Hail a Hybrid Program

Organization
Climate Change Central – Hail a Hybrid Program

Status
Completed. Final report completed June 2008. Climate Change Central is in ongoing communication with the participating companies.

Overview
Climate Change Central, an Alberta-based non-profit organization, launched the Hail a Hybrid program in June 2006 with funding from the Government of Alberta and in cooperation with the Calgary and Edmonton Taxi Commissions. The program was designed to collect on-the-ground data on the operation of hybrid vehicles in the taxi industry to assess their comparative operating costs, performance and greenhouse gas emissions. Four taxi companies tested five vehicles and three different models over an 18-month period. Results showed substantial operational cost savings for hybrid vehicles over conventional vehicles. Hybrid performance was also found to be equal or superior to conventional vehicles and customer satisfaction was positive. Perhaps most significantly, the study showed that hybrid taxis generated between 52% and 70% less GHG emissions than the conventional taxis used in the study.

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Resources
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Community context

While the Canadian taxi industry is a significant contributor to greenhouse gas (GHG) emissions, taxis are an important transportation option for individuals making the shift to more sustainable transportation modes. The availability of taxi services makes reliance on modes of active transportation and public transit more realistic for many people who need to have access to a car for certain trips. In many scenarios, the financial costs associated with taking an occasional taxi can be offset by reducing the number of personal vehicle trips or, even more so, by giving up a vehicle altogether. By incorporating hybrid vehicles into taxi fleets, the potential for an overall reduction in GHGs is even greater.

Taxi vehicles in Alberta drive in excess of 100,000 kilometres per year each and collectively emit approximately 120,000 tonnes of CO_2 (based on 3,000 taxis in Alberta emitting 40 tonnes of $C0_2$ per year). Personal vehicles, by comparison, log an average of only 16,000 kilometres. Taxis tend to have poor fuel consumption rates due to the nature of stop-and-go traffic and of the vehicle models typically purchased for use as taxis. These characteristics of the taxi industry – high kilometerage and low fuel efficiency – are directly related to the high levels of GHG emissions the industry is responsible for.

In Alberta, conventional taxi vehicles are generally full-sized vehicles, such the Chevrolet Impala, the Ford Grand Marquis and the Ford Crown Victoria, with fuel efficiency ratings of between 13 and 18 l/100km in city driving conditions. Hybrid vehicles have fuel efficiency ratings as low as 4 l/100km. Translating this to GHGs, the switch from a conventional vehicle to a hybrid could result in up to 27 tonnes of annual GHG savings. Despite this, when the Hail a Hybrid program was launched in 2006, there was not a single hybrid vehicle in use in any of the Alberta taxi company fleets.

As is the case with many emerging technologies, the uptake of hybrid vehicles in the Alberta taxi industry has been impacted by a lack of consumer confidence, mainly uncertainties associated with the

performance, reliability and operating costs of these vehicles. Of particular concern in Alberta is the performance of hybrid technology in cold weather conditions.

Climate Change Central (C3) is a non-profit organization that advocates for positive action towards the reduction of greenhouse gas emissions in Alberta. In 2006, they launched a project to address uncertainties around hybrid technologies by collecting and disseminating on-the-ground data for hybrid vehicle performance in day-to-day taxi operations in the City of Calgary and City of Edmonton.

A Toyota Prius operated by Mayfair Taxi – one of the Hail a Hybrid participating taxi companies

Policy context

Although some discussions have been initiated at the municipal level, there is no municipal or provincial policy in place in Alberta that encourages or promotes the use of hybrid vehicles in the taxi industry. In fact, the Hail a Hybrid study research discovered regulations that actually limited the use and uptake of hybrid vehicles in the taxi industry. For example, the Calgary Airport Authority specified a minimum cargo space for taxis operating at the airport that was larger than most of the hybrid trunk volumes. Because of this, C3 had to obtain an allowance for participating vehicles to be able to operate at the airport. Most major airports regulate a minimum cargo space requirement. Some, however, such as the Vancouver Airport Authority, have already amended regulations to accommodate hybrid taxis with smaller trunk sizes.

GHG reduction policy measures for the taxi industry have however been enacted in other Canadian jurisdictions. In line with British Columbia's overall GHG reduction targets, the BC Ministry of Transportation regulated in May 2007 that all new vehicle applicants for taxi licenses be 'eco-friendly', including certain fuel efficient models and hybrid vehicles. In January 2009, councilors in Halifax voted to allow smaller vehicles to be licensed as taxis, overruling previous bylaws that specified minimum size requirements in terms of wheelbase and 'post-to-post' size.

Rational and Objectives

In Canada, the transportation sector is the largest contributor of GHG emissions in terms of both absolute numbers and growth trends (*Source: Environment Canada Greenhouse Gas Outlook to 2020*). Passenger transportation is responsible for approximately half of these emissions. Conventional internal combustion engines are used in the vast majority of passenger vehicles (including taxis). Gasoline-electric hybrid vehicles have emerged as an alternative to conventional vehicles, but have faced some perceptual barriers to widespread consumer uptake. Consumer concerns range from purchase price to performance and reliability over the long term.

