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BEFORE THE ARIZONA CORPORATION COMMISSION

SUSAN BITTER SMITH	BOB STUMP	BOB BURNS
CHAIRMAN	COMMISSIONER	COMMISSIONER

TOM FORESE	DOUG LITTLE
COMMISSIONER	COMMISSIONER

IN THE MATTER OF THE APPLICATION OF UNS ELECTRIC, INC. FOR THE ESTABLISHMENT OF JUST AND REASONABLE RATES AND CHARGES DESIGNED TO REALIZE A REASONABLE RATE OF RETURN ON THE FAIR VALUE OF THE PROPERTIES OF UNS ELECTRIC, INC. DEVOTED TO ITS OPERATIONS THROUGHOUT THE STATE OF ARIZONA, AND FOR RELATED APPROVALS.	**DOCKET NO. E-04204A-15-0142** **DIRECT TESTIMONY OF MARK FULMER**

The Alliance for Solar Choice hereby provides notice of filing the Direct Testimony of Mark Fulmer in the above-referenced matter.

Respectfully submitted this 6th day of November, 2015.

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Direct Testimony of Mark Fulmer

On Behalf of

The Alliance for Solar Choice

November 6, 2015

Contents

I. INTRODUCTION

Q: Please state your name and business address.

A: My name is Mark E. Fulmer. I am a Principal and Co-owner at MRW & Associates, LLC ("MRW"). MRW is an energy consulting firm founded in 1986 that specializes in power and gas market assessments, regulatory matters, litigation support, expert witness testimony, contract review, and negotiations. My business address is 1814 Franklin Street, Suite 720, Oakland, California 94612.

Q: Please summarize your professional and educational background.

A: I have been an energy consultant with MRW since 1999. During that time, I have worked with non-utility retail energy service providers (both gas and electric), independent power producers, municipalities, end-use customers, consumer advocates, trade organizations, and financial institutions on a variety of matters related to natural gas and electric industry regulation and policy, utility ratemaking, price forecasting, demand-side management and asset valuation. Previously, I worked at Daniel, Mann, Johnson, & Mendenhall, where I consulted to utilities and others on energy efficiency. Prior to that, I worked at Tellus Institute in Boston, Massachusetts, where I consulted to numerous state agencies and non-governmental organizations on integrated resource planning and natural gas and electric industry restructuring.

I hold a Master of Science in Engineering from Princeton University and a Bachelor of Science degree in Engineering from the University of California at Irvine.

Q: Have you previously provided expert witness testimony before state public utility commissions?

A: Yes. I have testified before state utility commissions in California, Hawaii, New Mexico, Pennsylvania, Rhode Island and Washington. Here in Arizona, I have provided testimony before the Arizona Corporation Commission on behalf of Constellation Energy and Direct

Energy on direct access issues. Please see Exhibit MEF-1 for my qualifications and a list of my testimonies.

Q: On whose behalf are you testifying?

A: I am testifying on behalf of The Alliance for Solar Choice ("TASC"). TASC is an organization comprised of some of the nation's most prominent companies in the rooftop solar industry. TASC advocates for maintaining successful distributed solar energy policies throughout the United States.

Q: What is TASC's interest in this proceeding?

A: TASC is committed to supporting retail net energy metering ("NEM"), which empowers customer choice by providing fair credit to homes, businesses, churches, schools, public agencies, and other neighborhood places when solar systems generate on-site energy. As such, TASC is interested in ensuring that UNS's residential rate design does not hamper customer choice.

Q: Please summarize your conclusions and recommendations.

A: UNS Electric ("UNS" or "Company"), primarily through its renewables witness, Mr. Tilghman, inappropriately paints distributed solar in a very poor light, characterizing it as unreliable and a hindrance to grid operation. However, his statements are overly broad, not supported by evidence, and in some cases incorrect or grossly misleading. Even though all of the issues that Mr. Tilghman raises are being successfully addressed in other jurisdictions including those with significantly higher distributed solar penetration levels than UNS service territory, his only recommendation is to implement a rate design that will stifle further distributed solar. Furthermore, there are numerous benefits of distributed solar that go unmentioned that should be considered when making NEM policy and before consideration of any rate design change to disadvantage distributed solar.

The ACC should take Mr. Tilghman's concerns with a very large lump of salt and remember that the purpose of the Renewable Energy Standard and Tariff and associated Distributed Energy Requirement are in place for a reason, and that rate designs counter to the intent of these policies—such as what UNS is proposing here—are counterproductive and should be rejected.

II. UNS'S ANTI-DISTRIBUTED, CUSTOMER-SITED PV STANCE IS NOT SUPPORTED

Q: What part of Mr. Tilghman's testimony are you addressing?

A: One of the stated purposes of Mr. Tilghman's testimony is to "provide a general discussion regarding the impacts of renewable energy, particularly solar and distributed generation ("DG") resources, on the utility's operations." (p. 2)

Q. Is Mr. Tilghman's discussion of the impacts of solar and distributed generation offered in direct support of any policy change?

A. Yes. Mr. Tilghman's discussion of these impacts is in light of the Company's request to fundamentally shift its distributed generation policy by: eliminating NEM in favor of a scheme that pays customers a "Renewable Energy Rate" for all exports of electricity; and instituting a mandatory three-part rate for NEM customers. In this way, Mr. Tilghman's allegations of negative cost impacts carry significant policy implications and should be closely scrutinized.

Q: What is the difference between net energy metering and the Company's proposal?

A: Net energy metering is valuing the output of the behind-the-meter DG at the customer's retail rate when that DG is generating more electricity than is used on-site. i.e., it is exporting power. The Company's proposal calls for a specific rate to be credited to the customer whenever their DG system is generating more power than is consumed on-site. This "Renewable Energy Rate" is lower than the retail rate, is subject to regular

adjustments, and can get even lower as UNS develops or contracts with new central renewable resources.

Q: On pages 4 through 6 of his testimony Mr. Tilghman notes three "well documented" integration issues relating to customer-side solar DG. Does Mr. Tilghman provide any documentation or reference to documentation substantiating these claims of distributed generation integration issues?

A: No. Mr. Tilghman provides no "documented" examples of where distributed generation has caused UNS to incur costs on account of managing these issues.

When queried in discovery about his sources for his assertions, Mr. Tilghman responded:

> Whitepapers, presentations, and other forms of documentation are widely available from organizations such as National Engineering Laboratory (sic) ("NREL"), Massachusetts Institute of Technology ("MIT"), Lawrence Berkley (sic) Engineering Laboratory (sic) ("LBEL" (sic)), Solar Electric Power Association ("SEPA"), and others. All of these documents are public and easily attainable by TASC.[1]

As I will show, many of these sources produce reports and whitepapers, which I cite specifically, that call into question Mr. Tilghman's integration issues.

