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Reply to: Reno

October 28, 2015

Breanne Potter
Assistant Commission Secretary
Public Utilities Commission of Nevada
1150 East William Street
Carson City, Nevada 89701-3109

Re: Docket Nos. 15-07041/42; Corrected Pre-Filed Direct Testimony of Tim Woolf on behalf of The Alliance for Solar Choice

Dear Ms. Potter:

Please accept for filing in the above-referenced docket, the attached corrected Pre-Filed Direct Testimony of Tim Woolf on behalf of The Alliance for Solar Choice. The only correction to this testimony is the numbering of the questions and answers, there have been no revisions to the testimony itself.

If you have any questions or concerns regarding the same, please contact me directly at 775-326-4369.

Sincerely,

McDONALD CARANO WILSON LLP

Kathleen M. Drakulich

KMD/ajb
Enclosures (as stated)

BEFORE THE PUBLIC UTILITIES COMMISSION OF NEVADA

Application of Nevada Power Company d/b/a NV Energy and Application of Sierra Pacific Power Company d/b/a NV Energy for Approval of a Cost of Service Study and Net Metering Tariffs

DOCKET NOs. 15-07041 and 15-07042

PREPARED DIRECT TESTIMONY OF TIM WOOLF

ON BEHALF OF THE ALLIANCE FOR SOLAR CHOICE (TASC)

October 27, 2015

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I. INTRODUCTIONS AND QUALIFICATIONS

Q1. Please state your name, position and business address.

A1. My name is Tim Woolf. I am a Vice President at Synapse Energy Economics, located at 485 Massachusetts Avenue, Cambridge, MA 02139.

Q2. Please describe Synapse Energy Economics.

A2. Synapse Energy Economics (Synapse) is a research and consulting firm specializing in electricity and gas industry regulation, planning, and analysis. Our work covers a range of issues, including economic and technical assessments of demand-side and supply-side energy resources; energy efficiency policies and programs; integrated resource planning; electricity market modeling and assessment; renewable resource technologies and policies; and climate change strategies. Synapse works for a wide range of clients, including attorneys general, offices of consumer advocates, public utility commissions, environmental advocates, the U.S. Environmental Protection Agency, U.S. Department of Energy, U.S. Department of Justice, the Federal Trade Commission and the National Association of Regulatory Utility Commissioners. Synapse has over 30 professional staff with extensive experience in the electricity industry.

Q3. Please summarize your professional and educational experience.

A3. My experience and qualifications are described in my *curriculum vitae*, which is **Exhibit TW-1** to this testimony. Before rejoining Synapse, I was a commissioner at the Massachusetts Department of Public Utilities (DPU). In that capacity, I was responsible for overseeing a substantial expansion of clean energy policies, including significantly increased ratepayer-funded energy efficiency programs; an update of the DPU energy efficiency guidelines; the implementation of decoupled rates for electric and gas companies; the promulgation of net metering regulations; review and approval of smart

grid pilot programs; and review and approval of long-term contracts for renewable power. I was also responsible for overseeing a variety of other dockets before the commission, including several electric and gas utility rate cases.

Prior to being a commissioner at the Massachusetts DPU, I was employed as the Vice President at Synapse; a Manager at Tellus Institute; the Research Director at the Association for the Conservation of Energy; a Staff Economist at the Massachusetts DPU; and a Policy Analyst at the Massachusetts Executive Office of Energy Resources. I hold a Master's in Business Administration from Boston University, a Diploma in Economics from the London School of Economics, a BS in Mechanical Engineering and a BA in English from Tufts University.

Q4. Have you previously testified before the Nevada Public Service Commission?

A4. Yes. In 2006 I filed testimony in Docket Nos. 06-04002 & 06-04005 regarding Nevada Power Company's and Sierra Pacific Power Company's Renewable Portfolio Standard Annual Report, in Docket No. 06-06051 regarding Nevada Power Company's Demand-Side Management Plan in the 2006 Integrated Resource Plan, in Docket Nos. 06-03038 & 06-04018 regarding the Nevada Power Company's and Sierra Pacific Power Company's Demand-Side Management Plans, and in Docket No. 05-10021 regarding the Sierra Pacific Power Company's Gas Demand-Side Management Plan. I filed all these testimonies on behalf of the Nevada Bureau of Consumer Protection.

Q5. On whose behalf are you testifying?

A5. I am testifying on behalf of The Alliance for Solar Choice (TASC).

Q6. What is the purpose of your testimony?

A6. The purpose of my testimony is to provide an overview of TASC's findings and recommendations in this docket. My testimony reviews and critiques the Nevada Power

Company d/b/a NV Energy and Sierra Pacific Power Company d/b/a NV Energy (NVE or the Company) proposal to establish a new rate class and a new, three-part rate structure for net energy metering (NEM) customers. I describe how the Company's proposal is not in compliance with SB 374, is inconsistent with traditional ratemaking practices, will jeopardize the development of customer-sited renewable resources, is not in electricity customers' interest, and is not in the public interest.

I also introduce the other witnesses that are testifying on behalf of TASC. Mr. Monsen reviews the Company's cost of service studies in detail, and demonstrates how those studies show that the cost of serving net metering customers is actually lower than the cost of serving non-net metering customers. Mr. McDermott reviews the Company's analysis of the impacts of distributed generation on its transmission and distribution system. Mr. Beach reviews the Company's ratemaking and rate design proposals, and recommends an alternative proposal that is in compliance with SB374, will promote the goals of the NEM statute, will prevent unreasonable cost shifting between customers, and is in the public interest.

II. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Q7. Please summarize your primary findings.

A7. My primary findings are summarized as follows:

- The Company's proposed NEM rates will dramatically reduce, and potentially eliminate, customer adoption of NEM systems in the future.
- The Company's proposal is not compliant with SB 374, because it will not encourage private investment in renewable energy resources, it will not stimulate economic growth in Nevada, and it will not continue the diversification of Nevada's energy resources.

- The Company's own analysis demonstrates that the costs to serve NEM customers are not significantly different than the costs to serve non-NEM customers. Therefore, there is no need or justification for creating a separate class for NEM customers, and creating a separate class would be discriminatory.
- When the Company's own analysis is corrected it demonstrates that the cost to serve net metering customers is actually less than the cost to serve non-net metering customers.
- The Company's proposal is inconsistent with several fundamental ratemaking principles such as sending efficient price signals, maintaining customer equity, and ensuring customer acceptability and understanding.
- The Company's proposal to create new demand charges for customers is not cost-based, and will not provide NEM customers with appropriate price signals.
- The Company's proposal is neither in customers' interest nor in the public interest, because it will thwart the deployment of a very cost-effective resource that offers multiple benefits to electricity customers and to Nevada in general.

Q8. Please summarize TASC's recommendations.

A8. TASC recommends that the Commission reject the Company's proposal. We recommend instead that the Commission require the Company to establish NEM2 rates and tariffs with the following elements:

1. Retain the existing rate classes.
2. Retain the existing rate structures for the existing rate classes.
3. Retain the current $35 per customer NEM application fee to cover the incremental customer account and customer service costs associated with NEM customers.
4. Require NEM customers to pay upfront interconnection charges to cover the additional programming and inspection costs for new NEM installations.

These charges would start at $80 (RS), $90 (RS-M), and $130 (GS); and would be updated at the next rate case to make sure they remain cost-based.

5. Do not require NEM customers to install a meter to measure the NEM system generation. For those customers who choose to install generation meters, the Company should pay half of the cost of the meters in return for the load research data that the meters will provide.

This proposal is compliant with SB 374, will prevent cost-shifting between net metering and non-net metering customers, will provide customers with simple, appropriate price signals regarding the value of NEM resources, will create downward pressure on electricity rates, and will help promote the development of customer-sited renewable resources in Nevada.

III. SUMMARY OF THE COMPANY'S PROPOSAL

Q9. Please provide a summary of NVE's proposal.

A9. In response to SB 374, the Company has set forth a proposal to transition to a new set of NEM rates. Under the Company's proposal, NEM customers would be placed in separate NEM rate classes with a three-part rate structure that includes (a) a fixed monthly charge (comprised of a customer charge and a meter charge); (b) an energy charge (in $/kWh); and (c) a demand charge (in $/kW). Residential customers will be offered the choice of two tariff options: one with a flat energy charge; and one based on time-of-use (TOU), where energy and demand charges vary based on the time of day and season. Each existing residential subclass would have a different net metering tariff relevant to that subclass.

IV. THE COMPANY'S PROPOSAL IS NOT COMPLIANT WITH SB 374

Q10. What is the intent of SB 374?

A10. The Legislature reaffirmed the intent of the net metering provisions in SB 374 to be as follows:[1]

> 1. Encourage private investment in renewable energy resources;
>
> 2. Stimulate the economic growth of this State;
>
> 3. Enhance the continued diversification of the energy resources used in this State; and
>
> 4. Streamline the process for customers of a utility to apply for and install net metering systems.

Each of these points underscores the Legislature's intent to *promote*, rather than *restrict*, the development of distributed renewable resources (such as rooftop solar), continue growth of Nevada's solar industry, continue diversification of energy resources (such as through solar), and remove barriers to customers who wish to install net metered generation resources.

Q11. Does the Company's proposal comply with the legislative intent of SB 374?

A11. No. The company's proposal runs directly counter to the intent of SB 374. The Company's proposal will significantly reduce the value proposition for customers to install NEM systems, which will dramatically reduce adoption rates of NEM resources, and will severely impact the development of the renewable industry in Nevada.

The Company's proposal also runs directly counter to the Governor's signing statement, which notes that "Senate Bill 374 is a compromise measure that will allow the

[1] BDR 58-800 (as enrolled), Sec. 2.8; 2015 Leg., 78th Sess. (Nev. 2015).

rooftop solar industry to continue to create jobs and grow in Nevada while protecting non-solar ratepayers… This measure will also provide a smooth transition from the current net metering program to the PUC approved tariff providing market stability for the solar industry."[2]

Q12. How will the Company's proposed net metering tariffs reduce the value proposition for customers to install NEM systems?

A12. Customers only have a financial interest to install NEM systems if the bill savings they experience offset the cost of installing the system. The Company's testimony indicates that the proposed changes to the net metering tariff will dramatically reduce bill savings, thereby reducing customers' interest in installing distributed generation. The Company's own analysis indicates that switching from the current net metering tariff to the new three-part rate structure proposed by the Company will dramatically reduce NEM customer bill savings:

- For Nevada Power Company, customer savings from installing NEM systems would fall from 52 percent under current rate designs to 33 percent under the Company's rate proposal.[3]
- For Sierra Pacific Power Company, customer savings from installing NEM systems would fall from 55 percent under current rate designs to 37 percent under the Company's rate proposal.[4]

Furthermore, the Company has noted that under its proposal, customers who install net metering systems "might end up paying more for energy when the cost of buying or

[2] Signing Statement of Governor Brian Sandoval on SB 374, June 5, 2015, http://gov.nv.gov/News-and-Media/Press/2015/Sandoval-Signs-Additional-Legislation-into-Law-Today/.
[3] Nevada Power Company, Narrative and Technical Appendices, Vol. 2, p. 48, Table 3-5.
[4] Sierra Pacific Power Company, Narrative and Technical Appendices, Vol. 2, p. 49, Table 3-5.

leasing the system, or purchasing the output of the system is taken into consideration."[5] Very few customers, if any, would be willing to install or otherwise lease or purchase clean energy from customer-sited net metering systems if the end result is to simply increase their total energy costs. In fact, the Company notes that about 5% of customers would have no utility bill savings or even bill increases, so they would unambiguously pay much more for energy if they installed a solar system. [6] There is no question that such an outcome would be inconsistent with the clear intent of SB 374 to encourage private development of renewable resources, stimulate economic growth in Nevada, and enhance the diversification of Nevada's energy resources.

Q13. Are other states addressing similar issues with regard to net metering policies and alternative rate designs?

A13. Yes, many states are investigating these questions regarding net metering and rate design, and recently there have been many utility proposals to increase fixed customer charges.

Q14. What has been the experience in these states that are investigating alternative rate designs?

A14. In general, commissions have rejected the utilities' proposed increases in customer charges, primarily on the grounds that doing so would send incorrect price signals and reduce customers' ability to control their bills through energy efficiency, distributed generation or other means. I address this point in more detail in Section VII of my testimony.

[5] Nevada Power Company, Narrative and Technical Appendices, Vol. 2, p. 4.
[6] From the filing "Using the existing NEM1 customers for the calculation, some customers with very low load factors and high demand had bill increases or no bill reductions, however, the calculations showed approximately 95 percent of customers had bill reductions." – Nevada Power Company, Narrative and Technical Appendices, Vol. 2, p. 47.

Q15. Are you aware of other utilities that have implemented a rate design similar to NVE's proposal?

A15. Yes. The Salt River Project (SRP), a public power utility serving roughly 1 million retail customers in central Arizona, recently established a new residential rate class for net metering customers. The rate design for the new rate class included a three-part rate structure that was similar to, but less onerous, than the NVE proposal.

