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Hybrid cars: The high cost of saving fuel

By Richard Gilbert
Special to Globe and Mail Update

My last post ended with the suggestion that hybrid-drive automobiles – which have both an internal combustion engine (ICE) and an electric motor (EM) – might have been developed as a solution to the problems posed by batteries' low energy yield. (The gasoline in a full gas tank has more than 60 times as much usable energy as the best available battery of the same size.)

This suggestion is not historically correct. Hybrid vehicles on the road today were developed more to enhance the performance of ICEs rather than to compensate for the low energy yield of batteries. Toyota's Prius is the most widely used hybrid. Its small battery is charged only by on-board generators powered by the vehicle's ICE. Its EM is mostly used only during stop- and-start conditions, at which it excels. Its ICE drives the wheels at other times.

Another Toyota hybrid, the Camry, has a similar ICE-only counterpart. This allows a good illustration of the hybrid's superior fuel economy. According to U.S. government testers, the 2010 Camry Hybrid uses 34 per cent less fuel under city driving conditions and 7 per cent less on the highway compared with the comparable ICE-only Camry. Over all, the estimated annual saving in fuel cost in the U.S. is $385. It costs $4,000 more to buy the hybrid, so it would take more than 10 years at today's gasoline prices to recover the price difference through savings in gas purchases.

A new type of hybrid vehicle, General Motors' Volt, is designed to address the challenge of battery-vehicles' limited range. It went on sale this week in parts of the U.S. and will arrive in seven Canadian cities next August. GM describes the Volt as a "plug-in range-extended electric vehicle with an on-board

gasoline generator." Unlike hybrids on the road, the battery can be charged from the grid, even from a charger using a regular domestic socket.

The Volt's battery is several times the size of the batteries in the Prius and Camry and roughly four times the weight of a full gas tank in a comparable ICE-only vehicle. Fully charged, the battery stores enough energy to propel the vehicle on electric drive for 40 to 80 kilometres, according to how it is driven, the terrain, the draw on the battery for heating and cooling, and the age and condition of the battery. Most of this range is below is the average daily distance each new automobile moves in North America, which appears to be about 70 kilometres.

When the Volt's battery is low, its ICE starts up. The ICE charges the battery via a generator and, under some conditions, drives the wheels directly.

Even with the generous subsidies available in many jurisdictions, the Volt will cost more than twice as much as a comparable ICE-only automobile. The savings in fuel costs could be considerable, perhaps averaging about $940 per year at current fuel prices compared with an equivalent ICE-only vehicle, but more than 20 years of use would be required to compensate for the large difference in car purchase price.

The high cost of hybrid vehicles results in part from having two propulsion systems. The duplication also adds weight to the vehicle and consumes interior space.

Makers of such plug-in hybrid vehicles may say that most of their travel will be electrically propelled. A response to this could be to ask why burden the vehicles with the considerable weight and volume of a rarely used ICE and its associated gearing, fuel container, and emissions control system? If the vehicle is mostly to be driven long distances, being propelled much more by the ICE, why burden it with the considerable weight and volume of an electric motor and battery?

These concerns could point to a future in which people have two cars: a small battery vehicle for local journeys and an ICE-propelled vehicle for longer trips. As such, this extravagant use of materials and space and would only partially address the initial challenge, which was to move away from the use of oil products for transportation.

The pros and cons of other solutions will be explored in future posts.

Richard Gilbert is a Toronto-based consultant who focuses on energy and transportation. His latest book is Transport Revolutions: Moving People and Freight without Oil*, written with Anthony Perl.*