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Steven M. Olea
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Arizona Corporation Commission
1200 W. Washington St.
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RE: Inquiries re: Value and Cost of Distributed Generation
Docket No. E-00000J-14-0023

Dear Mr. Olea:

Tucson Electric Power Company ("TEP") and UNS Electric, Inc. ("UNSE") (jointly, the "Companies") hereby submit these joint comments in response to your Jan. 27, 2014 letter regarding the discussion of distributed generation ("DG") in Docket No. E-00000J-14-0023.

The Companies appreciate the Commission's interest in reviewing information regarding the costs and benefits of DG. Many public speakers and Interveners in Docket No. E-01345A-13-0248 offered broad, largely unsubstantiated claims about DG benefits as they argued against net metering changes proposed by Arizona Public Service Company ("APS"). The comments often failed to reflect ratemaking principles, the regulatory compact and the true costs that utilities incur to provide safe, reliable service to customers. This docket offers an opportunity to assess the quantifiable benefits that can be attributed to DG in a ratemaking context while also detailing DG costs and complications that can contribute to cost shifts and/or higher rates for utility customers.

Relevance and Significance of Potential DG Costs and Benefits

The relevance and significance of potential DG costs and benefits depends on the context in which they are considered. While rooftop photovoltaic ("PV") arrays and other DG systems create numerous impacts for their owners and the community at large, only some of these costs and benefits are relevant from a ratemaking perspective. Utility rates reflect only known and measurable service costs, not speculative future expenses, projected savings or broad societal impacts. To maintain consistency with ratemaking principles, the Commission should focus on DG costs and benefits that directly affect regulated utility rates and the cost of providing safe, reliable service. Just as utility rates do not reflect the comprehensive societal "value" of reliable grid power, they should not subsidize DG based on speculative economic and environmental benefits that have no direct, immediate effect on their utility's service costs.

The Commission also should consider DG's impact on the entirety of a utility's operations. Many of the most optimistic appraisals of DG's value focus exclusively on capacity, suggesting that a homeowner's installation of a rooftop PV system reduces a utility's potential long-term need to secure an equivalent amount of fossil fueled generating capacity. Such assertions ignore the immediate need for adequate operating reserves to account for the inevitable unavailability of intermittent DG resources and other necessary utility service costs, such as providing adequate voltage support on its local distribution grid to accommodate variable PV output. While the Companies are working to address the integration challenges associated with rising DG usage, the expense of these efforts must be considered in any comprehensive analysis of DG costs and benefits.

In this context, the Companies offer the following comments on the relevance and significance of the categories of DG values and costs listed in Mr. Olea's letter.

Capacity

- Distributed Energy Capacity Value (MW) – Assigning a proper capacity value to the variable output of renewable DG is relevant and significant to the Commission's consideration in this docket. The output of rooftop PV systems typically peaks at midday but fades significantly by the late afternoon, when the summer load served by Arizona utilities is at its highest. Accordingly, DG capacity is valued for long-term planning purposes based on the extent to which its output is coincident to the utility's summer peak loads. For net metering purposes, though, this value may be diminished because DG output is less coincident with system peaks in shoulder and winter months.

- Avoided Generation Capacity (New Generation $) – This is potentially relevant and significant over the long term, as DG output is reflected in utilities' long-term resource plans. However, the Commission also must consider additional generation capacity and future energy storage facilities that must be developed to balance the variable output of planned DG additions. For example, the Reference Case outlined in TEP's 2012 Integrated Resource Plan demonstrates the need for approximately 300 MW of natural gas turbines between 2018 and 2024 to provide backup capacity for intermittent renewable resources. In the near term, though, these potential costs and benefits are not relevant for ratemaking or net metering tariffs.

- PV System Orientation – This is relevant, as PV systems can be oriented to maximize their output during peak load periods. While this increases their capacity value, it reduces their overall energy production.

Grid Support Services

- Ancillary Services
    a) Reactive Supply and Voltage Control – DG systems cannot provide these services because they typically operate at full output, where reactive supply is unavailable. Also, while PV system inverters may be capable of reactive supply or voltage control, these features cannot be accessed by utilities' energy management systems. As such, this category is irrelevant.
    b) Frequency Regulation – Renewable DG systems cannot provide automatic frequency control on par with fossil fueled units and typically devote their full output to energy production, leaving no capacity to provide frequency regulation for the grid. As a consequence, utilities must devote a larger share of their own resources to this necessary service, reducing the efficiency of their generating units and increasing overall energy costs. These additional costs are both relevant and significant.

c) Energy Imbalance – Because DG resources are not scheduled, they do not contribute to imbalances between scheduled and actual grid resources. DG intermittency does create load balancing challenges and can contribute to gas supply imbalances when utilities must ramp up gas-fired resources to compensate for unexpected shortfalls in solar production. While such challenges might be addressed through participation in an Energy Imbalance Market, the cost of establishing and operating such a market in the southwest region may exceed its anticipated benefits for Arizona utilities. These additional costs would be both relevant and significant.

