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

The author, Ted Toal, can be contacted via email at ted@tedtoal.net

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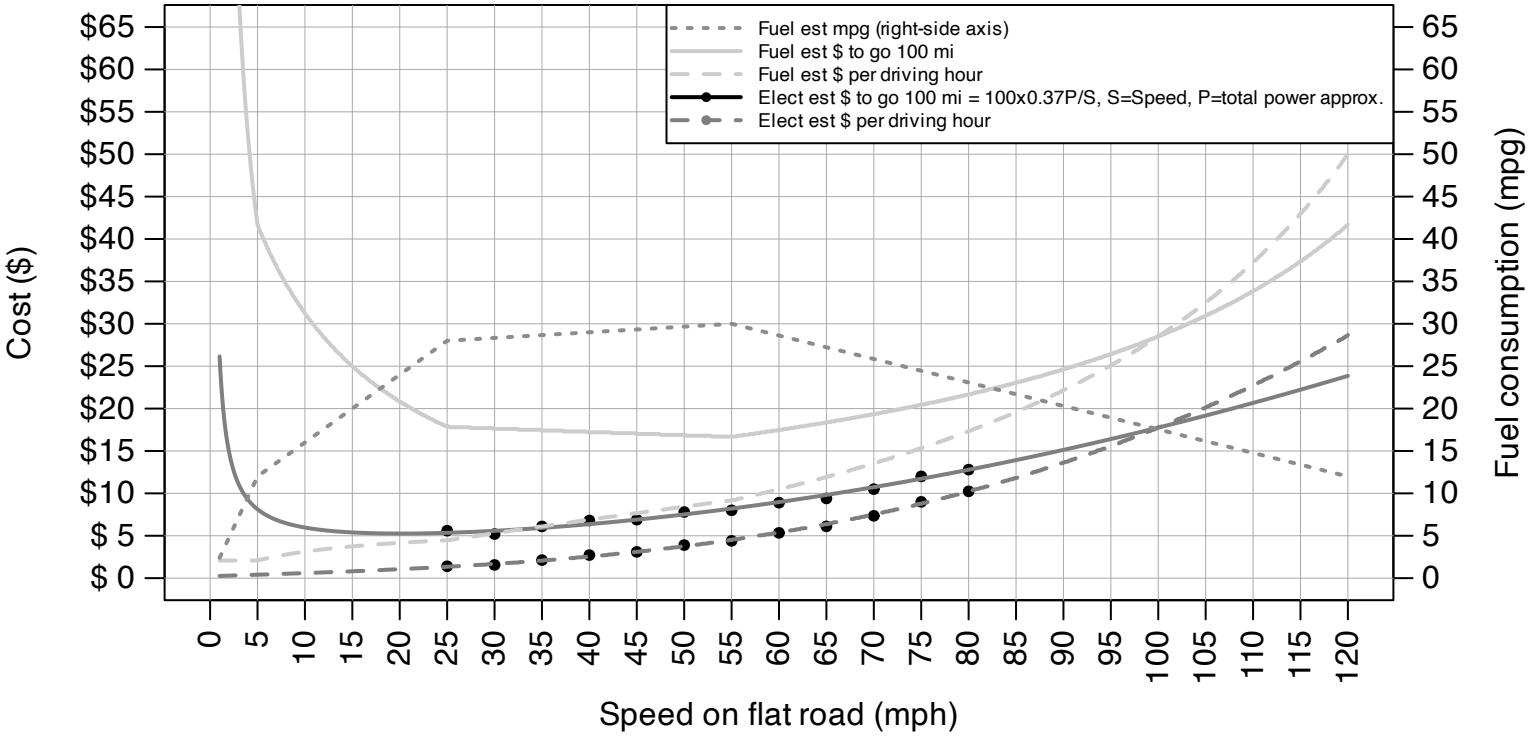
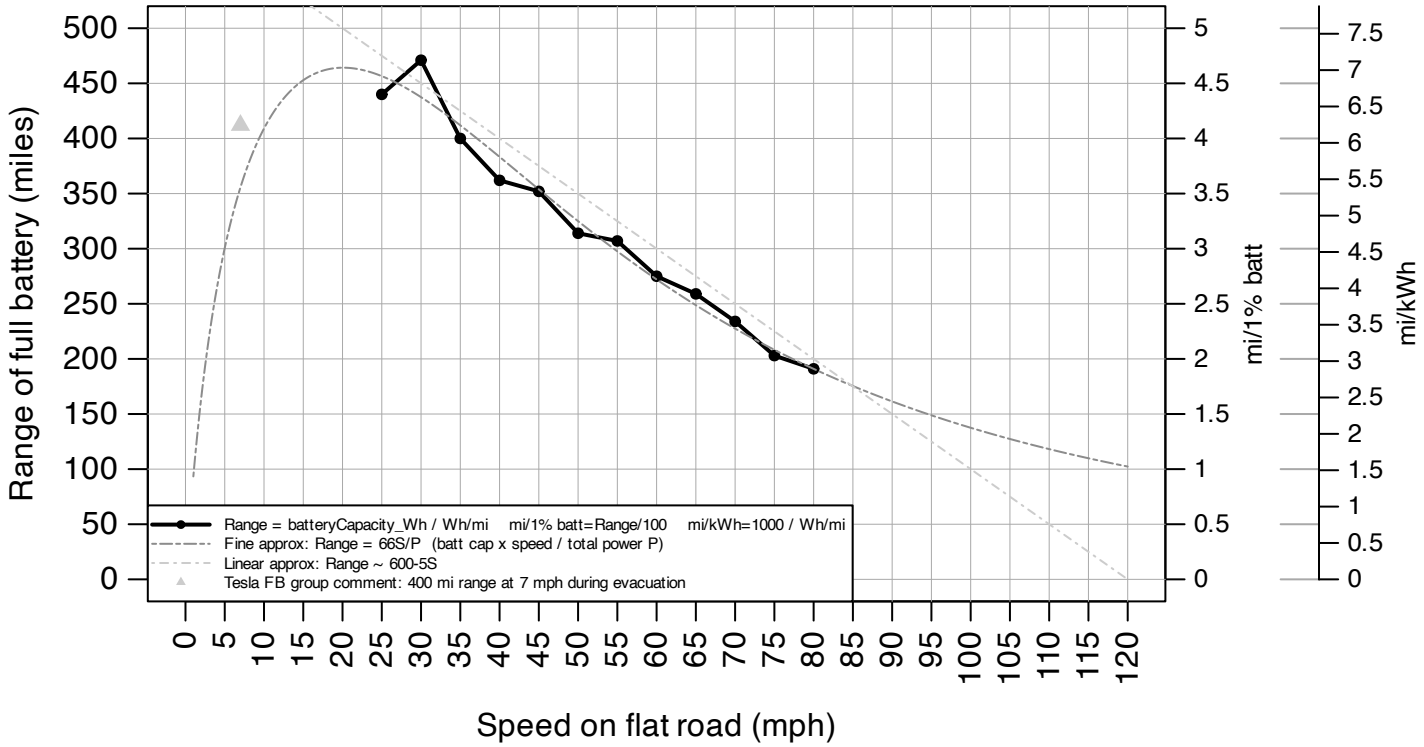
Cost in dollars per 100 mi or driving hour at various speeds compared to fuel vehicle

