**BEFORE THE STATE CORPORATION COMMISSION
OF THE STATE OF KANSAS**

In the Matter of the General Investigation to	)	
Examine Issues Surrounding Rate Design	)	Docket No. 16-GIME-403-GIE
for Distributed Generation Customers.	)	

MOTION TO INTERVENE AND RESPONSE OF WESTAR ENERGY, INC. AND KANSAS GAS AND ELECTRIC COMPANY TO STAFF'S MOTION TO OPEN DOCKET

COME NOW Westar Energy, Inc. and Kansas Gas and Electric Company (collectively referred to as "Westar") and file their Motion to Intervene and Response to the Staff of the State Corporation Commission of the State of Kansas ("Staff" and "Commission," respectively) Motion to Open Docket (Motion). In support of its motion and response, Westar states:

1. On March 11, 2016, Staff filed its Motion to Open Docket in the above matter. As Staff noted, its filing was made to comply with the Commission direction in its Order Approving Stipulation and Agreement in Westar's last general rate proceeding, Docket No. 15-WSEE-115-RTS (115 Docket).[1] As Staff noted in its Motion, prior to its filing, Staff circulated its draft Report and Recommendation among the parties to Westar's rate case seeking feedback on its draft. Westar provided such feedback and greatly appreciates both the opportunity to comment of the draft and Staff's consideration and incorporation of a number of Westar's suggestions in the final version of its Report and Recommendation. However, as will be discussed below, Westar has some concerns about the filing and by this Response requests changes in the scope and description of the proceeding in the Commission's Order opening the docket.

[1] Staff Motion, at ¶1.

Motion to Intervene

2. Westar requests leave to intervene in this matter. As was discussed above, this proceeding is an offshoot of Westar's most recent general rate proceeding and was established to address rate design issues that were initially included in Westar's general rate filing.[2] The results of this docket will control rate design for Westar's customers who install distributed generation.

3. As a result of the above, Westar clearly has an interest in the subject matter of this proceeding and will be directly affected by its outcome. In addition, as the largest electric utility in the State of Kansas, Westar clearly has the "direct Kansas nexus"[3] necessary for participation in this docket. No other party may adequately address issues affecting Westar. Westar therefore seeks intervention in this matter will full rights to make presentations, present witnesses, cross-examine witnesses, brief issues and other participate in this proceeding.

Response to Motion to Open Docket

Alleged potential benefits of DG should not be considered in this docket.

4. Staff stated in its Report and Recommendation, "when DG is substituted for the utility's generation, the utility's variable costs, and the demand costs embedded in the energy charge, at least in part, are not paid."[4] Westar agrees that, under current rate designs, the substitution of DG for utility generation creates a potential revenue shortfall that gives rise to the need for special rate designs to address DG customers. However, it is the inclusion of **fixed** costs – rather than variable – of generation, transmission, distribution and customer service as well as

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[2] As was noted, Staff's Motion to Open Docket was filed pursuant to the Commission's Order in Westar's 115 Docket. Therefore, Westar would expect to be included in the docket when it is opened. However, because no order including Westar in the docket has yet issued, out of an abundance of caution, Westar is seeking intervention in order to file the instant Response.

[3] Staff Report and Recommendation, at p. 7.

[4] Staff Report and Recommendation, at p. 4.

demand costs in the energy charge that causes the shortfall. Staff stated that one of the "fundamental questions" raised by DG is "What are the costs (fixed and variable) and the benefits of providing utility service to DG customers?"[5] While Westar agrees that the costs of providing service to DG customers are properly at issue – as they are in any rate case or rate design case – the alleged potential benefits are not.

5. Consideration of any alleged potential benefits of distributed generation – or the "value of solar" – in this docket is inappropriate for several reasons.

6. First, it should be noted that consideration of the alleged potential benefits of DG was not among the issues referred to this docket. In the 115 Docket Stipulation and Agreement – that was approved by the Commission – the parties reached agreement that

> the issue of whether a separate Residential Standard Distributed Generation Tariff is necessary, and, if so, ***how to structure the Residential Standard Distributed Generation Tariff in order to properly recover just and reasonable costs from customers with distributed generation*** should be deferred to a generic docket. Westar and Staff will work together to develop a procedural schedule for that generic docket in order to ensure timely resolution of the issues to be addressed.

Stipulation and Agreement (S&A), Revised Paragraph 39, Docket No. 15-WSEE-115-RTS (emphasis added). In other words, the parties agreed that this docket would address how to recover costs from customers. There was no agreement that cost recovery would be mitigated by potential benefits allegedly provided by distributed generation.

7. Staff attempted to justify consideration of benefits in this docket by stating "[t]he purpose of this Report and Recommendation is to outline specific issues related to DG . . . ."[6] That misstates the purpose of the Report and Recommendation. Its purpose was to comply with the

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[5] Staff Report and Recommendation, at p. 5.

[6] Staff Report and Recommendation, p. 5, fn. 18.

Commission's order concerning this docket. By attempting to expand the scope of the docket to address alleged potential benefits of DG, Staff's Report and Recommendation improperly deviated from the directions to Staff from the Commission.[7]

8. Second, the Kansas Net Metering and Easy Connection Act[8] and the Parallel Generation Act[9] clearly address the regulated price an electric utility is to pay a customer with his or her own generation for energy produced in excess of the customer's own consumption (NEG or net excess generation). Such is a matter of settled law.

9. Third, the suggestion that the benefits of distributed generation production, or private solar, should be considered in setting just and reasonable rates for electric service improperly combines two separate issues – (1) the determination of the regulated price for energy the utility purchases from customers with their own generation and (2) the regulated rate that the utility is allowed to charge customers for electric service.[10] To achieve the goal of transmitting appropriate price and cost signals to customers and energy producers in the most transparent way possible, regulated rates for electric service provided by utilities must be determined and charged separately from the regulated price a utility pays when purchasing energy.

10. Most prices a utility pays for energy are established by a competitive regional market or a bilateral, arm's length contact negotiated by the utility and the energy producer.

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[7] Westar recognizes that the proposed inclusion of a discussion of the alleged potential benefits of solar is likely in response to comments on Staff's draft Report and Recommendation by one or more of the solar parties to the 115 Docket. However, given the language of the 115 Docket Stipulation and Agreement, inclusion of such a discussion in this docket would be inappropriate.

[8] K.S.A. 66-1263, *et seq.*

[9] K.S.A. 66-1,184.

[10] These separate determinations have been combined through the use of net metering. However, this combination inappropriately obscures price signals and is based on the unfounded assumption that the appropriate price for distributed generation **energy** is always equal to the regulated commodity rate the utility charges for **electric service** – which implies the inclusion of the cost of transmission, distribution and customer service.

However, there is one instructive example where the utility is required to purchase energy and the price that the utility must pay is determined by regulation rather than the competitive market or negotiated contract. That example is required purchases under the Public Utilities Regulatory Policy Act (PURPA). When determining the price that a utility must pay for PURPA energy, PURPA requires consideration of the utility's costs of alternatives; it does not tie the price to utility rates nor does it even consider the latter when setting the regulated price. Moreover, PURPA prices are set without any consideration of the supposed external "value" of the energy purchased by the utility.[11]

11. The Commission should follow the same approach with respect to the price a utility must pay for distributed generation energy purchased from customers with private solar. The rates a utility is allowed to charge for electric sales to customers should be considered separately and independently from the regulated price a utility is required to pay for energy purchases. Any quantification of the value of distributed generation energy should occur, if at all, when determining the latter, not the former, and should be determined based on the utility's competitive options. This proceeding is limited to the former – the setting of rates for utility service. And, as is discussed above, the Kansas legislature has already addressed the latter, in the Net Metering and

[11] *See* 18 U.S.C.A. §824a-3(d) which provides:

> For purposes of this section, the term "incremental cost of alternative electric energy" means, with respect to electric energy purchased from a qualifying cogenerator or qualifying small power producer, the cost to the electric utility of the electric energy which, but for the purchase from such cogenerator or small power producer, such utility would generate or purchase from another source.

Easy Connection Act and the Parallel Generation Act, establishing the price at which utilities purchase net excess generation produced by customers with distributed generation resources.[12]

12. Fourth, consideration of the benefits provided by a generation source such as wind energy, private rooftop solar or any other customer-owned generation is entirely inconsistent with the principle of cost-based ratemaking and with Commission precedent.

13. Historically, utility rates have either been determined by a competitive market – where one exists – or determined by a regulator based on the costs incurred by the utility. In jurisdictions where the regulators establish cost-based rates, the requirement that electric utilities' rates be cost-based is considered to be a substitute for competition. In either scenario – market-based or cost-based rates – there is no consideration of the "value" of external benefits provided by the technology being used to serve customers.[13]

14. As the Executive Director of the Harvard Electricity Policy Group has explained in a co-authored article in The Electricity Journal:

> [o]ptimally, prices for electricity are determined by a competitive market or, absent competitive conditions, should be derived from

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[12] FERC has held that as long as there is no net sale from a net metered customer with distributed generation to the utility within a billing period, no wholesale sale occurs and the transaction is not FERC jurisdictional. *See MidAmerican Energy Co.*, 94 FERC ¶ 61,340, 62,261 (2001) (finding that federal law governs when an electricity-producing customer has produced more energy than the customer has consumed over the course of the billing period); *Sun Edison, LLC*, 129 FERC ¶ 61,146, 61,618 (2009). However, if such a net sale occurs, the sale would likely be FERC jurisdictional and PURPA would apply. PURPA allows states to set the rates to be paid to generators for net excess generator as the Kansas legislature has done in the net metering and parallel generation acts but provides that the rate paid to generators under PURPA cannot exceed "the incremental cost to the electric utility of alternative electric energy." 16 U.S.C.A. § 824a-3. PURPA defines "incremental cost of alternative electric energy" as "the cost to the electric utility of the electric energy which, but for the purchase from such cogenerator or small power producer, such utility would generate or purchase from another source." *Id.*

[13] Were the Commission to go down this path, it would not be a large leap to then introduce the social value of what one customer might use electricity for compared to another. Certainly one could argue that electricity used in furtherance of public health, safety, or education has greater ultimate public good than electricity used, say, to power arcade video games or for a distillery to make liquor and spirts for consumption. The Commission does not have the legislative authority to set rates arbitrarily to encourage the former and discourage the latter and must set rates for different classes of customers based on the costs the utility incurs to serve them.

> cost-based regulation. In both cases the prices are subject to an external discipline that should result in efficient resource decisions devoid of arbitrary or "official" biases. Subjective consideration of the "value" of particular technologies and where they may rank the merit order of "social desirability," effectively removes the discipline that is more likely to produce efficient results . . . . It is preferable to derive prices from the values established by either costs or market, not ephemeral and subjective considerations.

Valuation of Distributed Solar: A Qualitative View, The Electricity Journal, Ashley Brown and Jillian Bunyan (Dec. 2014) (attached hereto). Electric rates in Kansas are and have always been cost-based.

15. Introducing a new element into establishing rates – the consideration of the subjective external benefits of only one form of generation (solar generation owned by customers) – is inconsistent with well-established precedent and could result in unjust and unreasonable rates for all retail customers in Kansas.

