On the Fairness Debate Surrounding Electricity Tariff Design in the Renewable Energy Era

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See footnotes at end of text.

Households have begun to seize the means of (energy) production. Germany (Karl Marx's birthplace) was the first region to widely adopt small-scale electricity generation from renewable sources (Wirth 2020). Other regions, such as the U.S. state of California, are quickly catching up. As these residential generation units grow in number, the electricity tariffs used for households no longer seem suitable for an entity that both consumes and produces: a prosumer.

Energy is generally considered to be a public good; historically, pricing it has been a matter of not just economics, but also politics (Yakubovich, Granovetter, and Mcguire 2005). The debate surrounding electricity tariff design hosts the usual suspects. These are utilities, generation companies, grid operators, public regulators, politicians, and some relevant consultants. Recently, these stakeholders have been joined by the manufacturers, financiers, and installers of small-scale renewable energy systems. The arguments and concerns in the tariff debates have also changed.

One particular concern for all sides is fairness. Let's be clear about what "fairness" is in this context, or better to phrase what it is not: the undue transfer of costs from one consumer to another (Bonbright 1961). All stakeholders tend to agree that this is bad, but disagreement remains on the word "undue" (Heald 1997). Utilities find it "undue" to charge some tariff subscribers more and others less for the same product. Regulators find it "undue" to transfer a cost burden from the privileged to the disadvantaged. Households and generation companies, however, may have made large investments based on returns from a specific tariff. They would find it "undue" to have the tariff changed before their financial returns are realized.[1] For now, let's focus on the first definition, i.e. when customers pay more or less than they should for electricity.

With this definition, unfairness can appear in different ways. One of these is from a utility's fixed and/or sunk costs, which mostly reflect grid capacity investments and operations/maintenance (Simshauser 2016). Utilities often recover some or all of these costs from a per-kWh fee. If a household owns solar panels, they take fewer kWhs from the utility, and thus pay less of the fixed and sunk costs. But the utility must recover these costs regardless of how much energy it sells. When it inevitably increases prices to cover the revenue shortfall, solar non-owners are the disadvantaged ones who pay more than they would have otherwise. Hence, non-owners end up covering the fixed and sunk costs for solar owners.

The revenue shortfall complaint surfaces often, especially from utilities based where solar energy is growing. The U.S. states of California, Nevada, and Arizona have witnessed many such complaints towards public utility commissions (Klass 2019). For these commissions, and regulators in general, there are more concerning implications too. Solar panel owners tend to be well-off (Borenstein 2017), so there's an implication of cost transfers from the wealthy (owners) to the median (solar non-owners) energy user. In other words, there are wealth transfers from the median to the wealthy. Thus, regulators become particularly concerned, as this constitutes their form of "undue". Solar energy interest groups have a common retort to this: solar generation creates benefits for multiple stakeholders, both within and without the immediate tariff debate. These benefits can offset the wealth transfers, perhaps even negate them. However, there is widespread disagreement about these benefits and their extent (Klass 2019). Moreover, costs are incurred for the utilities, while benefits are for households and businesses (and the environment, of course). Principle agent problems are not lost on the public regulators, who are then faced with the need to internalize these benefits for utilities.

One common solution is to price a household's electricity generation separately, based on a Feed-in tariff. Pricing consumption and generation together, the reasoning goes, masks the differing burden and benefit of a household's generation versus its consumption. For example, consumption pricing would include fixed costs, generation benefits shouldn't. Likewise, generation benefits would include clean energy incentives, but consumption shouldn't. If both are priced separately, one can price benefits and costs as one sees fit.

But does this reasoning hold in the real world? We used some household consumption and generation and pricing data from Austin, Texas, to look into this.[2] For a set of households owning solar photo-voltaic panels, we compared the real costs of electricity trade with their tariff bills. The difference measures how equal are subscribers' costs and benefits, assuming that the utility generates revenue equal to costs. For a set of representative tariffs, from flat rates to real-time dynamic pricing, the conclusion is the same: fairness does not depend so much on whether or not we separate generation.

This result is driven by two important factors. First, Texas has a well-functioning Renewable Portfolio Standards market for solar generation, whose compensations trickle down to households in a way that offsets some of the utility's sunk and fixed costs.

Second, solar generation in Austin, TX, often offsets some of the customer base's peak energy demand, lessening the capacity burden on utilities by about 10%. The former is rare (for now), but the latter is common in many regions, especially those with high demand from air conditioning devices. The end-result is that solar owners indeed pay less than non-owners, but their benefits to the utility compensate for much of this loss.

