Compensating Solar Prosumers Using Buy-All, Sell-All as an Alternative to Net Metering and Net Purchasing: Total Use, Rebound, and Cross Subsidization

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Net metering (NM), currently used by 40 US states, compensates owners of solar PV systems who generate more electricity than they consume by crediting solar generation at the retail rate. However, there is increasing pushback to NM from electricity providers who argue that NM does not reflect the value of solar (VOS) to the utility. A cost-reflective rate would measure VOS as it affects electricity system generation, transmission, and distribution, operations and maintenance, and environmental attributes (Brown and Sappington (2017)). Furthermore, household solar generation is intermittent and not under the control of the electricity dispatcher, which requires ancillary services such as backup generation and technology to stabilize electricity system frequency and voltage.

To date, there is very limited empirical evidence on how solar pricing using NM affects electricity use, much less alternatives to NM. Given the resistance by solar proponents to replacing NM, the alternatives so far have attempted to maintain simplicity, while trying to address the utility-side concerns that solar customers are not paying enough to cover capacity costs and that prices do not reflect VOS, and the related fairness issue that non-solar customers are experiencing higher bills given the smaller contribution by solar customers.

Austin Energy is the first US electricity provider to replace NM with Buy-All, Sell-All (BASA), also known as Gross Metering (GM). BASA requires separate metering of solar generation and electricity consumption. Separate metering allows the provider to pay a different rate for solar generation than the customer pays for purchases from the grid. Under BASA, the customer buys all of its electricity from the utility at the retail rate and sells all of its solar-generated electricity to the utility at the VOS rate; the household can no longer self-consume its solar generation.

Net purchasing (NP) is another mechanism that is similar to NM, in that customers can consume what they produce, only buying from the grid when their total electricity consumption exceeds their solar generation. But like GM, there are separate meters to track solar sold to the electricity provider vs. electricity purchased from the grid. The electricity provider can pay a different rate for the net exports than the rate it charges for electricity from the grid.

We develop a theoretical model to compare rates and cross-subsidization under the three mechanisms. We also incorporate the increasing block rate structure employed by Austin Energy. We derive propositions that shape our empirical analysis. Our model suggests rebound effects and cross subsidies for NM and NP but not for GM.

Pecan Street Dataport provides detailed data for a sample of Austin Energy customers, with a focus on the Mueller Street neighborhood where there is a high concentration of solar adopters. We examine customer load curves to gain intuition into the differences in energy consumption between solar and non-solar customers for varying home sizes. We then use regression analysis to compare

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total electricity consumption for solar and non-solar customers in the Mueller Street sample. In particular, we consider whether solar generation (and compensation for generation) results in a rebound effect, whereby solar customers increase their total electricity consumption as compared to non-solar customers. Finally, we simulate customer bills under BASA and compare them to NM and NP. We compare customer bills under the three rates as well as cross-subsidies between solar and non-solar customers.

The load curve comparisons suggest that solar PV customers have higher consumption than non-solar customers during late afternoon and evening hours. We find from the regression analysis that solar customer air conditioning use, but not total use, is sensitive to the size of solar credit they receive. An increase in solar generation of 10 kWhs, resulting in a solar credit of about $1, increases air-conitioning electricity consumption by about 2 kWhs, a 20% effect. We interpret this as a rebound effect with a similar magnitude to that found by Deng and Newton (2017), who examined a GM rate in Australia.

The simulations show that net metering and net purchasing typically result in lower consumer bills and larger cross- subsidies than BASA, with almost 18 percent of bills of net metered and net purchasing prosumers paid by non-solar customers. But the comparisons depend on the structure of the tiered retail rates for all three rates as well as the rate paid for for solar under NP and GM. Finally, we simulate a flat rate in place of an increasing block rate, which reduces cross-subsidies to under 7 percent.