Q16. What was the impact of this new rate class on the development of net metering systems among Salt River Project customers?

A16. When the new net metering rate class and rate design was put in place, the number of customers applying for net metering interconnection plummeted dramatically. As described in more detail in the testimony of Mr. Beach, this new rate design resulted in an "almost complete shutdown of the solar market in SRP's service territory."[7] This is exactly what one would expect if customer value proposition for installing net metering systems were dramatically reduced or eliminated. And this is clearly not the intent of SB 374.

Q17. Does SB 374 require that Nevada Energy implement a three-part rate design?

A17. No. The plain language of the legislation clearly states that a three-part rate structure "may" be used, but is not required. The text of the legislation reads:

> The rates included in the terms and conditions of service established pursuant to subsection 2 may include, without limitation:

[7] Direct Testimony of Thomas Beach, October 27, 2015, p. 24.

(a) A basic service charge that reflects marginal fixed costs incurred by the utility to provide service to customer-generators; (b) A demand charge that reflects the marginal demand costs incurred by the utility to provide service to customer-generators; and (c) An energy charge that reflects the marginal energy costs incurred by the utility to provide service to customer-generators.[8]

The legislation clearly does not require the use of a three-part rate design. In light of my findings that a three-part rate design will thwart the development of NEM resources in Nevada, and therefore be inconsistent with the intent of SB 374, the Company's proposal should be rejected.

Q18. Does SB 374 require that NVE eliminate cost-shifting?

A18. No, it does not. The legislation requires the prevention of *unreasonable* cost-shifting, not the elimination of all cost-shifting.[9]

Q19. Has the Company demonstrated that continuation of the current net metering rate structure would result in unreasonable cost-shifting?

A19. No. The Company has not demonstrated that there will be any cost-shifting, and certainly not any unreasonable cost-shifting. First, as described in more detail in Mr. Monsen's testimony, the Company's own cost of service study indicates that the cost to serve net metering customers is very similar to the cost to serve non-net metering customers.[10] Second, when NVE's cost of service study is corrected to account for a significant flaw

[8] BDR 58-800 (as enrolled), Sec. 4.5; 2015 Leg., 78th Sess. (Nev. 2015).
[9] Id at Sec. 2.3.
[10] Direct Testimony of William Monsen, October 27, 2015, p. 17-47.

in the estimate of marginal distribution capacity costs, it indicates that there will be no cost-shifting as a result of net metering.[11]

Q20. If the cost to serve net metering customers were instead found to be higher than the cost to serve non-net metering customers, would that represent unreasonable cost-shifting?

A20. Not necessarily. In order to determine whether any amount of cost shifting is unreasonable, it is first necessary to estimate (a) the magnitude of any cost-shifting, and (b) the magnitude of the electricity system benefits of the NEM resource. These two critical pieces of information will indicate whether any cost-shifting, to the extent it does occur, is unreasonable. For example, if a resource results in a very small amount of cost-shifting, but provides a very large amount of electricity system benefits, this might be considered reasonable. If, on the other hand, a resource results in a large amount of cost-shifting, and a small amount of electricity system benefits, then that might be considered unreasonable. I address the two issues of cost-shifting and electricity system benefits in Sections V and VI of my testimony.

V. COSTS OF SERVING NEM AND NON-NEM CUSTOMERS ARE NOT SIGNIFICANTLY DIFFERENT

A. The Company's Cost of Service Study Shows NEM and Non-NEM Customers Have Very Similar Costs of Service

[11] Id.

Q21. Has NVE provided evidence to demonstrate that the cost of service for NEM customers is significantly different than for non-NEM customers?

A21. No. The Company's own studies indicate that the costs to serve NEM customers are not significantly different from those to serve non-NEM customers. This is demonstrated in the tables below, which present a summary of NVE's cost of service results for both Nevada Power Company and Sierra Pacific Power Company. The tables present results for customer and facility costs (in terms of dollars per customer), and for the energy, generation capacity, transmission and distribution costs (in terms of dollars per kWh).

Table 1. Summary of NPC Cost of Service Results[12]

NPC RS Customer Costs *($/customer/year)*

	Facilities Costs	Customer Costs	Total Customer Costs
Non-NEM	$171	$86	$257
NEM	$171	$150	$321
Difference	*$0*	*$64*	*$64*
% Difference	*0%*	*74%*	*25%*

NPC RS Marginal Costs *($/kWh)*

	Gen. Energy	Gen. Capacity	Transmission	Distribution	Total
Non-NEM	0.042	0.066	0.010	0.021	0.140
NEM	0.042	0.068	0.013	0.029	0.152
Difference	*(0.000)*	*0.002*	*0.002*	*0.007*	*0.012*
% Difference	*0%*	*4%*	*20%*	*35%*	*8%*

Table 2. Summary of SPPC Cost of Service Results

SPPC D-1 Customer Costs *($/customer/year)*

	Facilities Costs	Customer Costs	Total Customer Costs
Non-NEM	$230	$59	$289
NEM	$230	$233	$464
Difference	*$0*	*$175*	*$175*
% Difference	*0%*	*299%*	*61%*

SPPC D-1 Marginal Costs *($/kWh)*

	Gen. Energy	Gen. Capacity	Transmission	Distribution	Total
Non-NEM	0.043	0.036	0.005	0.028	0.113
NEM	0.043	0.027	0.005	0.037	0.111
Difference	*(0.001)*	*(0.010)*	*(0.000)*	*0.009*	*(0.002)*
% Difference	*-2%*	*-26%*	*-4%*	*31%*	*-2%*

Q22. What do these tables demonstrate, with regard to the differences between NEM and non-NEM customers?

A22. These tables demonstrate that costs to serve NEM customers are not significantly different than the costs to serve non-NEM customers. With regard to marginal costs, the Company estimates that this difference is between eight percent higher for NPC and two percent lower for SPPC. This can only be described as a very small difference in

[12] Id at 19.

customers' cost of service, especially given the extent to which customer cost of service already varies is considerably in the existing customer classes. The difference is somewhat greater with regard to the customer costs, ranging from 25 percent higher for NPC to 61 percent higher for SPPC.

Q23. Has TASC identified any problems with NVE's estimate of the cost of service for NEM customers?

A23. Yes. In estimating costs of service it is common practice to use customer load shapes that reflect the amount of energy that is delivered to an average customer in the relevant customer class. This is referred to as the "delivered load," and is indicated by the customer's metered consumption level. For NEM customers, the delivered load will be reduced whenever their NEM system is operating, and will be reduced to zero whenever the NEM system is operating at a level that exceeds the customer electricity demands.

Q24. What load shapes did NVE use in its cost of service study?

A24. For the generation energy and capacity cost of service estimates, NVE used load shapes based upon delivered loads. However, NVE made some adjustments to the load shapes for the transmission and distribution cost of service estimates.

- For transmission costs the load shapes are based on the NEM customer total load (i.e., assuming no NEM generation), adjusted for the impact of the diversity of NEM generators on the transmission system.
- For distribution costs the load shapes are equal to the greater of (a) the NEM customer total load (i.e., assuming no NEM system generation) or (b) the amount of excess generation that is sent back on to the distribution system (i.e., assuming full NEM system generation).

Q25. Why did NVE use these load shapes for transmission and distribution costs?

A25. The Company provides the following summary of how it applied different load shapes:

> The distribution and transmission load shapes reflect the standby nature of the service provided (and the additional cost of the distribution grid for distribution cost development); while the generation and energy cost development use only the delivered energy load shape.[13]

Specifically with regard to the load shape for transmission costs, the Company states that it has chosen to use the customer total load, instead of delivered load, to reflect the "standby nature of the grid."[14] Specifically with regard to the load shape for distribution costs, the Company implies that it is also accounting for "the cost that NEM customers impose by sending excess generation back to the grid for banking."[15]

Q26. Is it appropriate for the Company to use these load shapes for transmission and distribution cost of service estimates?

A26. No, not at all. This issue is described in more detail in the testimonies of Mr. Monsen and Mr. McDermott. Here I will summarize two key points.

First, NEM customers do not impose any additional costs on the grid for standby services. NVE does not have to plan for and maintain a distribution or transmission system necessary to support the full demands of every residential customer at the same time. Instead, the Company can recognize the diverse nature of customer consumption patterns, and plan for a distribution and transmission system that will provide reliable service at all times, given that not all customers experience peak loads at the same time.[16]

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[13] Nevada Power Company, Narrative and Technical Appendices, Vol. 2, p. 30.
[14] Id at 40.
[15] Id at 38.
[16] Direct Testimony of William Monsen, October 27, 2015, p. 26-7, 31-32. Direct Testimony of Thomas McDermott, October 27, p. 11-12.

Second, NEM customers do not impose any additional costs on the grid for banking services. In practice, there is no banking of electricity or electrons. The only banking that occurs is one of a financial nature, where the utility compensates a NEM customer for generation at a later point in time by rolling excess NEM generation from one billing period to the next.

Q27. What load shape does TASC recommend for estimating costs of service?

A27. TASC recommends that the cost of service for all types of costs (generation energy, generation capacity, transmission and distribution) be determined using the NEM customer's delivered load shape. This is consistent with standard industry practice for cost of service studies, and best reflects the costs imposed on the distribution system by NEM customers. Mr. McDermott's testimony explains that residential and small commercial NEM customers are unlikely to have a significant impact on their distribution circuit loadings through individual generation outages. It would take many simultaneous NEM generator failures to significantly affect distribution system loading, and NVE has not presented those probability calculations. Mr. McDermott would expect those probabilities to be near zero, and they should be discounted. Instead, the NEM customers should be handled on a class average basis, in which the load and generation will offset each other. Thus the actual impact that NEM customers place on the NV Energy system is best reflected in the NEM customer's delivered load.[17]

Q28. How are the Company's cost of service results affected when the proper load shapes are used?

A28. Tables 3 and 4 below present the same information as Tables 1 and 2, but with the distribution and transmission costs based upon the corrected load shapes (customer costs

[17] Direct Testimony of Thomas McDermott, October 27, 2015, p. 11-12.

are also updated.) As indicated, this correction dramatically reduces the distribution and transmission cost of service. In fact, the reduction is so large that it turns the differential between the total cost of service for NEM and non-NEM customers negative. In other words, the cost of service for NEM customers is actually lower than that of serving non-NEM customers.

Table 3. Summary of NVE's Cost of Service Results - Corrected Assumptions

NPC RS Customer Costs *($/customer/year)*

	Facilities Costs	Customer Costs	Total Customer Costs
Non-NEM	$171	$86	$257
NEM	$171	$86	$257
Difference	*$0*	*$0*	*$0*
% Difference	*0%*	*0%*	*0%*

NPC RS Marginal Costs *($/kWh)*

	Gen. Energy	Gen. Capacity	Transmission	Distribution	Total
Non-NEM	0.042	0.066	0.010	0.021	0.140
NEM	0.042	0.068	0.008	0.016	0.134
Difference	*(0.000)*	*0.002*	*(0.003)*	*(0.006)*	*(0.006)*
% Difference	*0%*	*4%*	*-26%*	*-26%*	*-4%*

Table 4. Summary of NVE's Cost of Service Results - Corrected Assumptions

SPPC D-1 Customer Costs *($/customer/year)*

	Facilities Costs	Customer Costs	Total Customer Costs
Non-NEM	$230	$59	$289
NEM	$230	$59	$289
Difference	*$0*	*$0*	*$0*
% Difference	*0%*	*0%*	*0%*

SPPC D-1 Marginal Costs *($/kWh)*

	Gen. Energy	Gen. Capacity	Transmission	Distribution	Total
Non-NEM	0.043	0.036	0.005	0.028	0.113
NEM	0.043	0.027	0.003	0.018	0.090
Difference	*(0.001)*	*(0.010)*	*(0.002)*	*(0.011)*	*(0.023)*
% Difference	*-2%*	*-26%*	*-38%*	*-38%*	*-20%*

Sources: NPC and SPPC MCOS Models (from NVE Response to TASC Data Request No. 3); MRW Analysis.

Q29. What are the key implications of TASC's findings that the cost-of-service for NEM customers is lower than that of non-NEM customers?

A29. There are two very important implications of this finding. First, it indicates that there will be no cost-shifting from NEM to non-NEM customers. Therefore, there is no justification for creating a new rate class for NEM customers. Second, it indicates that NEM resources will put downward pressure electricity rates. This is further indication of the value of NEM resources, as evidenced by the E3 NEM cost-benefit study overseen

by the Commission, and provides additional reason for ensuring that any NEM rates be designed to promote NEM systems and not inhibit them.

Q30. Please explain why it is possible for NEM customers to have a lower cost of service than non-NEM customers.

A30. Simply put, the total cost of service for NEM customers is lower than for non-NEM customers because the NEM customer's load shape is less expensive for the Company to serve. In other words, in those hours when the NEM system is generating electricity, the host customer's load is less expensive to serve because it is lower than it otherwise would be.

