

State Notes

TOPICS OF LEGISLATIVE INTEREST

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An Overview of Compensation and Billing Mechanisms for Distributed Generation **By Tyler VanHuyse, Legislative Analyst**

Introduction

Distributed generation, a method of producing energy through which electricity is generated at the point of its consumption, is one of many new technologies on the modern electric grid. The resource often involves rooftop solar panels or small-scale wind turbines, and it has grown in use significantly over the past 15 years. This growth has coincided with evolving legislative and regulatory actions taken by lawmakers and the Michigan Public Service Commission (MPSC) to balance the costs and benefits posed by distributed generation to all involved stakeholders.

Among these regulatory topics, the appropriate compensation/billing mechanism (mechanism) for distributed generation customers who generate electricity for themselves and the grid has been the subject of considerable debate. The mechanism consists of three major components (the retail-rate design, the sell-rate design, and the metering and billing arrangement); these components strongly influence the resource's value to distributed generation customers, utilities, and nondistributed generation customers. These stakeholders contend that some mechanisms fail to capture the costs or benefits of distributed generation, either overvaluing or undervaluing the resource.

This paper provides an overview of distributed generation mechanisms, discussing the function and effects of each component, and how the variation in these components combine to form four mechanisms that can value distributed generation differently. The paper also addresses the state of distributed generation in Michigan and the current mechanism employed by the MPSC.

Background on Distributed Generation

Distributed generation's decentralized manner of producing electricity allows consumers connected to a large utility's electric grid to produce and consume their own electricity, and then export excess electricity onto the grid for use by other consumers. Commercial and industrial sectors participate in distributed generation with resources such as combined heat and power systems, large solar and wind systems, and hydropower, among others. The residential sector participates in distributed generation with small-scale resources such as rooftop solar panels and smaller wind turbines.

Distributed generation resources pose many opportunities and challenges to the current electric distribution system. They can decrease the environmental impacts of energy production by introducing more renewable resources into the electric generation process, bolster the efficiency of the grid by reducing energy loss that naturally occurs during the transmission of electricity, and increase the reliability of energy production with multiple points of production spread across the grid. However, they also can make it difficult for utilities and grid operators to coordinate energy production and distribution and to calculate customers' rates since distributed generation customers can decrease significantly or eliminate entirely

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their electricity costs.ⁱ Stakeholders consider many of these opportunities and challenges when arguing their case for the most appropriate way to value distributed generation.

In Michigan, distributed generation has grown significantly over the past 15 years. The Michigan Public Service Commission's initial report on net metering (a mechanism for distributed generation discussed below) showed that eight customers in Michigan participated in the program in 2006.ⁱⁱ In 2018, the MPSC's report showed 5,219 distributed generation customers participating in the State's net metering program.ⁱⁱⁱ The MPSC attributes this growth in part to Public Act 295 of 2008, which established the State's net metering program and required each electric provider regulated by the MPSC to offer a distributed generation program with a net metering mechanism. The distributed generation program and net metering mechanism remained in place until 2016, when the Michigan Legislature enacted Public Acts 341 and 342, which required the MPSC to phase out the net metering mechanism and create a new distributed generation mechanism.

The 2016 legislation required the MPSC to establish a mechanism that is an "appropriate tariff reflecting equitable cost of service for utility revenue requirements for customers who participate in a net metering program or distributed generation program".^{iv} To fulfill that requirement, the MPSC established the inflow/outflow mechanism (explained below), but the debate regarding the appropriate valuation and mechanism for distributed generation continues in Michigan and other states.

Components of a Distributed Generation Compensation/Billing Mechanism

Distributed generation mechanisms are multi-faceted and complex. They must adhere to the principles and evolving approaches of rate design while considering the costs and benefits of distributed generation from the perspective of multiple stakeholders: utilities, distributed generation customers, and nondistributed generation customers, among others. They also must account for how generation and consumption of electricity to and from distributed generation customers is measured and billed. These elements combine into three essential components of a distributed generation mechanism: the retail-rate design, the sell-rate design, and the metering and billing arrangement.^v

Retail-Rate Design

As with any industry, electric utilities incur fixed and variable costs in the production and transmission of electricity. An electric utility's fixed costs include its powerplants or energy resources, its transmission grid, and upgrades to or investments in those resources. A utility's variable costs include fuel and operating costs required to meet its customers' electricity demands. Many electric utilities meet these costs through a combination of a fixed charge and incremental charge for electricity consumption on customers' bills. While not an exhaustive list, the retail rate that consumers pay for electricity from the grid generally consists of these costs, and it is these costs that distributed generation customers avoid by consuming the electricity they generate.

