ARTICLE

The Future of Distributed Generation: Moving Past Net Metering

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I. Introduction

"Distributed generation" is a term used to describe electricity that is produced at or near the location where it is used.[1] Distributed generation systems, also known as distributed energy resources, can rely on a variety of energy sources, such as solar, wind, fuel cells, and combined heat and power.[2] Over 90% of the current distributed generation capacity in the United States is solar,[3] and the number of installations is increasing rapidly.[4] As a result, many states are in the process of changing their utility structures and regulatory policies to accommodate more distributed energy resources.[5]

Most distributed generation systems are grid-tied, which means that they are connected to a utility's power grid.[6] Customers with connected distributed generation systems can buy power from their electric utility when they are not producing enough electricity to meet their needs, and sell power back to the utility company when their systems are producing more electricity than they are using.[7]

The question of how these customers should be compensated for that electricity they send to the grid has three significant policy implications. First, it plays a key role in determining the economic feasibility of clean electricity relative to electricity produced by fossil fuels. Second, distributed generation has benefits for the electric grid's resilience, as it provides a more diversified portfolio of energy sources than schemes that rely exclusively on centralized power plants.[8] Finally, the details of how distributed generation is compensated for various benefits will affect the composition of future clean energy projects.

Net metering is the most commonly used approach for setting distributed energy compensation.[9] The traditional net metering approach is functionally equivalent to having a single meter that runs forward when the customer needs more power than she produces, and backward when she sends excess power to the grid.[10] At the end of the billing period, the customer is billed at the retail electricity rate

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[1] *Distributed Solar*, Solar Energy Indus. Ass'n (2015), https://perma.cc/MA74-45JJ.

[2] American Public Power Ass'n, Distributed Generation: An Overview of Recent Policy and Market Developments A 3 (2013), https://perma.cc/62YC-P85G.

[3] *See id.* at 2–3.

[4] Interstate Renewable Energy Council, Trends Shaping Our Clean Energy Future: The 2014 IREC Perspective 25 (2014), https://perma.cc/359X-ZMTW [hereinafter IREC, Trends Shaping Our Clean Energy Future].

[5] *DPS—Reforming the Energy Vision,* N.Y. Dep't Pub. Serv., https://perma.cc/BB5Y-VFPA (announcing broad regulatory changes that promote "wider deployment of 'distributed' energy resources"); D.C. Pub. Serv. Comm'n, Formal Case 1130, Comment on the Scope of the Proceeding (Aug. 31, 2015), https://perma.cc/EG5M-PK68 (calling for grid modernization with a "focus on deployment of distributed energy resources"); Mass. Dep't of Pub. Utils., Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid, D.P.U. Order 12-76-B, 2 (June 12, 2014), https://perma.cc/6FZR-8J5Q (requiring every Massachusetts electric provider to submit a 10-year plan outlining how the utility will "integrate distributed resources."

[6] Andrew Mills et al., *Net Metering*, Sunlight Elec (July 2015), https://perma.cc/6S48-YKKQ.

[7] Edison Electric Inst., Straight Talk About Net Metering 1–2 (Jan. 2016), https://perma.cc/E5FF-C54F.

[8] Devi Glick et al., Rate Design for the Distribution Edge: Electricity Pricing for a Distributed Resource Future 16 (Rocky Mountain Inst. Aug. 2014), https://perma.cc/JNK4-52T7.

[9] Straight Talk, *supra* note 7 (laying out electric industry arguments against net metering).

[10] *Id.* at 2.

for the net power used.[11] In effect, suppliers are paid at the retail rate for their excess generation.[12]

As of October 2016, 45 states and the District of Columbia compensated utility customers with distributed generation for the power they generated.[13] Even though details of individual state approaches vary, in this Article, we use the term "net metering" to refer to the practice of compensating distributed generation customers at the retail price, which remains the most common practice.[14]

Utilities concerned about lost revenues have begun urging state legislatures and public service commissions to impose fixed charges for net metering customers and to decrease the rate of compensation those customers receive for the energy they generate.[15] Environmentalists and individuals seeking to generate their own electricity for financial or libertarian reasons have argued opposite positions.

