

HYBRID VEHICLES: IS THE ADDITIONAL EXPENSE OF A HYBRID WORTH THE EXTRA MONEY?

by
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With the price of gasoline dropping below \$3 nationally for the first time in the last 200 weeks, the efficiency of hybrid vehicles has been much publicized. But what is the true cost of purchasing a hybrid? Is a hybrid more economical than a traditional vehicle in the long run?

The main difference between gas and hybrid cars is the way the engine functions. A hybrid car combines a gasoline-powered engine with an electric motor, while a traditional vehicle gets its power from the engine only. In a hybrid, a complex system of electronic and mechanical controls manages the engine and motor to obtain the best efficiency for different driving conditions. Hybrid electric vehicles are powered by an internal combustion engine and an electric motor, which uses energy stored in batteries. The extra power provided by the electric motor allows for a smaller engine. Additionally, the battery can power auxiliary loads like sound systems and headlights and reduce engine idling when stopped. Together, these features result in better fuel economy without sacrificing performance.

To calculate the true cost of a vehicle, the main variables need to be ascertained. First, the price of the vehicle needs to be obtained. Hybrids tend to have a higher price tag than their regular complements, but they can often come with greater incentives from the dealers so the consumer will have greater financial motivation to purchase, which averaged \$3,400 in 2013. One needs to look at the amount of miles driven. For this study, the average miles driven in a year from the National Highway Traffic Safety Administration (NHTSA) for 2013, or 13,476 miles, was used. Another variable, which contrasts from vehicle to vehicle, would be the average gas mileage per vehicle. The price of gas also needs to be calculated. This study used the 2013 national average price of \$3.49 per gallon (based on AAA unleaded regular gas information). Finally, the cost of insurance needs to be factored. Edmunds.com reports that some insurers charge more for the hybrid, due to costlier repairs, while some insurers charge the same as a regular engine. For this study, Insure.com calculated the difference in premiums for gas and hybrid vehicles, and for the hybrids used in this study, the average difference was \$240 more for the hybrid. The expected lifespan of the vehicle is 5 years.

$$P_c - In + \sum \left(\left(\frac{\text{Miles Driven}}{MPG} \right) * P_g \right) + \sum P_m + \sum Ins = \text{Cost of Vehicle}$$

Where:

P_c = Price of car

In = Incentives

P_g = Price of gas

P_m = Price of Maintenance

Ins = Insurance

When inputting the average vehicle cost into the equation, the normal internal combustion vehicle and the hybrid were compared, and only vehicles that are offered by the factory with both the hybrid and normal options were compared. Looking at the top ten most popular models in the US, according to

Autos.com February 2014 sales numbers, five of those models had a hybrid option. The make, model, price, and miles per gallon for both the standard vehicle and the hybrid are located in Table 1.

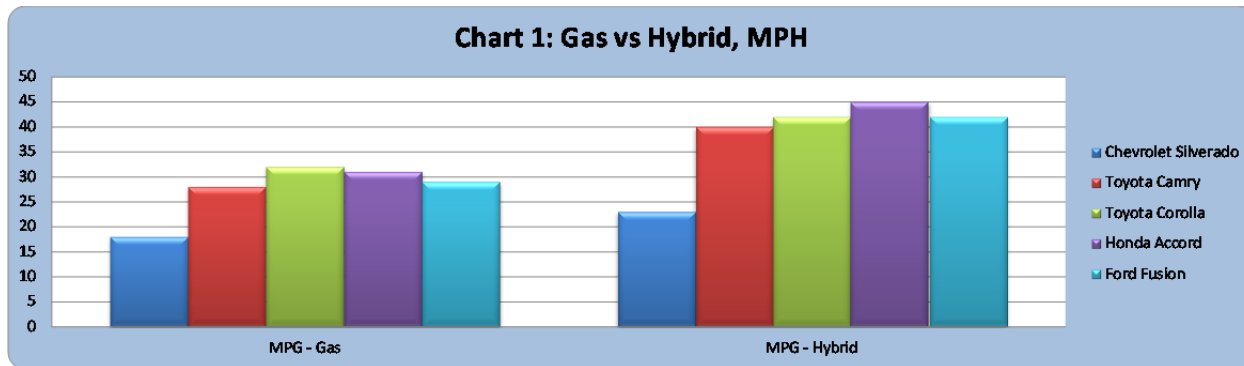
Table 1. Auto.com’s Most Purchased Vehicles with a Hybrid Option