16. When Westar acquires or constructs a new generating facility, the Commission determines what the cost of that facility is and sets rates based on the cost that Westar incurred to build the facility to serve its customers. The Commission does not consider any external benefits the new generation provides, even though all such investments – including the new gas plant Westar built in Emporia several years ago, the major projects recently completed at Wolf Creek, construction of wind generation in Kansas, and Westar's new community solar projects – create external benefits including jobs, enhanced economic development, property taxes, new public revenues, environmental benefits and public infrastructure improvements.

17. When Westar acquired its 1,700 MW of wind generation over the last several years, the Commission did not even consider allowing Westar to calculate the value of installing wind generation on the system and recover more than the installed cost of the generation from customers, despite the fact that wind generation reduces NO_x and SO_2 emissions and is carbon-free. In fact,

when Westar first added wind generation to its fleet, Westar asked the Commission to approve an adder to its return on equity of 1% for its wind investment, as is authorized by K.S.A. 66-117(e) when a utility invests in projects or systems that can be "reasonably expected to produce energy from a renewable resource other than nuclear for the use of its customers." The Commission rejected the request stating that "the circumstances in this docket justify relieving ratepayers of the cost of an additional return in light of the close analysis involved in determining prudence and weighing Westar's PPA and ownership proposal." Final Order, *In the Matter of the Petition of Westar Energy, Inc. and Kansas Gas and Electric Company (collectively "Westar") for Determination of the Ratemaking Principles and Treatment that Will Apply to the Recovery in Rates of the Cost to be Incurred by Westar for Certain Electric Generation Facilities and Power Purchase Agreements under K.S.A. 2003 Supp. 66-1239*, Docket No. 08-WSEE-309-PRE, pp. 39-40 (Dec. 27, 2007).

18. As Westar installs universal community solar generation throughout its service territory, assuming the Commission follows its precedents, the Commission likely will not allow Westar to recover more than the installed cost of the generation from customers. This is the case even though if private solar actually provides some external benefits, universal solar would provide those same benefits, albeit at lower cost. Valuing distributed generation, or private solar, at a premium based on supposed benefits would be inappropriate and unduly discriminatory. Such an approach would distort price signals related to generation sources even providing a benefit to distributed solar generation as compared to solar projects owned by Westar and used to supply its customers. Selectively compensating private solar for value streams that are provided by other resources is not a fair and equitable approach to rate design. Faruqui Affidavit, at ¶ 3.

19. In previous dockets, the Commission has made it clear that it does not believe externalities – such as indirect environmental and health benefits – should be considered when evaluating programs proposed by utilities. The Commission does not rely on the societal test when evaluating energy efficiency programs proposed by utilities because "attempting to quantify such indirect societal environmental and health benefits is difficult" and the "analysis may also be viewed as less closely related to the Commission's policy objectives arising from its statutory duty and role as a regulator of utility rates*.*" *In the Matter of a General Investigation Regarding Benefit-Cost Analysis and Program Evaluations for Energy Efficiency Programs, Order Setting Energy Efficiency Policy Goals, Determining a Benefit-Cost Test Framework, and Engaging a Collaborative Process to Develop Benefit-Cost Test Technical Matters and an Evaluation, Measurement, and Verification Scheme*, Docket No. 08-GIMX-442-GIV, at ¶ 36 (June 2, 2008) (emphasis added); see also *In the Matter of a General Investigation of Energy-Efficiency Policies for Utility Sponsored Energy-Efficiency Programs,* Order, Docket No. 12-GIMX-337-GIV, at ¶ 15 (March 6, 2013) (stating that quantifying indirect societal environmental and health benefits is difficult and the societal test is vague).

20. Additionally, while suggesting the consideration of benefits in this docket, Staff acknowledged the significant difficulties associated with determining the value of any such benefits. Thus, Staff stated that it "is not certain how to appropriately measure avoided generation capacity"[14] or that alleged benefits to grid security can be measured.[15]

21. Consideration of the potential value of externalities of private solar generation is more appropriately handled by legislative bodies when deciding whether to provide subsidies for

[14] Staff Report and Recommendation, at p. 6.

[15] *Id*.

solar generation and is not an appropriate consideration for the Commission in its "role as a regulator of utility rates." Such an approach is proper given the approach taken by the Commission to such issues historically, the difficulty – or impossibility – of proper measurement of such benefits and the potential for discrimination against competing sources of energy acquired by the utility to meet its customers' needs.

22. If the Commission chooses to consider benefits of private solar despite the fact that it would be inconsistent with Kansas statutes, Commission precedent, and the issues to be addressed in the docket, the Commission should limit the discussion to include only quantifiable benefits (and costs) related directly to the utility's cost of service and not intangible, unquantifiable benefits or broader benefits related to subjective notions of societal good. If any discussion of benefits occurs in the docket, the Commission should at the outset clearly define the scope of the benefits it will and will not consider when addressing the issues in the docket.

23. Such an approach would be consistent with steps taken by the Public Service Commission of Utah in a docket where it was statutorily required to conduct a benefit-cost evaluation of net metering and set cost-based rates for net metering customers.[16] *In the Matter of the Investigation of the Costs and Benefits of PacifiCorp's Net Metering Program*, Order Re: Conclusions of Law on Statutory Interpretation and Denying Motion to Strike, Docket No. 14-035-114 (Utah P.S.C., July 1, 2015). In that docket, the Utah Commission concluded that it would only consider quantifiable costs that "increase the utility's cost of service" and quantifiable benefits that "decrease the utility's cost of service." *Id*. at 16. The Utah Commission explained

[16] The Utah Commission was instructed by the legislature to conduct a benefit-cost analysis of net metering. It recognized that such an undertaking actually went beyond its traditional authority and responsibility to ensure the utility charges just and reasonable rates. *See id*. at 15, fn. 2. The KCC has not received similar direction from the Kansas legislature and, as a result, any consideration of the benefits of distributed generation arguably falls outside the scope of the KCC's traditional authority to establish cost-based rates for utility customers.

that its function is to "regulate public utilities to ensure reliable service at a reasonable, non-discriminatory cost." Even though it had been instructed by the legislature to conduct a benefit-cost analysis of PacifiCorp's net metering program, the Utah Commission concluded that there was nothing in the Utah statutes authorizing it to

> conduct an all-encompassing analysis that extends to the kinds of broad societal concerns Intervenors assert are relevant in this docket.[17] Indeed, Intervenors' interpretation would require the Commission to act as a *de facto* legislative body, weighing all societal benefits and costs and attempting to assign some value to them without direction from the legislature as to how competing interests ought to be prioritized and no matter how attenuated they may be from the business of the electric utility which it is the Commission's essential function to regulate. **We are not persuaded the legislature intended the Commission to undertake such an unprecedented analysis, which would significantly extend the Commission's regulatory purview from the business of public utilities to, essentially, the entire arena of public policy.**

Id. at 14-15 (emphasis added). The Utah Commission concluded that it had to limit its considerations of the benefits of distributed generation to its "traditional role as utility regulator" and only consider costs and benefits that accrue to the utility or its non-net metering customers *in their capacity as ratepayers of the utility*" and that have "some impact on the utility's cost of service." *Id*. at 15 (emphasis added). If the Commission considers any benefits of distributed generation in this docket, it should impose similar limitations.

24. As illustrated above, the Utah Commission carefully limited their consideration of benefits and costs to quantifiable items, and only considered those benefits and costs because of a legislative requirement to do so.

<u>The docket should be opened as a generic docket.</u>

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[17] The Intervenors argued that the Utah Commission should consider broad societal benefits such as public health and economic development benefits that accrue to Utah citizens all together and not just customers of the utility. *Id*. at 7-10.

25. Westar is concerned that the designation of this docket as a "General **Investigation**" may be misleading to the public and respectfully suggests that it be referred to as a "Generic Docket." Westar's concern is based on the way in which the word "investigation" is used in common parlance. To Westar's customers the opening of an "investigation" may imply that the Commission is concerned about possible wrongdoing by some party. However, as the Commission is aware, this docket is not being opened due to concerns about potential misconduct but to determine the proper course for future ratemaking for DG customers.

26. Westar appreciates that Staff, in its Report and Recommendation did not use the term investigation. Rather, Staff requested that the Commission address the issues deferred from the 115 Docket in "a generic docket."[18] And while Staff consistently referred to this proceeding as a "generic docket" in the Report and Recommendation, it used the term "General Investigation" in the caption, opening paragraph and prayer for relief in its Motion to Open Docket. Westar is concerned that the use of this term will be misleading to the public and respectfully requests that the caption in this case be modified to reflect that the Commission is opening a "Generic Docket" for the purpose of examining issues surrounding rate design for customers with distributed generation.

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[18] *See, e.g.,* Report and Recommendation, at 1.

WHEREFORE, Westar respectfully requests the Commission enter its order granting it full rights of intervention and participation in this docket, limiting the scope of the docket to addressing rates designed to recover the costs of utility service to customers who install distributed generation facilities on their premises, opening this docket as a "Generic Docket" and for such other and further relief as may be appropriate.

Respectfully submitted,

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ATTORNEYS FOR
WESTAR ENERGY, INC.
KANSAS GAS AND ELECTRIC COMPANY

VERIFICATION

STATE OF KANSAS)
) ss.
COUNTY OF DOUGLAS)

Cathryn J. Dinges, being duly sworn upon her oath deposes and says that she is one of the attorneys for Westar Energy, Inc. and Kansas Gas and Electric Company; that she is familiar with the foregoing **Motion to Intervene and Response of Westar Energy, Inc. and Kansas Gas and Electric Company to Staff's Motion to Open Docket**; that the statements therein are true and correct to the best of her knowledge and belief.

Cathryn Dinges
Cathryn J. Dinges

SUBSCRIBED AND SWORN to before me this 24th day of March, 2016.

Donna G. Quinn
Notary Public

My Appointment Expires: 8/28/2016

Donna G. Quinn
NOTARY PUBLIC–STATE OF KANSAS
MY APPT EXP: 8/28/2016

CERTIFICATE OF SERVICE

I hereby certify that on this 24th day of March, 2016, the foregoing **Motion to Intervene and Response of Westar Energy, Inc. and Kansas Gas and Electric Company to Staff's Motion to Open Docket** electronically served on all parties of record.

Cathryn Dinges
Cathryn J. Dinges

BEFORE THE STATE CORPORATION COMMISSION
OF THE STATE OF KANSAS

In the Matter of the General Investigation to Examine Issues Surrounding Rate Design for Distributed Generation Customers.	))))	Docket No. 16-GIME-403-GIE

AFFIDAVIT OF AHMAD FARUQUI

Ahmad Faruqui, being first duly sworn, deposes and says:

1. I am a Principal with the Brattle Group, an economics consulting firm. My address is 201 Mission Street, Suite 2800, San Francisco, California 94105.

2. I have 35 years of consulting and research experience in rate design. In my career, I have analyzed and evaluated a wide range of rate designs for more than one hundred clients in the United States and abroad. I have authored or co-authored more than one hundred papers on rate designs and related issues and co-edited three books on pricing and customer choice. I hold bachelor's and master's degrees in economics from the University of Karachi, Pakistan, a master's degree in agricultural economics and a master's degree in economics, both from the University of California at Davis, and a doctoral degree in economics also from the University of California at Davis.

