APPENDIX 1

Review of the Energy Retrofit Program at Community Centres and Arenas

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TORONTO Auditor General's Office

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EXECUTIVE SUMMARY

Energy Retrofit Program part of Auditor General's work plan

A high level review of the City's Energy Retrofit Program was included in the Auditor General's annual work plan.

By way of background, in 2004 the City embarked on an Energy Retrofit Program to reduce energy use at certain City operated facilities. The Energy and Waste Management Office of the Facilities Management Division is responsible for the management of the Retrofit Program.

Energy Retrofit Program has a total capital budget of $36 million

The Energy Retrofit Program consisted of 13 projects with a total capital budget of $36 million. In approving the program it was determined that the costs to finance the Program would be recovered from the energy savings realized.

Parks, Forestry and Recreation Retrofit Program had a budget of $21 million

Of the 13 projects included in the Program, four involved arenas, community centres and swimming pools. These four projects, known as the Parks Forestry and Recreation Retrofit Programs had a combined budget of $21 million. The Program consisted of four distinct phases with the first three complete and the fourth due for completion in 2013.

Energy Savings initiatives were significant

Energy saving improvements for the overall Program included:

- The updating of lighting systems
- Providing advanced building automation systems to control lighting, heating, cooling and ventilation
- The installation of heat recovery systems
- The reduction of drafts and leaks around windows, walls and doors
- Improving the efficiency of rink refrigeration equipment
- The installation of water heating systems
- The upgrading of heating, ventilation and air conditioning systems.

Phase I budget was $9.9 million

Phase I of the program involved the retrofitting of 89 City operated Arenas at a cost of $9.9 million. The Program included the installation of new energy saving technologies, the monitoring and verification of savings and the training of City staff to operate and maintain new equipment.

Objectives of Review

Phase I of the program was the major focus of this review. The general objectives of the review were to determine the extent of the energy savings realized and to ascertain whether or not the cost savings were adequate to finance the capital costs as required by the Program.

Energy savings were realized but not determinable that savings will adequate to finance capital costs

Based on our review of various documentation, our discussions with management, as well as front line staff and a review of information provided by the external contractor responsible for the retrofit, it is clear that energy savings were realized. However, it is equally clear that the extent of these savings have not been adequately quantified by staff. Consequently, it is not possible to determine whether or not the amount of the energy savings realized were adequate to finance the original capital costs as required by the Program.

We have also discussed this particular issue with the General Manager, Parks, Forestry and Recreation who also expressed concerns in terms of the non quantification of energy savings.

Energy savings not quantified

In addition, because cost savings were not appropriately quantified, it has not been possible to confirm that energy savings guaranteed by the independent contractor responsible for the Program have in fact been met. The guarantee provision has an impact on the final contract cost.

Reporting to Council required but not completed yet

Further, a Council directive at the time of the approval of the Retrofit Program required a reporting back to Council on information relating to energy savings. This reporting back has not yet been completed and consequently the reporting to Council of the Program results should be conducted as soon as possible.

Issues in connection with the building automation system identified

While the issue of energy cost savings has been the focus of this report a number of other concerns were identified during our review. For the most part these concerns related to the effectiveness of a major component of the program known as the building automation system. This part of the program which is fundamental to maximizing energy savings, cost somewhere in the range of $3.3 million and has generated a significant number of operational concerns with front line staff at various arenas.

Building automation system controls and monitors major mechanical and electrical equipment

Very simply the building automation system consists of software that controls and monitors major mechanical and electrical equipment in a building. The system primarily monitors heating, air conditioning, lighting and ice rinks. The system automatically adjusts heating and lighting so that rooms are comfortable only when needed based on established program schedules. The system also, for example, causes ice pad cooling to operate only when the temperature at ice level reaches a predetermined level. For the most part the intent of the system is to minimize staff intervention throughout the heating and cooling process and consequently maximize energy savings.