		MPG - Gas	MPG - Hybrid	MSRP - Gas	MSRP - Hybrid
Chevrolet	Silverado	18	23	\$38,440	\$41,135
Toyota	Camry	28	40	\$26,310	\$29,778
Toyota	Corolla	32	42	\$16,800	\$20,100
Honda	Accord	31	45	\$23,525	\$32,695
Ford	Fusion	29	42	\$24,979	\$31,270

Source: <http://blogs.cars.com/kickingtires/2014/03/top-10-best-selling-cars-february-2014.html>

For each model in Table 1, the hybrid sells at a premium, ranging from \$2,695 for the Chevrolet Silverado, to \$9,170 for the Honda Accord, with an average difference of \$4,985. The \$2,695 difference for the Chevrolet Silverado represents a 7.0% increase in price, whereas the \$9,170 difference for the Honda Accord represents a 39.0% increase in price. The average difference between the price of a normal internal combustion engine and a hybrid from the vehicles in Table 1 is 20.8%.

Table 1 also includes the mile-per-gallon (MPG) comparison for both the standard combustion engine vehicles and their hybrid counterpart. The increase for the hybrid power MPG ranges from 5 MPG for the Chevrolet Silverado, which represents a 27.8% increase, to 14 MPG for the Honda Accord, which is a 45.2% increase in MPG. The average increase in MPG efficiency for the representative hybrids in this study was 11 MPG, or 38.4%, greater efficiency. The comparison between the MPG for gas and hybrid are on Chart 1.



Source: www.fueleconomy.gov/

Table 2 focuses on the cost of gasoline, which each type of vehicle uses over a given year. Using the NHTSA average of 13,476 miles driven in a year, the gallons used for the vehicles were calculated by dividing the average by MPG for each, then, to obtain the cost of those gallons, multiplying it by the 2013 average price of \$3.49. The Chevrolet Silverado had the largest yearly cost savings, at \$568 per year for the hybrid, while the Toyota Corolla had the least amount of cost savings, at \$350 per year for their version of a hybrid vehicle. The limited gains between the hybrid option and the normal vehicle can be attributed to greater efficiency for the traditional vehicle in the past few years, with the smaller spread between the hybrid and traditional vehicles being a result of the gains in efficiency.

Table 2. Annual Cost Savings – MPG

	Average Miles Driven 2013	MPG - Gas	MPG - Hybrid	Average Price Per Gallon 2013	Gallons Used - Gas	Gallons Used - Hybrid	Fuel Cost - Gas	Fuel Cost - Hybrid	Difference (Per Year)
Chevrolet Silverado	13,476	18	23	\$3.49	749	586	\$2,613	\$2,045	\$568
Toyota Camry	13,476	28	40	\$3.49	481	337	\$1,680	\$1,176	\$504
Toyota Corolla	13,476	32	42	\$3.49	421	321	\$1,470	\$1,120	\$350
Honda Accord	13,476	31	45	\$3.49	435	299	\$1,517	\$1,045	\$472
Ford Fusion	13,476	29	42	\$3.49	465	321	\$1,622	\$1,120	\$502

Source: Department of Natural Resources Technology Assessment Division

Compiling all the data together, the 5-year total cost for each version of the vehicle is obtained. Because the overall 5-year total price of ownership is dependent on gas prices, the average 2013 price of \$3.49 per gallon was standardized for all 5 years involved in the study. Table 3 features the 5-year cost comparison for the hybrid and gas vehicles at \$3.49 gasoline. The Chevrolet Silverado had the most savings of \$2,338.05, with a total ownership cost of \$60,574.23 for the normal engine, and \$58,236.18 for the hybrid, or a hybrid discount of 4.01%, whereas the Honda Accord had a difference of \$4,617.01, or a hybrid premium of 10.31%. The average hybrid premium was 1.00% for the vehicles involved with this report. Each hybrid premium is listed in Table 4. Vehicles that incurred the most 5-year benefit for this report were the Chevrolet Silverado, the Toyota Camry, and the Toyota Corolla, each with an overall 5-year savings, while the Honda Accord and the Ford Fusion each incurred a premium for total cost of hybrid ownership.