Assumptions: A: 2018 Tesla Model 3 LR RWD B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph
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



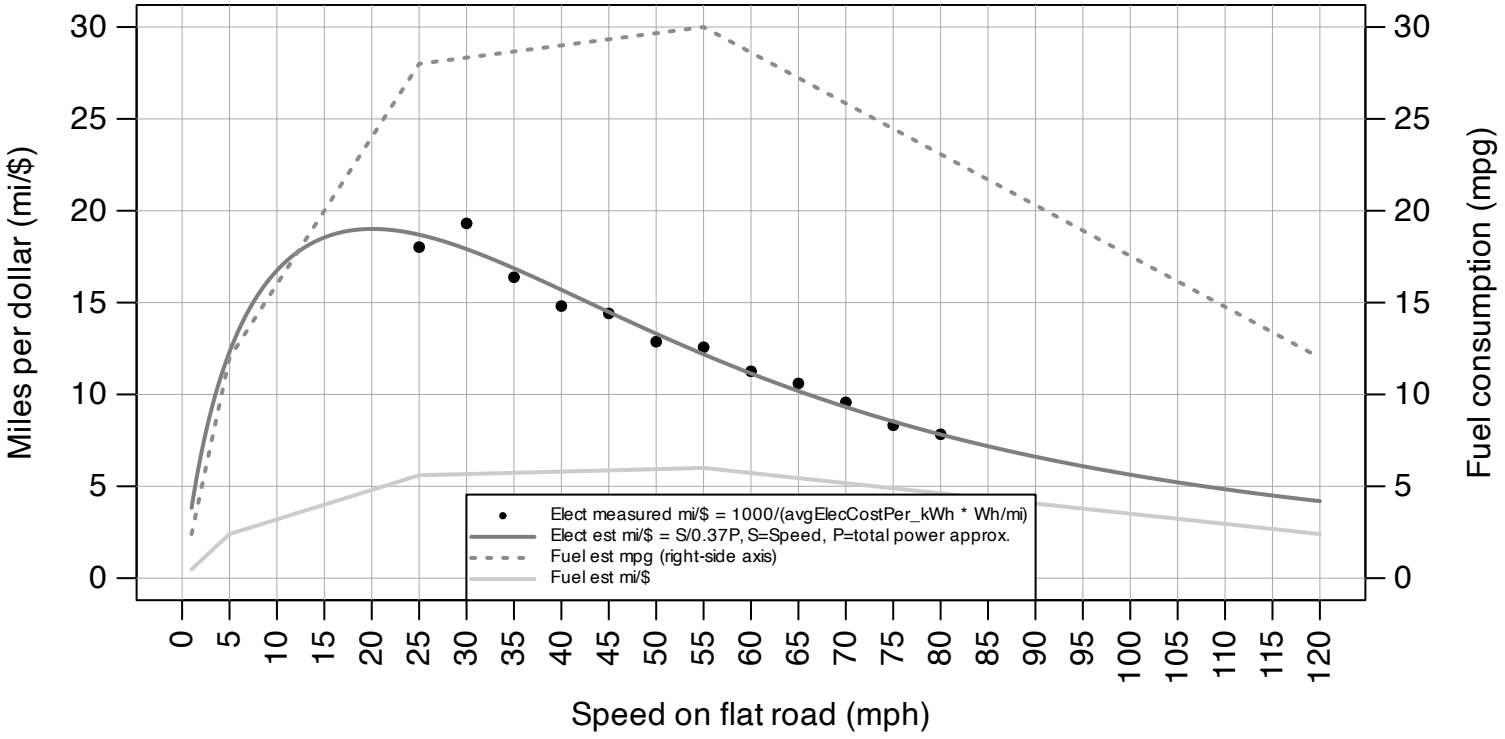
Estimated range at various speeds

This shows points computed from raw data, and includes linear and derived approximations.
Assumptions: A: 2018 Tesla Model 3 LR RWD 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: Est. Total Power P = baseline+rolling+drag power