To support these allegations, I would have expected UNS to provide analysis of how current and expected levels of distributed generation interact with its system. It did not provide this information. In terms of whether these alleged integration issues represent a cost to UNS and other ratepayers, I would expect UNS to discuss whether current interconnection policies adequately capture these integration issues and appropriately assign costs to the cost-causer at the time of interconnection. There is insufficient information from Mr. Tilghman's discussion to substantiate the current existence or extent of integration issues and the relative incremental costs of addressing those issues (as

[1] Response to TASC 1.06(a).

distinguished from normal operational costs). The information provided can hardly justify the creation of an arbitrary customer class subject to a discriminatory rate.

Q: Has UNS performed a solar integration study to quantify the potential integration costs that it alleges are associated with current or projected distributed generation on its system?

A: No. Solar integration studies have been undertaken in several other jurisdictions, but when asked if UNS had conducted any studies on its system to support its asserted integration issues, or demonstrate their magnitudes on the UNS system, the answer was always "no."[2]

Q: Mr. Tilghman states that residential solar DG applications have "increased by more than 25% per month, year over year" from May 2014 (when UNS's solar incentives ceased) to May 2015 (p. 3). Is this accurate?

A: I believe that Mr. Tilghman misspoke. I think that he meant to point out that the annual increase from June 2014 to June 2015 was 25%. This is quite different—and much lower—than a 25% per month increase. Even so, a 25% annual increase from a year ending May 2014 to year ending May 2015 is misleading. Figure 1 shows UNS residential NEM applications from January 2014 to July 2015. The orange triangle depicts June 2014, when the utility incentives were eliminated. While there were spikes in October 2014 and May 2015, there is no obvious trend upward in residential NEM applications from June 2014 to June 2015.

[2] Responses to TASC 3.01, 3.02.

Figure 1

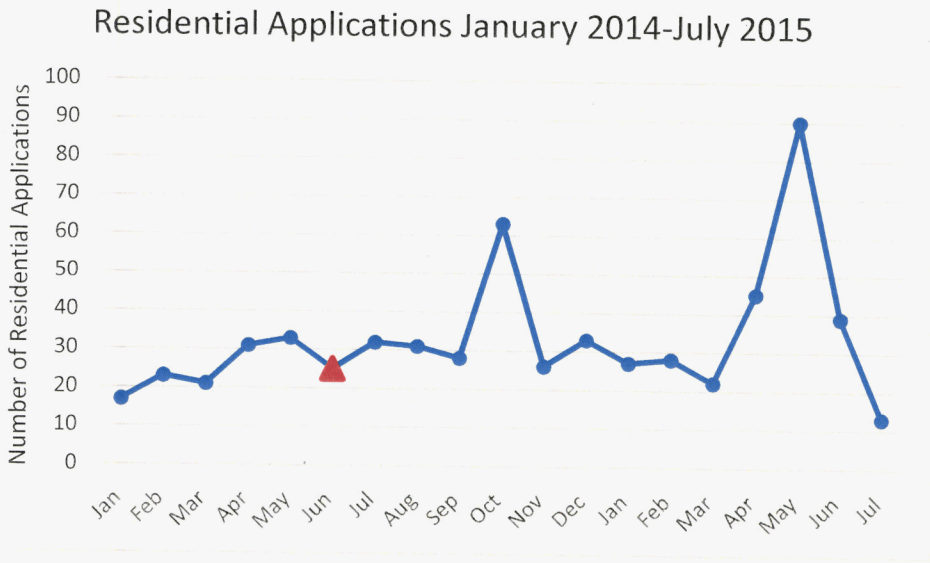
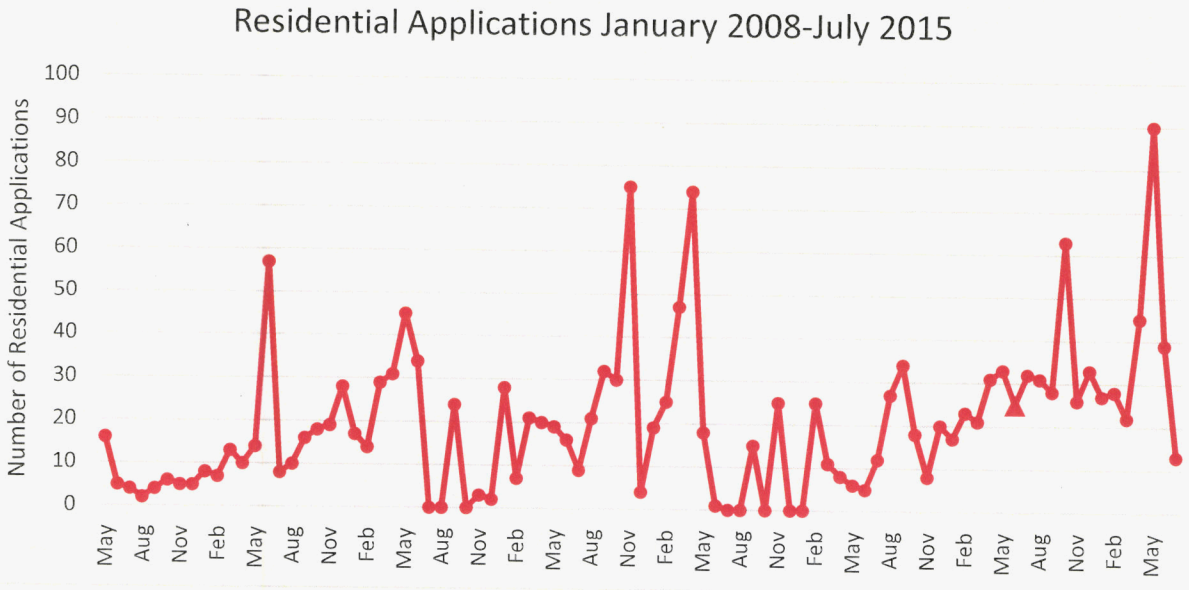


Figure 2 below shows the applications for residential NEM solar received by UNS over the past 6½ years. As this figure shows, there is no clear upward trend in the number of residential NEM applications. To suggest that there is some marked systematic increase in residential NEM applications from May 2014 to May 2015 is misleading.

Figure 2



Q: Mr. Tilghman also states, "the proliferation of the solar leasing model and the continued decline in solar panel prices, coupled with policies such as net metering, has effectively tripled the market penetration even though all utility incentives have been eliminated [in June 2014]"(p. 4). What does it mean for market penetration to triple?

A: Market penetration is a measure of the amount of sales or adoption of a product or service compared to the total theoretical market for that product or service.[3] Thus, if market penetration for NEM solar has tripled since June 2014, then there should be three times as much NEM capacity in May 2015 as there was in May 2014.

Q: Does UNS's data support this?

A: No. In response to a data request, UNS provided the number of NEM installations and solar capacity installed by year from 2008 through July 2015.[4] This is shown in Table 1 below. Even though the figure does not show monthly data, I cannot see how market penetration could have tripled since June 2014. Assuming that the incremental NEM capacity in the second half of 2015 is the same as the first, then the market penetration would have increased by 20%, not triple (300%).

