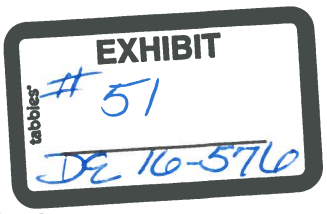

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The Net Metering Riddle

Net metering opponents have done a masterful job in casting the debate around mistaken assumptions. As regulators conduct NEM 2.0 and Value of Solar proceedings, those errant assumptions should be exposed and the real questions addressed.

Karl R. Rábago

Electricity Policy – the website ElectricityPolicy.com and the newsletter Electricity Daily – together comprise an essential source of information about the forces driving change in the electric power industry.

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After 25 years in the electric utility rate-making business, I have come to the conclusion that most rate "fairness" can be better understood if you keep this old math riddle in mind:

> *Three guys walk into a hotel and ask the manager if they can share a single room, none of them being able to afford a room on their own. The manager agrees, and charges them $30. Each man dutifully pays $10. As the men are headed to the room, the manager realizes that he has overcharged them—the room is priced at $25. He gives five $1 bills to the bellboy, and instructs him to refund the men. On the way to the room, the clever bellboy realizes that he will never make the men happy with $5 to divide among the 3 of them. He pockets $2, and gives $1 to each man.*
>
> *How much did each man pay for his share of the room? The answer is easy: $9.*
>
> *And 3 times $9 is $27. Add the $2 in the bellboy's pocket to get $29.*
>
> *Where is the other dollar?*

Spoiler alert: There is no other dollar. The riddle is arithmetic sleight of hand. The $29 is derived by adding where you should have subtracted, mixing up values on opposite sides of the equal sign. The math makes sense as

$27 minus $2, or $27 plus $3, but not as $27 + $2 + $1.

And so it goes with many rate making debates, especially those about net energy metering. Here is a net metering riddle:

> *The average retail customer consumes 100 kWh of energy. The average solar residential customer generates 75 kWh with her solar system. The bill credits her and charges a net bill of 25 kWh. The utility asserts that it still had 100 kWh of cost for serving the customer. And the utility wants to know, "Where will the 75 kWh worth of lost revenue come from?"*

Spoiler alert: Don't start charging the solar customer or other customers. There is no 75 kWh in lost revenue. The utility fully charged the customer for that 100 kWh—and then the customer earned an offset credit against that charge. The credit reflects a reduction in utility costs that were and will be avoided by the solar energy generation. In cost-plus-based pricing systems, reductions in costs mean reductions in revenue requirements. As with our three hotel guests, the assumptions in the riddle and the ultimate question should be carefully scrutinized, and not simply accepted. Net metering (sometimes called net energy metering) is a rate mechanism that bills or credits customers for their net consumption charges; the net of their consumption charges and their generation-offset credits.

At the heart of solving the net metering riddle is the realization that the net metering credit is not a tool to avoid actual costs that were incurred. It is a mechanism that provides customers an offsetting billing credit for reducing the costs fairly attributed to their use.

This essay addresses a number of assumptions that, like those in the riddle, are either outright false or misleading. These include:

—that net-metering customers avoid being fully charged for their use of the grid;

—that offset credits are a payment for a sale, and that the offsetting process inherent in net metering is a sale for resale;

—that subtracting wholesale prices from retail rates is a fair measure of the full value of solar energy;

—that customers create utility costs by reducing their use of electricity;

—that special charges to customers who reduce their use through solar generation (or any other means, for that matter are the proper treatment for revenue deficiencies and;

—that any discussion of fair rates for customer-generators can proceed without a full and fair evaluation of all the costs and benefits of solar.

Full and fair evaluation of the Value of Solar is an absolutely essential first step in addressing the challenges and issues raised by net energy metering. Indeed, such analysis has been a foundation for all of the meaningful policy initiatives addressing net metering. Where the Value of Solar has been ignored,

the results have been less than satisfactory. Understanding the costs and benefits of solar is central to economically-efficient rate design and distributed generation policy.

Now let's dispose of the false assumptions one by one.

First, how does net metering actually work? A little history is in order. Net metering is a legacy rate design from the analog days. The spinning metal disk meters that utilities once deployed (many are still in place) could only measure the *net* progress of the meter. Even though every unit of consumption applied spin force in one direction, and every unit of self-generation applied opposite force, the analog meter could only tell you the position of the meter on the day it was read. The math of the net metering rate with an analog meter is pretty simple.

> (Gross Consumption – Gross Production) x Retail Rate = Bill

And you will remember from grade school that this formula is exactly the same as:

> (Gross Consumption x Retail Rate) – (Gross Production x Retail Rate) = Bill

This means that every customer-generator with net metering is fully charged for every unit of their consumption. This is true whether the customer generates electricity or not. That is what the function of the meter ensures.

