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THE Vote Solar INITIATIVE

RE: **DOCKET NO. E-00000J-14-0023:** Value and Cost of Distributed Generation (Including Net Metering)

ORIGINAL

The Vote Solar Initiative (Vote Solar) appreciates the opportunity to share our perspective with the Staff of the Arizona Corporation Commission (Staff) regarding the workshops that will investigate the currently non-monetized benefits of distributed solar generation DSG and associated methodologies. Vote Solar is a national non-profit grassroots organization working to foster economic opportunity, promote energy independence and address climate change by making solar a mainstream energy resource across the United States. Since 2002, Vote Solar has engaged at the state, local and federal levels to remove regulatory barriers and implement the key policies needed to bring solar to scale. Vote Solar has approximately 3,500 members in AZ.

On January 27, 2014, Staff issued a memo (Staff Memo) seeking comments from interested parties regarding the relevance and significance of each of the listed categories of DSG values and costs, recommendations of other DSG-related issues that should be considered in this docket, and the process and methodology for assigning monetary values to DG costs and values.

As a preliminary matter, the analytical framework for determination of the net value of DSG must be determined, and in particular the following two elements:

1. Levelization & Discounting: The nature of resource acquisition and selection is to look at the comparative values over a specified period of time, and such is appropriate for evaluating the net costs and benefits of DSG as well. Frequently, utilities and regulatory bodies use the utility weighted average cost of capital (WACC) as the appropriate discount rate for consideration of future utility investments, often in the range of 7 to 9%. We recommend revisiting this practice to determine if it makes sense to use the WACC for each DSG value. Notably, the value analysis takes into account other factors that are not future *utility* investments. A societal discount rate based on U.S. T-bills may be more appropriate for the discounting of these future benefits.

2. Load Analysis Period: the value analysis should look to the economic life of the solar generation resource as a basis for establishing the timeframe for calculation. This timeframe is typically 20-30 years. With solar panels warranted for 25 years, we

believe the mid to upper end of the range is appropriate.

These factors need to be discussed among stakeholders and established before the start of any analysis of the costs and benefits of the deployment of DSG resources.

I. The Relevance and Significance Of DG Values Categories and Costs

The Staff Memo included a list of potential DG benefits and cost categories related to DSG. We think the upcoming workshop process is an excellent opportunity to incorporate the current "state of the art" in DSG benefit/cost studies and opens the door to further advancing the state of relevant knowledge and practice. We believe that each value category identified is sufficiently relevant to warrant a discussion. Clearly some values lend themselves more readily to quantification than others, and some will be more significant than others, however it is difficult to rank significance at this time. Below is a table of Vote Solar's comments for consideration. We also recommend the report[1] entitled "A Review of Solar PV Benefit & Cost Studies" assembled by the Electricity Innovation Lab (e Lab) program at the Rocky Mountain Institute. This report provides a detailed explanation of most of the values in the Staff Memo, and we borrow from this report liberally below.

Category	Comments
Capacity	Avoided Capacity Costs are usually one of the five largest avoided cost values; and typically comprised of a capacity value times an avoided capacity cost. It is the overarching heading that is dependent on the next three elements.
DSG Capacity Value	Capacity value measures how much of the solar capacity can be relied upon for meeting utility loads, and is frequently calculated based upon an effective load carrying capability (ELCC) study although such studies are frequently opaque to stakeholders. Recent analyses points to a need for use of NREL PVWatts solar generation profiles or profile data from large numbers of actual DSG systems and other recent activity in other states suggests application of ELCC to key peak periods, e.g. four summer months. Load duration analyses are sometimes used as an alternative due to their simplicity albeit some sacrifice in precision can occur.
Avoided Generation Capacity	The capacity *value* discussed above will be expressed as a percentage which then is applied to the capital costs of generation that may be avoided by the addition of DSG.

[1] See http://www.rmi.org/elab_empower

[2] *See* page 22 of Minnesota Value of Solar: Methodology; Prepared for the Minnesota Department of Commerce, Division of Energy Resources, January 31, 2014.