Table 1. NEM Capacity in UNS Service Area

Year	Incremental NEM capacity (kW)	Cumulative NEM capacity (kW)
2008	112	112
2009	778	890
2010	1,678	2,568
2011	2,809	5,377
2012	4,851	10,228
2013	2,279	12,507
2014	3,940	16,447
2015 (YTD)	1,876	18,323
2015 (extrap.)[5]	3,752	20,199

[3] http://www.investopedia.com/terms/m/market-penetration.asp Accessed November 2, 2015.
[4] Response to UDR 2.09(a).
[5] Extrapolated from the year-to-date value to a full year.

Q: What is the first of the "well documented" issues Mr. Tilghman alleges?

A: The first integration issue that he identifies is the intermittency of renewable generation. However, it is a concern that is being successfully addressed in numerous jurisdictions, including those with significantly higher DG penetration than UNS service territory. Simply pointing out that intermittent resources can create a challenge for grid operators while not acknowledging that the challenge is manageable is misleading.

Q: He goes on to note that "[t]his problem is exacerbated through policies such as net metering, which encourages customers to oversize their solar systems beyond their average load in order to "bank" as many credits as possible for use later" (p. 4). Do you agree that net metering encourages customers to oversize their systems beyond average load?

A: No. Net metered customers are credited for annual excess energy at utility wholesale costs, which are well under retail electric rates. Accordingly, solar customers are not incentivized to size solar systems to provide more energy than the home's annual usage. In addition, the Commission's administrative rules place a cap on the size of the system compared to the customer's load making it illegal for customers to install systems in excess of that cap.

Q. Is the intermittency of solar PV an inherent problem to grid operations or are there mitigating factors to consider that may relieve Mr. Tilghman's concerns?

A: The distributed nature of solar PV engaged in net metering provides a number of mitigating factors. First, a number of studies illustrate that spreading out the solar resources geographically mitigates much of the intermittency problem. Random clouds, such as fair weather cumulus —which are a greater concern than predictable clouds (such as a storm front)—do not cover all of the DG sites at one time. Just like having more, smaller power plants result in greater reliability than one or two large ones, having a greater number of geographically dispersed smaller solar sites decreases the grid intermittency. For example,

10 MW of PV capacity geographically dispersed over a few square miles (or more) via behind-the-meter systems will result in much less variability than 10 MW in one location.

A number of studies corroborate this conclusion. With roughly 80% of solar PV installed on residential rooftops corresponding to approximately 2.1 MW of output, the Pal Town neighborhood in Ota City, Japan serves as a good example of how geographic dispersion of PV acts to smooth out the inherent variability of the resource. A recent study at this location compared the output from one home with that of the aggregate, finding that overall grid variability decreased exponentially with increasing solar PV penetration.[6] The specific intermittency decrease depended on the timescale.[7] For timescales greater than 1 second, the reduction in variability eventually stabilized at an aggregation of about 100 homes, suggesting that a majority of the value of decreased intermittency could be achieved through a relatively modest penetration of PV; variability decreased indefinitely with additional homes at the 1 second timescale. A comparison analysis between the Ota City, Japan site and a 19 MW PV plant in Alamosa, Colorado further corroborated these results, finding that larger single-location PV system had significantly larger intermittency impact than the same amount of PV that is geographically disperse.[8]

A recent study by the Australian Renewable Energy Agency and CAT Projects investigated the impact of solar variability on grid stability.[9] The study evaluated the deployment of 10 MW of solar PV onto the Alice Springs grid in Australia, using actual grid monitoring stations deployed across the local grid. The study concluded that the distribution grid "encounters a significant level of load variance as part of normal

[6] Lave, Matthew, Joshua S. Stein, Abraham Ellis, Clifford W. Hansen, Eichi Nakashima, and Yusuke Miyamoto. "Ota City: Characterizing Output Variability from 553 Homes with Residential PV Systems on a Distribution Feeder." Sandia National Laboratories, November 2011. http://energy.sandia.gov/wp-content/gallery/uploads/Ota_City_Analysis-SAND2011-9011.pdf. Accessed October 14, 2015

[7] Effectively, timescale corresponds to measuring the voltage variability over a specific amount of time: 1 second, 10 seconds, 30 seconds, 1 minute and 10 minutes for this study.

[8] Lave, Matthew, Joshua S. Stein, and Abraham Ellis. "Analyzing and Simulating the Reduction in PV Powerplant Variability due to Geographic Smoothing in Ota City, Japan and Alamosa, CO." In *Photovoltaic Specialists Conference (PVSC), Volume 2, 2012 IEEE 38th*, 1–6. IEEE, 2012. http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6656719. Accessed October 14, 2015

[9] Australian Renewable Energy Agency , "Investigating the Impact of Solar Variability on Grid Stability." CAT Projects ABN 74 126 787 853, March 2015.

operation...without compromising on operational outcomes." [10] Furthermore, the intermittency variance created by the installation of an incremental 10 MW of geographically dispersed PV is very similar to the intermittency variance that currently occurs in the network in the absence of PV. ARENA concludes by stating, "while it is not surprising that the impact of solar intermittency can be reduced by geographically dispersing PV arrays, the statistical significance of the impact was beyond initial expectation."[11]

Researchers at Lawrence Berkeley National Laboratory studied 23 time-synchronized solar isolation sites, spaced between 40 and 450 km (25 to 280 miles) apart.[12] They found that "[a]ggregation of multiple sites at the system level leads to significant smoothing of ramps, particularly over short time-scales." As such, geographic dispersion of PV can have positive intermittency impacts both on the local distribution scale, as well as the system level.

Finally, the wind energy industry can be viewed as an example of how problems related to intermittent generation can be overcome. Wind, like solar, is variable, yet it has been integrated at scale.[13]

Q: What other alleged integration challenges does Mr. Tilghman mention?

A: Mr. Tilghman mentions that the grid operator (utility) cannot monitor or control the small, distributed solar systems. His also expressed concern by the fact that NEM solar sometimes generates more electricity than is used on site and thus exports this power onto the general grid. He points to a number of potential negative outcomes from this export.

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[10] *Ibid.*, p. 3.
[11] *Ibid.*
[12] Mills, Andrew, and Ryan Wiser. "Spatial and Temporal Scales of Solar Variability: Implications for Grid Integration of Utility-Scale Photovoltaic Plants." p. 13. Presented at the Electricity Markets Policy Utility-Scale PV Variability Workshop, Lawrence Berkeley National Laboratory, October 7, 2009. http://uvig.org/wp-content/uploads/2013/01/11-Mills-GeographicDiversityAndPV.pdf. Accessed October 14, 2015
[13] Curtright, Aimee E., and Jay Apt. "The Character of Power Output from Utility-Scale Photovoltaic Systems." *Progress in Photovoltaics: Research and Applications* 16, no. 3 (May 2008): 241–47. doi:10.1002/pip.786. Accessed October 14, 2015

Q: Does he demonstrate that these concerns are present on UNS's system?

A: No. Sound planning requires that the utility should both be aware of potential issues and proactively study how these issues might impact their unique system. Mr. Tilghman does not do this. His concerns are overstated and reflect largely **theoretical** and not **actual** current or near future implications. Moreover, while NEM exports can require changes by a grid operator, these changes are manageable and are being managed by grid operators elsewhere even where the grid has significantly greater solar DG penetration than UNS's system.