Issues identified with the building automation system include the following:

Automation system not functioning to its full potential

- Due to various operational difficulties experienced by staff, the systems have been bypassed partially or entirely in a number of facilities
- Equipment upgrades or new equipment have not been programmed into the system
- Operating staff do not have the expertise or experience to adequately maintain the system
- Certain staff do not have the necessary training to effectively operate the system
- Maintenance of the equipment is generally required from external third parties and is costly and time consuming.
- Consideration be given to centralizing the monitoring of the building automation system.

Each of these issues needs to be addressed in order to realize the energy savings benefits available.

Program had significant environmental benefits

While we realize and appreciate the significant benefits of the Retrofit Program from an energy savings/environmental perspective the lack of an accurate evaluation of the results of the program make it extremely difficult to measure the benefits. Future programs of this nature require more analysis and information in order to support the obvious benefits. There is little merit in investing significant capital funds if there are no assurances that the investment has been financially prudent.

BACKGROUND

Council direction to reduce energy use in City Operations and City buildings and facilities

In April 2000, City Council adopted Clause No. 7 of Report No. 4 of the Policy and Finance Committee, titled *Environmental Task Force – Environmental Plan, "Clean, Green and Healthy – A Plan for an Environmentally Sustainable Toronto*," or *The Environmental Plan*. *The Environmental Plan* contains 66 recommendations.

http://www.toronto.ca/legdocs/2000/agendas/council/cc/cc000411/pof4rpt/cl007.pdf

Recommendation 29 (a) of that report requested City divisions to prepare plans to reduce energy use in their operations and in City buildings and facilities by at least 15 per cent by 2005.

Energy Retrofit Program Financing Framework

One of the steps to be taken to meet energy reduction targets was to implement certain energy efficiency measures at city facilities. At its meeting of April 19-28, 2004, City Council adopted Clause No. 1 of Report No. 3 of the Policy and Finance Committee titled "A Framework for Establishing an Energy Retrofit Program and Financing Strategy."

http://www.toronto.ca/legdocs/2004/agendas/council/cc040419/pof3rpt/cl001.pdf

This framework set out some overriding criteria for the Energy Retrofit Program, (ERP). The report stated that:

Criteria for the Program

"Projects to be considered for Energy Retrofit Program shall be limited to those that are projected to generate energy savings sufficient to offset a debt service schedule of ten years or less inclusive of all financing costs. Energy Retrofit Program will be charged interest at the City's comparable cost of borrowing, 5% for ten-year debt. Based on these assumptions, projects will require a simple payback of about 8 years or less, or an implied rate of return of 14% to qualify."

Reporting to Council required

"Furthermore, the Commissioner of Corporate Services is responsible for monitoring and reporting reductions in energy use for retrofit projects to Council annually. Consequently, the level of accountability for achieving projected outcomes will be greater than for the normal capital approvals process."

The Energy and Waste Management Office of Facilities Management Division works with divisions to identify energy savings initiatives and is responsible for implementing related projects in City-owned facilities.

13 energy retrofit projects had a budget of $36M

Council approved $20 million in 2004, $15 million in the 2006 capital budget approval process and $1 million in 2011 for 13 projects.

Four projects in PFR facilities with a total cost of $21M are the subject of our review

Of the 13 projects, four involve arenas, community centres and pools. These four projects are the subject of our review. The four projects have a combined budget of $21.1 million.

The four projects relate to facilities operated by the City's Parks, Forestry and Recreation Division. The projects were divided into four separate phases as follows:

- Phase I – the Arena Project – $9.9 million for retrofitting 89 facilities including such items as insulation, lighting and building automation systems. This phase, completed in June 2007, was contracted to Optimira Controls Inc.

- Phase II – the Community Centres and Pools Project. The project, a retrofit of 53 facilities was completed near the end of 2008 and was sole sourced to Toronto Hydro for $6 million.

