“Charging an EV” 101

- A unit of power is a watt. 1000 of them is a kw.
- Power * time = energy. EV battery capacity (how much energy it can hold) is in kw * hours = kwh
- I have the smallest battery Tesla sells. It's 54 kwh, and it will drive my Model-3 250 miles.
- Charging rates are (helpfully) expressed in miles of range of charge delivered in an hour of charging. That is MPH - it looks like a speed.

Charging my Model-3

I have 3 ways of charging my Model-3:

1. the charger that came with the car: uses a 120 volt house receptacle, draws 12 amps of current, and charges at 6 MPH.
2. a Tesla wall-charger that I installed: uses 240 volts at 32 amps, charges at 35 MPH. [50 amp circuit, 6 gauge wire]
3. a Tesla supercharger that you drive up to (like a gas station): it charges at (drum roll please....) 328 MPH!! If it were using a 120 volt system (it's not) that would take ~570 amps. No wonder the charging icon is a lightning bolt.

Fuel costs

My electricity costs per kwh are $.1217/kwh

- $.0709 from the supplier (Constellation)
- $.0508 from BGE to deliver it.

A full charge = battery capacity = 54 kwh

Costs:

- 54 kwh * 0.1217 [$/kwh] / 250 [miles] = $.0262/mile.
- So my Tesla fuel costs are 2.6 cents/mile.
- Prius fuel costs had been 2.20 [$/gal] / 50 MPG = 4.4 ¢/mile.

Technology Improvements Over Time

Bought my 1st Prius in 2004. No competition to its 50 MPG!
Bought my 2nd Prius in 2011. Lots of hybrids to choose from.
Prius was still at 50 MPG, but compared favorably.
2020:

- The EPA rates EVs with "MPGe" [how many miles the chemical energy in 1 gallon of gas – when put into battery charge – will push an EV]
- Prius is still at 50 MPG [Toyota not putting any R&D into it??]
- Tesla Model-3 has an EPA rating of 141 MPGe !!!

Model-3 <> Prius Comparisons

Energy efficiency (how GREEN are you):

- [1/141] / [1/50] = .35 (Tesla has 65% reduction in energy)

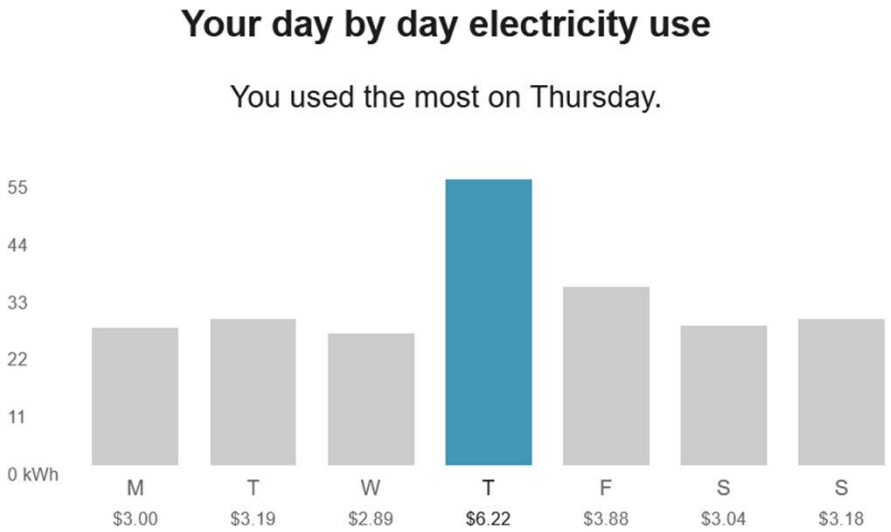
Cost reduction (how frugal are you):

