When Will All Cars be Electric?

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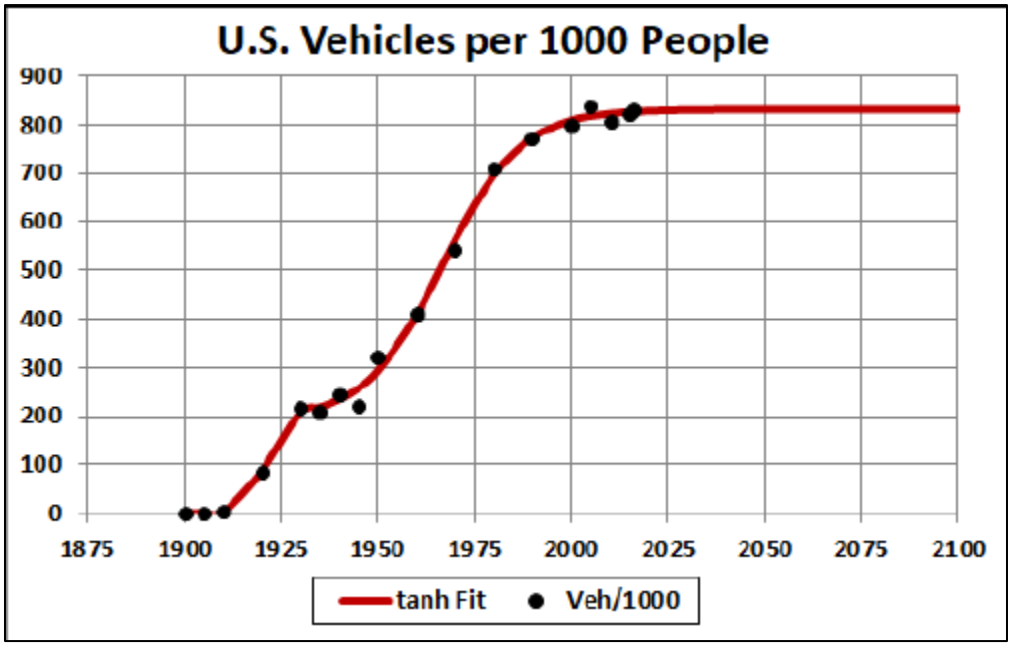
This is an attempt to estimate how fast electric cars will replace gasoline and diesel light vehicles, "cars" for short. It will use the data for cars for several past years. It is not always clear in the data whether pickups are included in the data for cars; it probably does not matter for this article as the "data" are rough estimates.

Definition of "Electric Car" or "Plug-In Car":

An electric car (EV) is any car with a battery that provides part or all of the energy for movement of the car and for which the battery can be charged from the grid or solar panels. This includes plug-in hybrid cars (PHEVs) and battery-electric cars (BEVs), but not hybrid cars. The data so far indicate that about half of electric cars put on the road in the U.S. are PHEV and half are BEVs. This is probably changing in favor of BEVs because of the advent of the Tesla Model 3 sedan, of which almost 400,000 have been made and are being produced at about 7,500/week. Eventually all electric cars (and almost all cars) will have to be BEVs because no oil will be available for making gasoline or diesel. Of course, there probably will be some hydrogen cars. (Some fuel-cell hydrogen cars could be electric cars if an external charging port for the battery is present.)

Eventual Number of Cars on the Earth:

The number of cars per 1000 people in the U.S. are shown here:

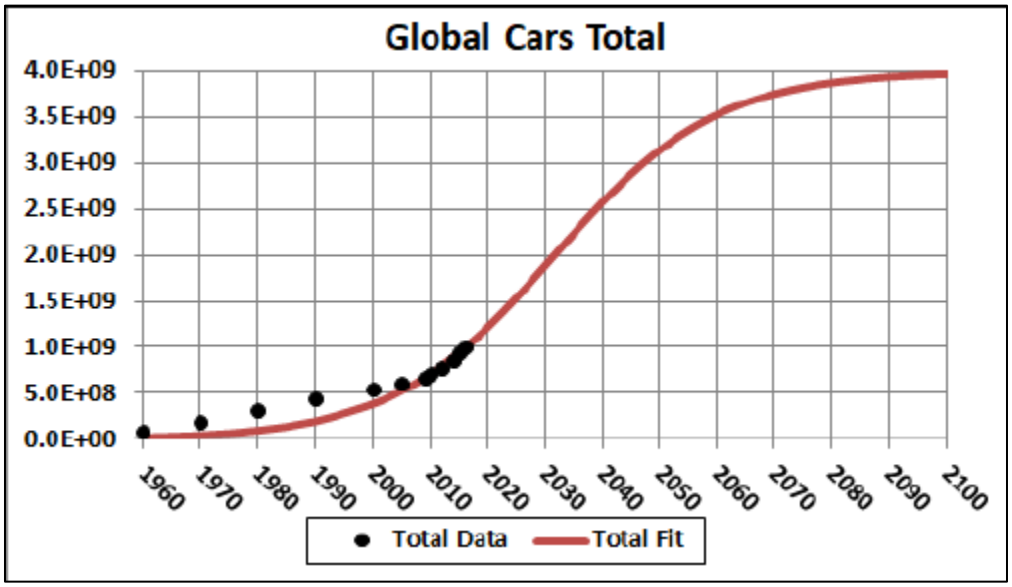


The red curve is a fit of two hyperbolic tangents to the data.

Assume that the leveling off at about 800/1000 will continue into the distant future and that the number of cars per 1000 people for the world will be about one-half of the U.S. value, 400/1000.

World population growth has been slowing down such that it appears that the asymptotic value will be about 10 billion. Multiplying that by 400/1000 yields about 4 billion for the eventual number of cars in the world.

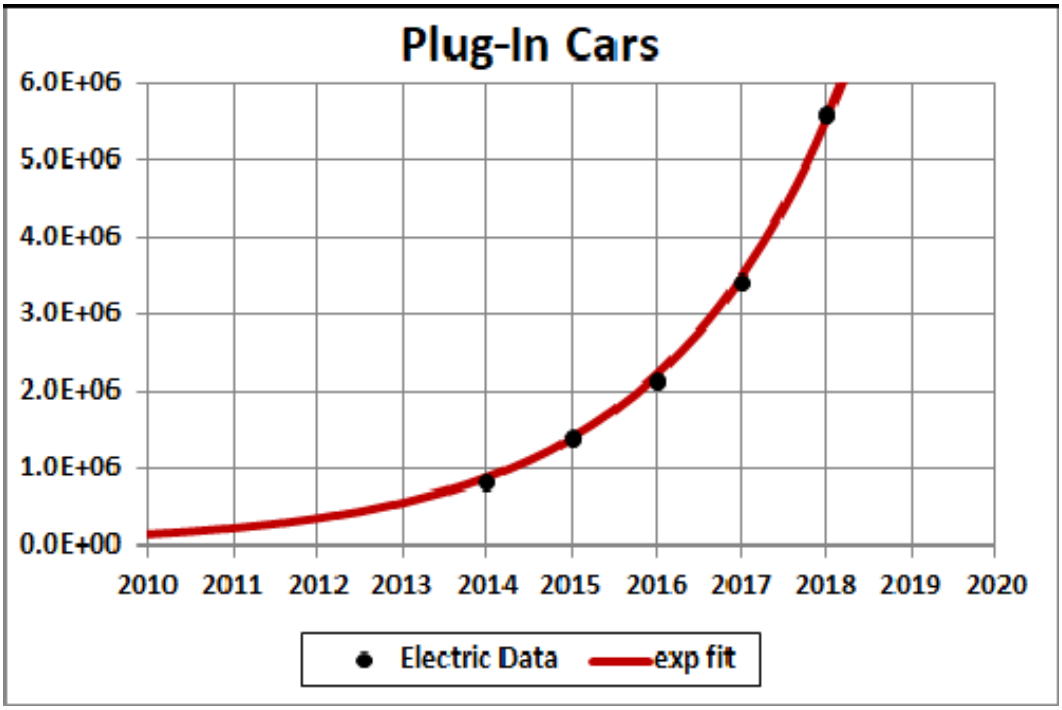
Fitting a hyperbolic tangent to the most recent data for the number of cars in the world and an asymptotic value of 4 billion yields:



The exponential time constant, rising and asymptotic, is about 28 years.

