UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

New England Ratepayers Association	)))	Docket No. EL20-___-000

PETITION FOR DECLARATORY ORDER OF NEW ENGLAND RATEPAYERS ASSOCIATION CONCERNING UNLAWFUL PRICING OF CERTAIN WHOLESALE SALES

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TABLE OF CONTENTS

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Pursuant to Rule 207 of the Federal Energy Regulatory Commission's ("FERC" or "Commission") Rules of Practice and Procedure,[1] the New England Ratepayers Association ("NERA") files this Petition for Declaratory Order requesting that the Commission (i) declare that there is exclusive federal jurisdiction over wholesale energy sales from generation sources located on the customer side of the retail meter, and (2) order that the rates for such sales be priced in accordance with the Public Utility Regulatory Policies Act of 1978 ("PURPA") or the Federal Power Act ("FPA"), as applicable.[2]

I. REQUEST FOR PROMPT ACTION

Full Net Metering ("FNM") is currently widespread and growing, in part because of the significant subsidy afforded by FNM pricing. Sellers of energy subject to FNM need to understand the economics of their decisions whether to invest in these facilities,

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[1] 18 C.F.R. § 385.207 (2019).

[2] The applicable filing fee, in the amount of $30,060, is being paid at the time of filing through pay.gov. *See Update of Annual Filing Fees*, 169 FERC ¶ 62,167 (2019).

which includes the appropriate price they will receive for wholesale sales from facilities currently subject to FNM. Accordingly, it is in the public interest for the Commission to address this Petition promptly so that the pricing of FNM sales becomes settled and affected parties can make appropriate decisions. NERA therefore requests that the Commission address this Petition as promptly as practicable.[3]

II. DESCRIPTION OF FULL NET METERING

FNM is a practice under which an electricity consumer produces electric energy from a generation source (most often solar panels) that is located on the same side of the retail meter as the customer's load.[4] Both the generation and load are connected to a bidirectional retail meter that measures the total amount of energy produced and used by the customer. When the customer consumes more energy than it produces, the interconnected utility supplies the difference, and the meter runs forward to measure the amount of retail service sold to the customer. When the customer produces more energy than it consumes, the meter runs backwards. Whenever the latter situation occurs, the customer is delivering energy to the interconnected utility. The energy so delivered

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[3] Notwithstanding the need for prompt Commission action, NERA recognizes that the Commission may wish to provide interested parties with some additional time to respond to this Petition in light of the current situation concerning COVID-19.

[4] In California, the California Public Utilities Commission staff reported in 2013, that 99 percent of customers on FNM tariffs had installed solar photo voltaic (PV), with wind and bioenergy generation making up the remaining 1 percent. *See* Cal. Pub. Utils. Comm'n Energy Div. *California Net Energy Metering (FNM) Draft Cost-Effectiveness Evaluation, FNM Study Introduction* at 4 (Sept. 2013), https://www.heartland.org/_template-assets/documents/publications/cpucnemdraftreport92613.pdf.

combines with other energy produced on the utility's system and the utility resells the energy to its retail (and in some cases wholesale) customer base.

The states that employ FNM (or equivalent pricing) treat the entire output of the rooftop generators as being subject to state jurisdiction. Common to all FNM programs is that the amount of energy the customer produces is netted, usually on a monthly basis, against the amount of energy the customer consumes. To the extent that the customer consumes more than it produced in the month, it is billed for retail electric service based on the net amount of energy the utility delivered to the customer over the course of the month. This results in the customer being compensated for all of the energy it produced behind the meter, including the energy it delivered to the interconnected utility for resale, at the bundled retail electric rate, or in some cases at a close proxy thereof.[5]

The United States Department of Energy's National Renewable Energy Laboratory ("NREL") reports that 41 States have in place mandatory net energy metering programs.[6] NREL describes these programs as allowing "utility customers with on-site

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[5] For example, under New Hampshire's net metering law and regulations, FNM customers receive a price (by way of a billing credit) that is slightly below the full bundled retail rate when their monthly output exceeds their load, although this price is several times higher than the market price for energy or the established avoided cost. N.H. Rev. Stat. § 362-A:9 (2019). Other New England states also require FNM. *See, e.g.*, *Connecticut Net Metering*, https://www.eversource.com/content/ct-c/about/about-us/doing-business-with-us/builders-contractors/interconnections/connecticut-net-metering, Rhode Island, *Net Metering Provision*, https://ngus.force.com/servlet/servlet.FileDownload?file=0150W00000ETJ1t, Massachusetts, *Net Metering Guide*, https://www.mass.gov/guides/net-metering-guide#-2.-net-metering-credit-calculation-and-billing.

[6] National Renewable Energy Laboratory, *Net Metering* (May 29, 2019), https://www.nrel.gov/state-local-tribal/basics-net-metering.html ("NREL Report"). *See also* Congressional Research Service, *Net Metering: In Brief* at 2 (Nov. 14, 2019), https://crsreports.congress.gov/product/pdf/R/R46010.

[distributed generation] to offset the electricity they draw from the grid throughout the billing cycle (e.g., one month)." According to the U.S. Energy Information Administration, the average residential retail rate in United States is slightly above 13 cents/kWh.[7] In some parts of the country, such as New York, New England and California, residential retail rate are now approaching or exceed 20 cents/kWh.[8] In contrast, wholesale energy prices in most of the country have recently averaged between approximately 2 and 6 cents/kWh.[9] As a result, customers who deliver energy to the interconnected utility as part of an FNM program are generally paid a price for that energy that is several times greater than the wholesale price for energy.

The NREL report further reveals that many states are not even in compliance with existing Commission precedent for determining whether a wholesale sale has taken place. As NREL explains: "If exports exceed imports during a billing cycle, typically the [net energy metering] customer can carry the balance forward into future billing cycles (i.e., a rollover credit). Again, depending on the policies in place, this balance can either be carried forward indefinitely, or it might expire at some fixed point in time (e.g., at the end of the calendar year)."[10]

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[7] U.S. Energy Info. Admin., *Electric Power Monthly*, Table 5.6A (Dec. 2019).

[8] *Id.*

[9] U.S. Energy Info. Admin., *Electricity Monthly Update, Regional Wholesale Markets* (Dec. 2019).

[10] NREL Report. As described below, under existing precedent, all of the excess determined over a monthly billing period is a wholesale sale subject to this Commission's jurisdiction. However, as NREL explained, many state FNM programs either allow the seller to carry over the excess amount to the next month (where it can be netted) or price the excess at the retail rate or a close proxy thereof. Accordingly, whether or not the Commission grants this

Therefore, although pricing rules may vary to some degree from state to state, there are two principles that characterize state FNM programs. First, within a single retail billing cycle, customers who produce energy behind the retail meter are economically compensated for the energy they produce at the rate for bundled retail electric service (or in some cases a close surrogate), regardless of how much of the energy so produced was in excess of customer demand at any point during the month and therefore delivered to the interconnected utility for resale. Second, to the extent a customer produces more energy than it consumes over the full retail billing cycle, states treat the monthly excess generation as being subject to state ratemaking jurisdiction and the prices typically far exceed the applicable wholesale rate.[11]

III. INTRODUCTION AND SUMMARY

This Petition asks the Commission to declare its jurisdiction over energy sales from rooftop solar facilities and other distributed generation located on the customer side of the retail meter (i) whenever the output of such generators exceeds the customer's

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Petition, it should direct all sellers of energy to comply with federal law with respect to these excess sales.

[11] Some states also have adopted variations to net metering, such as virtual or community net metering. These programs allow multiple consumers to share billing credits from a common generating facility. This Petition focuses on the more common form of net metering described above, as that was the subject of the Commission's prior rulings in *MidAmerican* and *Sun Edison*. However, to the extent these net metering variations result in energy being delivered to the interconnected utility for resale, then the principles set forth in this Petition would apply fully to those net metering variations. It may be that some or all of the energy produced through virtual or community net metering is sold at retail to consumers pursuant to the rules of a lawful, retail direct access program. However, to the extent that energy so produced is not sold to specific retail customers pursuant to a lawful retail direct access program, or is greater than the retail customers' consumption, then the energy delivered to the interconnected utility is sold at wholesale, and must be priced in accordance with federal, not state, law.

demand or (ii) where the energy from such generators is designed to bypass the customer's load and therefore is not used to serve demand behind the customer's meter. In these circumstances, energy is being delivered to the local utility for resale to the utility's retail customers for compensation, making the transactions wholesale sales in interstate commerce.[12] These wholesale energy sales should be priced at the utility's avoided cost of energy if the sale is being made pursuant to the Public Utility Regulatory Policies Act ("PURPA") or pursuant to a just and reasonable wholesale rate if the sale is pursuant to Section 205 of the Federal Power Act.

Under FNM, all energy produced by a generator, such as a rooftop solar panel, that is located on the customer's side of the retail meter is permitted to offset the metered amount of bundled retail service that the customer purchases from its local utility, thereby effectively compensating the retail customer at the bundled retail electric rate for all of the electric energy produced.[13] Energy transactions under FNM are currently treated as if they are retail transactions subject to regulation by the various states. In many cases,

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[12] This Petition does not apply to any such sales in the Electric Reliability Council of Texas, Hawaii or Alaska, as the electric systems in these jurisdictions are not in interstate commerce as defined in the Federal Power Act.

[13] In his attached Report (Attachment A), NERA expert witness Ashley C. Brown explains the difference between FNM and what he would consider to proper (but often misnamed) Net Energy Metering. FNM applies when a seller of energy from generation located behind the retail meter, such as rooftop solar, is permitted to offset its sales against all, or a substantial portion of, the bundled retail rate of the local utility, which values the energy produced at the bundled retail rate rather than at the level appropriate for what is being produced, which is non-firm energy. Under true Net Energy Metering, which is practiced in Texas for example, the seller is permitted to offset its energy against the unbundled energy component of the retail rate, which is economically appropriate. This Petition is directed toward the use of FNM, and specifically the component of FNM energy that is sold at wholesale.

however, a portion of the energy produced behind the retail meter either exceeds the customer's demand or is designed to bypass the customer's load and is physically directed entirely to the local utility, in which cases the energy is being sold to the local utility for resale to the utility's other customers.

The law is incontrovertible. The FPA draws a bright line between state and federal jurisdiction over energy sales. Sales of energy at wholesale are subject to the exclusive jurisdiction of this Commission. Sales of energy at retail are subject to the jurisdiction of the states. The sales at issue in this Petition are wholesale sales because the energy is being sold to the utility for resale to the utility's retail load, or for resale by an ISO/RTO,[14] and therefore the Commission is required to exercise its rate jurisdiction over them.

The Commission nonetheless previously disclaimed jurisdiction over most wholesale sales from generators located behind the retail meter on the theory that the net flow over the retail meter aggregated over a full retail billing cycle (typically, one month) determines jurisdiction. This reasoning was never correct. The Commission should not have been netting separate services with different cost structures and service characteristics to determine whether a jurisdictional sale has occurred, and it should not have allowed netting to occur over a full retail billing cycle. Indeed, the Commission has

[14] Some distribution utilities with FNM customers in ISO/RTO markets are not permitted to serve the energy requirements of retail load connected to their systems. In such cases, any power supplied by FNM customers would either be resold by the distribution utility to the ISO/RTO or addressed in the manner dictated by the ISO/RTO, such as being treated as imbalance or unaccounted for energy, and effectively re-sold to all load-serving entities on such basis.

always treated even the contemporaneous hourly exchange of the same service as two separate wholesale transactions.

In any event, the U.S. Court of Appeals for the District of Columbia Circuit has rejected the Commission's reasoning. The Court has held that the Commission cannot determine jurisdiction based on monthly (or any other) netting of injections into and withdrawals from the electric grid. The law is now clear that a wholesale sale of energy is being made whenever the amount of energy generated exceeds the retail load behind the meter, regardless of the duration of the excess, and the price of energy must be determined in accordance with federal law.

In the case of behind the retail meter generators utilizing renewable or other qualifying energy sources (such as rooftop solar), the sellers are virtually always Qualifying Facilities ("QFs") pursuant to PURPA. As such, the sellers are exempt from the administrative burdens of the FPA; and if equal to or smaller than one megawatt in size, are not required even to self-certify to obtain QF Status – they are automatically QFs by operation of law. QFs, however, are prohibited from compelling utilities to purchase their output at a price exceeding the buying utility's avoided cost. PURPA creates a market for the QF's output, but it also establishes the core principle that utilities cannot be compelled to purchase power from QFs at rates that result in the utility or its other customers subsidizing the sale. The Commission's prior disclaimer of jurisdiction has permitted states to employ FNM in order to price these QF sales significantly above avoided cost in violation of PURPA.

In the few cases where wholesale energy sales from behind the retail meter are not subject to PURPA (i.e. the seller is not eligible to be a QF or is eligible but larger than one megawatt and does not self-certify), the seller would be required to have a rate approved and on file with the Commission, together with a contract or tariff under which the wholesale purchaser has agreed to purchase its energy at that rate. The rate should be the applicable just and reasonable rate for non-firm energy, since that is the only service being supplied.

The policy implications of FNM are pronounced and adverse to the public interest. As Mr. Brown explains in his attached Report (Attachment A), FNM allows a limited category of sellers who supply only non-firm energy to be treated as if they are supplying capacity, transmission, distribution, and ancillary services, the costs of which are bundled in the retail rates that are offset by behind the meter generation. Mr. Brown explains that this treatment of the energy has many adverse effects on FERC-regulated markets and on customers:

1. Because all generators located on the other side of the retail meter must sell their energy at the locational price of energy ("LMP"), or at avoided cost if they are a QF, FNM compensates the sellers of one category of energy at a significantly higher price. The price differential is huge: FNM prices are typically three to five times the wholesale energy price. This discriminatory pricing distorts the wholesale market for energy in favor of FNM sellers that do not have to compete, inappropriately causes capital investment to be shifted toward the favored class of sellers, and reduces or eliminates the

incentive for FNM sellers to innovate or invest in storage or other technologies that will improve the quality and efficiency of their product.

2. Mr. Brown explains that rooftop solar, the primary beneficiary of FNM, is among the least efficient forms of renewable generation, significantly more expensive than grid-connected wind and solar generation. FNM therefore favors relatively inefficient and non-dispatchable generation located behind the retail meter at the expense of investment in both more efficient grid-connected renewables and the dispatchable generation needed for reliability. By overcompensating one of the least efficient forms of renewable generation, FNM increases the cost to achieve any given level of renewable energy use and thus makes it less likely that society will be able to achieve whatever level of renewable energy goals is chosen.

3. FNM shifts the fixed and other costs avoided by customers with behind the meter generation to other customers of the interconnected utility, who are thereby forced to subsidize the FNM sales. Because FNM is primarily available to higher income customers, lower income customers end up subsidizing higher income customers, which Mr. Brown aptly describes as "Robin Hood in reverse." Studies have demonstrated this effect.

Mr. Brown also addresses in detail the arguments that are typically made to support this favored pricing and shows that the arguments presented are meritless and should be rejected.

To the extent that no excess energy or energy physically delivered to the local utility is involved (*i.e.,* no wholesale energy sale is taking place), the problem with FNM pricing should be resolved at the State level through the appropriate pricing of retail service. NERA is not asking the Commission to assert jurisdiction in these circumstances.[15] However, this Commission cannot avoid its jurisdiction over wholesale energy sales when they occur, and as the agency responsible for supervising wholesale markets, the Commission should have every reason to act promptly to eliminate the portion of the FNM subsidy that is indisputably subject to its jurisdiction.

IV. THE COMMISSION CASES DISCLAIMING JURISDICTION ARE BASED ON A REJECTED LEGAL THEORY

In its 2009 *SunEdison* decision,[16] the Commission issued a declaratory order reaffirming its prior disclaimer of jurisdiction over FNM transactions in most instances based on the theory that the Commission could determine its jurisdiction by netting, over a full retail billing cycle, energy supplied from a customer's behind-the-meter generator against the energy delivered to the customer in connection with the provision of bundled retail service. The Commission previously had applied the same theory of netting to determine jurisdiction over the provision of energy to provide station service to generators in ISO/RTO markets.

[15] To be clear, all of the mispriced FNM energy distorts outcomes in the wholesale markets subject to this Commission's jurisdiction. A reasonable argument could be made, consistent with the holding in *FERC v. Elec. Power Supply Ass'n*, 136 S. Ct. 760, 773 (2016), that the Commission has authority to assert jurisdiction over the entirety of this energy output due to the substantial impact of FNM on wholesale prices.

[16] *Sun Edison LLC*, 129 FERC ¶ 61,146 (2009) ("*Sun Edison*"). *SunEdison* upholds the Commission's prior decision in *MidAmerican Energy* based on the same reasoning. *MidAmerican Energy*, 94 FERC ¶ 61,340 (2001) ("*MidAmerican Energy*").

This theory was always inconsistent with Commission precedent because (as described in detail below) the Commission does not permit sellers to net transactions when engaging in simultaneous purchase and sale transactions, even where the simultaneous transactions are for the same service. In this case, the Commission's reasoning was particularly improper because the services being netted against each other are not even the same. In the context of FNM, the power flowing over the retail meter to the customer is firm retail requirements service. The power generated behind the retail meter, whether or not it exceeds the in-flow, is non-firm energy. These two services have different costs, different market values, and different service characteristics. By netting the two, the Commission was implicitly accepting the notion that the services being provided in both directions are comparable and therefore appropriate to offset on a one-to-one basis. The Commission never explained in *SunEdison* why it was appropriate to net the inflows and outflows in order to determine whether a jurisdictional transaction has occurred in these circumstances.

