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BEFORE THE NORTH CAROLINA UTILITIES COMMISSION
DOCKET NO. E-2, SUB 1287
DOCKET NO. E-7, SUB 1261

DOCKET NO. E-2, SUB 1287 In the Matter of: Application of Duke Energy Progress, LLC for Approval of Smart $aver Solar Energy Efficiency Program DOCKET NO. E-7, SUB 1261 In the Matter of: Application of Duke Energy Carolinas, LLC for Approval of Smart $aver Solar Energy Efficiency Program	))))))))))))	**JOINT COMMENTS OF NORTH CAROLINA SUSTAINABLE ENERGY ASSOCIATION, SOUTHERN ALLIANCE FOR CLEAN ENERGY, AND VOTE SOLAR**

As Intervenors, and consistent with the Commission's January 13, 2022, extension of time to file comments in both the above-captioned dockets, the North Carolina Sustainable Energy Association (NCSEA), Southern Alliance for Clean Energy (SACE), and Vote Solar (collectively, the Joint Intervenors) submit the following joint comments and the Report on the Duke NEM Settlement and SmartSaver Solar EE Programs from Crossborder Energy (Crossborder Report), attached as Exhibit A. The Joint Intervenors support Commission approval of the Smart $aver Solar Energy Efficiency Programs. As set forth below, the Programs are (1) an innovative, cost-effective approach for recognizing the value of behind-the-meter distributed solar energy and for reducing system peak demand; (2) are an integral component of an overall settlement with the Duke Energy for revised net metering rates; and (3) comport with North Carolina law and are consistent with state public policy guidelines.

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1. In applications filed December 16, 2021, in the above-captioned dockets, Duke Energy Progress, LLC, and Duke Energy Carolinas, LLC, (DEP and DEC respectively, and Duke Energy collectively) have proposed energy efficiency programs that offer an incentive for residential customers who (a) install a rooftop solar photovoltaic system and (b) participate in the already-approved winter load control program. The Joint Intervenors support the proposed Smart $aver Energy Efficiency Programs (Programs) because they are expected to reduce on-peak and off-peak electricity demand on Duke Energy without material impact on the function of the customers' households.
2. The Programs will not be available to customers who participated in the Solar Rebate program approved in Docket Nos. E-2, Sub 1167, and E-7, Sub 1166 (Solar Rebate program). The Programs fall under different statutory authority (N.C. Gen. Stat. § 62-133.9 for energy efficiency) than the Solar Rebate (N.C. Gen. Stat. § 62-155). The Programs are not intended as a replacement for the Solar Rebate program because the Programs as energy efficiency measures can only be approved if cost effective,[1] whereas no such requirement exists for the Solar Rebate program.
3. Duke Energy's modeling shows the proposed Programs pass the Utility Cost Test (UCT), which is the threshold for approval of energy efficiency programs under the Commission-ordered Mechanisms (see footnote 1 below). DEP cites a 2.24 UCT score and DEC cites a 2.72 UCT score. In other words, reduced electric

[1] *See* the Commission's October 20, 2020, order in Docket Nos. E-2, Sub 931, and E-7, Sub 1032, which approves the Cost Recovery Mechanisms for DEP and DEC. Both Mechanisms state in part: "With the exception of Measures included in a Low-Income Program, or other Program in which PPI incentives are not requested that may potentially be filed with the Commission for approval, an EE or DSM Measure with a UCT result less than 1.0 will not be considered further, unless the Measure can be bundled into an EE or DSM Program to enhance the overall cost-effectiveness of that Program."

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consumption resulting from the Programs will cost Duke Energy much less than it would have cost to generate the electricity needed in the absence of the Programs, providing a substantial benefit to the utility system.

4. The proposed Programs are an integral part of a comprehensive settlement for revised net energy metering (NEM) rates between Duke Energy and several organizations that advocate for climate action, environmental issues, solar energy, and energy efficiency. *See* Memorandum of Understanding (filed with Duke Energy Carolinas, LLC's & Duke Energy Progress, LLC's Joint Application for Approval of Revised Net Energy Metering Tariffs), Docket No. E-100, Sub 180 (Nov. 29, 2021). Revised net metering rates are required under N.C. Gen. Stat. § 62-126.4 and Part III of Session Law 2021-165 (House Bill 951). Under the memorandum of understanding (MOU) between Duke Energy and NCSEA, the Solar Energy Industry Association, and the Southern Environmental Law Center on behalf of Vote Solar and SACE, the parties have worked to develop the next generation of NEM rates in North Carolina that comply with governing law and that can advance opportunities for rooftop solar customers to manage demand and reduce constraints on the grid to the benefit of all of the Companies' customers. The MOU also sets forth protections for existing rooftop solar customers beyond the January 1, 2027, expiration of the legacy NEM program (customers who would not be eligible for the incentives in the proposed Programs) as established in N.C. Gen. Stat. § 62-126.4(c). The proposed Programs would also serve as the backbone for future offerings targeted to make rooftop solar more accessible to low-income customers.

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5. The Smart $aver Energy Efficiency Programs are "pivotal – without this inventive, bill savings for a typical solar customer would drop" significantly. Crossborder Report at 3. The proposed Programs are part of a "complicated mix of inter-related concessions and compromises among the involved stakeholders" and are designed to work in concert with the proposed revised NEM tariffs proposed in Docket No. E-100, Sub 180. Id. The new, sharply differentiated time of use rates, along with dynamic critical pricing periods, work to incentivize reducing demand during those times when costs to the system are at their highest and shifting demand to lower-cost times of the day. The proposed Programs further encourage peak demand reductions by requiring participation in the Bring Your Own Thermostat winter-focused demand reduction production and by crediting the behind-the-meter solar production as an energy efficiency resource, because that on-site consumption of solar energy reduces the requirements for energy.

6. As noted in the attached Crossborder Energy report, this "innovative package" responds both to statutory dictates and successfully balances "the often-competing interests of both participants . . . and non-participants." Id. at 2. The proposed Programs are the result of constructive "dialogue and negotiation between the utilities and important stakeholders, including key representatives of the solar industry and well as clean energy advocates." Id. Crossborder Energy characterizes this settlement as "a welcome development" in the context of the often contentions fights concerning revised net metering policies around the country. Id. In the judgement of Crossborder Energy, "the DEC/DEP NEM tariffs and the SmartSaver Solar incentive will maintain a reasonable opportunity for customers to invest in

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expanding the clean energy infrastructure necessary to reduce greenhouse gas emissions. However, this result requires the approval of the entire package of changes, including the SmartSaver Solar incentive as well as the new NEM tariff." Id. at 4 (emphasis added).

7. Crossborder Energy concurs with Duke Energy that the proposed Programs are cost-effective, even passing the notoriously conservative Ratepayer Impact Measure (RIM), showing that the new tariffs and proposed Programs do not result in any cost shift to non-participating customers. Id. at 5. More importantly, the Programs pass the principal Utility Cost Test with much room to spare, "demonstrating that the distributed solar installed under the program will be less costly than providing the same service with utility generation and the associated T&D [transmission and distribution] facilities to deliver that power." Id. at 5.

8. One reason why the proposed Programs are an essential element of the comprehensive package agreed to in the MOU is that the new dynamic time-of-use rates are "far more complex than traditional NEM. . . .[a]s a result, it is critical to provide customers with an upfront inventive to participate in this complex package—this is the key purpose of the incentive included in the SmartSaver Solar EE Program." Id. at 6

9. The use of solar photovoltaic systems as part of an energy efficiency program satisfies the statutory definition in N.C. Gen. Stat. § 62-133.8(a)(4): "'Energy efficiency measure' means an equipment, physical, or program change implemented after January 1, 2007, that results in less energy used to perform the same function." Essentially the same definition appears in Commission Rule R8-

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67(a)(3). By supplanting energy from the electrical grid to provide electric power for household needs, the residential solar systems will enable the same functions to be performed with less energy from the grid. This raises the question of whether "less energy" in the statutory and rule definitions means "less energy from the grid." As discussed below, a prior order of the Commission and public policy both support an affirmative answer to that question.

10. In Docket No. E-2, Sub 937, Progress Energy Carolinas, Inc. (PEC), filed an application on October 31, 2008, for approval of its Residential Solar Water Heating Pilot Program as an energy efficiency program. Solar water heating had previously been approved as a measure within the Residential Advantage Program in Docket No. E-2, Sub 928. The application in Docket No. E-2, Sub 937, sought to make it a stand-alone pilot program to assist with evaluating cost effectiveness.

11. On December 30, 2008, the Public Staff filed a response in Docket No. E-2, Sub 937, recommending approval of the Residential Solar Water Heating Pilot Program. By order of April 21, 2009, the Commission approved the Program as a new energy efficiency program pursuant to Rule R8-68. In doing so, the Commission noted there were no objections to the program from either the Attorney General's office or Public Service Company of North Carolina, Inc. The Commission's order also states:

> The Public Staff further stated that it believes that the proposed SWHM pilot program is in the public interest, has the potential to encourage energy efficiency and reduce PEC's peak load and system energy consumption, is consistent with PEC's integrated resource plan, and should be approved as a "new" energy efficiency program pursuant to Commission Rule R8-68.

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Solar water heating, like solar photovoltaic, displaces customers' energy demand on Duke Energy's grid, and thereby qualifies as "energy efficiency." The conclusion in Docket No. E-2, Sub 937, should apply to the instant applications for residential rooftop solar photovoltaic just as it did to solar water heating.

12. In contrast, the Commission denied approval of a Commercial Distributed Generation (CDG) demand response program that was proposed by Virginia Electric and Power Company d/b/a Dominion North Carolina Power (Dominion) by order of September 14, 2011, in Docket No. E-22, Sub 466. There are significant factual differences between the CDG proposal of Dominion versus the solar water heating pilot of PEC and the solar photovoltaic proposals in the instant dockets.

    a. Dominion's CDG was designed to be a demand side management (DSM) program, not an energy efficiency program. The concept was that eligible commercial and industrial customers would use a third-party vendor to provide backup generation that would be owned by Dominion's customers so the customers could power their own energy needs when Dominion initiated load control events. In contrast, the proposed Smart $aver Energy Efficiency Programs are designed as energy efficiency measures.

    b. Dominion's CDG proposal involved construction of new diesel-burning generators. Under N.C. Gen. Stat. § 62-133.8(a), combined heat and power is the only form of nonrenewable energy that is recognized as qualifying as energy efficiency. The Smart $aver Energy Efficiency Programs are designed to replace energy from the grid with the use of renewable energy.

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c. The Commission's 2008 approval of a solar water heating pilot as an energy efficiency program in 2008 is more comparable, and thus carries more precedential weight, than the CDG program. The Residential Solar Water Heating Pilot Program of PEC was offered to residential customers, it used emission-free solar energy as the source to reduce energy consumption from the grid, and it was an energy efficiency program rather than DSM. These same factors are present in the Smart $aver Energy Efficiency Programs. None of these factors were present for the CDG proposal.

13. The Commission orders in Dockets E-22, Sub 466, and E-2, Sub 937, demonstrate that whether a particular utility measure or program qualifies as new "energy efficiency" under N.C. Gen. Stat. § 62-133.8(a)(4) has been viewed by the Commission as a matter of interpretation, based on the circumstances. In particular, the question of whether customer-owned (or leased) generation qualifies as DSM or energy efficiency status when it offsets consumption from the utility grid has been decided differently in different cases. As noted above, the circumstances of the PEC solar hot water heating pilot, which was approved as an energy efficiency program, are much more in line with the Smart $aver Energy Efficiency Programs than the circumstances of the Dominion CDG proposal.