Table 3. Total 5-Year Costs

	Total 5 Year Cost Gas	Total 5 Year Cost Hybrid	Difference
Chevrolet Silverado	\$60,574.23	\$58,236.18	(\$2,338.05)
Toyota Camry	\$43,778.44	\$42,533.91	(\$1,244.53)
Toyota Corolla	\$33,218.63	\$32,575.96	(\$642.67)
Honda Accord	\$40,180.68	\$44,797.69	\$4,617.01
Ford Fusion	\$42,157.83	\$43,745.96	\$1,588.12

Source: Department of Natural Resources Technology Assessment Division

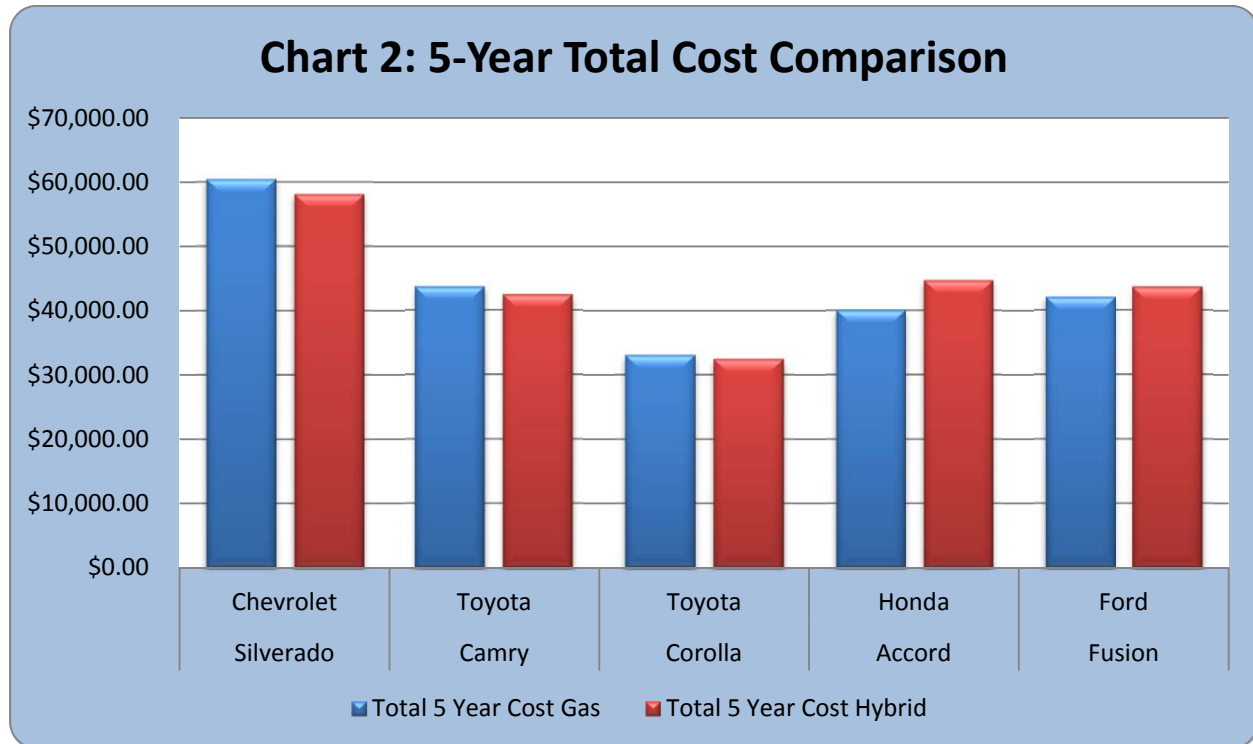
Table 4. Hybrid Premium

	Hybrid Premium
Chevrolet Silverado	-4.01%
Toyota Camry	-2.93%
Toyota Corolla	-1.97%
Honda Accord	10.31%
Ford Fusion	3.63%

Source: Department of Natural Resources Technology Assessment Division

Although there is a gain of fuel efficiency, there is also a premium for hybrid ownership, negating some of the per mile cost savings of the hybrid. This long-term price of the vehicle can decrease, though, with additional incentives from the manufacturer. The most dependent part of the equation is the price of gasoline, for which \$3.49 was used in this report. A lower price point for gasoline would make the hybrid even less economical, whereas a higher gasoline price would make the hybrid more economical.

Consumers looking into purchasing a hybrid should be cautious for not all hybrids have the same benefits. Some vehicles, such as the Silverado, have an economic benefit over the 5-year span of ownership, whereas others have a premium for ownership. However, with more efficient non-hybrid vehicles being produced and falling gasoline prices, the economic benefits of the hybrid vehicles may be less than the perceived benefits.



Source: Department of Natural Resources Technology Assessment Division