B. Cost-of-service Methodologies Are Not Necessarily Capable of Identifying the *Net Costs* Imposed by Customers

Q31. Are there general limitations regarding the use of cost of service studies that the Commission should be aware of?

A31. Yes. Cost of service studies have proven useful for many years for setting rates based upon the costs imposed by different types of customers. In the past, most customers imposed only costs on the electric system, and thus studies based on cost causation were sufficient for ratemaking purposes. With distributed generation resources and net metering systems, some customers are now both incurring costs and providing benefits. As such, cost-of-service methodologies are not necessarily capable of identifying the *net costs* imposed by customers; that is, the costs incurred minus the benefits provided. It is the *net costs* imposed by customers that are most relevant in making decisions about new rate classes and rate designs.

Q32. Please explain why cost of service studies are not necessarily capable of identifying the net costs imposed by customers.

A32. Cost of service studies, by design, are not suited for capturing three types of costs and benefits from distributed generation and NEM systems. First, cost of service studies do not account for long-term costs and benefits that may vary over time. Second, cost of service studies do not account for some electricity system benefits that are difficult to quantify. Third, cost-of-service studies do not account for additional benefits beyond those experienced by electric customers – benefits that are nonetheless important to regulators and legislators, like water savings, and pollution reduction and the positive impact on public health.

Q33. Please explain why cost-of-service studies do not account for long-term costs and benefits.

A33. Cost-of-service studies typically include costs for very short time periods. There is good reason for this, as regulators typically prefer to set rates based on the most reliable information available, which typically means actual historical information or very short-term forecasts.[18] However, this approach is somewhat limited because the costs and benefits of NEM resources, typically with a warrantied life of 20 year or longer, can impact the electricity system for many years. Over this time period, electricity systems can change significantly as can the costs and benefits of NEM systems. Cost-of-service studies that are based only on short-term information will not capture long-term impacts, which can be significantly different than short-term impacts. In addition, generation, transmission and distribution costs tend to increase over time, which means that the

[18] NVE used several different study periods depending upon the cost being analyzed, including forecasts for 2016-2018 for energy costs, and actual 2005-2014 plus a forecast of 2016 for distribution costs.

benefits of NEM systems (i.e., the costs avoided by these systems) are likely to be greater over the long-term than the short-term. Consequently, a cost-of-service study based on short-term information is likely to understate the long-term benefits of NEM systems. The issue of long-term benefits of NEM resources is discussed in more detail in Section VI of my testimony.

Q34. Please explain why cost-of-service studies do not account for some electricity system benefits that are difficult to quantify.

A34. NEM systems provide several benefits to the electricity system that are difficult to quantify in a cost of service study. For example NEM systems can reduce electricity system risk by diversifying the fuels used in generating electricity in Nevada. As discussed in Section IV of my testimony, increasing fuel diversity is one of the reasons cited by SB 374 for promoting NEM. In addition, NEM resources can provide increased reliability and resiliency benefits to the electricity system. NEM resources can also provide market price mitigation benefits. These additional benefits, discussed in more detail in Mr. Beach's testimony, accrue to all electricity customers, including non-NEM customers, but are not included in cost-of-service studies.[19]

Q35. Please explain why cost-of-service studies do not account for additional benefits beyond those experienced by electricity customers.

A35. NEM systems provide several benefits that do not affect the electricity system directly, but are important nonetheless. As discussed in more detail by Mr. Beach, NEM systems provide important benefits in terms of encouraging private investment in Nevada, stimulating economic growth in Nevada, and reducing harmful air emissions.[20] As

[19] Direct Testimony of Tom Beach, October 27, 2015, pp. 33-36.
[20] Id at 43-48.

discussed in Section IV of my testimony, encouraging private investment in renewables and stimulating economic growth are two of the reasons cited by SB 374 for promoting NEM.

Q36. Are you suggesting that the Company's cost of service study be modified in any way to account for any of these additional impacts that are not currently accounted for?

A36. No. I do not recommend a significant modification to the methodologies employed in cost of service studies. I wish to make two simple points here:

- A cost of service study, by design, is not capable of capturing all of the long-term benefits from NEM systems, both in terms of electricity system benefits and those that extend beyond the electricity system.
- The limitations of the cost of service study should be considered qualitatively when making decisions regarding new rate classes and new rate designs.

Q37. What do you mean when you say that the limitations of the cost of service study should be considered qualitatively?

A37. Ratemaking and rate design decisions are typically based on many factors, not all of which can be quantified. Rate design is not a simple, mechanical process. In Section VII of my testimony I describe the principles that are used in making rate design decisions. It is generally understood that these principles are sometimes in tension with each other, and that commissioners must strike the appropriate balance between these principles. Striking the appropriate balance will require consideration of many factors, some of which will be qualitative. My point here is that when making rate design decisions, and seeking to balance the key ratemaking principles, the Commission should consider the fact that the quantitative results of the cost of service study are not likely to not account for all the benefits of NEM, because of the inability of such studies to fully reflect the long-term costs and benefits to the utility system and Nevada as a whole.

VI. NET METERING PROVIDES SIGNIFICANT ELECTRICITY BENEFITS

Q38. Why is it important for the Commission to understand the long-term utility system benefits provided by net metering?

A38. It is very important to understand the long-term utility system benefits of net metering because this is critical information that should be used to inform the ratemaking and rate design decision.

- First, if net metering is recognized as being very cost-effective and offering significant long-term benefits to the utility system, then net metering policies and rates should be designed to promote such a beneficial resource. Similarly, net metering policies and rates should not be designed to thwart the development of such a beneficial resource.
- Second, if there are any concerns about cost-shifting, or any indication that cost shifting might exist, then the magnitude of the long-term utility system benefits can help inform the decision of whether any expected cost-shifting is reasonable.

Q39. How should the magnitude of the long-term benefits of net metering to the utility system be estimated?

A39. The conventional method for evaluating the long-term impacts of an electricity resource on the utility system is to quantify any increase or decrease in the utility's revenue requirements as a result of the resource. The revenue requirements are what the utility ultimately seeks to collect from customers, and are the best indication of costs and benefits to all customers as a whole, i.e., to the utility system. Revenue requirements are also an indication of impacts on average customer bills: a reduction in revenue requirements indicates that average customer bills will be reduced, and vice versa.

Q40. What is the conventional approach for evaluating revenue requirement impacts?

A40. Conventional practice involves comparing one or more long-term scenarios with the resource in question to other long-term scenarios without the resource in question, and determining which scenario has the lower revenue requirement. Revenue requirements are typically calculated each year, and then the cumulative present worth of revenue requirements (PWRR) over all years is used to compare different resources or scenarios. The PWRR is the primary criterion used to evaluate the cost effectiveness of electric resources in integrated resource planning (IRP) practices throughout the electricity industry in the US and Canada.[21] It is also used as the primary criterion to evaluate electricity resource plans in the Nevada IRP process; along with other criteria such as risk, reliability, societal costs and more.[22]

Q41. Are you aware of any studies that estimate the long-term electricity benefits of net metering in this way?

A41. There have been several studies in recent years of the costs and benefits of net metering. While there are many differences in how the studies are designed, and the inputs used in the studies, there is one conclusion that is consistent across many of them. Net metering resources are generally found to be very cost-effective, in terms of reducing customer revenue requirements.

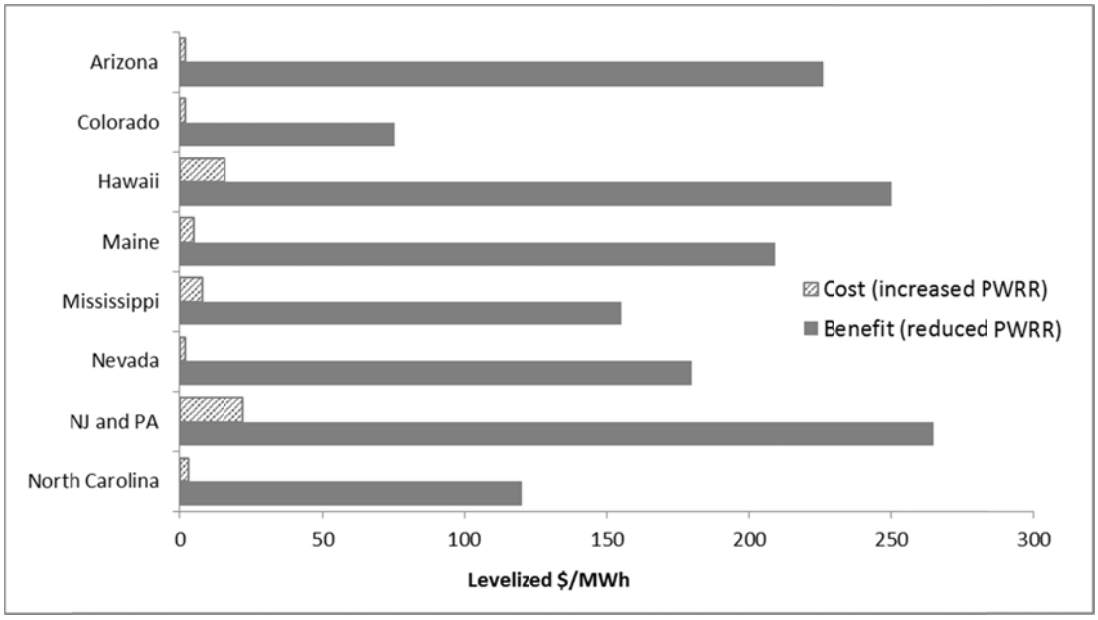
[21] Synapse Energy Economics, *Best Practices in Electric Utility Integrated Resource Planning: Examples of State Regulations and Recent Utility Plans*, Prepared for the Regulatory Assistance Project, June 2013.

[22] Application of Nevada Power Company d/b/a NV Energy Seeking Acceptance of the First Amendment to its 2013-2032 Integrated Resource Plan and its Energy Supply Plan Update for 2015, Volume 3 of 15, *Emissions Reduction and Capacity Replacement Plan*, p. 10.

Q42. Please provide a summary of how these recent studies indicate the extent to which net metering resources can reduce revenue requirements.

A42. Figure 1 presents a summary of the costs and benefits of net metering resources from the studies I reviewed. For each study the figure presents the long-term benefits of net metering and the long-term costs of net metering, in terms of levelized $/MWh. All of the benefits and costs provided in Figure 1 are presented in terms of the PWRR. As indicated in Figure 1, the benefits of net metering resources significantly outweigh the costs, by a wide margin. **Exhibit TW-2** provides citations and a discussion of the studies used for this figure.

Figure 1. Summary of NEM Costs and Benefits, in Terms of PWRR



Q43. Are you endorsing all of the assumption and findings in the studies used to create Figure 1?

A43. No. There are many different assumptions and methodologies used in each of these net metering studies, and I do not mean to endorse or critique any one of them. My main point is this: regardless of which study is considered, and regardless of the

methodologies and assumptions used, it is clear that net metering resources will significantly reduce customer revenue requirements, and should therefore be recognized as a very cost-effective resource.

Q44. Have you personally performed any analysis of the ability of net metering resources to reduce revenue requirements?

A44. Yes, I recently submitted testimony on behalf of TASC, the Sierra Club, and Utah Clean Energy on the appropriate method for assessing the cost-effectiveness of net metering.[23] In that testimony I prepared a high-level, illustrative analysis of the costs and benefits of net metering in Utah on the basis of PWRR. My analysis indicated that net metering in Utah could have a benefit-cost ratio anywhere in the range of 12:1 to 24:1. In other words, every ratepayer dollar spent by the utility on net metering resulted in 12 to 24 ratepayer dollars saved. (The difference between these two estimates is based on a low avoided cost assumption and a high avoided cost assumption.) The utility in that case, Rocky Mountain Power (another Berkshire Hathaway-owned utility), challenged my estimates on the grounds that my avoided costs were too high. When I applied the avoided cost assumption used by Rocky Mountain Power, the benefit-cost ratio was reduced from 12:1 to 10:1 – still an extremely cost-effective resource.

Q45. Why is it that net metering is so cost-effective?

A45. Net metering is extremely cost-effective in terms of PWRR because the system owner typically pays most, and sometimes all, of the cost of installing and operating the generation system over its useful life. Whether the customer owns the distributed

[23] Utah Pub. Serv. Comm'n (Docket No. 14-035-114): Direct, Rebuttal, and Surrebuttal Testimony of Tim Woolf on the benefit-cost framework for net energy metering. On behalf of Utah Clean Energy, the Alliance for Solar Choice, and Sierra Club. July 30, 2015, September 9, 2015, and September 29, 2015.

generation system, leases it, or purchases the power from it, the result is still the same. The host customer bears most, or all, of the cost of generating the power. This is fundamentally different from all other types of electricity resources where the utility must pay to construct and operate the facility, or pay a developer to do so through a power purchase agreement. The fact that the NEM customer bears more, or all, of the cost of generating the power is what makes net metering so extremely cost-effective from the perspective of PWRR.

