Program version: V12

These plotted curves show, from various perspectives, the battery range of a 2018 Tesla Model 3 LR RWD.

The data for these was obtained by driving the car back and forth on a fairly flat road multiple times, at different speeds, and recording the energy usage per distance as shown by the car in watt-hours per unit distance travelled. This data is shown on one of the plots. Also, certain data was found on the internet, such as vehicle weight.

Many plots show curves for a much wider range of speeds than those used in the testing described above. This was done by fitting a 3rd-order polynomial to the power curve obtained from the testing. From that polynomial power curve, the coefficients of rolling resistance and drag and the baseline power were estimated. From those, the rolling power and drag power were estimated for speeds from near 0 to quite fast. The total power is then the sum of the baseline power, rolling power and drag power. Finally, that total power estimate at different speeds is used to compute the curves for most of the plots.

Some plots take into account battery degradation. This was obtained for the car described above as follows: Ran Tesla battery test in hidden service menu.

If you would like curves plotted for another car and can provide the necessary energy data, contact me and we'll see if we can arrange it.

If you have questions or concerns about any of the plots, you can contact me on various online groups or at ted@tedtoal.net

The R code used to produce these plots is available on GitHub at: https://github.com/tedtoal/EV-battery-and-range-plots

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Cost in dollars per 100 mi or driving hour at various speeds compared to fuel vehicle

Assumptions: A: 2018 Tesla Model 3 LR RWD

B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph

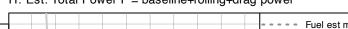
Fuel consumption (mpg)

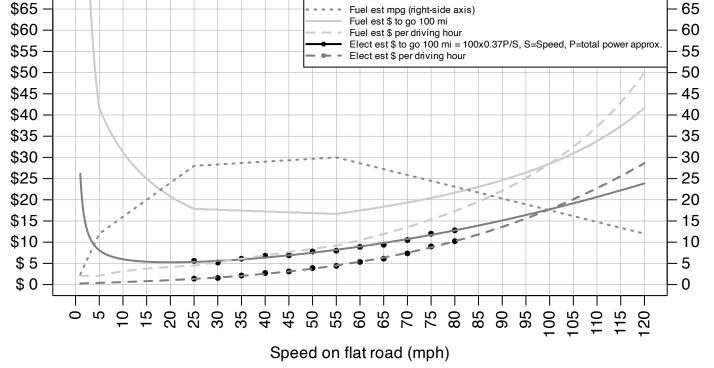
C: batt degraded 12% for 66kWh capacity

D: 100% SOC is 66kWh

E: electricity cost \$0.37/kWh (charging eff. excl.) F: fuel cost \$5/gal G: fuel efficiency as shown by dotted line with right-axis scale

H: Est. Total Power P = baseline+rolling+drag power





Estimated range at various speeds

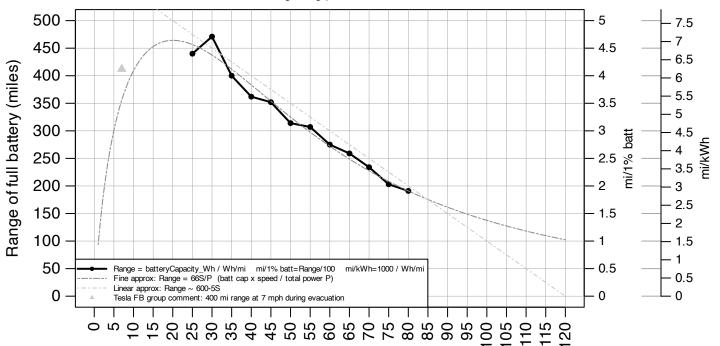
This shows points computed from raw data, and includes linear and derived approximations.

Assumptions: A: 2018 Tesla Model 3 LR RWD C: batt degraded 12% for 66kWh capacity

B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph

D: 100% SOC is 66kWh

E: Est. Total Power P = baseline+rolling+drag power



Speed on flat road (mph)