3. I understand from counsel for Westar that as Westar installs community solar generation throughout its service territory, assuming the Commission follows its precedents, the Commission likely will not allow Westar to recover more than the installed cost of the generation from customers. This is the case even though if rooftop solar actually provides some external benefits, community solar would provide those same benefits, albeit at lower cost. Valuing distributed generation at a premium based on supposed benefits would be inappropriate

and unduly discriminatory. Such an approach would distort price signals related to generation sources even providing a benefit to distributed solar generation as compared to solar projects owned by Westar and used to supply its customers. Selectively compensating rooftop solar for value streams that are provided by other resources is not a fair and equitable approach to rate design.

____
Ahmad Faruqui

State of _______________)
) ss:
County of _____________)

SUBSCRIBED AND SWORN to before me this __________ day of __________________, 2016.

____
Notary Public

My Appointment Expires:

Please see attachment

CALIFORNIA JURAT WITH AFFIANT STATEMENT **GOVERNMENT CODE § 8202**

☒ See Attached Document (Notary to cross out lines 1–6 below)
☐ ~~See Statement Below (Lines 1–6 to be completed only by document signer[s], *not* Notary)~~

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3 ______
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Signature of Document Signer No. 1 *Signature of Document Signer No. 2 (if any)*

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of San Francisco

Subscribed and sworn to (or affirmed) before me on this 22 day of March, 2016, by
Date *Month* *Year*

(1) AHMAD FARUQUI

(and (2) ______),
Name(s) of Signer(s)

proved to me on the basis of satisfactory evidence to be the person(s) who appeared before me.

SHERRY VALDEZ
Commission # 2102903
Notary Public - California
San Francisco County
My Comm. Expires Mar 13, 2019

Signature ______
Signature of Notary Public

Seal
Place Notary Seal Above

OPTIONAL

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Description of Attached Document

Title or Type of Document: Affidavit **Document Date:** ______

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Valuation of Distributed Solar: A Qualitative View

A critical evaluation of the arguments used by solar DG advocates shows that those arguments may often overvalue solar DG. It is time to reassess the value of solar DG from production to dispatch and to calibrate our pricing policies to make certain that our efforts are equitable and carrying us in the right direction.

Ashley Brown and Jillian Bunyan

Ashley Brown *is Executive Director of the Harvard Electricity Policy Group and Of Counsel in the Boston office of the law firm Greenberg Traurig LLP. Mr. Brown is a former Commissioner of the Public Utilities Commission of Ohio and former Chair of the National Association of Regulatory Commissioners Electricity Committee.*

Jillian Bunyan *is an associate in the Philadelphia office of Greenberg Traurig LLP. Prior to joining the firm, Ms. Bunyan was an attorney in the United States Environmental Protection Agency's Office of Regional Counsel in Seattle, Washington.*

I. Assessing the Value of Distributed Solar Generation – An Overview

The purpose of this article is to assess the value of residential distributed generation (DG) solar photovoltaics (PV) and appropriate pricing for its value and output. In particular, the article will address the question of whether retail net metering, the way that it is presently applied in most states, is an equitable way to compensate customers who own or lease solar DG. The article will also critically examine the argument for the ''value of solar'' approach to compensating residential solar DG customers. The article will conclude that retail net metering and ''value of solar'' are severely flawed schemes for pricing solar DG.

Retail net metering overvalues both the energy and capacity of solar DG, imposes cross-subsidies on non-solar residential customers, and is socially regressive because it effectively transfers wealth from less affluent to more affluent consumers. The ''value of solar'' approach being advanced by

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some solar DG advocates subjectively, and often artificially, inflates the value of solar DG and discounts the costs. This article also concludes that proposals for market-based energy prices, as well as demand and fixed charges as applied to solar DG hosts, are reasonable ways to rectify the cross-subsidies in net metering. It suggests that market-based prices for solar DG provide the best incentives for making solar more efficient and economically viable for the long term.

Solar PV has some very real benefits and long-term potential. The marginal costs of producing this energy are zero. If one looks at environmental externalities, then the carbon emissions from the actual process of producing this energy itself, without taking the secondary effects into consideration, are also zero. Significantly, the costs of producing and installing solar PV have declined in recent years, adding to the potential long-term attractiveness of solar. Those are very real benefits that would be valuable to capture. In its current, most common configuration, however, solar DG has some drawbacks that inhibit it from capturing its full value.

Solar PV is intermittent and thus requires backup from other generators and cannot be relied on to be available when called upon to produce energy. Thus, its energy value is entirely dependent on when it is produced and its capacity value is, at best, marginal. To fully develop the resource, therefore, it is imperative to provide pricing that will incent the fulfillment of solar PV's potential, by linking itself to storage, more efficient ways of catching the sun's energy, or with other types of generation (e.g. wind) that complement its availability. Thus, it is critical that prices be set in such a fashion as to provide incentives for productivity and reliability and not to subsidize solar DG at a decidedly low degree of optimization. Currently, rates for most residential consumers are based on volume. That is, residential customers are simply billed based on the number of kilowatt-hours that they consume based on average costs to serve all residential consumers. Solar has huge potential, but to attain it, solar DG needs to receive the price signals to actually fulfill its potential.

In its current, most common configuration, solar DG has some drawbacks that inhibit it from capturing its full value.

Not only does net metering deprive solar PV of the price signals necessary to capture its full value, it also leads the changes in retail pricing that undermine the promotion of energy efficiency. As solar DG becomes more widely deployed, utilities and their regulators will likely become increasingly concerned with diminution of revenues required to support the distribution system that is caused by the use of net metering. That concern will inevitably lead utilities and regulators to recover more of their costs through the fixed, rather than the variable, components of their rates. Thus, the price signal to be more efficient will be substantially diluted.

Many in the solar industry have come to recognize that retail net metering (NEM) is, in this age of smart grid and smart pricing, no longer a defensible method for pricing solar DG. Having recognized the inevitable demise of a pricing system that favors solar DG through cross-subsidization by other customers, many solar DG advocates have shifted to an argument that pricing should be based on consideration of the ''value of solar.'' While the authors do not subscribe to that point of view, as the argument is being included in the national conversation, it seems appropriate to address it.

II. Solar DG and Retail Net Metering – Definition of Terms

Powering your home with clean energy generated from the

  http://dx.doi.org/10.1016/j.tej.2014.11.005

solar panels on your roof, and selling the excess energy to the utility, are appealing prospects to a public increasingly attuned to environmental, energy efficiency, and self-sufficiency considerations. It is not hard to see why solar DG has substantial public appeal.

To begin, it is necessary to note that the terms ''net metering,'' ''retail net metering,'' and ''net energy metering'' will be used interchangeably and synonymously throughout the article. Net metering refers to when electricity meters run forward when solar DG customers are purchasing energy from the grid. When those customers produce energy and consume it on their premises, the meter slows down and then simply stops, and when the customer produces more energy than is consumed on the premises, the meter runs backwards. Thus, the solar DG customer pays full retail value for all energy taken off the grid, pays nothing for energy or distribution when self-consuming energy produced on the premises, and is paid the fully delivered retail price for all energy exported into the system. At the end of whatever period is specified, the meter is read and the customer either pays the net balance due, or the utility pays the customer for excess energy delivered. The reconciliation is made without regard to when energy is produced or consumed. This is how transactions between owners of residential DG and utilities have traditionally been handled.

There are other forms of net metering such as wholesale net metering, where exports into the system are compensated at the wholesale price, often the local marginal price (LMP). There are other variations as well, but for purposes of the article, when the terms NEM or net metering are used, they refer to the retail variety.

There are, conceptually, four possible approaches to pricing energy produced by solar DG.

There are, conceptually, four possible approaches to pricing energy produced by solar DG. One market-based approach is to set the price to reflect the market clearing price in the wholesale market at the time the energy is produced. A second approach would be a cost-based approach, where the price is set based on a review of the costs or according to standard costing methodology. A third approach, already defined above, would be net metering. Finally, a fourth approach would be to administratively derive a ''value of solar'' based on analysis of avoided costs and whatever else the evaluators believe to be worthy of measure.

As you will see, while the authors do not believe this fourth approach to be appropriate, analysis of the criteria its advocates believe are important should be conducted and evaluated – not to set the price, but simply to establish the context for evaluating the reasonableness of the pricing methodology approved.

III. 'Value of Solar' vs. Wholistic Analysis

Optimally, prices for electricity are determined by a competitive market or, absent competitive conditions, should be derived from cost-based regulation. In both cases the prices are subjected to an external discipline that should result in efficient resource decisions devoid of arbitrary or ''official'' biases. Subjective consideration of the ''value'' of particular technologies and where they may rank in the merit order of ''social desirability,'' effectively removes the discipline that is more likely to produce efficient results. Moreover, even where non-economic externalities are thrown into the valuation mix, the pricing of an energy resource must still be disciplined by examination of the economic merit order in attaining the externality objective. Whereas both the marketplace and transparent cost-based regulation are likely to produce coherent pricing that

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allows us to enjoy a degree of comfort knowing that efficient performance will likely lead to productivity, subjective consideration of soft criteria, like ''value of solar,'' are a step away from economic coherence and efficiency.

Economics are critical and efficiency is of vital importance. There are also other economic values, besides efficiency, including those that go beyond short-term efficiency. Certainly, many people believe that other, non-economic factors need to be considered. Similarly, the fairness of the impact on customers also needs to be factored into any decision. There has, for many years, been a running debate in electricity regulation as to whether externalities ought to be factored into regulatory decisions. This article does not intend to join that debate, nor express any point of view as to what is permissible or impermissible under applicable law. Rather, this article suggests that if externalities are to be considered, then all relevant ones deserve attention, as opposed to ''cherry picking'' the issues to best protect a particular interest. Further, if non-economic objectives are to be factored into ratemaking, then it is wise to carefully consider the most economically efficient ways of attaining those objectives.

There are a number of criteria that are important to the full valuation of solar PV. One should begin by looking at the cost of producing energy. Beyond that, the criteria would include availability/capacity, reliability, energy value, impact on system operations and dispatch, transmission costs and effects, distribution costs and effects, and hedge value. Solar DG proponents often phrase these issues in terms of avoided costs. In addition to those dimensions, there are also the following: degree of subsidization and cross-subsidization, efficiency considerations, impact on alternative technologies, market price impact, reliability, and social effects including the environmental, customer, and social class impacts. There is also the issue of whether solar DG enhances the level of competition in the industry.

Certainly, many people believe that other, non-economic factors need to be considered.

IV. Net Energy Metering – Why Are We Paying More for Less?

Retail net energy metering, as practiced, does not capture all of the value enumerated above. NEM significantly overvalues distributed solar generation. More specifically, it does the following:

1. Creates a cross-subsidy from non-solar to solar customers;
2. Fails to reflect the inefficiency of small-scale solar PV relative to other forms of generation, including alternative renewable resources;
3. Constitutes price discrimination in favor of an inefficient resource;
4. Significantly overvalues both the capacity and reliability value of solar DG;
5. Adversely impacts the degree of competitiveness in the industry;
6. Artificially inflates the transmission value of solar DG;
7. Fails to account for the fact that the value of energy varies widely depending on when it is actually produced;
8. Distorts price signals for energy efficiency;
9. Causes socially regressive economic impact;
10. Assumes system benefits from solar DG that, in fact, may not exist;
11. Overvalues its contribution to carbon reduction;
12. Vastly inflates its value as a fuel hedge; and
13. Undervalues and underfunds the distribution system.