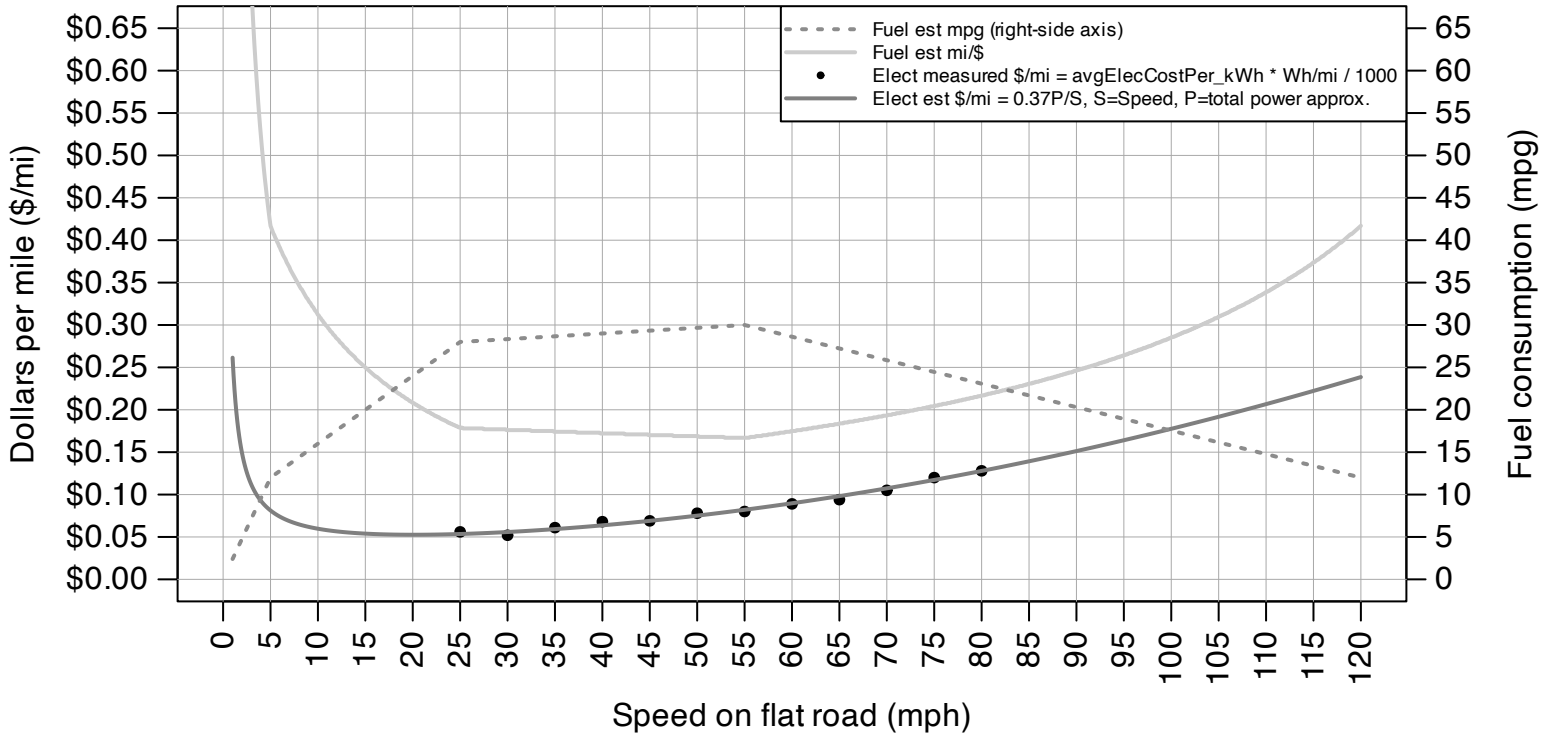
Miles per dollar at various speeds compared to fuel vehicle

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.) 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