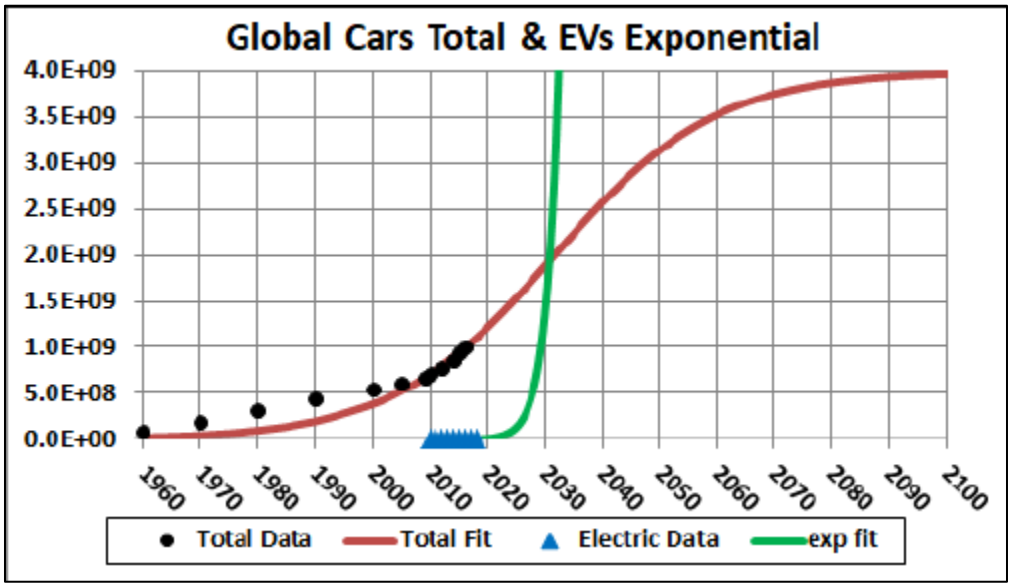
Eventual Number of Electric Cars on the Earth:

This graph shows an estimate of the number of electric cars in the world and an exponential fit to the data:

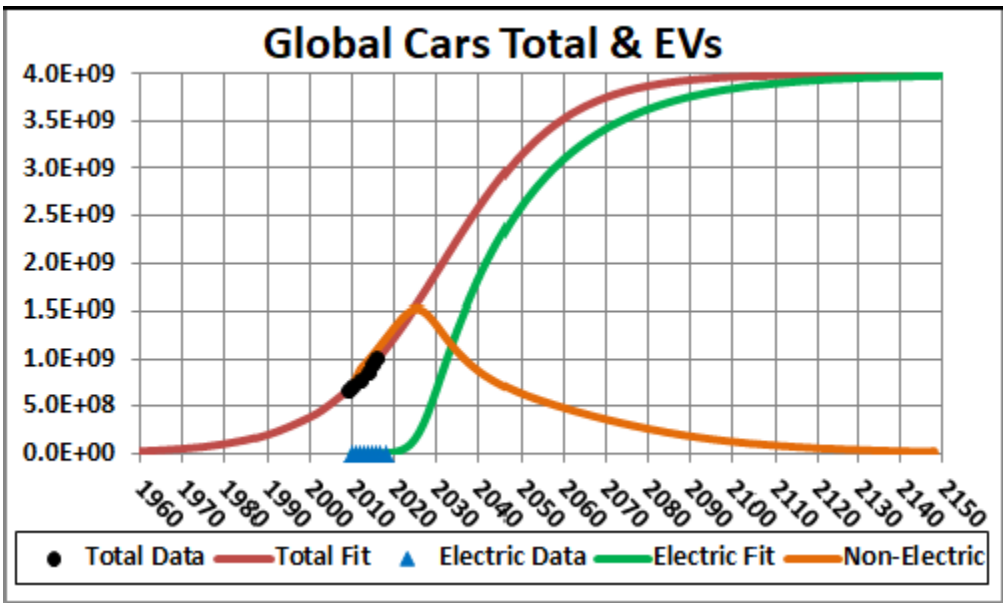


The exponential time constant is about 2.2 years.