PV System Orientation	System orientation can impact both DSG capacity factor (i.e. energy produced) and value. PV systems can be oriented for optimum energy generation, or to maximize capacity value at the system or at the local level.
Ancillary Services	At current penetration levels, these costs or values are usually small. However as penetrations increase, and as modern "smart" inverters are increasingly deployed, the significance of the costs or values can increase.
Integration Costs	Studies performed thus far have found pretty insignificant costs. This may change at higher penetration levels.
Avoided Capital Cost – Customer Contribution	Customers frequently contribute to certain capital projects, notably distribution upgrades necessary for interconnection to the grid.
Avoided Fuel & Purchased Power Costs	Avoided fuel/energy/purchased power costs is frequently the largest component of value provided by DSG, and is reasonably easy to calculate, however the data necessary to make the calculations is often not readily provided by the utilities. A common alternative is an assumption that natural gas generation is on the margin, and to base the avoided costs on projected costs of natural gas. Determining the plants on the margin, and the associated heat rates, can be a controversial endeavor.
Avoided Fuel Hedging Cost	Here it is important to note that a fixed price resource such as DSG removes all price risk, whereas a typical utility hedge only mitigates price volatility. Recognizing this, Minnesota's recent value of solar analysis noted "the avoided fuel cost must take into account the fuel as if it were purchased under a guaranteed, long term contract."[2] Despite the seemingly abundant supply of natural gas currently, there are regional and seasonal shortages that have far reaching implications.[3]
Avoided Line Losses	Takes into account that DSG is generated at or near the point of consumption thus avoiding the line losses that would occur if the energy consumed had been generated at a remote location and transmitted across the utility's transmission and distribution systems. Marginal line loss percentages are commonly used, and applied to other value factors.
Avoided Or Delayed Transmission Investment	Similar to avoided generation capital cost, transmission investments that can be avoided are frequently related to a reduction in load growth, or are connect new central station generation to the transmission grid.

[2] *See* page 22 of Minnesota Value of Solar: Methodology; Prepared for the Minnesota Department of Commerce, Division of Energy Resources, January 31, 2014.

[3] http://www.caiso.com/Documents/NaturalGasShortageTriggersNeedforStatewideConservation.htm

Avoided Or Delayed Distribution Investment	Similar to avoided or delayed transmission investment, distribution investments and upgrades can be avoided or deferred as a result of reduced local load growth resulting from deployment of DSG.
Avoided REST Costs	As a result of DSG-reduced total energy sales of ACC-jurisdictional utilities upon which the REST percentages are based, renewable requirements and costs for REST compliance are also reduced.
Avoided Utility Admin Costs	As in the reduced REST costs, reduction in overall sales levels should result in avoided costs to administer the REST program and other utility overheads.
Market Price Mitigation	The deployment of DSG can affect the market price of electricity in a particular market or service territory. Benefits can occur as DSG provides electricity close to demand, reducing the demand for centrally-supplied electricity and the fuel powering those generators, thereby lowering electricity prices and potentially fuel commodity prices.
Avoided Variable O&M Costs	These costs, expressed in terms of $/kWh, are offset on a one to one basis with reductions in utility energy generation.
Avoided Fixed O&M Costs	These fixed costs should first be associated with their function, i.e. generation, transmission, and distribution, and included with the fixed costs avoided in that function by DSG.
Avoided Power Plant Decommissioning Costs	These costs are an integral part of the fixed costs of utility generation. They are usually captured in the fixed rate charge (an amalgam of capital investment related fixed costs such as depreciation, taxes, cost of capital, and so forth).
Grid Security	DSG enhances the ability to reduce large-scale outages and potential terrorism targets by increasing the diversity of the electricity system's generation portfolio with smaller generators that are geographically dispersed.
Grid/Service Reliability	DSG provides the potential to reduce outages by reducing congestion along the T&D network. Power outages and rolling blackouts are more likely when demand is high and the T&D system is stressed.
Avoided Water Consumption	Conventional power plants and even certain renewable power generators use massive amounts of water in the production of electricity. DSG does not. We have found water is commonly undervalued in the Southwest.
Avoided Environmental Compliance Costs	The compliance costs of reducing pollutant emissions from power plants, or the added compliance costs to further decrease emissions beyond some baseline standard.