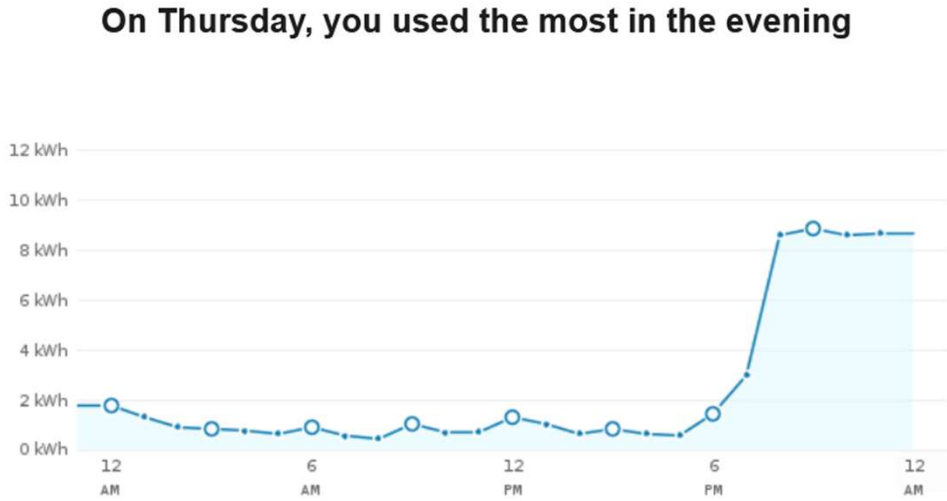
- 2.6 / 4.4 = .59 (Tesla has 41% reduction in fuel costs)

Still cheaper to buy energy in gasoline than in delivered electricity – but for how long?

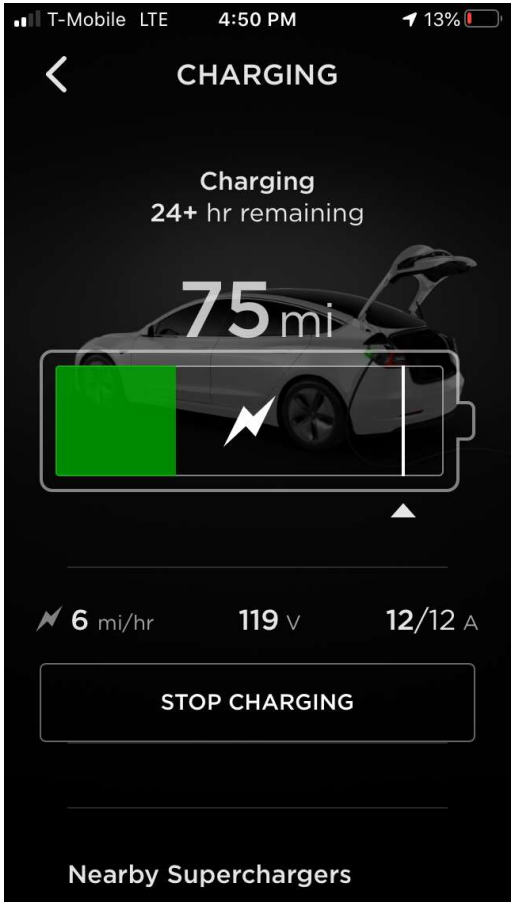
Charging at Home

I wait until the range drops < 100 miles, then charge overnight. Unless I force it, Tesla will stop charging at 220 miles (not 250) – to reduce lithium-ion battery wear. The claimed battery life is >300K miles; the guaranteed battery life is 100K miles.

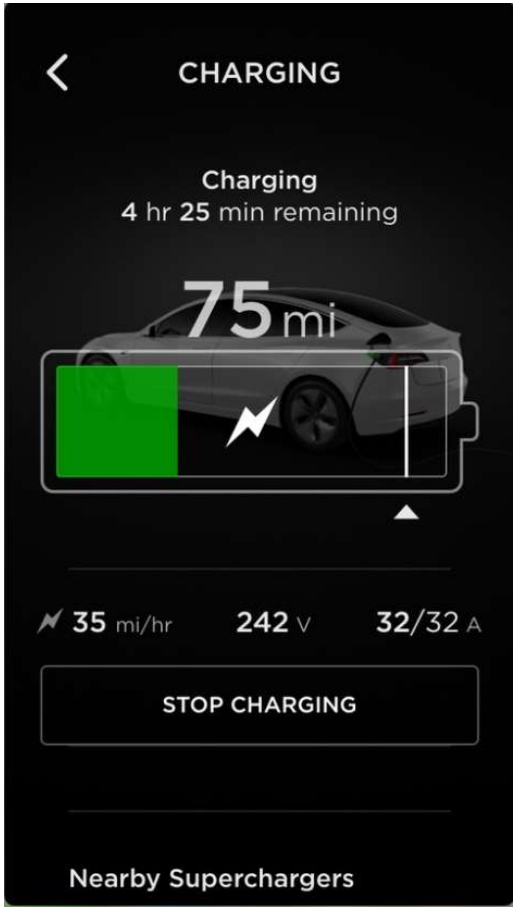




Level-1 Charging (6 MPH, 120 V @12 A)



Level-2 Charging (35 MPH, 240 V @32 A)



Supercharging (328 MPH, 480 V, 142A)