



**City of Richmond**

**Report to Committee**

**To:** Public Works and Transportation Committee  
**From:** Greg Scott  
Director of Operations  
**Re:** Hybrid Electric Pilot

**Date:** February 7, 2005  
**File:** 0005

**Staff Recommendation**

That the City purchase Hybrid Electric Vehicles (HEV's) rather than standard compact vehicles.

Greg Scott, P.Eng.  
Director of Operations  
(1206)

FOR ORIGINATING DIVISION USE ONLY					
<b>ROUTED TO: FINANCE</b> 	<b>CONCURRENCE</b>		<b>CONCURRENCE OF GENERAL MANAGER</b>		
	YES <input checked="" type="checkbox"/>	NO <input type="checkbox"/>			
<b>REVIEWED BY TAG</b>	YES 	NO <input type="checkbox"/>	<b>REVIEWED BY CAO</b>	YES <input type="checkbox"/>	NO <input type="checkbox"/>

**Staff Report**

**Origin**

On July 22, 2002 Council approved a recommendation from the Public Works and Transportation Committee (PWTC) dated July 17, 2002 to conduct a pilot program for Hybrid Electric Vehicles (HEV's). The direction from Council was for staff to monitor overall performance of HEV's and compare them with similar types of vehicles currently being operated and to report back the results of the pilot program.

**Analysis**

The City leased four Hybrid Electric Vehicles in August 2002. This report is for a period of twenty-six months from October 2002 to December 2004. During this time, all vehicles averaged the following; 5 - Cavaliers 15,544 km's, Honda's 15,396 km's and Toyota's 17,125 km's per year. Fuel consumption for the Hybrids averaged 56 miles per gallon compared to the Cavaliers at 23 miles per gallon. All vehicles were driven on urban, highway and variable paved road terrain.

Two types of HEV's were reviewed, Honda Civic and Toyota Prius. Both vehicles have similar operating performance parameters and produce ultra low emissions with only minor differences in interior features.

The main differences between the two vehicles are invisible to the user as it relates to transmission shifting and engine power requirements. The engines in both vehicles will shut down when they come to a full stop if the batteries are fully charged. However, while driving, only the Toyota engine will shut down and operate only on battery power when certain conditions exist, resulting in zero emissions being released. The Toyota fuel costs are slightly higher because the engine has to operate longer to charge the batteries when operating on battery power.

The data from this pilot test confirms that there is a cost benefit while using Hybrid technology. A combination of both Hybrid models (2002) when compared to similar vintage compact vehicles (5 Cavaliers (2001) currently in our fleet) demonstrated a substantial reduction in fuel and maintenance costs. Maintenance costs were comprised of regular preventative maintenance inspections and repairs. These included oil changes, tune-ups, brake repairs, cooling system, and transmission servicing.

The following chart represents the average cost (cents) per kilometre over a 26-month period.

Vehicle Type	Fuel (\$)	Maintenance (\$)	Total (\$)
Honda	0.033	0.017	0.050
Toyota	0.038	0.020	0.058
Cavalier	0.085	0.055	0.141

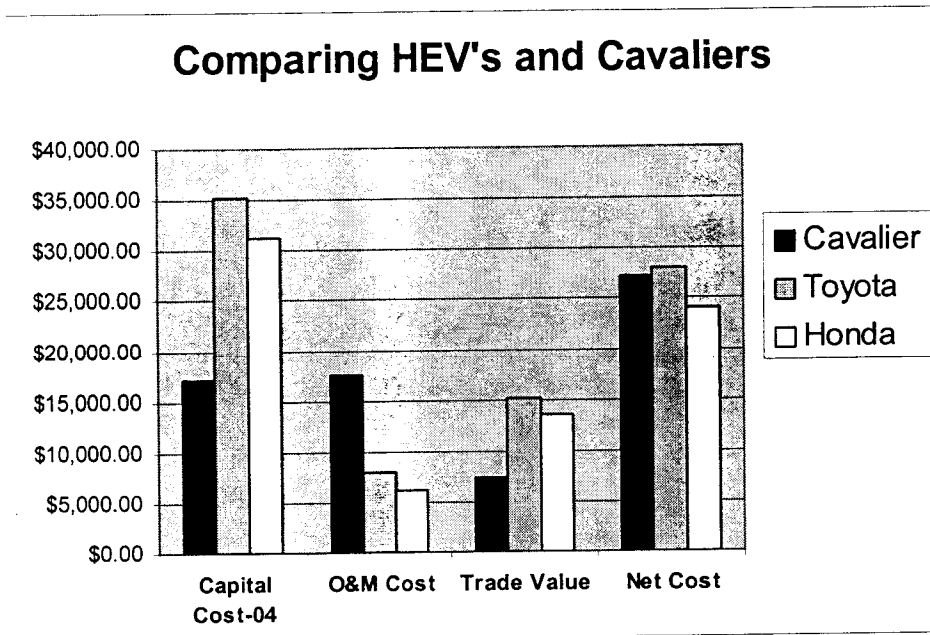
The total average annual fuel and maintenance costs for the pilot period are as follows;