One goal of this Article is to evaluate the respective arguments. An ideal pricing mechanism would take into account the potential environmental and health benefits of cleaner energy and the grid-related costs resulting from distributed generation. Our second goal is to provide an alternative compensation structure for distributed solar generation that can also be used consistently and fairly for all types of energy sources. Our final goal is to highlight the need to analyze net metering in the context of more comprehensive energy policies, such as much-needed reform in electricity pricing policy.

II. Net Metering Policies

The most common tool to track electrical output and compensate distributed generation owners is a billing arrangement known as net metering.[16] The 2005 Energy Policy Act catalyzed distributed generation by offering favorable tax treatment to individuals installing solar generators and by encouraging state adoption of net metering policies[17] that allow individual utility customers to produce and sell energy in state-regulated retail markets.[18] However, despite the near-ubiquitous adoption of net metering by states, the policies differ among jurisdictions.[19]

First, state net metering programs differ in how they compensate customer-sited generation. Currently, 34 net metering jurisdictions credit customers for generation at the retail rate,[20] which exactly mirrors the price charged by utilities to end-use consumers for electricity.[21] Only seven jurisdictions exclusively credit net excess generation at the avoided cost rates,[22] which reflect the cost to a utility of generating equivalent power or purchasing it from a non-qualifying facility third-party.[23] Many states offer a combination of rates.[24] A second variation is how long a customer's monthly excess generation may be "carried over" to future billing cycles. As of October 2016, net generation may be carried over month-to-month and applied in subsequent billing periods to offset later usage in all but two jurisdictions.[25] Third, nearly all jurisdictions place a cap on the maximum permissible size of any individual net-metered generator.[26] Fourth, 24 jurisdictions set aggregate capacity limits that constrain the total amount of net-metered generation permissibly installed within a state or utility service area.[27]

The differences among net metering policies can significantly affect the attractiveness of distributed generation to utility customers. Over 76% of net-metered distributed generation systems are located in states with favorable net metering policies.[28]

III. Evaluating Current Pricing Approaches

A. Net Metering

The argument that a kilowatt hour (kWh) of electricity produced and sent to the grid by a distributed generator should be compensated at the retail rate is grounded in the basic principles of perfectly competitive markets, in which buyers and sellers buy or sell the product at the same market-clearing price determined by the marginal cost of

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[11] *Id.*

[12] Naïm R. Darghouth et al., Net Metering and Market Feedback Loops: Exploring the Impact of Retail Rate Design on Distributed PV Deployment 1 (Lawrence Berkeley Nat'l Lab. July 2015), https://perma.cc/Y7GK-69WW.

[13] The only states that do not offer a statewide net metering policy are Alabama, Idaho, South Dakota, Tennessee, and Texas. Best Practices in State Net Metering Policies and Interconnection Procedures, Freeing the Grid (2015), https://perma.cc/USG7-HR3U [hereinafter Best Practices].

[14] *See* Steven Ferrey, *Virtual "Nets" and Law: Power Navigates the Supremacy Clause*, 24 Geo. Int'l Envtl. L. Rev. 267, 267 (2012); Benjamin Hanna, *FERC Net Metering Decisions Keep States in the Dark*, 42 B.C. Envtl. Aff. L. Rev. 133, 133–34 (2015).

[15] Peter Kind, Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business 18 (Edison Elec. Inst. 2013); *see also* Solar Energy Indus. Ass'n, Solar Market Insight Report: 2014 Year in Review (2015).

[16] U.S. Energy Info. Admin., State Energy Data System, Net Metering Customers and Capacity by Technology Type, by End Use Sector, 2004 Through 2014, tbl. 4.10 (2013), https://perma.cc/4C44-9JDK (noting a 53% annual growth rate in NEM customers); *see also* J. Heeter et al., Status of Net Metering: Assessing the Potential to Reach Program Caps 12 (Nat'l Renewable Energy Lab. 2014), https://perma.cc/2KPV-KC2M (noting net metering is a statistically significant driver of solar growth).

[17] Energy Policy Act of 2005 § 1251, 16 U.S.C. § 2621(d) (2012).

[18] According to the "net sales" test, retail market transactions include transactions between a utility customer and the utility as long as the customer does *not* consistently produce sufficient excess energy (beyond their own energy consumption) during a given time period to be considered a "net seller" of electricity. *See* 16 U.S.C. § 824(a).

