Understanding Plug-in EV Specs

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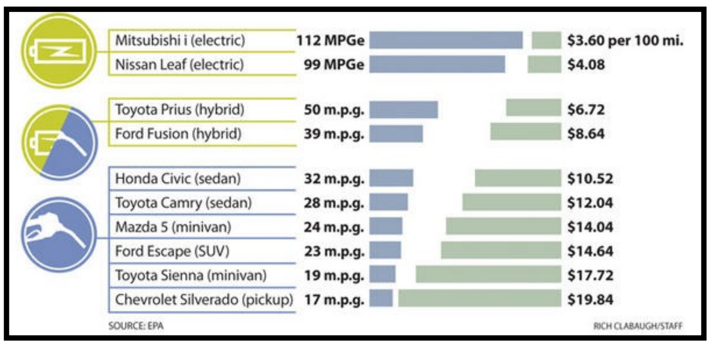
Horsepower

Many car shoppers are familiar with horsepower, because it's a term that for hundreds of years has described the power of machines. James Watt coined the term in the 18th century to make machine-power relevant to people familiar with muscle-power. It roughly describes the number of pounds of coal a horse can move over a prescribed period of time.

The term "horsepower" is well known to drivers who understand for example, that a Nissan Versa with 109-horsepower is a slowpoke while a Chevrolet Corvette Stingray ripping 455 horsepower is a thrill. The exact same thing holds true for comparing a 111-horsepower Fiat 500e to a 416-horsepower Tesla Model S.



MPGe vs MPG

It's silly to use miles-per-gallon as an efficiency term in an electric car that doesn't carry gallons of fuel, but for more than a half-century, consumers have associated vehicle fuel consumption with a single number: the federal government's Miles Per Gallon rating. When the window sticker reads "50 mpg," consumers know it's an amazing fuel-sipper. And when it reads "10 mpg," you know it's a gas-guzzler.

For plug-in cars, the government-issued window labels use the equivalent MPGe to describe the efficiency (based on the energy content of gasoline, the energy obtained from burning one US gallon is 34 kilowatt-hours).

EVs are so much more efficient than gas cars that the number on the window sticker, often exceeding 100 MPGe, ceases to have much meaning. Don't worry too much about the MPGe number. Focus instead on driving range, mostly determined by the number of kilowatt-hours stored in your car's battery pack.

Torque

Horsepower or kilowatts describe how fast your EV can travel. But torque applies to how quickly that maximum power is delivered.

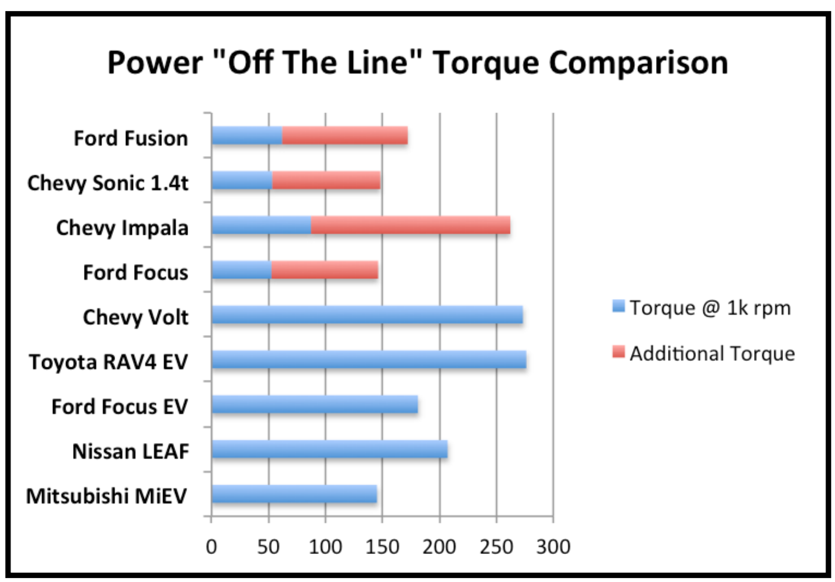
The electric powertrain in an EV, compared to what's found in an internal combustion car, is extremely efficient at delivering immediate bursts of power to the wheels. EVs have loads of low-end torque.

Torque is arguably a more important spec, because we feel a vehicle's torque on a regular basis as we zoom around a city. We frequently capitalize on torque, but we rarely test horsepower capabilities of our cars.

