



**To:** Public Works and Transportation Committee  
**From:** John Irving, P.Eng, MPA  
Director, Engineering  
**Re:** Gateway Theatre – Energy Retrofit Project

**Date:** March 26, 2014  
**File:** 06-2050-20-GT/Vol 01

**Staff Recommendation**

That the report entitled “Gateway Theatre – Energy Retrofit Project”, dated March 26, 2014, from the Director, Engineering be received for information.

John Irving, P.Eng, MPA  
Director, Engineering  
(604-276-4140)

Att. 1

<b>REPORT CONCURRENCE</b>	
<b>CONCURRENCE OF GENERAL MANAGER</b> 	
<b>REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE</b>	<b>INITIALS:</b> 
<b>APPROVED BY CAO</b> 	

## Staff Report

### Origin

In September 2008, Council signed the BC Climate Action Charter, voluntarily committing the City of Richmond to carbon neutral operations. In addition to this, Council adopted on April 26, 2010, the provincial greenhouse gas (GHG) reduction targets and approved an amendment to the Richmond Official Community Plan Bylaw 7100, which sets Richmond's community-wide GHG reduction targets at 33% below 2007 levels by 2020, and 80% below 2007 levels by 2050. In connection with these community targets, Council also adopted on July 14, 2010, the Energy Sustainability Strategic Program with the target to reduce energy consumption in the Richmond community by at least 10% by 2020, from 2007 levels.

Through these commitments, the City of Richmond has a mandate to reduce GHG emissions and integrate renewable technologies into its existing corporate energy systems.

### Background

Council endorsed staff's recommendation to implement a pilot project to install a sewage wastewater heat recovery system at Gateway Theatre on September 24, 2012. The heat recovery system was designed to provide a renewable heating source to the facility and displace natural gas use. A summary of the project and images of the technology are included in **Attachment 1**. In addition to the installation of the heat recovery system, other mechanical heating system components at Gateway Theatre that were at the end of their service life were upgraded.

It was estimated that the integration of the heat recovery system would reduce natural gas use annually by 900 gigajoules (GJ) or 35%, operating costs by an estimated \$8,100, and GHG emissions by 50 tonnes. Other measures, including boiler and coupling replacements were expected to further reduce annual natural gas use by approximately 300 GJ and operating costs by an estimated \$2,700.

A similar and larger scale sewer waste heat recovery system is currently the preferred technology for supporting the purposed River Green District Energy Utility.