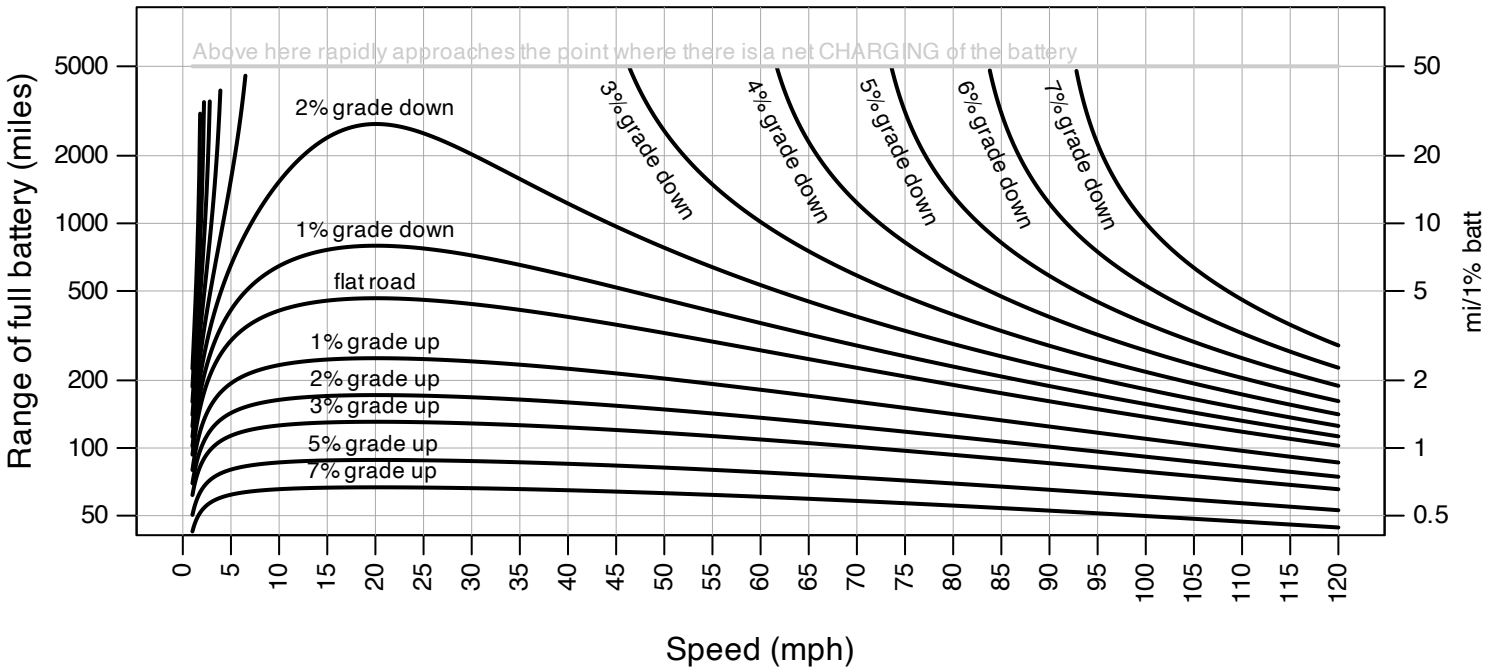
Dollars per mile at various speeds compared to fuel vehicle

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
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



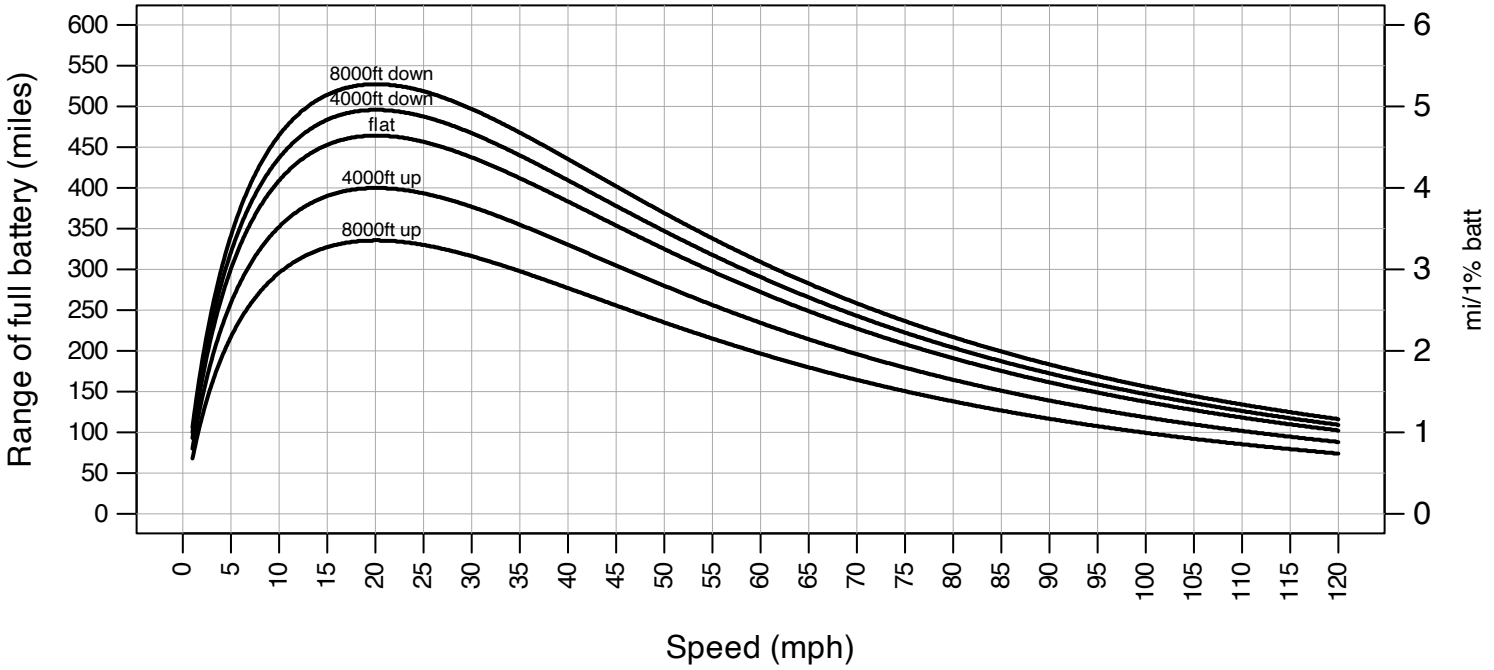
Estimated range on uphill and downhill grades at various speeds