[19] *See* Best Practices, *supra* note 13.

[20] *Id.*

[21] Yih-huei Wan & H. James Green, Current Experience With Net Metering Programs 1-2 (Nat'l Renewable Energy Lab., 1998), https://perma.cc/5CRH-D5AL.

[22] Best Practices, *supra* note 13.

[23] Wan & Green, *supra* note 21, at 1-2.

[24] Laurence D. Kirsch & Mathew J. Morey, Pricing Retail Electricity in a Distributed Energy Resources World (Christensen Ass'n Energy Consulting 2015), https://perma.cc/U5CN-R9SJ.

[25] Best Practices, *supra* note 13.

[26] *Id.*

[27] *See Net Metering State Database*, Database of State Incentives for Renewables & Efficiency, https://perma.cc/NA52-4BMV.

[28] *See* Best Practices, *supra* note 13 (noting states with favorable net metering policies).

production. However, many retail electricity tariffs use inefficiently designed, flat volumetric per-kWh rates. These rates are intended to cover not only the variable costs of the generation of electricity itself, but also fixed costs and a reasonable rate of return for the utilities.[29]

1. Shortcomings of a Bundled, Flat Volumetric Rate

A typical tariff for residential customers has two parts, a fixed monthly service charge and a flat, volumetric energy-consumption charge. Consequently, utilities' ability to recover their costs depends on the volume of electricity sold. The retail electricity price is essentially the bundled average cost of providing retail electricity to a customer, which includes electricity generation and additional services, as well as transmission, balancing, and local distribution. Hence the electricity sent to the grid by a distributed generator, which lacks those additional services, is not a perfect substitute for the retail electricity consumed by the end-user. When net-metered customers are compensated using retail rates, they avoid paying for the costs already incurred for their reliance on grid-delivered electricity and for the demand they place on the grid.[30]

2. Temporal and Locational Variations, and Production and Transmission Constraints

Another source of inefficiency in electricity pricing stems from the way in which energy charges are calculated for retail customers. Demand for electricity is higher at certain "peak" demand times during the day, and utilities use more expensive generators during these periods to meet demand. When variation in costs is not reflected in retail rates, net metering compensates distributed generation using the same flat volumetric rate at all times and locations. As a consequence, net metering policies lead to overcompensating distributed generation exports during off-peak times and undercompensating them during peak times, effectively exchanging a high-value product for a low-value one.

3. Demand Variations and Distribution Constraints

A consumer's contribution to the fixed costs of local distribution networks is also dependent on the time and location of consumption. The maximum demand during peak periods is the main driver of any new distribution system capacity investment.[31] A customer's maximum demand at the moment of highest usage among all customers in a particular location—"coincident peak demand"—is more important as a driver of infrastructure investments than the customer's individual peak demand—"non-coincident peak demand."[32] When distributed generation lowers the coincident peak demand at a location that is close to the peak network capacity, it lowers the need for future distributed capacity investment. As this variation is not reflected in the flat volumetric retail rates, common net metering policies cannot sufficiently capture the full value of distributed generation.

4. Equity Considerations

The mismatch between the way in which costs are incurred and how they are recovered due to flat, volumetric rates gives rise to the possibility of cost shifting among different customer groups when one group lowers its consumption for any reason, whether it is a result of distributed generation, energy efficiency, or personal preference. With net metering, while customers who own solar panels essentially get credited for the output they produce at the retail rate by being billed for a lower net volume of electricity, customers without distributed generation systems end up having to make up the lost revenue with higher rates.[33] Net metering is often disproportionately concentrated among wealthier customers. Thus, many fear that net metering acts as a socially regressive subsidy for utility customers with distributed generation by placing additional costs on moderate- and low-income customers.[34]

B. Fixed Charges and Net Metering Caps

An increase in fixed charges that applies only to distributed generators, as suggested in some states, would hurt efficiency if it does not reflect the costs that they actually impose on the grid.[35] Converting distribution expenses into flat service fees also ignores actual variation in delivery costs and undervalues the savings achieved by the *distributed* nature of distributed generation. Simply increasing fixed service charges can therefore transfer cost burdens from rural, higher-use ratepayers, who require greater delivery costs, to urban and low-use ratepayers, for whom these costs are lower.[36]

To the extent that a utility cannot recover its costs with the prevailing retail rates, a net metering cap could alleviate the cost recovery concerns of utilities. However, given that a proper tariff design would alleviate any cost recovery concerns, an arbitrary net metering cap would only lead to further inefficiency and under-deployment of distributed generation.