Miles per dollar at various speeds compared to fuel vehicle

Assumptions: A: 2018 Tesla Model 3 LR RWD

B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph

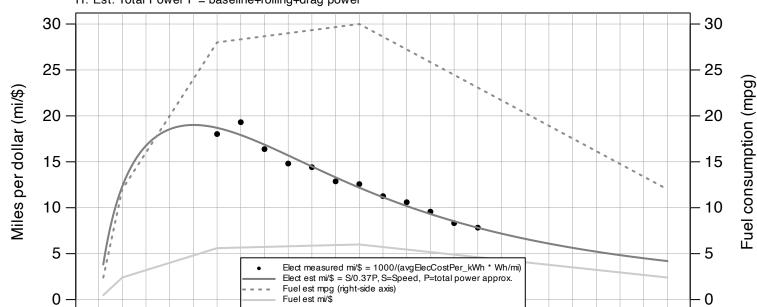
C: batt degraded 12% for 66kWh capacity

D: 100% SOC is 66kWh

E: electricity cost \$0.37/kWh (charging eff. excl.) G: fuel efficiency as shown by dotted line with right-axis scale

F: fuel cost \$5/gal

H: Est. Total Power P = baseline+rolling+drag power



Speed on flat road (mph)

Dollars per mile at various speeds compared to fuel vehicle

Assumptions: A: 2018 Tesla Model 3 LR RWD

B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph

C: batt degraded 12% for 66kWh capacity

D: 100% SOC is 66kWh

45 50 50 60 60 70 70 75 88 80 80 90

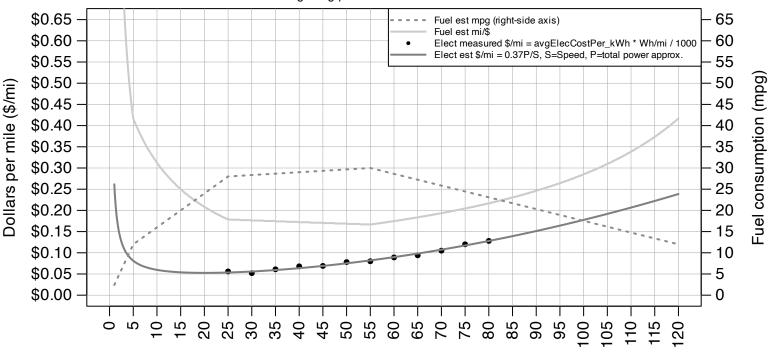
E: electricity cost \$0.37/kWh (charging eff. excl.)

F: fuel cost \$5/gal

G: fuel efficiency as shown by dotted line with right-axis scale

40

H: Est. Total Power P = baseline+rolling+drag power



Speed on flat road (mph)

Estimated range on uphill and downhill grades at various speeds

Assumptions: A: 2018 Tesla Model 3 LR RWD

B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph

D: batt degraded 12% for 66kWh capacity

C: weight 4250lb (with 250lb passengers)

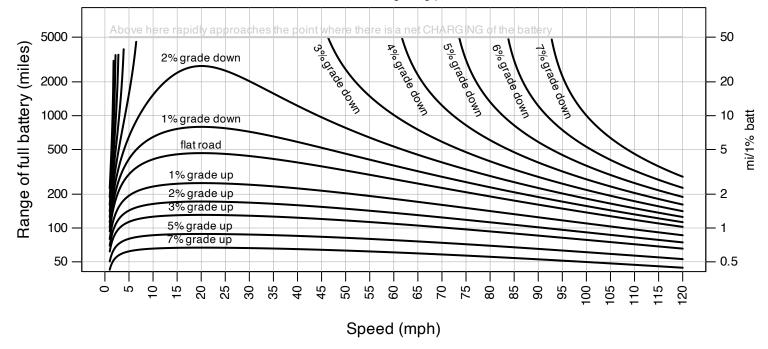
E: 100% SOC is 66kWh

F: 70% net energy efficiency upon increased load, 70% regen energy recapture efficiency

G: Range = Speed x batteryCapacity_kWh / (Flat Road Power + Lift Power)

H: Lift Power = vehicleWeight_kg x N_per_kg x Speed_kmps x fracGrade x energyEfficiencyFactor

I: Flat Road Power = Est. Total Power P = baseline+rolling+drag power



Estimated range with uphill and downhill elevation changes at various speeds

Assumptions: A: 2018 Tesla Model 3 LR RWD

B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph

C: weight 4250lb (with 250lb passengers)