The potential for avoided costs has created concern about distributed generation's financial burden between utilities and nondistributed generation customers. Some utilities are concerned that distributed generation customers do not pay their fair share while using the electric grid and that nondistributed generation customers subsidize distributed generation customers' usage of the grid.^{vi} A retail-rate design within a distributed generation mechanism must consider fairly all these factors of cost.

In these considerations, many policymakers and utilities have turned to new approaches in rate design. Some examples include further fixed charges on consumers' bills, time-of-use rates, or demand charges.^{vii} Larger fixed charges essentially create more stable revenue for utilities by increasing a standard fee that every consumer pays each billing cycle. Since production and transmission infrastructure must meet "peak" energy demand, time-of-use rates incentivize consumers to change their consumption habits by creating lower costs for different periods of the day based upon varying levels of demand. This allows utilities to coordinate more efficient electricity production by distributing it across the day—instead of during "peak" times. Demand charges also create an incentive for consumers to change consumption habits and decrease peak demands by charging customers at the rate that correlates with their highest level of consumption during a billing cycle. These evolving approaches to rate design, among others, factor into the retail- and sell-rate design for a distributed generation mechanism in its attempt to appropriately value the resource.

Sell-Rate Design

Distributed generation customers have costs in the production and transmission of electricity, as well. A customer's fixed costs could include installation of the generation system by a third-party solar installer and interconnection charges with a utility company's transmission grid. A customer meets these costs by the rate-of-return on the investment, which comes primarily from the decrease in electric consumption from a utility and the value of any excess energy the customer exports (sells) to the utility's grid.

The value of a distributed generation customer's production, consumption, and exportation is subject to significant debate. Distributed generation customers contend that their services avoid additional costs to the grid in the form of lower system demand, especially at peak demand hours, and lower fuel costs for utilities.^{viii} These customers also argue that their services provide clean and reliable electricity to the grid, which contributes to a decrease in pollution and power outages. A sell-rate design, like a retail-rate design within a distributed generation mechanism, must consider fairly these factors of cost and added value when determining an appropriate sell-rate for a distributed generation customer.

Metering and Billing Arrangement

The metering and billing component of a distributed generation mechanism determines how a distributed generation customer consumes, imports, and exports electricity to and from the grid. This component also determines how the distributed generation consumer's utility

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measures and bills that energy flow. Nevertheless, the metering and billing component does not determine the actual value, cost, and compensation within a distributed generation mechanism, except under the net metering arrangement (described below).

First, the metering aspect of this component determines the volumetric measurement of a distributed generation customer's electricity flow in kilowatt-hours (kWh). A distributed generation customer must have a meter that tracks electricity's bidirectional flow; two meters in which one tracks the importation and another tracks the exportation of electricity; or a smart meter that tracks electricity's bidirectional flow and also has the capacity to track electricity's time-of-use, among other things for retail- and sell-rate approaches.^{ix} The type of meter is an essential aspect of a distributed generation mechanism's metering and billing arrangement because it can limit or expand the scope of measurements a mechanism can use to determine distributed generation's appropriate value.

Linked to the metering aspect's measurements, the billing aspect of this component determines how, if, and when a distributed generation customer receives compensation for electricity exported onto the utility's grid. The billing aspect must specify a billing cycle that considers either the gross or net (importation less exportation) quantities of a distributed generation customer's importation and exportation of electricity. With this information, the billing aspect must provide a policy that either gives a credit to the customer or a cash payment for any excess electricity exported to the grid. The billing aspect also must specify if a credit can carry forward to offset a customer's future electricity importation.

While the parlance involved with metering and billing components may vary, this paper describes in practice three of the most common arrangements, as well as the arrangement adopted by the MPSC: net metering, buy-all/sell all, net billing, and inflow/outflow.^x Regulators within a state often determine the arrangement, and the arrangement partially determines a utility's capacity to recuperate costs, discern the resource's value, and compensate a distributed generation customer. However, as mentioned, only a combination of all three distributed generation mechanism components can determine the actual valuation, costs, and compensation of a customer's distributed generation resource.