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[29] *See* Tom Tanton, Reforming Net Metering: Providing a Bright and Equitable Future 1-5 (Am. Legis. Exch. Council 2014, https://perma.cc/K4XF-6BRD.

[30] *Id.* at 1.

[31] Paul Simshauser, *Distribution Network Prices and Solar PV: Resolving Rate Instability and Wealth Transfers Through Demand Tariffs*, 54 Energy Econ. 108, 108-09 (2016).

[32] *Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Staff White Paper on Ratemaking and Utility Business Models*, Case No. 14-M-0101, N.Y. PSC, Filing No. 416 at 80 n.81 (July 28, 2015).

[33] *See* Tanton, *supra* note 29, at 9-11.

[34] Ashley Brown, *Valuation of Distributed Solar*, 27 Elec. J. 27, 27 (2014), https://perma.cc/C35M-G2QV.

[35] Darghouth et al., *supra* note 12, at 6–8.

[36] Jim Lazar, Rate Design Where Advanced Metering Infrastructure Has Not Been Fully Deployed 59 (Reg. Assistance Project 2013).

IV. Evaluating the Contributions of Distributed Generation to the Electric Grid

A. *Benefits of Distributed Generation to the Electric Grid*

The clearest benefit of distributed generation to the overall electrical system is that it avoids the cost of operating a bulk system generator to meet customer demand. Avoided energy benefits can be especially significant if distributed energy resources help avoid generation from costlier "peaker" plants. Distributed energy resources also provide value to the transmission and distribution system; electricity travels shorter distances to the end user, directly curtailing energy losses that may occur because of inefficient power lines. Distributed renewables offer long-term cost savings by enabling utility and state entities to defer or avoid large capital investments in new fossil fuel generators, transmission, and distribution infrastructure.[37] Finally, distributed generation can be invaluable to providing power supply during extreme weather events such as storms or other emergency situations.

B. *Costs of Distributed Generation to the Grid*

The costs of distributed generation go beyond the costs of installing new meters. As electricity cannot be stored on a large scale, customer usage must be met in real time by utility generation.[38] Significant mismatches between consumer demand and available power supply can cause grid frequency levels to drop,[39] which may damage generator turbines or lead to blackouts.[40] The dependence of most distributed generation on weather conditions inescapably means that its output is variable and patterned, which can hamper the grid's reliability and interfere with its efficient operation.[41]

Unregulated, bi-directional energy flow introduced by net-metered customers also imposes additional strains on the physical electric grid,[42] leading to increased flow management and voltage regulation costs,[43] and may overload the circuits close to the distributed generator.[44] Another related challenge is that distributed solar units cannot be intentionally fueled or dispatched with certainty to meet consumer demand at a particular time.[45] As a result, utilities must provide adequate backup power. Erratic changes in output make matching electric generation and customer usage difficult,[46] and can require other power plants to remain online simply to ensure that adequate power is available to meet demand,[47] thereby forgoing environmental benefits of distributed generation and doing little to reduce the operational costs of utilities.[48] However, these costs can be lowered or eliminated as technology and forecasting methods become more advanced.

V. Considering the Social Benefits of Distributed Generation

The primary external benefit of distributed generation is arguably the reduced carbon dioxide emissions from fossil fuel sources displaced by distributed generators. Other benefits include public health and welfare improvements, water conservation, land preservation, and reductions in physical infrastructure necessary to support fossil fuel electricity generation.[49] As these benefits are not fully reflected in current retail tariffs, the existing net metering policies do not capture the true value of distributed generation to society, and will thus lead to less distributed generation than is socially optimal.

A. *Incorporating Climate Change Benefits*

1. Quantifying Net Avoided Emissions and Valuing Avoided Carbon Dioxide Emissions

The first step in valuing the climate change benefits of distributed generation is to calculate the amount of net avoided emissions. Avoided emissions depend on the type of generator that the distributed generation is displacing and thus the time and location of the energy generated.[50] The quantity of greenhouse gas emissions avoided by distributed generation should be calculated by looking at the quantity of emissions that the marginal generator at that location would have emitted at the time of the distributed generation production. This feature is a missing quality in

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[37] Anderson Hoke & Paul Komor, *Maximizing the Benefits of Distributed Photovoltaics*, 35 Elec. J. 55, 55–61 (2012).