d) Operating Reserves – The addition of intermittent DG systems to the grid forces utilities to increase the energy reserves they maintain to regulate voltage and recover from disturbances. Utility reserves must be sufficient both in size and operational capability (including location and response time) to account for contingencies that include the loss or reduction of renewable energy output. These energy reserves represent a significant, relevant and growing cost of DG.

e) Scheduling/Forecasting – Because renewable DG resources are neither monitored nor controlled by the grid operator, their intermittent nature complicates utility load forecasts and creates unanticipated intra-hour generation swings. When DG output drops below forecasted levels, utilities must either secure resources on the real-time energy market or ramp up local generation operations. The additional cost of these resources relative to those that might have been secured in advance represents a significant and relevant DG cost. Conversely, DG production that significantly exceeds forecasted levels may cause additional wear and tear on utility generating units forced to ramp down output to accommodate the discrepancy.

- DG System Integration Costs – This category is relevant and significant because utilities incur substantial costs to integrate renewable DG systems into their distribution grids without compromising reliability. These costs are described more fully below in the section addressing distribution system investments. DG integration also creates administrative costs associated with feasibility studies, interconnection agreements and facility inspections.

<u>Avoided Costs / Financial Risk</u>

- Avoided Power Plant Capital Costs (Customer's Capital Contribution) – Although energy efficiency and economic factors have reduced the projected need for new power plants, any such savings directly attributable to DG usage would be relevant if they materialize in the future. So too would any *additional* power plant capital costs attributable to DG, such as increased quick start generation to address intermittency. For now, though, DG systems obviously do not help utilities avoid the capital costs of plants already in service. Indeed, DG users depend on existing power plants for reliable service, since their utility's potential system peaks must account for periods when their DG system isn't producing power. Meanwhile, any future savings in power plant costs attributable to DG must be offset by the increased capital cost of quick-response generating units needed to balance their intermittent output.

  Avoided Fuel/Purchased Power Costs – Such savings are relevant and could be significant, though they would be offset by additional energy costs associated with increased DG usage. While DG does reduce the use of energy from other sources, utilities must nonetheless ensure that generation assets are available to respond to customer load at all times. To the extent that this requires additional reliance on natural gas-fired turbines, utilities will incur higher gas pipeline costs and additional fuel expenses associated with these quick response units. These costs can be volatile, as evidenced by recent swings in the wholesale gas markets that boosted next-day prices at the El Paso-Permian hub from $4.50 to more than $24 per million British thermal units between Jan. 21 and Feb. 5, 2014.

- Avoided Fuel Hedging Costs – Such savings are unlikely to materialize because utilities will likely increase their reliance on natural gas to fuel the quick response turbines needed to balance intermittent DG output. That increased reliance would create higher hedging costs that could become relevant to calculations of DG costs and benefits.

- Avoided Line Losses – By reducing reliance on the output of remote, base-load generating plants, DG systems can reduce the amount of energy lost during long-distance transmission. The economic value of these reductions are relevant and could be significant, though it would be partly offset by increased distribution line losses associated with net metering and higher energy costs associated with greater reliance on natural gas-fired turbines.

- Avoided/Delayed Transmission System Investment – This is neither relevant nor significant. While increasing DG usage might reduce energy flows on existing transmission facilities, the historic investments in these facilities cannot now be avoided. Meanwhile, future transmission investments will not be meaningfully reduced by DG because utilities must account for peak usage during periods when renewable DG systems are offline.

- Avoided/Delayed Distribution System Investment – The growing use of DG will actually increase distribution system investments to a significant and relevant degree. Utilities will need to bolster their telemetry and frequency response tools to accommodate the intermittent output of grid-tied PV systems. In engineering terms, greater reliance on DG will reduce overall inertia on the distribution system, forcing utilities to compensate with increasing use of spinning reserves to avoid shedding load in response to frequency deviations. Meanwhile, the installation of larger DG systems often necessitates upgrades to local distribution and sub-transmission facilities to properly manage their output to the grid. The cost of such necessary investments in service reliability may ultimately eclipse any DG-related savings realized in other areas of utility operations.

- Avoided Renewable Energy Standard Costs – This category is not relevant, as any DG-related costs or savings utilities may realize in complying with the standard are anticipated by the rules themselves and are duly passed along to customers through the Renewable Energy Standard Tariff ("REST"). DG users should not receive additional compensation through rates paid primarily by other customers based on a claim that their renewable energy certificates ("RECs") can be secured more cheaply than those from other available resources. By that logic, utilities would be entitled to rates that reflect the most costly sources of power they might have purchased, rather than the resources they actually use. If the Commission were to eliminate the DG requirement, the owners of such systems would be free to market their RECs to utilities in open competition with other available renewable resources – thus realizing their true market value. Otherwise, it cannot be fairly said that DG resources provided under the terms mandated by the Renewable Energy Standard have "avoided" any costs.