Q. Are technological advancements helping to mitigate the operational concerns associated with distributed solar generation?

A: Yes. For example, in December of 2014, the California Public Utilities Commission adopted new standards for so-called advanced inverters with the aim of overcoming the lack of grid operator visibility and control of distributed generation. These are devices that offer "easier and lower cost interconnection of distributed generation because of their ability to monitor and respond to grid conditions."[14] Smart inverters enable grid operators to remotely monitor and control distributed generation, either directly through a control system or by requiring settings that enable autonomous response to local grid conditions. These devices, which are commercially available today, have defined IEEE upcoming UL testing standards, and have been successfully deployed with utilities in various venues across the country. Smart inverters are ideally suited to provide increased visibility and control of variable generation solar PV to grid operators.

Furthermore, Hawaii Electric Power Company ("HECO") collaborated with a distributed solar provider and the National Renewable Energy Laboratory ("NREL") to

[14] Clean Coalition. "California Adopts Nation's First Advanced Inverter Standards," January 6, 2015. http://www.clean-coalition.org/site/wp-content/uploads/2015/01/California-establishes-advanced-inverters-standards-press-release-09_jb-6-Jan-2015.pdf. Accessed October 19, 2015

demonstrate the impact of commercially available smart inverters.[15] In particular, the demonstration examines how smart inverters can address potential transient over-voltage (both load rejection overvoltage and ground fault overvoltage) with the aim of enabling increased penetration of rooftop PV on the distribution grid.[16] As explained by the director of NREL's power systems engineering described the research as focused on "conducting investigations into how solar inverters can be programmed and controlled to trip on and off in response to grid voltage fluctuations, or to perform other grid balancing tasks."[17] Tapping into the inherent capability of these smart inverters will enable HECO to connect an additional 2,500 NEM PV systems onto its grid.

Portland General Electric ("PGE") installed a prototype PV Enhanced Inverter at a proof-of-concept solar demonstration site with the goal of preventing inverters from disconnecting during periods of peak demand. Mark Osborn, PGE's Distribute Resources Manager said, "Two-way communications with the inverters, combined with constant measurements from the synchrophasors, enables us to use the inverters to mitigate against sags and flicker much more effectively." Additionally, PGE's custom-designed control system, GenOnSys aims to treat all inverters equally, creating a kind of "virtual power plant" whereby large-scale PV becomes an asset, not a burden.[18]

Q: Does Mr. Tilghman's suggestion of technological solutions to integration challenges offer any ways UNS is actively addressing these concerns?

A: No. Given that this portion of Mr. Tilghman's testimony is in support of a proposed replacement to the existing net metering tariff, it appears the only action UNS is currently

[15] John, Jeff St. "HECO and SolarCity to Put Smart Solar Inverters Through Real-World Testing," December 8, 2014. https://www.greentechmedia.com/articles/read/HECO-and-SolarCity-to-Put-Smart-Solar-Inverters-Through-Real-World-Testing. Accessed October 19, 2015

[16] Nelson, A., A. Hoke, S. Chakraborty, J. Chebahtah, T. Wang, and B. Zimmerly. "Inverter Load Rejection Over-Voltage Testing," 2015. http://www.nrel.gov/docs/fy15osti/63510.pdf. Accessed October 19, 2015

[17] "NREL: Technology Transfer - NREL's ESIF Offers Equipment Testing on Grand Scale." *Smart Grid Today*, April 14, 2015. http://www.nrel.gov/technologytransfer/news/2015/16491.html. Accessed 19 October 2015

[18] Scharf, Mesa, and Michael Mills-Price. "Laying the Foundation for the Grid-Tied Smart Inverter of the Future." Advanced Energy: SEGIS Program Concept Paper, 2011. http://solarenergy.advanced-energy.com/upload/File/White_Papers/SEGIS-Laying%20the%20Foundation-2-FINAL.pdf. Accessed October 19, 2015

taking is to change the value proposition for customers that would like to install and use onsite solar generation. To the extent reducing the rate of distributed solar generation growth would reduce integration challenges, I suppose that modifying the net metering tariff to be less advantageous will have the desired result of slowing the rate of customer-sited solar growth, but he does not show that this will address his concerns.

Q: Does Mr. Tilghman provide any other rationale of how UNS's proposed changes to its net metering tariff might address these integration-related concerns?

A: No. He simply summarizes the rate changes proposed by Mr. Dukes. Mr. Tilghman does not reference any of the widely available utility demonstration efforts related to successfully integrating increasingly high penetrations of rooftop PV. For practical purposes, the only way that this rate change can "address" his operational concerns is by depressing distributed solar adoption. I believe this is the intent.

III. OTHER BENEFITS SHOULD BE CONSIDERED

Q: UNS proposes that the Renewable Credit Rate be a rate "equivalent to the most recent utility scale renewable energy purchased power agreement connected to the distribution system of UNS Electric's affiliate, TEP." Are there benefits of distributed generation that may not be reflected in a utility-scale avoided cost rate?

A. Yes. As many studies have discussed and illustrated, there are unique values to distributed solar generation. First, when a generation resource is located behind a customer's meter, it is avoiding line losses when compared to more remote generation that is delivered across transmission and distribution facilities. Second, distributed solar generation may enable a utility to avoid or defer capital distribution projects. Benefits such as this, among others, are not going to be reflected in a utility-scale power purchase rate.

Additionally, it is important to consider that net metered solar PV represents a resource that leverages private funds to bring the resource to the grid. A utility does not incur any direct costs to bring this capacity online. If a net metered system helps to reduce

a utility's revenue requirement overtime, then it will necessarily put a downward pressure on rates. For example, a recent study conducted by Synapse Energy Economics for the Mississippi Public Service Commission showed that instituting a net metering program in that state would put downward pressure on rates.[19]

I will provide further testimony on benefits in the next round of testimony related to cost of service and rate design.

Q: Can solar DG be cost-effective relative to other resources?

A: Yes. However, in order to understand how, one must look at the benefits beyond simple reductions of short-term utility energy purchases or generation. In particular, one needs to take a longer view to be able to see and quantify the contributions that solar DG makes. I briefly mention a few of these below.

Q: Can solar DG provide reliability benefits and reduce a utility's reserve margin requirement?

A: Yes. For example, a 2005 article by Duke, Williams and Payne in the *Energy Policy Journal* notes that PV deployment makes it possible to reduce the reserve margins needed to ensure power system reliability.[20] Duke *et al.* point out that grids with large generation facilities require a higher reserve margin since an unanticipated loss of output from even a single generating facility could affect service continuity. In contrast, a power system with a large number of distributed PV systems alleviates reserve requirements because individual systems are far smaller than central-station plants, and the risk of unexpected technical failure is uncorrelated across different PV systems.

This is echoed in a 2011 report prepared for the New York State Energy Research and Development Authority (NYSERDA), which noted that in general, distributed generation can increase system reliability by increasing the number and variety of

[19] Synapse Energy Economics, Inc, "Net Metering in Mississippi: Costs, Benefits and Policy Considerations." Prepared for the Public Service Commission of Mississippi, September 19, 2014.