Moreover, the D.C. Circuit has more recently rejected the "netting" theory of jurisdiction that stands at the heart of *SunEdison*. In *Southern Cal. Edison Co. v. FERC*, as clarified by *Calpine Corp. v. FERC*,[17] the court reversed its prior holding that netting was appropriate in the context of station service, and held that the Commission cannot rely on netting periods to determine jurisdiction over the transactions involved. In *Calpine*, the Court applied that logic in rejecting the Petitioner's argument that the

[17] *Calpine Corp. v. FERC*, 702 F.3d 41 (D.C. Cir. 2012) ("*Calpine*").

Commission has the authority to use monthly station power netting periods to transform a retail sale into a FERC-jurisdictional transaction. As explained below, the court found it "arbitrary and unprincipled" to rely on netting intervals to determine jurisdiction. The court's reversal of the Commission's station power cases removes the foundation upon which the Commission rested its disclaimer of jurisdiction in *Sun Edison*.

A. The Commission Disclaimed Jurisdiction in the *MidAmerican* and *Sun Edison* Cases

The Commission first set forth its reasons for disclaiming jurisdiction over FNM in *MidAmerican Energy.* There, MidAmerican asked that the Commission either institute an enforcement action under PURPA, or issue a declaratory order, to stop Iowa from requiring MidAmerican to provide customers with FNM. MidAmerican argued that FNM required it to pay rates to QFs that exceed avoided cost and to pay rates to non-QFs that are preempted by the FPA.[18]

The Commission rejected this request, stating that the issue presented was "similar to that in our recent decision addressing the netting of station power used at a generating station against certain wholesale sales from the generating station."[19] After discussing the station power analogy, the Commission determined that: "In the case before us we find likewise that no sale occurs when an individual homeowner or farmer (or similar entity such as a business) installs generation and accounts for its dealings with the utility

[18] *MidAmerican Energy*, 94 FERC at 62,261.

[19] *Id.* at 62,263 (citation omitted).

through the practice of netting."[20] The Commission further found that the monthly billing cycle used by the Iowa Commission was a reasonable time period to measure the netting.[21] The Commission also stated that, in the event there is a net sale from the individual to the utility over the monthly billing cycle, the sale must be priced in accordance with PURPA if the individual's generation is a QF, and must comply with the requirements of the FPA if the generation is not a QF.[22]

The Commission reaffirmed these holdings in *SunEdison*. SunEdison stated that it owns and installs solar-powered electric generation facilities on the premises of end-use customers and sells the electric output of those generation facilities to the host customers for the customers' consumption.[23] SunEdison asked the Commission to declare, among other things, that "[p]rovided that no 'net sale' occurs under the applicable state net metering program, and the Host Customer otherwise complies with the requirements of the state net metering program, then neither the Host Customer nor the owner, financial lessee or operator of the solar facilities will be deemed to have engaged in a sale for resale of any electric energy produced by the solar facilities and purchased by the Host Customer[.]"[24] Based on its analysis in *MidAmerican*, the Commission granted this request. The Commission stated that:

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[20] *Id.*

[21] *Id.*

[22] *Id.*

[23] *SunEdison*, 129 FERC ¶ 61,146 at P 5.

[24] *Id.* at P 11.

> [U]nder the holding of *MidAmerican*, where there is no net sale over the applicable [retail] billing period to the local load-servicing utility, there is no sale; accordingly, where there is no net sale over the applicable billing period to the local load-serving utility by the end-use customer that is the purchaser of SunEdison's solar-generated electric energy, SunEdison is likewise not making a sale "at wholesale," i.e., "a sale for resale."[25]

Thus, in *MidAmerican* and *SunEdison*, the Commission held, based expressly upon the reasoning of its station power cases, that no wholesale sale takes place from a net-metered customer to an interconnected utility if the total amount of energy the customer delivers to the utility does not exceed the total amount of energy the utility delivers to the customer over a full retail billing cycle. And, even where there is a monthly excess, the Commission reasoned that only the excess represents a wholesale sale. The Commission therefore determined that only when, over the course of the retail billing cycle, the total amount of energy the customer delivers to the utility exceeds the total amount of energy the utility delivers to the customer, is the net wholesale sale to the utility for the entire month governed by PURPA or the FPA.

B. The DC Circuit Rejected the Use of Netting Intervals as a Basis for Determining Jurisdiction

After the Commission decided *MidAmerican* and *SunEdison*, the U.S. Court of Appeals for the D.C. Circuit reversed the Commission's rules for the monthly netting of station power. In so doing, the court rejected the principle that the existence of a sale, for jurisdictional purposes, may be determined based on the length of a netting interval.

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[25] *Id.* at P 19.

In *Southern Cal. Edison v. FERC*,[26] the petitioner, Southern California Edison (“*SCE*”), challenged the Commission’s ruling in the station power cases that, as a matter of jurisdiction, no sale occurs (retail or otherwise) if the monthly net amount of station power a generator consumes is no greater than the amount of energy it produces. The court agreed with *SCE*. As the court stated: “The Commission claims that it is not encroaching on California’s jurisdiction over retail sales because no retail sale has taken place if in a *month* a generator delivers more electricity to the grid than it takes.”[27] This, the court found, implies that “whether a retail sale occurs depends, in [FERC’s] view, on the length of the netting period,” which the court found to be “rather arbitrary and unprincipled – certainly as a jurisdictional standard.”[28] Thus, the court rejected the premise that it is reasonable to determine the jurisdiction over a sale based on the length of a netting period.

The court reaffirmed and clarified its *SCE* decision in C*alpine*.[29] There, Calpine and other generators argued that the court’s holding in *SCE* did not fully decide the jurisdictional issue, but rather sent the case back to FERC for further explanation of its netting decision. They argued that the relevant jurisdictional transactions were wholesale sales, which the Commission had not addressed. The court, however, disagreed that this distinction mattered or that the Court had not affirmatively decided the issue, saying that,

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[26] 603 F.3d 996 (D.C. Cir. 2010) (“*SCE*”).

[27] *Id*. at 1000 (alteration in original).

[28] *Id.*

[29] 702 F.3d 41.

in *SCE*, it was "obliged to confront the jurisdictional issue squarely, and [it] rejected the Commission's position" as "arbitrary and unprincipled[,]" quoting the same language from *SCE* that is quoted above.[30]

To further illustrate its point, the court in *Calpine* discussed at length a hypothetical example that had been argued by the petitioners. In this example, a generator consumes 1 MWh of station power each day over the course of a 30-day month and then produces 100 MWh on the last day of the month (after producing nothing during the first 29 days).[31] The petitioners argued that if FERC's monthly netting rule were rejected and the states were to charge for station service on an hourly basis, the generator would be required to buy 29 MWh of station power (netting only the 1 MWh of station power against its production on the last day of the month). This, petitioners argued, would result in trapped costs because it would only be permitted to sell 70 MWh at wholesale.[32]

The court rejected this argument, explaining that it was based on a fundamental misconception of the relationship between netting intervals and actual wholesale sales. The court referred to netting intervals as "a kind of billing convention," that has an impact on the value of the generator's wholesale output.[33] "But," the court explained, "the netting interval does not determine how much energy is *actually available* at

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[30] *Id.* at 46 (citation omitted).

[31] *Id.* at 48.

[32] *Id.*

[33] *Id.* at 49.

wholesale."[34] According to the court, in petitioner's example, the generator would receive compensation at wholesale for 99 MWh – the last day's output less the 1 MWh of production consumed for station power.[35] Petitioner's theory, the court stated, "relies on the fundamental misconception that the netting interval determines how much energy is available for sale at wholesale."[36]

In short, the *SCE* and *Calpine* decisions rejected the very basis of the Commission's decision to disclaim jurisdiction over FNM and held that the existence of wholesale or retail sales is not determined by netting intervals. *MidAmerican Energy* and *SunEdison* are now "dead letters" even assuming they were properly decided in the first instance.

V. A WHOLESALE SALE TAKES PLACE WHENEVER THE AMOUNT OF ENERGY GENERATED EXCEEDS THE RETAIL LOAD BEHIND THE METER

As explained above, many states apply state-ratemaking rules to set the rates for deliveries of energy from FNM customers to the interconnected utility even when there is a net sale to the utility over the entire month or some other, longer period. Even under the reasoning of *MidAmerican* and *SunEdison*, state law may not govern the rates for net sales from the FNM customer to the interconnected utility over the full retail billing cycle. Accordingly, these actions invade FERC's exclusive jurisdiction and are preempted by the FPA and PURPA even under existing FERC precedent. The

[34] *Id.* (alteration in original).

[35] *Id.*

[36] *Id.*

Commission should so find and should direct all sellers to comply with federal law. In light of *SCE* and *Calpine*, however, fundamental principles of FERC jurisdiction establish that the rates charged for *all* deliveries of energy from FNM generators to interconnected utilities for resale are governed exclusively by federal law.

As shown below, the Commission defines a sale of energy as the delivery of energy to another entity for compensation. Where the energy is sold to a utility for resale, then the sale is at wholesale. It is also well established that the existence of a jurisdictional energy sale cannot be negated by a sale of energy from the buyer back to the seller. Rather, FERC has held that the return of energy creates an exchange transaction in which both the original energy sale and the return of the energy are treated as separate wholesale sales as to which payment is made in-kind. Moreover, for pricing, scheduling, and billing purposes, FERC consistently requires that wholesale sales be measured on an hourly or shorter-term basis. Thus, FERC jurisdiction attaches – not only to net energy deliveries over the course of a month – but to all energy delivered by the FNM customer to the interconnected utility.

A. FERC's Jurisdiction Includes All Deliveries of Energy, for Compensation, from an FNM Customer to an Interconnected Utility

The FPA includes within FERC's exclusive jurisdiction "the sale of electric energy at wholesale in interstate commerce."[37] A sale of electric energy occurs whenever

[37] 16 U.S.C. § 824(b)(1) (2012); *see also FPC v. S. Cal. Edison Co.*, 376 U.S. 205 (1964).

energy is delivered from one entity to another for compensation.[38] A sale of electric energy is made at wholesale whenever it is made "to any person for resale."[39] Finally, it is made in "interstate commerce" if the energy is delivered to a utility that merges and comingles the energy with other energy sources on the interstate electric grid.[40] The FPA recognizes no "*de minimis*" exception with regard to FERC's jurisdiction over the rates for wholesale sales.[41]

Moreover, the insertion point of a wholesale sale to a utility, whether on the distribution system and behind a retail meter, has no impact on whether the sale is made in interstate commerce.[42] The Commission has rejected the argument that sales from generation located on local distribution facilities are exempt from FERC jurisdiction: "The Commission's FPA authority to regulate sales for resale of electric energy and transmission in interstate commerce by public utilities is not dependent on the location of

[38] *PJM Interconnection, L.L.C.*, 94 FERC ¶ 61,251 at 61,889 (2001) (defining a sale as a "transaction between two parties, with one party using resources of another party for some form of consideration").

[39] 16 U.S.C. § 824(d).

[40] *FPC v. Fla. Power & Light Co.*, 404 U.S. 453, 457-58 (1972).

[41] *Prior Notice and Filing Requirements Under Part II of the Federal Power Act*, 64 FERC ¶ 61,139 at 61,995 (1993) ("The FPA makes no mention of a 'de minimis' exception for otherwise jurisdictional transactions. *Moreover, the courts have rejected the notion*.") (alteration in original); *FPC v. Texaco Inc.*, 417 U.S. 380, 394 (1974) (holding that the Commission may not, on *de minimis* grounds, exempt a class of utilities from regulation.); *Conn. Light & Power Co. v. FPC*, 324 U.S. 515, 536 (1945) ("We do not find that Congress has conditioned the jurisdiction of the Commission upon any particular volume or proportion of interstate energy involved, and we do not think it would be appropriate to supply such a jurisdictional limitation by construction.").

[42] *Cal. Pub. Utils. Comm'n*, 132 FERC ¶ 61,047 at P 72 (2010).

generation or transmission facilities, but rather on the definition of, as particularly relevant here, wholesale sales contained in the FPA."[43]

In sum, whenever a customer generates more energy than it consumes, it is making a FERC-jurisdictional wholesale sale. The interconnected utility merges and comingles the energy so delivered with other energy on its system and resells it to other customers. The Commission's jurisdiction over wholesale sales does not turn on the location of the generator or the size of the transaction. The pricing of this transaction is, therefore, subject to exclusive federal jurisdiction, whether under the FPA or PURPA.

B. Net Metering Involves an Exchange in Which Wholesale Energy Delivered to the Utility Is Exchanged for Retail Electric Service Delivered to the Customer

Under *SunEdison*, the existence of a wholesale sale from the customer to the interconnected utility is determined by comparing the amounts of energy the customer and the interconnected utility sold to one another during a full retail billing cycle, which is typically one month. For example, if a customer delivered energy to the interconnected utility continuously for the first half of the month, and purchased retail energy continuously for the last half the month, no wholesale sale would be found to exist throughout the entire first half of the month if the quantity of the energy delivered to the interconnected utility is no greater than the quantity of energy delivered to the customer over the month as a whole.

[43] *Id.* (citations omitted).

However, permitting the retail sale from the utility to the customer to negate (or offset) the existence of the wholesale sale of energy from the customer to the utility violates the Commission's longstanding definition of transactions over which it has wholesale rate jurisdiction. Even when energy is returned in kind in connection with a wholesale sale of energy, the Commission has always recognized that the existence of the returned energy does not diminish FERC's jurisdiction over the wholesale sale or the quantity being sold. The Commission refers to such transactions as exchanges. In *Prior Notice and Filing Requirements Under Part II of the Federal Power Act*, the Commission explained that energy exchange agreements must be filed with FERC as jurisdictional rate schedules because, under the Commission's regulations, they constitute sales where the payment is made in-kind.[44] Indeed, FERC's regulations define electric service "without regard to the form of payment or compensation" and specifically list an "exchange" as such a form of compensation for a wholesale sale.[45] As the Ninth Circuit has held: "There is no doubt that energy exchanges are considered sales, subject to FERC's jurisdiction[,]" and that FERC is therefore required to ensure that the level of the compensation for each transaction is just and reasonable.[46]

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[44] *Prior Notice*, 64 FERC at 61,992 ("[E]xchanges involve transfers of electric energy at wholesale, even though for payment in kind, our regulations require public utilities to file those agreements.").

[45] 18 C.F.R. § 35.2(a) (2019).

[46] *Pub. Utils. Comm'n of Cal. v. FERC*, 462 F.3d 1027, 1060-61 (9th Cir. 2006) (remanding case because FERC failed to determine whether the in-kind compensation provided in energy exchange transactions was just and reasonable).

FERC has applied this rule to find that it has jurisdiction over exchange transactions even where the return of energy falls entirely outside of its jurisdiction, as where the exchange is between a seller in the United States and a seller in Canada.[47] As FERC explained: "Unless *both* sides of the exchange occur outside" its jurisdiction, the exchange agreement must be filed with FERC.[48]

The Commission has also applied this same rule to "book out" transactions, in which the parties to offsetting sales make accounting adjustments that reduce the sale amounts for billing purposes. Book outs are just a form of netting. In Order No. 2001, FERC required wholesale sellers to report all of the components of "book outs."[49] FERC confirmed that, in a net book-out sale of 10 MW involving a sale from A to B of 100 MW and a sale from B to A of 90 MW, it would require the reporting of "both the 100 MW and 90 MW sales, and not just the [net] 10 MW delivered."[50] The Commission concluded that the components of a book out must be filed because they "fall within th[e] category" of "arrangements involving, among other matters, 'a public utility selling or exchanging wholesale power in interstate commerce.'"[51] Each component of the book-out transaction is a separate jurisdictional wholesale sale.

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[47] *Barton Village, Inc. v. Citizens Utils. Co.*, 63 FERC ¶ 61,329 (1993).

[48] *Prior Notice*, 64 FERC at 61,992 (emphasis added).

[49] *Revised Public Utility Filing Requirements*, Order No. 2001, FERC Stats & Regs Fed. Regs. ¶ 31,127 at PP 278-85 (2002) (subsequent history omitted).

[50] *Id.* at P 279.

[51] *Id.* at PP 285, 284 (citation omitted).

These precedents have been applied when the commodity or service being returned in kind is the same as what is being supplied. When the offsetting transactions do not even involve the same service, the transaction would not even qualify as an in-kind exchange, and the Commission has never suggested, nor could it rationally suggest, that the net amounts of an exchange establishes the existence or level of each transaction. When, as in the case of FNM, a customer delivers energy to the interconnected utility, it is making a wholesale energy sale in which the utility's sales of retail electric service offsets the metered quantity of energy supplied, but there is nothing that can properly be characterized as an exchange because the utility's retail sale is not just energy, but is a firm, bundled service that includes other service components with their own cost-bases or market prices. The Commission never had a rational justification for netting the two transactions involved in FNM for any purpose.

