



## Reforming Net Metering Policy with a “Value of Solar Tariff” (VOST)

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### Introduction

The compensation for rooftop solar is oversimplified. At a minimum, compensation rates should consider the net effects from the three elements of solar production that are both straightforward to measure, and have a significant effect on its value to the grid: 1) energy production, 2) generation capacity, and 3) assisting environmental compliance.

Solar presents power companies with unique opportunities and challenges. On one hand, the sporadic nature of solar generation requires back up power and additional utility planning. On the other hand, solar panels can reduce strain on utility power plants, improve environmental compliance, and provide many other grid benefits. Current compensation rates for solar, such as wholesale or retail electricity rates, do not account for these nuances. A value of solar tariff, a methodology proposed by various national laboratories, think tanks, and consultants, and now in place in a few states, would promote market-driven solar growth and lay the foundation for other emerging residential and commercial scale energy technologies.

### New electricity choices

America’s electric grid was built around large power plants. Since Thomas Edison invented the light bulb in 1879, electricity has been produced in industrial plants and delivered to where it’s needed via power lines.<sup>1</sup> Today, the grid connects more than 7,300 power plants to billions of outlets across the country.<sup>2</sup>

Until recently, making energy in small amounts where it’s needed made little economic sense because large power plants mass produced electricity at unbeatable rates. Additionally, monopolistic regulations helped cement the legacy of large power plants, restricting consumer choices and competition on the grid. Now breakthrough innovations in residential solar and battery technologies are challenging this status quo. Solar prices have dropped 60% since 2007.<sup>3</sup> Battery prices have fallen more than 50% since 2010.<sup>4</sup> On their

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<sup>1</sup> [ConEdison: Electricity](#)

<sup>2</sup> [Energy Information Administration: How many and what kind of power plants are there in the United States?](#)

<sup>3</sup> [ClearPath: America’s 2014 Solar Boom](#)

<sup>4</sup> [Utility Dive: Why Battery Storage is Just About Ready to Take Off](#)

current trajectory, solar panels and batteries should save millions of Americans money over the next decade.<sup>5</sup> Rooftop solar is gaining momentum, with more than half a million American households and businesses already making the switch.<sup>6</sup>

### **Net metering: a solar enabling policy**

Forty-four states and Washington DC have recognized the changing energy landscape by enabling ‘net metering’. Net metering policies allow rooftop solar owners to sell any unused solar electricity back onto the grid.<sup>7</sup> Without net metering, solar owners would not receive compensation for sharing unused solar electricity with their neighbors. The policy has proven critical to rooftop solar economics: virtually all U.S. rooftop solar has been installed with net metering arrangements.<sup>8</sup>

Net metering rules are typically set at the state level and can vary widely. One of the main differences is the compensation level solar owners receive for excess generation. The most commonly chosen compensation levels are the retail rate<sup>a</sup>, wholesale rate<sup>b</sup>, and the avoided cost<sup>c</sup>. Simply put, these rates are lacking. Each are crude estimations of the value of solar because rooftop solar has unique characteristics that can deliver additional value and impose unique costs on the grid that static rates cannot capture.

Existing forms of net metering are blunt policy instruments that fail to send appropriate market signals. If the compensation rate is set too high, utilities might be required to increase rates on those that do not install solar to cover their extra costs.<sup>9</sup> If the rate is set too low, not enough solar would be developed to maximize its benefits for the grid and consumers. A precise compensation rate would ensure more competitive, market-driven growth.

### **VOST: unbundling the value of solar**

A Value of Solar Tariff (VOST) is an emerging alternative to traditional net metering. Similar to net metering, a VOST gives solar owners credit for generation<sup>d</sup>. The compensation rate, however, is the sum of individually calculated costs and benefits a rooftop solar installation imposes or provides to a specific utility or region.<sup>10</sup> Consequently, the VOST will be different for each utility and may even vary within a service territory.

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<sup>a</sup> retail rate: the rate households pay the utility for electricity, including the costs of fuel, building new power plants, and other utility programs.

<sup>b</sup> wholesale rate: the rate of electricity large power plants sell to the grid

<sup>c</sup> avoided cost: the price utilities would need to pay for a marginal unit of electricity

<sup>d</sup> The VOST rate can be applied to either all solar generation or only the net excess.

<sup>5</sup> [Rocky Mountain Institute: The Economics of Grid Defection](#)

<sup>6</sup> [SEIA: Solar Industry Data](#)

<sup>7</sup> [SEIA: Net Metering](#)

<sup>8</sup> [Alliance for Solar Choice: Net Metering](#)

<sup>9</sup> [ALEC: Net Metering Reform](#)

<sup>10</sup> [NREL: Basic Value of Solar Tariffs](#)

The VOST methodology can also be applied to other residential and commercial generation technologies such as natural gas microturbines<sup>11</sup> and hydrogen fuel cells<sup>12</sup>. As all forms of localized generation become more mainstream, a standard formula to calculate compensation rates will be needed to optimize installations.