- Avoided Utility Administration Costs –This category is relevant, but the Companies' experience suggests that DG has significantly *increased* utility administration costs. These costs include, but are not limited to, staff to work with DG customers and installers, increased information technology ("IT") infrastructure to manage regulatory reporting requirements, new reporting and administrative duties in metering and distribution services and additional training requirements to address safety risks posed by DG facilities.

- Avoided Market Price Mitigation (reduction of market clearing prices for natural gas and electricity) – The difficulty of proving any such effect likely renders this category irrelevant for ratemaking purposes. However, it would be reasonable to conclude based on the available evidence that DG actually increases market energy costs by boosting utilities' reliance on hourly power purchases and natural gas-fired turbine generators to compensate for intermittent PV output.

- Avoided Variable Operation and Maintenance ("O&M") Costs – While this category is relevant, DG actually increases utilities' variable O&M costs by introducing intermittency to a system better suited to stable power sources and more predictable load. Starting, spinning and stopping quick-response turbines and manipulating the output of larger plants to follow the variable load created by DG systems is expected to increase maintenance costs and shorten the useful lives of such units. This is particularly true for coal-fired plants, which are ill suited for following intermittent load. These impacts, combined with the cost of installing, maintaining and replacing the distribution system facilities needed to manage intermittency, would likely exceed the modest savings that might conceivably be realized through reduced midday load on distribution circuits serving DG users.

- Avoided Fixed O&M Costs – As with variable O&M costs, fixed O&M costs are not reduced by DG usage. Indeed, increased DG usage would likely increase fixed O&M costs for quick-response gas turbines on a dollars/unit of output basis, contributing to higher rates. Also, various distribution system components are subject to higher failure rates and/or shorter life cycles due to the voltage variations associated with increased DG penetration, leading to higher O&M costs.

- Avoided Power Plant Decommission Costs – At the point when it can be proven that DG usage has allowed a utility to avoid building a base-load power plant of a certain capacity, it might be possible to estimate the savings associated with not having to decommission a plant of that size at a theoretical location and designate that amount as a benefit of DG. Any such benefits would be offset, though, by the decommissioning costs associated with quick-response gas turbines and other facilities – such as energy storage devices – that will be required *because of* DG.

Security and Reliability

- Grid Security – This category is not relevant or significant, as DG systems do not meaningfully affect utility service costs associated with grid security. It may be suggested that DG enhances grid security by reducing reliance on energy delivered across long-distance transmission lines. But due to DG intermittency, utilities could not rely on such resources to serve load in the event a transmission line is offline due to a security incident.

- Grid/Service Reliability – As noted above, the variable nature of renewable DG output challenges utilities' ability to maintain stable voltage and adequate inertia for safe, reliable service. Accordingly, the quick response gas turbines and other improvements necessary to maintain reliability amid growing DG usage can be fairly described as costs created by DG.

Environmental

- Water Consumption – This category is relevant. TEP's generating portfolio consumes, on average, approximately 605 gallons of water per megawatt-hour ("MWh"). While increased reliance on natural gas and renewable resources will reduce this average consumption over time, rooftop PV systems provide immediate reductions in water use by offsetting energy production from fossil-fueled units. These savings will be reduced somewhat by the water usage of natural gas-fired generators used to back up and balance the intermittent output of DG systems. The economic value of net water savings attributable to DG is difficult to quantify, though it should reflect the actual cost savings at power plants with reduced water consumption.

- Cost of Environmental Compliance – To the extent that DG allows utilities to avoid developing new fossil fuel generation resources, it also could be credited for reducing some associated environmental compliance costs, including lime, emissions fees or monitoring expenses. Similarly, DG would create new permitting and compliance costs for the quick response gas turbines installed to balance their intermittent output. Finally, the potential exists for increased environmental regulation of PV panel construction and disposal methods. As with power plant construction and decommissioning expenses, it would be inappropriate for these speculative future environmental costs and benefits to be reflected in utility rates until such time as they can be proven.

- Health Effects (Benefits) – Enthusiasm for solar DG and other renewable resources reflects their positive environmental impact, including the public health benefits that can be realized by reducing our society's reliance on fossil fuels. But even if that health benefit could be quantified, there would be no place for it in customers' electric bills. Utility rates are designed to recover costs incurred in the provision of service and to provide utilities an opportunity to earn a fair return on the capital prudently invested for that purpose. In this context, DG costs and benefits that do not affect a utility's cost of service – however meritorious they may be – are not relevant.