[38] *See* Timothy P. Duane, *Legal, Technical, and Economic Challenges in Integrating Renewable Power Generation Into the Electricity Grid*, 4 San Diego J. Climate & Energy L. 1, 7-9 (2013).

[39] Erik Ela et al., Active Power Controls From Wind Power: Bridging the Gaps 40 (Nat'l Renewable Energy Lab. 2014), https://perma.cc/XA7K-GRDP.

[40] *Id.* at 1.

[41] Tanton, *supra* note 29, at 4.

[42] *See* Am. Pub. Power Ass'n, *supra* note 2, at 11 (potential safety issues involving distributed generation include "islanding," high-voltage spikes, out-of-phase reclosing, and system-wide blackouts).

[43] *See* Mass. Inst. of Tech., The Future of the Electric Grid 17, 64 (2011), https://perma.cc/UKE4-SM36; *see also* Elec. Power Research Inst., The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources 14 (2014), https://perma.cc/U77P-W893.

[44] *See* Am. Pub. Power Ass'n, *supra* note 2, at 11.

[45] Severin Borenstein & James Bushnell, *The U.S. Electricity Industry After 20 Years of Restructuring*, 7 Ann. Rev. Econ. 437, 455 (2015).

[46] N. Am. Elec. Reliability Corp., Accommodating High Levels of Variable Generation ii (2009), https://perma.cc/NL4X-XNU4 [hereinafter NERC Report].

[47] *See* Borenstein & Bushnell, *supra* note 45, at 455.

[48] Lori Bird et al., Integrating Variable Renewable Energy: Challenges and Solutions 3-4 (Nat'l Renewable Energy Lab. 2013), https://perma.cc/28B5-XK8Y.

[49] Lazar, *supra* note 36, at 50.

[50] *See* Kyle Siler-Evans et al., *Regional Variations in the Health, Environmental, and Climate Benefits of Wind and Solar Generation*, 110 PNAS 11768, 11770 (2013).

current net metering or "value of solar" policies. The second step is to monetize the quantity of avoided emissions based on estimates of the monetary value of the damage they impose on society. Currently, the best estimate of the marginal damage caused by carbon emissions is the social cost of carbon (SCC).

2. Interaction With Other Regulatory Approaches

The variation in state policies regarding distributed generation is not limited to the specifics of net metering policies. States provide a variety of different incentives for renewable energy resources, and specifically for solar panels, including tax credits, for example.

The existence of other policies aimed at reducing emissions does not change the marginal external cost of carbon emissions, which is the monetary value of all the damages caused by one additional unit of emission. Thus, the marginal external damage associated with each additional unit of emissions is exogenously determined, and is independent of any other environmental policies that are in effect. If, however, there are other policies in effect that cause fossil fuel generators to internalize some of the external damage they are causing, then the environmental benefit adjustment in remuneration of distributed generation should only include the "uninternalized" damages.

The existence of a cap-and-trade program complicates the calculation of the quantity of net avoided emissions. A precise calculation of the quantity of net avoided emissions in the presence of a cap-and-trade program requires an in-depth study of how distributed generation affects the number of unused allowances and how fast those unused allowances in turn affect the long-term level of the cap. An alternative approach would be to use the quantity of emissions displaced by the distributed generator as an approximation. Once the quantity of avoided emissions is calculated, it can be then multiplied by the SCC to monetize the environmental benefits of distributed generation.

VI. Toward an "Avoided Cost Plus Social Benefit" Approach

The efficient price for distributed generation should reflect all of its costs and benefits, both private and external. Net metering falls short of accomplishing this goal because the current retail electricity rates do not fully reflect either the true marginal cost of electricity generation or the associated externalities. A new approach is needed until comprehensive retail rate reform corrects such inefficiencies. As state efforts to evaluate and reform net metering become increasingly common, it is important to establish a socially desirable framework that can be used consistently in different states and for different types of distributed energy resources.