Q46. What about the fact that the utility is effectively compensating NEM customers at the retail rate? How does this affect the long-term benefits of NEM?

A46. While it is true that NEM customers are effectively compensated at the retail rate, this type of compensation does not require any increase in utility revenue requirements. When net metering customers reduce their energy purchases from the utility, they are not being directly compensated by the utility. The ability of net-metered customers to avoid these purchases does not create any new, incremental costs for the utility, and thus does not increase customer revenue requirements. At the time of the next rate case, the utility may need to increase rates to account for the fact that its sales are lower than they otherwise would be, but this increase in rates is driven by the reduced sales, not by any increase in revenue requirements.[24]

Q47. Does NEM result in any increase in revenue requirements?

A47. Yes, but any increase tends to be much smaller than the reductions in revenue requirements that result from NEM. The only new costs that might increase customer revenue requirements are the administrative, interconnection, and integration costs

[24] Note that rates might not need to be increased at all, as a result of the reductions in future generation, transmission and distribution costs caused by NEM systems.

associated with NEM.[25] These are presented in Figure 1 as the costs of NEM. As indicated in that figure, these increased revenue requirements from NEM are significantly smaller than the reduced revenue requirements from NEM.

VII. NVE'S PROPOSAL IS INCONSISTENT WITH RATEMAKING PRINCIPLES

A. Ratemaking Principles

Q48. What ratemaking principles should be considered when designing rates?

A48. In his seminal work, *Principles of Public Utility Rates,* Professor James Bonbright discusses eight key criteria for a sound rate structure. These criteria are:

1. The related, "practical" attributes of simplicity, understandability, public acceptability, and feasibility of application.
2. Freedom from controversies as to proper interpretation.
3. Effectiveness in yielding total revenue requirements under the fair-return standard.
4. Revenue stability from year to year.
5. Stability of the rates themselves, with a minimum of unexpected changes seriously adverse to existing customers.
6. Fairness of the specific rates in the appointment of total costs of service among the different customers.
7. Avoidance of "undue discrimination" in rate relationships.
8. Efficiency of the rate classes and rate blocks in discouraging wasteful use of service while promoting all justified types and amounts of use:
   a. in the control of the total amounts of service supplied by the company;

[25] In some cases, these costs are paid for by NEM customers themselves.

b. in the control of the relative uses of alternative types of service (on-peak versus off-peak electricity, Pullman travel versus coach travel, single-party telephone service versus service from a multi-party line, etc.).[26]

Q49. Are these principles widely recognized and used by commissions?

A49. Yes. The principles listed above have been recognized and used by commissions throughout the country for many years. Bonbright's principles are also referenced by Company Witness Faruqui in his testimony supporting NVE's rate class and rate design proposal.[27]

Q50. Are these ratemaking principles sometimes in conflict?

A50. Yes. It is critical to understand that some of these ratemaking principles can be in conflict with each other. Consequently, regulators must strike a balance between some of these principles; too much emphasis on any one can lead to undermining the other principles.

Q51. Please provide an example of how some of these ratemaking principles are in conflict.

A51. One of the more difficult issues to work out in ratemaking is resolving the tension between revenue adequacy and economic efficiency:

- Revenue adequacy requires that the utility can recover all of its costs. Utility revenues are typically determined based on cost causation principles, using embedded or marginal short-term costs.

[26] James Bonbright, *Principles of Public Utility Rates*, Columbia University Press, 1961, p. 291.
[27] Direct Testimony of Ahmad Faruqui, pp. 4-5.

- Economic efficiency requires that customers be provided with price signals that will allow them to make economically efficient decisions with regard to their electricity consumption levels. In other words, customers must be given the proper price signals to invest in energy efficiency measures, invest in distributed generation resources, or simply consume less energy in order to save on electric bills. Price signals should also be based on cost causation principles, but in this case the relevant costs are future long-term costs.

Sometimes there is a significant difference between short-term costs used for revenue adequacy and long-term costs used for sending economically efficient price signals. In the short-term, fixed costs can include capacity costs associated with generation, transmission and distribution, while over the long-term none of these costs are truly fixed. This difference is one of the reasons why many states continue to set residential fixed charges (in the form of customer charges) at an amount that is lower than the actual short-term fixed costs to serve that customer; because a high fixed charge will inhibit customers from making economically optimal decisions about their electricity use.

Q52. Does Mr. Faruqui claim that NVE's rate proposal meets standard ratemaking principles?

A52. Yes. In his concluding section, Mr. Faruqui states that "NV Energy's proposed rates meet the widely held principles of rate design..."[28]

Q53. Does Mr. Faruqui's demonstrate that the Company's proposal meets standard ratemaking principles?

A53. No. After introducing these principles Mr. Faruqui discusses cost causation concepts and cost-shifting that can result from NEM, but he does not discuss how the Company's

[28] Id at 26.

proposal complies with the ratemaking principles. Mr. Faruqui does acknowledge that "[c]ost causation may need to be balanced against the other Core Principles, such as customer satisfaction or bill stability," but he does not provide any discussion or evidence as to whether or how the Company's proposal accomplishes this balance.

Q54. Do you believe that NVE's rate proposal properly balances standard ratemaking principles?

A54. No. The Company's proposal focuses almost entirely on the principle of revenue adequacy. By recovering more revenues through fixed charges and demand charges, the Company's rate design helps to ensure that the utilities will recover their full revenue requirement. The problem with this approach is that it does not address other key ratemaking principles, and in fact the Company's proposal violates the other ratemaking principles by placing so much emphasis on revenue recovery.

Q55. What rate design principles does the Company's proposal fail to satisfy?

A55. The Company's proposed increased fixed charge and demand charge for NEM customers fail to satisfy the principles of rate stability, efficiency, equity, and that of "simplicity, understandability, public acceptability, and feasibility of application." I address these principles in the following sections.

Furthermore, the demand charge proposed by the Company is not cost-based. The NVE proposal would impose a demand charge on residential customers based on their maximum demand in any hour, even though such maximum demands may occur outside of the hours that drive the utilities' marginal costs.[29]

[29] Direct Testimony of Tom Beach, October 27, 2015, pp. 12-18.

Q56. Does your critique of the Company's application of the standard ratemaking principles depend upon TASC's findings that the cost to serve NEM customers is lower than the cost to serve non-NEM customers?

A56. No. My critique of the Company's application of the standard ratemaking principles is relevant to the results of NVE's filed cost-of-service studies. It is also relevant in light of the corrected results presented by the TASC witnesses.

B. The Company's Proposal Violates the Principle of Rate Stability

Q57. In what way does the company's proposed rate design violate the principle of rate stability?

A57. Bonbright argued that rates should only be changed gradually, "with a minimum of unexpected changes seriously adverse to existing customers."[30] The Company's proposal violates this principle in two ways. First, the proposed increases in the residential customer charge cannot be described as "gradual." NVE is proposing to increase residential customer charges from $12.75 to $18.15 per month for Nevada Power Company (an increase of 42 percent), and from $15.25 to $24.50 for Sierra Pacific Power Company (an increase of 61 percent). Second, the Company's proposal shifts a significant portion of the customer's bill to the demand charge, which essentially represents a new fixed charge to NEM customers. These two changes clearly represent sudden, drastic changes in customer rates, with adverse impacts for NEM customers.

[30] Bonbright, at 291.

C. The Company's Proposal Violates the Principle of Efficiency

Q58. In what way does the Company's proposed rate design violate the principle of efficiency?

A58. Bonbright defines the principle of efficiency as "discouraging wasteful use of service while promoting all justified types and amounts of use."[31] By reducing the energy charge and shifting a large portion of the customer's bill to the customer charge and demand charge, the Company's rate design significantly reduces customers' ability and incentive to reduce electricity consumption and therefore electricity bills.

Q59. Please explain the price signal that fixed customer charges send to customers.

A59. In general, a fixed customer charge sends the signal to customers that they have no control over that portion of their bill, as they will have to pay the fixed portion of the bill regardless of how much electricity they consume. An increase in the fixed customer charge sends the signal that customers have less control over their bill than they used to, and that any actions to reduce their bills through reduced consumption will be less effective.

Q60. Please explain the price signal that demand charges send to customers.

A60. In principle, the demand charge encourages customers to reduce their maximum instantaneous energy demand. However, as TASC Witness Tom Beach testifies, residential customers lack both the tools and the information necessary to respond to demand charges.[32] A price signal that is not understood will simply not convey the information necessary for customers to reduce their electricity demand. In addition,

[31] Id.
[32] Direct Testimony of Tom Beach, October 27, 2015, pp. 6-11.

because photovoltaic systems are not dispatchable, NEM customers have no greater ability to respond to demand charges than non-NEM customers. As a result, demand charges essentially act as additional fixed charges to the customer, and therefore suffer from the same problems as increased fixed charges, in terms of sending improper price signals.

Q61. What impact do demand charges and increased customer charges have on customer incentives to use electricity more efficiently or install distributed generation?

A61. Demand charges and increased customer charges significantly reduce customers' incentive to use electricity more efficiently or to install distributed generation resources. The ultimate impact of these charges is greater energy consumption in the future relative to what would have occurred under the current rate design.

Q62. What impacts will this increased energy consumption have on customer costs?

A62. Higher electricity consumption will generally cause utilities to invest in new power plants, power lines, substations, and other capital projects sooner than would otherwise be the case. Higher electricity consumption may also increase the cost of compliance with environmental regulations, such as the Clean Power Plan. The end result of rate designs that do not encourage customers to implement cost-effective efficiency or distributed generation resources is that all customers will pay higher electricity costs as more utility investments are needed to meet higher electricity demand.

D. The Company's Proposal Violates the Principle of Equity

Q63. Please explain what is meant by "equity" in rate design.

A63. The concept of equity refers to treating similarly situated customers in a similar manner and avoiding "undue discrimination." To treat similar customers dissimilarly is

discriminatory to one or both groups of customers. The Company's proposal to create a new rate class for NEM customers is discriminatory.

Q64. Please explain why the Company's proposal is discriminatory.

A64. According to the Company's own cost-of-service study, the cost-of-service is not significantly different between NEM and non-NEM customers. With the corrections made to the Company cost-of-service analysis, described in Section V of my testimony, the cost-of-service for NEM customers is actually less than the cost-of-service of non-NEM customers. NVE's proposal creates significantly different rates for customers whose costs are very similar. This clearly constitutes "undue discrimination" between customers. Further, permitting such discriminatory treatment of NEM customers creates a poor precedent for future treatment of customers.

Q65. In what way does creating a new rate class set a bad precedent?

A65. The reasoning and logic used to justify a separate rate class for net-metered customers could easily be applied to other groups of customers not currently categorized as a sub-class. As explained above, the primary difference between residential NEM customers and residential non-NEM customers is the slight difference in load profile. But there is already significant variation of load profiles within the residential class, yet these customers are not forced into separate rate classes. If the Commission where to allow the utility to create a separate rate class for NEM customers, it could create a precedent for the formation of multiple new rate classes for all customers with even small differences in load.

Q66. Is the issue of customer equity already established as an important principle in Nevada?

A66. Yes. Nevada regulations require that a utility cannot set rates to reflect the marginal cost of serving that class, including seasonal or hourly differences, if the "rate would not be equitable".[33]

E. The Company's Proposal Violates the Principle of Simplicity, Understandability, and Customer Acceptability

Q67. In what ways does the Company's proposal violate the principle of simplicity, understandability, and customer acceptability?

A67. The Company's proposed rate structure would introduce a complex rate structure to residential customers that (a) is difficult for residential customers to understand, and (b) would reduce customer control of their bills. In general, such rate structures are not well understood and not readily accepted, particularly by residential and small commercial customers. The testimony of Tom Beach provides more detail on why demand charges are inappropriate for residential customers.[34] Furthermore, customers have frequently voiced their dissatisfaction when faced with a loss of control over their bills. For example, when Connecticut Light & Power proposed a significant increase in the fixed charge, many customers submitted comments opposing the charge. As one customer wrote, "If there has to be an increase, at least leave the control in the consumers' hands.

[33] NAC 704.662 1(c)(1).
[34] Direct Testimony of Tom Beach, October 27, 2015, pp. 6-11.

Charge based on the usage. At least you are not penalizing people who have sacrificed to conserve energy or cut their expenses."[35]

Q68. Is the issue of customer understandability already established as an important principle in Nevada?