The Mercedes B-Class Electric Drive, a luxury vehicle, has 177 horsepower, The Chevy Spark EV has 107 horsepower. Compare the two at a stoplight, and the B-Class's 251 pound-feet of torque are left in the dust behind the Spark's 327 pound-feet of torque.

In simplest terms, a pound-foot is how much energy is required to lift one pound one foot. A higher torque number will mean brisker acceleration, especially from relatively low speeds.

Heavier vehicles require more work to move down the road, so two cars with the same horsepower or torque might feel very different on the road. The lighter one is likely to provide a much zippier drive. Sky-high torque of some EVs might be more than a lightweight car can manage in terms of handling and maneuverability.



Kilowatts

An electric car's spec sheet often shows the max power of a vehicle not only in horsepower, but also in terms of kilowatts. It means exactly the same thing!

One horsepower equals 746 watts (or 0.746 kilowatts). Automakers convert the kilowatt term to the more familiar horsepower rating, multiplying the number of kilowatts by 1.34. In the case of the Nissan LEAF, take its 80-kilowatt motor, and multiply it by 1.34, to derive a rating of 107 horsepower.

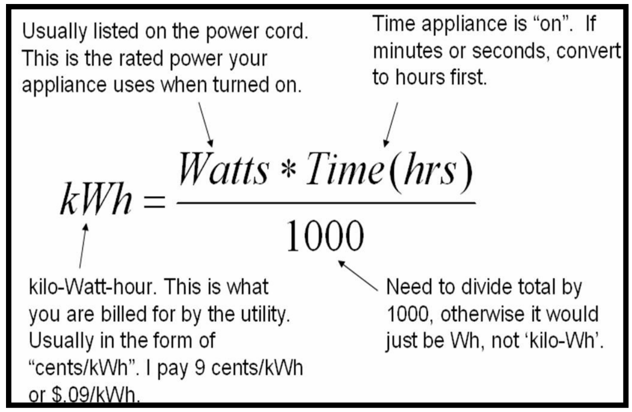
This allows us to compare gasoline-powered cars and EVs. But the fun of electric cars is mostly derived not from horsepower, but from torque.

Kilowatts (for Charging Rate)

With the relatively long time it takes to recharge an EV, versus how long it takes to pump gasoline, it's important to understand the kilowatt charging rate of an EV.

If your EV has a 6.6-kilowatt charger and you have it plugged in for one hour, then your battery will get an additional 6.6 kilowatt-hours of energy. If your EV has a faster 10-kW charger, in that same hour, you'll have 10 more kilowatt-hours of juice. That's the difference between adding about 20 to 25 miles of range in that hour of charging, versus about 35 to 40 miles of range in the same period of time.

This is less important for plug-in hybrids with relatively small battery packs commonly charged with 3.3-kW chargers. It's definitely important for big-battery EVs like the Tesla Model S. That's why Tesla equips the Model S with a 10-kW or 20-kW onboard charger.



Kilowatt-Hours (Battery Size)

Kilowatt is a measure of power (or the rate at which work is done).
Kilowatt-hour is a measure of energy (or the ability to do a certain amount of work).

Work is moving your car miles down the road. In an electric car, the amount of work from the battery pack is described by the number of kilowatt-hours stored in your EV's pack.

This is similar to the number of gallons of liquid fuel stored in a gasoline tank. If your car has a 10-gallon tank, and manages 25 miles per gallon, then a full tank holds enough energy for 250 miles of driving.

Electric cars can travel about four miles on a kilowatt-hour of energy. An EV with a 24 kilowatt-hour battery pack stores enough energy—when driven efficiently—to go 96 miles on a single charge. Unfortunately, most of us don't drive that efficiently, so it's more likely that we'll get around 80 miles on 24 kilowatt-hours. Very hot or cold weather can cut down on the efficiency of stored energy.

Engineers often limit the full use of battery kilowatt-hours as a way to prevent degradation over time. That's why you might hear about "usable" kilowatt-hours versus total kWhs.

The Kia Soul EV, with its 27 kWh battery pack yields an EPA-estimated range of 93 miles—while the Mitsubishi i-MiEV, with its 16 kWh pack provides about 62 miles of driving range. Size matters.

New EV drivers often have to spend some time with their vehicles before they fully understand the real-world capability of a battery pack. Electric cars are often erratic with their estimations of remaining range.

By Brad Berman · January 15, 2015