C. Where FERC Jurisdiction Lies, the Commission Must Exercise that Jurisdiction

Under Supreme Court and Commission precedents, once the Commission's jurisdiction is established under the FPA, the Commission must exercise its jurisdiction and has no discretion to allow the States to regulate in areas within exclusive federal authority. In the landmark "*Colton*" case (*FPC v. Southern Cal. Edison Co.,* 376 U.S. 205 (1964), the Supreme Court affirmed the Federal Power Commission's ("FPC") holding that once FPA jurisdiction has been determined, the FPC did not have the discretion to decline to assert that jurisdiction. In response to a petition by Colton asking the FPC to assert jurisdiction, the FPC found that SCE's sale of power to Colton was a sale at wholesale in interstate commerce subject to its jurisdiction. The FPC acknowledged that the CPUC had been assuming jurisdiction over the sale to Colton for many years and expressed some reluctance to change this relationship, but concluded that it could not decline jurisdiction, stating: "we have been given jurisdiction over Edison's rates to Colton [under the FPA], and *have no discretion to reject that jurisdiction*."[52] The Supreme Court upheld this holding, including specifically the Commission's determination that once it had jurisdiction, the FPC had no discretion to reject that jurisdiction.[53]

In subsequent orders, the Commission has recognized that once FPA jurisdiction is established, the Commission must exercise jurisdiction. For example, in *Florida Power & Light Co.,* 29 FERC ¶ 61,140 (1984), the Commission held that it has exclusive jurisdiction over the wheeling of QF power in interstate commerce. The Commission stated:

> Once the Commission's jurisdiction under the FPA is determined, it is exclusive and preempts the States from regulating the transmission of electric power or sale of wholesale electric power in interstate commerce. *Moreover, we have recognized that we have "no discretion to reject jurisdiction" under the FPA. City of Colton v. Southern California Edison, Co*., 26 FPC 223, 236 (1961), quoted with approval in *FPC v. Southern California Edison Co*., *supra*, 209, n.5.[54]

[52] *City of Colton, Cal. v. Southern Cal. Edison Co.*, 26 F.P.C. 223, 236 (1961) (emphasis added).

[53] *Southern Cal. Edison Co.*, 376 U.S. at 209 n.5.

[54] 29 FERC at 61,292 (emphasis added).

Accordingly, when the Commission has jurisdiction over wholesale sales associated with the production of energy behind the retail meter, that jurisdiction is exclusive, and the Commission does not have authority to decline to exercise it, even where states have been exercising jurisdiction previously.

D. The Commission's Rules Uniformly Measure and Bill Wholesale Sales on an Hourly or Shorter-Term Basis

As the court explained in *Calpine*, netting intervals do not determine the existence of jurisdictional wholesale sales, but they do impact the *value* of those sales.[55] For purposes of measuring and billing wholesale sales, the Commission consistently requires the use of time intervals of one hour or less. This is not a jurisdictional determination but is necessary to determine the level of compensation, or value. Even apart from *Calpine's* rejection of the use of any netting period to establish jurisdiction, it would be arbitrary and capricious for the Commission to use a different interval to measure and determine the compensation for or value of wholesale sales from FNM generators merely on the basis that the generator is located on the customer side of a meter and is eligible for a state FNM program.

In Order No. 888, the Commission provided for hourly transmission scheduling for wholesale sales in the *pro forma* open access transmission tariff ("OATT").[56] This

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[55] *Calpine*, 702 F.3d at 49.

[56] *Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities*, Order No. 888, FERC Stats. & Regs. ¶ 31,036 at 31,717 (1996), *order on reh'g*, Order No. 888-A, FERC Stats. & Regs. ¶ 31,048, *order on reh'g*, Order No. 888-B, 81 FERC ¶ 61,248 (1997), *order on reh'g*, Order No. 888-C, 82 FERC ¶ 61,046 (1998), *aff'd in part*

reflected the industry standard for measuring and settling wholesale power sales. Today, both inside and outside of Regional Transmission Organizations ("RTOs"), the quantity and pricing of wholesale sales is based on hourly or shorter intervals.[57] Indeed, the Commission's accounting rules require that hourly sale and purchase amounts be separately reported in Account No. 447 or Account No. 555 such that purchases and sales that did not occur in the same hour be reported separately.[58]

For QFs, the Commission requires the use of a "rolling-one-hour period" to measure whether a QF's sales quantities comply with its net output obligations.[59] The Commission found that the use of this hourly approach was consistent with precedent and policy.[60] FERC stated that an hourly measure is more accurate, and better matches the fact that "[s]ystem load or consumer demand typically is determined by averaging energy

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sub nom. *Transmission Access Policy Study Group v. FERC*, 225 F.3d 667 (D.C. Cir. 2000), *aff'd sub nom. New York v. FERC*, 535 U.S. 1 (2002) ("Order No. 888").

[57] *E.g.*, *AEP Tex. N. Co. v. Tex. Indus. Energy Consumers*, 473 F.3d 581, 583 (5th Cir. 2006) (noting that AEP system tariff required that in periods where the AEP system had excess generating capacity and sells that excess power at wholesale, AEP's service company was required to determine the profits from such sales "on an hourly basis"); *S. Cal. Edison Co. v. FERC*, 603 F.3d 996, 1002 (D.C. Cir. 2010) (noting that "CAISO's tariff uses an hourly netting period for certain 'transmission-related services'").

[58] *Accounting and Financial Reporting for Public Utilities Including RTOs,* 115 FERC ¶ 61,080 at P 16 (2006) ("For example, assume that an entity in the real-time market had net sales of 10 megawatt hours during hour one of day one of the month and net purchases of 15 megawatt hours during hour six and of 5 megawatt hours during hour ten of day one of the month. Assuming there were no other transactions during the month, the entity would report for the month for the real-time market 10 megawatt hours of sales in Account 447 and 20 megawatt hours of purchases in Account 555; the sales and purchases did not occur in the same hour and so would not be netted.").

[59] *Conn. Valley Elec. Co., v. Wheelabrator Claremont Co., L.P*, 82 FERC ¶ 61,116 at 61,420-21 (1998) ("*Conn. Valley*").

[60] *Id.* at 61,420.

use over a period of time of 15 to 60 minutes."[61] The *SunEdison* and *MidAmerican Energy* decisions disregard this rule.

In recent years, the Commission has moved towards requiring a shorter scheduling interval for certain wholesale transactions in recognition of the needs of variable energy resources ("VERs"). FERC defines a VER as "a device for the production of electricity that is characterized by an energy source that: (1) is renewable; (2) cannot be stored by the facility owner or operator; and (3) has variability that is beyond the control of the facility owner or operator. This includes, for example, wind, solar thermal and photovoltaics, and hydrokinetic generating facilities."[62] This is the type of generation typically used for FNM transactions.

To better accommodate the increased variability of VERs, the Commission adopted, in Order No. 764, a new rule requiring transmission providers to update their tariffs to allow for intra-hour scheduling, and adopted fifteen minutes as the appropriate scheduling interval.[63] The Commission did not prohibit the continued use of hourly billing and settlements, but required that the new intra-hourly scheduling be properly

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[61] *Id.*

[62] *Integration of Variable Energy Resources Notice of Proposed Rulemaking*, FERC Stats. & Regs. ¶ 32,664 at P 64 (2010).

[63] *Integration of Variable Energy Resources*, 139 FERC ¶ 61,246 at PP 91, 93, 96-98 (2012). The Commission had previously addressed a similar issue in Order No. 890. *Integration of Variable Energy Resources Notice of Proposed Rulemaking*, FERC Stats. & Regs. ¶ 32,664 at P 64. Although the Commission chose at that time not to change "the status quo of aggregating net generation over the hour," it acknowledged that transmission providers' requests to adopt a shorter interval would be considered on a case-by-case basis, and acknowledged that shorter intervals could be appropriate in certain circumstances. *Id*. at P 722.

accounted for when hourly settlements are made.[64] Moreover, the Commission recently-proposed a new rule to require each RTO and ISO to "align settlement and dispatch intervals by settling energy transactions in its real-time markets at the same time interval it dispatches energy and settling operating reserves transactions in its real-time markets at the same time interval it prices operating reserves."[65] Thus, for purposes of measuring and billing wholesale sales, the Commission always requires the use of time intervals of one hour or less, with the trend being to require shorter intervals in order to accommodate the characteristics of VERs and improve market efficiency.

The Commission would have no basis to adopt different rules for generation that would be subject to FNM. Consistency in the application of its rules is a governing principle of administrative law. As the Fifth Circuit stated: "There may not be a rule for Monday, and another for Tuesday, a rule for general application, but denied outright in a specific case."[66] This principle requires the consistent application of the Commission's rules determining the pricing and settlement intervals for sales into the wholesale market, regardless of whether the renewable or VER generator making the wholesale sale is located on the customer side, or the grid side, of the retail meter.

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[64] *Integration of Variable Energy Resources,* 141 FERC ¶ 61,232, Order No. 764-A at PP 15-19 (2012).

[65] *Settlement Intervals and Shortage Pricing in Markets Operated by Regional Transmission Organizations and Independent System Operators*, 152 FERC ¶ 61,218 at P 1 (2015).

[66] *NLRB v. Sunnyland Packing Co*., 557 F.2d 1157, 1160 (5th Cir. 1977) (quoting with approval *Mary Carter Paint Co. v. FTC*, 333 F.2d 654, 660 (5th Cir. 1964), *rev'd on other grounds*, 382 U.S. 46 (1965)).

In sum, the Commission's disclaimer of jurisdiction in *MidAmerican* and *SunEdison* is unsustainable based on the Commission's consistent practices with respect to identifying the existence of separate and distinct wholesale sales and for determining the value of those sales.

VI. FNM CUSTOMERS THAT SELL ENERGY TO THE INTERCONNECTED UTILITY FROM RENEWABLE RESOURCES ARE QUALIFYING FACILITIES. THIS STATUS EXEMPTS THEM FROM THE BURDENS OF THE FPA, BUT MANDATES THAT THEIR SALES BE PRICED AT NO MORE THAN AVOIDED COST

Although sales for resale to the interconnected utility are subject to federal law, FNM generators usually meet the qualifications to be QFs. FERC's PURPA regulations provide that a generator with a capacity of under 80 MW, whose primary energy source is biomass, waste, renewable (such as solar, wind or hydro), geothermal, or any combination thereof, qualifies as a QF.[67] Moreover, in 2010, the Commission amended its regulations to exempt all facilities with a net power production capacity equal to or less than 1 MW from the requirement to complete and file a self-certification of QF status.[68] The Commission stated that it made this change to reduce the administrative burden on "facilities that are comparatively small, such as solar generation facilities installed at residences or other relatively small electric consumers such as retail stores, hospitals, or schools."[69] As a result, FNM generators that are smaller than 1 MW and use

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[67] 18 C.F.R. §§ 292.203(a), 292.204(a) and (b) (2019).

[68] 18 C.F.R. § 292.203(d) (2019).

[69] *Revisions to Form, Procedures, and Criteria for Certification of Qualifying Facility Status for a Small Power Production or Cogeneration Facility*, 130 FERC ¶ 61,214, Order No. 732 at PP 34-35 (2010).

renewable (or other qualifying) energy sources are automatically QFs without the need for any certification or filing.[70]

FERC's PURPA regulations provide QFs with an exemption from nearly all of the requirements of the FPA. QFs under 20 MW are exempt from, among other things, all of the FPA's pricing, accounting, reporting, and filing requirements.[71] As explained below, the only significant requirement placed on FNM generators by PURPA is that the energy they sell to the interconnected utility must be priced at no more than the avoided cost of energy.

Therefore, the principal effect of granting this Petition would be to compel states using FNM to abide by PURPA's pricing rules, but would not impose any additional FPA burden on the individual sellers.

A. Sales from Behind-the-Meter Generators Must Be Priced in Accordance with PURPA

PURPA was designed to create a market for QF output but simultaneously prohibits QF sellers from imposing any economic burden on the utility or its other customers. The most important obligation imposed on FNM generators under federal law is that their sales of energy to the interconnected utility must be priced in accordance with PURPA. Avoided cost is the maximum rate a utility may be required to pay to a QF

[70] To be clear, if the FNM sellers were not QFs, they would need to have Commission-approved just and reasonable rates under Section 205 of the FPA, and would need to have a filed tariff in which their interconnected utility had agreed to purchase their energy at the filed rate.

[71] 18 C.F.R. § 601 (2019). Nearly all of the FPA sections to which QFs are not exempt (other than prohibitions on fraud and market manipulation) apply only to hydroelectric facilities or facilities with transmission.

under PURPA.[72] As the Commission has stated: "[T]he State can pursue its policy choices concerning particular generation technologies consistent with the requirements of PURPA and our regulations, so long as such action does not result in rates above avoided cost."[73]

PURPA, and the Commission's implementing regulations, require that avoided cost be set such that "utilities (and their ratepayers) be in the same financial position as if they had not purchased QF power."[74] As the Supreme Court explained, paying a rate based on avoided cost should result in no increase in costs to the utility compared generating the energy itself or purchasing from another source.[75] Federal law therefore prohibits the cost shifting that is occurring under FNM as presently constituted. The central principle behind PURPA avoided cost pricing is that there will be no net increase in costs to serve other customers.

FNM pricing produces a rate for QF-generated energy that substantially exceeds the purchasing utility's avoided cost. As Mr. Brown explains, a seller of rooftop solar or

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[72] PURPA § 210 (codified at 16 U.S.C. § 824a-3(a) and (b) (2012)) ("No such rule. . . provide for a rate which exceeds the incremental cost to the electric utility of alternative electric energy.").

[73] *Southern Cal. Edison Co.*, 70 FERC ¶ 61,215 at 61,676 (1995); *see also Cal. Public Utils. Comm'n.*, 132 FERC ¶ 61,047 at P 67 (2010).

[74] *Conn. Valley,* 82 FERC at 61,417 (citing Order No. 69, FERC Stats. & Regs., Reg. Preambles 1977-1981 ¶ 30,128, at 30,871).

[75] *Am. Paper Inst. v. Am. Elec. Power*, 461 U.S. 402, 415 n.9 (1983) ("Of course, even when utilities purchase electric energy from qualifying facilities at full avoided cost, rather than at some lower rate, the rates the utilities charge their customers will not be increased, for, by hypothesis, the utilities would have incurred the same costs had they generated the energy themselves or purchased it from other sources.").

other comparable behind the meter energy is compensated at the bundled retail rate, but it is not supplying a firm power product or avoiding the need for utility transmission or distribution and other fixed costs included in the bundled rate. The costs not recovered from the customer using FNM are then re-allocated and recovered from other customers. This need for re-allocation means, by definition, that the rate charged by the FNM supplier exceeds the utility's avoided cost. To be clear, under PURPA states are permitted in the first instance to establish rates for QF sales, but they must adhere to PURPA's mandate that the rates not exceed the purchasing utility's avoided cost. Where the QF is supplying non-firm, intermittent, and non-dispatchable energy only, the rate must be based on the utility's avoided cost of energy.

In addition, to the extent the customer does not already have appropriate metering, avoided cost pricing for FNM generation requires that the customer have a meter that is capable of measuring the net flow of energy between the customer and the utility on an hourly or shorter-term basis. Without such metering, there is no way to measure the quantity of energy the FNM generator delivers to the interconnected utility. The Commission has required hourly metering for compliance with PURPA's rules,[76] and the Commission's regulations include the cost of necessary metering within the definition of interconnection costs.[77]

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[76] *Conn. Valley*, 82 FERC at 61,420-21.

[77] 18 C.F.R. § 292.101(b)(7) (2019).

So long as the energy delivered to the interconnected utility is properly measured and priced at or below avoided cost, the QF generator has complied with federal law. Under FNM, QFs are being compensated for their energy in excess of avoided cost, and federal law is being violated.

Finally, in the few instances where an FNM generator is not a QF, then the generator's wholesale sales must comply with the FPA, and the sales must occur under a contract or tariff approved as just and reasonable. Should that occur, the Commission could choose to adopt a light-handed regulatory approach. Courts have approved the Commission's use of light-handed regulation where prices are constrained by market forces and where such regulation is dictated by practical considerations. *See*, *e.g.*, *Interstate Natural Gas Ass'n of Am. v. FERC*, 285 F.3d 18, 31 (D.C. Cir. 2002). Therefore, in the event that a non-QF FNM generator delivers energy to the interconnected utility for resale, the Commission could, for example, find that the sales are exempt from most FERC regulatory requirements, so long as they are made at rates based on the applicable wholesale market bench-mark for energy in the relevant market (i.e., LMP), and appropriate metering is in place to permit proper pricing.

B. Section 1251 of EPAct 2005 (PURPA Section 111(d)) Allows States to Consider Net Metering Only for the Energy Component of Electric Service

In Section 1251 of the Energy Policy Act of 2005 ("EPAct 2005"), Congress amended Section 111(d) of the PURPA and directed the States to evaluate whether to adopt net metering.[78] Section 111(d)(11) defines "net metering" as follows:

> Net Metering – Each electric utility shall make available upon request net metering service to any electric consumer that the electric utility serves. For purposes of this paragraph, the term "net metering service" means service to an electric consumer under which ***electric energy*** generated by that consumer from an eligible on-site generating facility and delivered to the local distribution facilities may be used to offset ***electric energy*** provided by the electric utility to the electric consumer during the applicable billing period.[79]

This provision does not require that electric utilities provide net metering, but directs that States must consider whether to adopt it.[80]

The amendment defines net metering such that the net metered customer is entitled to an offset for "*energy* provided by the electric utility to the electric customer during the applicable billing [cycle]."[81] The Texas Net Energy Metering program, described by Mr. Brown, is consistent with this provision, but FNM is not.[82] The requirements of this

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[78] In relevant part, PURPA provides that states are required to consider whether to adopt the various practices set forth in PURPA section 111(d). 16 U.S.C. § 2621(a) (2012) ("Each State regulatory authority. . . and each nonregulated electric utility shall consider each standard established by subsection (d) of this section and make a determination concerning whether or not it is appropriate to implement such standard to carry out the purposes of this chapter.").