14. The Smart $aver Energy Efficiency Programs also foster the declared policy of North Carolina in the Public Utilities Act. The incentive works in concert with the proposed new net metering rates and the winter-focused smart thermostat program in ways that support the express policies that assure that utilities use "the entire

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spectrum of demand-side options" and that promote renewable energy and energy efficiency:

> (3a) To assure that resources necessary to meet future growth through the provision of adequate, reliable utility service include use of the entire spectrum of demand-side options, including but not limited to conservation, load management and efficiency programs, as additional sources of energy supply and/or energy demand reductions. To that end, to require energy planning and fixing of rates in a manner to result in the least cost mix of generation and demand-reduction measures which is achievable, including consideration of appropriate rewards to utilities for efficiency and conservation which decrease utility bills
>
> (10) To promote the development of renewable energy and energy efficiency through the implementation of a Renewable Energy and Energy Efficiency Portfolio Standard (REPS) that will do all of the following:
>
> a. Diversify the resources used to reliably meet the energy needs of consumers in the State.
>
> b. Provide greater energy security through the use of indigenous energy resources available within the State.
>
> c. Encourage private investment in renewable energy and energy efficiency.
>
> d. Provide improved air quality and other benefits to energy consumers and citizens of the State.

N.C. Gen. Stat. § 62-2(a). The Smart $aver Energy Efficiency Programs take advantage of load management and behind-the-meter solar to achieve demand reductions in a way that will cost less than it would otherwise cost for the utility to meet that demand. The proposed Programs, by encouraging private investment in rooftop solar, will promote the diversification of resources, greater reliance on solar energy generated within the state, and contribute to improved air quality from reducing the need to run fossil-fuel generation plants.

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15. Another, new, compelling reason to approve the Smart $aver Energy Efficiency Programs is the statutory and public policy goal of emissions reductions. The power from regulated utilities, served over the grid, is partially generated from fossil fuels. House Bill 951 states in Part 1, Section 1:

> The Utilities Commission shall take all reasonable steps to achieve a seventy percent (70%) reduction in emissions of carbon dioxide (CO2) emitted in the State from electric generating facilities owned or operated by electric public utilities from 2005 levels by the year 2030 and carbon neutrality by the year 2050.

The legislation also requires the Commission to develop a plan by the end of 2022 to reduce carbon emissions, and the plan "may" include energy efficiency. Nothing in House Bill 951 prohibits approval of new energy efficiency measures outside of the Commission's carbon reduction plan. Such an interpretation would run counter to the statutory goal of House Bill 951 and the Governor's October 1, 2018, Executive Order 80 that initiated the State's Clean Energy Plan.[2] A cost effective energy efficiency program that incentivizes an integrated approach to rooftop solar, time-of-use rates, and smart thermostat control would advance the goals of House Bill 951 and the Clean Energy Plan. Accordingly, it is reasonable to interpret "energy efficiency" under N.C. Gen. Stat. § 62-133.8(a)(4) to include measures that result in less energy used to perform the same function, where participating customers consume less energy from the grid because their own solar photovoltaic systems allow them to perform the same function.

The Joint Intervenors respectfully request that the Commission approve the proposed Smart $aver Solar Energy Efficiency Programs.

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[2] *See* https://files.nc.gov/governor/documents/files/NC_Clean_Energy_Plan_OCT_2019_.pdf.

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Respectfully submitted, this the 15th day of March 2022.

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CERTIFICATE OF SERVICE

I hereby certify that all persons on the docket service list have been served true and accurate copies of the foregoing Joint Comments of North Carolina Sustainable Energy Association, Southern Alliance for Clean Energy, and Vote Solar by hand delivery, first class mail deposited in the U.S. mail, postage pre-paid, or by email transmission with the party's consent.

This the 15th day of March, 2022.

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DOCKET NO. E-7, SUB 1261

DOCKET NO. E-2, Sub 1287	)
	)
In the Matter of:	)
Application of Duke Energy Progress,	)
LLC For Approval of Smart $aver	)
Solar Energy Efficiency Program	)
	)
DOCKET NO. E-7, Sub 1261	)
	)
In the Matter of:	)
Application of Duke Energy Carolinas,	)
LLC for Approval of Smart $aver	)
Solar Energy Efficiency Program	)

EXHIBIT A

REPORT ON THE DUKE NEM SETTLMENT AND SMARTSAVER SOLAR EE PROGRAMS

R. THOMAS BEACH & PATRICK G. MCGUIRE OF CROSSBORDER ENERGY

ON BEHALF OF
NORTH CAROLINA SUSTAINABLE ENERGY ASSOCIATION, SOUTHERN ALLIANCE FOR CLEAN ENERGY, AND VOTE SOLAR

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Report on the Duke NEM Settlement and SmartSaver Solar EE Programs

Dockets Nos. E-100, Sub 180 and E-2, Sub 1287 & E-7, Sub 1261

R. Thomas Beach
Patrick G. McGuire
Crossborder Energy

Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) have filed an integrated package of rate design and net energy metering (NEM) reforms that will change the economics for residential customers who install distributed solar systems in their service territories. The Duke utilities filed for approval of the rate and NEM reforms on November 29, 2021 in Docket No. E-100, Sub 180; they also requested approval of the closely-related SmartSaver Solar Energy Efficiency program on December 16, 2021 in Docket Nos. E-2, Sub 1287 and E-7, Sub 1261. This package was developed through extensive consultations with a range of stakeholders, and adapts for North Carolina a similar package of rate design and NEM changes implemented or proposed in South Carolina.[1]

Key Provisions. The package of rate design and NEM reforms that DEC and DEP propose has the following key features:

- Moving away from the current NEM program, which allows solar customers to use "flat," non-time-differentiated residential rates and to net their costs or credits over an annual period. The new NEM program is based on monthly netting, with excess monthly net generation compensated at the utility's avoided cost.

- Requiring new solar customers to use a new, cost-based, sharply-differentiated time-of-use (TOU) rate design. The Commission has already approved this advanced residential rate design for both DEC and DEP, as part of a comprehensive rate design study and following DEC's dynamic pilot rates as ordered by the Commission in the 2017 general rate case.

- Using an overlay of very high Critical Peak Pricing (CPP) rates that will apply to solar customers on a limited number of high-demand days. The CPP rates will send a strong price signal for customers to moderate their demand and shift their usage away from system peaks on such days.

- Implementing a monthly minimum bill of $22 per month for DEC and $28 per month for DEP and recovering certain non-bypassable charges through a fixed charge, to ensure

[1] See *Order Approving Stipulations, Approving Interim Riders, and Establishing Solar Choice Tariffs*, South Carolina Public Service Commission Docket Nos. 2020-264-E and 2020-265-E (May 30, 2021) and *Commission Directive*, South Carolina Public Service Commission Docket Nos. 2021-143-E and 2021-144-E (January 13, 2022), available at https://dms.psc.sc.gov/Attachments/Matter/0562aa4c-6e03-4367-b34d-05861af5492c.

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that new solar customers contribute fairly to the recovery of utility costs that do not vary with usage. In addition, the largest residential solar customers, with systems in excess of 15 kW, would pay an installed capacity charge.

- Providing an upfront incentive of $0.36 per installed watt-DC for new solar customers, through the closely-related DEC/DEP Smart Saver Solar EE Program. To receive and retain the incentive, new solar customers will be required to participate in their utility's Winter Bring Your Own Thermostat (Winter BYOT) program, which provides additional incentives to participating customers. This demand response program will limit customers' peak demand on cold winter mornings when electric demand is high but solar output is likely to be low.

Policy Background. This innovative package responds to the statutory direction in House Bills 589 (S.L. 2017-192) and 951 (S.L. 2021-165) to develop revised NEM tariffs that reflect the costs and benefits of serving NEM customers who install on-site solar generation to serve a portion of their electricity needs. This requires a balancing of the often-competing interests of both participants (ratepayers who install solar and other types of distributed energy resources [DERs]) and non-participants (customers who do not adopt DERs such as solar and who will pay rates that may include costs associated with DER adoption). HB 951 reiterates the requirement for the Commission to revise net metering tariffs and requires implementation of a plan for North Carolina's public utilities to reduce carbon emissions. These requirements indicate that the revised NEM tariffs must allow for the sustainable growth of the opportunity for utility customers to reduce their carbon footprint by directly using their private capital or entering a lease arrangement to install on-site renewable generation.

Collaborative Process. The DEC/DEP NEM reform proposal is the product of dialogue and negotiation between the utilities and important stakeholders, including key representatives of the solar industry as well as clean energy advocates. The Memorandum of Understanding that these parties reached is included with the application for revised NEM tariffs in Docket No. E-100, Sub 180. The development of a complex new net metering program through constructive discussions, negotiation, and compromise is a welcome development given that similar issues in other states have resulted in protracted litigation and public controversy.[2] The proposed new

[2] For example, in late 2015, the Public Utilities Commission of Nevada (PUCN) adopted, without change, a cost-of-service study from the utility NV Energy that showed a significant cost shift from non-participating ratepayers to solar DG customers. As a result, the PUCN ended NEM in Nevada, increased the fixed monthly customer charge for DG customers, and reduced the export rate credited to DG systems from the full retail rate (about 11 cents/kWh for residential customers) to an energy-only avoided cost rate of 2.6 cents/kWh. The PUCN took this action even though its order found that there were eleven components to the value of DG, but only quantified two of those components. See PUCN Order in Dockets Nos. 15-07-041 and 15-07-042 issued December 23, 2015, at pp. 66-67 and 95-96. The reduction in the export rate and the increased fixed charge reduced the bill savings available to NEM customers in Nevada by at least 40%. Such a precipitate reduction decimated the market for new solar

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NEM tariffs and the associated SmartSaver Solar incentive represent a complicated mix of inter-related concessions and compromises among the involved stakeholders. Stakeholders will have different opinions about individual elements, but there was agreement among these diverse parties that, as a package, the deal is a reasonable and constructive compromise.

Opportunity for Participating Solar Customers. Customers who invest in clean distributed solar generation need to see adequate bill savings to make their investment a reasonable economic proposition. Based on the bill saving analyses we have reviewed and performed, the new DEC/DEP tariffs, combined with the SmartSaver Solar incentive and a behavioral response from new solar customers to shift some load off peak, will maintain about the same bill savings available to typical solar customers under the current NEM tariffs. Significantly, the availability of the SmartSaver Solar incentive is pivotal – without this incentive, bill savings for a typical solar customer would drop by about 15%, and would drop further for customers who do not adjust to the time of use periods. Because the costs of residential solar in North Carolina are similar to the available bill savings under traditional net metering, a reduction in bill savings could have a serious negative impact on the residential solar market.

In addition, under the proposed DEC/DEP tariff, participating customers will gain new opportunities to reduce their costs, if they take actions that also will benefit the grid and reduce costs for non-participants. The conclusion that the new NEM tariff and the SmartSaver Solar incentive can maintain potential bill savings that are about the same as traditional NEM assumes that customers take some actions to respond to the new price signals. Depending on the extent of this customer response, there may be additional opportunities for solar customers to further improve their bill savings. For example, the TOU rate structure will send a strong price signal to customers to use appliances and otherwise manage their home energy use to shift loads out of the on-peak periods and into off-peak and discount hours. The CPP overlay will send the strongest TOU price signals during those peak demand hours when the grid is most stressed; this feature will help to target customers' demand reductions to the high-demand days when they are most needed by the system. Finally, as discussed further below, the structure of the new rate promises to provide a superior platform for use with other types of distributed energy resources, including smart thermostats, storage, high-efficiency heat pumps, and electric vehicles (EVs). For example, customers who use the new structure to charge an EV at home will have the opportunity to realize significant additional savings in gasoline costs. Customers who include

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DG systems in the state, and resulted in more than 1,000 documented layoffs at solar companies. See *Prepared Direct and Rebuttal Testimonies of R. Thomas Beach on behalf of TASC*, served February 1 and 5, 2016 in PUCN Dockets Nos. 15-07-041 and 15-07-042. After a year of significant public outcry and political turmoil, the PUCN (with several new commissioners) reversed course, re-evaluated the benefits and costs of solar DG, and subsequently adopted a reopening of net metering in Nevada with a much more gradual change in the compensation to solar customers. See PUCN, *Order Granting in Part and Denying in Part Joint Application of NV Energy on Assembly Bill 405*, issued September 1, 2017 in Docket No. 17-07026, at p. 2.

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storage in their solar installation can store excess solar output for use during the on-peak TOU period or during high-cost CPP events.

