of standardization across all sites. Each supplier creates their own graphic template using their own software.
- Access levels and ability to set up trends, settings, and control variables will vary from supplier to supplier.
- Some suppliers bury the control parameters within the programming and do not expose them to the graphics making it difficult to troubleshoot or make changes without first contacting the BAS supplier.
- Employee reassignment to another building will require additional training is BAS systems are different.
- Multiple calendars and schedules need to be updated on annual basis and often greater frequency.

Based on the study analysis and findings, for the City's portfolio of municipal buildings, Ameresco recommends Option A, the use of a single ESS platform with common graphical user interface for all BAS products installed in buildings. The open license model used by Tridium Niagara provides for maximum flexibility to the owner. The Niagara Framework software is an open source ESS package that can communicate to multiple supplier BAS products through either its supervisory controllers or (the sub-network) controllers.

This report seeks approval to establish Tridium Niagara Framework software as a City Standard on a single source basis. In accordance with the Purchasing By-law #374-2006 "City Standard" means specific Goods approved by Council that best fill a long-term City-wide need or requirement. The Niagara Framework software is unique to Tridium, hence they are a single

source as described in the Purchasing By-law under Schedule “A” 1. (a) (iv) “the complete item, service or system is unique to one vendor…”

Financial Impact

The corporate report is not requesting any additional funds at this time. The cost to upgrade the BAS front end to Niagara Framework common platform is estimated at $20,000 plus applicable taxes, which include unlimited device capacity and Service Maintenance Agreement for 10 years, which will provide the City with all updates/revisions for the 10-year period.

However, the licence cost will be covered within individual project budgets and contracts; it is not a separate cost to the City. Budgets for individual projects with requirements for BAS are approved in the Capital budget. No direct contracts will be required as a result of this new BAS Standardization Strategy. Contracts will be executed, in accordance with the Purchasing By-law, with each successful bidder resulting from individual procurement processes.

In addition to energy savings as a result of improved BAS controls based on the recommendations in this report, it is estimated that the cost of implementing the recommended single common BAS front end software solution will have an initial savings of $150,000 over the individual multi-supplier software approach plus an additional $750,000 over the projected 10-year upgrade plan due to increased competitive bidding at all levels of future BAS projects.

Conclusion

There is a need to improve Building Automation Systems (BAS) to enable the City of Mississauga to operate its buildings’ portfolio in an efficient and cost-effective manner, support the Climate Change Action Plan and be positioned to grow in the smart buildings and Internet of Things (IoT). A comprehensive study was undertaken to evaluate the City’s BAS and develop a new approach to standardization.

This report recommends that the City establishes the Enterprise Server Software (ESS) platform Tridium Niagara Framework for BAS communication as a City Standard on a single source basis. In accordance with the Purchasing By-law #374-2006 “City Standard” means specific Goods approved by Council that best fill a long-term City-wide need or requirement. The Niagara Framework software is unique to Tridium, hence they are a single source as described in the Purchasing By-law under Schedule “A” 1. (a) (iv) “the complete item, service or system is unique to one vendor…”

This report also recommends that staff conduct an open procurement process to establish a pool of pre-qualified BAS product lines and suppliers to be named in future procurement processes for the supply, installation, programming and commissioning BAS systems which are compatible with the ESS platform Niagara Framework.

Attachments

N/A

Gary Kent, CPA, CGA, ICD.D, Commissioner of Corporate Services and Chief Financial Officer

Prepared by: Mili Alikalfic, P.Eng., LEED AP, Supervisor, Energy Programs, F&PM