[79] 16 U.S.C. § 2621(d)(11) (emphasis added).

[80] *See Swecker v. Midland Power Coop.*, 114 FERC ¶ 61,205 at P 27 (2006).

[81] 16 U.S.C. § 2621(d)(11) (emphasis added)

[82] Brown Report at 9.

provision stand in stark contrast to practice used in state FNM programs today, in which the customer is given an offset equal to the full retail electric rate, which includes not only energy but also transmission, distribution, ancillary services and other state-imposed costs. By specifying that the energy the consumer delivered to the local distribution facilities may be used to offset *energy* provided by the electric utility, Congress appears to be saying that the supplier should receive an offset equal to the avoided cost of energy consistent with the other relevant provisions of PURPA.

The Ohio Supreme Court addressed a similar statute (since amended) and found that it provided a credit for energy only.[83] The Ohio statute defined "net metering" as "measuring the difference in an applicable billing period between the electricity supplied by an electric service provider and the electricity generated by a customer-generator which is fed back to the electric service provider." FirstEnergy had proposed a tariff that would credit net metering customers only for the power component of the sale, but the Ohio Public Utilities Commission ("OPUC") ordered FirstEnergy to provide net metering at the full bundled retail rate. The Ohio Court reversed the OPUC, and held that the tariff proposed by the utility limiting offsets to the value of electricity had correctly interpreted the Ohio statute.[84] Because the customer does not provide transmission, distribution, or

[83] *FirstEnergy Corp. v. Pub. Utils. Comm'n of Ohio*, 768 N.E.2d 648, 650, 652-53 (Ohio 2002).

[84] *Id*.

ancillary service, the Court agreed that the "electricity" credit in the statue did not provide a credit for those services.[85]

As with the Ohio statute, the amendment to PURPA Section 111(d) provides an offset for energy only, and because it is part of PURPA, infers that the offset is equal to the avoided cost of energy. It does not purport either to change the existing rules for the pricing of QF energy or to redefine the jurisdictional line between FERC and State jurisdiction. Rather, it serves to encourage the development of net metering on an efficient basis and defines net metering in a manner that is limited to an offset for the energy provided. Thus, the form of net metering defined in the statute is different from the form of net metering, FNM, that is referred to in this Petition.

VII. THE COMMISSION'S PRIOR DISCLAIMER OF JURISDICTION HARMS CONSUMERS, DISTORTS INVESTMENT DECISIONS TO FAVOR LESS EFFICIENT RENEWABLES OVER MORE EFFICIENT RENEWABLES, AND PLACES AT A COMPETITIVE DISADVANTAGE THE FIRM CAPACITY NEEDED FOR RELIABILITY

For over two decades the Commission has been a constant and unyielding advocate for efficient, non-discriminatory power markets. As explained in the attached Report of Ashley Brown, FNM is undermining these markets by affording one particular set of generators a price for their energy that is typically several times the market price or avoided cost of energy supplied. The generators favored by FNM are typically much less efficient than their disfavored competitors and impose significant additional costs on the electric system due to their intermittent nature. These overpayments result in over-

[85] *Id.*

investment in the production of this less efficient and reliable energy with a corresponding reduction in investment in both grid-based renewable generation (e.g., wind and central station solar) and the resources that provide the dispatchable firm power required for reliable operations. They also provide perverse incentives for generators not to invest in storage or other technologies that will improve the quality of their product since they are already being compensated as if they were supplying a firm, load-following service. FNM allows the sellers of behind the meter energy to avoid competition, even if competition is defined narrowly to include only renewable forms of energy. As the Commission has observed, it is necessary that both FERC and the states ensure that QF rates do not exceed avoided cost "because QF rates that exceed avoided cost will, by definition, give QFs an unfair competitive advantage over other market participants …".[86]

Among the more important adverse effects of FNM is its impact on the transition to more renewable energy. This transition will necessarily be costly. Regulators owe it to the consuming public to make this transition as efficient as possible. But, as Mr. Brown explains, forcing electric consumers to pay the bundled retail rate for one form of variable renewable energy, when energy with all of the same environmental attributes can be purchase for a fraction of that amount from the grid, is untenable. It is likely to make it more difficult to achieve renewable energy goals, which face the headwind of increased electricity costs. It will also stifle innovation as capital is inefficiently directed to one of

[86] *Southern Cal. Edison Co*., 70 FERC ¶ 61,215 at 61,676 (1995).

the least efficient forms of renewable energy and FNM sellers are disincentivized to make their product better.

The Commission has endorsed competitive wholesale markets in order to ensure that buyers do not overpay for power and to provide an efficient allocation of capital to different industry sectors and technologies. Ultimately, consumers bear the additional costs associated with FNM. As the contribution to system costs from retail customers using FNM goes down, those costs are re-allocated to other retail customers. As explained below, this re-allocation perversely favors higher income consumers. FNM also inefficiently allocates capital to behind-the-meter generators by generating excessive profits to this class of generators while more efficient renewable and non-renewable generators located on the grid-side of the meter are paid wholesale market prices or avoided costs. If the Commission turns a blind eye to the distortions created by FNM, it will be abandoning its commitment to promoting efficient, non-discriminatory power markets.

A. Net Metering Is Inconsistent With Reducing Greenhouse Gas Emissions and with the Commission's Responsibility To Ensure Reliable Electric Service

Basic economic theory teaches that if the price of a good or service goes up, less of it will be purchased and supplied. FNM substantially increases the price of renewable energy, with inevitable consequences for the quantity of supply. Mr. Brown explains that growing FNM will therefore make it more difficult to achieve carbon reduction goals.

In 2015, the Massachusetts Institute of Technology ("MIT") completed a major study titled "The Future of Solar Energy" (the "MIT Study").[87] The purpose of the MIT Study was to examine the current state of US solar electricity generation with the objective of assessing "solar energy's current and potential competitive position and to identify changes in U.S. government policies that could more efficiently and effectively support the industry's robust, long-term growth."[88] The study examined FNM, and observed that it results in residential-scale solar being given a substantial subsidy not available to utility-scale solar:

> FINDING: Subsidizing residential-scale solar generation more heavily than utility-scale solar generation, as the United States now does, will yield less solar generation (and thus less emissions reductions) per dollar of subsidy than if all forms of solar generation were equally subsidized.[89]

The study examined the relative efficiency and costs of residential-scale and utility-scale solar and calculated that:

> any given total subsidy outlay borne by taxpayers and/or electricity consumers – if it is devoted to subsidizing residential-scale PV – will produce only a fraction [about a quarter to a half] of the solar electricity that would be produced if the same amount of subsidy were devoted to supporting utility-scale PV generation.[90]

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[87] *The Future of Solar Energy – An Interdisciplinary Study*, http://energy.mit.edu/wp-content/uploads/2015/05/MITEI-The-Future-of-Solar-Energy.pdf .

[88] *Id.*, Executive Summary at xiii.

[89] *Id.* at 223.

[90] *Id.*

Thus, the MIT Study concluded that if the policy objective "is to increase solar generation at least cost, favoring residential PV *makes no sense*."[91]

The overpayment of FNM generation also both increases the need for, and places at a competitive disadvantage, the generation resources needed for system reliability. The North American Electric Reliability Corporation ("NERC") has examined the reliability impacts of distributed solar generation.[92] NERC reported that the variability of solar generation can impact reliability of the bulk system at high penetration levels.[93] In particular, NERC explained that the variability risks posed by small, distributed solar PV plants is fundamentally different in nature from those posed by other variable resources such as wind because there may be less diversity among the resources; that is, they might see "more correlation in output as the sun rises and sets daily."[94] Most utility systems experience high demand during the evening at the same time that solar production is disappearing. As NERC stated, this "ramping" risk increases the need, not only for good forecasts of variability, but also for "adequate flexibility from other system resources to follow the variability."[95] Mr. Brown agrees, concluding that there will be an increased need for firm resources that can be counted on to provide varying amounts of energy and reserves to compensate for the unreliability of the generation used for FNM. He

[91] *Id.* (emphasis added).

[92] *See* NERC Special Report*, Potential Bulk System Reliability Impacts of Distributed Resources* (Aug. 2011).

[93] *Id.* at 38.

[94] *Id.* at 22-23.

[95] *Id.* at 38.

describes the "duck curve" phenomenon in California that is the product of the economic forces produced by the mispricing that occurs under FNM.

The resources required for reliability are among the firm resources that FNM places at a competitive disadvantage. The overpayments provided to the FNM generators results in over-investment in the production of the variable, non-dispatchable energy they produce. This, in turn, suppresses market prices and thereby reduces investment in the resources needed to provide reliable operations. These market distortions will produce either a dangerous over-reliance on unreliable resources, or a need for other subsidies and reliability must-run contracts to counteract the distortions caused by the net-metered generators.

B. Net Metering Both Increases Utility Costs and Shifts Those Costs in an Inequitable Manner

FNM increases costs for those consumers who do not engage in it, which as explained above violates a central tenet of PURPA avoided cost pricing. Mr. Brown shows that FNM generation, because of its limited availability and variability, does not reduce transmission investment costs and may not reduce losses. He also explains that FNM generation likely increases the cost of distribution due to the need to re-design distribution systems to accommodate two-flows of power.

The MIT Study examined the cost effects of residential PV generation on distribution network costs. It found that "[t]otal distribution costs (which include distribution investment and operations costs, plus losses) increase with PV energy share."[96] It explained that, "[a]lthough it seems reasonable to expect that generating electricity close to loads brings energy losses down and requires less network infrastructure to carry energy from other regions, these benefits are not realized in situations where distributed generators are not controllable" or "where mismatches exist between load and generation, both in terms of location and time[.]"[97] The study calculated that distribution costs could, in some areas, double when distributed solar contribution exceeds one-third of annual load.[98] Yet, under FNM, the customers who contribute to these higher costs are excused from paying them. They not only avoid these costs in their own rates, but are also compensated as if they are supplying the associated services when they make wholesale sales.

Moreover, these cost shifts are particularly inequitable, as they shift costs from wealthier customers to those who cannot afford large houses or businesses. Mr. Brown cites substantial evidence of this effect. He describes a recent study that evaluated the impacts of FNM on ratepayers. It found that the "median income of [the] population of FNM customers is about 78% greater than the median California household income and about 34% greater than the median household income of IOU customers."[99] Mr. Brown further explains that the cost shifting primarily benefits solar developers rather than the customers who lease or acquire rooftop solar facilities. A 2014 paper by the Edison

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[96] MIT Study at 164.

[97] *Id.* at 172.

[98] *Id.*

[99] *See California Net Energy Metering (FNM) Draft Cost-Effectiveness Evaluation, FNM Study* at 109-10.

Foundation Institute for Electric Innovation confirms his conclusion. It found that when the FNM customer chooses to lease solar facilities or enter into a power purchase agreement with a solar leasing company (which, it reported, is the case with regard to about 75 percent of households with rooftop solar PV facilities) the leasing company is the primary beneficiary of the FNM subsidy.[100]

In sum, FNM is not only unlawful, it is bad public policy. It harms consumers, impairs the efficient development of renewable resources, and undermines market efficiency and system reliability.

VIII. CONCLUSION

FERC has exclusive jurisdiction over the rates for wholesale sales and has an obligation to ensure that wholesale markets are non-discriminatory and produce just and reasonable results. It has a further obligation under PURPA to ensure that rates from QF sales do not exceed avoided cost. FERC is required to exercise this jurisdiction. Even if the Commission had discretion not to exercise its jurisdiction, the exercise of such discretion would be inappropriate because of the multiple adverse public policy implications of FNM pricing.

WHEREFORE, for all of the reasons set forth herein, NERA respectfully requests that the Commission find that the delivery, to a reseller, of energy that was produced behind the retail meter, is a wholesale sale that must be priced in accordance with the

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[100] Edison Foundation Institute for Electric Innovation, *Net Energy Metering: Subsidy Issues and Regulatory Solutions*, at 4 (Sept. 2014), https://www.edisonfoundation.net/iei/publications/Documents/IEI_NEM_Subsidy_Issues_FINAL.pdf.

PURPA or the FPA, and that the Commission find unlawful, and therefore reject, state net metering laws which assert jurisdiction over such wholesale sales and establish a price in excess of what PURPA or the FPA allows for wholesale sales subject to this Commission's exclusive jurisdiction.

Respectfully submitted,

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April 14, 2020

ATTACHMENT A

REPORT OF ASHLEY C. BROWN

EXECUTIVE DIRECTOR
HARVARD ELECTRICITY POLICY GROUP
HARVARD KENNEDY SCHOOL
HARVARD UNIVERSITY

TABLE OF CONTENTS

I. BACKGROUND AND QUALIFICATIONS

I am the Executive Director of the Harvard Electricity Policy Group (HEPG) at the Harvard Kennedy School, at Harvard University. HEPG is a "think tank" on electricity policy, including but not necessarily limited to pricing, market rules, and regulation, as well as environmental and social considerations. HEPG, as an institution, never takes a position on policy matters, so this paper represents solely my opinion, and not that of HEPG or any other organization with which I may be affiliated.

I served 10 years as a Commissioner of the Public Utilities Commission of Ohio (1983-1993), where I was appointed and re-appointed by Governor Richard Celeste. I also served as a member of the National Association of Regulatory Utility Commissioners (NARUC) Executive Committee and served three years as Chair of the NARUC Committee on Electricity. I was a member of the Advisory Board of the Electric Power Research Institute. I was also appointed by the U.S. Environmental Protection Agency as a member of the Advisory Committee on Implementation of the Clean Air Act Amendments of 1990. I am also a past member of the Boards of Directors of the National Regulatory Research Institute and the Center for Clean Air Policy. I have served on the Boards of Oglethorpe Power Corporation, Entegra Power Group, and e-Curve. I serve on the Editorial Advisory Board of the *Electricity Journal*.

I have been at Harvard continuously since 1993. During that time, I have also been Senior Consultant at the firm of RCG/Hagler, Bailly, Inc. and have been, at various times in the past, Of Counsel to the law firms of Dewey & LeBouef and Greenberg Traurig. I have also taught in training programs for regulators at Michigan State University, University of Florida, and New Mexico State University (the three NARUC sanctioned training programs for regulators), as well as at Harvard, the European Union's Florence School of Regulation, Association of Brazilian Regulatory Agencies, and a number of other universities throughout the world. I have advised the World Bank, Asian Development Bank, and the Inter-American Development Bank on energy regulation, and have advised governments and regulators in more than 25 countries around the world, including Brazil, Argentina, Chile, South Africa, Costa Rica, Guatemala, Zambia, Ghana, Tanzania, Namibia, Equatorial Guinea, Liberia, Mozambique, Hungary, Ukraine, Russia, India, Bangladesh, Saudi Arabia, Indonesia, and The Philippines. I have written numerous journal articles and chapters in books on electricity markets and regulation, and am the co-author of the World Bank's *Handbook for Evaluating Infrastructure Regulation.*

I hold a B.S. from Bowling Green State University, an M.A. from the University of Cincinnati, and a J.D. from the University of Dayton. I have also completed all work, except for completing my dissertation, on a Ph.D. from New York University. My current CV is provided as an attachment.

II. INTRODUCTION

In what follows I address the following topics:

- Basic principles of electricity pricing and ratemaking and the origins of net metering for distributed solar;
- Types of net metering
- How full net metering suffers from problems associated with cross-subsidies, inefficiency, unfairness to competing resources, and reallocation of capital to less efficient resources, causes regressive social effects, and has a highly adverse effect on competitive electricity markets;

- The problems with “value of solar” claims, and why value of solar analysis is usually based on largely meaningless conjecture that is not in accord with either the cost basis or market basis that underlies general principles of electricity pricing under PURPA and the Federal Power Act, and fails to provide meaningful justification for continuing the burdensome and unfair cross subsidies intrinsic to net metering; and
- How, given the national and wholesale market effects of net metering, as well as the importance of appropriate price signals to the future of solar energy in the United States, reform of retail net metering is an issue that is appropriate for national policymaking.

A. Basic Principles of Electricity Pricing and Ratemaking and the Origins of Retail Net Metering for Rooftop Solar

The delivery of electricity to homes and businesses has long been understood to be an essential service. The electricity industry, historically, was largely characterized by full vertical integration of the full bundle of electric services—generation, transmission, distribution, and retail sales. Utilities bore substantially all of the costs associated with these services, which were significant, including not only large upfront costs, but maintenance and improvement of facilities, requiring significant capital outlays.

Utilities were traditionally thought of as vertically integrated “natural monopolies.” That characteristic, however, has now, in many parts of the U.S. become limited to transmission and distribution (including dispatch and control functions).[1] This is because wires and wires-related (network) services have economies of scale and are in need of central coordination.[2] As natural monopolies, the theory is that utilities can supply services at lower cost without the duplication of facilities and other fixed costs. For this reason, in contrast with other aspects of the economy, natural monopoly theory would suggest that competition would ultimately not assuredly provide reliable, universal service, and would substantially increase costs without adding benefits. Transmission is a natural monopoly because the cost of building and operating competing parallel systems is prohibitive. That is also the case with distribution in most instances. In addition, due to the physics of electricity, the stability of the transmission and distribution systems requires central control.