[20] "Accelerating residential PV expansion: demand analysis for competitive electricity markets" Duke et al., *Energy Policy* 33, 2005 (Duke 2005) p. 1922

generating technologies; reducing the size of generators and the distance between generators and load; and by reducing loading on distribution and transmission lines.[21]

The reserve margin benefit issue is illustrated by an example cited in the NYSERDA study:

> During the last wave of nuclear plant construction, single units were built as large as 1100 MW in capacity. Seabrook I is an example. At the time Seabrook I came into service, its loss became the single largest risk to the reliability of the New England grid and substantially increased the risk of system outages. To remedy this situation, the New England Power Pool had to increase the required reserve margin for every utility in New England by several percentage points. A two percentage point increase in the region's required capability would amount to something on the order of 500 MW. The cost savings implicit in reducing the size of plants and dispersing them can be appreciated from that observation.[22]

While UNS is not contemplating adding a large nuclear plant, its acquisition of 138 MW (Gila Bend) out of a system of 400 MW does represent a large fraction of UNS's supply portfolio.

Q: Beyond providing reliability benefits by lowering reserve margin requirements, can solar DG provide other grid support or ancillary services?

A: Yes. According to a 2013 meta-study by the Rocky Mountain Institute, grid support services provided by solar DG can include reactive supply and voltage control, frequency regulation and response, supporting energy imbalances, providing operating reserves, and scheduling and forecasting benefits to ensure operational safety.[23] The study notes that differing standards and rules based on different systems could affect the valuation of solar

[21] "Deployment of Distributed Generation for Grid Support and Distribution System Infrastructure: A Summary Analysis of DG Benefits and Case Studies." Prepared for NYSERDA by Pace Energy and Climate Center and Synapse Energy Economics 2011 (NYSERDA 2011) p.17

[22] NYSERDA 2011, p. 17

[23] "A Review Of Solar PV Benefit & Cost Studies", Rocky Mountain Institute 2013 (RMI 2013) p. 15

DG grid support services,[24] however it is likely that with changes in technology, the net value proposition of solar DG as grid support will increase.[25]

This fundamental conclusion that solar DG can provide grid support is corroborated by reports and studies prepared for NREL[26] and NYSERDA.[27]

Q: Can solar DG provide a hedge against volatile fuel prices?

A: Yes. A 2013 paper by the Interstate Renewable Energy Council notes that solar DG provides a fuel cost price hedge benefit by reducing reliance on fuel sources that are susceptible to shortages and market price volatility.[28] It further notes that solar DG provides a hedge against uncertainty regarding future regulation of greenhouse gas and other emissions, which also impact fuel prices. Solar DG customer exports help hedge against these price increases by reducing the volatility risk associated with base fuel prices effectively blending price stability into the total utility portfolio.

Q: Does solar DG offer any environmental benefits?

A: Environmental benefits are a commonly referred to benefit of renewable power generally, and solar DG specifically. These benefits include reduced carbon emissions; avoided health costs resulting from reduced criteria air pollutants and improved air quality; avoided environmental compliance costs since solar DG is a zero-emissions technology; reduced stress on land and water resources.

These benefits can, of course, also be achieved through central solar facilities. However, solar DG also offers the same negligible water use and zero emissions as UNS central solar PV proposal, but without the potential habitat, visual and cultural impacts associated with utility-scale solar plants.[29]

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[24] RMI 2013 p. 33
[25] RMI 2013 p. 34
[26] "Photovoltaics Value Analysis," Prepared for National Renewable Energy Laboratory by Navigant Consulting 2008 (NREL 2008) p. 13
[27] NYSERDA 2011 p. 18
[28] "A Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation", Interstate Renewable Energy Council 2013 (IREC 2013) p. 30
[29] "The SunShot Vision Study," Department of Energy, February 2012 (DOE 2012) p. 170

Q: Does solar DG offer any socio-economic benefits?

A: Yes. As discussed in 2013 paper by the Interstate Renewable Energy Council, installation and construction associated with onsite generation facilities is inherently local in nature, as contractors or installers must be within reasonably close geographic proximity to economically install a system and be present for building inspections. Accordingly, the solar industry creates local jobs, thereby generating local revenue. Economic activity associated with the growing rooftop solar industry can create additional tax revenue at the state and local levels, as installers purchase supplies, goods and other related services subject to state and local sales tax, and pay payroll taxes. Locally spent dollars displace those frequently sent out of state for fuel and other supplies.[30]

These jobs impacts are backed up by data. Overall, from 2010 to 2014, the solar industry has added nearly 80,000 jobs in the US, an 86% increase,[31] and is expected to add another 36,000 jobs in 2015.[32] Installers make up the largest part of the solar workforce, with most working on small, distributed systems: 59.6% on residential systems and 23.6% on small to medium commercial systems (less than 200 kW).[33]

Q. Should all of these benefits be considered in determining whether a shift away from the existing net metering policy is justified or advisable?

A. Yes. It is appropriate to consider the full range of benefits provided by net metered solar in determining whether there is a compelling basis to fundamentally change the policy and justify a waiver of the net metering rules as well as the creation of an arbitrary class of customers subject to a discriminatory rate.

[30] IREC 2013 p. 35

[31] The Solar Foundation, *National Solar Jobs Census 2014,* Page 1. http://www.thesolarfoundation.org/wp-content/uploads/2015/01/TSF-National-Census-2014-Report_web.pdf Accessed November 2, 2015.

[32] *Ibid.*, p. 3

[33] *Ibid.*, p. 15

IV. POLICY RESPONSE: ACC SHOULD SUPPORT –OR AT LEAST NOT HINDER—DISTRIBUTED PV

Q: Does Arizona have any policies concerning distributed generation?

A: Yes. Arizona's Renewable Energy Standard and Tariff ("REST") order, ACC Decision No. 69127, set out specific requirements for utilities in the state with respect to the acquisition of renewable energy to serve their retail customers. Included in that REST were requirements for amounts of a utility's Annual Renewable Energy Requirement that must be met by distributed energy ("DE") resources. The RES requirements and the set-asides for DE resources reflect the Arizona policymakers' intent for renewable energy in general, and distributed renewables in particular, to be included in the state's energy portfolio. This is not simply because they result in the lowest possible rates. If that were the case, the REST would not be necessary. But the REST and DE requirements exist because they offer benefits, such as those I enumerated above, that cannot be easily reflected in a simplistic short term analysis.

Rate designs that directly or indirectly suppress renewable DE generation are at odds with this general policy direction. In setting rates, which will be explicitly addressed in the next round of testimonies, the ACC must keep in mind that customers who have, or are wishing to install, solar DG must not be not discriminated against through the imposition of unique and onerous tariffs.

Q: Does this conclude your testimony?

A: Yes.

