

Costs and Opportunities of Liquid Natural Gas Buses

Bus Fleet and Equipment Renewal and Natural Gas Pilot

Recommendation:

1. That Administration implement a natural gas pilot to analyze the future potential of incorporating natural gas buses into the fleet.
2. That a sole source agreement with New Flyer Industries for the purchase of 2 forty foot Compressed Natural Gas buses for the pilot, in an amount not to exceed \$1.1 million, be approved.
3. That Transportation and Infrastructure Committee recommend to Council:
 - That the April 24, 2012, Transportation Services/Corporate Services report 2012CRS002, be received for information.

Report Summary

The approach recommended in this report will allow for a pilot of compressed natural gas buses and release funds to maintain current bus life cycle schedules.

Previous Council/Committee Action

At the November/December 2011, City Council Budget meeting, the following motion was passed:

- That expenditure of \$9.641 million for Capital Project Profile 12-66-1281 *Bus Fleet and Equipment Renewal*, be subject to Administration

providing a report to Council through Transportation and Infrastructure Committee in the first quarter of 2012, outlining costs and opportunities with respect to liquid natural gas buses, and maintenance of buses.

Report

The release of \$9.641 million for Capital Project Profile 12-66-1281 *Bus Fleet and Equipment Renewal* will be used to fund five diesel replacement buses, two compressed natural gas buses for the pilot and the refurbishment of current buses. Compressed natural gas buses do have an increased cost of approximately \$35K over the standard diesel bus.

Bus Replacement and Refurbishment

The \$9.641 million in capital budget funding was targeted for up to seven replacement diesel buses (\$3.150 million) and the mid-life refurbishment of 69 buses (\$6.491 million) to extend their lifespan from 12 years to 18 years. The replacement buses would be ordered this year and be delivered in late 2012 or early 2013. The mid-life refurbishments that will be undertaken with this funding are scheduled for 2013 and 2014.

Pilot - Test

It is proposed that a compressed natural gas pilot be funded from 12-66-1281 *Bus Fleet and Equipment Renewal*, using funds from some of the identified replacement buses. The pilot would involve testing two buses. The major test for the pilot will be the performance of a compressed natural gas bus in cold weather. There are currently cold climate areas that operate compressed natural gas buses but very few have a

lowest monthly average temperature that compares to Edmonton (Attachment 1). The pilot, in addition to extended research, will be used to evaluate the impact cold weather has on the buses as well as risks associated with implementing a large scale natural gas fleet. The pilot and research will also evaluate the cost-effectiveness and expected benefits of compressed natural gas buses. The evaluation criteria for comparing compressed natural gas and diesel buses are provided in Attachment 2. This evaluation will be completed in cooperation with other transit agencies.

Challenges

There are three major issues for implementing a compressed natural gas program.

- Fuel - Finding a suitable fuelling source that is both cost-effective and has minimal impact on bus operations.
- Storage - Having a safe building in which to store the buses when it is not in operation.
- Maintenance - Having the building, training and safety in place to maintain the bus.

The solutions for a pilot, but not large scale implementation, are to have fuelling provided offsite and to have a temporary maintenance and storage site in addition to using vendor shops.

Timeline

Should compressed natural gas be identified as a beneficial fuel source for the bus fleet a feasible time to introduce compressed natural gas buses on the larger scale would be inline with a new garage that is expected to be constructed within five years. The

incremental costs to include a large number of compressed natural gas buses in a new garage, including a new fuelling station are estimated at \$14 million to \$17 million in capital. The timeline for larger scale operation of compressed natural gas buses could be:

- Acquire two compressed natural gas buses – late 2012
- Compressed natural gas pilot – late 2012/early 2013
- Report to Council on the pilot before decisions are made on compressed natural gas buses
- Revise garage design plans to include compressed natural gas readiness – based on outcome of pilot
- Opening of new garage – expected within 5 years.
- Compressed natural gas would be incorporated with replacement and growth buses purchased in conjunction with the opening of the new facility

These timelines allow for evaluation of our pilot as well as a joint initiative with the City of Calgary to evaluate the pilot of compressed natural gas buses they are undertaking. Furthermore, the timelines provide an opportunity to research and evaluate risks associated with a larger scale implementation of compressed natural gas buses.