Contrary to the popular understanding, net metering customers do not *avoid* any charges. Rather, they *offset* those charges with self-generation. Opponents of net metering use "avoid" to inaccurately portray the result because it serves their argument. It's just like asking, "Where is the other dollar?" in the hotel room riddle, nothing more than an assertion of a false premise buried in a question.

Words matter. The customer-generator avoids *paying* the amount they would have paid if they had used more, but that doesn't mean that the customer generator avoids paying for a *cost* they *created*. The utility claims, in effect, that it has incurred a cost to serve that customer, and that this is a sunk cost and an obligation of that particular customer. Three points undermine this argument.

First, there is a non-trivial question of whether that sunk cost was prudently and reasonably incurred. Many advocates have long pointed out that energy efficiency and distributed generation markets are growing, and will reduce the need for costly utility infrastructure. There is reason to ask whether some systems are overbuilt and unnecessarily costly.

Second, there is the notion that the customer-generator "uses" the system to sell its excess generation. Customer-generators are not selling electricity into the market. An offset credit is not a payment for a sale. At any rate, the utility takes the customer's excess generation and sells it to other customer at its retail rates, and does so immediately.

Third, there is a fundamental question whether a customer should ever be required to pay the utility for not using the system or not using as much electricity as the utility

believed/hoped/forecasted that she would. There is no legal, regulatory, or policy precedent for this notion, for very good reasons.

Now let's take the case of the utility service provider that has incurred a now-sunk cost, and assume that cost was prudently incurred and deserving of cost recovery. The rate set for that cost recovery is supposed to be allocated according to cost-causation; rate-making assigns those costs to customers according to their use of the system. Absent proof that a customer-generator creates some of that cost through the way she uses the system—and when she uses it—the cost should be assigned only to those customers who do indeed use it.

Costs should be recovered from cost-causers. If a customer takes action on their side of the meter to reduce their use, they will pay less of the total cost allocated to customers in that class. This is true whether that reduction in use results from solar self-generation, installation of energy efficiency measures, changes in occupancy and use, or the unlikely event that the resident teenagers suddenly remember to turn off the lights. Assuming nothing else changes in consumption patterns, remaining customers who do not reduce their use will—like the use-reducing customer—face incrementally higher rates when the projected sales volume is permanently reduced.

Revenue deficits for the utility attributable to net metering are limited to the period between rate cases, and are solely a product of poor forecasting or reduced sales that could not reasonably have been anticipated. In the event of imprudent utility overbuilding, these investments may even be permanently stranded, and never recovered through sales. Future test years and frequent rate cases can help ensure that the financial integrity of the utility—primarily, its access to adequate working capital—is not impaired. Prudent utilities will calibrate their capital spending to market realities.

With this overview in place, it is time to dive into the flaws in anti-net metering arguments in a bit more detail.

Does *not* using electricity create a cost? I say "cost" because utilities operate under cost of service regulation. The answer is "no." In the net metering argument, the utility position that a cost is created arises from the fact that the customer with a solar system is no longer using the average amount of energy for a customer in that class, or that the customer would have needed if she had never generated any for herself. The utility argument is, implicitly, that it had "counted on" collecting an average amount of its fixed costs from all customers through its volumetric energy sales, so customers that use less than they had, or less than the utility assumed, are "not paying their fair share" and "avoiding responsibility" for system costs.

Where's the other dollar?

Deviations from average or assumed consumption levels do not give rise to a cost for which a utility is entitled to recovery, especially not from the customer who failed to meet the utility's expected level of consumption. There is a legal argument

behind this, having to do with the way tariffed service by monopoly providers work. It makes no sense that a monopoly utility should ever be allowed to charge for service that it does not provide.

The idea that the utility could charge a customer for electricity the customer does not use, for whatever reason, evokes a creepy kind of socialism that only a monopolist could support. Three men walk into a hotel. To save money, they ask if they can share a room. The hotel manager says, "Yes, but you each have to pay $25 because we forecast earnings based on a revenue-per-occupant basis."

For services that utilities provide, public policy has established mechanisms for assessing costs. Not selling as much as a utility planned to sell is not proof of a cost, but the utility can perform a cost of service study to assess the cost of net metering customers' use of the system. The utility would have the burden of production and proof, of course.

As Warren Buffet's 2016 letter to shareholders said, "Historically, the survival of a local electric company did not depend on its efficiency. In fact, a 'sloppy' operation could do just fine financially."

When sales do not meet forecasts, some assume that uncollected costs must be collected elsewhere. When customers self-generate with solar (or otherwise permanently reduce their consumption levels), the anti-net metering crowd argues that customers who don't have solar—they always cite the poor, although many customers at all economic levels may not install solar—will be responsible for covering these costs. Alternatively, they may argue that solar customers must pay "access fees" or other charges to ensure their bill payments provide the expected revenue.

