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Designing Distribution Network Tariffs in the US with an Application to Increased Electric Vehicle Adoption

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Abstract-

Time-of-use (TOU) tariffs that vary the cost per kWh to reflect wide variations in generation and wholesale market costs give incentives to shift all electric vehicle (EV) charging to low-price periods. As EV penetration increases, such tariffs would substantially raise the local kW demand in those low-priced periods, which eventually would lead to increasing network expansion costs. A straightforward way to mitigate this problem is to separate energy charges from network charges, with appropriate rate designs for each. This paper uses a realistic case study to investigate the implications of combining TOU energy charges with various network tariff designs in the face of increased EV penetration. Our results provide support for the adoption in the US of ex-ante subscribed capacity tariffs (subscription charges), which give consumers incentives to reduce their peak kW demands. Reducing costs of EV ownership (a priority for many US states) need not be pursued at the expense of broader affordability goals.

Index Terms- electricity retail rates, electric vehicles, electricity distribution networks, efficiency, equity, electrification

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