MARK E. FULMER

PROFESSIONAL EXPERIENCE

Principal
MRW & Associates, LLC
(1999 - Present)
Conduct economic and technical studies in support of clients involved in regulatory and legislative proceedings and power project development. Advise clients on the economic issues associated with taking electricity service from non-utility sources or self-generating power. Work includes expert testimony on rate matters; economic analysis of end-use energy-efficiency projects, retail rate and wholesale price forecasting, and pro forma analysis of cogeneration and distributed generation facilities.

Project Engineer
Daniel, Mann, Johnson & Mendenhall
(1996 - 1999)
Acted as project manager and technical advisor on energy efficiency projects. Work included management of PG&E program to promote innovative energy efficient technologies for large electricity users. Coordinated the implementation of an intranet-based energy efficiency library. Directed technical and market analyses of small commercial and residential emerging technologies.

Associate
Tellus Institute
(1990-1996)
Advised public utility commissions in five states on electric and gas industry deregulation issues. Submitted testimony on the rate design of a natural gas utility to the Pennsylvania Public Utilities Commission. Testified before the Hawaii PUC on behalf of a gas distribution utility concerning a competing electric utility's demand-side management plan. Analyzed national energy policies for a set of non-governmental agencies, including critiquing the DOE's national energy forecasting model. Developed model to track transportation energy use and emissions and used the model to evaluate state-level transportation policies. Developed model to track greenhouse gas emission reductions resulting from state-level carbon taxes.

Research Assistant
Center for Energy and Environmental Studies, Princeton University
(1988-1990)
Researched the technical and economic viability of gas turbine cogeneration using biomass in the cane sugar and alcohol industries. First researcher to apply "pinch" analysis and a mixed-integer linear programming model to minimize energy use in cane sugar refineries and alcohol distilleries.

EDUCATION

M.S.E., Mechanical and Aerospace Engineering, Princeton University, 1991
B.S., Mechanical Engineering, University of California, Irvine, 1986

SELECTED PUBLICATIONS

1. A Technical and Economic Assessment of the Co-Production of Electricity and Alcohol From Sugar Cane. Presented at the *International Engineering Conference on Energy Conversion (IECEC-90).* American Institute of Chemical Engineers. New York, NY. August 1990. Principal author and presenter.

2. Cogeneration Applications of Biomass Gasifier/Gas Turbine Technologies in the Cane Sugar and Alcohol Industries. Proceedings, *Energy and Environment in the 21st Century*, MIT Press. Cambridge, Massachusetts. 1991. Co-author.

3. The Environmental Impacts of Demand-Side Management. Electric Power Research Institute report TR-101673. 1992. Co-author.

4. The Role of Gas Heat Pumps in Electric DSM. Presented at the 6th National Demand-Side Management Conference. Miami Beach, Florida. March 1993. Principal author and presenter.

5. Applying an Integrated Energy/Environmental Framework to the Analysis of Alternative Transportation Fuels. Invited paper at the European Council for an Energy Efficient Economy (ECEEE) 1993 Summer Study. Principal author.

6. Mistakes, Misconceptions, and Misnomers in DSM Cost-Effectiveness Analysis. Peer reviewed paper at the ACEEE 1994 Summer Study. Principal author and presenter.

7. A Social Cost Analysis of Alternative Fuels for Light Vehicles. *Energy Strategies for a Sustainable Transportation System*, ACEEE. Washington, DC. 1995.

8. Strategies for Reducing Energy Consumption in the Texas Transportation Sector. Project for the Texas Sustainable Energy Development Council. Austin, Texas. June 1995. Co-author.

9. Evaluation of Food Processing Effluent Treatment Alternatives. Paper presented at the American Chemical Society meeting, Las Vegas, Nevada. December 1997. Co-Author.

10. Market Transformation Effect Indicators for Government, Utilities, Retailers and Manufacturers. Invited panelist in a roundtable discussion at the American Council for an Energy Efficient Economy (ACEEE) 1998 Summer Study.

11. California: Crisis Over? Project Finance NewsWire, Chadbourne & Parke. October 2001. Co-author.

12. California: Back to Basics or Déjà Vu? Natural Gas & Electricity, Volume 20, Number 12. July 2004. Co-author.

13. Nuclear Fuel Reprocessing: Issues and Future Prospects. Report for the California Energy Commission. (Final Draft). March 2006. Co-author.

14. AB 1632 Assessment of California's Operating Nuclear Plants. California Energy Commission, CEC-100-2008-005-F. October 2008. Co-author.

15. Framework for Evaluating Greenhouse Gas Implications of Natural Gas-fired Power Plants in California. California Energy Commission, CEC-700-2009-009-F. May 2009. Co-author.

PREPARED TESTIMONY

1. Rhode Island Public Utilities Commission No. 2025
   Prepared Testimony on Behalf of Rhode Island Department of Public Utilities and Carriers (Commission Staff). Testimony addressed the costs, savings, and cost-effectiveness of the proposed demand-side management programs of Providence Gas Company. April 1993.

2. Pennsylvania Public Utility Commission R-943029
   Prepared Testimony on Behalf of the Pennsylvania Office of Consumer Advocate. Testimony reviewed 1307(f) filing of Columbia Gas of Pennsylvania, particularly the impact of the proposed gas cost recovery mechanism on residential customers. May 1994.

3. Public Utilities Commission of the State of Hawaii No. 94-0206
   Prepared Testimony on Behalf of the Gas Company of Hawaii (Gasco). Testimony identification of Gasco's concerns regarding HECO's proposed DSM programs for competitive energy end-use markets. December 1994.

4. Arizona Corporation Commission No. E-00000A-02-0051, E-01345A-01-0822, E-00000A-01-0630. E01933A-02-0069, E-01933A-98-0471
   Rebuttal Testimony on Behalf of Constellation NewEnergy, Inc. and Strategic Energy, L.L.C. Testimony addressed the future of the Arizona Independent System Administrator. July 28, 2002.

5. FERC Docket Nos. EL00-95-075 and EL00-98-063
   Affidavit on Behalf of Duke Energy Trading and Marketing LLC. March 20, 2003.

6. CPUC Rulemaking 01-10-024
   Prepared Testimony on Behalf of the Alliance for Retail Energy Markets. Testimony addressed the utility procurement plans with respect to resource adequacy. June 23, 2003.

7. CPUC Rulemaking 01-10-024
   Rebuttal Testimony on Behalf of the Alliance for Retail Energy Markets. July 14, 2003.

8. Arizona Corporation Commission No. E-00000A-02-0051
   Reply Testimony on Behalf of Constellation NewEnergy, Inc. and Strategic Energy L.L.C. August 29, 2003.

9. Arizona Corporation Commission No. E-01345A-03-0437
   Direct Testimony on Behalf of Constellation NewEnergy and Strategic Energy, Inc. February 3, 2004.

10. Arizona Corporation Commission No. E-01345A-03-0437
    Cross Rebuttal Testimony of Mark E. Fulmer on Behalf of Constellation NewEnergy and Strategic Energy, Inc. March 30, 2004.

11. CPUC Rulemaking 03-10-003
    Direct Testimony of Mark E. Fulmer on Behalf of The City and County of San Francisco on Community Choice Aggregation Transaction Costs. April 15, 2004.