Despite failing to capture these values, NEM has become the prevalent form of tariff for residential solar DG in

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the United States. This is because NEM was never developed as part of a fully and deliberatively reasoned pricing policy. NEM was simply never a conscious policy decision. It is basically a default product of two (no longer relevant) considerations, one practical and the other technological. The practical reason is that residential distributed generation had such an insignificant presence in the market that its economic impact was marginal at best. Thus, no one was seriously concerned about ''getting the prices right.'' The second, technological reason is that until recently the meters most commonly deployed, especially at residential premises, have had very little capability other than to run forward, backward, and stop. Thus, for technical reasons, NEM was simple to implement and administer and, as a practical matter given the paucity of DG, there was no compelling reason to go to the trouble of remedying a clearly defective pricing regime. Many states have recognized the problems with NEM but, seeing no alternatives, put in place production caps to limit any harm caused by a clearly deficient pricing regime.

V. Residential Retail Net Metering Sets Up Unfair and Counterproductive Cross-Subsidies

Beyond failing to capture the values above, there are other problems with NEM. Under NEM, when DG providers export energy to the system, consumers are required to pay them full retail rates for a wholesale product. What everyone agrees upon is that solar DG provides an energy value, but there is considerable disagreement about what that value is. Solar proponents argue that solar DG has a capacity value as well. That value, if it exists at all, is minimal. While there may well be reasons to treat DG differently with respect to wholesale transmission there is, absent a solar host leaving the grid, absolutely no reason to discriminate between wholesale and DG products with regard to the fixed costs of the distribution system and its operations.

If the costs of the distribution system were variable with energy production, that exemption would be sensible, but they are not.

Under NEM, however, solar DG providers are compensated at full retail prices for what they provide. That includes the not-insignificant cost of services that they do not provide, including distribution costs, administrative, and back office operations. There can be no justification for forcing consumers to pay a provider for service that they not only do not provide but, in fact, have no capability to provide.

Solar DG producers remain connected to the grid and are fully reliant upon it during the many hours of the day when solar energy is not available. Under NEM, that solar DG producer is excused from paying his/her share of the costs of the distribution system when energy is being produced on the premises. If the costs of the distribution system were variable with energy production, that exemption would be sensible, but they are not. Distribution costs are fixed, and do not vary with energy production or consumption. Thus, excusing solar DG customers from paying for their own distribution costs when their solar units are producing energy has no justification in either policy or economics. Making matters worse, the costs solar DG providers do not pay under NEM are either reallocated to non-solar customers or have to be absorbed by the utility. Both outcomes are unacceptable and unjustifiable. There is no reason why solar DG customers should receive free backup service, compliments of either their neighbors or the utility.

Utilities are obliged to provide full requirements service to all of their customers, including, of course, their solar host

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customers. In regard to solar hosts, the utility is obliged, in case the on-premises generation does not cover their full demand, to fill the gap between the full demand and the amount of self-generation. Utilities are also obliged to purchase energy and/or capacity so that solar hosts may rely on the utility when solar units are not generating. Given that solar PV units are intermittent and unpredictable regarding when they will produce, providing that backup is an ongoing responsibility and cost to utilities. Compounding those costs is the fact, as stated elsewhere in the article, peak times of electricity use (i.e. when prices are highest) are trending later in the day, when solar PV does not produce. As such, utilities must provide electricity to solar hosts at times when demand is high and energy prices are high. It would violate a the fundamental principle of regulation that cost causers should pay for the costs they impose, not to recognize the actual costs of that backup service in the rates paid by solar hosts.

Another cross-subsidy relates to the intermittent nature of solar energy. No utility with an obligation to serve can be fully reliant on the availability of solar when it is needed. Indeed, no solar host who values reliability can afford to be dependent on his/her own solar DG unit. While this point will be discussed further *infra* suffice it to say that this gives rise to two types of demand charge related cross-subsidy. The first arises when the distributor relies on the availability of solar for making day-ahead purchases and the other arises when it does not do so. When it does rely on the availability of solar and it turns out that solar energy is not available when called upon, the

utility is compelled to purchase replacement energy in the spot market at the marginal cost, which is almost certainly higher than the price of the solar energy on whose availability it had relied. In notable contrast to what happens in the wholesale market when a supplier who is relied upon fails to deliver, those incremental costs have to be borne by the utility, which passes them on to all customers, as opposed to being borne by the specific solar DG customer whose failure to deliver caused the costs to be incurred.

If the distributor, in recognition of solar's intermittency, instead chooses to hedge against the risk of solar's unavailability, the cost of the hedge is likewise passed on to all customers rather than simply those whose supply unpredictability caused the cost to be incurred. Both of these forms of cross-subsidy violate a bedrock principle of regulation – costs should be allocated to the cost causer. The function of that principle, of course, is to provide price signals to improve performance, but NEM fails to provide such signals and essentially holds solar DG providers harmless for their own very low capacity factors and inefficient performance.

NEM cross-subsidies, in large part, provide short-term benefits to the solar DG industry, but are highly detrimental to the value of solar in the long term. In the short term they constitute a wealth transfer from non-solar customers to the solar industry. In the long term, however, they are actually harmful to solar energy because NEM provides absolutely no incentive to improve the performance of a generating resource that, among renewables, already ranks last in efficiency and in cost effectiveness for reducing carbon emissions. In effect, the solar DG industry is putting its short-term profits ahead of the long-term value of solar energy. If solar DG advocates prevail in seeking to maintain NEM, that victory will be short-lived, because markets, both regulated and unregulated, do not prop up inefficient resources over the long term.

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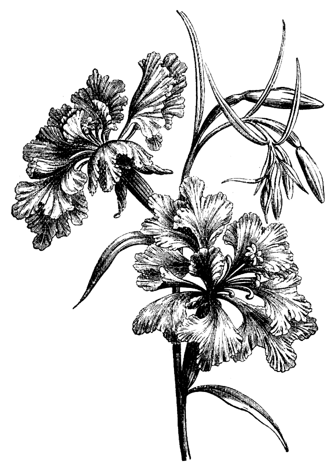
NEM is also woefully ineffective at providing the appropriate price signals. Electricity prices can be quite volatile over the course of every day and vary seasonally as well. Rather than reflecting those prices, NEM simply treats all energy the same regardless of the time during which it is produced. For example, NEM fails to differentiate between energy produced on-peak and off-peak. In one scenario, it prices off-peak solar DG at a level that is averaged with on-peak prices, thus effectively over-valuing the energy. Conversely, if solar DG were actually produced on-peak, NEM would average that price with off-peak prices, thus undervaluing the energy. Any form of dynamic pricing, ranging from time of use to real-time, could address this issue with more precision than flat, averaged prices. Interestingly, under the first scenario, cross-subsidies would be paid to solar producers, while in the second scenario, solar producers would be cross-subsidizing the other ratepayers. In short, the price signal, and the efficiency that would flow from that, is rendered incoherent.

Some may argue that cross-subsidies are necessary to promote the growth of renewable energy, and certainly that can be debated. However, modernizing NEM to provide appropriate price signals would not remove the tax credits and other government-sanctioned or -sponsored subsidies. The fact that conscious subsidies and/or cross-subsidies are designed to promote a particular technology raises two key issues. First, many would argue that the government, including regulators, should not be picking winners and losers in the marketplace. While there may be merit to that view, it must also be recognized that, there may be



circumstances where, for policy reasons, government might want to provide support for a socially and economically desirable technology and/or assist it with research funding and to get it over the commercialization hump. That leads inexorably to the second and more relevant issue concerning solar DG: namely, that subsidies and cross-subsidies need to be designed as near-term boosts rather than a permanent crutch, and should be transparent. In other words, subsidies/cross-subsidies should be designed to serve as both a stimulus for the designated technology and an incentive to the producers and vendors of the technology to become more efficient. It might also be noted that subsidies from the Treasury are more appropriate for achieving broad social benefits that are cross-subsidies derived from a subset of the full society deriving the benefit.

In the case of solar DG, the objective of a subsidy/cross-subsidy would be to attain grid parity, assuming reasonably efficient operations, with other resources. The objective is to assist a technology to achieve commercial viability. The problem with NEM, of course, is that it is effectively an arbitrary financial boost of potentially endless duration, with absolutely no built-in incentive to increase efficiency and/or to achieve grid parity. In effect it requires non-solar customers to pay more for the least efficient renewable resource in common use and provide the solar industry with no economic incentive to improve its productivity or availability or wean itself off dependence on the cross-subsidy. It also has the effect of putting more efficient resources, particularly other renewables, at a competitive disadvantage. In short, NEM effectively substitutes political judgment for economic efficiency to determining marketplace success.

The reason why solar DG vendors and providers cling to cross-subsidies is because they find more comfort in receiving substantial cross-subsidies than

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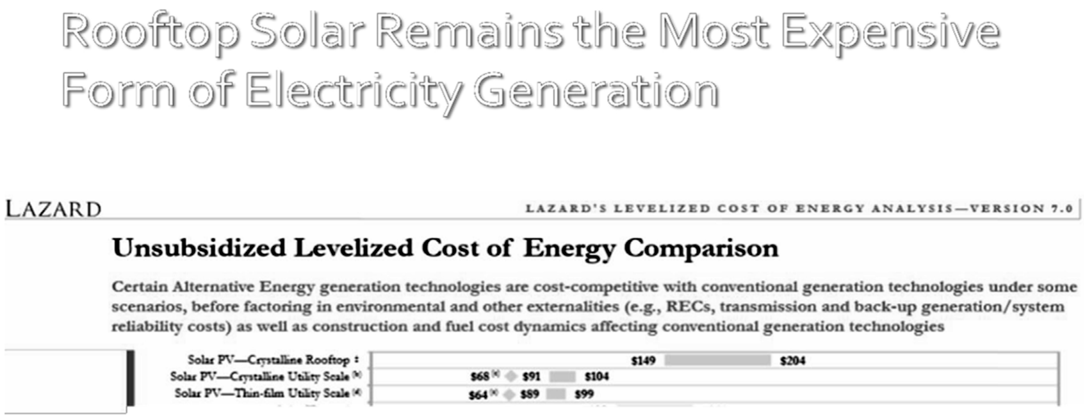

Figure 1: Rooftop Solar Remains the Most Expensive Form of Electricity Generation

they do in the prospect of becoming competitive. Solar DG is the most expensive form of renewable generation that is widely used today (Figure 1).

The technological and practical reasons for permitting such incoherent pricing are no longer present in the marketplace. We now have pricing methods that are capable of measuring DG production as well as consumption on a more dynamic basis. In addition, solar DG market penetration has dramatically increased to the point that it can no longer be dismissed as marginal, so appropriate pricing is now a non-trivial issue. In addition, we now have very precise, location-specific energy and transmission price signals that provide a very transparent market price by which one can measure the economic value of distributed generation. These new developments, plus the fact that NEM was put in place on a default basis, mean that it is now time for a full-blown policy consideration of the most appropriate pricing policy for distributed generation.