- Phase III – the Community Centres and Pools Project Lighting Retrofit was awarded to a company called MCW Custom Energy Solutions Ltd. for $1.75 million. MCW retrofitted 59 facilities. The project was completed in 2010.

- Phase IV – was also awarded to MCW Custom Energy Solutions, Ltd. for $3.50 million in 2010. This phase is to address general energy efficiency measures in 83 smaller facilities excluded from Phases I - III. MCW is expected to complete the project mid-2013.

Performance guarantees for Phases I, II and IV

Phases I, II and IV all included vendor performance guarantees with financial implications. Phase III was a straightforward lighting project and a savings guarantee was not considered necessary.

AUDIT OBJECTIVES, SCOPE AND METHODOLOGY

The Auditor General's 2011 Audit Work Plan included a review of the $21.1 million Energy Retrofit Program at City operated community centres and arenas.

Objectives were to verify energy savings

The objective of this review was to evaluate the management of the energy retrofit program and processes with respect to the monitoring and measuring of energy savings with a view to confirming that anticipated savings were achieved and the related loans will be repaid as planned.

Audit scope

This audit covers the period July 1, 2007, to June 30, 2011 and was focused for the most part on Phase I of the Energy Retrofit Program.

Audit methodology

Our audit methodology included the following:

- Review of Committee and Council minutes and reports
- Interviews with staff
- Site visits to retrofitted facilities
- Review of related operating costs arising from the Energy Retrofit Program
- Review of documents and records
- Review of energy retrofit agreements between the City and contractors
- Evaluation /analysis of various energy savings reports prepared by the Energy and Waste Management Office
- Review of energy savings reports prepared by third party contractors

Compliance with generally accepted government auditing standards

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

AUDIT RESULTS

A. Was the Program Successful in Achieving Energy Savings?

In a report to City Council regarding the Energy Retrofit Program it was indicated that projects to be considered for the program *"shall be limited to those that are projected to generate energy savings sufficient to offset a debt service schedule of ten years or less inclusive of all financing costs."* In addition there was a requirement that there "*should be a monitoring and reporting of reductions in energy use for retrofit projects to Council annually."*

Energy savings were not quantified

Based on our review of documentation, various discussions with senior management and front line staff and a review of the energy savings work conducted it is apparent that energy savings were realized. However, the extent of these savings has been difficult to determine. In this context, we have not been able to verify that the energy savings were sufficient to cover the program costs as planned. Further, there has been no reporting back to Council as required.

Budgets of each facility reduced by anticipated savings

In terms of the determination of energy savings, it was anticipated that each of the facilities involved in the program would be required to reduce their operating budgets by annual amounts equivalent to the loan repayments on the actual costs of the projects. The loan repayments, including interest, were spread over a 10 year term.

The budget reductions at each of the facilities were based on estimated energy savings from the energy retrofit initiative. Many staff we interviewed indicate that in their opinion anticipated savings were not achieved at their individual facilities. Since budgets were reduced based on expected savings, this has created additional financial pressures for these facilities.

For example, at Ted Reeve Arena, energy savings were estimated at $33,645 per year. Arena staff were able to demonstrate that actual savings realized were only $6,400 per year and their budget reduction was adjusted accordingly. This is the only instance we are aware of where budget reductions were adjusted to reflect shortfalls in savings. While this specific example may not be representative of overall project results, it does indicate a specific documented case where anticipated savings were not achieved.

Quantification of savings difficult because of varying circumstances

The quantification of actual savings has been problematic generally because of deficiencies in the energy management system data along with a lack of detailed staff analysis. In certain facilities for example the energy management system indicated that there was negative energy consumption which is not possible. We were advised in certain circumstances that there were *"errors in base year calculations, data entry errors, inconsistencies in gas consumption not accounted for in the base year and a change in the schedule of operations."*

Quite simply there is no accurate quantification of the energy savings and as a result it is not possible to determine whether or not the program objectives have been met.