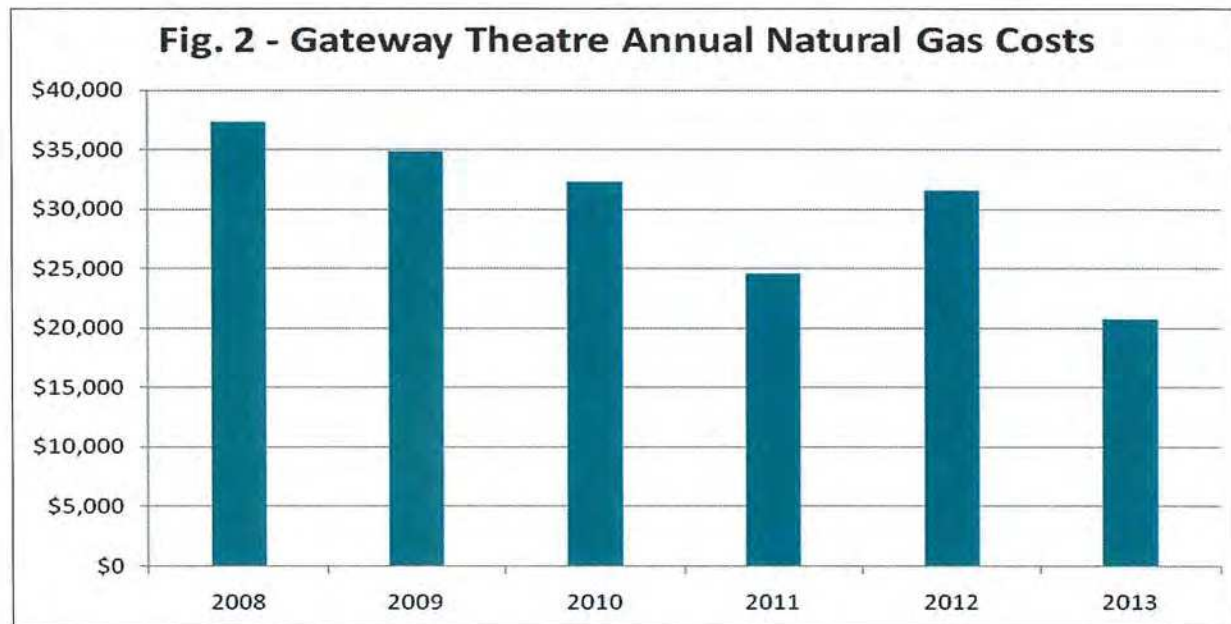
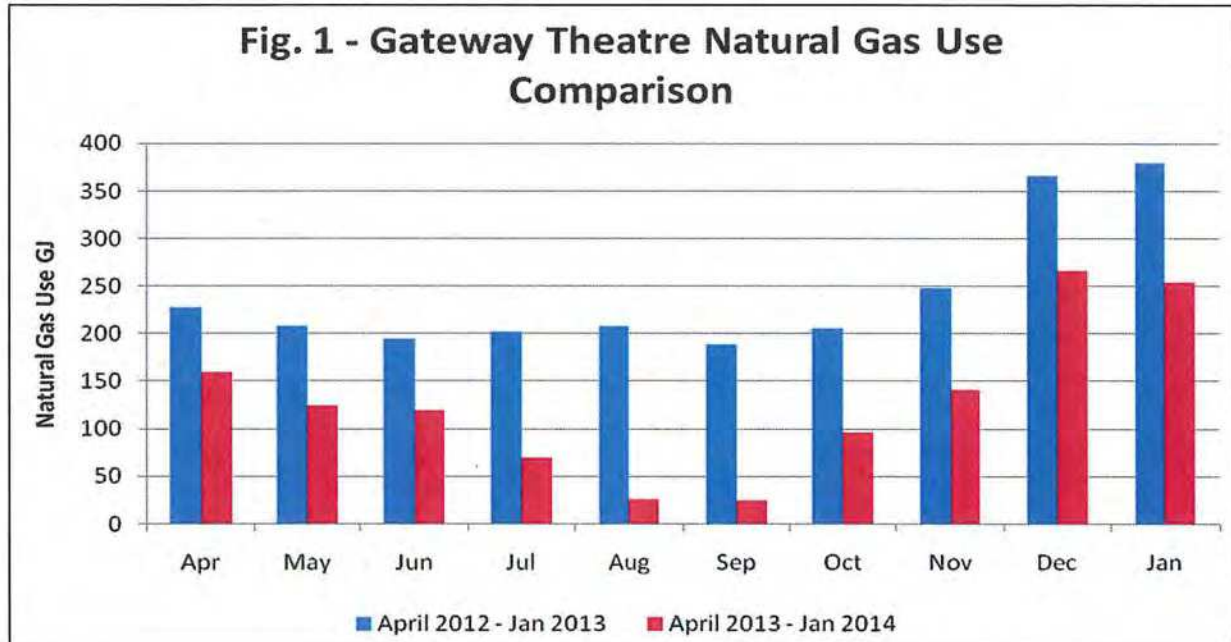
### Analysis

The installation of the Gateway Theatre sewage heat recovery system was completed in April 2013. Mechanical system upgrades, including a boiler replacement, coupling replacements, and a building envelop improvement were completed by September 2013.

The total capital cost of the heat recovery system was \$55,000. Including design costs, other associated building improvement measures included a boiler replacement and installation; the total cost of the combined energy retrofit and upgrade project was approximately \$192,000. Prior to project implementation, grant and incentive funding agreements were arranged with the Federal Government through the Western Economic Diversification Canada and with Fortis BC. Fortis BC has contributed \$15,000 and Western Economic Diversification Canada has committed to contribute \$85,000 for this combined project. This incentive funding of \$100,000 will help reduce the net capital cost of this project allowing for a shorter payback period.

**Results**

Initial results indicate that energy reduction estimates for this project were accurate. In the first four months of operation, natural gas use was reduced by approximately 30% when compared to the previous year. Once the couplings and the main boiler were replaced, additional natural gas reductions were realized. Over the latter part of 2013 and following the completion of other retrofit projects, the facility realized an overall gas use reduction of approximately 45% as detailed in Figures 1 and 2.



Natural gas reductions since April 2013 have resulted in an annual savings of approximately \$15,000, surpassing the project's conservative estimates. In addition, the facility has reduced its GHG emissions by approximately 70 tonnes annually, which is equal to removing 20 cars from Richmond roads.

Initial returns on the City's investment indicate that the project is successful and meeting expectations. Based on the first year cost avoidance savings and including the incentive funding, the project is estimated to have just over a 6 year payback period. It is estimated that the system's usable life is approximately 25 years.

**Conclusion**

The installation of an innovative sewage heat recovery system was a key component of this overall project, which will help displace and reduce natural gas use over the long term. It is through innovative and effective solutions that the City of Richmond can demonstrate how the community as a whole can transition to a more sustainable and low carbon community.