Assumptions: A: 2018 Tesla Model 3 LR RWD B: Testing: flat road, 85°F, elev 0 ft, 29.92 inHg, wind 0 mph
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 / (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



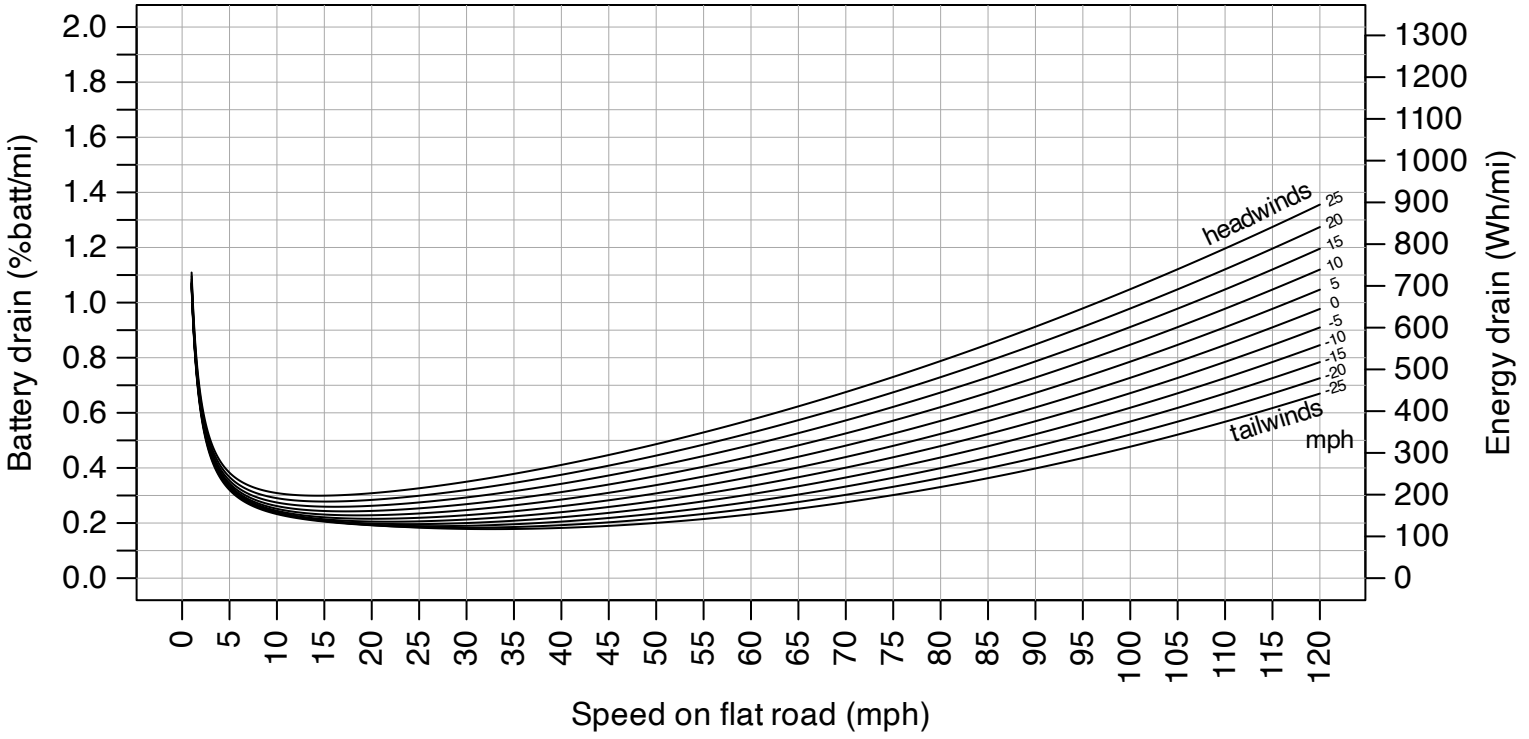
Estimated range with uphill and downhill elevation changes at various speeds