Unable to determine if contractor guarantees were met

Related to the quantification of cost savings are vendor performance guarantees. A certain level of contractor payments are based on contractors achieving energy savings performance targets. In terms of confirming whether or not performance guarantees have been met it has not been possible to verify savings. Consequently, it is not possible to determine whether or not performance guarantees were met.

We did review the analysis conducted by the external contractor in regard to energy savings. The reporting provided by the contractor indicated that the level of savings achieved had met its performance objectives. However, this analysis, although reviewed for reasonableness, was not verified by staff and in view of the deficiencies in the energy management system data it was not possible to independently verify the savings.

Recommendations:

1. **City Council request the Director, Energy and Strategic Initiatives to address the deficiencies relating to the energy management system with the objective of:**

    a. **Ensuring that energy savings are appropriately quantified;**

    b. **Ensuring that Phase IV performance guarantees have been met and appropriate adjustments, if any, are made in payment to the Contractor.**

2. **City Council request the Director, Energy and Strategic Initiatives to report to Council on the financial results of the program.**

3. **City Council request the Director, Energy and Strategic Initiatives, to provide appropriate operations staff with detailed facility by facility reporting of energy savings achieved as a result of the Energy Retrofit Program. Where such savings have not met objectives, appropriate remedial action, where feasible, be taken to maximize energy savings.**

4. **City Council request the Deputy City Manager and Chief Financial Officer in consultation with the Director, Energy and Strategic Initiatives and General Manager, Parks, Forestry and Recreation to report to Council on remedial steps that can be taken to alleviate unintended negative financial impacts of the Energy Retrofit Program on individual recreational facilities.**

B. Energy Retrofit Program Implementation and Sustainability Issues

The Energy Retrofit Program was a significant undertaking resulting in energy efficiency initiatives impacting approximately 250 separate City facilities. The benefits from the initiatives will be spread over many years in the future and appropriate steps need to be taken to ensure that benefits are sustained.

Basic energy savings initiatives were straight forward

The Arena Project was comprised of many different energy savings initiatives from basic to complex. Basic initiatives included improvements such as re-caulking windows, inserting draft stops on external doors and installing motion detectors so lights turn off automatically when rooms are not being used. These initiatives were implemented with few concerns or difficulties.

The most complex initiative, costing approximately $3.3 million, was the implementation of a building automation system in all facilities.

Building automation system has benefits

The building automation system in simple terms consists of software that controls and monitors all major mechanical and electrical equipment in a building. For City facilities this equipment is primarily related to heating, air conditioning, lighting and ice pads.

The building automation system for example is able to:

- Automatically adjust heating and lighting so that rooms are comfortable only when needed based on established program schedules; and

- Cause ice pad cooling equipment to operate only when the temperature at ice level reaches predetermined levels.

In reviewing various information during the course of our review, we noted an article in the March 2007 issue of *Building Operating Management* contains an article titled “The Automation Roadmap”. The article states:

Ongoing maintenance is required for the system to be effective

"Building automation systems cannot be installed and forgotten if they are to be effective. …the systems require staffing support. Operators will be needed to oversee the system, schedule equipment run times, change HVAC system operating parameters and…Maintenance technicians will be needed to fix problems with the system's operation when they occur. Facilities executives can expect that there will be ongoing problems, such as sensors going out of calibration and failed controllers. Unless these problems are identified quickly and corrected, the building automation system will gradually lose its effectiveness."

http://www.facilitiesnet.com/buildingautomation/article/Automation-Roadmap--6266

Many of the issues and concerns identified by front line staff with the building automation system directly relate to the issues identified in the article. Until these are addressed, the system will not realize its full potential and, as a result, energy savings will not be maximized.

