

Interpreting the Tesla Model S Energy Readings

NOTE: The write up below is for software version prior to 5.8 – it appears that on-screen measurements have been changed and are much closer to reality now

The Model S provides a lot of information about Energy used and remaining, directly and indirectly. Many of the measurements provided, though, aren't exactly what you'd expect and it takes some work to figure out how to use them. Here are some of the key measurements and what, based on experience, they appear to mean:



- **Rated Range (remaining):** this seems to use the measured battery charge level and the rated Wh/mi to calculate how many miles you can go per the EPA rated consumption.
- **Total Energy (used):** Energy used for driving – environmental controls, accessories don't appear to be included.
- **Avg Energy:** Total Energy divided by Distance.

Due to omissions described above, this is NOT the total energy used since the last charge.

You might think that this simple equation would be true:

$$\text{Initial Range (rated)} - \text{Range Used (rated)} = \text{Remaining Range (rated)}$$

$$\text{Where Range Used (rated)} = \text{Total Energy (used)} / \text{Rated Wh/mi}$$

But this does NOT seem to be true. You may have noticed that when you add up the remaining range and what you've used (adjusting for the stated 'avg energy'), it does not add up to the initial rated range.

Another discrepancy is that you do not seem to get a full 85 kWh worth of range. Even using 308 Wh/mi, 85 kWh would result in a rated range of 276 miles – but I haven't seen that on a 'range charge' since the initial delivery of my P85. I think there are several reasons for this:

- From the moment the battery is "fully charged", you are losing about .5 miles/hour due to parasitic losses (as of software version 4.5) – this is true whether you're parked or driving
- Some energy is reserved to prevent damage to the battery even when running to zero miles remaining
- The battery might not be getting charged all the way to 85 kWh (I estimate it is charged to about 82 kWh)

EVTripPlanner's Route Energy Planner DOES account for these things - so, more often than not, the Planner's estimates will be higher than what is displayed by the Model S – and more accurate.

Here is an example from my P85 run from Thousand Oaks, CA to the Barstow Supercharger in November '13 when it was under 80F outside, driving at an overall average of about 68mph (maybe 75 on I15 part!):

	Reported Rated Range Remaining	Reported Total Miles	Calculated Battery kWh Remaining	Reported kWh Used	Reported Avg Wh/mile	"Missing" Energy (Initial-Used-Remaining)	Wh/mi Reporting Error
Start	257	0	79.2	0			
End	69	148	21.3	53.5	349	4.4	8%
Diff	188	148	57.9	53.5			
			Calculated Wh/mile:		391		

As you can see, the Trip Meter (SINCE LAST CHARGE) significantly under-reports actual consumption – independent of the actual Wh/mile value that Tesla is using. This is why I assume that it does NOT include accessories (like A/C) or parasitic leakage. EVTripPlanner's [Route Energy Planner](#) is actually much more accurate (it was off by 1-2% on this trip. You have to measure accuracy according to Rated Miles consumed since you can't use the Trip Meter numbers!).