Health Benefits	The estimated cost of damages, such as medical expenses for asthma patients or the value of mortality risk, attempting to measure willingness to pay for a small reduction in mortality risk.
Non-Compliance Environmental Effects	There are a number of anticipated regulations from the US EPA in the near future that can affect future costs, notably carbon. These should not be overlooked.
Economic Development & Jobs	The assumed social value from DPV is based on any job and economic growth benefits that DPV brings to the economy, including jobs and higher tax revenue. The value of economic development depends on number of jobs created or displaced, as measured by a job multiplier, as well as the value of each job, as measured by average salary and/or tax revenue.
Civic Engagement & Conservation Awareness	We offer no comments at this time.
Ratepayer & Consumer Interest	While technically not a value or cost, this is a context for all the Commission does, and is important here as well. The interest of, and relative importance to, the general body of customers of promoting the deployment of DSG is part of this consideration.
Ratepayer Cross-Subsidization	This, too, is not a value or cost, but rather a <u>result</u> of the process upon which we are embarking. At the outset however, it's important to recognize that cross subsidization can go in multiple directions (solar customers subsidizing non-solar customers, or the reverse), and should be kept in perspective.
Technology Synergies	We believe new technologies and synergies between technologies will play a major role in shaping the future of the electric utility industry. The opportunities to integrate DSG with other technologies including demand response, load shifting, combined heat and power, and storage is important as the Commission moves to improve the efficiency of the utility system. We question however how the value of such synergies can be reasonably determined and assigned to the integrated technologies in this process. Moreover, there are likely other non-solar technology advocates, proponents, and vendors that should participate in the discussion. We urge the Commission to host a similar but separate set of workshops to delve into this and related topics.
Energy Subsidies	It may be best to address energy subsidies as a threshold issue, to determine if and how government support for all energy resources should be taken into account. In addition, subsidies are notoriously difficult to quantify. For example, the federally subsidized nuclear insurance is critical to an industry unable to insure itself, but how does one quantify the value of that subsidy?

II. Recommendations Of Other DG-Related Issues That Should Be Considered

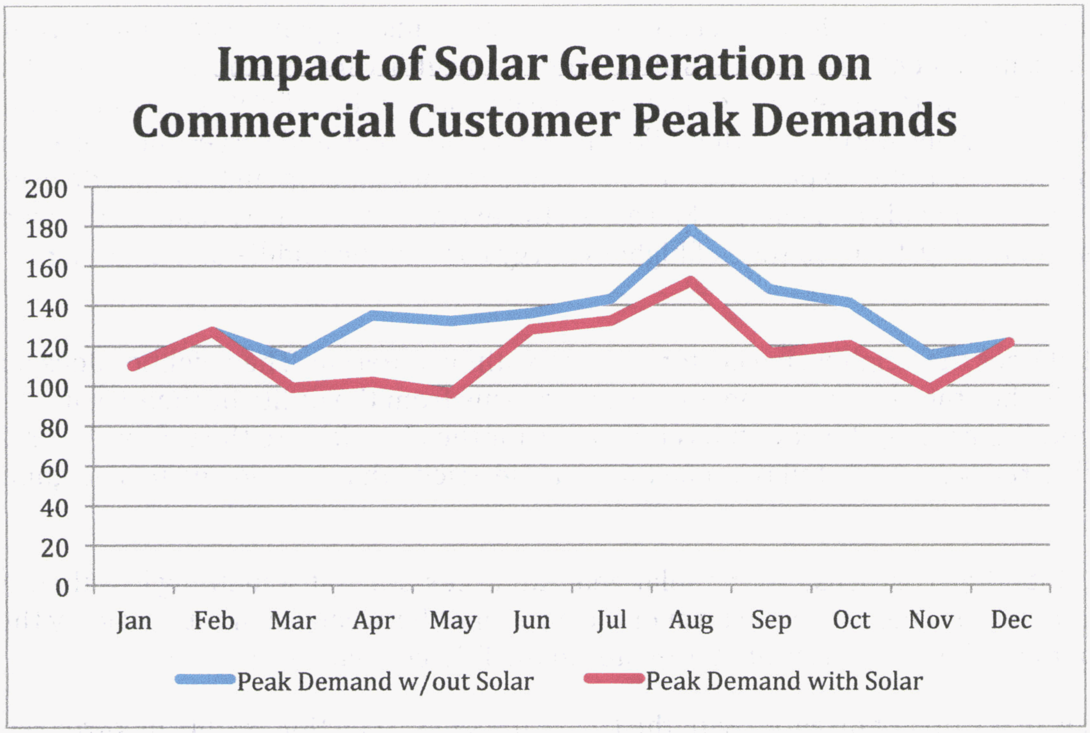
A. Analysis Of Values And Costs Must Be Comprehensive Across All Customer Classes

The submittal by Arizona Public Service On July 12, 2013 focused entirely on the residential customer class because of the energy-only rate structure. In contrast, commercial customers with DSG produce a *bill* savings based on average fuel (and other variable) costs, but a *cost* savings to the utility based on marginal costs. The implication is that the fuel cost savings to the utility (and other customers) are greater than the electricity bill savings to the customer for the energy charge/revenue portion of the bill.