Overall, in our judgement, the DEC/DEP NEM tariffs and the SmartSaver Solar incentive will maintain a reasonable opportunity for customers to invest in expanding the clean energy infrastructure necessary to reduce greenhouse gas emissions. However, this result requires the approval of the entire package of changes, including the SmartSaver Solar incentive as well as the new NEM tariff.

Mitigating Impacts on Non-Participants. The new NEM tariffs include multiple features that will mitigate adverse impacts on non-participating customers. The new TOU/CPP rate design aligns the rates for solar customers more closely to the utility's costs. A key criticism of today's NEM with simpler, volumetric rate designs that do not vary with time is that solar customers can offset the volumetric rate – which includes demand-related costs – even though solar customers may not achieve significant reductions in their maximum coincident demands.[3] In addition, Duke Energy also includes what it classifies as a portion of customer-related costs in the volumetric rate, resulting in an under recovery of those so-called "fixed" costs from solar customers.[4] The new NEM tariff addresses these issues in several ways:

- Demand-related costs are allocated to on-peak TOU and CPP rates, providing a strong price signal to reduce peak energy use, charging customers demand-related costs for their peak usage, and focusing on the highest demand days when CPP events are called. The TOU/CPP rate structure will encourage solar customers to shift usage out of the on-peak TOU periods.[5] The additional benefits of these load shifts are not included in the utilities' analyses of the proposed NEM tariffs.

- The requirement to participate in the Winter BYOT program in order to receive the SolarSaver incentive provides a direct means to control the demands of these customers during peak demand conditions on winter mornings.

- The proposed DEC/DEP tariffs include elements that strongly encourage customers to limit the sizes of their solar systems, and thus to limit any possible cost shift. The $22 and $28 per month minimum bills and the compensation for monthly net exports at a low

[3] See, *Duke Energy Carolinas, LLC's and Duke Energy Progress, LLC's Joint Petition for Approval of Revised Net Energy Metering Tariffs*, p. 9, Docket No. E-100, Sub 180 (November 29, 2021).

[4] A number of the parties to the MOU have historically disputed Duke Energy's use of the so-called minimum system method, which classifies a portion of the distribution grid as customer-related; the Companies do not set their fixed customer charged based on the results of that analysis, but instead collect about half of those supposed "customer-related" costs in the volumetric rate.

[5] Ahmad Faruqui and others at the Brattle Group have assembled a database of the peak reductions produced by different types of time-varying rate design. CPP rates have reduced peak demands by 10% to 50%. See Ahmad Faruqui, *The Transformative Power of Time-Varying Rates* (March 8, 2019), at Figure 1, available at https://energycentral.com/c/em/transformative-power-time-varying-rates.

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wholesale avoided cost rate will sharply reduce bill savings as the size of the customer's solar system approaches the customer's annual usage. The grid access fee for systems larger than 15 kW will recover additional revenue from the largest residential customers who may have the roof space, available land, or financial means to install very large systems.

- The minimum bills and non-bypassable riders ensure that solar customers contribute a certain amount each month. As noted above, there is an ongoing debate over the level of Duke's "customer-related" costs that do not vary with usage. The minimum bills are a generous allocation of customer-related costs to solar customers that reflect the per unit customer-related costs from the Commission-approved embedded cost of service study for DEC and DEP. Importantly, these are minimum bills only for the service that customers receive from the utility. The minimum bill can be offset by revenues from exports at wholesale rates, which is a different service that the solar customer provides to the utility.

Cost-effectiveness. The most comprehensive cost-effectiveness analyses of the new DEC/DEP program are contained in the utilities' requests for approval of the SmartSaver Solar EE Program. These analyses incorporate and assume that customers are taking service under the reformed NEM tariff. The scores for DEC and DEP on the most stringent Ratepayer Impact Measure (RIM) tests average above 1.0 (0.91 for DEP; 1.12 for DEC, and 1.03 for the combined programs), showing that on average the new tariffs plus the SmartSaver Solar incentive do not shift costs to non-participating ratepayers.[6] The program comfortably passes the Utility Cost Test (UCT), with benefit/cost ratios exceeding 2.0, demonstrating that the distributed solar installed under the program will be less costly than providing the same service with utility generation and the associated T&D facilities to deliver that power. The Commission relies primarily on the UCT in approving other demand-side energy efficiency and demand response programs.[7]

The DEC/DEP cost-effectiveness (C/E) analysis appears to be conservative, as it does not include the benefits and costs of the winter BYOT program. Given that continued participation in the Winter BYOT program is required to obtain and retain the full SmartSaver Solar EE incentive, the benefits and costs of Winter BYOT should be included in the C/E analysis. For example, the C/E analysis includes almost no capacity-related benefits. Winter capacity benefits

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[6] These RIM test scores are low, because there are several benefits of distributed renewable generation that DEC and DEP have not quantified. These include avoided costs for carbon emissions and fuel hedging benefits, which combined could add approximately 4 to 5 cents per kWh to the benefits. See, for example, *Rebuttal Testimony of R. Thomas Beach for the South Carolina Coastal Conservation League, Southern Alliance for Clean Energy, Upstate Forever, Vote Solar, the Solar Energy Industries Association, and the North Carolina Sustainable Energy Association* in South Carolina Docket No. 2019-182-E (October 29, 2020), at pp. 13-16.

[7] See *Order Approving Revisions to Demand-Side management and Energy Efficiency Cost Recovery Mechanisms,* Dockets Nos. E-2, Sub 931 & E-7, Sub 1032 (October 20, 2020).

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are the key benefit in the Winter BYOT program. We have combined Duke's C/E analysis for the SmartSaver Solar program with its C/E analysis for Winter BYOT (scaled down to the number of expected participants in SmartSaver Solar). The C/E metrics for the RIM tests improve modestly when the costs and benefits of the Winter BYOT program are included. There is also a slight improvement in the scores on the Participant Test, as a result of the small incentive paid for participation in Winter BYOT.

Most important, the package of NEM reforms is complex, requiring customers to understand a new, complicated TOU/CPP rate design with a minimum bill and non-bypassable charges, and to participate in the Winter BYOT program. This structure is far more complex than traditional NEM, whose key strength always has been the mechanism's easy understandability for prospective solar customers – i.e. "running the meter backward." As a result, it is critical to provide customers with an upfront incentive to participate in this complex package – this is the key purpose of the incentive included in the SmartSaver Solar EE Program.

Even with the incentive, the overall score of these three inter-related programs on the Participant test is just 0.88 – 0.89. This is a marginal score, indicating that the benefits for participants fall short of the costs. Experience has shown that an upfront incentive is critical to overcoming this hurdle.[8] Without the SmartSaver Solar incentive, the score on the Participant test falls to 0.72. Without the incentive, these programs will not achieve a reasonable balance between participating and non-participating ratepayers.

Rate Platform for Further DER Adoption. The new DEC/DEP NEM tariffs focus on a new rate and compensation structure for customers who install solar. In addition, the tariffs are a reasonable first step toward tariffs that should be applicable to customers who install other types of DERs as well. This package of changes to NEM, of which the SmartSaver Solar EE program is an integral part, will be the first test of the use of advanced residential rate designs for DEC and DEP. These rate designs are intended to be a comprehensive new rate platform for other types of distributed energy resources (DERs), such as EVs, on-site storage, and the adoption of more efficient heat pumps for space conditioning and water heating. Like solar, all of these DERs require significant customer investments, as well as incentives and an associated rate design that, together, provide customers with an opportunity to earn a reasonable return of and on these investments. Customers increasingly will adopt solar in conjunction with these other DER technologies. Some types of DERs, such as EVs and electric heat pumps that replace gas appliances, provide incremental loads that will benefit all ratepayers. We note the agreement to work on a low-income incentive and an incentive for other technologies that would reduce demand by at least 1 kW, such as battery storage, so that the incentive program can expand to customers with non-electric heat.

[8] The importance of incentives in stimulating customer participation in solar programs is shown in Duke Response to Public Staff Data Request 1-2, included as **Attachment 1.**

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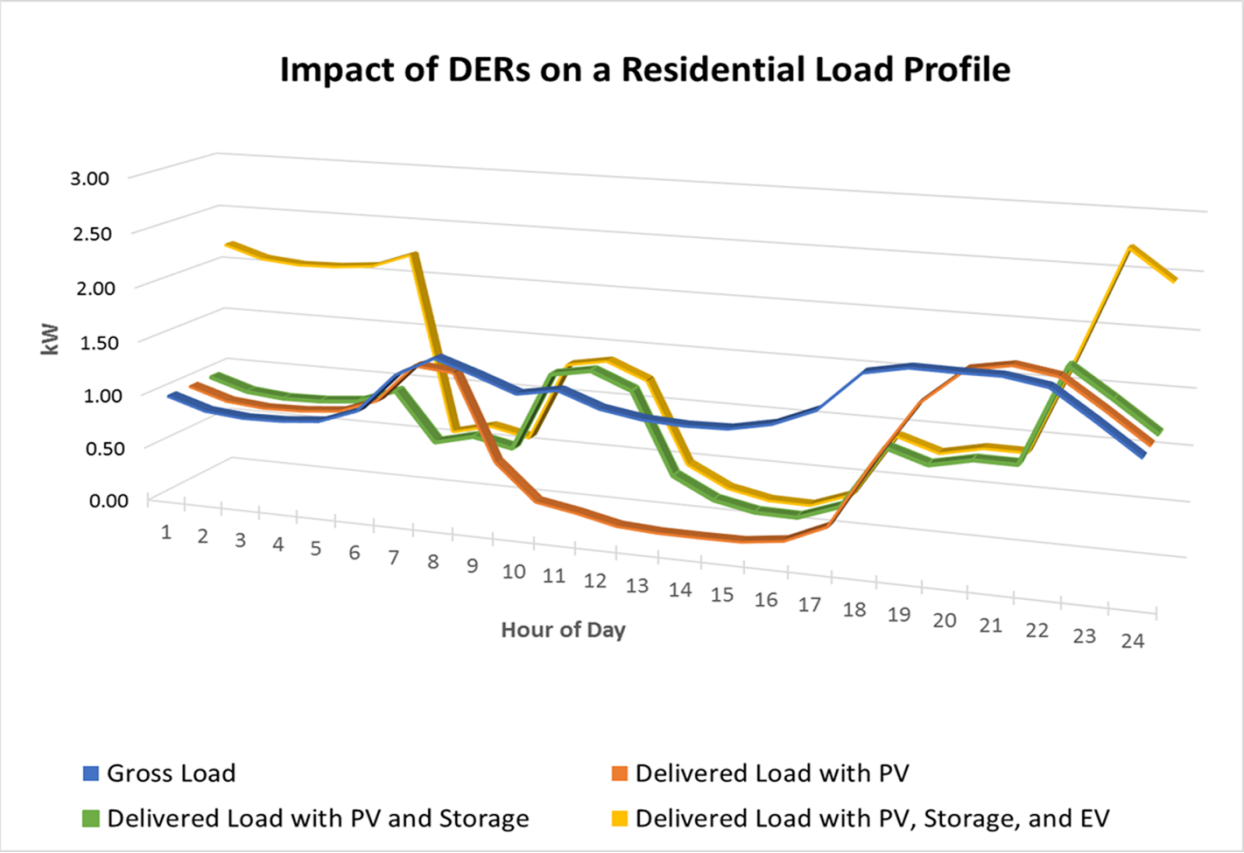
Solar is a DER that produces on-site power over the daylight hours, reducing the loads that the solar customer takes from the grid, and exporting excess generation to serve neighboring loads. Other DERs such as storage, smart thermostats, and programmable appliances also allow the loads served from the grid to be reduced and/or shifted in time. EVs and heat pumps are DERs that build new loads, with customers enabled and encouraged to use those technologies at times that do not stress the grid. In the coming future, customers will be able to use combinations of all of these DERs in ways that will have significant impacts on the time profile of their energy use. As an example, **Figure 1** below shows four distinct residential load profiles that illustrate how a single DEC/DEP residential customer's load profile for delivered energy can change as the customer adopts three different DER technologies in succession. The four profiles are:

1. **Blue:** Residential customer using 11,500 kWh per year with no DERs.
2. **Orange:** the customer adds solar with output equal to 75% of the annual load.
3. **Green:** customer adds 11 kWh of battery storage; the storage is charged during the solar production hours, and discharged in the 6:00 pm to 9:00 pm summer peak period and the 6:00 am to 9:00 am winter peak period.
4. **Yellow:** the customer adds an EV using 3,500 kWh per year. The EV is charged between 10:00 pm and 6:00 am (during off-peak and discount periods).

