

Vehicle-to-grid and intermittent renewables: Substitutes or compliments?

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Abstract

In this paper we ask: i) Who loses and who gains among the electricity market actors on vehicle-to-grid (V2G) adoption and ii) Will free market adoption of V2G by EV owners lead to the socially efficient adoption rate? Based on a theoretical model and simulations, we find: Increasing the share of EV owners with V2G tends to lower the expected price of electricity, which is good for all consumers of electricity. Still, even if the expected price of electricity decreases, the investment in renewable energy is spurred. This counter intuitive result is due the fact that electricity prices increase when weather conditions are good (for renewable energy), and since production in these periods is higher, the profitability of renewable investments improve with V2G.

Moreover, we show that the laissez fair market uptake of V2G is pareto optimal. The reason is that there are no scale advantages to V2G adoption, and thus, the marginal incentive to adopt V2G is perfectly aligned with the marginal benefit of V2G adoption. In a perfect market, in which electricity prices reflect scarcity and are not in any way regulated, there is thus no need to subsidize V2G. Finally, incumbent producers of base load electricity will loose on the decline in the expected price.