A68. Yes. Nevada regulations require that a utility cannot set rates to reflect the marginal cost of serving that class, including seasonal or hourly differences, if the "expected level of understanding or acceptance of the rate by the customers of the class" would not serve the purpose of such a rate design.[36]

F. Additional Concerns with the Company's Proposal

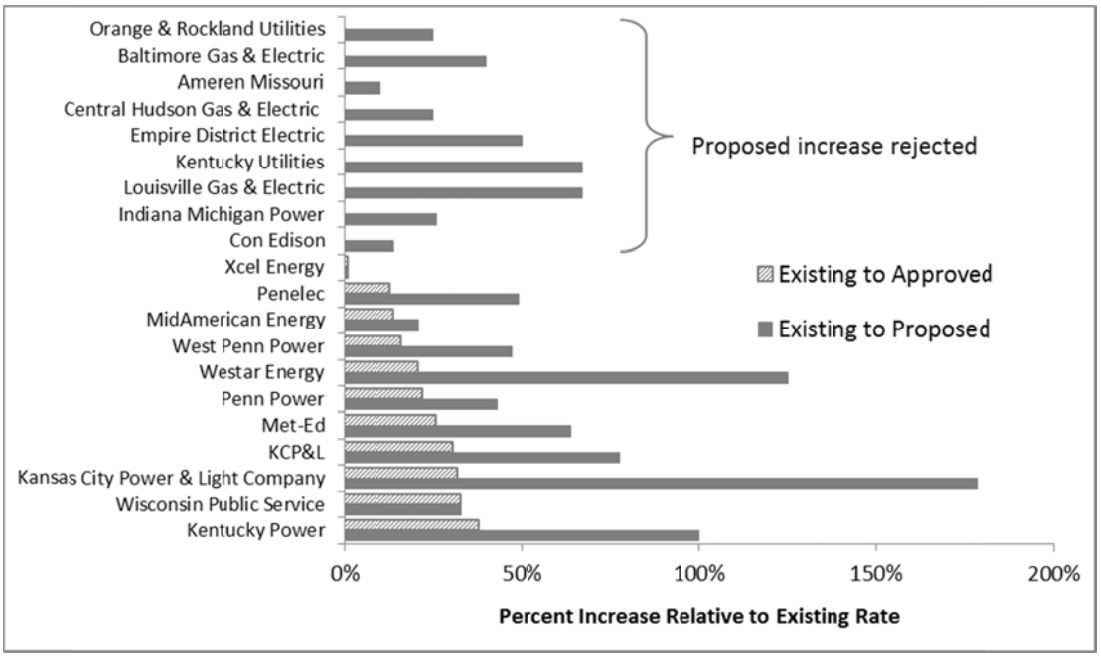
Q69. Do you have any further concerns with the Company's proposal?

A69. Yes. The Company's proposal is inconsistent with recent decisions from commissions in several states on this issue. Many utilities across the country have been requesting increased fixed charges in recent years. Many of these requests have been in the context of rate cases, while some of them are in the context of NEM dockets. In all cases there is a similar theme in the utility proposals: utilities are trying to ensure revenue recovery at the expense of the other ratemaking principles of efficiency, equity and customer acceptability. There has been a fairly consistent response from commissions across the country. Many commissions have completely rejected requests for an increase in fixed charges, while others have approved only a portion of the utility request. This trend is evident in Figure 3, which shows the percent difference between existing rates and

[35] Written comment of Deborah Pocsay, Docket 14-05-06; Conn. Dept. of Energy & Envtl. Prot. Pub. Util. Reg. Auth.; July 30, 2014.
[36] NAC 704.662 1(c)(2).

(a) the rates requested by utilities, and (b) the rates allowed by commissions.[37] The details and citations for this table are provided in **Exhibit TW-3.**

Figure 3. Recent Commission Orders on Requests for Increased Fixed Charges



Q70. Are you aware of recent commission orders rejecting increased fixed charges specifically for NEM customers?

A70. Yes. The Utah Public Service Commission recently rejected a proposal from PacifiCorp to impose a fixed facilities charge on all residential NEM customers. In making its decision, the Commission stated that

> We cannot determine from the record in this proceeding that this group of customers is distinguishable on a cost of service basis from the general body of residential customers. Simply using less energy than average, but about the same amount as the most typical of PacifiCorp's residential customers, is not sufficient

[37] Note that in these instances the utilities were requesting increased customer charges for all customers, not just NEM customers.

justification for imposing a charge, as there will always be customers who are below and above average in any class. Such is the nature of an average.[38]

Q71. Do you have any additional concerns with the Company's proposal?

A71. Yes. In addition to the incompatibility of the Company's proposal with widely accepted rate design principles, the Company's proposal to create a separate rate class for NEM customers is inconsistent with on-going changes in the electricity industry.

Q72. Why is a separate rate class for net metering customers inconsistent with on-going changes in the electricity industry?

A72. Electricity customers are being provided with increasing options to control their electricity consumption through energy efficiency, demand response, distributed generation, advanced meters, improved information and price signals, and more. Electricity storage and plug-in electric vehicles are expected to result in significantly different consumption patterns and load shapes in the not-too-distant future. The concept of creating a new rate class for every type of technology that has an impact on customers' load shapes, large or small, is impractical and will soon become unsustainable. It raises some very difficult questions: Should there be separate rate classes for customers that implement deep energy efficiency retrofits, participate in aggressive demand response programs, install smart meters with energy management systems, use plug-in electric vehicles, or install storage technologies? How then would the Company treat a customer that implements multiple measures such as energy

[38] Utah Pub. Serv. Comm'n., *In the Matter of the Application of Rocky Mountain Power for Authority to Increase its Retail Electric Utility Service Rates in Utah and for Approval of its Proposed Electric Service Schedules and Electric Service Regulations*, Report and Order, Docket No. 13-035-184, August 29, 2014, pp. 67-68.

efficiency, roof-top PV and battery storage? The potential number of permutations clearly make this path impractical and unsustainable.

VIII. RECOMMENDATIONS

Q73. Please summarize TASC's recommendations.

A73. TASC recommends that the Commission reject the Company's proposal. We recommend instead that the Commission require the Company to establish NEM2 rates and tariffs with the following elements:

1. Retain the existing rate classes.
2. Retain the existing rate structures for the existing rate classes.
3. Retain the current $35 per customer NEM application fee to cover the incremental customer account and customer service costs associated with NEM customers.[39]
4. Require NEM customers to pay upfront interconnection charges to cover the additional programming and inspection costs for new NEM installations. These charges would start at $80 (RS), $90 (RS-M), and $130 (GS); and would be updated at the next rate case to make sure they remain cost-based.[40]
5. Do not require NEM customers to install a meter to measure the NEM system generation. For those customers who choose to install generation meters, the Company should pay half of the cost of the meters in return for the load research data that the meters will provide.[41]

[39] Direct Testimony of Tom Beach, October 27, 2015, pp. 30-31.
[40] Id at 29-30. (TASC does not recommend an interconnection charge for the NPC LRS class, as the utilities' cost estimate for the bidirectional meters for this class is actually lower than the cost of regular meters for these customers.)
[41] Id at 27-28.

When these recommendations are applied to NVE's cost of service analysis, the difference between NEM and non-NEM customer costs is eliminated.[42] Further, when NVE's load shapes are corrected for the errors identified by TASC, the cost of service for NEM customers are estimated to be lower than those for non-NEM customers.[43] This proposal is compliant with SB 374, will prevent cost-shifting between net metering and non-net metering customers, will provide customers with simple, appropriate price signals regarding the value of NEM resources, will create downward pressure on electricity rates, and will help promote the development of customer-sited renewable resources in Nevada.

Q74: What is TASC's proposal for the "Interim" DG customers, who have chosen to take service under the current NEM1 structure but have signed up after NVE reached is 235 MW NEM cap?

A74: TASC recommends that the Commission require the Company to continue the NEM1 structure whereby DG customers can use net metering based on existing residential and small commercial rates. The Interim DG customers who have taken NEM service since September 1, 2015 should be allowed to simply continue under their present NEM1 service. TASC also recommends that the NEM application and interconnection fees that it has proposed should take effect when the order in this docket becomes effective. Thus, for both NEM1 and Interim DG customers, if they have not interconnected as of the effective date of this order, then they would pay the new interconnection fee.

Q75: If NEM2 rates are substantially different than NEM1 rates or TASC's proposal, how should existing DG customers be treated?

[42] Direct Testimony of William Monsen, October 27, 2015, p. 47-48.
[43] Id.

A75: TASC recommends that existing DG customers, including all those that initiated NEM service prior to the Commission's final order on NEM2 rates, be grandfathered under NEM1 rates and tariff rules.

Q76: If NEM2 rates are substantially different than NEM1 rates or TASC's proposal, when should the Commission implement NEM2 rates?

A76: The Commission can adopt a new NEM2 rate design by December 31, 2015, as the statute requires. However, as discussed in more detail in the testimony of Mr. Beach, a new NEM2 rate design will not impact other ratepayers until new rates take effect after the utilities' next general rate case (GRC) decisions.[44] Accordingly, TASC recommends that the Commission allow new DG customers who commence service after December 31, 2015 to take service under the existing "interim" NEM1 rates until the utility GRCs, and then move to the "permanent" NEM2 rate when rates approved in those GRCs take effect.

Q77. Does this conclude your direct testimony?

A77. Yes, it does.

[44] Direct Testimony of Tom Beach, October 27, 2015, pp. 48-51.

AFFIRMATION

STATE OF Massachusetts)
) ss.
COUNTY OF Middlesex)

I, TIM WOOLF, do hereby swear under penalty of perjury the following:

That I am the person identified in the attached Prepared Direct Testimony, and that such testimony was prepared by me or under my direct supervision; that the answers and information set forth therein are true to the best of my knowledge and belief; and that if asked questions set forth herein; my answers thereto would, under oath, remain the same.

Tim Woolf
TIM WOOLF

Subscribed and sworn to (or affirmed) before me on this 26 day of October, 2015, by TIM WOOLF, proved to me on the basis of satisfactory evidence to be the person who appeared before me.

NOTARY PUBLIC

JANICE CONYERS
Notary Public
Commonwealth of Massachusetts
My Commission Expires
July 27, 2018

Docket Nos. 15-07041/42

Exhibit TW-1

Tim Woolf, Vice President

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twoolf@synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. *Vice President*, 2011 – present.

Provides expert consulting on the economic, regulatory, consumer, environmental, and public policy implications of the electricity and gas industries. The primary focus of work includes technical and economic analyses, electric power system planning, climate change strategies, energy efficiency programs and policies, renewable resources and related policies, power plant performance and economics, air quality, and many related aspects of consumer and environmental protection.

Massachusetts Department of Public Utilities, Boston, MA. *Commissioner*, 2007 – 2011.

Oversaw a significant expansion of clean energy policies as a consequence of the Massachusetts Green Communities Act, including an aggressive expansion of ratepayer-funded energy efficiency programs; the implementation of decoupled rates for electric and gas companies; an update of the DPU energy efficiency guidelines; the promulgation of net metering regulations; review of smart grid pilot programs; and review of long-term contracts for renewable power. Oversaw six rate case proceedings for Massachusetts electric and gas companies. Played an influential role in the development of price responsive demand proposals for the New England wholesale energy market. Served as President of the New England Conference of Public Utility Commissioners from 2009-2010. Served as board member on the Energy Facilities Siting Board from 2007-2010. Served as co-chair of the Steering Committee for the Northeast Energy Efficiency Partnership's Regional Evaluation, Measurement and Verification Forum.

Synapse Energy Economics Inc., Cambridge, MA. *Vice President*, 1997 – 2007.

Tellus Institute, Boston, MA. *Senior Scientist, Manager of Electricity Program*, 1992 – 1997.

Association for the Conservation of Energy, London, England. *Research Director*, 1991 – 1992.

Massachusetts Department of Public Utilities, Boston, MA. *Staff Economist*, 1989 – 1990.

Massachusetts Office of Energy Resources, Boston, MA. *Policy Analyst*, 1987 – 1989.

Energy Systems Research Group, Boston, MA. *Research Associate*, 1983 – 1987.

Union of Concerned Scientists, Cambridge, MA. *Energy Analyst*, 1982-1983.

EDUCATION

Boston University, Boston, MA
Master of Business Administration, 1993

London School of Economics, London, England
Diploma, Economics, 1991

Tufts University, Medford, MA
Bachelor of Science in Mechanical Engineering, 1982

Tufts University, Medford, MA
Bachelor of Arts in English, 1982

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Woolf, T., C. Neme, P. Stanton, R. LeBaron, K. Saul-Rinaldi, S. Cowell. 2014. *The Resource Value Framework: Reforming Energy Efficiency Cost-Effectiveness Screening.* The National Efficiency Screening Project for the National Home Performance Council.

Malone, E. T. Woolf, K. Takahashi, S. Fields. 2013. "Appendix D: Energy Efficiency Cost-Effectiveness Tests." *Readying Michigan to Make Good Energy Decisions: Energy Efficiency.* Synapse Energy Economics for the Council of Michigan Foundations.

Stanton, E. A., S. Jackson, G. Keith, E. Malone, D. White, T. Woolf. 2013. *A Clean Energy Standard for Massachusetts.* Synapse Energy Economics for the Massachusetts Clean Energy Center and the Massachusetts Departments of Energy Resources, Environmental Protection, and Public Utilities.

Woolf, T., K. Saul-Rinaldi, R. LeBaron, S. Cowell, P. Stanton. 2013. *Recommendations for Reforming Energy Efficiency Cost-Effectiveness Screening in the United States.* Energy Efficiency Screening Coalition for the National Home Performance Council.