Sample value of solar tariff calculation:

± Metric A ± Metric B ± Metric C ... ± Metric X = <b>VOST Rate</b>
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Twelve general metrics have been identified in Department of Energy, regulatory, and academic documents.<sup>13 14 15</sup> When implementing a VOST, policymakers pick and choose which metrics are considered. Most metrics can be positive or negative, depending on region and utility-specific factors, as described in the table below.

	<i>Benefits</i>	<i>Costs</i>
<b>1. Energy production</b>	Electricity produced from rooftop solar reduces generation and fuel use from conventional power plants.	The intermittency of rooftop solar production may increase standby generation requirements.
<b>2. Generation capacity</b>	Rooftop solar may reduce the need for investments in new power plants or maintenance of existing plants.	A utility may need to invest in fast-ramping power sources to ensure grid reliability.
<b>3. Air pollution</b>	Unlike conventional power plants, rooftop solar does not create pollution detrimental to public health. Pollutants include NOx, SOx, fine particulate matter, mercury, ozone, and carbon dioxide.	The solar installation and decommissioning process may contribute to local air pollution.
<b>4. General environmental impacts</b>	Solar provides many other environmental benefits compared to conventional power. For example, they use no water during times of drought, release no thermal or chemical water pollution, and produce little hazardous byproducts (e.g. coal ash and nuclear waste).	The decommissioning and recycling of solar panels may add to lifecycle costs.
<b>5. Grid security</b>	Solar can reduce blackout risks by removing congestion on power lines, regulating voltage, and increasing geographic diversity among generators. If an outage occurs, solar and batteries can also act as an emergency power source.	Additional planning and resources may be required to ensure grid stability.
<b>6. Economic activity</b>	Solar power creates about seven times more jobs than conventional power and broadens the tax base. The benefits of increased economic activity could be valued and credited back to solar owners.	N/A
<b>7. Transmission losses</b>	Rooftop solar does not have transmission losses that is typical when shipping power from distant power plants.	N/A
<b>8. Transmission capacity</b>	Power lines, like highways, run inefficiently when congested. Rooftop solar can reduce the congestion on power lines by producing power on-site.	Excess generation from rooftop solar can increase power line congestion at certain times of day.
<b>9. Grid support</b>	Rooftop solar, combined with smart inverters, can help	Rooftop solar, without smart inverters, can

<sup>11</sup> [Department of Energy: High Efficiency Microturbine with Integral Heat Recovery](#)

<sup>12</sup> [WBDG: Fuel Cells and Hydrogen](#)

<sup>13</sup> [NREL: Methods for Analyzing the Value of Distributed Photovoltaic Generation](#)

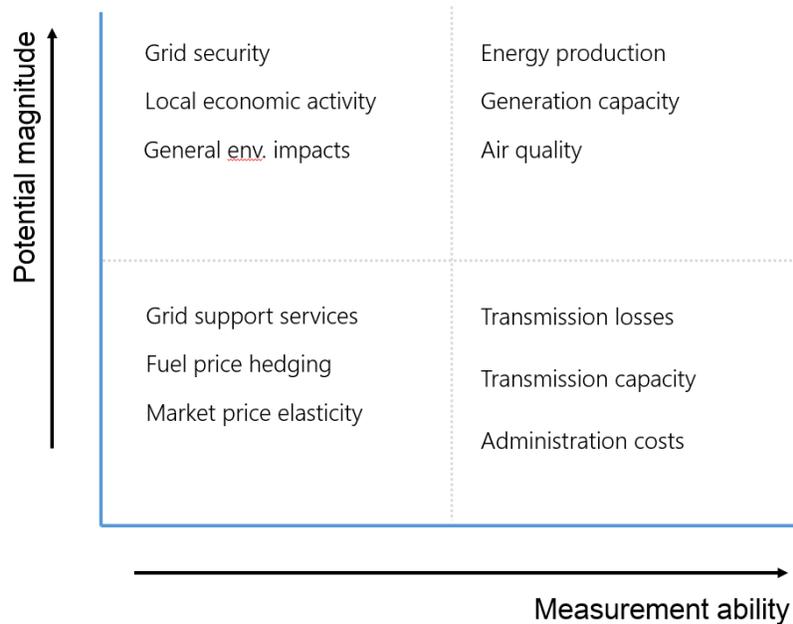
<sup>14</sup> [Rocky Mountain Institute: Accurately Valuing Distributed Energy Resources](#)

<sup>15</sup> [IRECUSA: Calculating the Benefits and Costs of Distributed Solar Generation](#)

<b>services</b>	balance the grid's frequency and reactive power needs.	decrease power quality and present challenges to grid operators.
<b>10. Fuel price hedging</b>	Rooftop solar can diversify a utility's energy portfolio. Since solar prices are very predictable, it can help insulate ratepayers from coal and natural gas price spikes.	N/A
<b>11. Market price elasticity</b>	At high levels of solar adoption, production from conventional plants and the demand for fuels could fall. The drop in demand could create lower fuel prices that traditional power plants use and result in lower electricity prices.	N/A
<b>12. Administration and integration</b>	N/A	Utilities could face additional administration costs associated with running VOST programs and connecting systems to the grid.

