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CITY OF VANCOUVER

ADMINISTRATIVE REPORT

Report Date:	May 12, 2010
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Meeting Date:	May 18, 2010

TO: Vancouver City Council

FROM: Director of Facility Design & Management

SUBJECT: Implementation of a Real-Time Monitoring And Continuous Optimization Program for Energy and Greenhouse Gas Management in City Facilities.

RECOMMENDATION

A. *THAT Council authorize the General Manager of Business Planning and Services to negotiate and execute agreements with BC Hydro to allow the City to participate in BC Hydro's Continuous Optimization Program.*

B. *THAT Council approve financing for building energy system improvements at a net cost of $462,000 from the Capital Financing Fund Greenhouse Gas Reduction loan program, to be repaid by annual energy savings estimated at $75,000.*

C. *THAT Council approve $16,000 of ongoing costs for "pulse" metering and $178,000 of energy management staff resources to be added to the Facilities Design and Management 2010 Operating Budget ($100,000 prorated), to be offset from ongoing energy cost savings of $225,000 in civic buildings.*

D. *THAT the Director of Facilities Design and Management report back to Council prior to expiry of the BC Hydro Continuous Optimization program on:*
- *the effectiveness of the Real Time Monitoring Program and how it fits within an ongoing energy monitoring and management program for City buildings;*
- *the impact of the Energy Analyst and DDC Programmer in achieving energy cost savings and GHG reductions, and*
- *a recommended strategy for the next phase of energy use / GHG reduction at City buildings.*

GENERAL MANAGER'S COMMENTS

The General Manager of Business Planning and Services RECOMMENDS approval of Recommendations A, B, C and D.

COUNCIL POLICY

In April 2002, Council adopted the Definition and Principles of Sustainability to guide, prioritize and improve the sustainability of City actions and operations.

In December 2003, Council approved the Corporate Climate Change Action Plan that established a greenhouse gas (GHG) emission reduction target of 20 percent from 1990 levels for the City operations and identified the importance of building operations in energy conservation and emission reductions.

In September 2007, Council adopted a carbon neutral target for City operations by 2012 under the *British Columbia Climate Action Charter*.

On February 4, 2010, Council adopted the long-term environmental goals recommended by the Greenest City Action Team (GCAT) in their report entitled "Vancouver 2020: A Bright Green Future".

PURPOSE

The purpose of this report is to:

- request authority and funding to participate in BC Hydro's Continuous Optimization Program including initial implementation of real-time energy monitoring at nine City Facilities;
- add resources to Facilities Design and Management to provide active monitoring and management of energy use in civic facilities; and
- outline the business plan to make energy efficiency improvement initiatives a cost-neutral operation.

BACKGROUND

On September 22, 2005, Council approved Phase 1 of the Energy Performance Contract program, as the first step in achieving Council's mandated target for a 20% reduction in greenhouse gas emissions by 2010. Phase 1 focused on the buildings in the City Hall Precinct and was followed by two further phases encompassing wide ranging energy efficiency/ greenhouse gas reduction initiatives at 36 City, Library and Park Board facilities. The projects include lighting retrofits, upgraded, automated building environmental controls, water conservation measures, new higher efficiency boilers and other facility specific work identified in consultation with the ESCO contractor.

The following table summarizes the program status to date:

Table 1 GHG Reduction Program

		Budget Capital Cost	Annual Savings		GHG Reduction (tonnes)		Project Status	Loan Repayment Date
Phase 1	City Hall Campus	$1,820,000	$121,900	A	361	A	Complete	December 2006
Phase 2	Park Board Facilities (30)	$8,635,000	$543,200	E	2,240	E	90%	December 2030
Phase 3	Museum, Library Square, Engineering Yards	$5,126,000	$275,800	E	698	E	80%	December 2030
	Total	$15,581,000	$940,900	E	3,299	E		

Note: "A" means Actual; "E" means estimated

Phase 1 of the program, which focused on the City Hall Precinct, was completed and the loan which financed the project has been repaid from energy and utility savings. Phase 2 of the project is 90% completed with final work scheduled for 2010. Energy savings from this phase are expected to be in the range of $550,000 annually. Phase 3 will also be completed in 2010 with utility savings estimated at $275,000 annually. These savings are used initially to repay the loans and, where possible, loan repayments are expedited if target savings are exceeded.

To date, these initiatives have resulted in a 23% reduction in fossil fuel consumption compared to 1990 levels, despite a 24% increase in the square footage of civic buildings being monitored. Despite this increase in building area, electricity consumption has increased just 8%. Collectively, these initiatives are expected to reduce building-generated greenhouse gas production to 19.4% of the 20% target of the Greenhouse Gas Reduction Program. Phase 4 of the GHG Reduction Program, currently under development, will enable the City to surpass the 20% target. The benefits of this final phase will not be fully realized until 2012. This phase of the program will focus on the City's non-market housing facilities which will be explained in detail and recommended to Council in September.