For all of the reasons noted, NEM pricing results in large cross-subsidies, offers no incentives for efficiency – indeed, may even provide disincentives to invest in efficiency improvements – and results in consumers paying energy prices for solar DG that are far in excess of its market value and not even subject to cost-based oversight. Moreover, its *raison d'être* – inability to more accurately price solar DG facilities and low market penetration by solar energy – no longer exists. Solar energy is penetrating the market in greater numbers and is likely to continue to do so. Secondly, more sophisticated pricing enables us to measure solar energy and customer behavior on a much more efficient, dynamic basis. The fundamental reality is that NEM completely fails to capture the value of the product being priced.

VI. Placing a Value of Solar DG – Pricing and Economic Efficiency

Needless to say, pricing is of critical importance. It is important to address pricing in the context of tangible, enumerated values. Such an analysis is in contrast to certain efforts by solar DG advocates to attach a subjective value to solar and then derive prices from that value. It is preferable to derive prices from the values established by either costs or market, not ephemeral and subjective considerations.

It is worth re-emphasizing just how imperfect NEM actually is. The price of electric energy is not constant. Wholesale markets reflect that reality. Net metering and many forms of incentives do not reflect the values established by the market. Rather, a net metering regime relieves the solar panel host of any obligation to pay for the costs of the distribution system when energy is being produced, even though he/she

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Table 1: Rooftop Solar Subsidies Heavily Utilize Funding from Non-Solar Customers

DTE Energy

Consumers Energy
Count on Us

SolarCurrents and Net Metering funding mechanism for residential customers

	SolarCurrents (Phase 1)	SolarCurrents (Phase 2)	Funding Mechanism
Up-front solar subsidy	$2.40/W	$0.20/W	Renewable Surcharge
On-going solar subsidy	$0.11/kWh	$0.03/kWh	Renewable Surcharge
Net metering subsidy (unrecovered fixed cost)	$0.09/kWh	$0.09/kWh	*Unrecovered fixed costs are funded by non-solar customers
Total SolarCurrents and Net metering subsidy	**$0.20/kWh**	**0.12/kWh**	

remains reliant on it and, when the meter runs backwards, is effectively paid the full retail price for energy exported from the customer's premises. As a point of illustration, see Table 1 for a funding mechanism for residential customers presented by DTE Energy to the Michigan Public Service Commission. According to DTE, the 9 cent per kilowatt-hour (kWh) net metering credit represents a differential that non-participating customers must pay.

Under NEM, compensation at retail rates is not cost-reflective because net metering means that solar DG energy exported into the distribution network is compensated at the full bundled retail rate rather than at a price based on the unbundled cost of producing the energy. In almost all jurisdictions, that retail rate is flat and constant. Thus, it does not reflect the obvious fact that the energy has greater value at peak demand than it does off-peak. It is a deeply flawed value proposition. The fact is that the wholesale market produces hour-by-hour prices that provide generators, renewable and non-renewable alike, and consumers with important price signals that reflect real-time values. Both generators and demand responders are compensated according to those real-time prices. Solar DG-produced energy, by contrast, is compensated on a basis that lacks a foundation in either market or cost. The compensation is out of market because it is a flat price regardless of when it is produced or, for that matter, fails to reflect that many hours of the day that solar panels produce absolutely nothing. It is hard to avoid the conclusion that on an economic basis, the NEM-derived price paid for solar DG energy completely misses the value of solar during most hours of the day. Interestingly, part of the cause for this incorrect valuation is that rooftop solar units have generally been installed facing south, as opposed to west. Because demand peaks have been trending later in the day (as illustrated in the California and New England figures below), this southern exposure has proven to render peak production for solar even less coincident with demand. Had the appropriate market prices been in effect, it is highly unlikely that such a costly error would have occurred.

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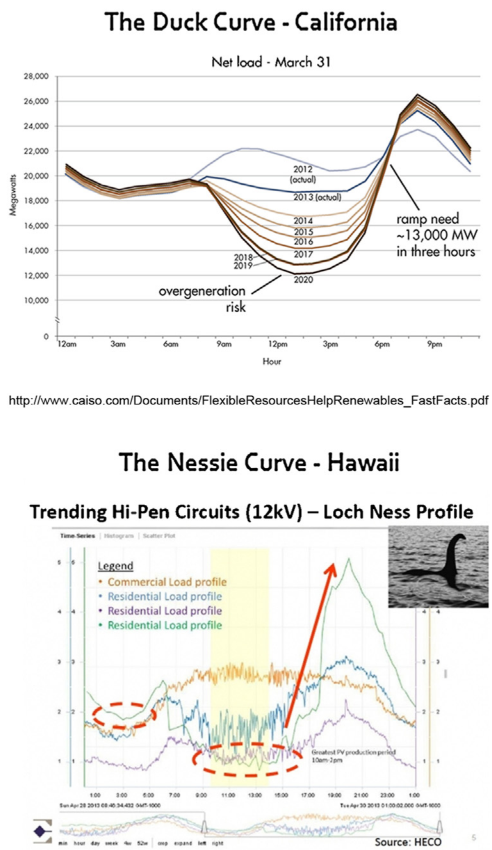

www.greentechmedia.com/articles/read/hawaiis-solar-grid-landscape-and-the-nessie-curve.

Figure 2: Ramping Needs Increased Due to Lack of Solar Prodution During Peak Demand

As is dramatically illustrated in the graph at left in Figure 2, enticed by a number of factors, not the least of which is net metering, 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 dropoff in solar production at peak. In that context, the absence of any meaningful signal to make solar more efficient (e.g. linking it with storage) is simply something that can no longer be tolerated. Not coincidentally, the charts from both the California and New England ISOs (found further *infra*), as well as that from DTE, illustrate the wisdom of compensating solar DG at LMP, so its price accurately reflects its value at the time of actual production and avoids requiring non-solar customers to pay prices for energy that far exceed its value.

A. Capacity value

The capacity value of a generating asset is derived from its availability to produce energy when called upon to do so. If a generator is not available when needed, it has little or no capacity value. By its very nature, solar DG on its own, without its own backup capacity (e.g. storage), can only produce energy intermittently. It is completely dependent on sunshine. Unless sunshine is guaranteed at all times solar DG is called upon to produce, it cannot be relied upon to always be available when needed. Moreover, even if all days were reliably sunny, the energy derived from the sun is only accessible at certain times of the day. In many jurisdictions, the presence and potency of sunshine is not coincident with peak demand. Frequently, for example, solar DG capacity is greatest in the early afternoon, while peak demand occurs later in the afternoon or in early evening. The two charts in Figure 3 illustrate the lack of coincidence of solar production and peak demand in New England.[1]

These two charts dramatically demonstrate that, on the days chosen as representative of summer and winter in New England, solar PV is completely absent during the winter peak, reaches its peak production as peak demand is rising in the summertime, and drops off dramatically during almost the entire plateau period when demand is at peak. It should also be noted that on the days chosen, the sun was shining. The graph, of course, would look very different on cloudy days when solar production is virtually nil.

The Electric Power Research Institute (EPRI) graphs in Figure 4 reveal similar patterns on a national level. The first graph

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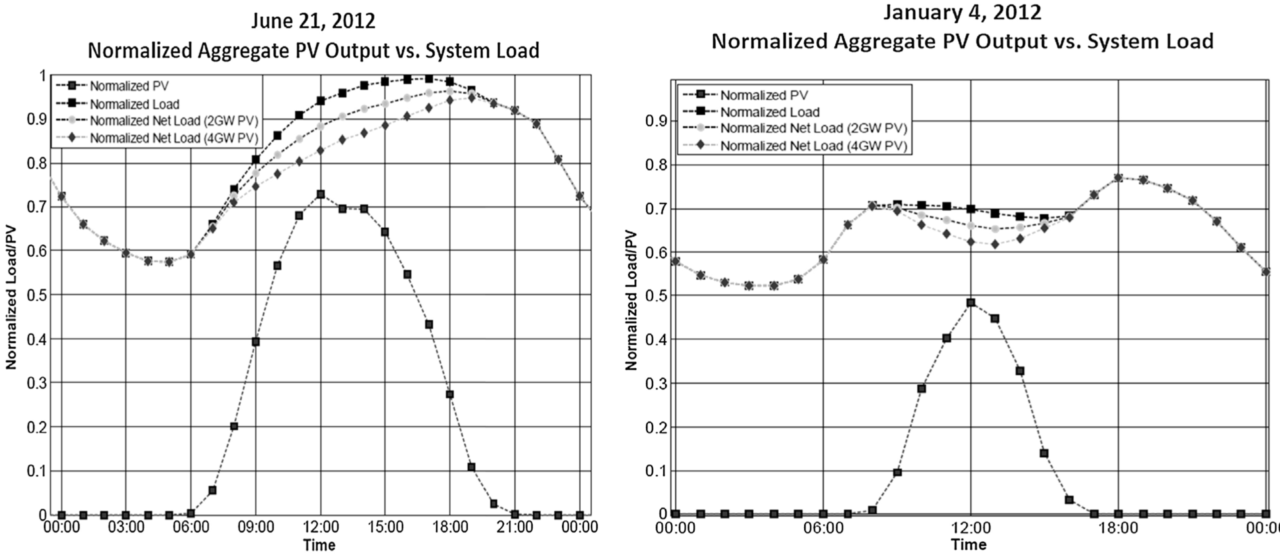

Figure 3: Lack of Coincidence of Solar Production and Peak Demand in New England

depicts the peak load reduction and ramp rate impacts resulting from high penetration of solar PV. The second illustrates the fact that because residential load and PV system output do not match, solar DG hosts use the grid for purchasing or selling energy most of the time.

As noted above, providers of capacity in the wholesale market may also have availability issues. In their case, however, if they are not available when called upon to produce, they are typically obligated to either provide replacement energy or to pay the

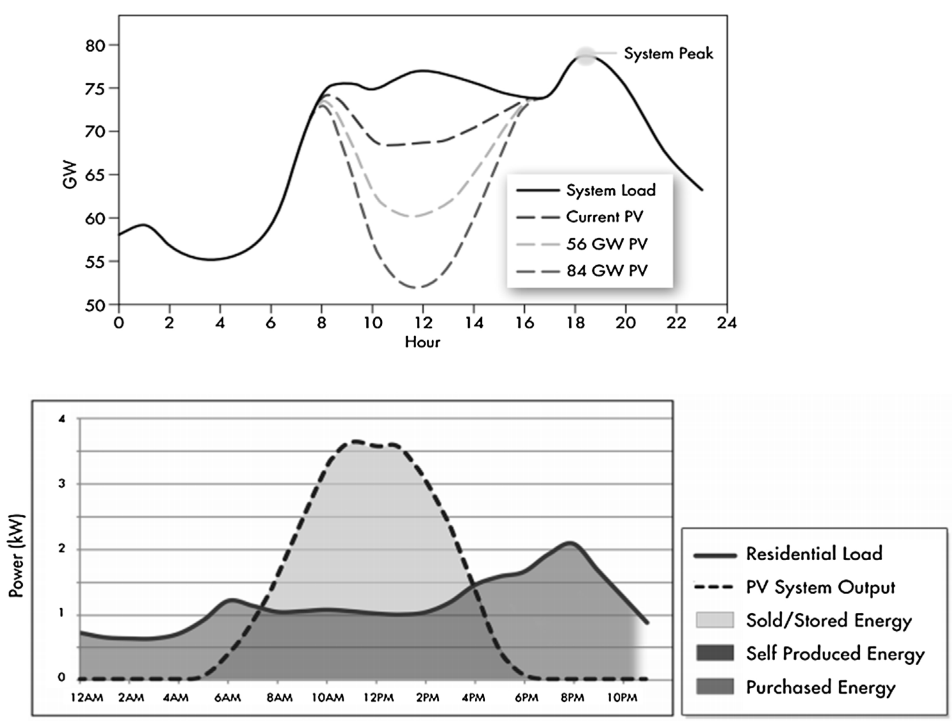

Figure 4: Increased Ramp Rates, Peak Load Reduction and Reliance on the Grid

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marginal cost of energy that they failed to deliver. Unless a similar obligation is imposed on solar DG providers, the capacity value of solar DG is reduced even further. Good pricing policy would suggest that DG prices should be fully reflective of the value of the type of capacity that is actually provided. As currently implemented, net metering does not adequately reflect how the capacity availability measures up to demand.