Natural monopolies are typically found in industries with high capital costs and the opportunity for substantial economies of scale. Historically, this was a fitting description of the electricity industry, where natural monopolies were the norm during most of the 20th Century.[3] Typically, utilities were provided with a monopoly over a specific service territory.

While utilities were granted monopolies in their service territories, it was universally recognized that there would have to be some check on their rate-setting ability. Otherwise, utilities would have unfettered power to extract monopoly rents for an essential service. A

[1] For an early discussion that developed the idea of natural monopolies in gas and water, *see*, *e.g*., John Stewart Mill, cited in Garfield and Lovejoy, Public Utility Economics, 1964, p. 15.

[2] The transmission monopoly, at least in organized markets, is no longer in ownership of physical assets, but, rather, has been reduced to dispatch and control operations, a function wholly detached from ownership of poles, wires, etc. Thus, there has not only been very substantial vertical disaggregation, but important horizontal disaggregation as well.

[3] As noted elsewhere in this report, the generation and energy services/retail sales segments of the industry are increasingly regarded as outside the scope of natural monopoly and are contestable, but that recognition changes nothing in terms of the obligations incumbent on a distributor of electricity to incur fixed and capacity costs to sustain its obligation to serve.

number of different oversight models developed in various localities and states across the United States. In nearly all cases, however, a utility's rates are subject to independent review and approval, either by an independent regulator, or, as in the cases of public power or electric cooperatives, often by officials thought to be accountable to the customers being served.[4] Since the review was largely in the context of monopoly power, the market would not discipline prices, so the decision was to discipline prices on a cost basis.

In his seminal 1961 book on utility ratemaking, the economist James Bonbright,[5] whose writings on the subject are widely regarded as authoritative, argued for the importance of a "cost of service" standard in setting rates.[6] Writes Bonbright:

> [O]ne standard of reasonable rates can fairly be said to outrank all others in the importance attached to it by experts and by public opinion alike—the standard of cost of service, often qualified by the stipulation that the relevant cost is *necessary* cost or cost reasonably or prudently incurred.[7]

In implementing "cost of service" ratemaking, ratemaking bodies typically follow a two-step process: 1) determining the utility's total costs—including a fair rate of return on capital investments; and 2) setting rates by allocating a share of those costs to different classes of customers and then selecting rate structures to recover sufficient revenue from each class of customer, based on the prudent and documented costs incurred to serve each class.

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[4] *See, e.g.*, https://mitei.mit.edu/system/files/Electric_Grid_8_Utility_Regulation.pdf.

[5] Bonbright, who died in 1993, was a longtime member of the Business School Faculty at Columbia University and served for some time as Chairman of the New York Power Authority. He is widely regarded as one of the nation's most distinguished writers and commentators on regulation and a most important thought leader on the subject.

[6] This view is generally held by others as well. *See, e.g.*, https://mitei.mit.edu/system/files/Electric_Grid_8_Utility_Regulation.pdf.

[7] Bonbright, op cit, p. 67.

The three most important categories of costs for electric utilities are: 1) variable, largely, energy, costs—the total number of kilowatt hours (kWh) used; 2) demand costs—the total capacity (kilowatts, or KW) the utility must build and maintain in order to meet peak demand, *i.e.*, generation, transmission, and distribution facilities adequate to supply all the power needed at the moment of the very highest demand; and 3) fixed costs—costs that must be incurred regardless of kWh, *i.e.*, that do not vary with demand or consumption. Examples of fixed costs include the costs of wires, poles, customer service, and billing.

For residential customers, those three separate kinds of costs have traditionally not been recovered in the same fashion as they were incurred. This is because most, if not all, of the fixed and demand costs were recovered through volumetric rates, either on a one-part basis, or, more commonly, on a two-part basis consisting of a small monthly fixed charge and a variable charge (based on total kWh used) that include the bulk of fixed and demand costs and the variable costs. Commercial and industrial (C&I) utility customers, in contrast, have long been subject to three-part rates, corresponding to the three types of utility costs. Thus, rates for a commercial or industrial customer typically include a fixed charge and two variable charges—an energy charge, based on total kWh used, and a demand charge, based on how much capacity (kW) the utility needs to maintain to meet the customer's peak demand.[8] Accordingly, C&I customers are not only positioned to reduce both system costs and their own costs by getting a discrete demand price signal, but by providing that signal, new market entrants with the capability of managing demand costs could enter the market and provide such services.

[8]It is interesting that when talking about the forces that likely would prompt a utility to adopt a demand charge for industrial customers, Bonbright calls out distorting effects caused by industrial customers who provide some of their own generation. (Bonbright, pp. 309-311).

With respect to the two-part residential rates, it is important to note that the fixed and variable parts of the rates do not reflect cost causation. Typically, the fixed part of the tariff reflects only a small, almost token, part of the actual fixed costs of the utility, often only the costs of billing and metering. The bulk of the revenues are derived from the variable component of the tariff. Therefore, while the actual variable costs are largely energy, the variable component of the bill is very heavily inflated by demand and fixed costs, the recovery of which is on a volumetric, rather than fixed, basis. The result is that cost recovery is not based on cost causation, but rather on a largely arbitrary allocation of costs. As I show below, this fact has very significant implications for the impact and effects of the design and deployment of net metering.

III. RESIDENTIAL UTILITY RATES AND NET METERING

The initial connection of rooftop solar systems to the grid posed an issue for utilities and regulators: If customers having on premises generation produce more energy than they consume at any given time, and supply that excess supply to the grid, how should they be compensated? Similarly, how should they pay the full fixed and demand costs incurred to serve them? When rooftop solar systems were first connected to the grid in the 1980s and 1990s, most households had a single meter capable only of running forwards, backwards, and standing still. This characteristic left utilities and their ratemaking authorities with limited options for pricing the output of the rooftop systems.[9] Given the very limited amount of rooftop solar market

[9] Appropriate metering was not the only thing missing at the time net metering was first deployed that precluded more meaningful and accurate pricing of distributed solar. There was little, if any, dynamic or time-sensitive pricing, and organized markets with transparent real-time and geographically-sensitive energy prices were non-existent. Thus, any pricing other than net metering would have been based on heavily subjective judgments.

penetration at the time, and the fact that the high cost of rooftop solar seemed to preclude large scale deployment, large scale investment in new metering technology and/or broad-based tariff reform were not considered priority issues. [10] Simplicity and minimal investment in technology and effort seemed more in order than undertaking more sophisticated measures, when measuring all of the social, economic, and policy considerations.[11] More importantly, given the lack of any significant market penetration at the time net metering was first deployed, little or no attention was paid to issues resulting from pricing rooftop solar output based on the variable cost component of the tariff, which allowed rooftop solar customers to be compensated not only for energy, but also for all of the demand and fixed costs included in the variable portion of the bill.[12] Consequently, when rooftop solar units were producing energy, they were not paying for those demand and fixed costs included in the variable part of the tariff. In short, net metering exacerbated a fundamental tariff flaw, namely the failure to align cost recovery with cost causation.

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[10] Indeed, some utilities, trying to avoid the issue altogether, simply refused to interconnect rooftop solar units to the grid at all, or if they did, declined to compensate for any energy delivered to the grid.

[11] Because the impact and effects of full net metering were unknown at the time of its adoption, many jurisdictions, just to be cautious about the unknown, actually hedged against severe distortions by capping the amount of rooftop solar and/or sizes of units that would be on a full net metering tariff. A 1996 overview of state net metering programs prepared by NREL found that almost all included individual capacity limits, while three states (including New Hampshire) also had statewide capacity limits. *See* Yih-hui Wan, *Net Metering Programs*, NREL Topical Issues Brief (December 1996), Table 1, p. 3. Available online at: http://www.nrel.gov/docs/legosti/old/21651.pdf. Subsequent to that NREL study, other states adopted similar hedges against unbridled growth of full net metered facilities.

[12] For simplicity in this Report, I use the term "rooftop solar" to apply to all forms of distributed generation located on the retail customer's side of the retail meter. The vast majority of such generation is currently in the form of rooftop solar panels, but the pricing issues discussed in this Report apply equally if the distributed generator uses a different source, such as wind or a fossil fuel to produce energy.

It is important to point out that the term net metering is imprecisely applied to different pricing structures. Common, albeit sloppy, nomenclature describes net metering generically, as net energy metering (NEM). That term, however, is highly misleading. Technically speaking, NEM describes a regime where the cost allocations for billing purposes are reflective of cost causation. That means that all fixed costs are recovered on a fixed basis, all demand costs on a demand basis, and only variable costs, primarily energy, are recovered on a volumetric basis. If cost recovery and causation were properly aligned, then net metering would mean that solar customers would always pay their fixed costs, but the energy component of the bill would be adjusted to net the energy purchased off the grid against the energy produced on premises. Such a system would also enable the pricing of the energy delivered to the grid by rooftop solar and other forms of behind the meter distributed generation to be priced at the market price of energy. That pricing system would be true NEM, and the netting of the energy would be reflective of energy prices in the wholesale market.[13]

Unfortunately, only a few jurisdictions, most notably Texas, actually use NEM. Most jurisdictions use what, for purposes of this Report, is described as Full Net Metering (FNM). Simply stated, that term applies to a methodology in which the costs that are netted out for solar customers as compensation for the energy they deliver to the grid reflect all of the costs in bundled retail rates, including not only energy, but all fixed, demand, and other variable costs as well. That means that rooftop solar customers do not pay their share of the utility's fixed and demand costs when they are generating, and that what is netted is significantly more than simply

[13] Optimally, in an organized market, that would be the locational marginal price (LMP), a figure that would be the energy price including internalized congestions costs.

energy costs that reflect the market price.[14] That happens despite the fact that rooftop solar customers cause the utility to incur demand and fixed costs to serve them but provide no offsetting fixed assets or reliable capacity to offset the costs incurred by the utility. The result is that FNM pricing reflects neither cost nor market, distorts energy market prices by compensating rooftop solar at a significantly higher prices than any other energy source including other renewables, fails to provide appropriate price signals, and, as I discuss further below, discourages investment in both more efficient sources of power and in making distributed solar generation more efficient.[15]

Under an FNM tariff, a single meter for these customers runs forward when rooftop solar customers are purchasing energy from the grid. When those customers produce energy and consume it on premises, the meter simply stops, and when the customer produces more energy than is consumed on premises, the meter runs backwards as the excess energy is exported to the grid. The energy exported to the grid is used by the utility to serve its retail load and is physically indistinguishable from energy delivered to the grid from generators located on the other side of the retail meter. Thus, the rooftop solar customer pays full retail price for electricity taking energy off the grid. When generating energy (for both self-consumption and for export to the grid), however, the solar customer not only pays nothing for energy, but also pays nothing for fixed and demand costs even though those costs as incurred by the utility do not

[14] A further disconnect between the energy market and FNM is that retail tariffs, more often than not, are not dynamic, so the difference between peak and off-peak energy prices is not captured at all in FNM, and perhaps not in NEM either.

[15] The discouragement of incremental investment in rooftop solar and other forms of behind the meter distributed generation, as I discuss below, is not only a perverse incentive for overall system efficiency, but is also a serious hindrance to the future evolution of solar power. If the prices are not aligned with incentives for productivity and efficiency gains, solar energy is unlikely to reach its full potential as an energy source.

vary with on premises energy production. At the end of whatever period is specified, the meter is read and the customer either pays the net balance due or the utility credits the customer for excess energy delivered.[16]

While the use of FNM was, as noted above, largely an historical accident, there were some who, at the time, suggested one policy consideration in its adoption, namely that FNM would provide a short-term stimulus to the commercialization of the then very expensive, distributed solar technology. FNM was never seen as a sustainable, long-term pricing methodology.[17] Thus, FNM was originally conceived and applied at a time when the market penetration of rooftop solar was negligible, when rooftop solar systems were far more expensive than they are today, when metering technology was relatively primitive, when wholesale energy and capacity markets did not generate the very transparent, sophisticated and unbundled signals they do today, and when the amount of fixed and demand costs that would be bypassed by widespread deployment of rooftop solar was not anticipated.

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[16] There are some variations on this construct, usually in regard to the total compensation paid, but the basic construct is most common. In New Hampshire, for example, the payment for excess energy (over the course of a monthly billing cycle) includes the fixed and demand costs for firm power plus transmission and a portion of the costs of distribution. The price is therefore slightly below the full bundled retail rate. In some jurisdictions, the netting or production and supply results in the customer owing money to the utility or vice versa. In other tariffs, the amount paid to the customer is capped regardless of the quantity of sales and purchases. That cap is often set so that the customer's bill at the end of the period specified cannot be negative.

[17] While the full effects of retail net metering were unknown at the time of their adoptions, many jurisdictions, just to be cautious about the unknown, actually hedged against severe distortions by capping the amount of rooftop solar that would be on an FNM tariff. The fact is, however, that the only policy rationale for initiating FNM was to boost rooftop solar past its embryonic status, and that the policymakers and regulators put in place measures to assure that the public was protected against undue price exposure from increased market penetration makes clear that they fully understood at the time that they were creating a cross-subsidy that at some point would no longer be justifiable or sustainable.

Today, the technological limitations that were an important driver of residential rate design are disappearing. "Smart meters," as well as internet-based technology, are capable of measuring how much electricity consumers use in a month and how they use it. These technologies are now readily available and at reasonable cost. Similarly, in those parts of the country with organized markets, we now have transparent locational marginal cost pricing that provides real-time price data on energy prices and, in some places, deployment of time-sensitive retail pricing that would enable more efficient price signals for retail customers, including those deploying rooftop solar. [18]

At the same time, we have seen the costs of solar systems decline, although the cost of residential solar panels remains significantly higher than centralized solar generation. In short, rooftop solar is no longer an embryonic technology in need of an economic boost to achieve commercial viability.[19] As I explain more fully below, it appears that these declines in costs are not being fully passed on to customers.

Finally, it should be noted that the issue in this proceeding, FERC assertion of jurisdiction over the wholesale component of FNM will not interfere with state policy choices on power resources. The portion of rooftop solar generation that is used to serve load behind the retail meter will still be subject to state policies on FNM, and states will retain other options to

[18] The reflection of wholesale energy prices in retail rates also enable effective demand response. Indeed, the price signals for dg generation should be identical to those for DR.

[19] Rooftop solar has other economic supports besides net metering. Those include federal and state tax credits as well as renewable energy credit programs. Any changes in net metering will not terminate those programs.

promote solar generation and other forms of renewables that do not present the problems associated with the use of FNM.[20]

A. Perverse Effects of Full Net Metering (FNM)?

Although some states, Kansas and Arizona for example, have made relatively recent tariff reforms applicable to rooftop solar customers, in most jurisdictions solar customers are treated, for rate design purposes, as if they are identical to non-solar customers. In some of the states that have reformed rooftop solar tariffs, the objective was to reflect the fact that solar customers are now partial requirements customers and need more discreet price signals. This objective is accomplished by moving to three-part tariffs in order to accurately reflect the fact that the demand characteristics of rooftop solar customers are different from those of non-solar customers. Another reform compatible with three-part tariffs would be to remove most or all fixed and demand costs from the variable component of customers' bills, and moving to a straight fixed/variable rate structure.[21] It is worthy of note that it has long been FERC policy to require utilities selling requirements-type service at wholesale to use fixed/variable rate structures that include all fixed costs in the demand component of the wholesale rate. Doing so

[20] I do not intend to oppose or endorse alternative policy or support options that may be available to the states within the scope of their jurisdiction. The only point being made is that such alternatives do exist.

[21] The inclusion of fixed and demand costs in the variable (volumetric) component of the bill occurred for a number of historical reasons. One was simply that it was easy to do and in a monopoly setting was of no significance for revenue recovery purposes. A second reason was that straight fixed/variable rates were thought by some to impose an unfair burden on lower income households. Still another reason was that by including more costs in volumetric prices, customers would be incented to conserve energy. None of these reasons is still relevant. The flaws associated with billing fixed and demand costs volumetrically, are, in fact, a threat to revenue recovery, and FNM is testimony to this. The social impact of straight fixed/variable can be mitigated in various ways through low income subsidies, and the conservation incentive would be much more effective by sending discrete price signals.

aligns cost causation and cost recovery and produces clear and precise price signals to encourage efficient use of electricity. In the majority of jurisdictions where solar and non-solar customers are subject to identical, traditional/tariff structures, there are a number of consequences that substantially distort prices, and these distortions directly affect FERC-jurisdictional wholesale power markets.

This breakdown in the relationship between costs and rates has several negative consequences. These include cross subsidies, anti-competitive impacts, socially regressive effects, inefficiencies, and unfairness to competitive technologies. I discuss each of these in detail below.