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



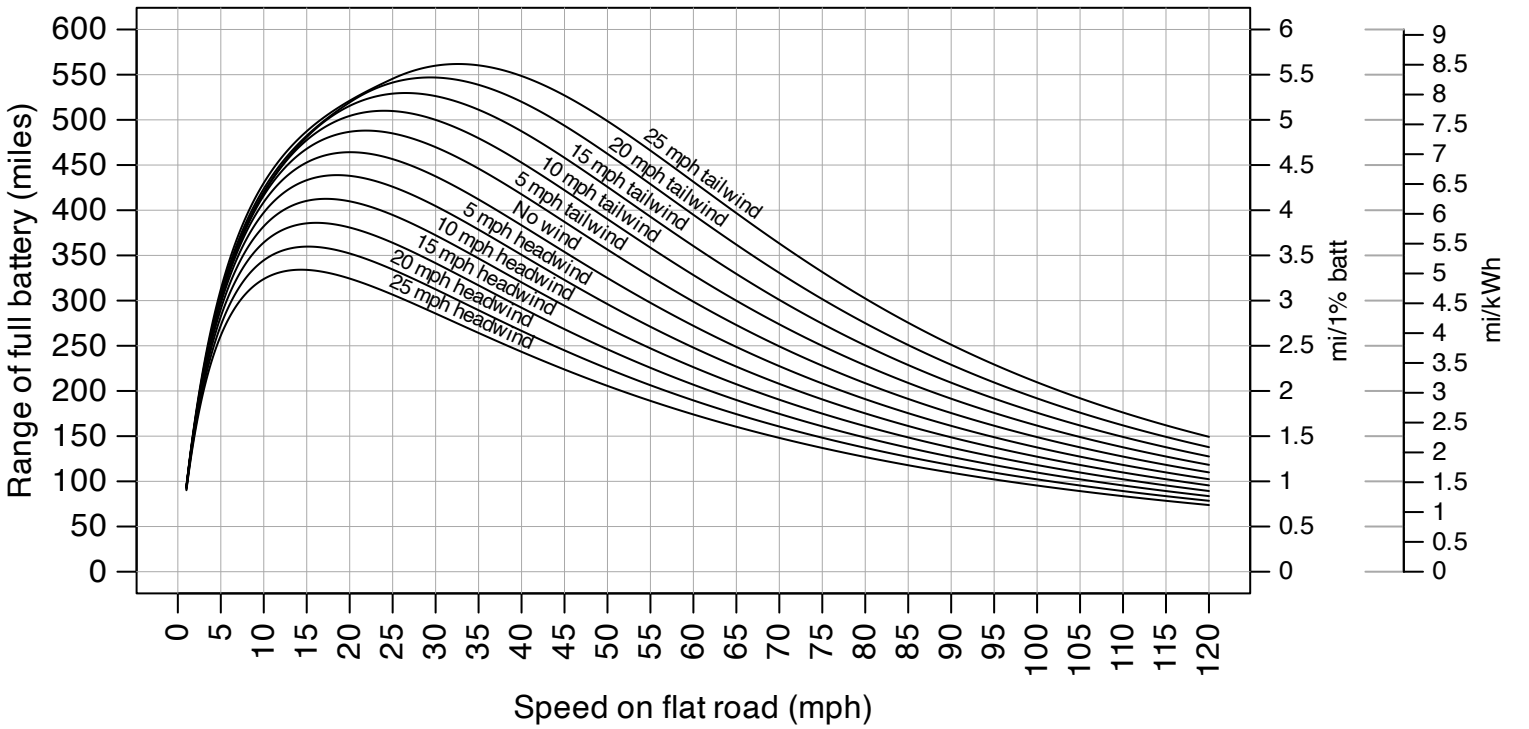
Energy used per mile at various car and wind speeds

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
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)



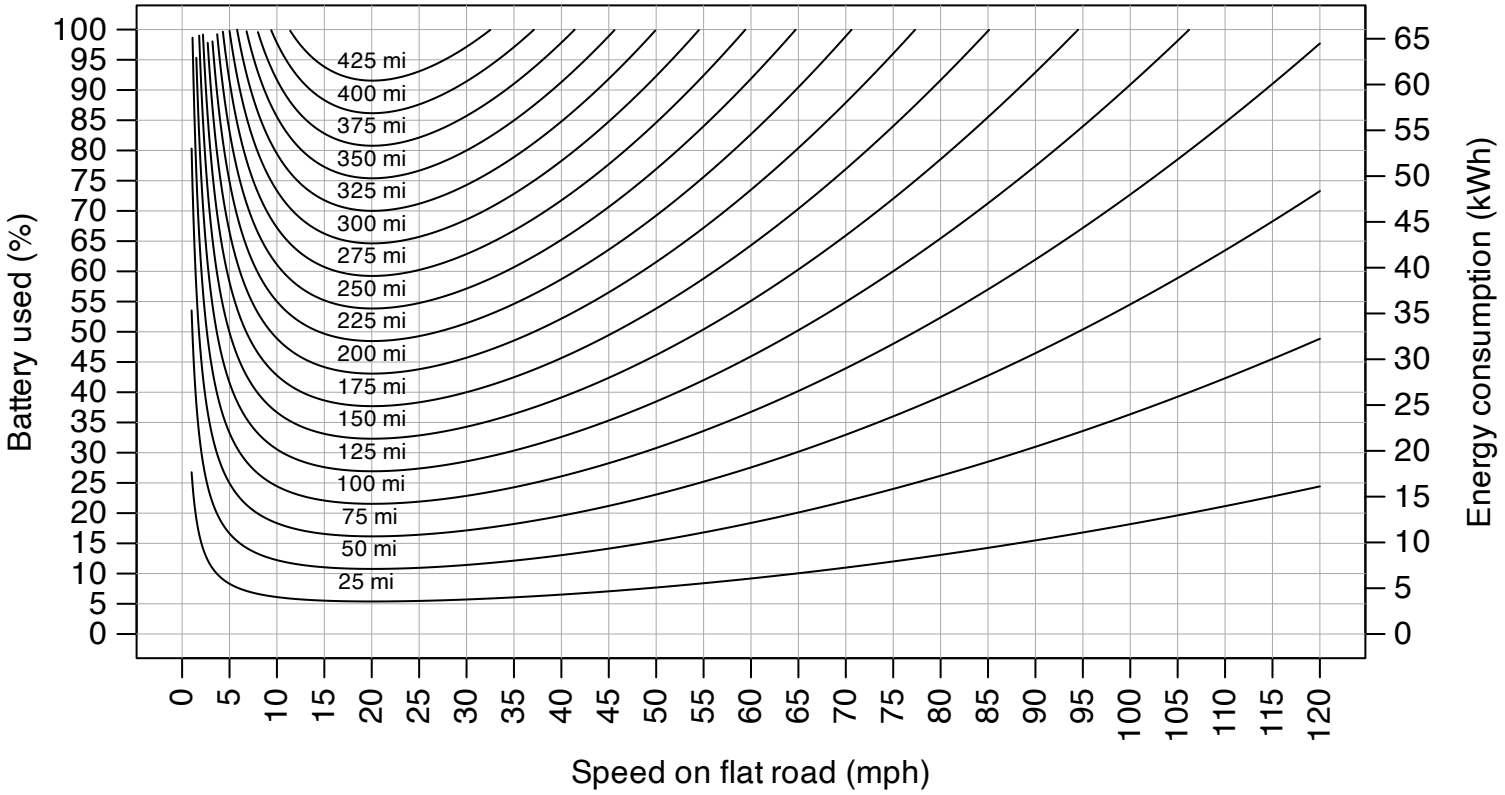
Estimated range at various car and wind speeds