B. Availability and reliability

Many advocates of solar DG assert that it enhances overall reliability because the units are small, widely distributed but close to load, and not reliant on the high-voltage transmission system. It is argued that they are less impacted by disasters and weather disturbances. At best, these claims are highly speculative and, for the reasons noted below, quite dubious. It would be a mistake to attribute added value to solar DG because of reliability.

Solar DG is subject to disaster as much as any other installations. High winds, for example, can harm rooftop solar as much as any other facility connected or unconnected to the grid. Cloudy conditions can disrupt solar output while not affecting anything else on the grid.

Solar DG has more reliability benefit in some places than others. In Brazil, for instance, a system that largely relies on large hydropower plants with large storage reservoirs, solar has considerable long-term reliability value because whenever it generates energy it conserves water in the reservoirs, thereby adding to the reliability of the system. However, in a thermal-dominated system (like much of the United States), where there is little or no

storage, reliability has to be measured on more of a real-time basis. Therefore, solar's intermittency makes it unable to assure its availability when called upon to deliver energy. Indeed, it is far more likely that a thermal unit will have to provide reliability to back up a solar unit than the other way around.

It is also important to examine rooftop solar reliability issues in two contexts: that of the individual customer and that of the system as a whole. Solar DG vendors, as part of their sales pitch, claim that reliability is increased for a specific customer with a rooftop solar unit because on-site generation provides the possibility of maintaining electric power when the surrounding grid is down. When the sun is shining, this claim may be true. Conversely, without the sun, the claim has no validity. However, that argument only applies to the solar host.

On a technical point, a power inverter is an electronic device or circuitry that changes direct current to alternating current. During a system outage the power inverter is automatically switched off to prevent the backflow of live energy onto the system. That is a universal protocol to prevent line workers and the public from encountering live voltage they do not anticipate. Thus, if a solar DG unit is functioning properly, when the grid is down, the solar DG customer's inverter will also go down, making it impossible to export energy. If the solar DG unit is not functioning properly, then the unit may be exporting, but will do so at considerable risk to public safety and to workers trying to restore service. The result is that the solar panel provides virtually no reliability to anyone other than perhaps to the solar host.

Attributing reliability benefits to an intermittent resource is a stretch. By definition, intermittent resources are supplemental to baseload units. The only possible exceptions to that are, as noted above, where there are individual reliability benefits or where the availability of the unit is

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coincident with peak demand or has the effect of conserving otherwise depletable resources. Absent those circumstances, and absent storage, it is almost certainly the case that the system provides reliability for solar DG, rather than the other way around. That is particularly ironic given that in the context of net metering, solar DG hosts do not pay for that backup service while generating electric energy. In essence, in a net metering context, non-solar customers pay solar DG providers for reliability benefits that solar DG does not provide them, while solar DG customers do not pay for the reliability benefits they actually do receive.

From an investment perspective, solar DG pricing methods, like NEM, which redirect distribution revenues from distributors to solar PV providers who offer no distribution services are detrimental to reliability as they either deprive the sector of capital needed to maintain high levels of service or demand additional revenues from non-solar DG users who would ordinarily not have to pay such a disproportionate share of the costs. For utilities, the diversion of funds leaves them with a Hobson's choice of either delaying maintenance and/or needed investment, or seeking additional funds – in effect, a cross-subsidy from non-solar users. It is also relevant to reliability to again note that the prevalence of intermittent resources on the grid, including solar DG, may well cause new, cleaner, and more efficient generation to appear less attractive to investors. Over the long term, that effect could lead to reliability problems associated with inadequate generating capacity, especially at times of peak demand.

C. Solar DG does not avoid transmission costs

It is nearly impossible to demonstrate that solar DG will obviate the need for transmission, much less quantify the cost savings associated with this purported benefit. Of course, there is a simple way to calculate any actual transmission savings, and that is by compensating solar DG providers in the organized markets at the locational marginal cost of electricity at their location. That compensation model would have the benefit of capturing both the energy value and the demonstrable transmission value of solar DG. Absent that formulation, efforts to calculate actual transmission savings would be a difficult, perhaps entirely academic, task.

Solar DG advocates assert that real transmission savings are achieved through the deployment of DG, especially in systems that use locational marginal cost pricing. The argument is that by producing energy at the distribution level, less transmission service will be required, thereby reducing or deferring the need for new transmission facilities. It is also often contended that DG will reduce congestion costs, and perhaps even provide some ancillary services. All of that is theoretically possible but certainly not uniformly, or even inevitably, true.

Of course it is true that DG, absent any adverse, indirect effect it might have on the operations of the high-voltage grid, does not incur any transmission costs in bringing its energy to market. However, that is quite different than asserting that DG provides actual transmission savings. In fact, it would be incorrect to simply conclude across the board that solar DG will achieve transmission savings. It is possible that there could be transmission savings associated with solar DG deployment, but that can only be ascertained on a fact- and location-specific basis. Such savings would most likely be derived from reducing congestion or providing ancillary services of some kind. It is also theoretically

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possible, but highly unlikely, that massive deployment of solar DG will eliminate (or, more likely, defer) the need to build new transmission facilities. For a variety of reasons, including the complexities of transmission planning, the time horizons involved, the complex interactions of multiple parties, and economies of scale in building transmission, it is improbable that solar DG actually saves any investment in transmission capacity.

Indeed, a mere glance at the California ISO duck graph showing the need for ramping capacity to make up for the intermittent availability of solar DG provides a *prima facie* case for believing that the opposite is true and that solar DG may cause a need for more transmission to be built. These and other charts also show that as long as solar does not reduce peak energy use, transmission is likely needed to serve peak hours. Regardless, it is virtually impossible to demonstrate that, other the possibilities of reducing congestions costs (a value fully captured by LMP), there is very little likelihood of transmission saving being derived from solar DG.

D. Solar DG does not avoid distribution costs

It is more likely that solar DG will cause more distribution costs than it saves. That is because these generation sources could change voltage flows in ways that will require more controls, adjustments, and maintenance. Moving from a one-way to a two-way system will certainly increase the need for technical equipment to manage the reliability of the system. While DG solar may not be the only cause of this move the intermittent nature of solar makes

it particularly difficult to manage. It will also inevitably increase transaction costs for the utility to execute interconnection agreements and do the billing for an inherently more complicated transaction than simply supplying energy to a customer. It is impossible, unless a solar DG host leaves the grid, to envision a circumstance where solar DG would effectuate distribution savings.

Regarding distribution line losses, DG offers value only to DG providers when they consume what they produce because any DG output exported to the system is subject to the same line loss calculations that any other generator experiences. If there were locational prices on the distribution system, there might be line loss benefits that could be captured by DG but, since those price signals do not exist, the argument is purely academic.

VII. Lower Hedge Value

The theory advanced by some solar DG proponents is that because the marginal cost of solar is zero, it serves as a hedge against price volatility. In theory, that might make sense. In reality, however, solar is an intermittent resource that cannot serve as a meaningful hedge unless such zero-cost energy is both sufficiently and timely produced. Thus, solar DG is the equivalent of a risky counterparty whose financial position renders him incapable of assuring payment when required. Moreover, the value of a hedge depends on the amount of money the purchaser of the hedge is obliged to pay for the insurance and the amount and probability of the price he/she seeks to avoid paying. With a NEM system (or the high-priced ‘‘value of solar’’ approach that solar DG advocates seek), the price paid is highly likely to exceed the fuel or energy price most utilities would hedge against. In short, the argument ventures into the realm of the absurd. It amounts to: *Pay me a fixed price that is higher than the price you want to avoid, in order to avoid price volatility*.

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The argument that solar DG provides a valuable hedge function is reduced to virtual absurdity by the fact that the so-called hedge is not callable. In short, if the price rises to the level against which the hedge purchaser wants to be insured against, the solar provider of the hedge is not obliged to pay. That being the case, there is no hedge whatsoever.

VIII. Effects of Solar DG on Other Renewable Resources

A. Impact of a low capacity factor

Since 2008, as **Figure 5** from the United States Energy Information Administration (EIA) points out, solar PV has had the lowest capacity factor of any commonly used renewable energy resource in the U.S. It is also worth noting that while the overall costs of installing solar panels has declined (as noted above) the productivity of solar PV has remained constant at consistently low levels. It should be noted that the chart below compares only ''utility-scale'' projects. As noted in the Lazard study above, distributed solar is even less cost effective than utility-scale solar, which already occupies last place on the Department of Energy (DOE) ratings.

The stark reality of solar PV's combination of high prices and poor capacity factor carries over into the cost of reducing carbon emissions. An interesting dialog occurred recently between Charles Frank, an economist at the Brookings Institution, and Amory Lovins of the Rocky Mountain Institute.[2] Their dialogue, while contentious on many points, reflects similar views on the realities depicted in the EIA chart. Frank analyzed five non- or low-emitting generation resources by their cost effectiveness in reducing carbon and concluded that nuclear and natural gas, followed by hydro, wind, and solar were, in that order, the most cost-effective types of generators for reducing carbon. Lovins took issue with Frank for using outdated data and for not looking at energy efficiency. He also argued that nuclear ranked last in cost effectiveness, and expressed some reservations about the ranking of natural gas. However, what is significant is that, among renewable resources, Lovins concurred with Frank that solar DG is the least efficient renewable resource for reducing carbon. Thus, in the view of both men – who hold quite divergent views on how best to reduce carbon emissions – not only is solar DG expensive, it is the least cost-effective renewable resource for reducing carbon emissions.