The National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy, has developed a comprehensive list of methods to value these metrics.<sup>16</sup> Unlike the static rates assumed by existing net metering bills, it can be difficult to individually value the metrics listed above. Some are easy to quantify, such as the energy production and generation capacity benefits—the main components in avoided cost. Other benefits are harder to quantify and may require extensive work to pinpoint a precise value.

Figure 1: Discrete metrics to value solar



### Early VOST adopters

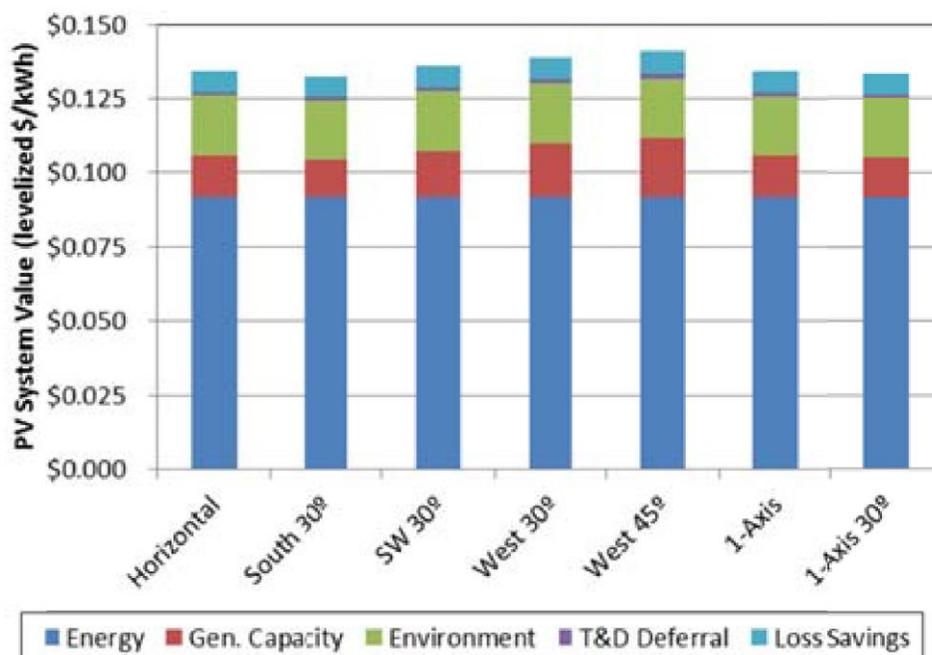
Only two places in America have active VOST policies: Minnesota and Austin, TX. South Carolina has also passed a third that will come into effect in 2021.

<sup>16</sup> [NREL: Value of Solar](#)

Minnesota. An optional alternative to retail net metering are community solar gardens<sup>e</sup>. Rates must consider the value of energy and its delivery, generation capacity, transmission capacity, transmission and distribution losses, and environmental value. The cost or benefit of solar operation, local economics, and systems installed at high-value locations on the grid can also be considered.<sup>17</sup>

Austin, Texas. The program applies to all residential solar customers. It includes line loss savings, avoided fuel costs, avoided costs of installing new generation capacity, fuel price hedge value, avoided transmission and distribution expenses, and environmental benefits.<sup>18</sup> As seen below, the energy is the most valuable metric, but others are also significant.

Figure 2: Austin, TX solar photovoltaic value by component and configuration



South Carolina. The pending program calls for valuation of avoided energy, energy losses / line losses, avoided capacity, ancillary services, transmission capacity, avoided criteria pollutants, avoided CO<sub>2</sub>, fuel edge, utility integration and interconnection costs, utility administration costs, and environmental costs.<sup>19 20</sup>

<sup>e</sup> Community solar gardens are centralized solar facilities owned by individual community members who receive credits on their electricity bill for the power produced. (source: [Clean Energy Collective](#))

<sup>17</sup> [DSIRE: Minnesota Value of Solar Tariff](#)

<sup>18</sup> [DSIRE: Austin Value of Solar Tariff](#)

<sup>19</sup> [North Carolina State University: 50 States of Solar](#)

<sup>20</sup> [Public Service Commission of South Carolina: DOCKET NO. 2014-246-E - ORDER NO. 2015-194](#)