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Woolf, T., W. Steinhurst, E. Malone, K. Takahashi. 2012. *Energy Efficiency Cost-Effectiveness Screening: How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs.* Synapse Energy Economics for Regulatory Assistance Project and Vermont Housing Conservation Board.

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Woolf, T., D. White, C. Chen, A. Sommer. 2005. *Potential Cost Impacts of a Renewable Portfolio Standard in New Brunswick*. Synapse Energy Economics for New Brunswick Department of Energy.

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Environmental Institute for the North American Commission for Environmental Cooperation, with the Global Development and Environment Institute.

Woolf, T. 2001. *Repowering the Midwest: The Clean Energy Development Plan for the Heartland*. Synapse Energy Economics for the Environmental Law and Policy Center and a coalition of Midwest environmental advocates.

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Woolf, T., B. Biewald, D. Glover. 1998. *Competition and Market Power in the Northern Maine Electricity Market*. Synapse Energy Economics and Failure Exponent Analysis for the Maine Public Utilities Commission.

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Woolf, T. 1994. "Retail Competition in the Electricity Industry: Lessons from the United Kingdom." *The Electricity Journal* 7 (5): 56–63.

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Woolf, T. 1993. "It is Time to Account for the Environmental Costs of Energy Resources." *Energy and Environment* 4 (1): 1–29.

Woolf, T. 1992. "Developing Integrated Resource Planning Policies in the European Community." *Review of European Community & International Environmental Law* 1 (2) 118–125.

PRESENTATIONS

Woolf, T. 2014. "The Resource Value Framework: Reforming Energy Efficiency Cost-Effectiveness Screening." Presentation at the ACEEE Summer Study, August 21, 2014.

Woolf, T. 2013. "Recommendations for Reforming Energy Efficiency Cost-Effectiveness Screening in the United States." Presentation at the National Association of Regulatory Commissioners Annual Meeting, November 18, 2013.

Woolf, T., B. Biewald, and J. Migden-Ostrander. 2013. "NARUC Risk Workshop for Regulators." Presentation at the Mid-Atlantic Conference of Regulatory Utility Commissioners, June 2013.

Woolf, T. 2013. "Energy Efficiency Screening: Accounting for 'Other Program Impacts' & Environmental Compliance Costs." Presentation for Regulatory Assistance Project Webinar, March 2013.

Woolf, T. 2013. "Energy Efficiency: Rates, Bills, Participants, Screening, and More." Presentation at Connecticut Energy Efficiency Workshop, March 2013.

Woolf T. 2013. "Best Practices in Energy Efficiency Program Screening." Presentation for SEE Action Webinar, March 2013.

Woolf, T. 2013. "Energy Efficiency Screening: Application of the TRC Test." Presentation for Energy Advocates Webinar, January 2013.

Woolf, T. 2012. "Best Practices in Energy Efficiency Program Screening." Presentation for American Council for an Energy-Efficient Economy Webinar, December 2012.

Woolf, T. 2012. "In Pursuit of All Cost-Effective Energy Efficiency." Presentation at Sierra Club Boot Camp, October 2012.

Woolf, T. 2012. "Best Practices in Energy Efficiency Program Screening." Presentation at NARUC Summer Meetings – Energy Efficiency Cost-Effectiveness Breakfast, July 2012.

Woolf, T. 2011. "Energy Efficiency Cost-Effectiveness Tests." Presentation at the Northeast Energy Efficiency Partnerships Annual Meeting, October 2011.

Woolf, T. 2011. "Why Consumer Advocates Should Support Decoupling." Presentation at the 2011 ACEEE National Conference on Energy Efficiency as a Resource, September 2011.

Woolf, T. 2011. "A Regulator's Perspective on Energy Efficiency." Presentation at the Efficiency Maine Symposium *In Pursuit of Maine's Least-Cost Energy*, September 2011.

Woolf, T. 2010. "Bill Impacts of Energy Efficiency Programs: The Importance of Analyzing and Managing Rate and Bill Impacts." Presentation at the Energy in the Northeast Conference, Law Seminar International, September 2010.

Woolf, T. 2010. "Bill Impacts of Energy Efficiency Programs: The Implications of Bill Impacts in Developing Policies to Motivate Utilities to Implement Energy Efficiency." Presentation to the State Energy Efficiency Action Network, Utility Motivation Work Group, November 2010.

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Woolf, T. 2009. "Price-Responsive Demand in the New England Wholesale Energy Market: Description of NECPUC's Limited Supply-Side Proposal." Presentation at the NEPOOL Markets Committee Meeting, November 2009.

Woolf, T. 2009. "Demand Response in the New England Wholesale Energy Market: How Much Should We Pay for Demand Resources?" Presentation at the New England Electricity Restructuring Roundtable, October 2009.

Woolf, T. 2008. "Promoting Demand Resources in Massachusetts: A Regulator's Perspective." Presentation at the Energy Bar Association, Northeast Chapter Meeting, June 2008.

Woolf, T. 2008. "Turbo-Charging Energy Efficiency in Massachusetts: A DPU Perspective." Presentation at the New England Electricity Restructuring Roundtable, April 2008.

Woolf T. 2002. "A Renewable Portfolio Standard for New Brunswick." Presentation to the New Brunswick Market Design Committee, January 10, 2002.

Woolf, T. 2001. "Potential for Wind and Renewable Resource Development in the Midwest." Presentation at WINDPOWER 2001 in Washington DC, June 7, 2001.

Woolf T. 1999. "Challenges Faced by Clean Generation Resources Under Electricity Restructuring." Presentation at the Symposium on the Changing Electric System in Florida and What it Means for the Environment in Tallahassee, FL, November 1999.

Woolf, T. 2000. "Generation Information Systems to Support Renewable Portfolio Standards, Generation Performance Standards and Environmental Disclosure." Presentation at the Massachusetts Restructuring Roundtable on behalf of the Union of Concerned Scientists, March 2000.

Woolf, T. 1998. "New England Tracking System Project: An Electricity Tracking System to Support a Wide Range of Restructuring-Related Policies." Presentation at the Ninth Annual Energy Services Conference and Exposition in Orlando, FL, December 1998.

Woolf, T. 2000. "Comments of the Citizens Action Coalition of Indiana." Presentation at Workshop on Alternatives to Traditional Generation Resources, June 2000.

Woolf, T. 1996. "Overview of IRP and Introduction to Electricity Industry Restructuring." Training session provided to the staff of the Delaware Public Service Commission, April 1996.

Woolf, T. 1995. "Competition and Regulation in the UK Electric Industry." Presentation at the Illinois Commerce Commission's workshop on Restructuring the Electric Industry, August 1995.

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TESTIMONY

New Jersey Board of Public Utilities (Docket No. ER14030250): Direct testimony on Rockland Electric Company's petition for investments in advanced metering infrastructure. On behalf of the New Jersey Division of Rate Counsel. September 4, 2015.

Utah Public Service Commission (Docket No. 14-035-114): Direct, rebuttal, and surrebuttal testimony on the benefit-cost framework for net energy metering. On behalf of Utah Clean Energy, the Alliance for Solar Choice, and Sierra Club. July 30, 2015, September 9, 2015, and September 29, 2015.

Nova Scotia Utility and Review Board (Matter No. M06733): Direct testimony on EfficiencyOne's 2016-2018 demand-side management plan. On behalf of the Nova Scotia Utility and Review Board. June 2, 2015.

Missouri Public Service Commission (Case No. ER-2014-0370): Direct and surrebuttal testimony on the topic of Kansas City Power and Light's rate design proposal. On behalf of Sierra Club. April 16, 2015 and June 5, 2015.

Missouri Public Service Commission (File No. EO-2015-0055): Rebuttal and surrebuttal testimony on the topic of Ameren Missouri's 2016-2018 Energy Efficiency Plan. On behalf of Sierra Club. March 20, 2015 and April 27, 2015.

Florida Public Service Commission (Dockets No. 130199-EI et al.): Direct testimony on the topic of setting goals for increasing the efficiency of energy consumption and increasing the development of demand-side renewable energy systems. On behalf of the Sierra Club. May 19, 2014.

Massachusetts Department of Public Utilities (Docket No. DPU 14-__): Testimony regarding the cost of compliance with the Global Warming Solution Act. On behalf of the Massachusetts Department of Energy Resources and the Department of Environmental Protection. May 16, 2014.

Kentucky Public Service Commission (Case No. 2014-00003): Direct testimony regarding Louisville Gas and Electric Company and Kentucky Utilities Company's proposed 2015-2018 demand-side management and energy efficiency program plan. On behalf of Wallace McMullen and the Sierra Club. April 14, 2014.

Maine Public Utilities Commission (Docket No. 2013-168): Direct and surrebuttal testimony regarding policy issues raised by Central Maine Power's 2014 Alternative Rate Plan, including recovery of capital costs, a Revenue Index Mechanism proposal, and decoupling. On behalf of the Maine Public Advocate Office. December 12, 2013 and March 21, 2014.

Colorado Public Utilities Commission (Docket No. 13A-0686EG): Answer and surrebuttal testimony regarding Public Service Company of Colorado's proposed energy savings goals. On behalf of the Sierra Club. October 16, 2013 and January 21, 2014.

Kentucky Public Service Commission (Case No. 2012-00578): Direct testimony regarding Kentucky Power Company's economic analysis of the Mitchell Generating Station purchase. On behalf of the Sierra Club. April 1, 2013.

Nova Scotia Utility and Review Board (Matter No. M04819): Direct testimony regarding Efficiency Nova Scotia Corporation's Electricity Demand Side Management Plan for 2013 – 2015. On behalf of the Counsel to Nova Scotia Utility and Review Board. May 22, 2012.

Missouri Office of Public Counsel (Docket No. EO-2011-0271): Rebuttal testimony regarding IRP rule compliance. On behalf of the Missouri Office of the Public Counsel. October 28, 2011.

Nova Scotia Utility and Review Board (Matter No. M03669): Direct testimony regarding Efficiency Nova Scotia Corporation's Electricity Demand Side Management Plan for 2012. On behalf of the Counsel to Nova Scotia Utility and Review Board. April 8, 2011.

Rhode Island Public Utilities Commission (Docket No. 3790): Direct testimony regarding National Grid's Gas Energy Efficiency Programs. On behalf of the Division of Public Utilities and Carriers. April 2, 2007.

North Carolina Utilities Commission (Docket E-100, Sub 110): Filed comments with Anna Sommer regarding the Potential for Energy Efficiency Resources to Meet the Demand for Electricity in North Carolina. Synapse Energy Economics on behalf of the Southern Alliance for Clean Energy. February 2007.

Rhode Island Public Utilities Commission (Docket No. 3765): Direct and Surrebuttal testimony regarding National Grid's Renewable Energy Standard Procurement Plan. On behalf of the Division of Public Utilities and Carriers. January 17, 2007 and February 20, 2007.

Minnesota Public Utilities Commission (Docket Nos. CN-05-619 and TR-05-1275): Direct testimony regarding the potential for energy efficiency as an alternative to the proposed Big Stone II coal project. On behalf of the Minnesota Center for Environmental Advocacy, Fresh Energy, Izaak Walton League of America, Wind on the Wires and the Union of Concerned Scientists. November 29, 2006.

Rhode Island Public Utilities Commission (Docket No. 3779): Oral testimony regarding the settlement of Narragansett Electric Company's 2007 Demand-Side Management Programs. On behalf of the Division of Public Utilities and Carriers. November 24, 2006.

Nevada Public Utilities Commission (Docket Nos. 06-04002 & 06-04005): Direct testimony regarding Nevada Power Company's and Sierra Pacific Power Company's Renewable Portfolio Standard Annual Report. On behalf of the Nevada Bureau of Consumer Protection. October 26, 2006

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South Dakota Public Utilities Commission (Docket No. EL04-016): Direct testimony regarding the avoided costs of the Java Wind Project. On behalf of the South Dakota Public Utilities Commission Staff. February 18, 2005.

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British Columbia Utilities Commission. Direct testimony regarding the Power Smart programs contained in BC Hydro's Revenue Requirement Application 2004/05 and 2005/06. On behalf of the Sierra Club of Canada, BC Chapter. April 20, 2004.

Maryland Public Utilities Commission (Case No. 8973): Oral testimony regarding proposals for the PJM Generation Attributes Tracking System. On behalf of the Maryland Office of People's Counsel. December 3, 2003.

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California Public Utilities Commission (Rulemaking 01-10-024): Direct testimony regarding the market price benchmark for the California renewable portfolio standard. On behalf of the Union of Concerned Scientists. April 1, 2003.

Québec Régie de l'énergie (Docket R-3473-01): Direct testimony with Philp Raphals regarding Hydro-Québec's Energy Efficiency Plan: 2003-2006. On behalf of Regroupment national des Conseils régionaux de l'environnement du Québec. February 5, 2003.