The rate structure of most commercial customers includes a demand charge for the recovery of the utility's fixed costs. The APS/Navigant study[4] showed DSG had little impact on commercial demand charges and in turn on the utility's recovery of fixed costs. Table 10 in Appendix B delineates the demand charge reductions for a commercial customer assuming a solar installation that matches its peak load of 178 kW. The APS/Navigant study demonstrates DSG has little effect on the customer's peak demand – only about 10% of the DSG system capacity, as shown here.

Month	Peak kW Demand w/out Solar	Peak kW Demand with Solar	Solar Impact on Peak - kW	% of Solar System Size
Jan	110	110	0	0%
Feb	127	127	0	0%
Mar	113	99	14	8%
Apr	135	102	33	19%
May	132	96	36	20%
Jun	136	128	8	4%
Jul	143	132	11	6%
Aug	178	152	26	15%
Sep	148	116	32	18%
Oct	141	120	21	12%
Nov	115	98	17	10%
Dec	121	121	0	0%
	Average kW Reduction		**16.5**	**9%**

[4] Navigant "Billing Gap" study submitted to the Commission on December 6, 2012 by Arizona Public Service in its Renewable Energy Standard (Docket Nos. E-01345A-10-0394 and E-01345A-12-0290).



Additionally, some demand rates are ratcheted, which further minimizes revenue loss to the utility. The workshop process cannot simply review one class of customers, but must consider whether the same policy utilized by customers in other rate classes produces a countervailing effect. A proper valuation of the costs and benefits of DSG must take into account the proportionality of DSG across all customer classes.

B. Analysis Must Consider the Differences Between Self-consumption and Exports

Whether the analysis will consider all DSG-produced energy or only the portion that is exported should be established at the outset. As a matter of principle, we believe individual customers have the right to choose how much electricity or other energy to use, how to use it, and when to use it. These choices cannot be dictated by the utility.

Self-generation and consumption: If a customer were not exporting any energy at all from their DSG system, the utility would only see reduced consumption from a single customer - no different than any other type of sales reduction. As a practical matter, the utility would not even "see" the load reduction because it doesn't measure what did not happen. In other words, it is not possible to know what an individual customer's energy consumption would have been, but for the installation of DSG. It is well known that customers with DSG are more energy-aware and likely to deploy additional energy savings measures. What is less known is the effect of the increased awareness on the potential for "fuel-switching" actions like utilizing electric vehicles, switching appliances from natural gas to electricity, and so forth.

Exported self-generation: As a matter of physics, exported energy serves a neighboring customer. Energy pushed back out of one residence, for example, follows the path of least resistance to the nearest load and is consumed there. This happens instantaneously and there is no incremental cost to the utility. Indeed, the utility has no control over the flow and doesn't know it happened. For example if a customer with a 5kW system at maximum output is only using 4 kW, the other kilowatt leaves the home and serves the non-solar neighbor(s). The utility experiences a 5 kW reduction at that point in time, but does not know the mix of loads and energy. Moreover, the extra kilowatt likely reduces the load on the distribution system at a time of higher energy costs in the middle of the day, a benefit for all.

But what does the neighboring customer see? Nothing different. The neighbor does not know whether the electricity she is consuming came from the utility or their solar neighbor. Either way, she pays full retail prices for the electricity to the utility. As a result, the utility recovers full retail revenue for solar electricity that is exported to a neighboring home.

If the utility then compensates the solar generating customer at something less than retail rates, it receives a benefit in the form of the difference between retail rates paid by the neighbor and the compensation it provides to the DSG customer-generator.

To be clear, we do not disagree with the fact that a sales reduction results in lower revenue and reduced fixed *embedded* cost recovery for classes whose rates are based on a single-part energy rate. This phenomenon is also true for sales reductions due to energy efficiency technologies, weather conditions, or shrinking households, not to mention the economic recession. It should also be noted that increases in sales due to weather effects, growing households, new appliances or electric vehicles will lead to increased fixed cost recovery, and the potential for over-recovery. Will the utility compensate a customer for the additional fixed costs it pays when it increases its load to charge an electric vehicle?

It is clear these issues can and should be sorted out in the context of a formal rate case, with the help of information developed through this workshop process.

III. The Process And Methodology For Assigning Monetary Values To DSG Costs And Values.

There are two good resources for appropriate methodologies for valuing the costs and benefits of DSG. First, Vote Solar recommends the IREC paper "A REGULATOR'S GUIDEBOOK: Calculating the Benefits and Costs of Distributed Solar Generation" released in October of 2013. Second, while it was not developed for a net metering review and thus focuses on the value side of the equation, the January 2014 "Minnesota Value of Solar: Methodology" is a very recent analysis of methodologies that resulted from a workshop process that took place in the fall of 2013 managed by the Minnesota Department of Commerce Division of Energy Resources.