Figure 1



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As DERs proliferate, TOU rates will become an essential platform to unlock the benefits of these new technologies. The availability of sophisticated metering for all sizes of customers is enabling TOU pricing for all customer classes, including residential customers. The use of TOU rates by customers who adopt solar and other types of DERs is important in order to realize the full benefits of these new technologies, to increase the accuracy of pricing the services that utilities provide from the grid, and to minimize the potential for DERs to shift costs to other customers. States with high penetrations of DERs – Hawaii, California, and Arizona, for example – have strongly encouraged or required DER customers to use TOU rates.[9] DERs have proven to be an important tool that encourages customers to learn about and to adopt TOU rates, and then to invest not just in solar, but in a range of new DER technologies that change the profile of their energy use from the grid in ways that benefit all ratepayers and the environment.

[9] See, for example, California Public Utilities Commission Decision No. 16-01-044 adopting revisions to NEM in California, including a requirement to use TOU rates.

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Attachment 1

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DUKE ENERGY CAROLINAS, LLC AND DUKE ENERGY PROGRESS, LLC

Request:

With respect to the "reduced financial barriers" mentioned in paragraph 3 of the Applications, please provide any evidence that would indicate how such incentives (Rooftop Incentive and the BYOT Incentive) work to promote adoption and installation of behind-the-meter solar PV facilities that would not otherwise happen without the Rooftop Incentives or the BYOT Incentive. The response should address the free ridership associated with solar PV adoption that has been observed through each Company's respective traditional NEM, any adoption that has occurred through the Solar Rebate Programs,[2] and any adoption that has occurred without any incentives or rebates.

Response:

The Smart Saver Solar Program is designed to offer customers a financial incentive to encourage their adoption of solar PV recognizing the potential void of financial incentives when the NC Solar Rebate expires. Historical solar participation indicates that the lack of a financial incentive, such as a rebate or subsidized retail rates like the "1:1", adoption of solar PV is considerably lower. Please see the attached spreadsheet for monthly solar participation data in NC.

PSDR%201-2_Caroli
nas_historical_NEM_

North Carolina established 1:1 net metering in 2005. From 2005 to 2015, Duke did not offer any financial incentive for installation beyond the 1:1 NEM rate, and customers were not compensated for unused exported energy (often referred to as "banked" kWh). During this period, privately owned solar PV installations were very limited. In NC, Duke began offering an upfront rebate for solar PV in 2018, and in response the Companies saw applications for customer-owned solar PV spike. The correlation between the availability of upfront financial incentives and higher levels of solar PV adoption is strong. When the Companies offer upfront financial incentives to offset the required upfront cost associated with installing solar PV, adoption of solar PV is far higher. Conversely, if the Companies do not offer customers a way to reduce financial barriers such as upfront installation costs, customers are significantly less likely to install solar PV. Clearly the Smart Saver Solar incentives for solar PV installation will increase the likelihood that a

[2] Approved for DEC and DEP in Docket Nos. E-7, Sub --- and E-2, Sub ---, respectively.

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customer will invest in solar PV and to reduce energy consumption from the grid while not reducing the participating customer's household function.

Responsible Person: Lynda S. Powers, Senior Strategy & Collaboration Manager

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Year		Counts			Capacity (MWs)		
Year	Month	DEC NC	DEP NC	NC Totals	DEC NC	DEP NC	NC Totals
2002	1	0	0	0	0.000	0.000	0.000
2002	2	0	0	0	0.000	0.000	0.000
2002	3	0	0	0	0.000	0.000	0.000
2002	4	1	0	1	0.075	0.000	0.075
2002	5	0	0	0	0.000	0.000	0.000
2002	6	0	0	0	0.000	0.000	0.000
2002	7	0	0	0	0.000	0.000	0.000
2002	8	0	0	0	0.000	0.000	0.000
2002	9	0	0	0	0.000	0.000	0.000
2002	10	0	0	0	0.000	0.000	0.000
2002	11	0	0	0	0.000	0.000	0.000
2002	12	0	0	0	0.000	0.000	0.000
2003	1	0	0	0	0.000	0.000	0.000
2003	2	0	0	0	0.000	0.000	0.000
2003	3	0	0	0	0.000	0.000	0.000
2003	4	0	0	0	0.000	0.000	0.000
2003	5	0	0	0	0.000	0.000	0.000
2003	6	0	0	0	0.000	0.000	0.000
2003	7	0	0	0	0.000	0.000	0.000
2003	8	0	0	0	0.000	0.000	0.000
2003	9	0	0	0	0.000	0.000	0.000
2003	10	0	0	0	0.000	0.000	0.000
2003	11	0	0	0	0.000	0.000	0.000
2003	12	0	0	0	0.000	0.000	0.000
2004	1	0	0	0	0.000	0.000	0.000
2004	2	0	0	0	0.000	0.000	0.000
2004	3	0	0	0	0.000	0.000	0.000
2004	4	0	0	0	0.000	0.000	0.000
2004	5	0	0	0	0.000	0.000	0.000
2004	6	0	0	0	0.000	0.000	0.000
2004	7	0	0	0	0.000	0.000	0.000
2004	8	0	0	0	0.000	0.000	0.000
2004	9	0	0	0	0.000	0.000	0.000
2004	10	0	0	0	0.000	0.000	0.000
2004	11	0	0	0	0.000	0.000	0.000
2004	12	0	0	0	0.000	0.000	0.000
2005	1	0	0	0	0.000	0.000	0.000
2005	2	0	0	0	0.000	0.000	0.000
2005	3	0	0	0	0.000	0.000	0.000
2005	4	0	0	0	0.000	0.000	0.000
2005	5	0	0	0	0.000	0.000	0.000
2005	6	0	0	0	0.000	0.000	0.000
2005	7	0	0	0	0.000	0.000	0.000
2005	8	0	0	0	0.000	0.000	0.000
2005	9	0	0	0	0.000	0.000	0.000
2005	10	0	0	0	0.000	0.000	0.000
2005	11	0	0	0	0.000	0.000	0.000
2005	12	0	0	0	0.000	0.000	0.000
2006	1	0	0	0	0.000	0.000	0.000
2006	2	0	0	0	0.000	0.000	0.000

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2006	3	0	0	0	0.000	0.000	0.000
2006	4	0	0	0	0.000	0.000	0.000
2006	5	0	0	0	0.000	0.000	0.000
2006	6	0	0	0	0.000	0.000	0.000
2006	7	1	0	1	0.003	0.000	0.003
2006	8	1	0	1	0.002	0.000	0.002
2006	9	0	0	0	0.000	0.000	0.000
2006	10	0	1	1	0.000	0.003	0.003
2006	11	0	0	0	0.000	0.000	0.000
2006	12	0	0	0	0.000	0.000	0.000
2007	1	0	0	0	0.000	0.000	0.000
2007	2	0	0	0	0.000	0.000	0.000
2007	3	0	0	0	0.000	0.000	0.000
2007	4	0	0	0	0.000	0.000	0.000
2007	5	0	1	1	0.000	0.005	0.005
2007	6	0	0	0	0.000	0.000	0.000
2007	7	1	0	1	0.002	0.000	0.002
2007	8	0	0	0	0.000	0.000	0.000
2007	9	0	0	0	0.000	0.000	0.000
2007	10	0	0	0	0.000	0.000	0.000
2007	11	0	0	0	0.000	0.000	0.000
2007	12	2	0	2	0.004	0.000	0.004
2008	1	0	0	0	0.000	0.000	0.000
2008	2	0	0	0	0.000	0.000	0.000
2008	3	0	0	0	0.000	0.000	0.000
2008	4	0	0	0	0.000	0.000	0.000
2008	5	0	0	0	0.000	0.000	0.000
2008	6	0	2	2	0.000	0.004	0.004
2008	7	0	0	0	0.000	0.000	0.000
2008	8	0	0	0	0.000	0.000	0.000
2008	9	1	0	1	0.002	0.000	0.002
2008	10	0	0	0	0.000	0.000	0.000
2008	11	0	0	0	0.000	0.000	0.000
2008	12	0	0	0	0.000	0.000	0.000
2009	1	0	1	1	0.000	0.003	0.003
2009	2	2	0	2	0.081	0.000	0.081
2009	3	1	0	1	0.002	0.000	0.002
2009	4	0	1	1	0.000	0.005	0.005
2009	5	0	0	0	0.000	0.000	0.000
2009	6	0	0	0	0.000	0.000	0.000
2009	7	0	0	0	0.000	0.000	0.000
2009	8	0	0	0	0.000	0.000	0.000
2009	9	0	1	1	0.000	0.005	0.005
2009	10	0	0	0	0.000	0.000	0.000
2009	11	0	0	0	0.000	0.000	0.000
2009	12	2	1	3	0.006	0.006	0.012
2010	1	0	4	4	0.000	0.009	0.009
2010	2	1	2	3	0.001	0.013	0.014
2010	3	0	4	4	0.000	0.008	0.008
2010	4	1	1	2	0.001	0.004	0.005
2010	5	2	3	5	0.060	0.007	0.067
2010	6	0	3	3	0.000	0.012	0.012

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2010	7	0	3	3	0.000	0.010	0.010
2010	8	1	4	5	0.008	0.016	0.024
2010	9	1	0	1	0.004	0.000	0.004
2010	10	0	0	0	0.000	0.000	0.000
2010	11	4	0	4	0.029	0.000	0.029
2010	12	2	6	8	0.005	0.164	0.169
2011	1	9	8	17	0.217	0.546	0.763
2011	2	1	2	3	0.002	0.007	0.009
2011	3	2	5	7	0.017	0.021	0.038
2011	4	1	5	6	0.004	0.019	0.023
2011	5	2	8	10	0.701	0.025	0.726
2011	6	6	13	19	0.014	0.048	0.062
2011	7	3	9	12	0.013	0.031	0.044
2011	8	4	10	14	0.016	0.058	0.074
2011	9	3	13	16	0.015	0.050	0.065
2011	10	7	14	21	0.200	0.045	0.245
2011	11	9	21	30	0.258	0.427	0.685
2011	12	21	29	50	0.087	0.951	1.038
2012	1	8	25	33	1.276	0.106	1.382
2012	2	6	11	17	0.443	0.056	0.499
2012	3	4	19	23	0.160	0.184	0.344
2012	4	5	13	18	0.023	0.046	0.069
2012	5	4	13	17	0.022	0.084	0.106
2012	6	9	20	29	0.031	0.168	0.199
2012	7	15	17	32	0.079	0.059	0.138
2012	8	10	21	31	2.321	0.080	2.401
2012	9	10	16	26	0.047	0.059	0.106
2012	10	16	24	40	0.058	0.464	0.522
2012	11	11	14	25	0.317	0.103	0.420
2012	12	34	34	68	0.221	0.137	0.358
2013	1	9	30	39	0.049	0.146	0.195
2013	2	13	30	43	0.044	0.367	0.411
2013	3	12	19	31	0.047	0.081	0.128
2013	4	16	24	40	0.070	0.099	0.169
2013	5	10	23	33	0.832	0.088	0.920
2013	6	12	30	42	0.051	0.136	0.187
2013	7	15	28	43	0.060	0.136	0.196
2013	8	13	17	30	0.060	0.087	0.147
2013	9	19	23	42	0.071	0.098	0.169
2013	10	22	22	44	0.344	0.085	0.429
2013	11	20	19	39	0.700	0.182	0.882
2013	12	31	24	55	0.397	0.744	1.141
2014	1	33	44	77	0.428	0.213	0.641
2014	2	7	29	36	0.041	0.631	0.672
2014	3	11	25	36	0.067	0.085	0.152
2014	4	18	28	46	0.115	0.142	0.257
2014	5	27	44	71	0.137	0.210	0.347
2014	6	25	33	58	0.148	0.357	0.505
2014	7	31	38	69	0.121	0.182	0.303
2014	8	47	29	76	0.301	0.162	0.463
2014	9	41	36	77	0.525	0.186	0.711
2014	10	51	43	94	0.231	0.251	0.482