Hybrid vehicles typically employ a smaller and more efficient internal combustion engine in combination with an electric motor. The engine configuration is particularly efficient in stop-and-go traffic where conventional vehicles are least efficient. Additional savings in energy consumption are accrued through regenerative braking technologies where the kinetic energy in the breaking motion is captured and used to recharge the electric motor.

The Hail a Hybrid program was designed to test the environmental and economic benefits of gasoline-electric hybrid vehicles in the taxi industry in Alberta. In addition to cost data, the program assessed performance and driver/customer satisfaction to determine how hybrid vehicles could

impact consumers' perceptions of taxi companies in terms of environmental responsibility.

Actions

The Hail a Hybrid program provided cash incentives for taxi companies towards the purchase of a hybrid vehicle. In exchange, drivers collected data and kept records over a 12-month period. Participating companies were provided $5,000 towards the purchase price of each hybrid vehicle. Five cars were purchased by four participating companies. Study models included a 2006 Toyota Prius, a 2007 Toyota Camry and three 2006 Ford Escape Hybrids. A 2006 Ford Crown Victoria, one of the most commonly used vehicles in the taxi industry, was used as the non-hybrid baseline vehicle for comparison.

Data was collected between June 2006 and January 2008. Drivers recorded their daily odometer readings, litres of fuel purchased, cost of fuel and total amount spent at each fuel purchase. Results from the driver logs were compiled, and distance driven per fuel purchase, fuel efficiency and total average cost per kilometer driven were calculated. The study also collected qualitative data on costs (e.g. insurance, maintenance), performance and customer feedback.

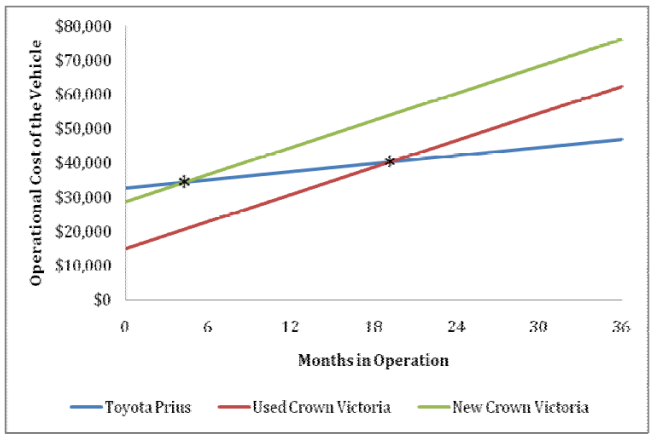
Results

All hybrid taxis involved in the study achieved higher fuel efficiency than the conventional taxi vehicles. Fuel cost savings for the hybrid models was between 52% and 70% compared to the conventional taxi vehicle. Similarly, GHG emissions were also reduced by between 52% and 70% in the hybrid vehicles.

The Toyota Prius was the top performer in the study. Based on fuel cost savings alone, it was determined that the incremental purchase cost difference between the Toyota Prius and conventional vehicle would be recovered in between four and 19 months (based on a price of fuel of $0.936/l) depending on whether the conventional vehicle was new or used. With reduced maintenance costs for hybrid models, additional savings are possible. Key project results are outlined in the following.

- **Fuel economy**: Using study data, researchers compared the average fuel economy performance of a theoretical fleet of five hybrid vehicles versus five conventional vehicles. It was calculated that the hybrid fleet would produce a total fuel savings of 58%, or approximately $45,845 in fuel savings over 100,000 km (the average yearly distance each taxi was driven) based on a fuel price of $.936.

- **Purchase cost recovery**: Researchers also evaluated the amount of time required to recover the incremental costs of purchasing a hybrid vehicles versus a new or used Crown Victoria. The Toyota Prius recovered the incremental purchase value most quickly – between 4.23 and 19.10 months depending on whether the conventional vehicle was a new or used model. The following graph illustrates the operational costs over time of a hybrid Toyota Prius versus both a new and used, conventional vehicle (Crown Victoria). Fuel prices in the graph were estimated to be $0.936 per litre.



- **GHG emissions:** Based on an average emission figure of 2.36 kg of CO_2 per litre of gas used, researchers calculated total GHG emissions for each of the hybrid test vehicles. The conventional Crown Victoria taxi was calculated to release 39,801 kg of CO_2 per 100,000 km traveled. By comparison, the Toyota Prius emitted 11,918 kg of CO_2 for a reduction of 70%,

while the Toyota Camry emitted 16,810 kg of CO_2 for a reduction of 58%, and the Ford Escape emitted 18,229 kg of CO_2 for a reduction of 54% over the conventional taxi.