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)



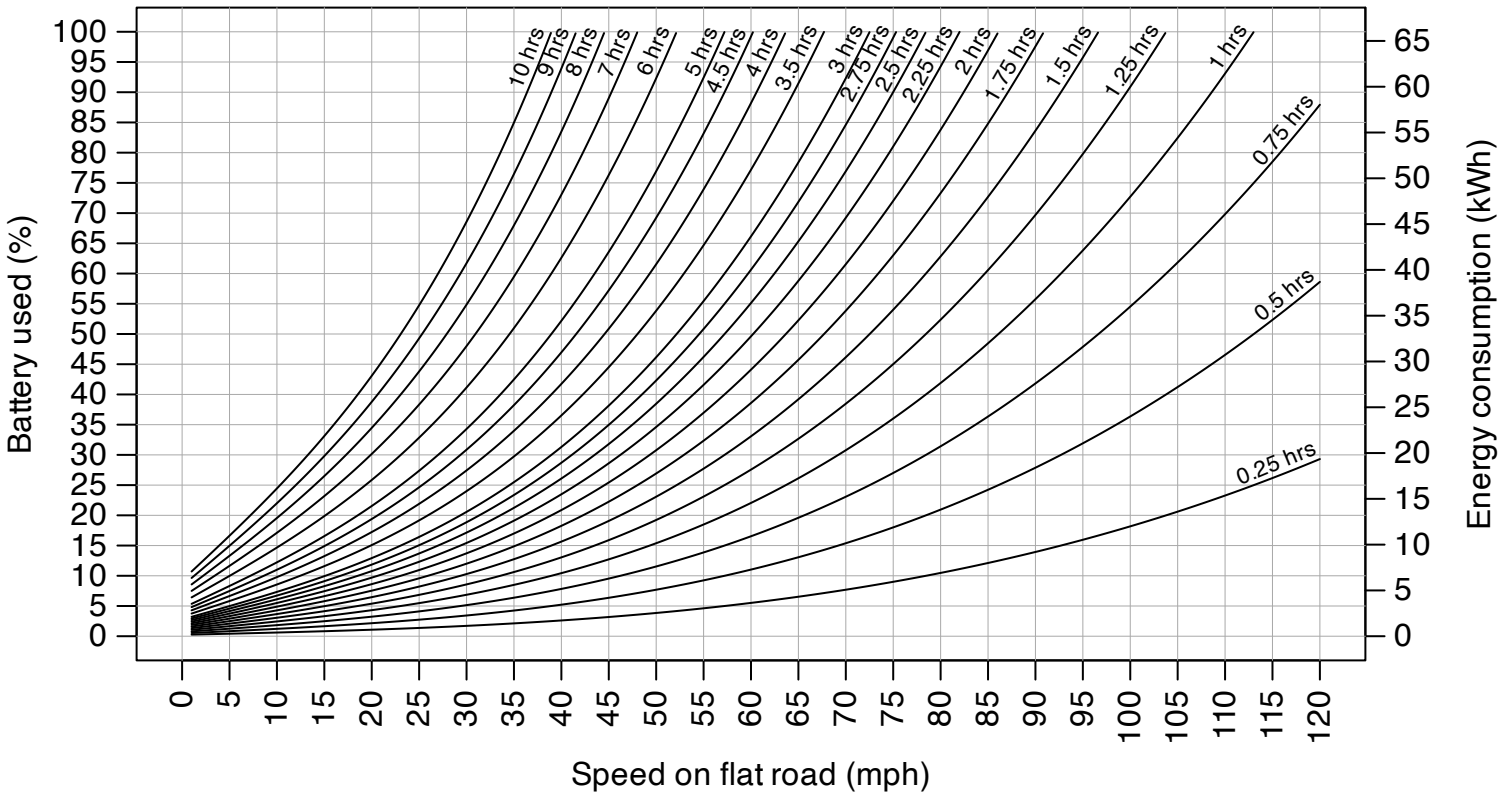
Energy used at various speeds and distances