Metering and Billing Arrangements in Practice

Net Metering

Net metering is the simplest of the metering and billing arrangement discussed in this paper. The arrangement employs a standard or bidirectional meter that calculates the net total of electricity imported from the grid less the electricity exported to the grid. The arrangement does not track the actual amount of electricity produced by the customer's distributed generation resource since the customer can consume that energy first before the meter makes any measurement.

This arrangement allows a distributed generation customer to produce and then consume the electricity. After consumption, any excess energy flows through the meter and onto the grid for use by the utility or other consumers. This flow onto the grid essentially spins the meter's volumetric measurement "backwards". Conversely, when a customer does not produce

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enough electricity to cover his or her consumption, the customer imports electricity from the utility's grid through the meter. When that energy is consumed, the meter's volumetric measurement spins "forward". During a billing cycle, the meter's continuous "forward" and "backward" spinning determines the net energy consumption for which a utility bills the distributed generation customer.

If a distributed generation customer's net energy consumption leads to a surplus of electricity produced, then a customer receives a credit for that surplus. The billing agreement between a distributed generation customer and a utility determines whether a credit can roll forward to offset future billing payments and the credit's expiration, if any. As mentioned, net metering is the only metering and billing arrangement that has an inherent value or compensation for the distributed generation customer—the retail rate. In net metering, the retail rate applies to the electricity imported from the utility's grid and the electricity exported from the distributed generation resource because only net energy consumption is measured.

Net metering has many benefits and challenges for stakeholders. The major benefit of net metering is its simplicity; the arrangement usually does not need an upgrade in metering infrastructure, and the sell-rate, which is difficult to determine, is equal to the utility's retail rate. Many studies on distributed generation attribute the resources' growth from a nascent technology to its status today to these simple qualities of net metering.^{xi} However, many are concerned that the retail rate overvalues the resource, which may burden nondistributed generation customers and utilities. The fact that net metering allows customers to consume their production before the meter's measurement also raises concerns about the unpredictability of sales for utilities, the difficulty of incorporating newer rate designs, as well as the loss of sales altogether.^{xii}

Buy-All, Sell-All

The buy-all, sell-all arrangement employs two independent meters to measure a distributed generation customer's gross consumption and gross production of electricity. The standard consumption meter tracks the volumetric measurement of electricity imported from the utility's grid, and the production meter tracks the measurement of electricity exported by the customer to the grid.

Unlike net metering, this arrangement does not allow a distributed generation customer to consume the electricity he or she produces. Instead, the production flows directly to the grid for use by the utility or other consumers. A distributed generation customer consumes only electricity imported from the utility's grid and likely purchases this electricity at the retail rate. Essentially, distributed generation customers under this arrangement buy all their consumed electricity from the utility and sell all their produced electricity in return.

During a billing cycle, these totals are calculated separately, and consumers pay the utility for electricity while receiving compensation, bill credits, or another determination of the sell-rate for all electricity produced and exported to the grid. The billing agreement between a distributed generation customer and a utility determines whether a credit can roll forward to offset future billing payments and the credit's expiration, if any. The value of distributed generation under

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the buy-all, sell-all metering and billing arrangement depends predominantly upon the sell-rate design, but also the retail-rate design if a utility opts to employ different approaches to the rate design, e.g., a fixed charge specific to distributed generation customers.

The buy-all, sell-all metering and billing arrangement presents challenges and benefits to various stakeholders. The arrangement requires consumers to purchase all their electricity from the utility, effectively nullifying the challenge facing utilities when coordinating electricity production and anticipated consumer demand. However, some of the suggested environmental and reliability benefits of distributed generation may be reduced because a consumer must export all electricity, which does not necessarily offset any of the utility's production or waste in distribution. The arrangement also allows regulators and utilities to incorporate new approaches to rate design, such as time-of-use pricing and demand charges since a meter can measure distributed generation consumers' gross production of electricity. Some are concerned, however, that the arrangement may undervalue the distributed generation resource since the valuation depends almost wholly upon the sell rate determined appropriate by regulators and utilities.^{xiii}

Net Billing

The net billing metering and billing arrangement employs two independent meters, or one smart meter, to measure a distributed generation customers' net consumption and net exportation instantaneously. Net billing allows the customer to consume the electricity he or she produces. Essentially, when a customer produces more electricity on-site than he or she consumes, the customer exports that excess electricity to the grid. One meter measures that as net exportation. When a customer consumes more electricity than he or she produces, another meter measures that import from the grid as net consumption.