- **Vehicle performance:** Results of the driver surveys indicated that insurance and regular maintenance costs for hybrid vehicles were equal to or lower than those associated with conventional taxi vehicles. One operator noted that at the 200,000 km mark, his Toyota Prius had not accrued any costs related to brake replacement. By comparison, the driver estimated that a typical, conventional vehicle would likely have required three brake changes. None of the test vehicles reported issues with battery malfunction or replacement.

  Overall, drivers found hybrid performance to be as good as or better than conventional vehicles and driver feedback was consistently positive. Many drivers made particular note of the vehicle's surprisingly impressive interior and cargo space.

Perhaps one of the most telling results of the project is that all participating companies have since committed to incorporating additional hybrid vehicles into their fleets. Since the beginning of the study, one cab company has already incorporated an additional ten hybrids into their fleet and is planning on adding more.

Participants

Climate Change Central designed and coordinated the study in partnership with the City of Calgary and City of Edmonton Taxi Commissions. Funding was provided by the Government of Alberta. The participating taxi companies were Alberta Co-Op Taxi Line Ltd., Associated Cabs Ltd., Checker Cabs Ltd., and Mayfair Taxi Ltd.

Resources

Hail a hybrid was made possible through the collaboration of several staff at Climate Change Central on various aspects of program design, implementation and data analysis. The participating taxi drivers were responsible for data tracking. These activities included recording mileage, collecting fuel receipts and submitting information to Climate Change Central on a regular basis.

Funding for this initiative came from the Government of Alberta. This included money for the cash incentive for the purchase of hybrid vehicles, as well as C3's program costs.

Decals advertising the Hail a Hybrid program on a Ford Escape Hybrid taxi

Timeline

Hail a Hybrid was launched in June 2006. Data collection occurred between June 2006 and January 2008. Study drivers collected data for periods ranging between eight and 14 months. The final project report was released in June 2008.

Challenges

Study researchers identified several perceptual, policy and financial challenges for taxi companies looking to integrate hybrid vehicles into their fleets. These challenges are highlighted below.

- **Cost:** Hybrid vehicles can cost in the range of 25% to 50% more than a conventional new or used taxi vehicle. While these costs can be recaptured through operating

savings, the initial, up-front cost can be a deterrent.

- **Consumer misperceptions:** Due to their relatively new place in the auto market, fleet operators have questioned the reliability and performance of hybrid vehicles. Although comprehensive vehicle testing has largely debunked these misconceptions, the following concerns continue to circulate among potential consumers, including taxi companies:
  - **Battery life**: Many consumers have called the battery life of hybrid vehicles into question. This is coupled with a concern for the cost of replacement. To date, however, battery life has not been an issue. Here it is worth noting that Toyota has not had to replace a single Prius battery due to wear and tear since the vehicles went on sale in 2000 (*Source: Hail-a-Hybrid Pilot Program Final Report, June 2008*).
  - **Vehicle performance:** Some drivers have expressed concern around acceleration, especially in circumstances such as a left-hand turn across traffic where responsive acceleration is crucial. Participants, however, indicated that hybrid performance was equal to or better than conventional models.
  - **Cold weather performance**: Study participants expressed initial concern around the performance of hybrids in cold weather conditions. The study provided the first body of data for cold weather testing of hybrid vehicles. No drivers reported any issues with vehicle performance in cold weather.
  - **Inadequate interior space:** There is a perception that some models of hybrid vehicles lack adequate interior and cargo space. While some interior trunk space is lost to the vehicle's battery pack, study drivers did not identify trunk and interior space as an issue.
- **Restrictive regulations and licensing:** In some jurisdictions, regulations around minimum trunk size and vehicle size have restricted the use of hybrid vehicles in taxi fleets. An exemption from the Calgary Airport Authority was required for hybrid vehicles participating in this study. An exemption was also needed for vehicles included in the Conserve Nova Scotia hybrid taxi pilot program in Halifax. In both cases, regulations have not changed, although Halifax Regional Municipality has approved a study to examine a potential amendment to allow hybrid taxis in fleets.

Lessons learned

This program demonstrated that first-hand experience with the hybrid vehicles is key to influencing taxi companies to incorporate hybrid vehicles into their fleets. While every company that participated in the study purchased additional hybrid vehicles, no other companies have purchased hybrids in the study area. This shows that additional education and experience are needed to encourage this transition.

Policy action could help speed uptake by providing positive incentives for the incorporation of fuel-efficient or hybrid vehicles into fleets or by restricting vehicles with poor fuel efficiency performance. A valuable lesson that emerged from this study was the realization of how municipal policies (e.g. oversize trunk space restrictions) require revision where they can hinder the operation and use of hybrid taxi vehicles. In this vein, it should be noted that wheelchair accessible and special purpose vehicles need to be given particular consideration when constructing policies for the taxi industry so as to not exclude vehicles that are appropriate (i.e. large enough) for these applications.

Next steps

Since the completion of the program, C3 has maintained contact with the participating taxi companies. They continue to promote the results of the project and have collaborated through information sharing with other companies interested in implementing similar programs.