DISCUSSION

In order to maintain the energy (and financial) savings and the greenhouse gas reductions achieved through the Energy Performance Contract initiatives and to take City facilities to the next level of reductions, it is proposed that the City take two steps:

1. introduce real-time energy monitoring in selected City facilities through participation in the BC Hydro Continuous Optimization for Commercial Buildings program; and
2. add energy monitoring and management resources to Facilities Design and Management to lever real-time monitoring and to support a continuous improvement imperative in all City facilities by putting a focus on further energy efficiency opportunities and on energy-conscious operations.

1. Real Time Energy Monitoring

BC Hydro has introduced a program called *Continuous Optimization for Commercial Buildings* that supports persistent energy savings in a holistic way. It is intended to assist commercial building owners in retro-commissioning[1] and improving the level of efficiency of their buildings. BC Hydro identifies the benefits of this program as:

[1] Retrocommissioning is a study to identify existing systems that are not operating to original design intent or to optimal energy performance.

- Improving the understanding of building energy usage;
- Determining whether energy use is appropriate;
- Taking advantage of low-cost operational measures to achieve energy reductions of up to 10%;
- Quantifying the savings arising from retro-commissioning efforts; and
- Ensuring the persistence of energy savings by measuring performance.

The key elements of this program include:

- Installation of "interval" and "pulse" meters to achieve "real-time" monitoring of energy consumption;
- Connection to a Energy Management Information Software (EMIS) software service;
- Retro-commissioning audits to determine cost-effective measures to bring facilities to their optimal energy performance levels;
- Implementation of the approved measures;
- Provision of in-house Building Operator training on how to best utilize the information from the EMIS system and how to implement best practices in energy management;
- Provision of a "coaching service" involving a quarterly visit to evaluate progress.

Through the City's aggressive program of energy retrofits funded on a cost recovery basis from energy savings, civic buildings are already achieving significantly reduced energy consumption and GHG reductions. In fact, these initiatives have caused BC Hydro to reduce its estimates of energy savings achievable through the Continuous Optimization Program from 10% to 4%. In order to test the limits of this success, the City has applied to participate in the BC Hydro program and has been approved for an initial phase of up to nine facilities, including:

- City Hall & East Wing
- West Annex (VanCity Building)
- One Kingsway
- Library Square
- Sunset Community Centre
- Museum of Vancouver
- Manitoba Works Yard
- National Works Yard
- Vancouver Aquatic Centre

Subject to the City entering into the necessary agreements, BC Hydro will cover the direct cost of converting the current BC Hydro electric meters to "pulse" meters and the costs of the EMIS software, training and licenses for two years. The value of these elements that BC Hydro will pay for directly is estimated at approximately $51,000.

In addition, BC Hydro will reimburse the City for costs related to consultant fees for the retro-commissioning studies, for building operator training, and for the "coaching" program. These costs, valued at approximately $106,000, are initially borne by the City but will be reimbursed by BC Hydro. The cost recovery mechanisms will be detailed in the applicable agreements with BC Hydro.

By participating in this program, the City must commit to implementing improvements identified in the retro-commissioning studies that have a reasonably short payback, to adding secondary metering equipment in the facilities where necessary to make the real time monitoring program effective, and to having staff in place to monitor the systems and to

respond to energy alerts. These cost estimates are summarized in Table 1 and are generally as follows:

- **Supplementary Installation Costs**. The cost of infrastructure needed to support new meters and monitoring equipment supplied by BC Hydro. This would include conduit and wiring and any modifications to sub-metering systems. This is estimated at an average of $3,750 per building.
- **Implementation Costs.** BC Hydro has set the maximum cost of implementing improvements identified in the retro-commissioning studies at $0.36 per square foot including project management fees.
- **Additional Annual Monitoring**. For metering points not needed by the BC Hydro program but deemed necessary by City staff for meaningful interpretation of data (tenant meters, etc), the software provider has estimated an additional software license cost of $16,000 per year.

Table 2 Real Time Monitoring: Installation and Operational Cost Summary

	2010	2011		2012		2013	Total	
	Cost	Cost	Reimburse.	Cost	Reimburse.	Reimburse.	**Gross**	**Net**
EMIS Installation	50,000						50,000	50,000
Investigation & Coaching	57,000	44,800		6,100			107,900	107,900
Reimbursement			(60,300)		(41,500)	(3,900)		(105,700)
Implementation		265,000		138,000			403,000	403,000
Project Management	3,400	2,600		400			6,400	6,400
Net Total	110,400	312,400	(60,300)	144,500	(41,500)	(3,900)	**567,300**	**461,600**

Based on the advice provided by BC Hydro in considering the application to participate in their program, the cost of implementing the first phase of real-time energy monitoring is estimated at $567,000 of which approximately $106,000 will be reimbursed by BC Hydro, leaving the net capital cost to the City at a maximum of $461,000. The actual implementation costs are capped at this amount and will be confirmed during the retro-commissioning phase of the project.

Based on experience from BC Hydro modelling, overall energy savings will increase by an estimated $75,000 annually providing a payback on the anticipated capital investment in approximately 8 years.