Connecticut Department of Public Utility Control (Docket No. 01-10-10): Direct testimony regarding the United Illuminating Company's service quality performance standards in their performance-based ratemaking mechanism. On behalf of the Connecticut Office of Consumer Counsel. April 2, 2002.

Nevada Public Utilities Commission (Docket No. 01-7016): Direct testimony regarding the Nevada Power Company's Demand-Side Management Plan. On behalf of the Bureau of Consumer Protection, Office of the Attorney General. September 26, 2001.

United States Department of Energy (Docket Number-EE-RM-500): Comments with Bruce Biewald, Daniel Allen, David White, and Lucy Johnston of Synapse Energy Economics regarding the Department of Energy's proposed rules for efficiency standards for central air conditioners and heat pumps. On behalf of the Appliance Standards Awareness Project. December 2000.

US Department of Energy (Docket EE-RM-500): Oral testimony at a public hearing on marginal price assumptions for assessing new appliance efficiency standards. On behalf of the Appliance Standards Awareness Project. November 2000.

Connecticut Department of Public Utility Control (Docket No. 99-09-03 Phase II): Direct testimony regarding Connecticut Natural Gas Company's proposed performance-based ratemaking mechanism. On behalf of the Connecticut Office of Consumer Counsel. September 25, 2000.

Mississippi Public Service Commission (Docket No. 96-UA-389): Oral testimony regarding generation pricing and performance-based ratemaking. On behalf of the Mississippi Attorney General. February 16, 2000.

Delaware Public Service Commission (Docket No. 99-328): Direct testimony regarding maintaining electric system reliability. On behalf of Delaware Public Service Commission Staff. February 2, 2000.

Delaware Public Service Commission (Docket No. 99-328): Filed expert report ("Investigation into the July 1999 Outages and General Service Reliability of Delmarva Power & Light Company," jointly authored with J. Duncan Glover and Alexander Kusko). Synapse Energy Economics and Exponent Failure Analysis Associates on behalf the Delaware Public Service Commission Staff. February 1, 2000.

New Hampshire Public Service Commission (Docket No. 99-099 Phase II): Oral testimony regarding standard offer services. On behalf of the Campaign for Ratepayers Rights. January 14, 2000.

West Virginia Public Service Commission (Case No. 98-0452-E-GI): Rebuttal testimony regarding codes of conduct. On behalf of the West Virginia Consumer Advocate Division. July 15, 1999.

West Virginia Public Service Commission (Case No. 98-0452-E-GI): Direct testimony regarding codes of conduct and other measures to protect consumers in a restructured electricity industry. On behalf of the West Virginia Consumer Advocate Division. June 15, 1999.

Public Service Commission of West Virginia (Case No. 98-0452-E-GI): Filed expert report ("Measures to Ensure Fair Competition and Protect Consumers in a Restructured Electricity Industry in West Virginia," jointly authored with Jean Ann Ramey and Theo MacGregor) in the matter of the General Investigation to determine whether West Virginia should adopt a plan for open access to the electric power supply market and for the development of a deregulation plan. Synapse Energy Economics and MacGregor Energy Consultancy on behalf of the West Virginia Consumer Advocate Division. June 1999.

Massachusetts Department of Telecommunications and Energy (DPU/DTE 97-111): Direct testimony regarding Commonwealth Electric Company's energy efficiency plan, and the role of municipal aggregators in delivering demand-side management programs. On behalf of Cape and Islands Self-Reliance Corporation. January 1998.

Delaware Public Service Commission (DPSC 97-58): Direct testimony regarding Delmarva Power and Light's request to merge with Atlantic City Electric. On behalf of Delaware Public Service Commission Staff. May 1997.

Delaware Public Service Commission (DPSC 95-172): Oral testimony regarding Delmarva's integrated resource plan and DSM programs. On behalf of the Delaware Public Service Commission Staff. May 1996.

Colorado Public Utilities Commission (5A-531EG): Direct testimony regarding the impact of proposed merger on DSM, renewable resources and low-income DSM. On behalf of the Colorado Office of Energy Conservation. April 1996.

Colorado Public Utilities Commission (3I-199EG): Direct testimony regarding the impacts of increased competition on DSM, and recommendations for how to provide utilities with incentives to implement DSM. On behalf of the Colorado Office of Energy Conservation. June 1995.

Colorado Public Utilities Commission (5R-071E): Oral testimony on the Commission's integrated resource planning rules. On behalf of the Colorado Office of Energy Conservation. July 1995.

Colorado Public Utilities Commission (3I-098E): Direct testimony on the Public Service Company of Colorado's DSM programs and integrated resource plans. On behalf of the Colorado Office of Energy Conservation. April 1994.

Delaware Public Service Commission (Docket No. 96-83): Filed comments regarding the Investigation of Restructuring the Electricity Industry in Delaware (Tellus Institute Study No. 96-99). On behalf of the Staff of the Delaware Public Service Commission. November 1996.

Colorado Public Utilities Commission (Docket No. 96Q-313E): Filed comments in response to the Questionnaire on Electricity Industry Restructuring (Tellus Institute Study No. 96-130-A3). On behalf of the Colorado Governor's Office of Energy Conservation. October 1996.

State of Vermont Public Service Board (Docket No. 5854): Filed expert report (Tellus Institute Study No. 95-308) regarding the Investigation into the Restructuring of the Electric Utility Industry in Vermont. On behalf of the Vermont Department of Public Service. March 1996.

Pennsylvania Public Utility Commission (Docket No. I-00940032): Filed comments (Tellus Institute Study No. 95-260) regarding an Investigation into Electric Power Competition. On behalf of The Pennsylvania Office of Consumer Advocate. November 1995.

New Jersey Board of Public Utilities (Docket No. EX94120585Y): Initial and reply comments ("Achieving Efficiency and Equity in the Electricity Industry Through Unbundling and Customer Choice," Tellus Institute Study No. 95-029-A3) regarding an investigation into the future structure of the electric power industry. On behalf of the New Jersey Division of Ratepayer Advocate. September 1995.

Resume dated September 2015

Docket Nos. 15-07041/42

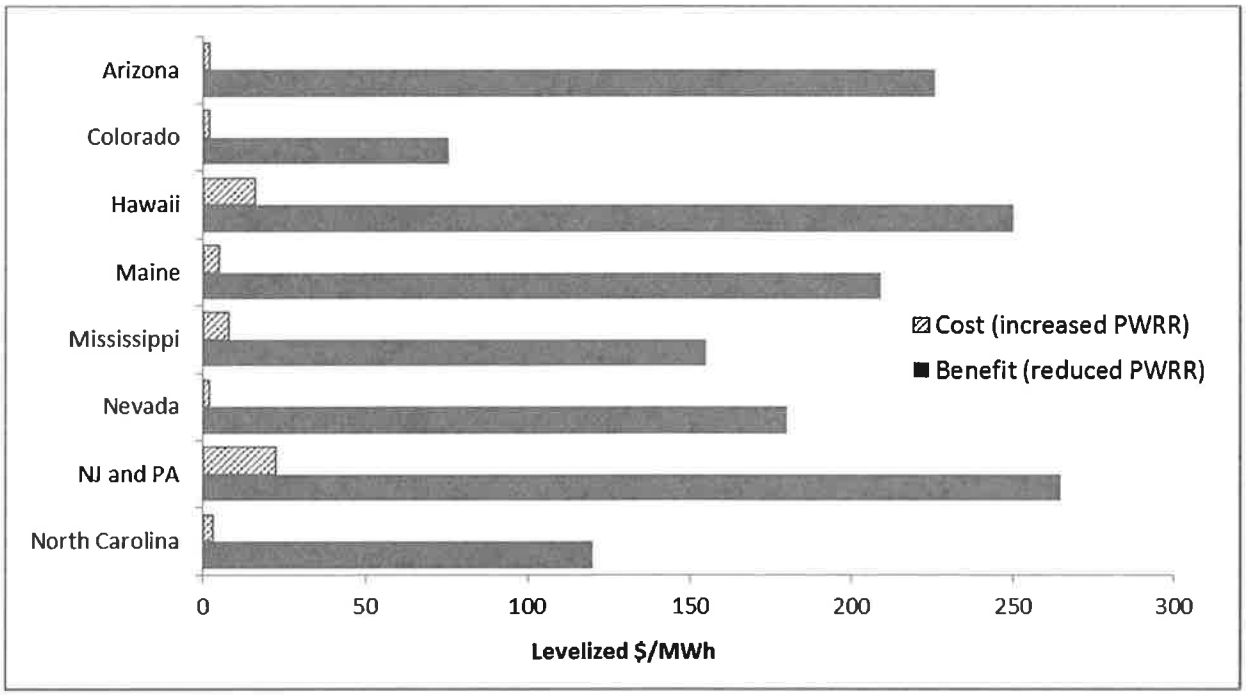
Exhibit TW-2

Exhibit TW-2

Analyzing the Costs and Benefits of Net Energy Metering in terms of PWRR Framework:

Avoided costs, like avoided energy, capacity, line losses, etc., put downward pressure on revenue requirements and are a benefit from a Present Value of Revenue Requirements (PWRR) perspective. Costs associated with integration, administration, and interconnection of net metering can put upward pressure on revenue requirements. Over the past few years, at least eight net metering studies have quantified revenue requirement costs and benefits, though not always explicitly, see Table 1. It is important to note that some of the benefits included in several of these studies – though they are very real benefits – don't result in a downward pressure on revenue requirements. Such benefits include environmental externality costs, reduced risk, fuel hedging value, economic development, and job impacts. The reports listed in Table 1 and the values displayed in Figure 1 are adjusted to exclude the value of these benefits from the reported PWRR benefits. The PWRR costs shown in Table 1 and Figure 1 only include integration, interconnection, and administration costs.[1] Other costs are sometimes reported that do not actually translate into increased pressure on revenue requirements, most notably lost revenues associated with reduced sales.

Figure 1. PWRR Costs and Benefits of NEM from Various Studies



[1] Historically, some utilities have offered incentives to customers that install solar panels (or other NEM installations). While these incentive payments do put upward pressure on revenue requirements, the incentives themselves are removed from Table 1 and Figure 1 to help compare costs and benefits when utility-specific incentives are taken out of the equation.

Table 1. Net Metering Studies that report PWRR benefits and costs

Year	State	Funded / Commissioned by:	Prepared by:	Benefit ($/MWh)	Cost ($/MWh)	Benefit Cost Ratio
2013	Arizona	---------	Crossboarder Energy	226	2	113.00
2013	Colorado	Xcel Energy	Xcel Energy	75.4	1.8	41.89
2014	Hawaii	HI PUC	E3	287	16	17.94
2015	Maine	Maine Public Utilities Commission	Clean Power Research, et. al.	143	5	28.60
2014	Mississippi	Mississippi Public Service Commission	Synapse Energy Economics	155	8	19.38
2014	Nevada	State of Nevada Public Utilities Commission	E3	180	2	90.00
2012	NJ and PA	Mid-Atlantic Solar Energy Industries Association & Pennsylvania Solar Energy Industries Association	Clean Power Research	265.6	22.5	11.81
2013	North Carolina	NC Sustainable Energy Association	Crossborder Energy	130.5	3	43.50

Source: Synapse Energy Economics, 2015.

Arizona:

The Arizona study presents 20-year levelized values in 2014 dollars on page 2. Benefits include avoided energy, generation capacity, ancillary services, transmission, distribution, environmental and renewables. The avoided environmental benefits amount to 0.1 cents/kWh ($1/MWh) and appear to account for non-CO_2 market costs of NO_x, SO_x, and water treatment costs.[2] The benefits range from $215/MWh to $237/MWh. Integration costs are presented as $2/MWh.

[2] Crossborder Energy. 2013. *The Benefits and Costs of Solar Distributed Generation for Arizona Public Service.* Page 12 and 13.

Colorado:

The Colorado study, performed by the utility Xcel energy, presents 20-year levelized net avoided costs under three cases, including a base case, in the report's Table 1.[3] The benefits include avoided energy, emissions, capacity, distribution, transmission and line losses. It also includes an avoided hedge value of $6.60/MWh and "solar integration costs" of $1.80/MWh. Removing both the hedge value benefit and the solar integration costs yields a revenue requirement value of $75.6/MWh. All of these benefits and costs reflect the study's base case assumptions.

Hawaii:

E3 presents the 20-year levelized costs and benefits of PV on the various Hawaii utilities (HECO, MECO, HELCO, and KIUC). The integration costs ($6/MWh) and interconnection costs ($10/MWh to account for incremental T&D costs) are included in the study, but the T&D values are proxy values from Western Electricity Coordinating Council (WECC) meta-analysis.[4] The base case 20-year levelized avoided costs for PV for KIUC is $213/MWh,[5] for MECO is $234/MWh,[6] for HELCO is $242/MWh,[7] and for HECO is $287.[8]

Maine:

The Maine study presents the 25-year levelized market and societal benefits in $/kWh for Central Maine Power Company (CMP) and the first year benefits for all three Maine utilities. For CMP, the long-term market benefits are calculated at $138/MWh, which includes a $5/MWh integration cost and excludes a $66/MWh Market Price Response benefit.[9] Adjusting for these two values yields a gross revenue requirement benefit of $209/MWh.

