eGallon

How much does it cost to drive an electric vehicle the same distance you could go on one gallon of gas?

The average American measures the day-to-day cost of driving by the price of a gallon of gasoline. In other words, as the price of gasoline rises and falls, it tells consumers how much it costs to drive. If you drive past a gas station, watch the evening news or read the newspaper, you'll see the price of a gallon of gas posted. But for electric vehicle (EV) owners -- who generally fuel at home -- it's hard to measure just how much it costs to drive. To help current and potential EV drivers better understand the cost of driving an EV, the Energy Department created a metric called the "electric gallon" -- or "eGallon." The eGallon represents the cost of driving an electric vehicle (EV) the same distance a gasoline-powered vehicle could travel on one (1) gallon of gasoline.

Why do we need an eGallon?

The cost of driving an EV depends on the cost of electricity. Generally, consumers think about the cost of electricity in the context of monthly electricity bills, not discrete units such as kilowatt hours. Because of this it is hard for most consumers to make the jump from the cost of electricity per kilowatt hour, to the "dollars-per-mile" cost of fueling an EV. The eGallon does this for them by providing a metric that is easily comparable to the traditional gallon of unleaded fuel -- the dominant fuel choice for vehicles in the U.S.

eGallon Methodology

The eGallon is measured as an "implicit" cost of a gallon of gasoline. It is calculated by multiplying the average U.S. residential electricity price (EP) by the average comparable passenger car adjusted combined fuel economy (FE) by the average fuel consumption of popular electric vehicles (EC), as follows:

$$eGallon\ (\$/gal) = FE * EC * EP$$

where

FE = the average comparable passenger car adjusted combined fuel economy, miles/gallon

EC = the average electricity consumption (kWh/mi) of the top 5 selling PEVs in the U.S.[1],

and

EP = the average U.S. electricity price, $/kWh.

For instance, if the average comparable[2] 2012 passenger car adjusted combined fuel economy, mi/gal[3] is 28.2 mi/gal and the average efficiency for the top selling U.S. EV brands in 2012[4] is .35kwh/mi, the price of an e-gallon would be:

*28.2 mi/gal * .35 kWh/mi * .1233 $/kWh =* ***$1.22/gal***

In other words, it costs about $1.22 to drive an EV the same distance that a vehicle powered by an internal combustion engine (ICE) can go on a gallon of gasoline.

As the EV market expands and fuel efficiency of ICE vehicles changes, eGallon numbers can be revised to provide consumers with more current information that will help them inform their purchasing and driving decisions.

Helping consumers make smart choices

The eGallon will allow consumers to make better choices regarding the vehicles they drive. It does this by succinctly informing drivers of the difference between gasoline and electric fuel costs. In this way, the eGallon is a valuable tool for communicating one important benefit of electrification: cheap, stable fuel prices.

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[1] The top 5 EVs that can execute the UDCC drive cycle on pure electricity or the number of EV models that would be required to comprise 80 percent of said EV sales in the U.S. market for the previous year

[2] "Comparable" is defined as those vehicles in the size classes in which EVs are available. For model year 2012, the harmonic mean fuel economy of small (28.8 mpg, 25.1% of cars sold) and midsize (27.5 mpg, 21.7% of cars sold) cars is 28.2 mpg.

[3] EPA Fuel Economy Trends Report, March 2013

[4] This includes .35 kWh/mi (Volt), .34 (Leaf), .38 (Model S), .32 (Focus), and .33 (Active E). All fuel economy numbers are model year 2012 according to fueleconomy.gov, except Active E, for which fueleconomy.gov provides only 2011 fuel economy numbers.

Table 1. Plug Electric Vehicle (PEV) fuel economy.

PEV Model	kWh/100 Miles Combined[1]
Chevrolet Volt	35
Nissan Leaf	34
Tesla Model S	38
Ford Focus EV	32
BMW Active E (2011)[2]	33
Average[3]	35

1. Model Year 2012 Fuel Economy Guide. http://www.fueleconomy.gov/feg/pdfs/guides/FEG2012.pdf
2. 2012 BMW Active E data were not available in the Model Year 2012 Fuel Economy Guide. Instead, the 2011 data from the 2011 Guide was used.
3. Average (mean). (35 + 34 + 38 + 32 + 33) / 5 = 35 average kWh per 100 miles.

Table 2. Vehicle size class fuel economy.

EPA Size Class	Miles per Gallon Combined[1]	Sales %
Small Car	28.8	25.1%
Midsize Car	27.5	21.7%
Average[2]	28.2	n/a

1. EPA Fuel Economy Trends Report. http://www.epa.gov/oms/fetrends.htm#summary
2. Average (harmonic mean). (.251 + .217) / (.251/28.8 .217/27.5) = 28.2 average mpg.

Table 3. Weekly Retail Gasoline Price (12/10/12).

	Weekly Retail Gasoline (Dollars per Gallon, Including Taxes)[1]
Gasoline – All Grades	3.42

1. U.S. Energy Information Administration. Petroleum & Other Liquids. http://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_w.htm 12/10/12. Most recent retail price data available.

Table 4. Average residential retail price of electricity September 2012.

Sector	Average Retail Price of Electricity (cents per kilowatt-hour)[1]
Residential	12.33

1. U.S. Energy Information Administration. Electricity Data. http://www.eia.gov/electricity/data.cfm Sales, Revenue & Prices. Retail Price to Customers. Table 5.3. Average Retail Price of Electricity to Ultimate Customers: Total by End-Use Sector, 2003 – September 2012 (Cents per Kilowatt-hour). Most recent residential price data available.