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2014	11	32	41	73	0.841	0.184	1.025
2014	12	84	57	141	0.444	0.261	0.705
2015	1	47	32	79	0.287	0.558	0.845
2015	2	41	17	58	0.312	0.187	0.499
2015	3	56	34	90	0.268	0.449	0.717
2015	4	56	50	106	0.217	0.247	0.464
2015	5	58	27	85	0.209	0.127	0.336
2015	6	73	32	105	0.289	0.172	0.461
2015	7	89	39	128	0.511	0.221	0.732
2015	8	69	64	133	0.464	0.274	0.738
2015	9	51	47	98	0.281	0.235	0.516
2015	10	58	56	114	0.339	0.306	0.645
2015	11	109	70	179	0.631	2.436	3.067
2015	12	157	165	322	2.758	4.749	7.507
2016	1	49	55	104	0.917	0.783	1.700
2016	2	120	66	186	2.739	0.739	3.478
2016	3	78	46	124	1.250	0.787	2.037
2016	4	54	33	87	0.826	0.226	1.052
2016	5	41	29	70	0.603	0.140	0.743
2016	6	45	41	86	0.387	0.286	0.673
2016	7	33	31	64	0.302	0.159	0.461
2016	8	45	30	75	0.268	0.216	0.484
2016	9	40	29	69	0.251	0.210	0.461
2016	10	51	28	79	0.730	0.158	0.888
2016	11	40	36	76	0.219	0.235	0.454
2016	12	46	28	74	0.280	0.189	0.469
2017	1	39	35	74	0.251	0.214	0.465
2017	2	61	27	88	0.378	0.175	0.553
2017	3	57	37	94	0.389	0.231	0.620
2017	4	51	33	84	0.271	0.192	0.463
2017	5	57	33	90	0.282	0.167	0.449
2017	6	53	46	99	0.294	0.339	0.633
2017	7	70	45	115	0.398	0.359	0.757
2017	8	67	46	113	0.448	0.268	0.716
2017	9	55	39	94	0.350	0.255	0.605
2017	10	58	50	108	0.330	0.333	0.663
2017	11	68	46	114	0.394	0.292	0.686
2017	12	37	40	77	0.484	0.272	0.756
2018	1	67	50	117	1.437	0.325	1.762
2018	2	68	59	127	0.455	0.404	0.859
2018	3	81	83	164	0.549	0.609	1.158
2018	4	108	100	208	1.045	1.684	2.729
2018	5	126	131	257	0.927	0.946	1.873
2018	6	139	102	241	1.020	0.752	1.772
2018	7	158	135	293	1.186	1.055	2.241
2018	8	124	139	263	0.935	1.003	1.938
2018	9	89	86	175	1.389	0.620	2.009
2018	10	194	177	371	1.515	1.392	2.907
2018	11	170	178	348	1.360	1.326	2.686
2018	12	163	222	385	1.141	1.670	2.811
2019	1	218	162	380	2.217	1.276	3.493
2019	2	171	162	333	1.586	1.369	2.955

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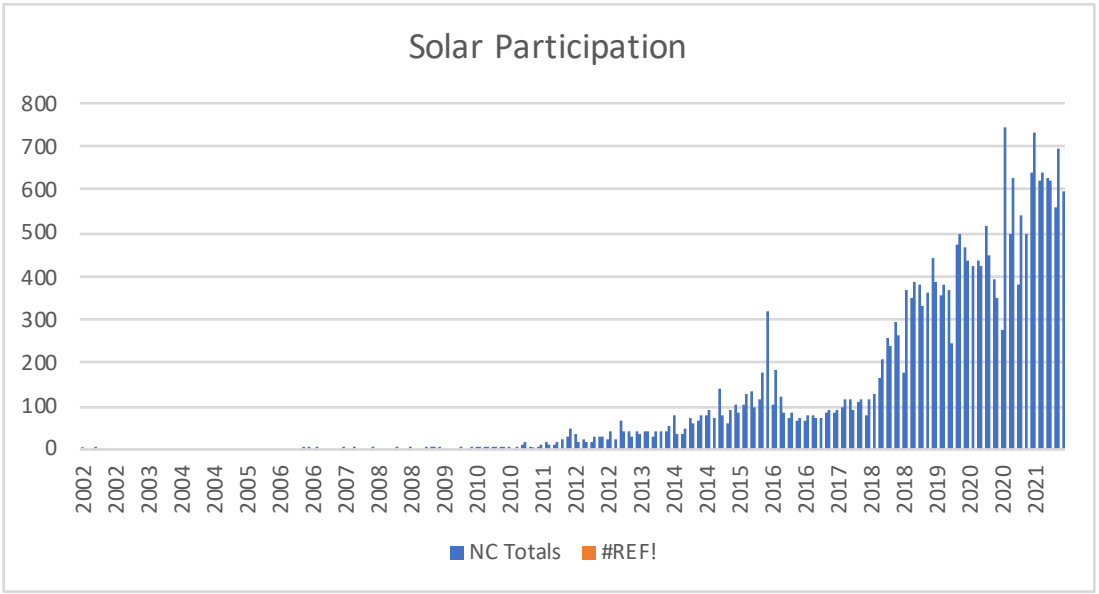
2019	3	229	134	363	1.817	0.998	2.815
2019	4	242	203	445	1.881	1.513	3.394
2019	5	216	169	385	2.675	1.296	3.971
2019	6	210	149	359	1.893	1.412	3.305
2019	7	218	162	380	2.180	1.225	3.405
2019	8	208	160	368	1.410	1.463	2.873
2019	9	141	104	245	1.151	0.835	1.986
2019	10	264	207	471	2.072	1.797	3.869
2019	11	228	271	499	1.844	2.494	4.338
2019	12	247	222	469	1.981	2.020	4.001
2020	1	240	197	437	1.929	1.697	3.626
2020	2	230	193	423	4.649	1.518	6.167
2020	3	222	215	437	1.903	1.718	3.621
2020	4	235	191	426	2.126	1.554	3.680
2020	5	282	232	514	2.294	2.058	4.352
2020	6	241	208	449	1.691	1.530	3.221
2020	7	201	191	392	1.580	1.796	3.376
2020	8	188	162	350	1.415	1.561	2.976
2020	9	162	114	276	1.119	0.903	2.022
2020	10	373	374	747	2.958	3.007	5.965
2020	11	264	233	497	2.096	2.095	4.191
2020	12	278	347	625	2.321	2.771	5.092
2021	1	208	171	379	1.622	1.336	2.958
2021	2	232	306	538	1.681	2.261	3.942
2021	3	276	220	496	2.174	1.826	4.000
2021	4	314	328	642	2.425	2.421	4.846
2021	5	301	430	731	2.123	3.277	5.400
2021	6	317	307	624	2.512	2.368	4.880
2021	7	343	294	637	2.385	2.734	5.119
2021	8	344	282	626	2.417	2.223	4.640
2021	9	240	383	623	1.598	3.191	4.789
2021	10	304	254	558	2.306	1.960	4.266
2021	11	312	382	694	2.612	3.117	5.729
2021	12	263	336	599	2.054	3.015	5.069



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Attachment 2

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Mr. Beach is principal consultant with the consulting firm Crossborder Energy. Crossborder Energy provides economic consulting services and strategic advice on market and regulatory issues concerning the natural gas and electric industries. The firm is based in Berkeley, California, and its practice focuses on the energy markets in California, the U.S., and Canada.

Since 1989, Mr. Beach has had an active consulting practice on policy, economic, and ratemaking issues concerning renewable energy development, the restructuring of the gas and electric industries, the addition of new natural gas pipeline and storage capacity, and a wide range of issues concerning independent power generation. From 1981 through 1989 he served at the California Public Utilities Commission, including five years as an advisor to three CPUC commissioners. While at the CPUC, he was a key advisor on the CPUC's restructuring of the natural gas industry in California, and worked extensively on the state's implementation of the Public Utilities Regulatory Policies Act of 1978.

AREAS OF EXPERTISE

- *Renewable Energy Issues:* extensive experience assisting clients with issues concerning Renewable Portfolio Standard programs, including program structure and rate impacts. He has also worked for the solar industry on rate design and net energy metering issues, on the creation of the California Solar Initiative, as well as on a wide range of solar issues in many other states.

- *Restructuring the Natural Gas and Electric Industries:* consulting and expert testimony on numerous issues involving the restructuring of the electric industry, including the 2000 - 2001 Western energy crisis.

- *Energy Markets:* studies and consultation on the dynamics of natural gas and electric markets, including the impacts of new pipeline capacity on natural gas prices and of electric restructuring on wholesale electric prices.

- *Qualifying Facility Issues:* consulting with QF clients on a broad range of issues involving independent power facilities in the Western U.S. He is one of the leading experts in California on the calculation of avoided cost prices. Other QF issues on which he has worked include complex QF contract restructurings, standby rates, greenhouse gas emission regulations, and natural gas rates for cogenerators. Crossborder Energy's QF clients include the full range of QF technologies, both fossil-fueled and renewable.

- *Pricing Policy in Regulated Industries:* consulting and expert testimony on natural gas pipeline rates and on marginal cost-based rates for natural gas and electric utilities.

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EDUCATION

Mr. Beach holds a B.A. in English and physics from Dartmouth College, and an M.E. in mechanical engineering from the University of California at Berkeley.

ACADEMIC HONORS

Graduated from Dartmouth with high honors in physics and honors in English.
Chevron Fellowship, U.C. Berkeley, 1978-79

PROFESSIONAL ACCREDITATION

Registered professional engineer in the state of California.

EXPERT WITNESS TESTIMONY BEFORE THE CALIFORNIA PUBLIC UTILITIES COMMISSION

1. Prepared Direct Testimony on Behalf of **Pacific Gas & Electric Company/Pacific Gas Transmission** (I. 88-12-027 — July 15, 1989)

   - *Competitive and environmental benefits of new natural gas pipeline capacity to California.*

2. a. Prepared Direct Testimony on Behalf of the **Canadian Producer Group** (A. 89-08-024 — November 10, 1989)
   b. Prepared Rebuttal Testimony on Behalf of the **Canadian Producer Group** (A. 89-08-024 — November 30, 1989)

   - *Natural gas procurement policy; gas cost forecasting.*

3. Prepared Direct Testimony on Behalf of the **Canadian Producer Group** (R. 88-08-018 — December 7, 1989)

   - *Brokering of interstate pipeline capacity.*

4. Prepared Direct Testimony on Behalf of the **Canadian Producer Group** (A. 90-08-029 — November 1, 1990)

   - *Natural gas procurement policy; gas cost forecasting; brokerage fees.*

5. Prepared Direct Testimony on Behalf of the **Alberta Petroleum Marketing Commission and the Canadian Producer Group** (I. 86-06-005 — December 21, 1990)

   - *Firm and interruptible rates for noncore natural gas users*

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6. a. Prepared Direct Testimony on Behalf of the **Alberta Petroleum Marketing Commission** (R. 88-08-018 — January 25, 1991)
   b. Prepared Responsive Testimony on Behalf of the **Alberta Petroleum Marketing Commission** (R. 88-08-018 — March 29, 1991)

   - *Brokering of interstate pipeline capacity; intrastate transportation policies.*