Mississippi:

The Mississippi study presents base case 25-year levelized benefits associated with energy, capacity, T&D, system losses, environmental compliance, and risk. Adjusting for the $15/MWh risk benefit, the total benefit to revenue requirements is $155/MWh.[10] The administrative costs associated with a net metering program are also included, estimated in the study to translate to a value of $8/MWh.

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[3] Xcel Energy. 2013. *Costs and Benefits of Distributed Solar Generation on the Public Service Company of Colorado System*. Executive Summary, page V.

[4] E3 for Hawaii PUC. 2014. *Evaluation of Hawaii's RE Policy*. Page 55 and 56.

[5] Ibid. Page 53.

[6] Ibid. Page 50.

[7] Ibid. Page 47.

[8] Ibid. Page 43.

[9] Clean Power Research, Sustainable Energy Advantage, & Pace Law School Energy and Climate Center for Maine PUC. 2015. *Maine Distributed Solar Valuation Study*. Page 50.

[10] Synapse Energy Economics for Mississippi PSC. 2014. *Net Metering in Mississippi*. Page 38.

Nevada

E3 estimates the total avoided utility cost to be 180/MWh and the "incentive, program, and integration costs" to be $6/MWh.[11] the integration costs where assumed to be $2/MWh[12] and the program costs appear negligible.

New Jersey and Pennsylvania:

The New Jersey and Pennsylvania study reports the levelized value of solar for seven locations. The highest reported value was in Scranton and the lowest value was reported in Atlantic City. The values presented in the report where on a net basis (and included solar penetration costs between $22-$23/MWh).[13] They also included economic development value. To calculate the gross benefit on revenue requirements, these values where removed from the net value.

North Carolina:

The North Carolina study presents 15-year levelized values in 2013 dollars per kWh. The benefits are presented for DEC, DEP, DNCP (Duke Energy Carolina, Progress). The costs are reported to be 0.3 cents per kWh ($3/MWh). The study also includes an estimated range of lost revenues. Because lost revenues are not a cost under the UCT framework, they are excluded. A high/low range of benefits were presented for each benefit category (energy, line losses, generation capacity, transmission capacity, avoided emissions, and avoided renewables). The low avoided emissions reflect Duke's IRP base case (a regulatory compliance value) but the high case reflects the social cost of carbon (an externality value). The lowest benefit value presented by the study is $93 per MWh. The high value presented is $165/MWh, but that includes $22/MWh for the social cost of carbon. The high value presented in Table 1 preserves $4/MWh of the social cost of carbon amount for CO_2 compliance costs, but excludes the remaining $18/MWh of the social cost of carbon. (Figure 1 displays the midpoint of the benefits and costs.)

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[11] E3 for Nevada PUC. 2014. *Nevada Net Energy Metering Impacts Evaluation*. Page 96.

[12] Ibid. Page 61.

[13] Clean Power Research for Mid-Atlantic & Pennsylvania Solar Energy Industries Associations. 2012. *The Value of Distributed Solar Electric Generation to NJ and PA*. Page 17.

Docket Nos. 15-07041/42

Exhibit TW-3

EXHIBIT TW-3

Table 1. List of Utility Requests to Increase Fixed Charges, Proposed Versus Approved

Utility	State	Application Filed	Existing	Proposed	Approved	Existing to Proposed	Existing to Approved	Date	Docket
Kentucky Power	KY	12/23/2014	$8.00	$16.00	$11.00	**100%**	**38%**	9/24/2015	15-WSEE-115-RTS
Wisconsin Public Service	MI	10/17/2014	$9.00	$12.00	$12.00	**33%**	**33%**	6/17/2015	15-E-0050
Kansas City Power & Light Company	MO	10/30/2014	$9.00	$25.00	$11.88	**178%**	**32%**	6/22/2015	2014-00396
KCP&L	KS	1/2/2015	$10.71	$19.00	$14.00	**77%**	**31%**	8/14/2015	U-17698
Met-Ed	PA	8/4/2014	$8.11	$13.29	$10.25	**64%**	**26%**	6/30/2015	2014-00372
Penn Power	PA	8/4/2014	$8.89	$12.71	$10.85	**43%**	**22%**	6/30/2015	2014-00371
Westar Energy	KS	3/2/2015	$12.00	$27.00	$14.50	**125%**	**21%**	9/2/2015	ER-2014-0370
West Penn Power	PA	8/4/2014	$5.00	$7.35	$5.81	**47%**	**16%**	4/23/2015	U-17669
MidAmerican Energy	SD	8/4/2014	$7.00	$8.50	$8.00	**21%**	**14%**	3/25/2015	U-17710
Penelec	PA	8/4/2014	$7.98	$11.92	$9.99	**49%**	**13%**	6/24/2015	ER-2014-0351
Xcel Energy	MI	10/3/2014	$8.65	$8.75	$8.75	**1%**	**1%**	4/9/2015	R-2014-2428743
Con Edison	NY	1/30/2015	$15.76	$18.00	$15.76	**14%**	**0%**	4/9/2015	R-2014-2428745
Indiana Michigan Power	MI	12/15/2014	$7.25	$9.10	$7.25	**26%**	**0%**	6/17/2015	EL-14-072
Louisville Gas & Electric	KY	11/26/2014	$10.75	$18.00	$10.75	**67%**	**0%**	4/9/2015	R-201402428742
Kentucky Utilities	KY	11/26/2014	$10.75	$18.00	$10.75	**67%**	**0%**	4/9/2015	R-2014-2428744
Empire District Electric	MO	8/29/2014	$12.52	$18.75	$12.52	**50%**	**0%**	6/17/2015	14-E-0318
Central Hudson Gas & Electric	NY	7/25/2014	$24.00	$30.00	$24.00	**25%**	**0%**	4/29/2015	ER-2014-0258
Ameren Missouri	MO	7/3/2014	$8.00	$8.77	$8.00	**10%**	**0%**	12/4/2014	9355
Baltimore Gas & Electric	MD	7/2/2014	$7.50	$10.50	$7.50	**40%**	**0%**	9/10/2015	15-KCPE-116-RTS
Orange & Rockland Utilities	NY	11/14/2014	$20.00	$25.00	$20.00	**25%**	**0%**	10/16/2015	14-E-0493

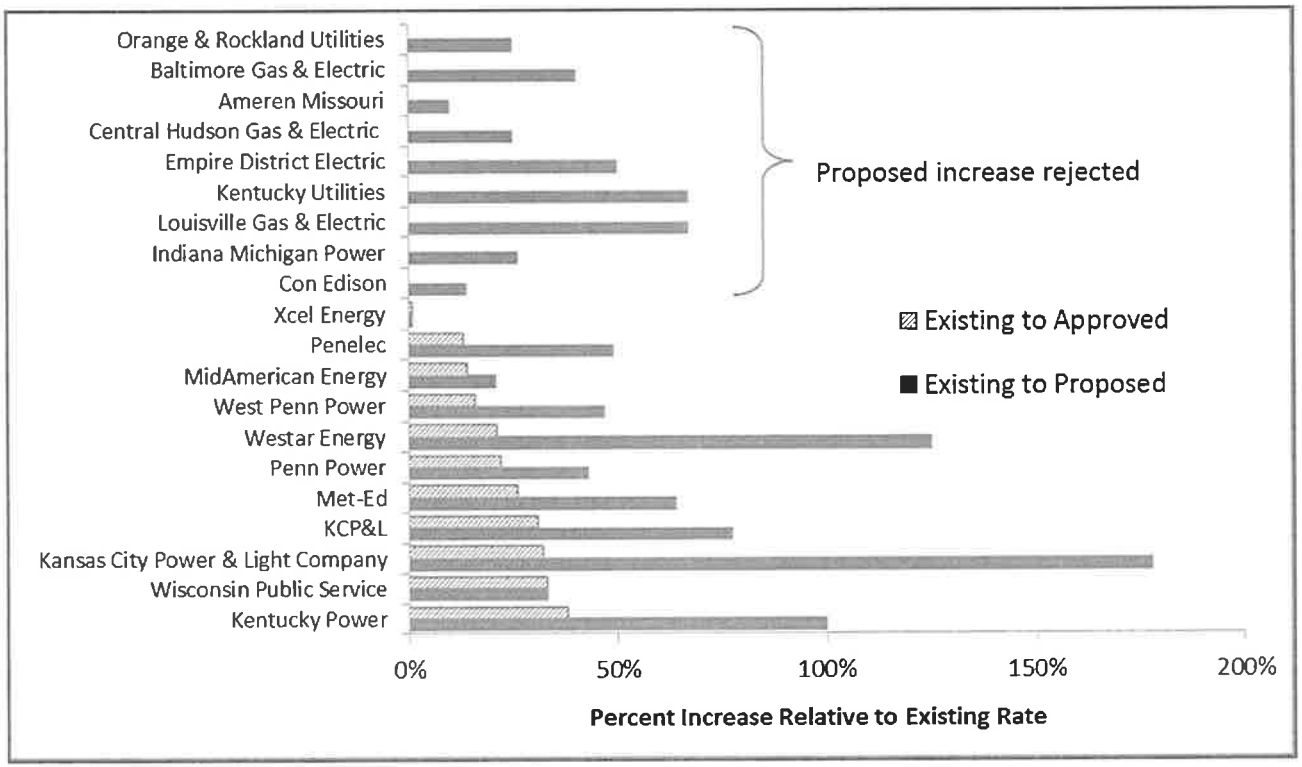
Source: Synapse Energy Economics

Table 2. List of Utilities Requests to Increase Fixed Charges, with links to orders

Utility	State	Link to Order, Ruling, or Settlement	Reference
Kentucky Power	KY	http://estar.kcc.ks.gov/estar/ViewFile.aspx/20150924104744.pdf?Id=29b7b55e-b40c-4f66-9335-153bfe44a81e	PDF @ 22
Wisconsin Public Service	MI	http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B7B0359F5-FD01-4541-A64B-21BB3A9CF8F7%7D	extends 2013 settlement
Kansas City Power & Light Company	MO	http://psc.ky.gov/pscscf/2014%20Cases/2014-00396/20150622_PSC_ORDER.pdf	PDF @ 61-62
KCP&L	KS	http://efile.mpsc.state.mi.us/efile/docs/17698/0043.pdf	PDF @ 2, 6
Met-Ed	PA	http://psc.ky.gov/pscscf/2014%20Cases/2014-00372/20150630_PSC_ORDER.pdf	PDF @ 5
Penn Power	PA	http://psc.ky.gov/pscscf/2014%20Cases/2014-00371/20150630_PSC_ORDER.pdf	PDF @ 4
Westar Energy	KS	https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=ER-2014-0370&attach_id=2016003894	PDF @ 91
West Penn Power	PA	http://efile.mpsc.state.mi.us/efile/docs/17669/0038.pdf	PDF @ 50
MidAmerican Energy	SD	http://efile.mpsc.state.mi.us/efile/docs/17710/0034.pdf	PDF @ 17
Penelec	PA	https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=ER-2014-0351&attach_id=2015030590	PDF @ 11, 14
Xcel Energy	MI	http://www.puc.state.pa.us/pcdocs/1352575.doc	Exh. 4 of Settlement
Con Edison	NY	http://www.puc.state.pa.us/pcdocs/1352610.doc	Exh. 4 of Settlement
Indiana Michigan Power	MI	http://www.puc.sd.gov/commission/Orders/electric/2015/EL14-072final.pdf	Settlement PDF @ 13
Louisville Gas & Electric	KY	http://www.puc.state.pa.us/pcdocs/1352597.doc	Exh. 4 of Settlement
Kentucky	KY	http://www.puc.state.pa.us/pcdocs/1352583.doc	Exh. 4 of

Utilities			Settlement
Empire District Electric	MO	http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BFBCE2FF2-61D7-47A9-9956-773EFC20944A%7D	PDF @ 60-61
Central Hudson Gas & Electric	NY	https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=ER-2014-0258&attach_id=2015025958	PDF @ 78
Ameren Missouri	MO	http://webapp.psc.state.md.us/Intranet/casenum/NewIndex3_VOpenFile.cfm?filepath=C:%5CCasenum%5C9300-9399%5C9355%5CItem_55%5C%5COrd86757.pdf	PDF @ 28
Baltimore Gas & Electric	MD	http://estar.kcc.ks.gov/estar/ViewFile.aspx/20150910114007.pdf?Id=fce20218-fbcb-4a93-b060-5a0be2f9328f	PDF @ 58
Orange & Rockland Utilities	NY	http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BB9E430C5-CF00-4465-86B2-6C0B61338818%7D	PDF @ 13

Figure 1. Utilities Requests to Increase Fixed Charges, Proposed Versus Approved



Source: Synapse Energy Economics