1. Cross Subsidies

Having on premises generation does not typically change overall consumption patterns. It merely changes the source of energy for those periods of time when the solar panels are producing energy. Similarly, having solar panels on one's rooftop does not significantly change the costs that the utilities have to incur in transmission, distribution, and generation in order to meet their legal obligation to supply their retail customers with their full energy requirements .[22] In fact, the use of rooftop solar appears to increase distribution costs because the electric distribution system must, among othert things, be redesigned to handle two-way flows of power. Use of rooftop solar may also increase the cost of balancing the electric system because the solar energy disappears rapidly in the late afternoon when most U.S. utility systems are approaching

[22] If an on premises generator provided a firm supply of energy, it might, under some circumstances, offset some utility investment, but solar units are intermittent, often unpredictably so, and, as noted below, largely off peak. Thus, no utility, legally mandated to meet the full demand of its customers, can avoid incurring the costs of providing full service simply because there are intermittent solar generators connected behind the retail meter.

the evening peak. Thus, although customers who generate their own electricity on premises purchase, in the aggregate, less energy than conventional customers, they consume at least the same level of fixed and demand service. The result of using FNM where volumetric rates recover a substantial, if not the predominant, portion of all fixed and demand costs is a very substantial subsidy to rooftop solar customers. The costs of that subsidy are borne by the rest of the utility's customer base. Simply stated, the solar customers are fully dependent on the utility to ensure a firm requirements power supply on a 24/7 basis because, in addition to enabling the delivery and export of energy to solar customers, the utility must backstop the intermittent supply of solar energy. They are, however, under FNM, fully excused from having to pay for those services when, on an intermittent basis, they happen to be producing energy. That results in two forms of cross-subsidy from non-solar customers.[23] The first is that non-solar customers pay that portion of the fixed and demand costs not borne by rooftop solar customers. The second is that because the price a utility has to pay when rooftop solar owners export energy to the grid is the full retail price, such that the rooftop owners are compensated for fixed and demand costs they do not incur (actually incurred by the utility) when they are not supplying those services and have made no investments to enable them to do so. The result is that rooftop solar energy, under FNM, is compensated at price level substantially higher than the energy prices in the wholesale market.

[23] The size of the cross subsidy can be quite substantial. For discussion of that *see* Barbara Alexander, Ashley Brown, and Ahmad Faruqui, "Rethinking Rationale for Net Metering," Public Utilities Fortnightly, October 2016. The overall costs of FNM are also discussed in some detail in the Doctoral Dissertation of Scott Berger, "Rate Design for the 21st Century: Improving Economic Efficiency and Distributional Equity in Electric Rate Design," Massachusetts Institute of Technology, September 2019.

There is an important demand cost aspect to the cross-subsidy that is noteworthy. Most non-solar customers' peak demand (measured in KW) and overall kWh usage typically vary together. (This is true for customers who invest in energy efficiency, as well as other customers). For rooftop solar customers, however, the traditional relationship between peak demand and overall kWh usage breaks down. Solar customers can reduce their kWh usage by a lot (especially if they get credit for excess kWh produced) while only slightly reducing their peak demand (or even, in some cases, increasing it). FNM pricing gives them no incentive to reduce their peak demand, which is a major driver of utility costs. The pricing incentives associated with FNM are contrary to the desired result. The fact that customers with rooftop solar may produce energy when the sun is shining does nothing to reduce the utility's fixed per-customer costs and does not reduce the capacity costs the utility must incur in order to make sure that it is prepared to comply with its legal obligation to meet all of the electric requirements of the solar customers. Thus, when solar DG customers are producing energy and not buying it, the utility cannot fully offset the revenue loss by simply buying or producing less energy. Thus, the utility has a revenue shortfall, which can only be made up by requiring the non-solar customers to make up the shortfall.

2. Intermittency

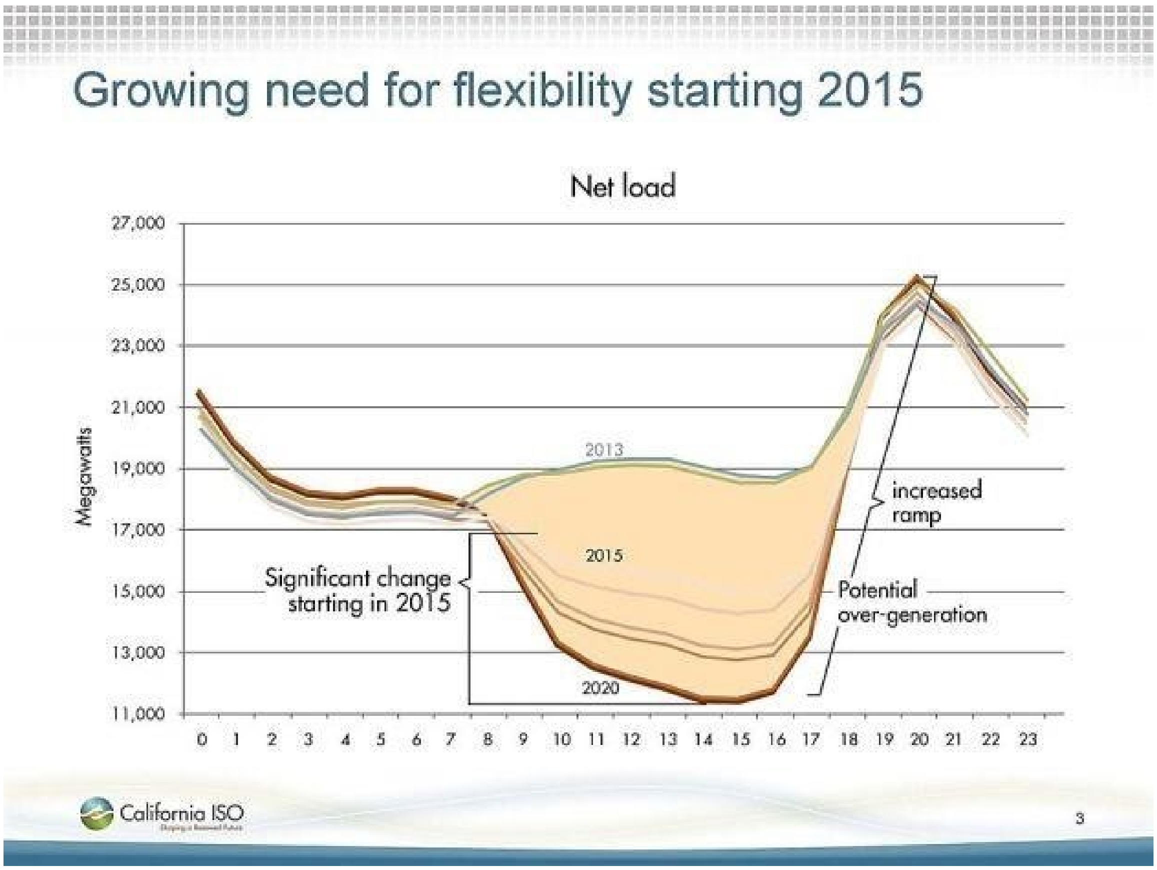
Rooftop solar generation does not significantly offset a utility's capacity costs for two reasons. The first is that peak solar production in the continental U.S. is almost always non coincident with system-wide peak demand.[24] The second reason is that even if solar production

[24] Peak demand in the U.S., in general, is moving to later in the day, late afternoon and early evening, at the very time that the sun is either setting or has gone down. That means that the supply of rooftop solar produced energy, always unpredictable in real time, is even less reliable at peak.

generally matched the time when demand is peaking, solar production of energy is intermittent, unpredictably so, and thus not reliably or predictably available. It is also typically not dispatchable (i.e., the grid operator cannot call upon it to produce energy to meet peak demand, or stop producing when there is a congestion issue requiring redispatch. For a utility that is obliged to meet all the electricity demand of customers in its service territory in real time, intermittent and unpredictable production does little, if anything, to avoid the need to incur the costs of meeting that mandate.

In fact, rooftop solar production generally creates a new and challenging daily variation in the net load that must be served by the utility, a pattern that has come to be known as the "duck curve." Briefly stated, the "duck curve" refers to the phenomenon by which rooftop solar generates large amounts of power in the middle of the day, but as solar production declines throughout the afternoon, the corresponding increase in demand must be met by other generation sources available to the utility.[25] The "duck curve" phenomenon is illustrated in the chart below, in which the belly of the duck shows the increasingly steep drop off and ramp up of net load that is occurring and expected to increase with greater adoption of solar generation:

[25] http://instituteforenergyresearch.org/solar-energys-duck-curve/; https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf.



As is dramatically illustrated in the graph, enticed by a number of factors, not the least of which is FNM, substantial investment in the growth of solar capacity in the Golden State has enormously magnified the need for additional fossil plants, operating on a ramping basis, to compensate for the drop off in solar production at peak. In that context, the absence of any meaningful signal to make solar more efficient (e.g., directing solar panels to the west, or linking solar production with storage) is becoming less and less tolerable to system operators. .[26]

Intermittent sources of generation add additional complexity and cost to maintaining the high degree of reliability expected from the system. This is particularly true because the grid was originally designed to accommodate one-way delivery of electricity, not the two-way

[26] For further discussion of the implications of the duck curve, see *What the duck curve tells us about managing a green grid*, CAISO, 2013 (http://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf).

exchange associated with rooftop solar generation.[27] Thus, when rooftop solar penetration increases beyond minimal levels, new investments to the distribution grid are required.[28]

Maintaining reliability on a distribution system where market penetration of rooftop solar has increased significantly requires a substantial investment in more modern control and monitoring technology, as well as a substantial rethinking of pricing and the incentives produced from the economic signal produced, in order to move the entire system in directions that will best accommodate all of the changes in the power sector, particularly those related to the increasing deployment of intermittent generating facilities.

3. Anti-Competitive Impact of Full Net Metering

The vendors/lessors of rooftop solar with FNM pricing have no incentive to pass on to consumers some or most of the cost reductions in their supply chain, and typically do not do so. The failure to pass cost reductions on to customer would, in a normal market context, make their product less attractive. Under FNM, however, the vendors have less incentive to make their product more attractive because the FNM rate structure provides a subsidy that is paid for by non-solar customers. Many of the leading rooftop solar providers in the country have a business model premised on keeping prices high in a declining cost industry, and relying on subsidies and cross subsidies in lieu of the classic economic formulation that lower prices (in this case enabled from lower costs) stimulate demand. This business model was explicitly articulated by Solar

[27] The two-way flow, particularly since the energy inputs to the distribution system are from diverse and unpredictable places, can alter grid dynamics by impacting such critical elements as voltage support and reactive power. Since location of distributed solar units can be a critical element in how these grid phenomena play out, the inability to plan locations for rooftop solar almost inevitably drives up utility costs.

[28] https://mitei.mit.edu/system/files/MIT%20Future%20of%20Solar%20Energy%20Study_compressed.pdf at xviii.

City, then the nation's leading vendor of rooftop solar, in its 2015 10K filing.[29] Rather than compete with other suppliers, they knowingly use preferential retail ratemaking to avoid the marketplace or cost-based disciplines of other energy producers that cannot use FNM. This very substantial cross-subsidy disrupts competitive wholesale energy markets by favoring one category of generating resources.

A second aspect of the anti-competitive nature of FNM relates to the incentives to maximize customer savings that are or are not provided to the rooftop solar industry. It appears that the solar installation market is currently such that generous subsidies provided through programs like FNM do not get fully translated into reduced customer costs. The MIT study, *The Future of Solar Energy,* observes a "striking differential" between MIT's estimate of the cost of installing residential solar systems (even allowing for a profit margin) and the reported average prices for these systems—actual prices for residential systems were approximately 150% of MIT's cost estimate—a difference between cost and price the MIT researchers did not observe for utility-scale installations.[30] As documented in the MIT study, there is evidence now that the declining costs of solar panels, which have been quite dramatic in recent years, are not being passed through to consumers, enabling most of the benefits of declining panel costs to be retained by solar vendors. FNM, by effectively shielding rooftop solar suppliers from both competition and cost-based regulation, may be removing a key incentive for rooftop solar installation companies to pass on declining costs to customers.[31]

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[29] SolarCity Corp 10K, filed 2/24/15 for period ending 12/31/14, p. 38 (available at http://files.shareholder.com/downloads/AMDA-14LQRE/1445127011x0xS1564590-15-897/1408356/filing.pdf).

[30] MIT, The Future of Solar, p. 86.

[31] The failure to pass on declining input costs to customers is pricing behavior characteristic of monopoly pricing.

A Lawrence Berkeley National Labs study found that out of four countries it compared to the U.S. (Germany, Japan, France, and Australia), the U.S. had the highest prices (per watt of capacity) for installed residential solar systems.[32] The reasons for these high U.S. prices are not fully understood—it is something more than market size since the U.S. market is smaller than the rooftop solar market in some of the four other countries studied, but larger than others. A 2014 study aimed at better understanding variations in rooftop solar pricing, involving collaboration between researchers from Yale, Lawrence Berkeley National Laboratory, the University of Wisconsin at Madison, and the University of Texas at Austin, found a revealing association:

> [R]egions with a higher consumer value of solar, considering retail electricity prices, solar insolation levels, and incentives, tend to face higher prices. This phenomenon may be the result of a shift in consumer demand caused by the presence of rich incentives, enabling entry by higher-cost installers and allowing for higher-cost systems. Alternatively, the results may be a symptom of high information search costs or otherwise imperfect competitions, whereby installers in these markets are able to "value price" their systems, effectively retaining some portion of the incentive offered…In the short-run at least, policies that stimulate demand for [rooftop solar] may have the exact opposite of their intended effect, by causing prices to go up rather than down.[33]

That is, FNM, by effectively shielding rooftop solar suppliers from both robust competition and from cost-based regulation, may be removing a key incentive for rooftop solar installation companies to pass on declining costs to customers. Financial analysts have recognized that the rooftop solar industry has adopted a business model that depends on FNM to

[32] Barbose, Galen and Naim Darghouth. Tracking the Sun IX: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States. Lawrence Berkeley National Laboratory (August 2016):22-23.

[33] Gillingham, Kenneth, Hao Deng, Ryan Wiser, Naim Darghouth, Gregory Nemet, Galen Barbose, Varun Rai, and C.G. Dong. *Deconstructing Solar Photovoltaic Pricing: The Role of Market Structure, Technology, and Policy*. (December 2014): 20-21. Available online at: http://www.seia.org/sites/default/files/LBNL_PV_Pricing_Final_Dec%202014.pdf.

sell its product. As Barclays observed earlier, residential solar "business models are currently predicated on their ability to create value from FNM."[34]

Indeed, one of the ironies of FNM is that the pricing regime is dependent on the monopoly power in a time where electricity markets have become competitive. In the absence of the retail service monopoly, it would be impossible to extract revenues from non-solar customers to subsidize solar customers who do not pay their full share of the utility's fixed and demand costs, or to extract a retail price for a wholesale product. While the vendors of rooftop solar often choose to describe themselves as competitors to utilities, they are in fact, under FNM pricing, taking advantage of monopoly power to extract above market prices from consumers. In the wholesale market, this Commission has been vigilant against the exercise of market power. There is no policy reason for the Commission not to extend that vigilance to the prices paid for rooftop solar produced energy.

4. Socially Regressive Effects of Full Net Metering

The reallocation of the responsibility for costs under FNM pricing results in a subsidy from customers without rooftop solar systems to those with solar. These subsidies associated with retail net metering are particularly hard to defend because, in the aggregate, they benefit wealthier customers at the expense of less affluent customers. As Scott Burger has noted:

> PV adopters reduce their contributions to residual cost recovery, placing a higher share of the burden of residual cost recovery on non-adopters. Given that the lion's share of PV adopters are wealthy, the net effect is that average expenditures for affluent customers decrease at the expense of low income customers.[35]

[34] SCTY00088139.

[35] Burger, *supra*.

Less affluent customers lack the means to invest in solar and often do not own their residences, so they are less able to install rooftop solar, even if they could afford to. This gap is exacerbated by the practices of rooftop solar providers, who offer a lease model for customers without the cash to buy a whole system up front—but the lease product is only available to customers who meet often high credit requirements.[36]

Some have, with considerable justification, concluded that FNM is Robin Hood in reverse. The heavy cross subsidies associated with FNM transfer wealth, in the aggregate, from lower income consumers to higher income ones. It takes some level of affluence to be able to invest substantial capital in installation of rooftop solar, not to mention to own a home with the size and a rooftop able to sustain the weight of such a facility. FNM encourages rooftop solar providers to "cherry-pick" high-income, high-energy usage customers. A 2013 study by E3 Consulting shows the socially regressive impact of net metering. The study found that the median income of rooftop solar customers under FNM was 168% of the median California household income.[37] A similar analysis of rooftop solar customers in California by Severin Borenstein also found installations, despite some decline in social regressivity recently, "heavily skewed towards the wealthy."[38] The Massachusetts DPU has made a finding that the costs of

[36] The idea of lowering credit requirements was raised by one large provider, but there is no evidence of how widespread that practice is/was, and it is also unclear whether such a practice would cause more problems than it resolved. http://www.reuters.com/article/us-solarcity-fico-idUSKCN0T82ZO20151119.

[37] *California Net Energy Metering Ratepayer Impacts Evaluation.* Prepared for the California Public Utilities Commission by Energy and Environmental Economics (October 8, 2013).

[38] Borenstein, Severin. "Private Net Benefits of Residential Solar PV: The Role of Electricity Tariffs, Tax Incentives and Rebates." Energy Institute at Haas Working Paper. 2015: 26. Paper available online at http://ei.haas.berkeley.edu/research/papers/WP259.pdf. Another study reaching similar conclusions is Smith, Josh, Patty, Grant, and Colton, Katie, "Net Metering in the States," The Center for Growth and opportunity at Utah State University, August 2018.

incentives for on-site generation, such as full net metering, disadvantaged the poor, and gave the state's low income customers relief from having to subsidize [rooftop solar] customers in Massachusetts: "… low-income customers have experienced an increase in bills as a result of the growth of on-site generation."[39]

5. Inefficiency

FNM encourages inefficient behavior, both on the part of individual customers and the rooftop solar industry as a whole. For individual customers, FNM (especially in conjunction with a flat rate that does not vary with time of day or peak energy demand) fails to provide any incentive to maximize the value (as opposed to the output) of their rooftop solar systems. FNM customers with distributed solar are motivated to produce as many kWh as possible, but not necessarily to target production or manage demand to offset peak consumption.