7. Prepared Direct Testimony on Behalf of the **Canadian Producer Group** (A. 90-08-029/Phase II — April 17, 1991)

   - *Natural gas brokerage and transport fees.*

8. Prepared Direct Testimony on Behalf of **LUZ Partnership Management** (A. 91-01-027 — July 15, 1991)

   - *Natural gas parity rates for cogenerators and solar thermal power plants.*

9. Prepared Joint Testimony of R. Thomas Beach and Dr. Robert B. Weisenmiller on Behalf of the **California Cogeneration Council** (I. 89-07-004 — July 15, 1991)

   - *Avoided cost pricing; use of published natural gas price indices to set avoided cost prices for qualifying facilities.*

10. a. Prepared Direct Testimony on Behalf of the **Indicated Expansion Shippers** (A. 89-04-033 — October 28, 1991)
    b. Prepared Rebuttal Testimony on Behalf of the **Indicated Expansion Shippers** (A. 89-04-0033 — November 26,1991)

    - *Natural gas pipeline rate design; cost/benefit analysis of rolled-in rates.*

11. Prepared Direct Testimony on Behalf of the **Independent Petroleum Association of Canada** (A. 91-04-003 — January 17, 1992)

    - *Natural gas procurement policy; prudence of past gas purchases.*

12. a. Prepared Direct Testimony on Behalf of the **California Cogeneration Council** (I.86-06-005/Phase II — June 18, 1992)
    b. Prepared Rebuttal Testimony on Behalf of the **California Cogeneration Council** (I. 86-06-005/Phase II — July 2, 1992)

    - *Long-Run Marginal Cost (LRMC) rate design for natural gas utilities.*

13. Prepared Direct Testimony on Behalf of the **California Cogeneration Council** (A. 92-10-017 — February 19, 1993)

    - *Performance-based ratemaking for electric utilities.*

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14. Prepared Direct Testimony on Behalf of the **SEGS Projects** (C. 93-02-014/A. 93-03-053 — May 21, 1993)

    - *Natural gas transportation service for wholesale customers.*

15 a. Prepared Direct Testimony on Behalf of the **Canadian Association of Petroleum Producers** (A. 92-12-043/A. 93-03-038 — June 28, 1993)
   b. Prepared Rebuttal Testimony of Behalf of the **Canadian Association of Petroleum Producers** (A. 92-12-043/A. 93-03-038 — July 8, 1993)

    - *Natural gas pipeline rate design issues.*

16. a. Prepared Direct Testimony on Behalf of the **SEGS Projects** (C. 93-05-023 — November 10, 1993)
    b. Prepared Rebuttal Testimony on Behalf of the **SEGS Projects** (C. 93-05-023 — January 10, 1994)

    - *Utility overcharges for natural gas service; cogeneration parity issues.*

17. Prepared Direct Testimony on Behalf of the **City of Vernon** (A. 93-09-006/A. 93-08-022/A. 93-09-048 — June 17, 1994)

    - *Natural gas rate design for wholesale customers; retail competition issues.*

18. Prepared Direct Testimony of R. Thomas Beach on Behalf of the **SEGS Projects** (A. 94-01-021 — August 5, 1994)

    - *Natural gas rate design issues; rate parity for solar thermal power plants.*

19. Prepared Direct Testimony on Transition Cost Issues on Behalf of **Watson Cogeneration Company** (R. 94-04-031/I. 94-04-032 — December 5, 1994)

    - *Policy issues concerning the calculation, allocation, and recovery of transition costs associated with electric industry restructuring.*

20. Prepared Direct Testimony on Nuclear Cost Recovery Issues on Behalf of the **California Cogeneration Council** (A. 93-12-025/I. 94-02-002 — February 14, 1995)

    - *Recovery of above-market nuclear plant costs under electric restructuring.*

21. Prepared Direct Testimony on Behalf of the **Sacramento Municipal Utility District** (A. 94-11-015 — June 16, 1995)

    - *Natural gas rate design; unbundled mainline transportation rates.*

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22. Prepared Direct Testimony on Behalf of **Watson Cogeneration Company** (A. 95-05-049 — September 11, 1995)

    - *Incremental Energy Rates; air quality compliance costs.*

23. a. Prepared Direct Testimony on Behalf of the **Canadian Association of Petroleum Producers** (A. 92-12-043/A. 93-03-038/A. 94-05-035/A. 94-06-034/A. 94-09-056/A. 94-06-044 — January 30, 1996)
    b. Prepared Rebuttal Testimony on Behalf of the **Canadian Association of Petroleum Producers** (A. 92-12-043/A. 93-03-038/A. 94-05-035/A. 94-06-034/A. 94-09-056/A. 94-06-044 — February 28, 1996)

    - *Natural gas market dynamics; gas pipeline rate design.*

24. Prepared Direct Testimony on Behalf of the **California Cogeneration Council and Watson Cogeneration Company** (A. 96-03-031 — July 12, 1996)

    - *Natural gas rate design: parity rates for cogenerators.*

25. Prepared Direct Testimony on Behalf of the **City of Vernon** (A. 96-10-038 — August 6, 1997)

    - *Impacts of a major utility merger on competition in natural gas and electric markets.*

26. a. Prepared Direct Testimony on Behalf of the **Electricity Generation Coalition** (A. 97-03-002 — December 18, 1997)
    b. Prepared Rebuttal Testimony on Behalf of the **Electricity Generation Coalition** (A. 97-03-002 — January 9, 1998)

    - *Natural gas rate design for gas-fired electric generators.*

27. Prepared Direct Testimony on Behalf of the **City of Vernon** (A. 97-03-015 — January 16, 1998)

    - *Natural gas service to Baja, California, Mexico.*

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28. a. Prepared Direct Testimony on Behalf of the **California Cogeneration Council and Watson Cogeneration Company** (A. 98-10-012/A. 98-10-031/A. 98-07-005 — March 4, 1999).
    b. Prepared Direct Testimony on Behalf of the **California Cogeneration Council** (A. 98-10-012/A. 98-01-031/A. 98-07-005 — March 15, 1999).
    c. Prepared Direct Testimony on Behalf of the **California Cogeneration Council** (A. 98-10-012/A. 98-01-031/A. 98-07-005 — June 25, 1999).

    - *Natural gas cost allocation and rate design for gas-fired electric generators.*

29. a. Prepared Direct Testimony on Behalf of the **California Cogeneration Council and Watson Cogeneration Company** (R. 99-11-022 — February 11, 2000).
    b. Prepared Rebuttal Testimony on Behalf of the **California Cogeneration Council and Watson Cogeneration Company** (R. 99-11-022 — March 6, 2000).
    c. Prepared Direct Testimony on Line Loss Issues of behalf of the **California Cogeneration Council** (R. 99-11-022 — April 28, 2000).
    d. Supplemental Direct Testimony in Response to ALJ Cooke's Request on behalf of the **California Cogeneration Council and Watson Cogeneration Company** (R. 99-11-022 — April 28, 2000).
    e. Prepared Rebuttal Testimony on Line Loss Issues on behalf of the **California Cogeneration Council** (R. 99-11-022 — May 8, 2000).

    - *Market-based, avoided cost pricing for the electric output of gas-fired cogeneration facilities in the California market; electric line losses.*

30. a. Direct Testimony on behalf of the **Indicated Electric Generators** in Support of the Comprehensive Gas OII Settlement Agreement for Southern California Gas Company and San Diego Gas & Electric Company (I. 99-07-003 — May 5, 2000).
    b. Rebuttal Testimony in Support of the Comprehensive Settlement Agreement on behalf of the **Indicated Electric Generators** (I. 99-07-003 — May 19, 2000).

    - *Testimony in support of a comprehensive restructuring of natural gas rates and services on the Southern California Gas Company system. Natural gas cost allocation and rate design for gas-fired electric generators.*

31. a. Prepared Direct Testimony on the Cogeneration Gas Allowance on behalf of the **California Cogeneration Council** (A. 00-04-002 — September 1, 2000).
    b. Prepared Direct Testimony on behalf of **Southern Energy California** (A. 00-04-002 — September 1, 2000).

    - *Natural gas cost allocation and rate design for gas-fired electric generators.*

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32. a. Prepared Direct Testimony on behalf of **Watson Cogeneration Company** (A. 00-06-032 — September 18, 2000).
    b. Prepared Rebuttal Testimony on behalf of **Watson Cogeneration Company** (A. 00-06-032 — October 6, 2000).

    - *Rate design for a natural gas "peaking service."*

33. a. Prepared Direct Testimony on behalf of **PG&E National Energy Group & Calpine Corporation** (I. 00-11-002—April 25, 2001).
    b. Prepared Rebuttal Testimony on behalf of **PG&E National Energy Group & Calpine Corporation** (I. 00-11-002—May 15, 2001).

    - *Terms and conditions of natural gas service to electric generators; gas curtailment policies.*

34. a. Prepared Direct Testimony on behalf of the **California Cogeneration Council** (R. 99-11-022—May 7, 2001).
    b. Prepared Rebuttal Testimony on behalf of the **California Cogeneration Council** (R. 99-11-022—May 30, 2001).

    - *Avoided cost pricing for alternative energy producers in California.*

35. a. Prepared Direct Testimony of R. Thomas Beach in Support of the Application of **Wild Goose Storage Inc.** (A. 01-06-029—June 18, 2001).
    b. Prepared Rebuttal Testimony of R. Thomas Beach on behalf of **Wild Goose Storage** (A. 01-06-029—November 2, 2001)

    - *Consumer benefits from expanded natural gas storage capacity in California.*

36. Prepared Direct Testimony on behalf of the **County of San Bernardino** (I. 01-06-047—December 14, 2001)

    - *Reasonableness review of a natural gas utility's procurement practices and storage operations.*

37. a. Prepared Direct Testimony on behalf of the **California Cogeneration Council** (R. 01-10-024—May 31, 2002)
    b. Prepared Supplemental Testimony on behalf of the **California Cogeneration Council** (R. 01-10-024—May 31, 2002)

    - *Electric procurement policies for California's electric utilities in the aftermath of the California energy crisis.*

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38. Prepared Direct Testimony on behalf of the **California Manufacturers & Technology Association** (R. 02-01-011—June 6, 2002)

    - *"Exit fees" for direct access customers in California.*

39. Prepared Direct Testimony on behalf of the **County of San Bernardino** (A. 02-02-012 — August 5, 2002)

    - *General rate case issues for a natural gas utility; reasonableness review of a natural gas utility's procurement practices.*

40. Prepared Direct Testimony on behalf of the **California Manufacturers and Technology Association** (A. 98-07-003 — February 7, 2003)

    - *Recovery of past utility procurement costs from direct access customers.*

41. a. Prepared Direct Testimony on behalf of the **California Cogeneration Council, the California Manufacturers & Technology Association, Calpine Corporation, and Mirant Americas, Inc.** (A 01-10-011 — February 28, 2003)
    b. Prepared Rebuttal Testimony on behalf of the **California Cogeneration Council, the California Manufacturers & Technology Association, Calpine Corporation, and Mirant Americas, Inc.** (A 01-10-011 — March 24, 2003)

    - *Rate design issues for Pacific Gas & Electric's gas transmission system (Gas Accord II).*

42. a. Prepared Direct Testimony on behalf of the **California Manufacturers & Technology Association; Calpine Corporation; Duke Energy North America; Mirant Americas, Inc.; Watson Cogeneration Company; and West Coast Power, Inc.** (R. 02-06-041 — March 21, 2003)
    b. Prepared Rebuttal Testimony on behalf of the **California Manufacturers & Technology Association; Calpine Corporation; Duke Energy North America; Mirant Americas, Inc.; Watson Cogeneration Company; and West Coast Power, Inc.** (R. 02-06-041 — April 4, 2003)

    - *Cost allocation of above-market interstate pipeline costs for the California natural gas utilities.*

43. Prepared Direct Testimony of R. Thomas Beach and Nancy Rader on behalf of the **California Wind Energy Association** (R. 01-10-024 — April 1, 2003)

    - *Design and implementation of a Renewable Portfolio Standard in California.*

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44. a. Prepared Direct Testimony on behalf of the **California Cogeneration Council** (R. 01-10-024 — June 23, 2003)
    b. Prepared Supplemental Testimony on behalf of the **California Cogeneration Council** (R. 01-10-024 — June 29, 2003)