During a billing cycle, the net consumption and net exportation are calculated and billed or credited separately. The customer receives compensation, bill credits, or another determination of the sell rate for all electricity exported to the grid. The value of distributed generation under the net billing arrangement has two factors. The electricity produced and consumed by the customer is inherently worth the retail rate, since it avoids the cost of imported electricity from the grid, and the net export's value depends upon the sell-rate design. In addition, the retail-rate design can factor into the valuation if a utility opts to employ different approaches to the rate design, e.g., a fixed charge specific to distributed generation customers.

Net billing poses similar benefits and challenges as the previous arrangements. Net billing has the capacity to compensate distributed generation in two ways since it can offer distributed generation customers the retail rate for electricity produced and consumed on-site, then a regulator-and-utility-approved sell rate for net exportation of the remaining electricity. Some stakeholders consider this a more precise approach to valuation and compensation, and it allows the sell- and retail-rate designs to adopt new approaches like time-of-use pricing and demand charges.^{xiv} These new approaches could better capture the costs imposed by the distributed generation customer on the grid. However, the utility that used this arrangement could have difficulty in recuperating lost utility sales or effectively coordinating its electricity production with consumer demands since the customer can consume the resource before its measurement through the net exportation meter.

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Michigan's Distributed Generation Compensation/Billing Mechanism

After Public Acts 341 and 342 of 2016 took effect, the MPSC considered the input of utilities and distributed generation stakeholders to conduct a study for the development of a cost-of-service-based distributed generation program tariff. The tariff, or compensation/billing mechanism, recommended by the MPSC was the inflow/outflow arrangement, and any electric utility rate case filed with the MPSC after June 1, 2018, is required to include the new inflow/outflow arrangement as its basis.^{xv} The MPSC agreed to the recommendation because of its belief that the arrangement "creates a more complete picture of a customer's energy usage and excess generation and is better equipped to reflect distributed generation customers' service cost".^{xvi}

The inflow/outflow arrangement is similar to net billing. It employs a smart meter that measures individually the power inflow (net consumption of electricity) and the power outflow (net exportation of electricity) instantaneously. (Two separate meters also could make these measurements, but MPSC documents used in this article only reference the use of a smart meter). The arrangement allows a distributed generation customer to consume the electricity he or she produces. When a customer produces more electricity on-site than he or she consumes, that customer exports the excess electricity to the grid, and the meter measures that outflow as net exportation. When a customer consumes more electricity than he or she produces, another meter measures that inflow as net consumption. When deciding upon this arrangement, the MPSC report determined that the use of bidirectional smart meters capable of independently metering and recording customers' inflow and outflow "is critical to establishing cost of service, as any netting of inflow with outflow obfuscates the true level of electric grid use" by these customers.^{xvii}

During a billing cycle, the net consumption and net exportation are calculated and credited or billed separately. The MPSC determined that credits for outflow can be used in each billing cycle period to offset power supply charges on the bill, and any excess credits can carry forward to offset power supply charges on future bills.^{xviii} Distributed generation's value under the inflow/outflow arrangement has two factors: the value of avoided costs and the sell-rate design. The electricity produced and consumed by the customer is inherently worth the retail rate, since it avoids the cost of imported electricity from the grid, and the net export's value depends upon the sell-rate design.

The sell-rate design received its first practical consideration in July 2018 when DTE Electric Company proposed a rate case in accordance with the inflow/outflow mechanism. The Company proposed for residential distributed generation customers a retail rate equal to the regular retail rate of all customers plus an additional fixed charge for grid access, and a sell-rate credited to the customer "at the average monthly wholesale price of energy."^{xix} The MPSC approved the use of the retail-rate design and the metering and billing arrangement, but denied the proposed fixed charge and ordered DTE to establish a sell-rate design that credited a distributed generation customers' outflow based on the retail rate minus transmission charges. This sell-rate credit equated to 7.477 cents per kWh and, for the time being, the sell rate demonstrates the MPSC's assumption that distributed generation customers add value to the utility's grid by reducing a utility's electric capacity demands, energy and capital costs, among other things.^{xx,xxi}