D: batt degraded 12% for 66kWh capacity

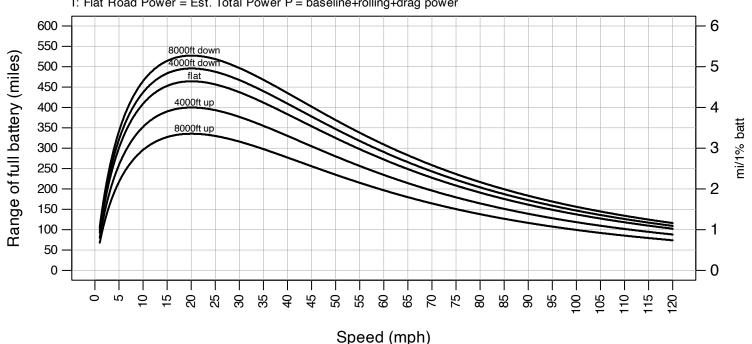
E: 100% SOC is 66kWh

F: 70% net energy efficiency upon increased load, 70% regen energy recapture efficiency

G: Range = Speed x (batteryCapacity_kWh - Lift Energy) / Flat Road Power

H: Lift Energy = vehicleWeight_kg x N_per_kg x ElevChg_m x kWh_per_Nm x energyEfficiencyFactor

I: Flat Road Power = Est. Total Power P = baseline+rolling+drag power



Energy used per mile at various car and wind speeds

Assumptions: A: 2018 Tesla Model 3 LR RWD

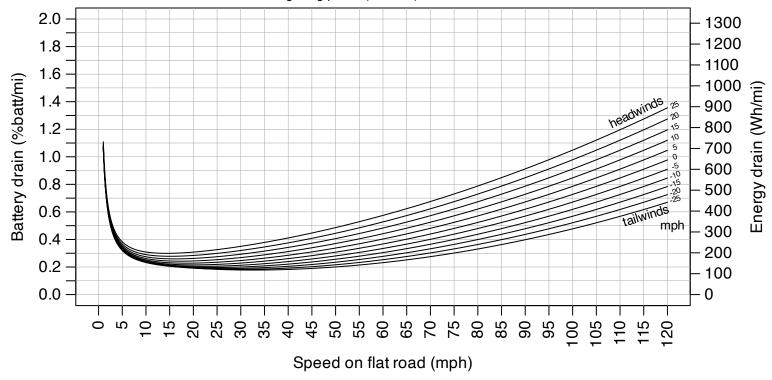
B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph

C: weight 4250lb (with 250lb passengers)

D: drag coef 0.22, roll coef 0.008, base power 0.61kW F: air density computed using density altitude

E: batt degraded 12% for 66kWh capacity G: 70% net energy efficiency upon increased load, 70% regen energy recapture efficiency

H: Est. Total Power P = baseline+rolling+drag power (flat road)



Estimated range at various car and wind speeds

Assumptions: A: 2018 Tesla Model 3 LR RWD

B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph

C: weight 4250lb (with 250lb passengers)

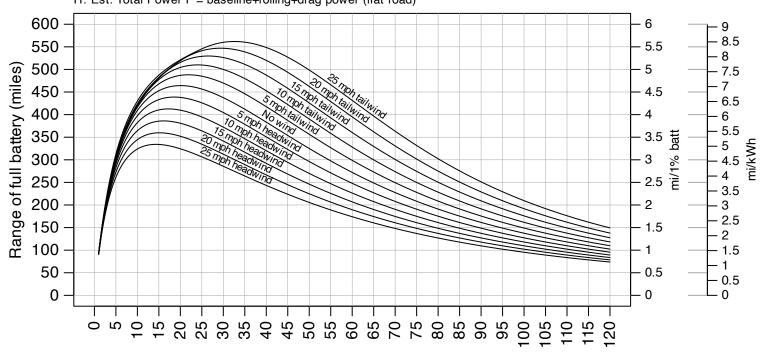
D: drag coef 0.22, roll coef 0.008, base power 0.61kW

E: batt degraded 12% for 66kWh capacity

F: air density computed using density altitude

G: 70% net energy efficiency upon increased load, 70% regen energy recapture efficiency

H: Est. Total Power P = baseline+rolling+drag power (flat road)



Speed on flat road (mph)

