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Real-world usage of plug-in hybrid vehicles in the United States

BACKGROUND

Plug-in hybrid vehicles (PHEVs), which have both an electric motor and an internal combustion engine, made up around 20% of all electric vehicle sales in the first half of 2022. PHEVs can run entirely on electricity but can also utilize gasoline when the battery runs out. The most familiar PHEV model to many U.S. consumers, the Chevrolet Volt, has a relatively small gasoline tank which acts as a range extender. However, most new PHEVs sold today blend motor and engine usage simultaneously, leading to significantly more fuel burn. PHEVs offer the potential to deliver significant greenhouse gas (GHG) savings compared to conventional gasoline vehicles if driven primarily on electricity, but the size of that benefit depends on driver behavior.

Previous research has suggested that U.S. drivers utilize nearly the full electric range of their PHEVs. In its fuel economy labeling and light-duty vehicle regulations, the U.S. Environmental Protection Agency (EPA) assumes drivers will drive more of the time in electric mode in PHEVs with larger batteries and longer electric range. A new ICCT study presents the most comprehensive analysis of real-world data on PHEV driver behavior, using two newly available datasets. California Bureau of Automotive Research (BAR) data includes 59 PHEV models and 1,465 individual vehicles that collectively traveled more than 24 million miles. The BAR data is automatically collected, not user reported or self-selected, and thus represents the most unbiased dataset available that covers many PHEV models. Fuelly, a website that tracks user-reported fuel economy, has data for 135 PHEV models, totaling 3,889 individual vehicles traveling over 97 million miles.

KEY FINDINGS

Real-world data shows that U.S. drivers use 42%–67% more gasoline and drive 26%–56% less on electricity than shown in EPA's fuel economy labels. The figure below shows the regulatory label curve of utility factor (black)—the share of driving performed in battery charge depleting mode—in comparison to the new Fuelly (blue) and BAR (orange) datasets. Each circle represents data for one vehicle model, and the larger the circle, the greater the sample size for that model. The best-fit electric drive share curves for each dataset are shown in their respective color. These new datasets

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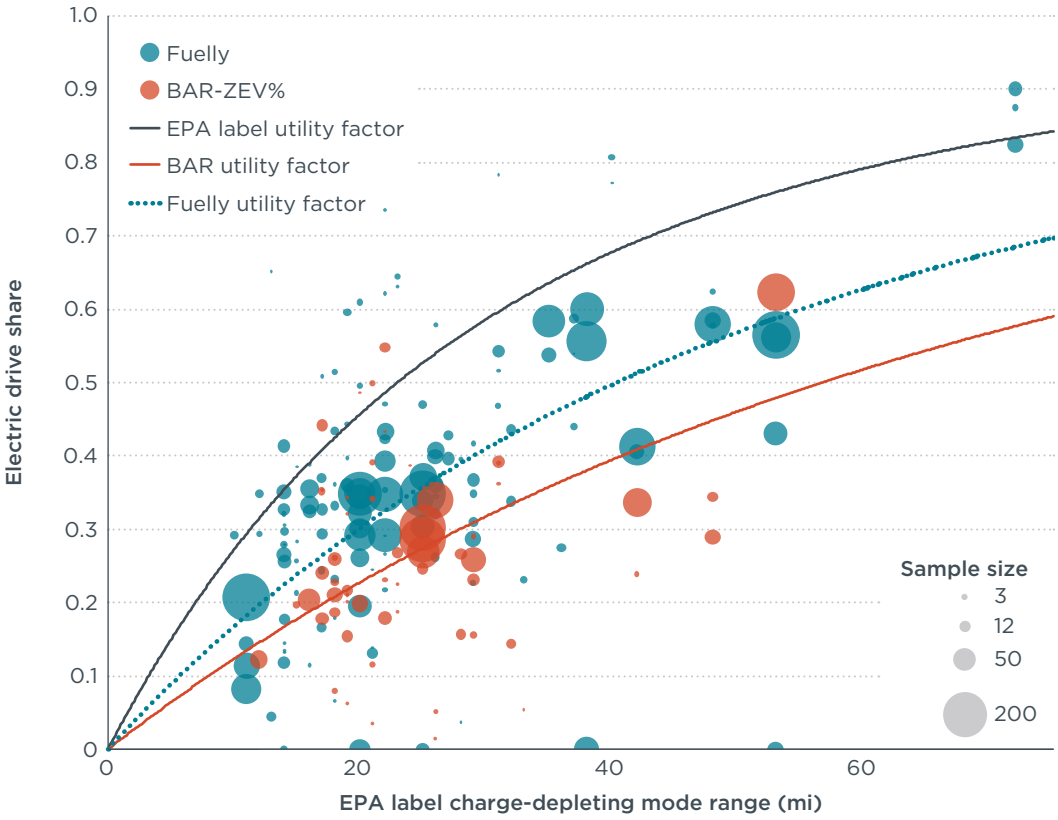
present strong evidence that real-world electric drive share is far below EPA's label rating. **Because EPA uses similar curves to calculate the electric drive share of PHEVs for its light-duty vehicle GHG standards, the agency is likely significantly over-crediting automakers for the GHG savings from their PHEV sales.**



PHEV electric drive share curves based on California BAR (using direct on-board vehicle measurement of all-electric travel fraction) and Fuelly (calculated from user-reported fuel consumption) datasets.

As might be expected, the self-selected user-reported electric drive share (the Fuelly data, in blue) is higher than that reported in the more unbiased data (the BAR data, in orange). This suggests that drivers who actively track their fuel consumption are more likely to charge their PHEVs, but when all drivers are considered, the electric drive share of U.S. PHEVs is far lower than recognized by EPA.

POLICY RECOMMENDATIONS

The results of the analysis suggest the treatment of PHEVs in the light-duty vehicle GHG standards is too generous. As all-electric driving is the only way to guarantee tailpipe emissions are eliminated or reliably reduced, regulators should consider all means of encouraging PHEVs be built and driven to maximize all-electric utility. Policy options include:

- Adjusting the regulatory electric drive share downwards for PHEVs to reflect current real-world performance.
- Requiring in-use data reporting for specific PHEV models to receive a higher assumed electric drive share.

- Adopting minimum all-electric driving range requirements, similar to California's range requirements for zero-emission vehicle crediting in its Advanced Clean Cars II regulation.
- Adopting other vehicle model-level technical requirements such as minimum all-electric power, maximum fuel tank size, fast-charging capability, and minimum cold weather performance.
- Relegating PHEVs which fail to comply with the updated requirements intended to increase real-world electric drive share to conventional, non-plug-in hybrid status within the regulations.
- Establishing a higher electric drive share corresponding to demonstrated purchase of PHEV by drivers with home chargers or proof of manufacturer-provided charging access assistance.

Meanwhile, manufacturers could incentivize regular charging by assisting in home charger installation and by actively reporting cost of driving to users. Tax administrators can incentivize PHEV purchases by offering purchase or tax credits for PHEVs whose in-use data show high utility factor.

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