

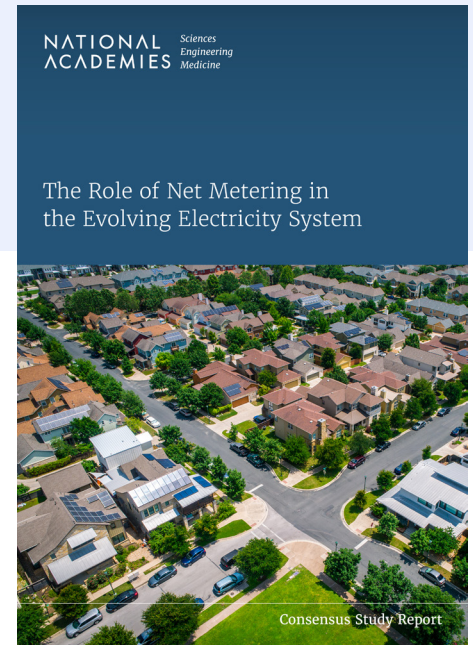
The Role of Net Metering in the Evolving Electricity System

Over the past three decades, changing economics, innovations in energy technologies, new policy objectives, and increasing customer expectations have driven fundamental shifts in the electricity system, including the growth of clean distributed generation (DG) such as rooftop solar. Net metering has been instrumental in supporting DG adoption but integrating the growing number of clean DG systems installed by residential, commercial, or industrial electricity customers is posing challenges for the grid. Given the many ways in which the electricity system and technology are changing, net metering must also evolve.

At the request of Congress and the Department of Energy, the National Academies convened a committee of experts to explore the issues associated with net metering, including the medium- to long-term impacts of net metering on the electricity grid and customers. This report, *The Role of Net Metering in the Evolving Electricity System*, examines how net metering must change to continue to support and advance a decarbonized, equitable, and resilient electricity system.

UNDERSTANDING NET METERING

Net metering is a billing mechanism that compensates electricity provided to the electrical grid by customers with DG, such as solar panels on their property. When a customer's solar panels are producing more electricity than the building is using—for example, perhaps when the occupants are away from home, few appliances are turned on, and the sun is shining—then excess solar-generated electricity can be fed back into the grid. It has supported the deployment of behind-the-meter (BTM) DG to achieve a variety of objectives—clean energy, resource diversity, carbon reduction,



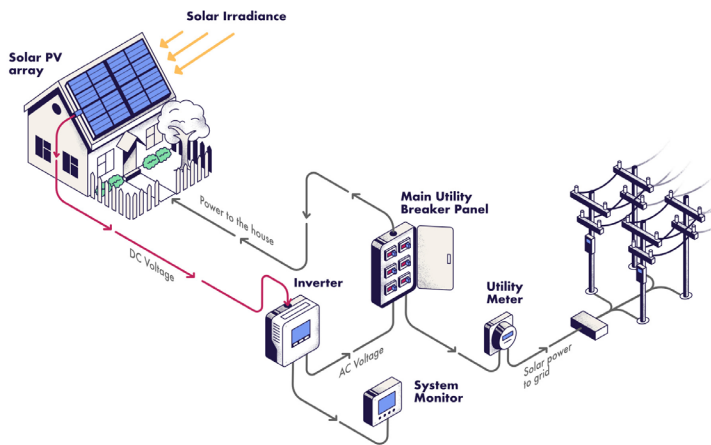


FIGURE 1 Technical configuration of a behind-the-meter rooftop solar system.

economic development, equity, and resilience—as well as customer expectations for choice and savings.

The most common type of household DG in the United States is a rooftop solar photovoltaic net-metered system. These systems provide customers with options for producing their own power and managing their energy bills, driving down the costs of renewables as the markets expand and technologies improve, and producing power with reduced carbon emissions.

NET METERING: TRENDS AND TENSIONS

In its early stages, when the costs of DG systems were high and deployment low, net metering provided important support for rooftop solar. The past decade has seen rapid advancements and cost reductions in solar and other DG system technologies, making these systems more affordable for many households. In many jurisdictions, net metering policies combined with multiple solar support mechanisms and financial incentives have further improved the customer economics for solar. As a result, larger numbers of customers have adopted rooftop solar systems and participate in net metering programs.

The growth in rooftop solar challenges the traditional approaches of planning, designing, funding, and maintaining the electricity system. Customers face uncertainties from changing prices, rate structures, and reliability and resilience of supply. Grid operators and utilities grapple with variable demand, hard-to-

predict operational conditions, changing customer and policymaker expectations, and evolving regulatory and utility business models.

Mechanisms for compensating solar customers vary widely across the country with differences among state legislation, regulatory decisions, and implementation policies. State policymakers and regulators are considering variants and alternatives to traditional net metering that may better accomplish decarbonization, equity, and resilience objectives. Reforms in net metering policy have already been implemented or have been under active consideration in over half of all U.S. states over the past few years.

NET METERING CONSIDERATIONS

The report examines the economics, equity, technology, and policy and regulation considerations of net metering policies and the role they play in the growth of DG.

