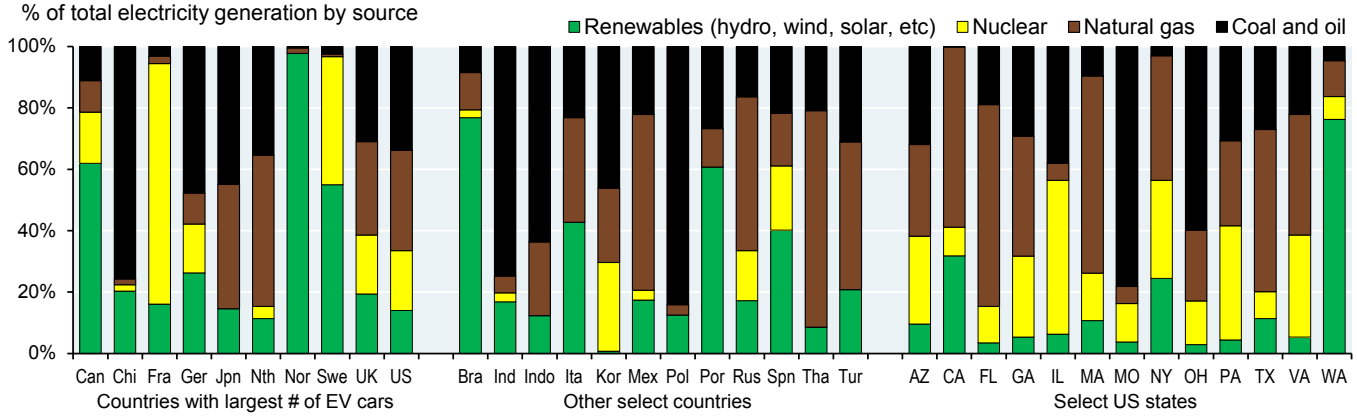
Sparse penetration aside, how "green" are EVs compared to hybrids?

Energy use and GHG comparisons of hybrids with EVs are very complex. A comprehensive "well-to-wheels" analysis has to factor in the current electricity mix and how it's changing over time, energy used and lost in transmission of electricity and gasoline, energy used on oil extraction and refining, energy used in the manufacturing of EVs vs. hybrids, battery disposal and other subtleties such as driver habits.

Based on data from the ICCT and a November 2015 paper from the Union of Concerned Scientists, our sense is that the GHG footprint of a full hybrid like the Prius is roughly the same as an EV in a state with the ***average*** US electricity mix. The chart below shows the electricity mix by country and by US state. Where coal usage is high, hybrid cars can produce better GHG results than an EV. As penetration of renewable energy increases, the EV becomes the greener choice.

How Green is My Valley: the CO_2 footprint of your electric car is heavily dependent on where you live



Source: World Bank (2014) for countries, EIA (2015) for US states, JPMAM.

A few things to keep in mind when looking at this chart:

- ***Coal vs. natural gas***. An EV charged by a grid powered 100% by natural gas has ~50% of the GHG footprint of an EV charged by a grid powered 100% by coal. Of the countries shown, only the US experienced a double-digit decline in coal's share of generation from 2006 to 2014, mostly due to expansion of natural gas. From 2006-2014, coal's share of *global* electricity generation was unchanged.
- ***Renewable energy mostly hydro***. As per the chart on page 1, green renewable energy segments are mostly made up of hydroelectric power, whose global share of electricity generation was 3.6x higher than wind and solar power combined in 2015.
- ***How green is nuclear*?** Difficult question. The Clean Air Task Force, climatologist James Hansen of Columbia University, David Mackay of Cambridge, Robert Hargraves from Dartmouth and 65 biologists who signed an open pro-nuclear letter in 2015 support it. On the other hand, there are disturbing reports of Fukushima's aftermath: rain and other sources of water flowing through the site and becoming radioactive, some of which seeps into the ground or the ocean; signs that cesium and strontium were still leaking into the ocean as of 2013; and the lack of knowledge as to exactly where the molten cores from the reactors are located. I don't know what color to make the nuclear bars in the chart: green when it works and vantablack (the darkest color in the universe) when it doesn't?