IV. Recommendations for Workshop Presenters

Vote Solar suggests the following presenters for the workshops:

A. Lena Hansen or Virginia Lacey from Rocky Mountain Institute. Lead authors of the RMI study noted and quoted above.

B. Tom Beach, Crossborder Energy. Mr. Beach has completed cost benefit analyses of net metering in Arizona, California, Colorado, and Virginia. He is an expert in the field of DSG cost and benefit evaluations.

C. Tom Hoff, Clean Power Research. Mr. Hoff Tom Hoff is the founder of Clean Power Research and President of its Research and Consulting Group. He is a pioneer in the science of valuing distributed solar generation, and brings over 25 years of relevant work experience in this field to the table.

D. Karl Rabago, Rabago Consulting. Mr. Rabago helped design Austin Energy's Value of Solar tariff, and has testified in front of Public Utility Commissions on this topic in Georgia, Louisiana, and elsewhere.

V. Final Thoughts

The growth of DSG on homes and businesses represents the intended outcome of the public policies established by the ACC. Solar businesses have grown-up in or moved to Arizona, responded to the price signals presented and have driven down the cost of DSG for Arizona consumers. Arizona ratepayers have seen dramatic reductions of utility financial incentives over a much shorter time frame than expected because thriving competition in this market has led to aggressive cost declines. Indeed, the incentive levels are approaching zero, meaning that the cost of solar energy produced approximates the cost of grid supplied energy.

This workshop process, if thorough and comprehensive, will provide well documented information supported by facts and analysis to inform the Commission, its Staff, and the participants in the next rate case. In turn, informed decisions can be made at that time as to the appropriate rate designs and structures to keep the utility whole and to continue growing a vibrant distributed solar market.

Ratemaking is an art, not a science. The process of determining revenue requirements, classifying and allocating costs, and designing rates is full of assumptions, estimates, modeled data, statistical methods, and adjustments made in a legitimate effort to spread cost responsibility to customer classes based on causation, and achieve a reasonably consistent relationship between costs and revenue so that the utility can have an opportunity to recover its costs and earn its authorized return on equity between rate cases. Moreover, even accepting all the approximations in the process, the rate for a class is designed for that mythical customer that represents the weighted mean of the group. Rates in general, and residential rates in particular, can be considered a reasonable approximation – at best – for an individual customer. Drastic changes to customers and customer classifications should only be considered where drastic impacts are known. Such is not the case here.

It is in the rate case where a full review of the effects of the capacity value of DSG will be captured in the allocation factors used to assign costs to various classes, even if load research is required to ascertain those figures. It is also where the full costs associated with excess generating capacity can be examined and discussed in the context of keeping the overall cost of service as low as possible.

Finally, the next rate case is the place where a comprehensive discussion of cross-subsidies of all types can occur based on current data, with the potential for realignment of cost responsibility based on customer impacts, efficiency and furthering the policy goals of the State of Arizona.

If the Commission Staff finds sufficient reason to address rate policy in this proceeding, we recommend prioritization of the following:

- *Cost causation*: Perform a thorough review of APS's assets and expenses and the underlying cause for their incurrence. These cost causation principles form the basis of allocation of cost responsibility in rate cases, and to some extent of revenue recovery. We support a closer tie between cost causation and revenue recovery. This is particularly timely given the penetration of AMI metering and the expanded data now available. Moreover, a more decentralized future with more emphasis on the distribution network and less on generation and transmission should be considered.

- *Rate structures*: Time of use rates and potentially modest and gradual changes to the basic rate structure should be considered, including adding a small monthly customer charge or adding a demand charge.

- *Differentiated incentives*: There are clearly certain locations on the APS system (and presumably those of other utilities) where solar generation may be more valuable for certain reasons, e.g. avoiding a distribution system upgrade. The current motivation for customers is to maximize electricity production from their solar systems. However, if strategically siting and orienting systems (to the Southwest for example) to provide additional support to the grid is desired – even while reducing overall energy production somewhat – then the solar customer should correspondingly be compensated.

- *Integrating other resources*: To address some of the concerns of the utility, integrating rooftop solar with other demand side technologies including combined heat and power, demand response technologies, load shifting technologies, and storage can dramatically improve the value of adding DSG to the grid.

We thank the Commission Staff for the opportunity to submit these comments and look forward to participating further.

Sincerely,

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