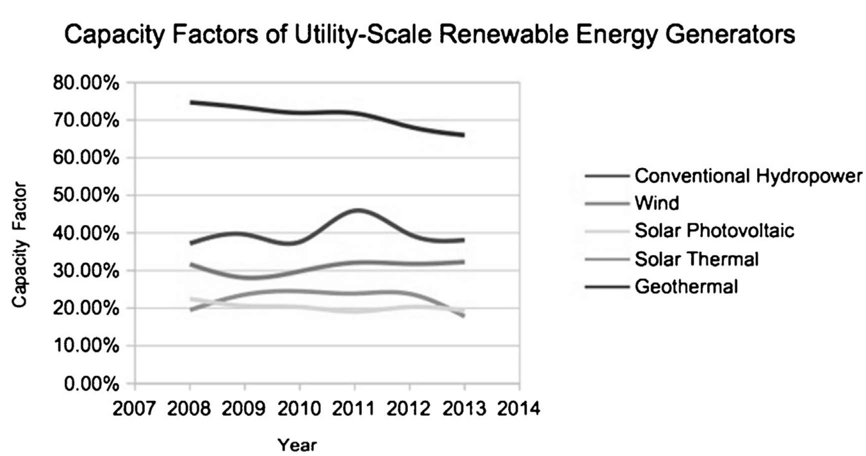

Figure 5: Capacity Factors of Utility-Scale Renewable Energy Generators

B. Impact of higher-than-market price

Higher-than-market prices paid for solar DG has adverse effects on other renewable resources. All wholesale generators, renewable and otherwise, have to incorporate transmission and distribution costs into the price of energy delivered to customers. As mentioned above, it is true that transmission issues play out differently for distributed generation than for wholesale generation. Since DG, by definition, does not rely on transmission capacity, although DG might impact congestion costs in various ways, wholesale energy's delivered cost reflects transmission capacity

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costs while DG's does not. Thus, any competitive advantage for DG on that score is quite natural. However, under the net metering scheme, DG providers also do not have to incorporate distribution costs into their end product, and that results in a serious economic distortion of the generation markets in general as well as specifically in renewable markets. In fact, as noted *supra*, solar DG providers under NEM are actually paid for delivering their energy even though they provide no such service. Wholesale generators, unlike their DG counterparts, enjoy no such comparable enrichment for service they do not provide. The effect of NEM's highly inefficient and non-cost-reflective rates is to distort market prices in ways that reward inefficiency and will likely distort price signals that are essential for an efficient marketplace.

In addition, at a critical mass, artificially elevated solar DG prices are highly likely to create distortions and inefficiencies in the capacity and energy prices found within organized markets. An environment with two parallel pricing regimes, one market- or cost-based, and the other an arbitrary one neither market- nor cost-based, is simply economically incoherent and unsustainable. The overall effect of net metering is to increase the prices consumers pay for energy overall, without any assurance of any long-term benefit. Solar DG is artificially elevated to a preferential position above more-efficient, larger-scale generation, including all other renewables. The disparity in treatment between solar DG and other forms of energy suggests that net metering is not only federal preemption bait (as further discussed below); it is fundamentally anti-competitive as well. Indeed, it compels consumers to both cross-subsidize less efficient producers and to pay higher prices

than necessary for energy. It will also entice investors to allocate their capital to toward more profitable but less efficient generation. In terms of efficiency and public benefit, the incentives inherent in NEM are simply perverse.

Large-scale bulk power renewables (e.g. large-scale wind and solar farms, geothermal) are put at a particular disadvantage by NEM pricing of solar DG independent of costs or market for two basic reasons. First, large-scale renewables are more efficient and more cost-effective than DG, yet net metering provides a subsidy only to the less efficient form of generation. In fact, solar DG providers are compensated for the energy they export at a price that can range from two to six times the market price for energy. Second, in those states with renewable portfolio standards (RPS), the entry of a critical mass of non-cost-justified solar DG units into the market could have the effect of driving more efficient, large-scale renewables out of a fair share of the RPS market. The effect, in a competitive market, is to bias the market to incentivize highly inefficient small-scale solar to the detriment of less costly larger-scale solar.

C. Comprehensive environmental analysis

Any analysis of the environmental impact of the generation mix should include an examination of the least-cost, most efficient ways to get to the desired results. Problematically, the preferential pricing of less efficient solar DG imposes an unnecessarily high-cost approach to reducing carbon. Results such as that cannot be justified on the basis of externalities, which are no different between DG and larger-scale renewables. Indeed, it seems probable that overpayments for DG have the effect of squeezing more efficient forms of renewable energy out of RPS markets by using preferential pricing to grab a disproportionate share of the RPS market and driving up the cost of reducing carbon.

In the long run, of course, the inherent favoritism in pricing DG

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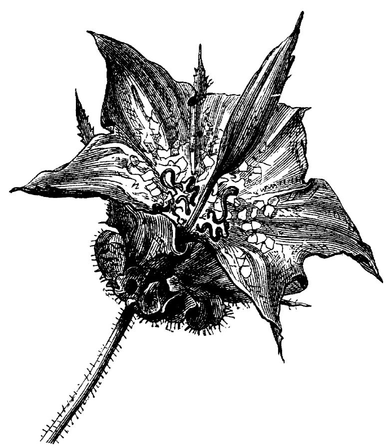
at levels arbitrarily higher than other renewable energy sources does not bode well for either the future of renewables or the objective of efficiently reducing carbon emissions. Discrimination in favor of inefficient resources on a long-term basis is simply not sustainable. The inevitable backlash in both the marketplace and public perception has the potential to sweep away public support for renewable energy and perhaps for strong environmental controls as well, an outcome no one concerned about the environment would want. One of the most notable ironies emanating from the use of net metering to price solar DG is that it will almost certainly lead to changes in retail pricing that will undermine the promotion of energy efficiency. The reason for this is that as solar DG becomes more widely deployed, utilities and their regulators will likely become increasingly concerned with the diminution of revenues required to support the distribution system that is caused by the use of net metering.

Those concerns are derived from the fact that under NEM, when solar DG is being self-consumed at the host premises, no revenues are being paid by that host to the utility for providing what essentially amounts to a battery to supplement their self-generation. Since the costs of the distribution are fixed and not variable with the use of ''behind the meter'' generation, net metering results in a delta of revenue that is either made up for by non-solar customers or constitutes a loss for the utility. Neither outcome is likely to be satisfactory to either the utility or the regulators. Inevitably there will be ratemaking consequences. That problem is compounded, of course, by the fact that when the excess output of rooftop solar is being exported into the grid the solar provider is



being paid as if he/she was delivering the energy, a service obviously provided by the distribution utility. Thus, not only are solar hosts not paying their fair share of fixed costs, they are, by the operation of net metering, actually taking revenues away from the entity that actually provides the service. From the standpoint of the utility and of the non-solar ratepayers who have to bear the burden of such uneconomic and inequitable revenue allocation, rate design remedies will be sought.

One likely remedy to be proposed is to modify the fixed/variable ratio in rates. While distributions are indisputably fixed costs, regulators have generally divided the recovery of those costs on a different basis. Some have been recovered on a fixed basis, while others have been recovered on a variable, volumetric basis. There are two critical policy reasons why this has been the case. The first is that fixed charges tend to impose a disproportionate burden on low-income households and on customers whose consumption is relatively light. The other reason is that volumetric-based charges send a signal to end users that the more they consume, the more they pay. Stated succinctly, the price signal promotes the efficient use of energy. If the revenue stream to cover distribution costs is diminished through mechanisms like net metering, utilities concerned about revenue requirements and regulators, concerned about reliability will, almost inevitably, shift more costs into non-by passable fixed charges, thus imposing more of a burden on low-income households and, equally important, diluting price signals for energy efficiency. In short, net metering will almost certainly, at some point, serve to both cause cost recovery to be socially regressive, and to discourage energy efficiency. In effect, net metering will likely become a classic case of anti-green pricing.

The anti-green pricing aspect of net metering is also exemplified by the behavioral pattern it incents among solar hosts. As shown on both the California and New England

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graphs above, solar production slacks off and ultimately disappears as demand reaches its peak. Despite that, solar hosts are never signaled through prices that their consumption is no longer being supported by zero-marginal-cost solar production. Indeed, in most cases net metering determines prices on an average-cost basis, even though solar production, even in the best of circumstances, is only available a fraction of the time period used for averaging. Thus, solar hosts are essentially lulled into a pattern induced by low marginal prices, which continue in periods of peak demand, thereby driving the peak demand even higher, a result that is truly perverse, both economically and environmentally. In short, net metering and energy efficiency are simply not compatible.

D. Net metering and energy efficiency are incompatible

Many experts from all facets of the renewable energy discussion will assert that energy efficiency is an important, if not the most important, means to increase carbon reductions. Assuming those experts are correct, it is important to consider the ways in which net metering impacts incentives for energy efficiency. While solar DG and energy efficiency are not inherently anathema, net metering is not compatible with energy efficiency. As discussed above, net metering is a compensation mechanism that causes utilities and regulators to move costs into the fixed category, thereby diluting the price signals that would encourage energy efficiency.

E. Possible federal preemption

State regulators, in setting prices for solar DG, should also be

conscious of the potential for jurisdictional disputes should DG prices cause any dislocation in wholesale markets. Because of the economic distortions caused by NEM, there are some who are calling for DG to be under the control of the Federal Energy Regulatory Commission (FERC) rather than state public utilities commissions' jurisdiction.[3] Unless states begin to remedy the price distortions inherent in net metering, it would be surprising if many aggrieved wholesale generators did not seek relief from FERC. In a somewhat analogous situation, New Jersey and Maryland sought to use state subsidies/mandates to support the construction of new power plants in order to manipulate and/or bypass the PJM capacity market. FERC, in a decision which was later affirmed by the Third Circuit Court of Appeals, struck down the state program by preemption. State commissions that continue to prop up a net metering regime with no basis in either market-based pricing or cost-of-service regulation may well discover the prospect of preemption hanging over them.[4] Further foreshadowing preemption are several other examples of state net metering programs running contrary to federal pricing regimes.

The Public Utility Regulatory Policies Act (PURPA) places an avoided-cost ceiling on power purchases; net metering evades that ceiling. Under net metering arrangements, not only are purchases of excess power mandated at levels well in excess of avoided costs, but they also include a cross-subsidy from non-solar customers for the distribution costs of solar DG providers. Bulk power renewables are subject to all of the rules of the wholesale market, which may include such costs as congestion costs, ancillary services, penalties for no availability, and others. Under net metering, solar DG providers are subject to none of these disciplines. In addition, some wholesale renewable generators complain that the arbitrarily high prices paid under net metering have the effect of attracting enough solar DG providers to fill up the RPS market, so that they

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are being effectively squeezed out of the portfolio entirely.

What is particularly ironic about this effect is that, as noted above, distributed, small-scale solar is the least efficient form of commonly used renewable energy sources in the United States. All of these factors indicate that an increasing number of parties are likely to be motivated to ask FERC to preempt net metering and other state-mandated regimes that allow for unreasonably discriminatory and anti-competitive pricing.

IX. Factors Mitigating Environmental Benefits

Expectations of environmental externality benefits may be the biggest motivator for supporting and subsidizing solar DG. Proponents of solar DG note that solar has zero carbon or other harmful emissions from the process of producing energy. Additionally, to the extent that wide deployment of solar PV avoids the need to invest in technologies that do have carbon and other undesirable emissions, there is an environmental benefit that avoids the social costs associated with pollution. In the absence of legal limits on relevant emissions such costs, solar DG advocates correctly point out, are not captured in the internalized costs of the competing technologies. Therefore, solar DG advocates suggest that regulators and policymakers should take these external social costs into consideration in setting prices for various forms of energy.