    - *Power procurement policies for electric utilities in California.*

45. Prepared Direct Testimony on behalf of the **Indicated Commercial Parties** (02-05-004 — August 29, 2003)

    - *Electric revenue allocation and rate design for commercial customers in southern California.*

46. a. Prepared Direct Testimony on behalf of **Calpine Corporation and the California Cogeneration Council** (A. 04-03-021 — July 16, 2004)
    b. Prepared Rebuttal Testimony on behalf of **Calpine Corporation and the California Cogeneration Council** (A. 04-03-021 — July 26, 2004)

    - *Policy and rate design issues for Pacific Gas & Electric's gas transmission system (Gas Accord III).*

47. Prepared Direct Testimony on behalf of the **California Cogeneration Council** (A. 04-04-003 — August 6, 2004)

    - *Policy and contract issues concerning cogeneration QFs in California.*

48. a. Prepared Direct Testimony on behalf of the **California Cogeneration Council and the California Manufacturers and Technology Association** (A. 04-07-044 — January 11, 2005)
    b. Prepared Rebuttal Testimony on behalf of the **California Cogeneration Council and the California Manufacturers and Technology Association** (A. 04-07-044 — January 28, 2005)

    - *Natural gas cost allocation and rate design for large transportation customers in northern California.*

49. a. Prepared Direct Testimony on behalf of the **California Manufacturers and Technology Association and the Indicated Commercial Parties** (A. 04-06-024 — March 7, 2005)
    b. Prepared Rebuttal Testimony on behalf of the **California Manufacturers and Technology Association and the Indicated Commercial Parties** (A. 04-06-024 — April 26, 2005)

    - *Electric marginal costs, revenue allocation, and rate design for commercial and industrial electric customers in northern California.*

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50. Prepared Direct Testimony on behalf of the **California Solar Energy Industries Association** (R. 04-03-017 — April 28, 2005)

    - *Cost-effectiveness of the Million Solar Roofs Program.*

51. Prepared Direct Testimony on behalf of **Watson Cogeneration Company, the Indicated Producers, and the California Manufacturing and Technology Association** (A. 04-12-004 — July 29, 2005)

    - *Natural gas rate design policy; integration of gas utility systems.*

52. a. Prepared Direct Testimony on behalf of the **California Cogeneration Council** (R. 04-04-003/R. 04-04-025 — August 31, 2005)
    b. Prepared Rebuttal Testimony on behalf of the **California Cogeneration Council** (R. 04-04-003/R. 04-04-025 — October 28, 2005)

    - *Avoided cost rates and contracting policies for QFs in California*

53. a. Prepared Direct Testimony on behalf of the **California Manufacturers and Technology Association and the Indicated Commercial Parties** (A. 05-05-023 — January 20, 2006)
    b. Prepared Rebuttal Testimony on behalf of the **California Manufacturers and Technology Association and the Indicated Commercial Parties** (A. 05-05-023 — February 24, 2006)

    - *Electric marginal costs, revenue allocation, and rate design for commercial and industrial electric customers in southern California.*

54. a. Prepared Direct Testimony on behalf of the **California Producers** (R. 04-08-018 – January 30, 2006)
    b. Prepared Rebuttal Testimony on behalf of the **California Producers** (R. 04-08-018 – February 21, 2006)

    - *Transportation and balancing issues concerning California gas production.*

55. Prepared Direct Testimony on behalf of the **California Manufacturers and Technology Association and the Indicated Commercial Parties** (A. 06-03-005 — October 27, 2006)

    - *Electric marginal costs, revenue allocation, and rate design for commercial and industrial electric customers in northern California.*

56. Prepared Direct Testimony on behalf of the **California Cogeneration Council** (A. 05-12-030 — March 29, 2006)

    - *Review and approval of a new contract with a gas-fired cogeneration project.*

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57. a. Prepared Direct Testimony on behalf of **Watson Cogeneration, Indicated Producers, the California Cogeneration Council, and the California Manufacturers and Technology Association** (A. 04-12-004 — July 14, 2006)
    b. Prepared Rebuttal Testimony on behalf of **Watson Cogeneration, Indicated Producers, the California Cogeneration Council, and the California Manufacturers and Technology Association** (A. 04-12-004 — July 31, 2006)

    - *Restructuring of the natural gas system in southern California to include firm capacity rights; unbundling of natural gas services; risk/reward issues for natural gas utilities.*

58. Prepared Direct Testimony on behalf of the **California Cogeneration Council** (R. 06-02-013 — March 2, 2007)

    - *Utility procurement policies concerning gas-fired cogeneration facilities.*

59. a. Prepared Direct Testimony on behalf of the **Solar Alliance** (A. 07-01-047 — August 10, 2007)
    b. Prepared Rebuttal Testimony on behalf of the **Solar Alliance** (A. 07-01-047 — September 24, 2007)

    - *Electric rate design issues that impact customers installing solar photovoltaic systems.*

60. a. Prepared Direct Testimony on Behalf of **Gas Transmission Northwest Corporation** (A. 07-12-021 — May 15, 2008)
    b. Prepared Rebuttal Testimony on Behalf of **Gas Transmission Northwest Corporation** (A. 07-12-021 — June 13, 2008)

    - *Utility subscription to new natural gas pipeline capacity serving California.*

61. a. Prepared Direct Testimony on behalf of the **Solar Alliance** (A. 08-03-015 — September 12, 2008)
    b. Prepared Rebuttal Testimony on behalf of the **Solar Alliance** (A. 08-03-015 — October 3, 2008)

    - *Issues concerning the design of a utility-sponsored program to install 500 MW of utility- and independently-owned solar photovoltaic systems.*

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62. Prepared Direct Testimony on behalf of the **Solar Alliance** (A. 08-03-002 — October 31, 2008)

    - *Electric rate design issues that impact customers installing solar photovoltaic systems.*

63. a. Phase II Direct Testimony on behalf of **Indicated Producers, the California Cogeneration Council, California Manufacturers and Technology Association, and Watson Cogeneration Company** (A. 08-02-001 — December 23, 2008)
    b. Phase II Rebuttal Testimony on behalf of **Indicated Producers, the California Cogeneration Council, California Manufacturers and Technology Association, and Watson Cogeneration Company** (A. 08-02-001 — January 27, 2009)

    - *Natural gas cost allocation and rate design issues for large customers.*

64. a. Prepared Direct Testimony on behalf of the **California Cogeneration Council** (A. 09-05-026 — November 4, 2009)

    - *Natural gas cost allocation and rate design issues for large customers.*

65. a. Prepared Direct Testimony on behalf of **Indicated Producers and Watson Cogeneration Company** (A. 10-03-028 — October 5, 2010)
    b. Prepared Rebuttal Testimony on behalf of **Indicated Producers and Watson Cogeneration Company** (A. 10-03-028 — October 26, 2010)

    - *Revisions to a program of firm backbone capacity rights on natural gas pipelines.*

66. Prepared Direct Testimony on behalf of the **Solar Alliance** (A. 10-03-014 — October 6, 2010)

    - *Electric rate design issues that impact customers installing solar photovoltaic systems.*

67. Prepared Rebuttal Testimony on behalf of the **Indicated Settling Parties** (A. 09-09-013 — October 11, 2010)

    - *Testimony on proposed modifications to a broad-based settlement of rate-related issues on the Pacific Gas & Electric natural gas pipeline system.*

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68. a. Supplemental Prepared Direct Testimony on behalf of **Sacramento Natural Gas Storage, LLC** (A. 07-04-013 — December 6, 2010)
    b. Supplemental Prepared Rebuttal Testimony on behalf of **Sacramento Natural Gas Storage, LLC** (A. 07-04-013 — December 13, 2010)
    c. Supplemental Prepared Reply Testimony on behalf of **Sacramento Natural Gas Storage, LLC** (A. 07-04-013 — December 20, 2010)

    - *Local reliability benefits of a new natural gas storage facility.*

69. Prepared Direct Testimony on behalf of **The Vote Solar Initiative** (A. 10-11-015—June 1, 2011)

    - *Distributed generation policies; utility distribution planning.*

70. Prepared Reply Testimony on behalf of the **Solar Alliance** (A. 10-03-014—August 5, 2011)

    - *Electric rate design for commercial & industrial solar customers.*

71. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 11-06-007—February 6, 2012)

    - *Electric rate design for solar customers; marginal costs.*

72. a. Prepared Direct Testimony on behalf of the **Northern California Indicated Producers** (R.11-02-019—January 31, 2012)
    b. Prepared Rebuttal Testimony on behalf of the **Northern California Indicated Producers** (R. 11-02-019—February 28, 2012)

    - *Natural gas pipeline safety policies and costs*

73. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 11-10-002—June 12, 2012)

    - *Electric rate design for solar customers; marginal costs.*

74. Prepared Direct Testimony on behalf of the **Southern California Indicated Producers** and **Watson Cogeneration Company** (A. 11-11-002—June 19, 2012)

    - *Natural gas pipeline safety policies and costs*

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75. a. Testimony on behalf of the **California Cogeneration Council** (R. 12-03-014—June 25, 2012)
    b. Reply Testimony on behalf of the **California Cogeneration Council** (R. 12-03-014—July 23, 2012)

    - *Ability of combined heat and power resources to serve local reliability needs in southern California.*

76. a. Prepared Testimony on behalf of the **Southern California Indicated Producers** and **Watson Cogeneration Company** (A. 11-11-002, Phase 2—November 16, 2012)
    b. Prepared Rebuttal Testimony on behalf of the **Southern California Indicated Producers** and **Watson Cogeneration Company** (A. 11-11-002, Phase 2—December 14, 2012)

    - *Allocation and recovery of natural gas pipeline safety costs.*

77. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 12-12-002—May 10, 2013)

    - *Electric rate design for commercial & industrial solar customers; marginal costs.*

78. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 13-04-012—December 13, 2013)

    - *Electric rate design for commercial & industrial solar customers; marginal costs.*

79. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 13-12-015—June 30, 2014)

    - *Electric rate design for commercial & industrial solar customers; residential time-of-use rate design issues.*

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80. a. Prepared Direct Testimony on behalf of **Calpine Corporation** and the **Indicated Shippers** (A. 13-12-012—August 11, 2014)
    b. Prepared Direct Testimony on behalf of **Calpine Corporation, the Canadian Association of Petroleum Producers, Gas Transmission Northwest,** and **the City of Palo Alto** (A. 13-12-012—August 11, 2014)
    c. Prepared Rebuttal Testimony on behalf of **Calpine Corporation** (A. 13-12-012—September 15, 2014)
    d. Prepared Rebuttal Testimony on behalf of **Calpine Corporation, the Canadian Association of Petroleum Producers, Gas Transmission Northwest,** and **the City of Palo Alto** (A. 13-12-012—September 15, 2014)

    - *Rate design, cost allocation, and revenue requirement issues for the gas transmission system of a major natural gas utility.*

81. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (R. 12-06-013—September 15, 2014)

    - *Comprehensive review of policies for rate design for residential electric customers in California.*

82. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 14-06-014—March 13, 2015)

    - *Electric rate design for commercial & industrial solar customers; marginal costs.*

83. a. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A.14-11-014—May 1, 2015)
    b. Prepared Rebuttal Testimony on behalf of the **Solar Energy Industries Association** (A. 14-11-014—May 26, 2015)

    - *Time-of-use periods for residential TOU rates.*

84. Prepared Rebuttal Testimony on behalf of the **Joint Solar Parties** (R. 14-07-002 — September 30, 2015)

    - *Electric rate design issues concerning proposals for the net energy metering successor tariff in California.*

85. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 15-04-012—July 5, 2016)

    - *Selection of Time-of-Use periods, and rate design issues for solar customers.*

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86. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 16-09-003 — April 28, 2017)

    - *Selection of Time-of-Use periods, and rate design issues for solar customers.*

87. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 17-06-030 — March 23, 2018)

    - *Selection of Time-of-Use periods, and rate design issues for solar customers.*

88. Prepared Direct and Rebuttal Testimony on behalf of **Calpine Corporation** (A. 17-11-009 – July 20 and August 20, 2018)

    - *Gas transportation rates for electric generators, gas storage and balancing issues*

89. Prepared Direct Testimony on behalf of **Gas Transmission Northwest LLC** and the **City of Palo Alto** (A. 17-11-009 – July 20, 2018)

    - *Rate design for intrastate backbone gas transportation rates*

90. Prepared Direct Testimony on behalf of **EVgo** (A. 18-11-003 – April 5, 2019)

    - *Electric rate design for commercial electric vehicle charging*

91. Prepared Direct and Rebuttal Testimony on behalf of **Vote Solar** and the **Solar Energy Industries Association** (R. 14-10-003 — October 7 and 21, 2019)

    - *Avoided cost issues for distributed energy resources*

92. Prepared Direct and Rebuttal Testimony on behalf of **EVgo** (A. 19-07-006 – January 13 and February 20, 2020)

    - *Electric rate design for commercial electric vehicle charging*

93. Prepared Direct Testimony on behalf of the **Solar Energy Industries Association** (A. 19-03-002 — March 17, 2020)

    - *Electric rate design issues for solar and storage customers*

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EXPERT WITNESS TESTIMONY BEFORE THE ARIZONA CORPORATION COMMISSION

1. Prepared Direct, Rebuttal, and Supplemental Testimony on behalf of **The Alliance for Solar Choice (TASC)**, (Docket No. E-00000J-14-0023, February 27, April 7, and June 22, 2016).