But what if the reduction in sales was reasonably foreseeable, and should have been reflected in the forecasts? What if reductions in some sales are offset by increases from others? Even in an average rates system, customers do not bear an individual responsibility for meeting the average sales level that the provider assumed. Automatically adjusting for a revenue shortfall due to decreased sales is not prudent, and singling out customers for special charges for using less is unjustly discriminatory. Automatic recovery of revenue deficiencies resulting from sales shortfalls encourages sloppy forecasting, may encourage overbuilding, and unwisely transfers risks from utilities to customers.

Those that oppose net metering sometimes argue that intermittent generation creates grid management and reliability costs. These costs usually don't justify the anti-competitive charges, fees, and limitations that many solar opponents propose to impose on customer-generators. Most engineers agree that at some high level of solar penetration—far higher than typically exists—intermittent generation may well create such costs. More than a century of regulation has led to processes for quantifying and allocating such costs.

The Value of Solar tariff concept addresses these issues directly. Anti-net metering arguments are seldom accompanied by such proof or full Value of Solar analysis. Ironically, some cost-of-service regulated

utilities have argued boldly that charges must be collected from net metering customers *now* to "get ahead of the game," *before* actual costs are recognized!

Any revenue issue is also an accounting issue—debits and credits—and it is better not to mix them up, as in the hotel room riddle. If the utility bill simply reported gross consumption and gross production separately—something that is now possible with two-channel digital meters—or with the addition of a separate production meter for the solar system on the customer side of the utility revenue meter, utility accountants could address the real issue. Again, this is a feature of the Value of Solar Tariff design. Net billing demonstrates that customer-generators are fully charged for 100% of consumption according to cost-of-service based rates, and also sends a strong energy efficiency message to the customer. With properly presented charges and credits, the issue then is proper allocation of the offset credit, which should be based on what costs the credit helps the utility avoid. This is exactly what Value of Solar studies have demonstrated across the United States.

The kWh that the net-metering customer generates does all of the work that the utility-provided kWh does, plus they are climate-proof, drought-proof, and they reduce wholesale market prices.

Some net metering opponents argue the entire offset credit is a "cost" to the system. Unfortunately, this position is both wrong and common. That position ignores the benefits that the entire system receives from customer-generators. Even more importantly, it ignores that the fact that distributed generation that is excess to the customer-generator immediately serves nearby load, after first being metered for charging to that second customer.

Not only is the offset credit not a cost, it is not even lost revenue to the utility when the generation is excess to the distributed generator's needs. Charging net metered customer-generators when their generation exceeds their use incorrectly and falsely implies that these customers are "using" the system to conduct a sale for resale, especially when it is the utility that immediately "sells" the electricity at full retail to the nearby customer whose load is served with that excess generation.

The premise of the avoided-cost test for purchased power rates under PURPA is cost-effectiveness. PURPA and the Federal Power Act speak to wholesale transactions because interstate wholesale markets are what is within the federal government's jurisdiction. The broader principle is that if utilities are required to buy energy from a non-utility generator, it doesn't make sense to require utilities to pay more than they would save (avoid) by not generating the energy themselves. The avoided-cost test is an economic-indifference test. When all the supply is wholesale, the physical point at which to measure indifference is the power plant busbar.

An offset credit is not payment for a purchase, and the vast majority of customer-generators are not federal jurisdictional sellers. Generation by distribution-sited systems must be measured at a different point in the system, because the costs avoided are different from a wholesale setting. The avoided cost values are different, too. Here is how the anti-net metering position is much like the hotel room riddle:

The classic anti-solar PV opposition view is that the "cost" of net metering is calculated by subtracting the wholesale rate from the retail rate. Instead, the offset value should be calculated by starting with the wholesale value of energy and adding the capacity value, transmission and distribution value, price suppression value, unaccounted-for environmental value, and other benefits. This analysis should take place in an open, transparent Value of Solar methodology development process.

The proper point at which to measure revenue indifference for customer-generators is the customer meter. After all, properly constructed retail rates should reflect the costs of producing and delivering a kWh to the customer meter. A rate of return on investment is added to compensate investors for their risk and profit for deploying their capital for utility use—costs that customer-generators also bear, along with insurance and operational risk.

The kWh that the net-metering customer generates does all of the work that the utility-provided kWh does, plus they are climate-proof, drought-proof, reduce wholesale market prices, and will never cost more to operate. No wonder Value of Solar analysis finds value above the prevailing rate. Net metering avoids all the costs that the utility faces, plus more.

No wonder Value of Solar analysis finds value above the prevailing rate. Net metering avoids all the costs that the utility faces, and more.

There is no missing money. Opponents of net metering are not posing the question in the right way.

As in the hotel room riddle, there is another, better way to ask the question. An answer is available, and can be supported by abundant data.

What would be the cost-of-service utility charge for a kWh of solar or solar-equivalent electricity delivered to the customer meter?

The answer, of course, is generally close to the retail rate plus a value premium, based on environmental and fixed price value. Most value-of-solar studies, which are basically comprehensive avoided-cost studies, arrive at a similar conclusion.