Electric vehicle footprint analysis is misleading

Tessum et al. (1) use state-of-the-art spatial models to evaluate electric vehicle (EV) environmental impacts. Unfortunately, in my view, the article's assumptions and framing lead readers toward misguided conclusions. I believe that the decision to compare air quality with climate change dollar-for-dollar, invokes an inappropriate framing of competing with each other. This has led to misinterpretation in the media (2).

Furthermore, Tessum et al.'s (1) main EV impact analysis is primarily determined by the proportion of coal in the national "grid average," because their models show that EVs running on any other major generation source are far cleaner than gasoline vehicles. The article's grid average assumes a 2020 scenario, in which 10% of national miles driven are electric, powered by a 45% coal grid. The authors call it an "aggressive but plausible" (1) assumption. In fact, it is physically impossible.

First, EVs are 0.1% of the current United States fleet. Achieving 10% electric miles requires ~30 million EVs, or 6 million annual EV sales, on average, from now through 2020. However, in 2014 about 120,000 EVs were sold in the United States (3); this is approximately the current manufacturing capacity. Several major automakers (Toyota, Honda, Chrysler) are largely sitting out. Some EV makers plan to dramatically increase production starting in 2–3 years, but it will likely take at least until 2030 (optimistically speaking) to accumulate 30 million EVs on American roads.

Second, for coal proportion, Tessum et al. (1) use the Energy Information Administration's (EIA) 2011 annual outlook, but the 2013 outlook, lower by 5%, was already available. The EIA outlook still lags reality: from 2007 to 2013, the actual United States coal fraction dropped from 49% to 38%, already below the EIA's 2020 forecast and substantially below the 45% used in Tessum et al.'s article. All signs indicate the trend will continue: coal plant closures are announced frequently with almost no new ones built (4), and renewables increase faster than the EIA's projections. The EIA now adds a more realistic "accelerated coal retirement" version, forecasting coal fractions of 34% in 2020 and 29% in 2030 (5).

Third, because of local social and regulatory factors, early EV adoption occurs mostly on the West Coast (45% are in California alone). In that region, coal is almost absent from the grid. The coal fraction currently powering actual American EV miles is likely around 5–15%.

Setting aside the use of incorrect input numbers, there is the issue of overall context. EVs are a leading avenue for keeping oil below ground while switching transportation to a power source that can potentially become fossil-free. It would make little sense to simply swap one fossil source for another, and this is universally understood. Governments, EV makers, and drivers take tangible steps to ensure that EVs serve as a catalyst for accelerating the grid-cleaning process already underway. See for example, Tesla's launch of home and commercial battery storage units using technology developed for EVs, or the collaboration of governments and companies on vehicle-to-grid systems that turn the EV itself into a renewable-energy storage unit. These dynamics are completely missed by static analyses like Tessum et al.'s article (1).

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