Corporate Outcomes

- The impact of City operations on air, land, and water systems is minimized.
- Edmonton strives to be a leader in environmental advocacy, stewardship, preservation, and conservation.
- The City has well managed and sustainable assets and services

Budget/Financial Implications

Release of \$9.641 million from Capital Profile 12-66-1281 *Bus Fleet and Equipment Renewal*

Justification of Recommendation

1. The release of the funds for Capital Project Profile 12-66-1281 *Bus Fleet and Equipment Renewal* allows the City to fund a compressed natural gas pilot, extend the lifespan of existing buses and replaces buses past their lifespan which in turn reduces maintenance costs.
2. Conducting a pilot provides continued evaluation of compressed natural gas buses and provides the ability to manage risks and costs associated with compressed natural gas buses.
3. The City of Edmonton has standardized on the New Flyer diesel bus through previous open tender competitions. Testing of New Flyer compressed natural gas buses will allow for ease of comparison to the existing City diesel bus fleet. New Flyer has a production model of compressed natural gas bus that aligns with the City fleet and is able to deliver in time for a winter 2012 timeframe.

Attachments

1. Cold Weather Climates Using Compressed Natural Gas Buses
2. Compressed Natural Gas Evaluation Criteria

Others Reviewing this Report

- L. Rosen, Chief Financial Officer and Treasurer

Cold Weather Climates Using Compressed Natural Gas Buses Attachment 1

City	Country	Number of CNG Buses	Model Years of CNG Buses	Lowest Monthly Average
Harbin	China	unknown	unknown	-25 ⁵
Edmonton	Canada	0	N/A	-19 ¹
Calgary	Canada	Pilot	N/A	-15 ¹
Anchorage	USA	0 (acquiring)	TBD	-13 ²
Boden	Sweden	*fueling station	*fueling station	-10 ³
Moscow	Russia	328	2005	-10 ⁴
Hamilton	Canada	71	1996-2003	-9 ¹
Helsinki	Finland	82	2007	-7 ³
Boston	USA	358	1999-2004	-5 ²
Stockholm	Sweden	50	2011	-3 ³
Reykjavik	Iceland	50	2006	-3 ⁵
Sør-Rogaland	Norway	77	2007	0 ³
Haugesaud	Norway	131	2011	0 ³
Vancouver	Canada	50	2006	0.5 ¹

¹ Environment Canada

² TheWeatherChannel.com

³ YR.no - Joint service by the Norwegian Meteorological Institute and the Norwegian Broadcasting Corporation


⁴ Weatheronline.co.uk

⁵ www.Wmo.int - World Meteorological Organization

Compressed Natural Gas Evaluation Criteria

Attachment 2

	Evaluation Criteria	Measure/Notes
Environmental	Fuel emissions	Well to wheel emissions.
	Vehicle emissions	CO ₂ emissions per kilometre.
Social	Noise levels	Noise levels in decibel (dB).
	Environmental perception	Positive profile to City of Edmonton of being active in reducing emissions output and exploring alternative fuels.
	Fuel supply	Readily available as Alberta is a large natural gas producer.
Economic	Incidence of maintenance	Number of maintenance incidents. Average cost of maintenance.
	Maintenance	Labour time and training time.
	Changeovers / deadhead	Complications around changeovers and deadheading.
	Fuel pricing	Fuel price per kilometre.
	Fuel budgeting	Cost of long term gas rate contracts.
	Bus capital cost	Cost of natural gas bus.
	Building capital cost	Cost of compressed natural gas readiness to a transit garage.
	Fuelling infrastructure capital cost	Cost of fuelling infrastructure per 100 buses.
	Fuel supply	Cost of supplying the fuel to the fuelling infrastructure.
	Fuelling operating costs	Fuelling station operating costs compared to operating costs of a diesel station. Potential change in fuel price overtime.
	Removal of compressed natural gas before 18 year life-cycle	Cost per bus of removing compressed natural gas buses from the fleet.
	Training	Cost of additional maintenance, fuelling, and operation training is required.
	Overall cost comparison	Annual savings per bus.



	Range of bus	Average and maximum range of a bus.
	Fuel tank costs	Costs of maintaining/replacing tanks.
	Bus growth	Expected bus growth.