Concerns expressed with the system

For example, the majority of front line staff we spoke to expressed significant concerns with the operation of the system. They indicated that in many cases they were not able to resolve operational issues with the system and there was insufficient support to assist in the resolution of problems. As a result, malfunctions were increasing maintenance calls, causing undue delays and ultimately incurring additional costs. As a result and in order to guarantee a more stable operating environment, many staff were disabling the building automation system. Obviously, in these circumstances, energy savings were not being maintained.

Problems attributed to the building automation system were resulting in public complaints such as insufficient lighting, inadequate heating and, poor quality ice surfaces.

Training on the system inadequate

Although operational staff received training on the system, staff turnover at many of the facilities was as high as approximately 30 per cent per year. This was not planned for in the implementation process and as new staff moved into these positions they were not receiving the training needed to operate the system effectively. Further, even staff that were trained could not solve many problems as they arose.

Maintenance and support becoming costly

Additional maintenance and support costs for the system were not included in the original business plans and consequently were not budgeted. Further, these costs are not being separately identified and accounted for so it is difficult to assess the extent of these costs.

System technician hired for City's civic centres

In 2010, the Energy and Waste Management Office hired an experienced automation system technician, primarily for the City's civic centres. Although not specifically responsible for the system at the smaller facilities, operational staff indicated that they were able to contact this technician for assistance in a limited number of cases.

The availability of this expertise needs to be better communicated to all facilities although the resulting work may be excessive for one individual.

In addition to maintenance and support costs front line staff indicated that they have been required to absorb additional related costs in excess of those originally contemplated when the project was initiated. These costs for example include:

- Loss of revenue when events have been cancelled due to equipment malfunction.
- Cost of service calls to the vendors of various equipment because of difficulties with the building automation system.
- Cost of additional staff time.

In general, front line staff while endeavoring to work with the building automation system expressed concerns with the effectiveness and economy of the initiative.

Consider the centralization of monitoring the system

An issue that needs to be considered relates to the potential of the introduction of a centralized function to monitor all automation systems. This monitoring could be established at one central location. Such a process would have the following advantages:

- one central resource would be available for all facilities
- it would eliminate the need and the duplication of individual facilities each contracting their own external maintenance and support resources
- common problems could be identified and addressed more effectively.

We appreciate that there may be additional costs to central monitoring but in the longer term this may be more cost-effective. In any event, a cost benefit analysis of such a process should be completed to determine the appropriateness of such an initiative.

New equipment not always connected to the system

An additional and ongoing implementation problem exists with the installation of new or upgraded equipment at facilities where a building automation system has been installed.

Staff report that in many cases, new or upgraded equipment is not being connected to the building automation system. This is partly because operational staff are not confident in being able to address system problems and partly due to lack of expertise to integrate new equipment with the system.

Providing appropriate support to operating staff should resolve many of the issues with the system. This, in turn, will help alleviate budget pressures from any energy savings shortfalls at facilities and extra costs being incurred for service calls.

Recommendations:

5. **City Council request the Director, Energy and Strategic Initiatives, in consultation with the General Manager, Parks, Forestry and Recreation to review alternatives and implement effective support and maintenance of building automation systems. The alternatives should include:**

   a. **Centralized monitoring of building automation systems;**

   b. **Establishing in house building automation system expertise;**

   c. **Additional and ongoing training for staff responsible for monitoring and maintaining building automation systems; and**

   d. **Reviewing equipment not currently connected to each building automation system to determine if it would be advantageous to control the equipment through the building automation system.**

6. **City Council request the Director, Energy and Strategic Initiatives in consultation with the General Manager, Parks, Forestry and Recreation to track costs specifically attributable to support and maintenance of building automation systems, where feasible, and include this information in any analysis of the net benefits achieved.**

CONCLUSION

This report presents the results of our review of the Energy Retrofit Program at community centres and arenas. The issues identified include savings verification and quantification, and a need to ensure operational staff are provided appropriate support to realize the full benefits of building automation systems.

Addressing the recommendations in this report will assist in ensuring project results are appropriately reported and ongoing energy savings are maximized.