Levi Higgs, B.Sc, EMIT  
Energy Manager  
(604-276-1239)

Attachment 1	Community Energy Association Award Submission - 2013	REDMS# 3917596
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# Heat Recovery System Integration

Gateway Theatre in Richmond, BC

**A first in North America!**

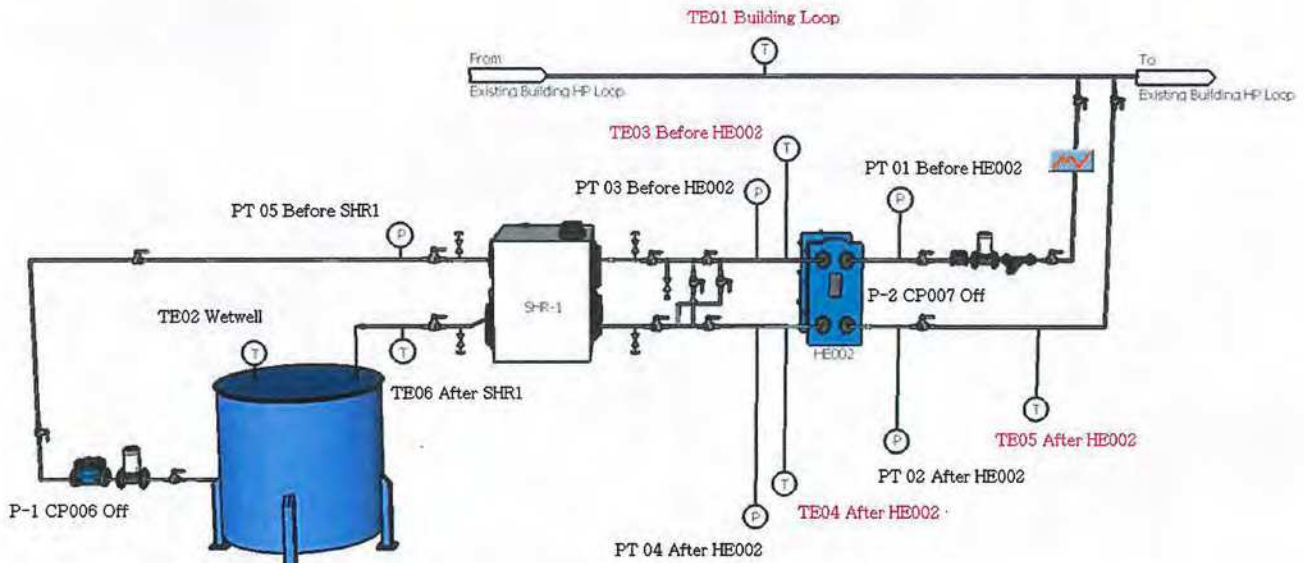




- With the successful integration of a sewage heat recovery system into the building's heating system at Gateway Theatre, the City of Richmond, BC and its partners have achieved a North American first at a publically owned facility.
- The recently installed sewage heat recovery system is estimated to displace over 900 GJ of natural gas annually = 35% reduction, and reduce GHG emissions by over 45 tonnes annually = 35% reduction
- Gateway Theatre is a dynamic 50,000 ft<sup>2</sup> community facility that supports emerging and established artists in the region, and fosters growth in the theatrical arts. Its continued operational success is very important for the cultural viability of the City of Richmond.
- The theatre is owned by the City of Richmond and operated by a charity association. The City is responsible for energy utility costs, and to maintain and upgrade the facility as needed.
- The theatre was constructed in 1984, and was identified as a good candidate facility for some significant energy retrofit projects, due to its life expectancy, its existing water source heat pump heating system with a natural gas boiler, and the proximity to a large sanitary pump station situated beneath the Theatre.







- The US EPA estimates that 385 billion kwh of energy in the form of waste heat is send down the drain every year in North America.
- To extract heat for use, the sewage SHARC® system processes incoming raw sewage pumped from a sanitary wet well, which typically averages between 15 and 20 Celsius throughout the year.
- The processed sewage is then pumped through a heat exchanger where heat is extracted from the sewage water to process fluid, which is then supplied directly to the building’s low temperature heat loop.
- Up to 250 gallons per minute of raw sewage can be pumped through the SHARC® system to supply heat to the building.
- The system uses a unique clog-free filter and heat exchange combination made specifically to perform with raw sewage, which allows it to achieve heating COP of over 5.3 and an EER of over 20. The system has an anticipated life in excess of 25 years.
- The City of Richmond is proud of the work that was done to integrate this new technology, and is looking forward to the potential of using this system in other existing or new buildings.
- The City is committed to reducing our corporate carbon footprint, and it is through new and innovative technology, such as this heat recovery system, that the City will be able to make great progress.