One example of this problem has to do with the orientation of rooftop solar panels. The monetary value of energy provided to the grid by rooftop solar panels varies depending on the time of day. Generally speaking, energy provided at the time of peak usage is the most valuable because the generating fleet is dispatched (subject to reliability constraints) on the basis that the least expensive plants are generally dispatched first. As demand increases, more and more expensive plants are dispatched until all demand is met.[40] However, FNM (in conjunction with flat, time-invariant rates), provides only one performance signal to customers with rooftop solar

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[39] See D.P.U. 15-155, September 30, 2016 at p. 470,://web1.env.state.ma.us/DPU/FileRoomAPI/api/Attachments/Get/?path=15-155%2f15155_Order_93016.pdf.

[40] It is worth noting that, in general, the economic order to dispatch power plants also has a salutary environmental effect. That is because, in general, the least expensive plants are either non-emitting of pollutants (e.g. renewables), or low emitting, more efficient plants. Thus, if solar were available at peak demand, the likelihood is that it would displace more heavy emitting plants than if it was only available off peak when the energy being displaced would, as a general rule, be from lesser emitting plants.

systems—the more you produce, the more you are paid, regardless of supply and demand, regardless of location and congestion, and in complete disregard of the market price of energy at the time of production.[41]

For this reason, as the *New York Times* pointed out, flat FNM pricing has contributed to solar panels generally being installed facing south, to generate the largest total quantity of solar energy over the course of the day (and the greatest savings and/or revenue for homeowners under FNM).[42] If solar rates instead reflected the real-time price of energy, these panels would be adjusted more to the west to capture the most sun during peak hours (late afternoon or early evening). This westward adjustment would likely generate less total energy, but would capture the late afternoon power of the setting sun to serve peak load.[43] In fact, the savings from solar electricity might even encourage such a user to use more peak electricity than he or she otherwise would—keeping the house a little cooler, or otherwise being more *laissez faire* with his or her energy use. Solar City's marketing materials, taking advantage of the lack of explicit and transparent demand cost price signals, have promoted this type of expensive, highly inefficient use of energy.[44]

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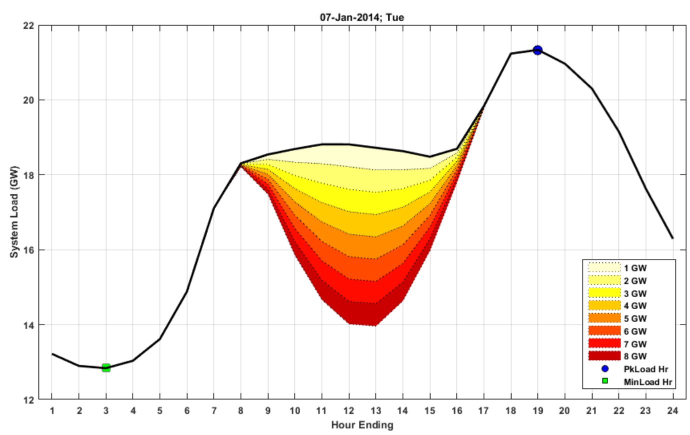
[41] Energy prices in the electricity market, as one might expect when supply and demand have to be instantaneously matched, vary widely over the course of every day. Thus, the time at which energy is produced is a critical determinant of the price suppliers are paid. FNM ignores that market place reality and, consequently, fetches an above-market price for rooftop solar output that is exported onto the grid.

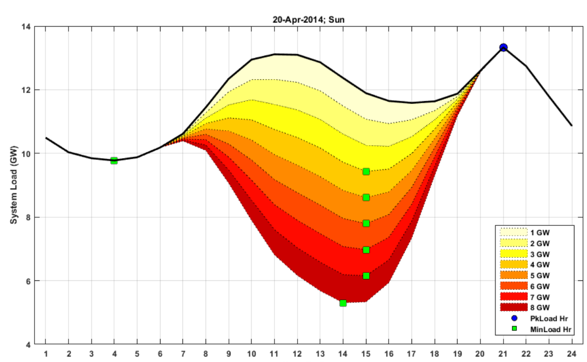
[42] There is technology available that would enable automatically shifting the direction of solar panels in order to track the sun and thereby enhance capacity factor of solar panels.

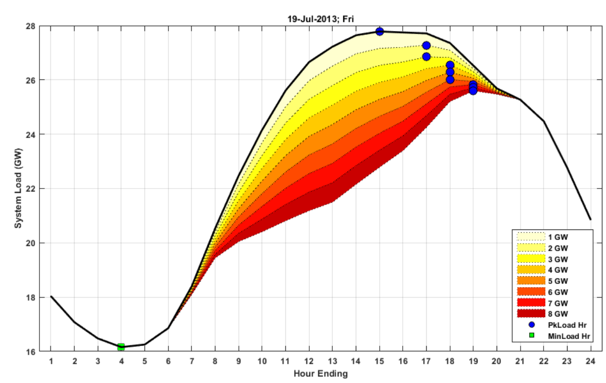
[43] Matthew L. Wald. "How Grid Efficiency Went South" *New York Times*. October 7, 2014.

[44] A SolarCity advertisement encourages just this behavior: "Go ahead," it reads. "Sleep with the lights on. Solar energy is limitless." https://mobile.twitter.com/solarcity/status/731167148882690048. This advertisement is particularly irresponsible because solar power is not generated at night.

Similarly, FNM discourages the adoption of batteries or other forms of storage in conjunction with rooftop solar production. This is because, under an FNM tariff, the utility operates essentially as a giant free battery available for use by rooftop solar customers. —New England provides a useful illustration of the issue. The following three charts show the relationship in that region during different seasons of the year. They are copied from the ISO New England's webpage titled "Solar Power in New England: Locations and Impact,"[45] and illustrate that solar benefits do not include near-term reductions in peak generation.[46]







[45] Page can be found online at https://www.iso-ne.com/about/what-we-do/in-depth/solar-power-in-new-england-locations-and-impact.

[46] Black, John. "Update on Solar PV and Other DG in New England." ISO New England (June 2013).

These charts dramatically demonstrate that on the days chosen as representative of summer, winter, and spring in New England, rooftop solar peak output and peak system demand are not the same. Solar is absent during the winter peak and spring peak (it is interesting to note that winter solar production suggests the possibility of New England having its own "duck curve"). During the summer, there is an overlap between solar production and peak demand, but as can be seen on the chart, and as ISO New England explains in the accompanying text, "Because greater amounts of [rooftop solar] will actually shift the timing of peak demand for grid electricity to later in the afternoon or evening, [rooftop solar's] ability to reduce peak demand will actually diminish over time." It should also be noted that on the days chosen, the sun was shining. The graphs would look very different on cloudy days when solar production is virtually nil.

Technologies currently exist that would enable customers with rooftop solar to manage their production and consumption so as to maximize the overlap between solar production and peak demand hours. Possible efficiency enhancers could include pointing panels to the west, using batteries to store off-peak energy, or smart thermostats to optimize energy usage patterns. Additionally, the installation of smart inverters would enable rooftop solar to sync better with the grid and enhance both its value and grid operations. However, under a flat FNM tariff, rooftop solar customers have little incentive, and perhaps even a disincentive, to invest in such products, therefore delaying the development of the integrated solar/battery home systems that may be a logical next step for making distributed generation more valuable. This is creating conflicts between solar panel suppliers and storage providers – entities who, if the pricing rules were rational, would be natural allies.[47] But

The incentives inherent in FNM are almost precisely the opposite of how the wholesale market functions, where prices reflect real-time supply and demand, recognize the costs/benefits of generators' capabilities, operations, and location, and otherwise incent investment in technology that optimizes both market value and value to the market. Thus, if FNM for solar was replaced by true net energy metering (NEM), where payments for the sale of excess energy were the real time energy prices (e.g., LMP in organized markets, and a reasonable proxy for LMP in other regions), the incentives for solar customers to invest in batteries, smart inverters, and more intelligent positioning would be there. That would encourage system optimization, and over time would provide a far better foundation for the evolution of the solar industry into a widely used source of energy.

6. Unfairness to Competing Technologies

The problems with FNM pricing have important wholesale market implications. When rooftop solar owners sell their excess energy to the grid and are compensated at the full retail price, they are taking advantage of much higher available prices that are enabled by subsidies provided by non-solar customers. Thus, FNM broadly discriminates against other forms of generation competing to serve load in the wholesale market, and allows rooftop solar to be paid for supplying capacity and other wholesale products, such as reserves and balancing, they do not supply. In seeking cost-effective means of reducing their electricity bills and environmental impact, consumers have a variety of options. Rooftop solar is one possibility, but there are a

[47] "Net Metering vs. Storage Creates Clash Between Some Allies." http://www.eenews.net/stories/1060025111.

variety of competing alternatives; many of them provide greater value to the grid, most notably various energy efficiency programs, demand response, and means of flattening out their load profile.[48] The subsidies associated with FNM, however, substantially distort the economics to favor rooftop solar over these other, often more efficient, options.

Rooftop solar is the most expensive form of renewable generation with meaningful usage in the U.S. today. The latest annual update of Lazard's *Levelized Cost of Energy Analysis* shows a levelized cost for rooftop solar ranging from $151-$242 per MWh, higher than all other energy sources analyzed, including fuel cell, solar thermal, utility-scale solar, geothermal, biomass, wind, and energy efficiency.[49] The Lazard analysis goes on to compare the cost of carbon abatement per ton for different alternative energy resources. As one would expect based on its levelized cost, rooftop solar power had the highest cost per ton of carbon emissions avoided ($210 per ton, assuming gas is the comparison generation). In contrast, Lazard's calculations found that utility-scale rooftop solar could abate the same ton of carbon emissions at a fraction of the rooftop solar cost, only $23 per ton. The difference here is staggering.[50]

A recent study by the Brattle Group comparing generation costs of utility-scale and residential-scale rooftop solar in Colorado confirms that most of the environmental and social

[48] Load profile is the configuration of how much energy a customer consumes (kilowatts hour, (Kwh)) and precisely when it is consumed. The time when the demand hits its maximum defines the amount of capacity (kilowatt (kw)) a utility must have available to serve that customer.

[49] *Lazard's Levelized Cost of Energy Analysis-Version 13.0.* November 2019. Data cited is from p. 2 table, "Unsubsidized Levelized Cost of Energy Comparison." Full report available online at https://www.lazard.com/media/451086/lazards-levelized-cost-of-energy-version-130-vf.pdf.

[50] *Lazard's Levelized Cost of Energy Analysis-Version 13.0.* November 2019. Data cited is from p. 15 table, "Value of Carbon Abatement Comparison." Full report available online at https://www.lazard.com/media/2390/lazards-levelized-cost-of-energy-analysis-90.pdf.

benefits provided by rooftop solar systems can be achieved at a much lower cost at utility-scale than at residential-scale."[51] FNM, however, operates to make rooftop solar more attractive than other forms of renewable generation via subsidies from non-solar ratepayers, diverting resources (including capital) to the least efficient energy source and away from competing (and, arguably, superior, technologies).

IV. SOME PROPONENTS OF FNM MAKE ARGUMENTS UNDER THE LABEL "VALUE OF SOLAR" THAT ARE IRRELEVANT AND WRONG

In the face of the substantial arguments against FNM, advocates of FNM have tried to develop theories as to why the obvious cross-subsidization does not occur in FNM. Their line of argument is based on what has been described as "value of solar" (VOS) theory. While state-specific studies have been carried out in a number of states, there is a wide gap in conclusions. The poles in the findings are in Maine and Louisiana. In Maine, a Maine PUC-sponsored study found distributed generation to have an astonishing levelized value of 33.7 cents per kWh (in a state in which a typical residential customer rate might be around 13 cents per kWh).[52] In Louisiana, an LPSC-sponsored study yielded an equally surprising, although polar opposite, conclusion, namely that the levelized value of rooftop solar was negative.[53] As the extremely

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[51] Bruce Tsuchida, Sanem Sergici, Bob Mudge, Will Gorman, Peter Fox-Penner, and Jens Schoene, "Comparative Generation Costs of Utility-Scale and Residential-Scale PV in Xcel Energy Colorado's Service Area." The Brattle Group, July 2015, p. 3.

[52] Grace, Robert C., Philip M. Gruenhagen, Benjamin Norris, Richard Perez, Karl R. Rabago, and Po-Yu Yuen. *Maine Distributed Solar Valuation Study*. Prepared for the Maine Public Utilities Commission. Revised April 14, 2015. *Please see:* http://www.maine.gov/mpuc/electricity/elect_generation/documents/MainePUCVOS-ExecutiveSummary.pdf.

[53] Dismukes, David E. Estimating the Impact of Net Metering on LPSC Jurisdictional Ratepayers. Prepared on behalf of the Louisiana Public Service Commission. Prepared on Behalf of Louisiana Public Service Commission Draft, February 27, 2015. Please see: http://lpscstar.louisiana.gov/star/ViewFile.aspx?Id=f2b9ba59-eaca-4d6f-ac0b-a22b4b0600d5.

divergent findings of those two studies suggests, "value of solar" numbers, in general, should be treated with extreme caution.

My position should not be misunderstood. I do not doubt the value of solar as an energy resource whose utilization should be encouraged. Encouraging solar means providing appropriate incentives to make it fully competitive with competing resources and encouraging its evolution both technologically and economically. It does not mean applying poorly designed, often counterproductive, subsidies that provide little incentive for rooftop solar to become more efficient than its competitors and shielding it from real competition. Unfortunately, most of the VOS studies that I have reviewed have been used to justify the heavy cross-subsidies under FNM without regard to overall social and economic consequences.

1. Problems with the "Value of Solar" from PURPA to Today

Generally speaking, studies of the VOS are highly subjective and readily manipulated because there is no established methodology for assessing the value of solar, and, furthermore, given the complexity of the analyses needed to assess all the various "VOS" claims, no analysis can effectively avoid the need to make multiple subjective judgments. Indeed, the "calculation" requires so many inputs, assumptions, estimates, etc., all of which are highly contestable, that no consensus may be possible. There are two noteworthy reasons for the lack of accepted methodology for such studies. The first, as noted above, is that electric energy prices have always been premised on one of two methods, cost-based regulation or market. Regulators and policymakers, with perhaps some methodological variations, have never deviated from those two sound bases for pricing. The notion of using "value" to determine pricing is far too subjective and easy to manipulate. [54] In fact, even though the article cited in the prior sentence is somewhat "tongue in cheek," its underlying premise is correct. All sources of generation have value that is not always recognized in their prices. This is particularly noteworthy in grid scale wind and solar, both far more efficient than rooftop solar, and which have most, and in some cases, more of the same values claimed for rooftop solar in VOS studies, but they do not receive the FNM "value" price boosters for them. It is virtually impossible to systematize all the variables that go into such a calculation.

Stated simply, VOS pricing is an attempt to quantify the costs a utility (economic or otherwise) avoids by acquiring rooftop solar generation. Unlike these subjective VOS studies, avoided cost under PURPA is a market-based concept, based on the economic notion of marginal cost, rather than some vague notions of "value." Unlike FNM, avoided cost pricing under PURPA was designed to encourage the development of alternative power at the market price the utility would otherwise pay for energy and/or capacity from an alternative source. "Avoided costs" was defined as: "[T]he incremental costs to the electric utility of electric energy or capacity or both which, but for the purchase from the QF or QFs, such utility would generate itself or purchase from another source."[55]That concept of "avoided cost" is therefore directly related to the marginal cost of supply. It is not based on subjective determinations of value. To be sure, PURPA's avoided cost standard was often abused to provide subsidies to alternative generators, which led to billions of dollars of stranded costs. Recent actions by this Commission on possible reforms in the administration of PURPA bear witness to the continuing controversy

[54] For a somewhat "tongue in cheek" look at what Value Pricing, applied to all generating resources, might yield, see Brown, Ashley, "The value of solar writ large: A modest proposal for applying value of solar' analysis and principles to the entire electricity market", *The Electricity Journal,* Volume 29, Issue 9, November, 2016.

[55] 18 CRF §292.101(b)(ii)(6) (Public Utility Regulatory Policies Act of 1978).

over PURPA. If even the limited notion of "avoided cost" could lead to distortions, one can only imagine what scale of distortion could result from the much more vague notion of "value" being applied to prices.

