LETTER

Reply to Oron: Electric vehicles provide an opportunity to reduce environmental health effects of transportation

Oron (1) argues that our study (2) uses "inappropriate" methods and is framed in a way that leads "readers toward misguided conclusions." Both of these arguments are misplaced and seem more focused on some media coverage of our article than on our article itself. Oron's (1) specific critiques do not call into question any of the main conclusions of our report (2).

Oron (1) argues that an economic comparison of the air quality and climate damages caused by transportation is inappropriate. However, using a common metric such as the dollar to compare different options in a cost-benefit analysis is a useful, widely used method for policy analysis (3).

Oron (1) states that our "main EV [electric vehicle] impact analysis is primarily determined by the proportion of coal in the national 'grid average'," and argues that we should have used a different estimate of future coal use. We make clear in our article (2), however, that the "grid average" scenario is not our "main EV impact analysis" (1) but just one possible scenario. Our text states: "Because year 2020 electric generation infrastructure is not predetermined, we explore a range of electricity technologies rather than attempting to predict future electrical generation and dispatch deterministically" (2). In general, we take the differences in coal fraction among projections to be evidence that the future electricity fuel mix is not predetermined, which reinforces our decision to frame our results as alternative scenarios rather than deterministic predictions.

Oron (1) states that the number of vehicle miles traveled by EVs in our year 2020 scenarios is "physically impossible," and puts forward his personal prediction for EV adoption. We are not of the opinion that Oron sufficiently supports this "physically impossible" claim. Oron appears to have missed the point of our investigation. In our study (2) we compare a range of hypothetical scenarios using 10% of vehicle miles traveled as the functional unit. Some of the scenarios (e.g., corn ethanol) may be more likely to occur than other scenarios (e.g., EVs), but that does not make any of the conclusions of our article, which compare vehicles on a per mile basis, any less useful. Any adoption of EVs large enough to make a noticeable difference in air quality would likely include use of EVs in areas that currently include substantial amounts of coal in the electric grid mix. Electricity generation in these areas may or may not be cleaner by the time that EV adoption actually happens.

We find Oron's comment, "it would make little sense to simply swap one fossil source for another" (1) to be factually incorrect. Replacing coal with natural gas can be strongly beneficial for reducing air pollution, as our article (2) shows.

As we conclude in our report (2), EVs present an opportunity—the only opportunity we found in the scenarios we analyzed—to substantially decrease the health damages from our transportation system, but only if we as a society ensure that they are powered by electricity from low-emitting sources.

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1 Oron AP (2015) Electric vehicle footprint analysis is misleading. *Proc Natl Acad Sci USA* 112:E3973.

2 Tessum CW, Hill JD, Marshall JD (2014) Life cycle air quality impacts of conventional and alternative light-duty transportation in the United States. *Proc Natl Acad Sci USA* 111(52): 18490–18495.

3 U.S. Environmental Protection Agency (2000) *Guidelines for Preparing Economic Analyses*. Available at: yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-50.pdf/$file/EE-0568-50.pdf. Accessed June 14, 2015.

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