An "Avoided Cost Plus Social Benefit" approach that compensates distributed generation for the net avoided cost and net social benefits is preferable to net metering. Distributed generation should be compensated for social benefits such as environmental and health benefits while taking into account the additional costs imposed by distributed generation and rewarding distributed generation only for costs it avoids, thus eliminating utilities' concerns about recovering costs of existing infrastructure. Until recently, the Federal Energy Regulatory Commission (FERC) explicitly prohibited the inclusion of externality adders in avoided-cost rates in the wholesale markets.[51] However, in 2010, FERC changed course, and ruled that avoided cost rates could permissibly differentiate between "various [qualifying facility] technologies on the basis of the supply characteristics of the different technologies" opening the way to incorporating environmental benefits that are monetized through compliance with state policies such as renewable portfolio standards.[52] Thus, state utility commissions now have discretion to tailor avoided cost rates for certain policies,[53] and "the authority to dictate the generation resources from which utilities may procure electric energy,"[54] opening the door to avoided-cost rates that reflect the characteristics of a qualifying facility.

VII. The Promise of Time-, Location-, and Demand-Variant Pricing

The "Avoided Cost Plus Social Benefit" approach to compensating distributed generation advocated in this Article is only a stopgap measure until comprehensive retail electricity reform can take place. The first-best solution to the problems caused by net metering is simply to correct the inefficiencies of the retail rates.

Current tariff designs almost universally use one flat volumetric price per kWh to recover costs incurred in non-volumetric ways. Using a cost-reflective tariff that is properly unbundled and granular would improve overall system efficiency and the value of distributed generation. First, a bundled, flat volumetric rate insulates consumers and producers from receiving the correct price signals about the true social cost of generating energy. As a result, consumers have no incentive to adjust their usage based on the actual cost of electricity. More importantly, a flat rate prevents prices from being interpreted as efficient investment signals.

Second, using a flat volumetric rate that is uniform across the service territory of a utility undercompensates distributed generation for other benefits it provides, such as reducing grid congestion when the system is close to capacity during peak hours. Third, a flat volumetric rate creates perverse incentives for customers during the installation phase. As net-metered customers are compensated using the same flat rate regardless of what time they send

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[51] S. Cal. Edison Co., 70 FERC ¶ 61,215 (1995), 71 FERC ¶ 61,269 (1995).

[52] *See* Cal. Pub. Utils. Comm'n, 133 FERC ¶ 61,059, 61,628 (2010).

[53] Kaylie E. Klein, *Bypassing Roadblocks to Renewable Energy: Understanding Electricity Law and the Legal Tools Available to Advance Clean Energy*, 92 Or. L. Rev. 235, 258 (2013).

[54] Cal. Pub. Utils. Comm'n, 134 FERC ¶ 61,044, 61,160 (2011).

energy to the grid, their inherent incentive is to install solar panels with the goal of maximizing their total production, and hence compensation, rather than overall power system benefits. Finally, the amount of greenhouse gas emissions displaced by distributed generation also depends on time and location. Once again, the use of a flat volumetric rate that does not granularly reflect changes in the external costs of electricity generation prevents the realization of the full value of distributed generation.

A. Valuing Distributed Generation With Time-, Location-, and Demand-Variant Pricing

The efficiency problems created by the interaction of net metering policies and inadequate retail rate designs are preventable. Regulators need only move toward more sophisticated rate designs that are unbundled—with generation, distribution, and transmission valued and priced separately—and more cost-reflective.[55] Thus, costs are recovered similarly to the way they are incurred, based on the unit of their drivers. For example, energy generation costs that are based on the volume of energy sold should be recovered using volumetric charges. To avoid any cross-subsidization, volumetric energy charges should be designed to reflect the variation in locational and temporal changes in the cost of providing electricity.

Similarly, distribution network charges should be carefully designed.[56] If the highest electricity capacity a customer needs at a particular time period is driving the need for further infrastructure investment, charges based on this coincident peak demand could be imposed. To ensure that existing network costs are recovered fairly, a charge based on connected load, similar to a network subscription charge, could be imposed.[57] Cost-reflective retail tariff rate structures that provide customers proper price signals that reflect the actual costs underlying the provision of electricity, including the associated externalities, will improve economic efficiency.