Economics

Net metering provides a direct economic value to participating customers by compensating them for their DG production based on the underlying rate structure. Moving forward, to encourage the integration of rooftop solar and other DG into the electricity system to maximize benefits for all customers, DG should be compensated based on the value it provides to the electricity system, society, and the customers adopting it.

The report recommends that regulators **strive to develop retail rate structures—for both DG and non-DG customers—with usage-based energy prices that correspond as closely as possible to the social marginal cost¹ of producing and delivering electricity** while recognizing other competing rate-design objectives. In the absence of economically efficient rate structures for all customers, the committee recommends **implementing changes to the net metering mechanism for DG customers, with DG compensation levels set at or near the social marginal cost of electricity production and delivery.**

¹ The incremental cost to the company supplying an additional unit of the good or service *plus the costs of any externalities*, such as pollution, that result from that incremental supply.

Equity

Low-income households, populations of color, and renters are less likely to adopt rooftop solar and participate in net metering than other customers. Thus, net metering can play a role in alleviating—or exacerbating—existing inequities associated with electricity supply and delivery across the United States. To remove barriers to the adoption of DG by, and reduce any cost consequences for, low-income and other disadvantaged customers and communities, the report calls for policymakers to build equity considerations into the design of net metering and its variants. The report also recommends consideration of alternatives to ratepayer-funded support for BTM DG, especially for low-income customers, such as legislative and taxpayer-funded programs.

Rates should be designed consistent with updated ratemaking principles, with particular attention to the equity impacts for customers least able to afford them. To help accomplish this, **utilities and policymakers should ensure that information about utility rates is easily available to all customers, and that all customers have a voice and can participate in the design of rates.**

Those involved in setting electricity rates **should consider both the impacts of the distribution of benefits and costs, as well as total benefits and costs when designing net metering policies and ensure that adequate data are collected and made publicly available to do so.** These benefits and costs should include and balance among other things: public health impacts, job impacts, land use impacts, and the future options that will be enabled or precluded.

Technology

Exponential advances in technologies related to metering, communication, computation, and power electronics have contributed to a steady increase in DG, which has implications on the larger electricity system. Modernizing the grid will require better integrating sources of renewable energy; incorporating advances in power electronics, storage, communications, and control technologies; and confronting issues surrounding cybersecurity and resilience. The report recommends that

utilities make **investments in the distribution system to integrate, increase the visibility of, and manage (either directly or indirectly through price signals) increasing amounts of BTM DG such as rooftop solar, to ensure the continued safe and reliable operation of the grid and provision of grid services.**

The committee further finds **investments in distribution system technologies aimed toward integration of DG and Distributed Energy Resources must be accompanied by revisions in policies and state and federal utility regulations to facilitate the recovery of their costs.**

Policy and Regulation

Policies and regulations define the framework and market conditions that enable utilities and, as applicable, non-utility participants to invest in the distribution system for integrating BTM DG into the grid, with an opportunity to earn a reasonable rate of return on their investment.

The committee recommends state legislators, utility regulators, governing boards of publicly owned electric utilities, and others involved in making decisions about electric utility rates should consider that **DG technology costs and market maturity are at a stage both technically and economically where traditional net metering policies to support the deployment of DGs need to be assessed and revisited.**

The committee recommends that decision makers **rely on traditional ratemaking principles as updated to reflect the application of new technologies and service offerings, and the design of compensation approaches for the export of power from BTM generation according to principles that are consistent with how the utility values other sources of power that offer comparable energy, capacity, and other grid services to the system, which may vary by time and location.** Externalities, such as pollution, from some sources of power are generally unpriced, and in many jurisdictions, there are constraints on the ability of regulators to reflect externalities in utility planning and/or ratemaking. Sound economic principles would support the consideration of such

externalities in utility regulation; policymakers should consider how to address such impacts in utility and other energy policies.

LOOKING FORWARD

Fully integrating BTM DG into the electricity system can lead to a cleaner, more resilient electricity system. Achieving this goal will require systematic, coordinated, and sustained investments. Redesigned rate structures and net metering need to be consistent with the basic principles of electricity rate design, balancing efficiency, simplicity, stability, fairness, and revenue adequacy. Thus, traditional net metering needs to be revised to achieve greater economic efficiency and equity. The report calls for a more intentional and integrated approach focused on maximizing benefits for all stakeholders. Policymakers and regulators should design

net metering for the circumstances of their systems and markets, with input from affected stakeholders, and with an eye toward equity, resilience, and decarbonization.

The recommendations in this report provide guidance for net metering policies to compensate BTM DG for the value it provides, but not everything can or should be achieved through electricity rates. Broader societal goals may be best pursued through non-rate approaches. Additional supporting mechanisms that go beyond ratemaking will likely be necessary for attaining certain key objectives, especially equity. With a more open, transparent, deliberate, and intentional approach that leverages the locational, temporal, and contextual value streams of BTM DG, an evolved net metering policy could enable an electricity system that is more sustainable, equitable, and resilient.

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FOR MORE INFORMATION

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