Energy used at various speeds and distances

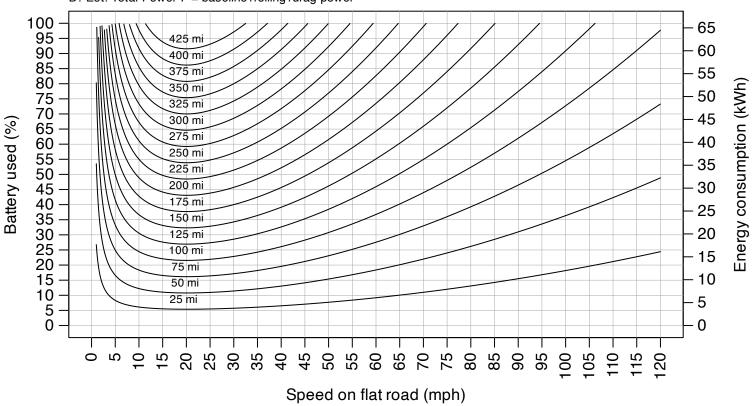
B: 100% SOC is 66kWh

B: 100% SOC is 66kWh

Assumptions: A: batt degraded 12% for 66kWh capacity

C: Fine approx: %batt/mi = 100P/66S

D: Est. Total Power P = baseline+rolling+drag power

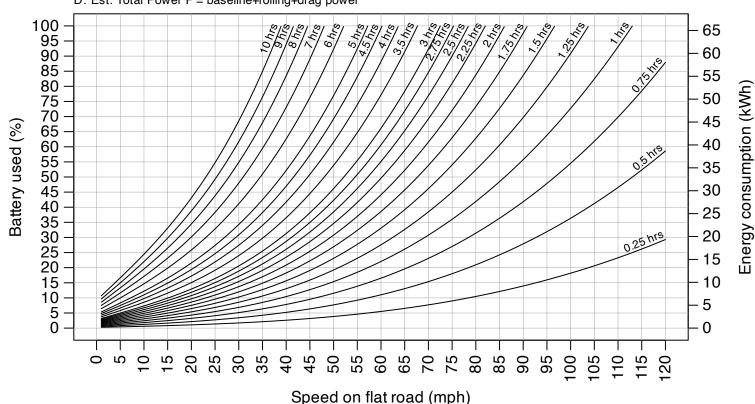


Energy used at various speeds and times

Assumptions: A: batt degraded 12% for 66kWh capacity

C: Fine approx: %batt/h = 100P/66

D: Est. Total Power P = baseline+rolling+drag power



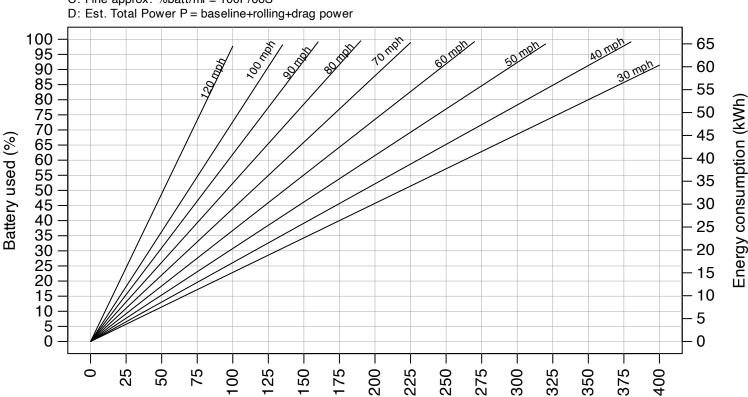
Energy used at various distances and speeds

Assumptions: A: batt degraded 12% for 66kWh capacity

C: Fine approx: %batt/mi = 100P/66S

B: 100% SOC is 66kWh

B: 100% SOC is 66kWh



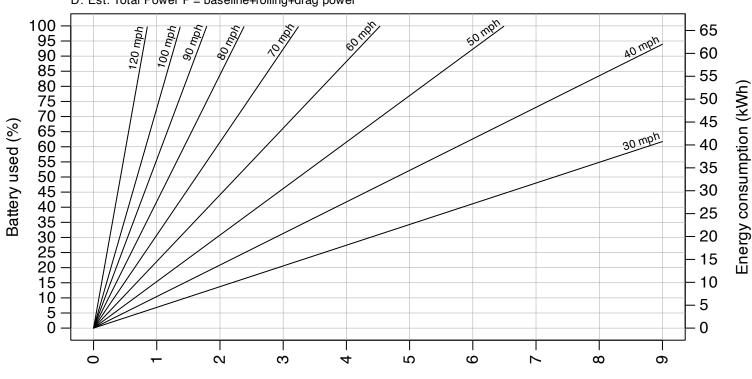
Energy used at various times and speeds

Distance travelled (miles)

Assumptions: A: batt degraded 12% for 66kWh capacity

C: Fine approx: %batt/h = 100P/66

D: Est. Total Power P = baseline+rolling+drag power



Elapsed time (hours)