The use of external social costs, as opposed to solely the internalized economics of various forms of energy is a controversial subject. Many oppose the use of externalities as a factor in pricing because it distorts the market and makes social judgments economic regulators may not be

empowered to make. In the views of such opponents, the only externalities that ought to be incorporated into pricing are those that are internalized by legal mandate. Proponents of incorporating externalities into rates contend that doing so is the only way to accurately reflect all social costs. They also contend that factoring in environmental externalities is a form of insurance against future regulatory requirements. While this article takes no position as to the merits of incorporating externalities into ratemaking, it will address this issue, on the assumption that at least some regulators and policymakers will look at externalities for purposes of assessing the value of solar DG.

Before delving into this issue any further, it is important to note that the United States Environmental Protection Agency (EPA), whose jurisdiction over carbon emissions has been affirmed by the U.S, Supreme Court,[5] has proposed new rules under Section 111(d) of the Clean Air Act that would, if promulgated, internalize the costs of carbon into electricity ratemaking, so the issue of whether or not to consider the costs of carbon would no longer be debatable. Thus, there is a great deal of uncertainty which, in the short term, effectively strengthens the hand of those who contend consideration of carbon emissions would be a form of insurance against future regulation. In the longer term, however, the likelihood that carbon emissions will be internalized gives rise to very serious questions as to the value of including externalities which, over time may run contrary to the economics of internalized carbon costs. It is also worth noting that there are already several states that have adopted controls on carbon emissions. In those states, it is especially important to make certain that renewable policy and pricing enhances efficiency in compliance, as opposed to confusing means and ends. Regardless, the environmental issue, in terms of solar DG, is

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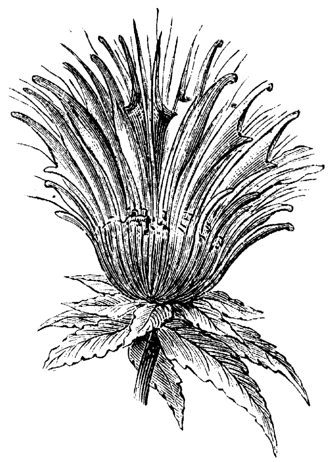
how cost effective such installations are for reducing carbon.

There is little dispute that solar DG is the least efficient of all renewable energy resources in common use in this country. As noted, there is even a consensus, which includes Amory Lovins, that agrees that solar DG is the least efficient renewable resource for reducing carbon. That view is fully supported by the facts in the California duck graph, as well as the ISO-New England and EPRI Value of the Grid data, which demonstrate conclusively that solar DG is consistently off-peak. When priced at net metering levels, it is also the most expensive renewable resource, thereby producing a perverse paradigm that where the least efficient resource costs the most. Therefore, it is evident, without considering any other factors, that solar DG is the least cost-effective use of renewable energy to reduce carbon emissions. There is also the reality that, as a general rule the least efficient and ''dirtiest'' plants are most likely getting dispatched at times of peak demand. Thus, in the rare instance that solar DG is available at peak in the United States, it is not displacing the most carbon emitting plants. Instead, it is displacing more efficient, less polluting generating units. Moreover, as an intermittent resource, its availability is highly uncertain and fossil plants are often called upon to operate on a less efficient, more carbon-emitting basis than if they were running as pure baseload. Thus solar DG is not only expensive, it is also much more likely to displace low-emitting, more efficient generation than less efficient, dirtier units. In addition, as noted earlier, net metering significantly dilutes the price signals for environmentally benign energy efficiency.



Those conclusions have been borne out by developments in Germany. In that country, where there has been a very dramatic increase in reliance on intermittent energy, prices have risen 37 percent since 2005, and were accompanied by spikes in both carbon emissions and the use of brown coal (lignite). While there are very significant difference between most states and Germany, perhaps most notably that Germany has decided to close down its nuclear plants (although it has replaced much of the domestic nuclear with imported nuclear energy), the experience in that country is very telling.[6] The German example clearly demonstrates that increased dependence on renewable energy resources, particularly intermittent resources, does not, as many solar DG proponents claim, *ipso facto*, mean fewer carbon emissions, and may, in fact, cause the opposite to occur. It also demonstrates that prices will escalate dramatically if the feed in tariffs are as far in excess of market as NEM prices are, as shown by the DTE graph above. The Germans, incidentally, have recognized their miscalculations and are dramatically recalibrating their strategy.

X. Regressive Social Impact

There are social effects beyond the environment that have to be taken into account if externalities are to be factored into ratemaking. Any failure to examine environmental externalities without recognizing that there are other social externalities to be considered as well will yield highly skewed results. Perhaps the most important of those is the social impact.

The social impacts of solar DG are caused by three main factors. First, as noted above, solar DG users have their electricity costs cross-subsidized by their neighbors who completely rely on the grid. Second, some data suggests that solar DG users are unusual electricity users. Third, not everyone can afford to be a solar DG user. To address the second point, unlike typical residential customers, in some regions solar

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DG users use little or no grid power at midday but quickly ramp up demand on peak, when PV production wanes (as is demonstrated by the charts in from the New England and California ISOs). Utilities must be able not only to serve full load on days when solar PV is not performing, but also to ramp up resources quickly to address the peak created by solar DG users. In order to ramp up as needed, utilities will purchase energy at the marginal price and then distribute those costs across all users, not just solar DG users. Thus, users without solar DG may be penalized for the use patterns of their solar DG neighbors. A comparison of residential electricity consumers in the western United States may be found below in **Figure 6**.[7]

Further, the impact of net metering is not simply the creation of a cross-subsidy from non-solar PV customers to solar PV customers but, as has been pointed out in a recent study by E3,[8] it is a cross-subsidy from less affluent households to more affluent ones. Indeed, the average median household income of net energy metering customers in California is 68 percent higher than that of the average household in the state, according to the study. In a recent proceeding, the staff of the Arizona Commerce Commission noted the same consequence.[9] As one wry observer in California noted, net metering is not ''Robin Hood'' but rather it is ''robbin' the hood.'' In order to install rooftop solar panels, often individuals must be homeowners with high credit ratings or sufficient capital. Leasing arrangements are also widespread, but are generally available only to customers who own their own premises and they require the assignment of most of the rooftop solar benefits to the lessor. Many electricity customers, particularly less affluent ones, do not own homes or lost their homes in the most recent recession. The electricity customers who are unable to afford rooftop solar are forced to subsidize those who are already in a more favorable financial position. Thus, it is entirely fair to characterize NEM as a wealth transfer from less affluent ratepayers to more affluent ones.

Tariffs with a regressive social impact are certainly worthy of consideration from a policy and rate-making perspective. Thus, if externalities are to be weighed in setting pricing for solar DG, then it is important to avoid inordinate cost shifting and, in particular, to avoid adding new burdens to the less affluent in order to provide benefits to those further up on the income scale.

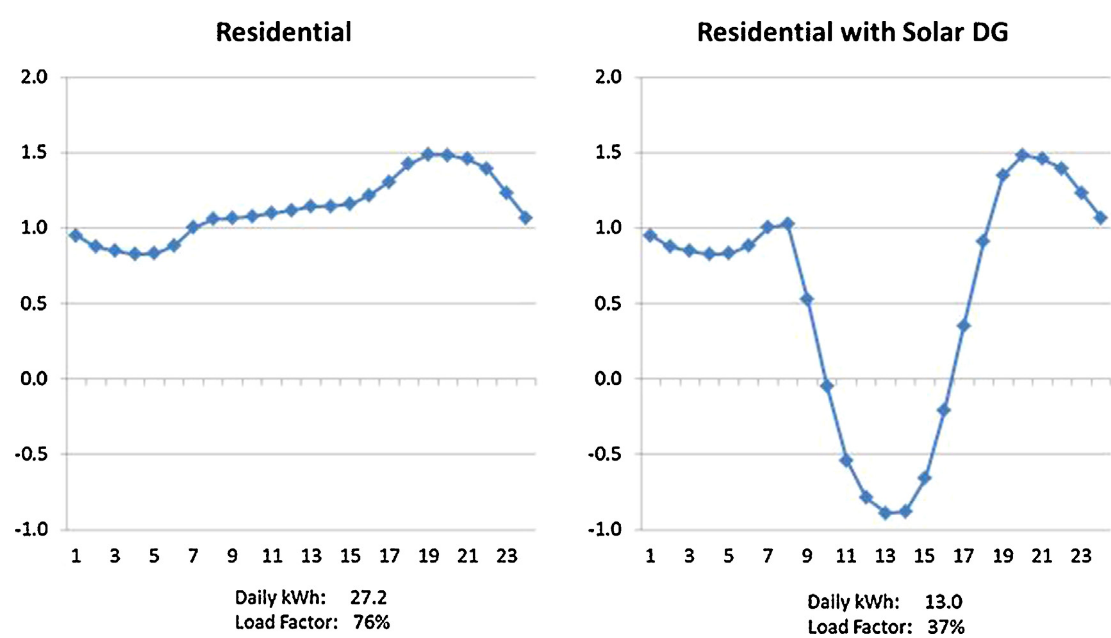

Figure 6: Typical Residential Loads Average Day – Iowa

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XI. Impact on Job Creation

The impact of solar PV on jobs is often cited as an externality benefit. Any analysis of the job impact must be comprehensive and not an effort to cherry pick data. For instance, merely citing the number of solar installers employed does not tell us much. Many aspirations for more jobs manufacturing PV units in the United States have not materialized due to China's capture of the market. Other impacts to be considered are the effect of solar PV on electric rates and the impact of that on the job market, not only in terms of what happens with rates, but also in terms of the rate structure that is implemented as a result of more market penetration by solar DG. For example, it is conceivable that any movements toward more fixed costs could discourage energy efficiency work thus displacing jobs in manufacturing and installing energy efficiency technology.

XII. Conclusion

There is value in solar DG, but that value is severely diminished and placed in peril if its pricing discourages efficiency improvements and distorts critical price signals in the marketplace. It is similarly counterproductive to the future of solar DG if its pricing has socially regressive effects and if it sucks needed revenue away from the essential distribution grid. From an economic point of view solar DG has energy value, the potential for reducing some transmission costs, and perhaps under the right circumstances, some capacity value, and ought to be compensated accordingly. With regard to externalities, it is not entirely clear, when viewed in the entire scope of its impact, that solar DG, has positive environmental value, but it is absolutely

clear that when net metering is deployed, it is simply not a cost-effective means for reducing carbon emissions. In fact, it is possible that solar DG might do more harm than good if it has the effect of removing price incentives for energy efficiency, and if it causes older plants to extend their lives and to operate inefficiently on a ramping basis for which they were not designed. It seems clear that if we are to capture the full value of solar DG, net metering must be discarded and replaced with a market-based pricing system that values the resource appropriately and includes incentives for making it more efficient over the long run.■

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4. 135 FERC 13 61,022, April 12, 2011 *affirmed* New Jersey Board of Public Utilities et al. v. FERC, 744 F.3d 74 (2014).

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