- Non-Compliance Environmental Effects – Because utilities would not realize cost savings for reductions in non-compliance environmental effects, this category is not relevant for ratemaking purposes.

Social

- Economic Development and Jobs – Although DG installations have created jobs and widespread economic activity, utility rates are not designed to bill or credit customers for such broad societal externalities. Thus, this category is irrelevant in this docket.

- Civic Engagement/Conservation Awareness – DG systems literally bring home the benefits of "green" energy to utility customers, helping reinforce broader marketing messages about the societal benefits of renewable power. Children raised in the shadow of rooftop PV arrays can be expected to grow into adults who embrace the technology as a standard component of our energy infrastructure. That such beliefs do not impact utility service costs does not diminish their societal value. It does, however, suggest that they are not relevant for ratemaking purposes.

- Ratepayer/Consumer Interest – Consumer interest in renewable DG technology is driven in large part by the savings that can be realized through its use, partially due to incentives, tax advantages and cost shifts subsidized by other customers. Those savings are likely to increase over time, in part because higher utility rates will be required to recover the fixed costs that DG users avoid paying. In Docket No. E-01345A-13-0248, the Companies advocated higher charges for DG users to offset this cost-shifting impact for non-DG customers. While such a charge could affect consumer interest in DG, it would nonetheless serve the best interests of all ratepayers.

- Ratepayer Cross-Subsidization – As discussed more broadly in in Docket No. E-01345A-13-0248, the use of DG creates significant cross-subsidies that contribute to higher electric rates. Because electric utilities recover their largely fixed service costs through usage based rates, DG users enjoy subsidized grid service at the expense of customers without such systems. Arizona's net metering rules exacerbate this problem by overcompensating DG users for their systems' excess energy. Importantly, these cross-subsidies will persist *regardless of the economic costs and benefits that may be attributed to DG users.* In other words, the DG benefits discussed in this docket do nothing to mitigate the acknowledged cost-shifting that such systems are causing today under Arizona's existing net metering rules.

- Technology Synergies – If DG usage by a particular utility's customers can be proven to have created technology synergies that led directly to a reduction in that utility's service costs, such savings could be reflected in rates for DG users. Short of that, though, the assignment of benefits for theoretical synergies achieved through DG use is far too speculative for ratemaking purposes.

- Energy Subsidies – Taxpayers and utility customers subsidize DG systems through credits, incentives and rates established by elected officials. These subsidies have significantly boosted DG adoption rates, increasing the impact of any associated costs and benefits for utilities. To the extent that such subsidies are funded through utility rates, they increase energy costs and promote cross-subsidization, as noted above. While the merits and economic impact of these subsidies can be debated in their own right, such issues are not strictly relevant to the discussion in this docket – the determination of costs and benefits created by DG itself.

Process and Methodology

The costs and benefits discussed herein should be viewed from a ratemaking and service reliability perspective. Accordingly, the process and methodology for assigning monetary values to relevant DG costs and benefits should reflect the standards applied in utility rates. Those standards include:

- Relevance – Costs and benefits that fall outside the scope of utility ratemaking should be discarded. While DG systems may create broad societal benefits, such benefits are irrelevant for ratemaking purposes unless they measurably reduce utility service costs. Moreover, any identified benefits must be balanced by any costs necessary to ensure the DG does not interfere with safe, reliable service.

- Timeliness – Just as utilities are generally precluded from recovering costs not yet incurred or for plant not yet in service, the quantified value of DG generally should exclude estimates of future savings not yet realized. For example, a new rooftop PV system should not be credited for avoided power plant capital costs until it can be proven that the local utility has, in fact, avoided building a power plant. Such a method ensures that DG systems are not overvalued based on speculation about future benefits that may not materialize.

- Evidence – Any costs or benefits attributed to DG should be proven to the standards appropriate for utility ratemaking. For example, utilities' load balancing costs should not be attributed to DG systems unless research or other evidence can establish that such facilities are necessitated by intermittent DG output.

Potential Presenters

The Commission would benefit from presentations by experts familiar with the challenges of integrating renewable DG systems into utility grids and micro-grids. For example, Sean Hearne Ph.D, Manager of Energy Storage Technology & Systems of the Sandia National Laboratories, could provide helpful information regarding the complex integration of disparate generation types into a micro-grid and the challenges of modeling the different technologies. Additionally, a representative of the Western Electricity Coordinating Council ("WECC") should be sought out to address how DG systems affect utilities' ability to comply with grid reliability requirements mandated by the Federal Electric Regulatory Commission. Finally, the Commission should analyze the experiences of other jurisdictions as it continues to evaluate the value and cost of DG.

The Companies appreciate this opportunity to comment and look forward to further discussion of these issues in the proposed workshops.

Sincerely,

Carmine Tilghman

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