Assumptions: A: batt degraded 12% for 66kWh capacity B: 100% SOC is 66kWh
C: Fine approx: %batt/mi = 100P/66S
D: Est. Total Power P = baseline+rolling+drag power



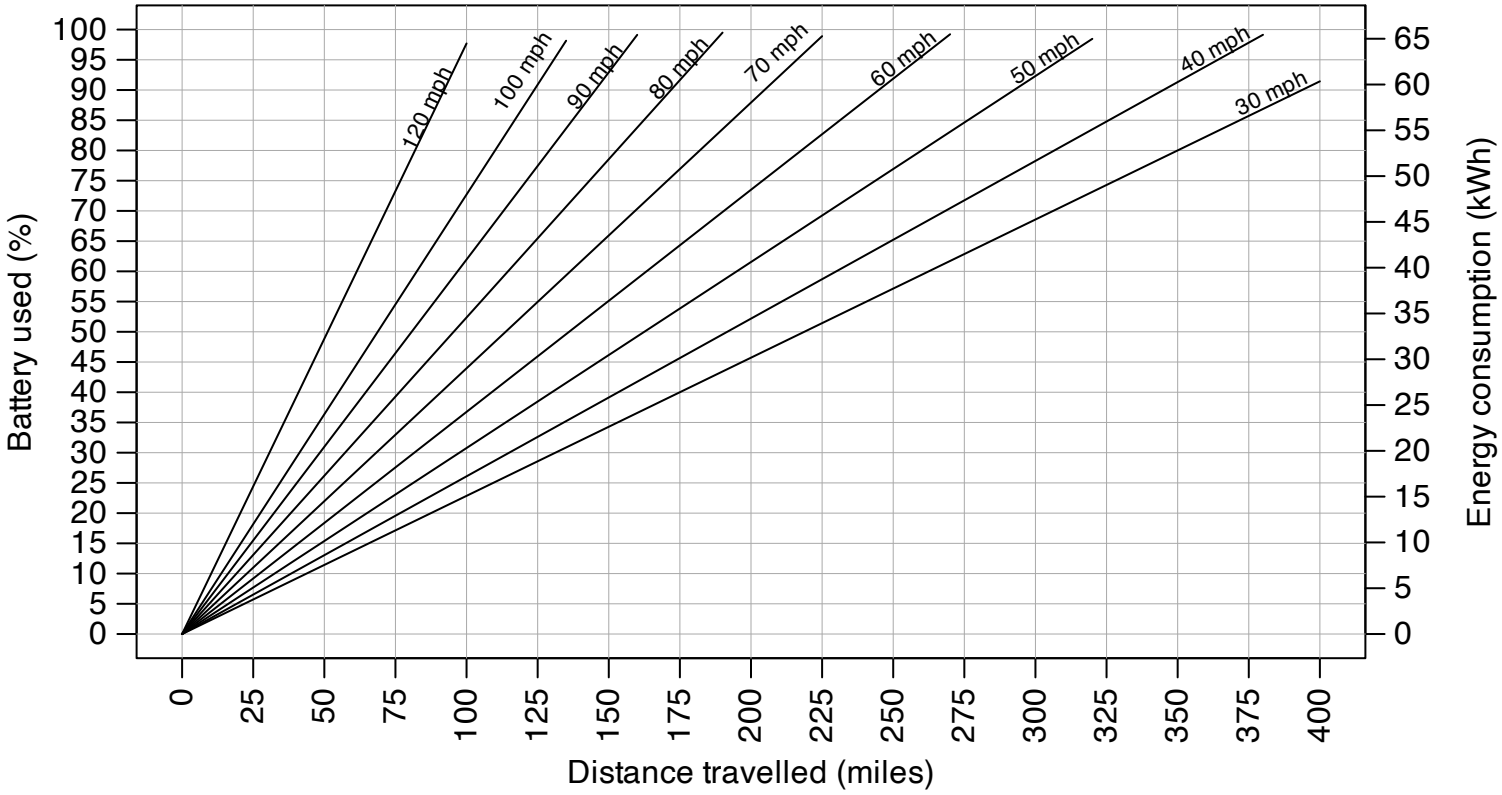
Energy used at various speeds and times

Assumptions: A: batt degraded 12% for 66kWh capacity B: 100% SOC is 66kWh
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 B: 100% SOC is 66kWh
C: Fine approx: %batt/mi = 100P/66S
D: Est. Total Power P = baseline+rolling+drag power



Energy used at various times and speeds

Assumptions: A: batt degraded 12% for 66kWh capacity B: 100% SOC is 66kWh
C: Fine approx: %batt/h = 100P/66
D: Est. Total Power P = baseline+rolling+drag power