Working with BC Hydro, the City will partner with Pulse Energy, a Vancouver company, to provide the real-time monitoring and reporting software. Pulse will provide building by building reporting of energy consumption in a dashboard style, web-based report format as well as detailed consumption information. In addition, the City will utilize additional metering points beyond the BC Hydro requirement to better manage energy consumption at an additional operating cost of $16,000 annually.

The relationship with BC Hydro is for two years. Prior to expiry of the program, the Director of Facilities Design and Management will report back to Council with: a review of the program impacts; an assessment of real time monitoring and a recommendation related to its continued use in the City GHG and energy consumption management program; and, an assessment of the effectiveness of the additional staff resources documented below.

2. Operational and Staff Resources to Actively Manage Energy Use

Just as clocks do not improve productivity, displayed energy meters do not improve energy efficiency. Information gained by detailed energy metering must be matched with appropriate monitoring and risk mitigation capabilities and a mandate to reduce energy use throughout facility operations.

Energy management, greenhouse gas reductions and utility cost control are related, ongoing efforts. The BC Hydro *Continuous Optimization Program* is one element of a cohesive approach to managing the impact of our operations. Several types of change influence energy usage within our organization; utility rate changes, operating changes, portfolio growth and new technologies all affect the energy is used in City facilities. To continue to reduce energy use, organization-wide strategic energy management must be implemented.

In order to meet the requirements of the organization, including the success of the Continuous Optimization program, it must be ensured that the City has the expertise to manage energy performance in its broad range of facilities, Facilities Design and Management requires the following resources which are not currently available:

- **Energy Analyst**. This position will provide in-depth assessment of energy consumption trends in all City facilities, oversee the real-time energy monitoring program, investigate energy trend variances and conduct research into new technologies; and
- **Direct Digital Control (DDC) Technician**. This position will be responsible for the maintenance of Building Automaton Systems (BAS) and DDC control systems, monitoring performance, identifying and implementing program changes to yield improved energy performance, assisting facility staff in the commissioning new systems, and educating building operations staff.

By working together and with building operations staff, these positions will:

- ensure that the improvements achieved through the *Continuous Optimization Program* are sustained and that the lessons learned are broadly applied at facilities across the City;
- ensure that the energy efficiency functionality introduced in City facilities through the Energy Performance Contracts are effectively levered to maximize consumption reductions and GHG generation;
- provide advice to building operators about operational changes that can be made to achieve further enhance reductions; and
- provide a Centre of Expertise for future expansion of the energy management program across City facilities.

The value of these positions will not be limited to the facilities included in the *Continuous Optimization Program* but rather expanded across the City's portfolio. The annual operating cost of these two positions is estimated to total $178,000 subject to classification by the General Manager of Human Resources, to be offset from the estimated $225,000 in savings as indicated below. Staff is currently making application to Terasen Gas for funding assistance to support the Energy Analyst position.

Addition of these positions to the Energy Management Group in Facilities is expected to have further benefits in terms of energy consumption and GHG emissions. These benefits arise because of the active management of energy use and advice to building operators on the most

effective operational considerations. Based on experience observed by BC Hydro in other organizations, these positions could be expected to reduce energy consumption from 2% to 5% beyond that available from energy system initiatives alone. Based on current energy consumption pattern in City facilities, these savings (calculated at 2%) would be approximately $225,000.

*FINANCIAL IMPLICATIONS*It is recommended that the estimated $462,000 net capital cost of the energy system retrofits arising from the BC Hydro *Continuous Optimization Program* be financed as part of the overall Greenhouse Gas Reduction Program to be repaid from energy savings estimated at $75,000 annually (beginning in 2011 and reaching full savings in 2013) in approximately 8 years. It is recommended that funding for the two energy management positions ($178,000 annually and prorated at $100,000 in 2010)be added to the Facilities 2010 Operating Budget, offset by savings from a broad reduction estimated at 2% of current energy consumption costs ($225,000 annually) to be achieved from more effective energy management.

It should also be noted that these initiatives are important in working toward the carbon neutrality expected for City buildings. To the extent that GHG reductions can be expedited the City will avoid the cost of carbon offsets that will be required beginning in 2012. Participating in the BC Hydro initiative and having experienced energy management staff will provide a strong opportunity to pursue these reductions and the associated cost savings.

ENVIRONMENTAL IMPLICATIONS

The BC Hydro *Continuous Optimization Program* normally targets electrical energy cost reductions of approximately 10% for new entrants, however, due to the degree of savings already achieved through extensive GHG reduction projects in the affected City buildings this target has been reduced to 4%. Notwithstanding this change, the annual reduction upon completion of the program is estimated to be 140 tonnes of GHG and $75,000 per year in electricity consumption by 2013.

CONCLUSION

Participating in BC Hydro's Continuous Optimization Program leverages 3rd party funds and expertise to deliver meaningful real-time energy monitoring and enables the City to optimize building energy performance in the facilities included in this initiative. The program supports meter installation, facility study, and ongoing staff training needed to maintain and improve on energy performance over the long term.

While the City must invest financially in this program, the long term benefits will enable the City to better achieve its Greenest City goals through the reduction of energy consumption and green house gases.

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