

Orchestrating incentive designs to reduce adverse system-level effects of large-scale EV/PV adoption - The case of Portugal

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Abstract-

The adoption of energy transition technologies for residential use is accelerated through incentive designs. The structure of such incentives affects technology adoption patterns, that is, the locations where new technologies are installed and used. These spatial adoption patterns influence network expansion costs and provide indication on potential cross-subsidization between population groups. While until today, most programs have been involuntarily favoring households with high-income and above-average educated population groups, incentive designs are currently under review. This paper presents a spatiotemporal technology adoption model that can predict adoption behavior of residential electric vehicle (EV) chargers and photovoltaic (PV) modules up to a predefined time horizon. A set of EV and PV adoption patterns for nine incentive design combinations are compared in order to assess potential synergies that may arise under orchestrated EV and PV adoption. Effects on adoption asymmetries are evaluated using an Information-Theoretic inequality metric. Results for Continental Portugal show that global network expansion costs can be reduced while minimizing technology adoption asymmetries, if specific incentive designs are combined.

Index Terms- Distribution systems; Incentive designs; Power system planning; Spatial analysis; Technology adoption

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