OBJECTIVE AND SIGNIFICANCE: This project analyzed the state’s overall CO2 emission impact with increasing PV growth and electric vehicle (EV) adoption. While EVs can improve CO2 emissions, the amount of overall CO2 reductions depends on the generation mix of the underlying grid, the time of vehicle charging, and the fuel economy of the vehicle replaced. Because Hawaii’s grids are largely oil-based, additional EV loads still have significant carbon emissions.

Significant carbon reductions can be achieved by further decarbonizing the power grid, and by targeting the replacement of low fuel economy vehicles with EVs. Incentives may be better targeted toward replacing lower MPG vehicles with EVs, and to use EV charging for load management and demand response.

BACKGROUND: Hawaii’s power sector accounts for 32% of the annual CO2 emissions for the state, whereas transportation accounts for 58%. Therefore, it is critical to address transportation sector emissions, and the Electrification of transportation (EoT) has been identified as a key component to doing so.

While EVs have zero tailpipe emissions, they are not emissions-free. These indirect EV emissions depend on those of the electricity produced to charge the vehicle. Unlike on the mainland, where EVs have shown a significant emissions benefit, Hawaii’s current largely oil-fired generation reduces the emissions benefit of EVs.

PROJECT STATUS/RESULTS: Currently Oahu does significantly curtail solar generation, and it is expected that near-term, the grid will be able to accommodate additional solar growth. As a result, additional EV charging loads will be incrementally served by increased oil-fired generation - even for homeowners who own both rooftop solar and an EV - because absent the new EV load, that solar energy would have gone directly to the grid and used to offset oil generation. Because of this, replacing the average Hawaii vehicle with a hybrid has more emission benefits than an EV (Figure 1). Policies could be implemented to incentivize the replacement of lower mileage vehicles to increase the emission reduction benefits.

It is not until the grid is more fully decarbonized that the emissions savings from an EV are higher. As PV generation increases, so does the underlying emissions benefits (Figure 2). In addition, EV charging can be utilized as an effective load management tool, providing valuable grid services. This would allow for further PV adoption and improved emissions benefits.

Figure 1. CO2 emissions comparison

Figure 2. CO2 emissions reductions with increasing PV

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