Wheel to Well Analysis of EVs

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As green vehicle technologies become more popular and enter the market, consumers have questions about the validity of their environmental impact. Compared to internal combustion engine (ICE) vehicles, do electric vehicles (EVs) actually use less energy and emit less carbon dioxide (CO2)? To answer this question, analyses have been conducted that account for all of the energy consumed and green house gases (GHG) emitted from the time a vehicles energy source leaves the well to the time it is consumed by the vehicle. These analyses are known as well to wheel studies. From these analyses, EVs have been shown to reduce energy consumption by up to 50% and GHG emissions by up to 60%.

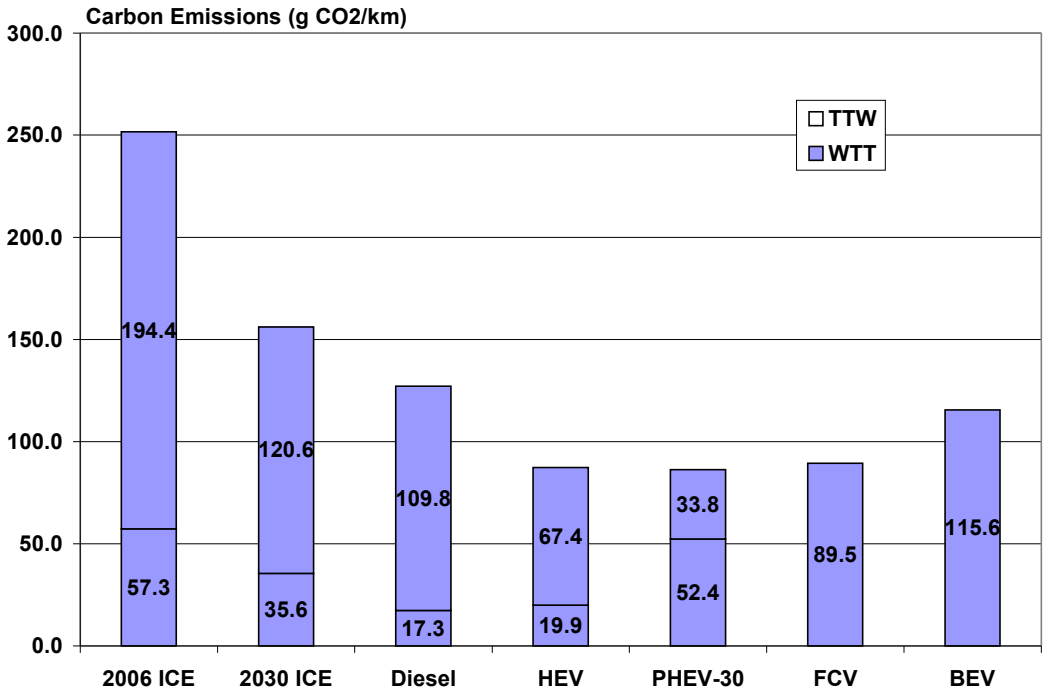

Figure 1: Well-to-wheels (WTT) and Tank-to-wheels (TTW) analysis of carbon emissions for conventional and advanced vehicles [Kromer 2007]

There are many factors to be considered in estimating the well to wheel emissions of an EV. First, consider the production of its energy source, electricity. In the U.S. electricity is produced in a number of ways. Fifty percent is produce using coal, an emissions heavy process. Twenty percent of the country's electricity is produced by nuclear power, a process with a negligible emissions footprint. As a result, an electric vehicle that is charged using coal produced electricity will have a much larger footprint than an EV using electricity derived from nuclear power. The data above reflects the well to wheel footprint of an EV using a "U.S. mix". This accounts for different modes of electricity generation by modeling the EV as using each form of electricity in the same proportion as it is used in the U.S.

Source:

Kromer, M. A.; Heywood, J. B. (2007) *Electric Powertrains: Opportunities and Challenges in the U.S. Light-Duty Vehicle Fleet,* MIT Laboratory for Energy and the Environment, Cambridge, Massachusetts.