Regulators also have other tools to internalize solar costs and benefits. One could separate fixed costs as a bill item, as Arizona and Nevada utilities have done with mixed results (Klass 2019; Singh and Scheller-Wolf 2017). However, such fixed costs would be a disproportionately larger burden on low-income households than high-income households.[3] This concern of regulators leads them to disfavor fixed costs as a means to solve the revenue shortfall issue. In other words, regulators appreciate the previous cross-subsidy that existed when all costs were contained in a per-kWh charge. Yet some research, e.g., (Borenstein 2012), has shown that simpler means-tested programs can perform equally well, with fewer side effects. Separating these implicit cross-subsidies into a means-tested program seems like an easy but important step in the solution.

Another promising development, smart meters, can also simplify solutions. Smart meters (more precisely, advanced metering infrastructure) measures a user's electricity consumption (or generation) on a far more granular basis than legacy meters, with automated communications (and in some instances, control) infrastructure. In many regions, smart metering programs have shown significant cost savings for operations and maintenance activities. Smart meters can also provide price signals to households, increasing their responsiveness to electricity prices (Office of Electricity Delivery and Energy Reliability 2016). A consequence of this frequent measurement of electricity is the ability to price electricity with more granularity, leading to fewer unfairness concerns. Indeed, our research found that using smart meters, combined with suitable tariffs, could greatly reduce pricing unfairness. Compared to flat-rate tariff with legacy meters, even a simple time-of-use tariff with high daytime and low nighttime prices reduced the median cost transfer by an order of magnitude. Instead of debating whether or not generation units should be separately measured (and accounted), we should debate whether or not smart meters and smart tariffs should be used.

In the renewable energy era, many regulators still encourage households to install solar panels. Yet in so doing, these passive consumers transform into active and calculating prosumers. They may no longer view their electricity trade passively as an added household bill; rather, it becomes an investment with implicit positive social-environmental outcomes. For our dataset, the median household subscribed to a flat-rate per-kWh tariff unfairly paid (or gained) about 0.4% of median annual household income, or about $220: small on the median (albeit important for the poor). However, $220 is also equal to about 27% of the annual return on investment of an average solar PV installation in our dataset. The losers of this unfairness would complain about their lost returns on investment. The winners would complain about any change that would threaten their returns on investment. Hence, these prosumers would no longer view energy as a public good, but as something they can and should privately control. One could reason similarly with regards to electric vehicles, which make it possible to privately acquire the energy used for transportation, and smart meters, which give consumers the necessary information for optimizing their consumption. Energy is a public good; that is, it used to be.

Given these observations, two changes in the solar energy debate seem warranted. First, and foremost, there is a need for accurate and objective (and publicly disseminated) information about the costs and benefits of small-scale renewable energy installations. Some good examples are Value of Solar studies from the US states of Texas (Rábago et al. 2012) and Minnesota (Division of Energy Resources 2014). Second, electricity has become less of a public good and more of a marketable product. Much of the fairness consequences of traditional tariff designs reflect the designers' public goods approach. Electricity is in transition, however, to a private good and demands pricing that matches its nature. These two changes would ensure that all participants in the tariff debate can reach a shared understanding of what is and is not fair. It then becomes rather straightforward to turn the tariff debate into a tariff agreement.

Footnotes

[1] These mirror the terms used by (Burger et al. 2019). A survey among Dutch households of the meaning of "fairness" can be found in (Neuteleers, Mulder, and Hindriks 2017).

[2] We are grateful to the Pecan Street Dataport and the Electricity Reliability Council of Texas for granting us access to datasets, and to Austin Energy for their continued provision of public data.

[3] (Borenstein 2016) describes fixed costs recovery from various tariffs.

References

Bonbright, James. 1961. Principles of Public Utility Rates. New York, NY, USA: Columbia University Press. http://media.terry.uga.edu/documents/exec_ed/bonbright/principles_of_public_utility_rates.pdf.

Borenstein, Severin. 2012. "The Redistributional Impact of Nonlinear Electricity Pricing." American Economic Journal: Economic Policy 4 (3): 56–90. https://doi.org/10.1257/pol.4.3.56.

———. 2016. "The Economics of Fixed Cost Recovery by Utilities." The Electricity Journal 29 (7): 5–12. https://doi.org/10.1016/j.tej.2016.07.013.

———. 2017. "Private Net Benefits of Residential Solar PV: The Role of Electricity Tariffs, Tax Incentives, and Rebates." Journal of the Association of Environmental and Resource Economists 4 (S1): S85–122. https://doi.org/10.1086/691978.

Burger, Scott, Ian Schneider, Audun Botterud, and Ignacio Pérez-Arriaga. 2019. "Chapter 8 - Fair, Equitable, and Efficient Tariffs in the Presence of Distributed Energy Resources." In Consumer, Prosumer, Prosumager, edited by Fereidoon Sioshansi, 155–88. Academic Press. https://doi.org/10.1016/B978-0-12-816835-6.00008-5.

(References continued on page 30)