12. CPUC Rulemaking 03-10-003
    Reply Testimony of Mark E. Fulmer on Behalf of The City and County of San Francisco on Cost Responsibility Surcharge for Community Choice Aggregation. May 7, 2004.

13. CPUC Rulemaking 03-10-003
    Rebuttal Testimony of Mark E. Fulmer on Behalf of The City and County of San Francisco on Cost Responsibility Surcharge for Community Choice Aggregation. May 20, 2004.

14. CPUC Rulemaking 04-04-003
    Testimony of Mark Fulmer on Behalf of Strategic Energy LLC and Constellation NewEnergy concerning the Long Term Procurement Plans of PG&E, SCE and SDG&E. August 6, 2004.

15. CPUC Rulemaking 04-04-003
    Rebuttal Testimony of Mark Fulmer on Behalf of Strategic Energy LLC and Constellation NewEnergy concerning the Long Term Procurement Plans of PG&E, SCE and SDG&E. August 20, 2004.

16. CPUC Rulemaking 03-10-003
    Opening Testimony of Mark E. Fulmer on Behalf of the City and County of San Francisco on Allocation of Costs for Community Choice Aggregation Phase 2. April 28, 2005.

17. CPUC Rulemaking 04-12-014
    Testimony of Mark E. Fulmer on Behalf of the Alliance for Retail Energy Markets Concerning SCE's Test Year 2006 General Rate Case Application. May 6, 2005.

18. CPUC Rulemaking 03-10-003
    Rebuttal Testimony of Mark E. Fulmer on Behalf of the City and County of San Francisco on Allocation of Costs for Community Choice Aggregation Phase 2. May 16, 2005.

19. CPUC Rulemaking 04-12-014
    Testimony of Mark E. Fulmer on Behalf of the Alliance for Retail Energy Markets Concerning SCE's Test Year 2006 General Rate Case Application. May 25, 2005.

20. CPUC Application 06-03-005
    Testimony of Mark E. Fulmer on Behalf of the Direct Access Customer Coalition Concerning Phase 2 of the PG&E's 2007 General Rate Case Marginal Cost, Revenue Allocation and Rate Design. October 27, 2006.

21. CPUC Application 07-01-045
Testimony of Mark E. Fulmer on Behalf of The Alliance for Retail Energy Markets and The California Manufacturers and Technology Association Concerning SCE's Application to Update is Direct Access and Other Service Fees. June 22, 2007.

22. CPUC Rulemaking 08-03-002
Testimony of Mark Fulmer Behalf of Debenham Energy, LLC. Concerning Tariffs Supportive of Green Distributed Generation. October 31, 2008.

23. CPUC Application 09-02-022
Testimony of Mark E. Fulmer on Behalf of The Direct Access Customer Coalition Concerning PG&E's 2009 Rate Design Window Application. July 31, 2009.

24. CPUC Application 09-02-019
Testimony of Mark E. Fulmer on Behalf of the Direct Access Customer Coalition Concerning the Cost Recovery Proposed By PG&E in its Application to Implement a Photovoltaic Program. August 14, 2009.

25. Superior Court of San Francisco
Deposition of Mark E. Fulmer on Behalf of the City and County of San Francisco in PG&E v. CCSF. (Verbal deposition only.) September 2, 2009.

26. California Superior Court of San Francisco Court Case No. CGC-07-470086 Testimony of Mark E. Fulmer on Behalf of the City and County of San Francisco in PG&E v. City and County of San Francisco. (Trial exhibits only in electronic file.) September 25, 2009.

27. CPUC Application 09-12-020
Testimony of Mark E. Fulmer on Behalf of The Direct Access Customer Coalition Concerning Phase 1 of PG&E's Test Year 2011 General Rate Case. May 19, 2010.

28. CPUC Application 10-03-014
Testimony of Mark E. Fulmer on Behalf of the Direct Access Customer Coalition Concerning Phase 2 of PG&E's Test Year 2011 General Rate Case Application. October 6, 2010.

29. CPUC Rulemaking 07-05-025
Testimony of John P. Dalessi, Mark E. Fulmer, Margaret A. Meal on Behalf of the Joint Parties on a Fair and Reasonable Methodology to Determine the Power Charge Indifference Adjustment (PCIA) and the Competition Transition Charge (CTC). January 31, 2011.

30. CPUC Rulemaking 07-05-025
Testimony of Mark E. Fulmer on Behalf of the Direct Access Parties Concerning the Transitional Bundled Service Rate, Direct Access Switching Rules, Minimum Stay Provisions, and Energy Service Provider Financial Security Requirements. January 31, 2011.

31. CPUC Rulemaking 07-05-025
Rebuttal Testimony of Mark E. Fulmer on Behalf of The Direct Access Parties Concerning the Transitional Bundled Service Rate, Direct Access Switching Rules, Minimum Stay Provisions, and Energy Service Provider Financial Security Requirements. February 25, 2011.

32. CPUC Rulemaking 07-05-025
Rebuttal Testimony of John P. Dalessi, Mark E. Fulmer, Margaret A. Meal on Behalf of The Joint Parties on a Fair And Reasonable Methodology to Determine the Power Charge Indifference Adjustment (PCIA) and the Competition Transition Charge (CTC). February 25, 2011.

33. CPUC Application A.11-03-001, 11-03-002, 11-03-003
Testimony of Mark E. Fulmer on Behalf of The Direct Access Customer Coalition and The Alliance for Retail Energy Markets Concerning Competitive Issues in the 2012-2014 Demand Response Program Proposals. June 15, 2011.

34. CPUC Application 11-03-001, 11-03-002, 11-03-003
Rebuttal Testimony of Mark E. Fulmer on Behalf of The Direct Access Customer Coalition and The Alliance for Retail Energy Markets Concerning Competitive Issues in the 2012-2014 Demand Response Program Proposals. July 11, 2011.

35. CPUC Application 11-06-004
Testimony of Mark E. Fulmer on Behalf of the Direct Access Customer Coalition and the Alliance for Retail Energy Markets concerning PG&E's 2012 Energy Resource Recovery Account (ERRA) and 2012 Generation Non-bypassable Charges Forecast. August 26, 2011.

36. CPUC Application 11-05-023
Testimony of Mark Fulmer on Behalf of the Direct Access Customer Coalition, the Alliance for Retail Energy Markets and the Western Power Trading Forum concerning the Application of SDG&E for Authority to Enter into Purchase power Tolling Agreements with Escondido Energy Center, Pio Pico Energy Center, and Quail Brush Power. September 22, 2011.

37. CPUC Application 11-06-007
Testimony of Mark Fulmer on Behalf of the Direct Access Customer Coalition Concerning Phase 2 of SCE's Test Year 2012 General Rate Case Application. February 6, 2012.

38. CPUC Application 11-12-009
Testimony of Mark E. Fulmer on Behalf of the Direct Access Customer Coalition, the Alliance for Retails Energy Markets and the City and County of San Francisco Concerning PG&E's Application to Revise Direct Access and Community choice Aggregation Service Fees. May 14, 2012.