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The MPSC study considered the benefits and challenges presented by the inflow/outflow arrangement. The most significant benefit was the framework's simplicity, which according to the study, accommodates "a wide array of potential future rate designs, such as those including demand charges, dynamic pricing, and dynamic credits."^{xxii} As discussed, these factors contribute to a greater flexibility in retail- and sell-rate designs. The arrangement, by allowing customers to self-consume the electricity they generate, could continue utilities' concerns regarding lost sales or inefficient energy production when coordinating with all customers' demands. However, given the MPSC's sell-rate determination in the DTE case, which suggests that the arrangement could further grid efficiency and reduce environmental impacts, utilities could be inclined to value and incorporate the resource as a supply of electricity in its capacity-demand calculations, especially as the resource expands to produce more electricity in the State.

Conclusion

The future of distributed generation, its benefits, and challenges, are the subject of much debate. This paper addresses the discourse regarding the appropriate valuation of costs and benefits, and the appropriate compensation/billing mechanism for the developing resource. The three major components of a distributed generation mechanism include the retail-rate design, the sell-rate design, and the metering and billing arrangement, and as discussed throughout the article, each component has its own set of complexities.

While the MPSC determined the inflow/outflow mechanism as the most appropriate, cost-of-service-based distributed generation mechanism in Michigan, the MPSC also insists that the best implementation of its retail- and sell-rate designs remains contingent upon further distributed generation data.^{xxiii} Furthermore, some continue to disagree with the MPSC's initial determination, evidenced in part by the recent legislation proposed in the Michigan Senate. Senate Bills 596, 597, and 598, would amend Michigan's distributed generation laws to repeal the MPSC's authority to determine the appropriate distributed generation mechanism, and the bills would require utilities to offer net metering again, among other significant modifications.

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- ⁱⁱⁱ Michigan Public Service Commission, "Distributed Generation and Legacy Net Metering Programs Report", p. 1, 2019.
- ^{iv} MCL 460.6a.
- ^v Zinaman, Owen, *et al.*, "Grid-Connected Distributed Generation: Compensation Mechanism Basics", p. 1-3, 2017.
- ^{vi} "Combined Comments of Consumers Energy Company, DTE Electric Company, and the Electric Members of the Michigan Electric and Gas Association Regarding the MPSC Staff's draft 'Report on the MPSC Staff Study to Develop a Cost of Service-Based Distributed Generation Program Tariff'", https://www.michigan.gov/documents/mpsc/Detailed_Responses_612317_7.pdf, 2018. Retrieved 6-4-2020.
- ^{vii} Proudlove, Autumn, "50 States of Solar: Q4 2019 Quarterly Report & 2019 Annual Review", p. 5, 2020.
- ^{viii} Linvill, Carl, *et al.*, "Designing Distributed Generation Tariffs Well: Fair Compensation in a Time of Transition", p.23, 2013.
- ^{ix} Andersen, Glen, p. 8.
- ^x Stanton, Tom, "Review of Net Energy Metering and Successor Rate Designs", p. 11, 2018.
- ^{xi} Andersen, Glen, p. 27.
- ^{xii} Zinaman, Owen, *et al.*, p. 4.
- ^{xiii} *Id.* p. 6.
- ^{xiv} *Id.* p. 9.
- ^{xv} Michigan Public Service Commission, "Issue Brief: Distributed Generation", p. 3, 2018.
- ^{xvi} *Id.* p. 2.
- ^{xvii} Michigan Public Service Commission Staff, "Report on the MPSC Staff Study to Develop a Cost of Service-Based Distributed Generation Program Tariff", p. 1, 2018.
- ^{xviii} Michigan Public Service Commission, "Issue Brief: DTE Distributed Generation, p. 2, 2019.
- ^{xix} *Id.* p. 1.
- ^{xx} Michigan Public Service Commission Staff, "Report on the MPSC Staff Study to Develop a Cost of Service-Based Distributed Generation Program Tariff", p. 15, 2018.
- ^{xxi} "*In re application of DTE Electric Co.*, order of the Michigan Public Service Commission, entered May 2, 2019 (Case No. U-20162)." p. 90.
- ^{xxii} Michigan Public Service Commission Staff, "Report on the MPSC Staff Study to Develop a Cost of Service-Based Distributed Generation Program Tariff", p. 10, 2018.
- ^{xxiii} Michigan Public Service Commission, "Issue Brief: DTE Distributed Generation, p. 4.