Expanding the electric-cars exponential fit into future years compared to the total-cars curve yields:



Of course, the electric-cars green curve cannot be larger than the total-cars red curve starting at about year 2030. This can be fixed by using the Verhulst function which has the rising exponential time constant of about 2.2 years but a different asymptotic time constant. Thereby fold this exponential curve into a Verhulst-function curve that melds into the total-cars curve for far future years in order to estimate when all cars will be electric:

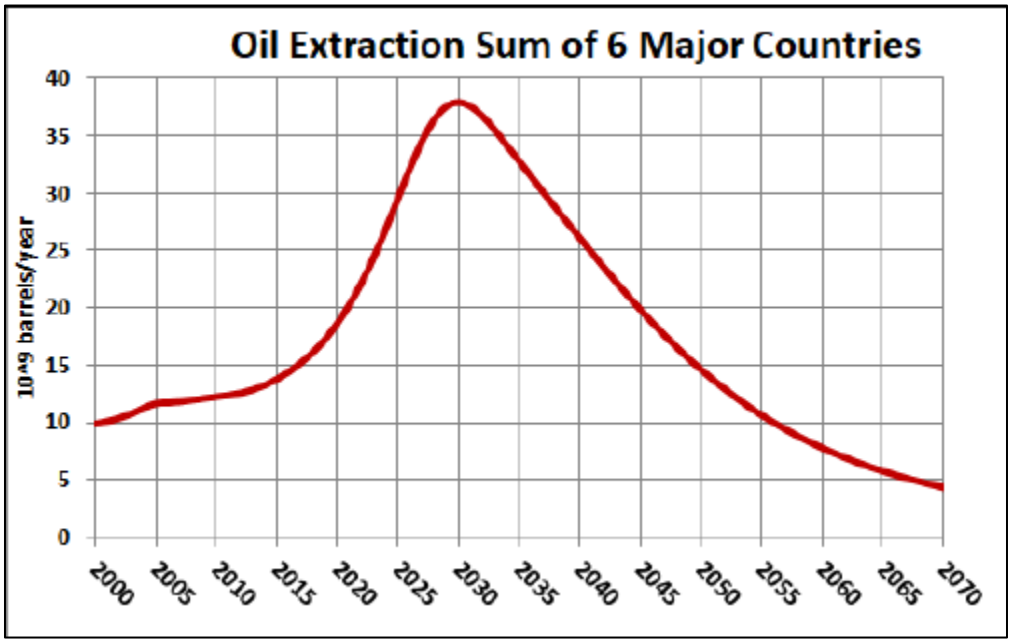


The electric-fit asymptotic time constant is about 23 years.
Number of non-electric cars on global roads (ICEVs) peaks at about year 2025.

If this analysis is approximately correct, about half of the cars in the world will be electric by about year 2035 and almost all cars will be electric by 2100. Probably by 2100 almost all electric cars will be BEVs with few PHEVs.

If the final number of cars in the world is more than 4 billion, the Verhulst function melding electric-cars data into total-cars data would have a different set of parameters.

The future electric-cars estimate calculated above corresponds well with an estimate of the maximum amount of oil that can be extracted for the six major oil-extracting countries in the world as a function of time:



Maximum oil extraction for the six major oil-extracting countries peaks at about year 2030, about 5 years after number of ICEVs on global roads peaks.

References

- Oil Industry To Crash & Burn By Early 2030s
- https://ark-invest.com/articles/analyst-research/finding-signal-in-noisy-auto-data