39. CPUC Rulemaking 12-03-014
Testimony on Behalf of the Alliance for Retail Markets, Direct Access Customer Coalition, and Marin Energy Authority. With Sue Mara. June 25, 2012.

40. CPUC Rulemaking 12-03-014
Reply Testimony on Behalf of the Alliance for Retail Energy Markets, Direct Access Customer Coalition, and Marin Energy Authority. With Sue Mara. July 23, 2012.

41. CPUC Application 12-03-001
Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets Concerning PG&E Company's Application to Implement Economic Development Rates for 2013-2017. August 24, 2012.

42. CPUC Application 12-02-001
Rebuttal Testimony of Mark E. Fulmer on Behalf of the Alliance for Retail Energy Markets Concerning PG&E's Application to Implement Economic Development Rates for 2013-2017. October 19, 2012.

43. CPUC Application 12-04-020
Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets, the Direct Access Customer Coalition and 3 Phases Renewables Regarding PG&E's Application to Establish a Green Option Tariff. October 19, 2012.

44. CPUC Application 12-04-020
Rebuttal Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets, the Direct Access Customer Coalition and 3 Phases Renewables Regarding PG&E's Application to Establish a Green Option Tariff. November 9, 2012.

45. CPUC Application 11-11-002
Testimony of Mark Fulmer on Behalf of the City of Long Beach. November 16, 2012.

46. CPUC Application11-11-002
Rebuttal Testimony of Mark Fulmer on Behalf of the City of Long Beach. December 14, 2012.

47. CPUC Investigation 12-10-013
Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets and the Direct Access Customer Coalition Regarding the Rate Treatment of the San Onofre Nuclear Generating Station. September 10, 2013.

48. CPUC Application 13-06-015
Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets and the Direct Access Customer Coalition Regarding SDG&E's Application for Approval of an Amended Power Purchase Tolling Agreement with Pio Pico Energy Center. September 20, 2013.

49. CPUC Investigation12-10-013
Rebuttal Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets and the Direct Access Customer Coalition Regarding the Rate Treatment of the San Onofre Nuclear Generating Station. September 23, 2013.

50. CPUC Application 13-06-015
Rebuttal Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets and the Direct Access Customer Coalition Regarding SDG&E's Application for Approval of an Amended Power Purchase Tolling Agreement with Pio Pico Energy Center. October 4, 2013.

51. CPUC Application 13-08-004

Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets and the Direct Access Customer Coalition Regarding the SCE's 2014 "ERRA" Forecast. November 20, 2013.

52. CPUC Application 13-06-011
Testimony of Mark Fulmer on Behalf of the Core Transport Agent Consortium Concerning PG&E's Core Gas Capacity Planning Range. November 20, 2013.

53. CPUC Application 13-04-012
Testimony of Mark E. Fulmer on Behalf of the Direct Access Customer Coalition Concerning Phase 2 of PG&E's Test Year 2014 General Rate Case Application. December 13, 2013.

54. CPUC Application 13-06-011
Testimony of Mark Fulmer on Behalf of the Core Transport Agent Consortium Concerning PG&E's Core Gas Capacity Planning Range. December 18, 2013.

55. CPUC Application 13-12-012/Investigation 14-06-016
Testimony of Mark Fulmer on Behalf of the Core Transport Agent Consortium Concerning Core Transport Issues in PG&E's Gas Transmission and Storage Rate Case and Consolidated Order Instituting Investigation. August 11, 2014.

56. New Mexico Public Regulation Commission Case No. 13-00390-UT
Direct Testimony of Mark E. Fulmer on Behalf of Renewable Energy Industries Association of New Mexico. August 29, 2014.

57. CPUC Application 14-05-024
Rebuttal Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets and the Direct Access Customer Coalition. September 2, 2014.

58. CPUC Application 13-12-012
Rebuttal Testimony of Mark Fulmer on Behalf of the Core Transport Agent Consortium Concerning Core Transport Issues In PG&E's Gas Transmission and Storage Rate Case. September 15, 2014.

59. CPUC Rulemaking 12-06-013
Direct Testimony of Mark Fulmer on Behalf of the Interstate Renewable Energy Council, Inc. Concerning Residential Electric Rate Design Reform. September 15, 2014.

60. CPUC Application 14-06-011
Testimony of Mark Fulmer on Behalf of the Alliance for Retail Energy Markets, the Direct Access Customer Coalition and the Public Agency Coalition. October 3, 2014.

61. Washington Utilities & Transportation Commission Docket UE-140762 ET AL.
Direct Testimony of Mark Fulmer on Behalf of the Alliance for Solar Choice. October 10, 2014.

62. CPUC Rulemaking 12-06-013
Rebuttal Testimony of Mark Fulmer on Behalf of the Interstate Renewable Energy Council, Inc. Concerning Residential Electric Rate Design Reform. October 17, 2014.

63. Washington Utilities & Transportation Commission Docket UE-140762 ET AL.

Cross-Answering Testimony of Mark Fulmer on Behalf of the Alliance for Solar Choice. November 14, 2014.

64. CPUC Application 14-06-014
Testimony of Mark E. Fulmer on Behalf of the Direct Access Customer Coalition Concerning Phase 2 of SCE's Test Year 2015 General Rate Case Application. March 13, 2015.

65. CPUC Application 14-06-014
Testimony of Mark E. Fulmer on SCE's Application to Establish Marginal Costs, Allocate Revenues, Design Rates, and Implement Additional Dynamic Pricing Rates. March 13, 2015.

66. CPUC Application 13-12-013
Testimony of Mark Fulmer on Behalf of the City of Long Beach, Gas & Oil Department. May, 8, 2015.

67. CPUC Application 14-11-003
Testimony of Briana Kobor, Laura Norin, and Mark Fulmer on Behalf of the Utility Consumers' Action Network Concerning Sempra's Revenue Requirement Proposals for SDG&E and SoCal Gas. May 15, 2015.

68. CPUC Application 13-12-013
Rebuttal Testimony of Mark Fulmer on Behalf of the City of Long Beach, Gas & Oil Department. June 12, 2015.

69. CPUC Application 14-12-017
Testimony of Mark Fulmer on Behalf of the City of Long Beach, Gas & Oil Department. June 22, 2015.

70. CPUC Application 14-12-007
Testimony of Mark Fulmer and Laura Norin on Behalf of the Utility Consumers' Action Network Concerning Risk Assignment of SONGS Decommissioning Costs. July 15, 2015.

71. Federal Energy Regulatory Commission Docket Nos. EL02-60-007, EL02-62-006 (Consolidated)
Answering Testimony of Mark Fulmer on Behalf of Shell Energy North America (US), L.P. July 21, 2015.

72. CPUC Application 14-12-007
Rebuttal Testimony of Mark Fulmer and Laura Norin on Behalf of the Utility Consumers' Action Network Concerning Risk Assignment of SONGS Decommissioning Costs. August 3, 2015.

73. CPUC Rulemaking 14-07-002
Joint Solar Parties Net Energy Metering Successor Tariff Rebuttal Testimony of R. Thomas Beach, Mark Fulmer and Jose Luis Contreras. September 30, 2015.