B. Equity Issues

Any significant tariff change should be implemented with regard for the stakeholders who stand to lose in the short term. The possibility of such transitional equity problems should be recognized, and policy solutions aimed at these problems should be discussed as part of any reform. However, keeping volumetric rates artificially low is not the solution to equity concerns regarding vulnerable low-income energy customers. Social welfare is maximized when the market price reflects both private and external marginal costs.[58] Once such a price is established so that the maximum possible net benefits can be realized, distributing this net value among different groups of stakeholders is best done through direct transfer programs that have specific policy goals, such as crediting low-income customers with fixed amounts on their energy bills, or subsidizing programs that would allow low-income customers easier access to distributed energy resources.

C. Incorporating Externalities Into Dynamic Pricing

Internalizing externalities like environmental and health benefits in retail rates and tariff design aimed at maximizing net social benefits is crucial to the success of clean energy policies, especially when dynamic tariffs are used. While dynamic tariffs using time-, location-, and demand-variant pricing provide more incentives for distributed generation deployment and result in a decreased energy demand from the bulk system, they may also cause consumers without distributed generation systems to shift their loads to periods where dirtier plants are on the margin, unless the externalities are fully internalized in retail rates.

As peaker plants are often less efficient and dirtier,[59] overall emissions decrease when distributed generation reduces the need for the electricity generated from such plants. However, if time-varying rates shift consumption to other periods, calculating the net effects requires a more careful analysis. If the temporal dimensions are not taken into account while calculating environmental and health benefits, and all distributed energy resources are rewarded based on the same average quantity of avoided emissions, market incentives will lead to more investment in cheaper distributed energy resources, regardless of whether they are the most beneficial for society when taking externalities into account.

Overall, having the right price signals would ensure an efficient allocation of resources by directing the right type of distributed energy resource investments to where they are needed most. While solar panels may be more valuable when installed near areas where demand peaks during the day, investing in wind turbines may be more valuable in areas where demand peaks later in the day, as that is when wind production also peaks.[60] Only by using a comprehensive framework that can recognize granular variations in valuation can we move beyond narrow, shortsighted debates that may inefficiently favor one low-carbon resource over another.

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[55] Ahmad Faruqui, The Global Movement Towards Cost-Reflective Tariffs 30–31 (Brattle Group 2015), https://perma.cc/6QH4-GAB3.

[56] *See generally,* Toby Brown et al., *Efficient Tariff Structures for Distribution Network Services*, 48 Econ. Analysis & Pol'y 139 (2015).

[57] Ahmad Faruqui, The Case for Introducing Demand Charges in Residential Tariffs (Brattle Group 2015), https://perma.cc/8HQY-4Q5G.

[58] *See* Jonathan Gruber, Public Finance and Public Policy 127, 138–42 (MacMillan Higher Education, 4th ed. 2012).

[59] Robin Bravender & Collin Sullivan, *Utility to Build First Power Plant With Greenhouse Gas Emissions Limits in California,* Sci. Am. (Feb. 5, 2010), https://perma.cc/Q4GW-TGWU; *see also Flexible Peaking Resource*, Energy Storage Ass'n, https://perma.cc/9YUH-5AXV; Janice Lin, *The Value of Energy Storage*, Cal. Energy Storage All. (Mar. 25, 2014), https://perma.cc/R2MM-M23G.

[60] *See generally* Joseph Cullen, *Measuring the Environmental Benefits of Wind-Generated Electricity*, 5 Am. Econ. J.: Econ. Pol'y 107,107-133 (2013).

VIII. Conclusion

As many states are looking to integrate more distributed energy resources into the grid, current net metering policies are proving to be inadequate to properly value the clean energy produced by distributed generation, or the services provided by the electric grid and the utilities.

Our analysis identifies the sources of the inefficiencies of current policies and we propose a preferable protocol, which we refer to as the "Avoided Cost Plus Social Benefit" approach. This approach both rewards clean distributed energy for the environmental and health benefits it provides and ensures that utilities are compensated for the services they provide. This approach is the best that can be accomplished given the limitations of the current energy policy framework, which relies too heavily on fixed volumetric rates. Finally, this Article provides a roadmap for more comprehensive energy policy reform, which is necessary in order to properly value all energy resources, including distributed generation, and thereby ensure that states' clean energy and resilience goals can be achieved as efficiently as possible.