Net Metering and Market Feedback Loops:

Exploring the Impact of Retail Rate Design on Distributed PV Deployment

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Overview

Deployment of customer-sited solar photovoltaics (PV) in the United States has been driven by a combination of steeply declining costs, financing innovations, and supportive policies. Among those supportive policies is net metering, which in most states effectively allows customers to receive compensation for distributed PV generation at the full retail electricity price. This has elicited concerns about under-recovery of fixed utility costs from PV system owners that could lead to increased retail electricity prices for all electricity customers. In part to address these concerns, an increasing number of states are exploring changes to net metering rules and/or retail rate structures. Such changes would impact how much PV customers contribute to utility fixed costs, but would also impact the value of PV to host customers and hence overall PV deployment levels.

This study investigates how various retail rate designs and PV compensation mechanisms might impact total PV deployment. Our results demonstrate that future adoption of distributed PV is highly sensitive to retail rate structures. Whereas flat, time-invariant rates with net metering would lead to higher deployment levels, moving towards time-varying rates, rate structures with higher monthly fixed customer charges, or compensation at prices lower than the full retail rate can dramatically slow long-term customer adoption of PV.

The report also considers the possibility of feedback effects, where increases in solar deployment impact retail electricity rates that in turn impact PV compensation and future deployment levels. The first feedback considered results from the possible impact of PV on increasing retail electricity prices as fixed utility infrastructure costs are spread over a shrinking base of electricity sales, thereby further increasing PV deployment. The report shows that this commonly-noted feedback effect is mitigated by another, less-recognized feedback effect between solar deployment and the timing of peak electricity prices, which reduces bill savings for solar customers on time-varying rates. Currently, solar generation coincides reasonably well with peak wholesale electricity prices in many regions, but as solar generation increases, peak price periods are likely to shift to later in the day. Our results indicate that, at an aggregate national level, the two feedback effects nearly offset one another and therefore produce a modest net effect. Their magnitude and direction can vary by rate design and by state, however, highlighting the importance of understanding these effects at the regional level and for different customer groups.

Methods and Data

The analysis leverages NREL's Solar Deployment System (SolarDS) model, which simulates distributed PV adoption by residential and commercial customers within each U.S. state through 2050. We build on prior applications of this tool by incorporating two key feedback mechanisms between PV adoption and retail electricity prices related to: (a) increases in average retail rates required to ensure *fixed-cost* recovery, and (b) changes in the timing of peak and off-peak periods under *time-varying* rate structures. In doing so, we show whether and under what conditions retail rate changes caused by distributed PV might either accelerate or dampen future PV deployment. Given these feedback dynamics, we then consider deployment trends under a range of possible changes to retail rate design and net-metering rules, including widespread adoption of fixed customer charges, flat vs. time-varying energy charges, feed-in tariffs, and partial net metering (whereby PV generation exported to the grid is compensated at an avoided-cost-based rate).

This fact sheet summarizes the full report: N. Darghouth, R. Wiser, G. Barbose, A. Mills. 2015. *Net Metering and Market Feedback Loops: Exploring the Impact of Retail Rate Design on Distributed PV Deployment*. Berkeley, CA: Lawrence Berkeley National Laboratory. The full report, along with a summary slide deck, is available here or via emp.lbl.gov/reports. This work was funded by the Solar Energy Technologies Office, Office of Energy Efficiency and Renewable Energy of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

Results and Conclusions

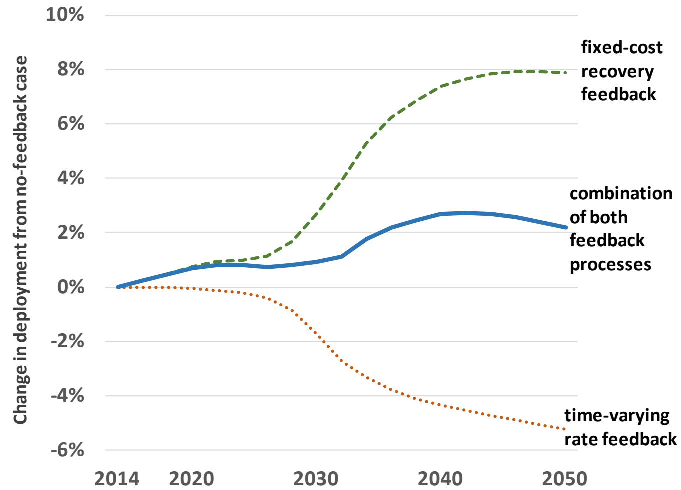

Figure 1. Difference between national PV deployment with and without feedback under the reference scenario

Considering both feedback effects, we find that distributed PV deployment grows to 157 GW in 2050 under a reference scenario that includes net metering and is based on current rate designs (and therefore includes some customers on time-varying rates—mostly in the commercial sector—and others on flat rates—mostly in the residential sector). Our analysis further suggests that, at an aggregate national level, the two rate feedback mechanisms largely counteract one another under this reference scenario (Figure 1). The fixed-cost feedback effect, in isolation, increases cumulative national PV deployment in 2050 by 8% relative to a scenario in which the feedback effect is ignored, while the feedback associated with a temporal shift in peak period electricity prices reduces cumulative PV deployment by 5%. Depending on the particular region or rate design, the net impact of these two feedback mechanisms can differ substantially from these aggregate national results. Nonetheless, current discussions that focus largely on the fixed-cost recovery feedback miss an important and opposing feedback mechanism that can moderate the issue of concern.

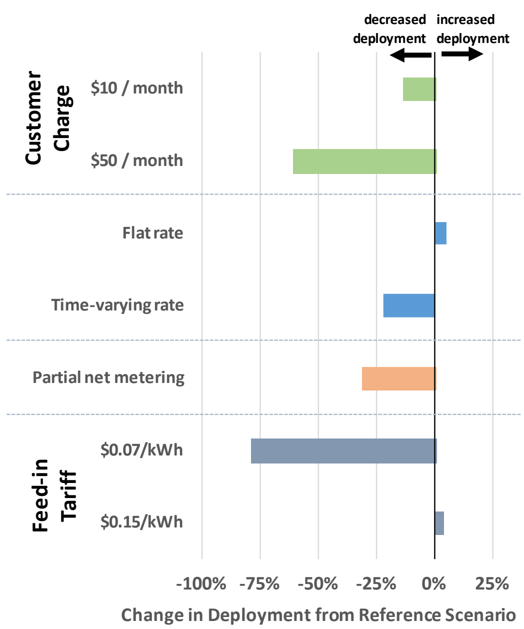

Figure 2. Change in modeled cumulative national PV deployment by 2050, relative to reference scenario (feedback effects included)

In part to address concerns about fixed-cost recovery, a number of utilities have proposed increased fixed customer charges, especially for the residential sector, and/or a phase-out of net metering. Though a variety of considerations must come into play when contemplating such changes, our analysis suggests that a natural outcome of these changes would be a substantial reduction in the future deployment of distributed PV: we estimate that cumulative national distributed PV deployment in 2050 could be ~15% lower with a $10/month residential fixed charge, ~60% lower with a $50/month residential fixed charge, and ~30% lower with "partial" net metering, when compared to a reference scenario based on a continuation of current electricity rates and net metering.

Indeed, as seen in Figure 2, retail rate design and PV compensation mechanisms can have a dramatic impact on PV deployment levels Regulators will need to weigh these impacts with many other considerations when considering changes to underlying rate designs and PV compensation mechanisms.