A central flaw in the use of VOS studies is that they almost always fail to examine the viability and costs of acquiring the "values" produced by rooftop solar through alternative means in order ascertain if rooftop solar is the most cost-effective manner of attaining the desired result. VOS studies rarely, if ever, look at the opportunity costs associated with spending money on rooftop solar, as opposed to using that money on something that produces energy and/or reduces emissions more efficiently (many other major renewable technologies, as discussed above, beat rooftop solar by these measures). Simply stated, the reality and role of competition is simply ignored. [56]

2. Avoided Energy Costs

Rooftop solar generation, when produced, does reduce the amount of electric energy the utility must provide from other resources, but so does every other form of generation. If a particular resource like rooftop solar provides unique value depends on whether it is less costly to produce than these alternatives or whether it produces energy with other desirable characteristics not offered by these same alternatives. Caution should be exercised, however, the value of the generation to be offset is calculated on a "levelized" basis—projected for, say, twenty years, and then averaged. This introduces unnecessary and almost always incorrect

[56] To be fair, it is not always clear how advocates propose to use VOS studies. Some suggest that it is to actually set the actual price paid to rooftop solar, while others seek only to use the calculations derived from such studies as a justification for continuing FNM. Regardless, the substitution of "value" pricing for market or cost based pricing, whether used for justifying FNM or to actually set rates, constitutes an excuse for distorting prices.

speculation about multiple variables, including future gas prices and inflation, while doing little to illuminate how actual current cost savings, if any, should be considered. A "levelized" value number looks bigger, but caution must be used in understanding what this number means—comparing a larger "levelized" value of solar against current (non-levelized) costs of FNM, for example, is comparing apples and oranges. Certainly, our experience with PURPA contracts in the 1980's and early 90's provide insight into speculating on long term energy prices.[57] Indeed, the leveling of costs over the long-term is a very compelling reason to view VOS studies with a heavy dose of skepticism

3. Avoided Capacity Costs (Generation and Transmission)[58]

The idea that having a lot of distributed solar on the system means that the utility requires less capacity of various kinds is one of the commonly asserted claims made by FNM advocates. These claims are unfounded. Solar energy is intermittent and only available when the sun is shining, and, in the case of rooftop solar, only available for export to the grid if the sun is shining and the solar customer is not using all the energy produced on his/her rooftop. It is not available on call and cannot be relied upon to produce any energy when called upon to do so, nor to reduce demand reliably. Absent storage, there is no way to be certain that the conditions necessary for rooftop solar energy to both produce and export from premises when asked to do so will be met.[59]

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[58] Capacity in electricity refers to the generating resources to deliver energy when called upon to do so. What is produced, of course, is energy, whereas capacity is the ability to produce when called upon to do so.

[58] Capacity in electricity refers to the generating resources to deliver energy when called upon to do so. What is produced, of course, is energy, whereas capacity is the ability to produce when called upon to do so.

[59] This problem, of course, could be largely eliminated if solar hoists deployed sun tracking panels and/or had storage to complement the rooftop solar panel. FNM, of course, is a powerful

In the wholesale market, when a generator obtains a capacity payment, the generator agrees to either deliver the energy called for, or assumes liability for supplying replacement energy. In contrast, rooftop solar providers under FNM make no such assurances. If the utility incorporates any capacity "value" into rates, as it effectively does under FNM, it pays twice—first, in a lower rate (caused by the phantom capacity) for rooftop solar customers, and, second, if the rooftop solar producer fails to deliver, the utility must pay again, this time to an alternative supplier to provide what the solar provider did not.

4. Potential Savings Related to Power Flow: Line Loss Reductions and Ancillary Services

Energy losses occur during transmission and distribution. However, whether or not rooftop solar systems reduce the amount of energy lost in long distance transmission and distribution is a fact-specific question, dependent on an array of variables (including the location of rooftop solar systems and what else is occurring on the grid in real time), and the answers may be counterintuitive. Electricity flows on wires according to laws of physics, following the course of least impedance, a natural phenomenon impacting every interconnected wire, regardless of whether the wire is sized to withstand the current.[60] As a result, energy flow on the grid is highly dynamic in real time. Every injection or withdrawal of energy impacts the ability to access the grid throughout the system. Maintaining optimal grid functionality requires careful planning, vigilant and prudent dispatchers, and the ability to call upon resources to provide what

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deterrent to making such investments because it pays the same premium price regardless of the time and place at which the energy is produced.

[60] The flows of the high voltage transmission system and the low voltage distribution system are separate and distinct from one another, so the flows according to least impedance are system specific. While demand shifts at any given interconnection point where high voltage is stepped down to low voltage can influence flows on the high voltage system, the actual flows between the two systems are separated by transformers, so the flows between systems are controlled.

are called ancillary services, such as voltage support, reactive power, black start, and other very location-specific services that are essential to grid operations, many of which also affect line losses.

Thus, with respect to the distribution grid, the production or non-production of energy affects line losses on a very location- and time-specific basis. While it is true that rooftop solar can have a salutary effect on line losses, it is equally correct to say that it could have an adverse effect of line losses. As a matter of physics, there is simply no generic "value" associated with rooftop solar reducing line losses on the distribution grid.[61]

With respect to the transmission grid, the issue is a bit different, because rooftop solar is not directly interconnected to the high voltage system. Nonetheless, rooftop solar, in locations with little market penetration, simply as a matter of scale, may have very little impact on transmission line losses. Further (here the counterintuitive interconnected properties of electricity grids come into play), there is no simple and reliable relationship whereby less power delivered to a certain location guarantees less congestion on the grid, and correspondingly fewer transmission losses. Electricity on an interconnected grid impacts the whole grid according to Kirchhoff's law. Inputs into the grid need to be carefully balanced with withdrawals to avoid overloading any specific wire and to allow for access to the cheapest possible generation. The impact of lessening demand from a particular node on the grid depends on the specific constraints affecting dispatch at a given point in time. Just as in the case of distribution, to the

[61] By assuming positive effects of rooftop solar on-line losses, the authors of many VOS studies also conveniently avoid acknowledging the costs that utilities often have to incur to accommodate bi-directional flows on their system.

extent that rooftop solar impacts transmission line losses at all, it is very location and time specific, so generic conclusions are baseless.[62]

If system planner were able to select exactly where distributed generation was installed, it might be possible to leverage rooftop solar to provide more reliable transmission and distribution benefits. But FNM does not account for any of these potential locational benefits of rooftop solar, and rooftop solar is not a "planned" resource that utilities have the authority to locate according to their engineering preferences.

5. Environmental Benefits (Emission Mitigation Costs)

As discussed above, rooftop solar has no emissions when producing energy[63]—but this benefit, from an economic perspective depends on what it is actually displacing. If it is displacing coal or oil fired generation, it has one value, if it is displacing natural gas, it has less value, and if it is displacing other renewables, it has even less, and perhaps even negative value It is simply not the case that rooftop solar that receives FNM pricing always displaces carbon emitting units.[64] The issue is made even more complex by the fact that even when it is carbon emitting plants that are being displaced, the displaced plants are forced to ramp up and down in response to the intermittent flow of the solar produced energy because of the "duck curve," as discussed above. Such ramping, in most fossil plants, runs contrary to the design parameters of

[62] For a technical discussion, *see* M. Rivier, "Electricity Transmission," in Perez-Arriaga, ed. *Regulation of the Power Sector* (p. 276, footnote 8), which acknowledges that in some cases, increased demand at a node (a distribution node) can decrease system costs overall.

[63] If one considers the entire cycle of manufacturing solar panels, most of which are made in the world's most carbon intense economy, China, plus the necessity of shipping the panels halfway around the world, it can hardly be argued that rooftop solar is carbon neutral.

[64] As a quantitative matter, of course, carbon emitting power plants possess widely varying emissions patterns, so no analysis of the carbon reduction benefits of rooftop solar is meaningful without a careful, detailed, analysis of exactly which plants will be displaced.

the plant, therefore causing it to operate on a considerably less efficient basis, a circumstance that is very likely to lead to more emissions, not less.[65] Simply stated, it is counterfactual to assume, as a linear proposition, that more rooftop solar means fewer emissions.

One other note on VOS analysis of environmental impact is that most, if not all, of the studies invariably fail to holistically analyze the overall costs of shifting our generation fleet away from dependence on fossil fuel. There is simply no public policy or economic rationale to paying the highest prices for the least efficient non-carbon emitting generation.[66] Continuing to do so will drive up the cost of carbon reduction, while providing no incentive to the highest paid generation to increase efficiency. In fact, it is worrisome that if the already expensive cost of weaning our economy away from carbon is made even more costly to consumers through mechanisms like FNM, the public support for sound environmental practice will diminish.

6. Avoided Purchased Power/Risk ("Hedging")

Many "value of solar" advocates suggest that distributed solar power should get credit, when evaluating net energy metering, as a hedge against increasing natural gas costs. This does not make sense in the context of discussions of FNM and the value distributed solar offers to the system as a whole. Solar power potentially has value as a hedge against natural gas, but only for the owner of the solar panels. For a utility that will be buying power from solar panel owners without a long-term fixed price contract (as is the case under FNM), the hedge value under net metering is essentially nonexistent. The reason is that the price to be paid by the utility for power from rooftop solar will contain all of the elements included in the monthly electric utility

[65] It is also true that some fossil plants are "must run" units whose production can only be constrained in limited circumstances.

[66] *See supra* Lazard.

bill, including the full cost of energy. When gas is expensive, this price paid by non-solar customers will be higher; when it is cheaper, it will be lower. So, if it is worth hedging against variations in the price of natural gas, the utility should buy the same hedge against variations in the price of rooftop solar power. From the utility's and the non-solar customer's point of view, the two costs will vary together. Thus, the hedge value is not only zero, any consideration paid for such a hedge would be more expensive than incurring the risk from which protection is sought—this is like paying for vacation insurance that costs more than the trip itself.

7. Avoided Distribution Grid Costs

The facts suggest that rooftop solar and other forms of distributed generation, could theoretically avoid distribution costs, it is far more probable that distributed generation will impose higher costs on the distribution system. Distributed generation, particularly where there is no locational planning, imposes costs and burdens by adding transaction costs and, in many cases, by compelling substantial changes in local networks to reflect the fact that the flow of energy is being changed from one directional to bidirectional,. In California, in fact, serious consideration is being given to restructuring distribution grids in order to effectively manage the new flows, both physical and financial.[67] While such accommodations can be made, there are costs associated with making them and policymakers should be mindful of who must bear responsibility for those costs.

[67] Southern California Edison, for example, in 2016, put forward a rate case which included $2.3 billion for changes to the grid to accommodate distributed energy resources. *See* September 21, 2016 Utility Dive article: http://www.utilitydive.com/news/how-southern-california-edisons-new-rate-case-would-transform-the-grid/426493.

8. Avoided Water Use

Avoided water use is in some cases cited as an additional "value" provided by rooftop solar. However, the cost of water is included in the cost of producing energy—so there should not be a need to count "avoided water use" as a separate value. In other words, if rooftop solar offsets the need for energy produced where water is used in the production process, that water is being saved and is, therefore, internalized into the cost of energy. Considering water in value calculations essentially double counts avoided water use.

9. Job Benefits

Advocates for rooftop solar claim widespread deployment of the resource will give rise to many good solar energy jobs. That may or may not be true, but to ascertain whether that is a net positive, the issue needs to be considered with a balanced perspective that evaluates the job gains from rooftop solar against the job losses associated with the reduction in other energy sources, plus the costs to the economy from using a higher cost resource and then paying it a huge FNM subsidy. Few VOS studies made the correct "net" calculation of costs and benefits.

A study found that subsidies for rooftop solar, over the years, lead to significant job losses and decreased wealth for the state.[68] The main problem is that the money spent on distributed generation reduces the amount available to be spent in other sectors of the economy. Thus, while the model does predict additional jobs associated with solar installation and other services, "Any benefits emanating from each scenario are at best temporary, only coincident with the timing of the solar installations, and quickly counteracted by their long-run/legacy effects."[69]

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[68] James, Tim, Anthony Evans, and Lora Mwaniki-Lyman. The Economic Impact of Distributed Solar in the APS Service Territory, 2016-2035. Willia Seidman Research Institute, W.P Carey School of Business, Arizona State University, February 16, 2016.

[69] James et al., p. i.

Over the twenty-year period studied, with results varying depending on the level of penetration of rooftop solar, the Arizona model predicts billions of dollars of lost gross state product and thousands of "job years" lost.[70]

V. CONCLUSION

The inequities and inefficiencies of existing FNM rates across the country are increasingly being recognized as both unjustifiable and unsustainable in a world in which rooftop solar power is no longer an infant industry, but rather a growing part of the energy sector. The long-term success of distributed solar as an energy resource must depend on it becoming truly cost competitive with other resources, and rate reforms to more realistically compensate distributed solar are an important part of making this transition. While some of the issues discussed herein relate to retail ratemaking jurisdictional to the states, it is clear that the energy price paid for the energy produced by rooftop solar is a matter of serious concern for the wholesale energy markets. As noted in this Report, rooftop solar, through the application of FNM, is being compensated for the intermittent, mostly off-peak, energy it exports to the grid, at the full retail price of electricity rather than the wholesale energy price that all other resources are paid. In addition, rooftop solar, under FNM, because of being paid the retail price for a wholesale product, and despite its intermittent nature, is being paid for capacity and demand products it does not provide. What is especially troublesome is that energy sold from rooftop solar installation includes the full retail price, while wholesale wind and solar units, which provide the same environmental benefits, are only compensated at wholesale rates despite the

[70] A job year is not the same as a job. It is one year of employment.

fact that wholesale wind and solar are both more efficient, both economically and in terms of carbon reduction. That disparity in compensation motivates investors to allocate more capital toward less efficient production and away from the more efficient. As pointed out, the result is not only more expensive rates for other consumers, but is also inconsistent with the future of solar energy. While it is not suggested that the Commission look to displace or preempt the states in regard to tariff structure, it would be a very positive step toward protecting the competitive nature of the wholesale market to take action within the scope of its jurisdiction over wholesale prices that would provide the country with fully competitive, non-discriminatory, energy and capacity markets.

APPENDIX

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Ashley Brown is an attorney. He is the Executive Director of the Harvard Electricity Policy Group at Harvard University's John F. Kennedy School of Government. It is a leading "think tank" on matters related to electricity restructuring, regulation, and market formation. He has been an instructor in Harvard's Executive program on "Infrastructure in a Market Economy," at the World Bank Regulatory Training Program at the University of Florida, and at the European University's Florence School of Regulation. Mr. Brown has also served as an arbitrator in matters relating to the evolution of competition in infrastructure industries.

Before his current activities, Ashley Brown served as Commissioner of the Public Utilities Commission of Ohio, appointed twice by Governor Richard F. Celeste, first for a term from April 1983 to April 1988 and for a second term from April 1988 to April 1993. As Commissioner, he was of five members responsible for the regulation of the state's electricity, telecommunications, surface transport, water and sanitation, and natural gas sectors.

Prior to his appointment to the Commission, Mr. Brown was Coordinator and Counsel of the Montgomery County, Ohio, Fair Housing Center. From 1979-1981 he was Managing Attorney for the Legal Aid Society of Dayton, Inc. From 1977 to 1979 he was Legal Advisor of the Miami Valley Regional Planning Commission in Dayton. While practicing law, he specialized in litigation in federal and state courts, as well as before administrative bodies. He has served as an expert witness in litigation in the courts and administrative agencies In addition, Mr. Brown has extensive teaching experience in public schools and universities.

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	1977	J.D.	University of Dayton School of Law, Dayton, Ohio Doctoral Studies (all but dissertation) New York University, New York, New York

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Chair, American Bar Association Annual Conference on Electricity Law

Member, The Keystone Center Energy Advisory Committee

Member, National Association of Regulatory Utility Commissioners

Member, Executive Committee, National Association of Regulatory Utility Commissioners

Chair, Committee on Electricity, National Association of Regulatory Utility? Commissioners

Chair, Subcommittee on Strategic Issues, National Association of Regulatory Utility Commissioners

Member, Great Lakes Conference of Public Utilities Commissioners

Member, Great Lakes Conference of Public Utilities Commissioners Executive Committee

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Member, Board of Directors, The National Regulatory Research Institute

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Member, U.S. EPA Acid Rain Advisory Committee

Chair, Planning Section, National Governors' Association Task Force on Electric Transmission

Member, the Keystone Center Dialogue on Emissions Trading

Member, the Keystone Center Project on the Public Utility Holding Company Act of 1935

Member, The Keystone Center Project on State/Federal Regulatory Jurisdictional Issues Affecting Electricity Markets

Member, Policy Steering Group, The Keystone Center Project on Electricity Transmission

Member, Advisory Council of the Board of Directors of Nuclear Electric Insurance Limited

Member, Advisory Council of the Consumer Energy Council of America Project on Electricity

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Member, U.S. Delegation to International Electric Research Exchange (IERE), Rio de Janeiro, Brazil, 1991

Consultant, Hungarian Ministry of Industry and Trade on Gas and Electric Regulatory policy, 1991-1992

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Consultant, SNE, Costa Rican Regulatory Agency, on Transmission Access Issues, 1992

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Consultant, World Bank Mission to Hungary Investigating the Financing of New Power Plants for MVM (Hungarian Electric Co.), 1992

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Consultant, The Province of Salta, Argentina on infrastructure regulation, 1996

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Participant, Harvard University's East Asian Electricity Restructuring Forum, 1994-1995

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Consultant, Government of Ukraine on Electricity regulatory policy and industry restructuring, 1994-1995

Advisor to the National Energy Regulatory Commission on the Structure, Processes and Substance of Electricity Regulation

Consultant, Government of Brazil on Electric Sector Restructuring, 1995-1996

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Consultant, Government of Mozambique on reform of the commercial code, 2000

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Consultant to Government of Guinea-Bissau on Infrastructure Regulation, 2005

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Consultant to the Government of Mozambique on Electricity Regulation, 2006-2007

Assisting in the Re-Establishment of the Electricity Regulatory Agency

Consultant to the Government of Equatorial Guinea, 2007

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