Honda:	\$ 769
Toyota:	\$ 993
HEV's average -	\$ 881
Cavalier:	\$2,191
Difference:	\$1,310

This difference represents a 60% savings in annual operating and maintenance costs.

The lower operating and maintenance costs of the HEV's are associated with the new Hybrid technology with an anticipated potential savings of \$10,480 over the estimated 8-year warranty period. The 8-year time frame was also used with a declining-balance depreciation of 10% to determine a projected trade-in value for all vehicle types.

The following chart is based on data from October 2002 to December 2004, comparing the associated costs for the HEV's (Prius and Civic) and the Cavalier. Although the HEV's have a higher capital cost, what makes this an attractive choice is the higher projected residual trade-in value and lower (O&M) operating and maintenance costs and significant reductions in greenhouse emissions.



Vehicle Make	Capital Cost-04	O&M Cost	Trade Value	Net Cost
Cavalier	\$17,178	\$17,528	-\$7,395	\$27,311
Toyota	\$35,158	\$7,944	-\$15,134	\$27,968
Honda	\$31,330	\$6,152	-\$13,486	\$23,996

The application of Hybrid technology will reduce operating expenses and greenhouse gas emissions. The only limitation as we know it today, is our limited ability to service the Hybrid components of these vehicles. Regular maintenance will be performed in-house while repairs to the Hybrid system will be performed by the dealership. At this time, specialized training is only available to dealerships. However, this will most likely change as Hybrid vehicles continue to gain popularity.

Warranty coverage is similar for HEV's and Cavaliers having the following coverage; Basic - 3 years or 60,000 km; Powertrain - 5 years or 100,000 km; while Hybrid components are covered for 8 years or 130,000 km for Honda and 8 years or 100,000 km for Toyota.

Other manufacturers are realizing the value of Hybrid technology and the City can expect various vehicle classes to be introduced into the market place in the near future. More recently, Ford introduced their Hybrid "Escape" in 2005 and Azure Dynamics is developing a prototype for delivery vans that can be considered by the City in the future.

The following chart identifies the social impact and relative pollutants emitted by each vehicle type represented by volumes in metric tonnes per year.

Description	Urban	Highway	Yearly	8 yr. Total
	Pollutants	Pollutants	Totals	
<b>Prius/Civic</b>				
CO <sup>2</sup> Metric Tones	15.02	2.40	2.17	17.42
<b>Cavalier</b>				
CO <sup>2</sup> Metric Tonnes	38.83	3.94	5.34	42.77

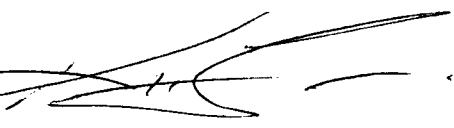
The 8 year life cycle represents the total (CO2) Carbon Dioxide pollutants produced while driving approximately 16,000 km per year or 128,000 km over the life of the vehicles. The mileage is split between Urban (15%) and Highway (85%). The Prius/Civic have an overall health impact of 17.42 metric tonnes while the Cavalier has 42.77 metric tonnes over the projected life cycle.

**Financial Impact**

Future purchases will form part of the Public Works Vehicle Replacement plan funded from the Vehicle Reserve. Vehicle rates will be adjusted to recover all costs associated with ownership and operation of Hybrid Electric Vehicles.

**Conclusion**

Hybrid Electric Vehicles have been well received by staff and although we cannot predict the long-term technical merits, it is quite clear that Hybrid vehicles are effective in the effort to reduce green house gases and in the last twenty-six months have performed well. They have also removed the perceived inconveniences that people associate with alternative vehicles. It's just a normal car from a user's perspective. We recommend that the City purchase Hybrid Electric Vehicles (HEV's) rather than standard compact vehicles.



Ken Fryer  
 Manager, Fleet Operations