   - *Development of a benefit-cost methodology for distributed, net metered solar resources in Arizona.*

2. Prepared Surrebuttal and Responsive Testimony on behalf of the **Energy Freedom Coalition of America** (Docket No. E-01933A-15-0239 – March 10 and September 15, 2016).

   - *Critique of a utility-owned solar program; comments on a fixed rate credit to replace net energy metering.*

3. Direct Testimony on behalf of the **Solar Energy Industries Association** (Docket No. E-01345A-16-0036, February 3, 2017).

4. Direct and Surrebuttal Testimony on behalf of **The Alliance for Solar Choice and the Energy Freedom Coalition of America** (Docket Nos. E-01933A-15-0239 (TEP), E-01933A-15-0322 (TEP), and E-04204A-15-0142 (UNSE) – May 17 and September 29, 2017).

EXPERT WITNESS TESTIMONY BEFORE THE COLORADO PUBLIC UTILITIES COMMISSION

1. Direct Testimony and Exhibits on behalf of the **Colorado Solar Energy Industries Association** and the **Solar Alliance**, (Docket No. 09AL-299E – October 2, 2009). https://www.dora.state.co.us/pls/efi/DDMS_Public.Display_Document?p_section=PUC&p_source=EFI_PRIVATE&p_doc_id=3470190&p_doc_key=0CD8F7FCDB673F1043928849D9D8CAB1&p_handle_not_found=Y

   - *Electric rate design policies to encourage the use of distributed solar generation.*

2. Direct Testimony and Exhibits on behalf of the **Vote Solar Initiative** and the **Interstate Renewable Energy Council**, (Docket No. 11A-418E – September 21, 2011).

   - *Development of a community solar program for Xcel Energy.*

3. Answer Testimony and Exhibits, plus Opening Testimony on Settlement, on behalf of the **Solar Energy Industries Association**, (Docket No. 16AL-0048E [Phase II] – June 6 and September 2, 2016).

   - *Rate design issues related to residential customers and solar distributed generation in a Public Service of Colorado general rate case.*

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EXPERT WITNESS TESTIMONY BEFORE THE GEORGIA PUBLIC SERVICE COMMISSION

1. Direct Testimony on behalf of **Georgia Interfaith Power & Light and Southface Energy Institute, Inc.** (Docket No. 40161 – May 3, 2016).

    - *Development of a cost-effectiveness methodology for solar resources in Georgia.*

EXPERT WITNESS TESTIMONY BEFORE THE IDAHO PUBLIC UTILITIES COMMISSION

1. Direct Testimony on behalf of the **Idaho Conservation League** (Case No. IPC-E-12-27—May 10, 2013)

    - *Costs and benefits of net energy metering in Idaho.*

2. a. Direct Testimony on behalf of the **Idaho Conservation League and the Sierra Club** (Case Nos. IPC-E-15-01/AVU-4-15-01/PAC-E-15-03 — April 23, 2015)
    b. Rebuttal Testimony on behalf of the **Idaho Conservation League and the Sierra Club** (Case Nos. IPC-E-15-01/AVU-4-15-01/PAC-E-15-03 — May 14, 2015)

    - *Issues concerning the term of PURPA contracts in Idaho.*

2. a. Direct Testimony on behalf of the **Sierra Club** (Case No. IPC-E-17-13 — December 22, 2017)
    b. Rebuttal Testimony on behalf of the **Sierra Club** (Case No. IPC-E-17-13 — January 26, 2018)

EXPERT WITNESS TESTIMONY BEFORE THE MASSACHUSETTS DEPARTMENT OF PUBLIC UTILITIES

1. Direct and Rebuttal Testimony on behalf of **Northeast Clean Energy Council, Inc.** (Docket D.P.U. 15-155, March 18 and April 28, 2016)

    - *Residential rate design and access fee proposals related to distributed generation in a National Grid general rate case.*

EXPERT WITNESS TESTIMONY BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

1. Prepared Direct Testimony on behalf of **Vote Solar** (Case No. U-18419—January 12, 2018)

2. Prepared Rebuttal Testimony on behalf of the **Environmental Law and Policy Center, the Ecology Center, the Solar energy Industries Association, Vote Solar, and the Union of Concerned Scientists** (Case No. U-18419 — February 2, 2018)

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EXPERT WITNESS TESTIMONY BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

1. Direct and Rebuttal Testimony on Behalf of **Geronimo Energy, LLC**. (In the Matter of the Petition of Northern States Power Company to Initiate a Competitive Resource Acquisition Process [OAH Docket No. 8-2500-30760, MPUC Docket No. E002/CN-12-1240, September 27 and October 18, 2013])

    - *Testimony in support of a competitive bid from a distributed solar project in an all-source solicitation for generating capacity.*

EXPERT WITNESS TESTIMONY BEFORE THE MONTANA PUBLIC SERVICE COMMISSION

1. Pre-filed Direct and Supplemental Testimony on Behalf of **Vote Solar and the Montana Environmental Information Center** (Docket No. D2016.5.39, October 14 and November 9, 2016).

    - *Avoided cost pricing issues for solar QFs in Montana.*

EXPERT WITNESS TESTIMONY BEFORE THE PUBLIC UTILITIES COMMISSION OF NEVADA

1. Pre-filed Direct Testimony on Behalf of the **Nevada Geothermal Industry Council** (Docket No. 97-2001—May 28, 1997)

    - *Avoided cost pricing for the electric output of geothermal generation facilities in Nevada.*

2. Pre-filed Direct Testimony on Behalf of **Nevada Sun-Peak Limited Partnership** (Docket No. 97-6008—September 5, 1997)

    - *QF pricing issues in Nevada.*

3. Pre-filed Direct Testimony on Behalf of the **Nevada Geothermal Industry Council** (Docket No. 98-2002 — June 18, 1998)

    - *Market-based, avoided cost pricing for the electric output of geothermal generation facilities in Nevada.*

4. a. Prepared Direct Testimony on behalf of **The Alliance for Solar Choice (TASC)**, (Docket Nos. 15-07041 and 15-07042 –October 27, 2015).
   b. Prepared Direct Testimony on Grandfathering Issues on behalf of **TASC**, (Docket Nos. 15-07041 and 15-07042 –February 1, 2016).

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c. Prepared Rebuttal Testimony on Grandfathering Issues on behalf of **TASC**, (Docket Nos. 15-07041 and 15-07042 –February 5, 2016).

- *Net energy metering and rate design issues in Nevada.*

EXPERT WITNESS TESTIMONY BEFORE THE NEW HAMPSHIRE PUBLIC UTILITIES COMMISSION

1. Prepared Direct and Rebuttal Testimony on behalf of **The Alliance for Solar Choice (TASC)**, (Docket No. DE 16-576, October 24 and December 21, 2016).

   - *Net energy metering and rate design issues in New Hampshire.*

EXPERT WITNESS TESTIMONY BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

1. Direct Testimony on Behalf of the **Interstate Renewable Energy Council** (Case No. 10-00086-UT—February 28, 2011)
   http://164.64.85.108/infodocs/2011/3/PRS20156810DOC.PDF

   - *Testimony on proposed standby rates for new distributed generation projects; cost-effectiveness of DG in New Mexico.*

2. Direct Testimony and Exhibits on behalf of the **New Mexico Independent Power Producers** (Case No. 11-00265-UT, October 3, 2011)

   - *Cost cap for the Renewable Portfolio Standard program in New Mexico*

EXPERT WITNESS TESTIMONY BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

1. Direct, Response, and Rebuttal Testimony on Behalf of the North Carolina Sustainable Energy Association. (In the Matter of Biennial Determination of Avoided Cost Rates for Electric Utility Purchases from Qualifying Facilities – 2014; Docket E-100 Sub 140; April 25, May 30, and June 20, 2014)

   - *Testimony on avoided cost issues related to solar and renewable qualifying facilities in North Carolina.*

April 25, 2014: http://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=89f3b50f-17cb-4218-87bd-c743e1238bc1
May 30, 2014: http://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=19e0b58d-a7f6-4d0d-9f4a-08260e561443
June 20, 2104: http://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=bd549755-d1b8-4c9b-b4a1-fc6e0bd2f9a2

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2. Direct Testimony on Behalf of the North Carolina Sustainable Energy Association. (In the Matter of Biennial Determination of Avoided Cost Rates for Electric Utility Purchases from Qualifying Facilities – 2018; Docket E-100 Sub 158; June 21, 2019)

    - *Testimony on avoided cost issues related to solar and renewable qualifying facilities in North Carolina.*

EXPERT WITNESS TESTIMONY BEFORE THE PUBLIC UTILITIES COMMISSION OF OREGON

1. a. Direct Testimony of Behalf of **Weyerhaeuser Company** (UM 1129 — August 3, 2004)
   b. Surrebuttal Testimony of Behalf of **Weyerhaeuser Company** (UM 1129 — October 14, 2004)

2. a. Direct Testimony of Behalf of **Weyerhaeuser Company and the Industrial Customers of Northwest Utilities** (UM 1129 / Phase II — February 27, 2006)
   b. Rebuttal Testimony of Behalf of **Weyerhaeuser Company and the Industrial Customers of Northwest Utilities** (UM 1129 / Phase II — April 7, 2006)

    - *Policies to promote the development of cogeneration and other qualifying facilities in Oregon.*

3. Direct Testimony on Behalf of the **Oregon Solar Energy Industries Association** (UM 1910,01911, and 1912 — March 16, 2018).

    - *Resource value of solar resources in Oregon*

EXPERT WITNESS TESTIMONY BEFORE THE PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA

1. Direct Testimony and Exhibits on behalf of **The Alliance for Solar Choice** (Docket No. 2014-246-E – December 11, 2014)
   https://dms.psc.sc.gov/attachments/matter/B7BACF7A-155D-141F-236BC437749BEF85

    - *Methodology for evaluating the cost-effectiveness of net energy metering*

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EXPERT WITNESS TESTIMONY BEFORE THE PUBLIC UTILITIES COMMISSION OF TEXAS

1. Direct Testimony on behalf of the **Solar Energy Industries Association** (SEIA) (Docket No. 44941 – December 11, 2015)

    - *Rate design issues concerning net metering and renewable distributed generation in an El Paso Electric general rate case.*

EXPERT WITNESS TESTIMONY BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

1. Direct Testimony on behalf of the **Sierra Club** (Docket No. 15-035-53—September 15, 2015)

    - *Issues concerning the term of PURPA contracts in Idaho.*

EXPERT WITNESS TESTIMONY BEFORE THE VERMONT PUBLIC SERVICE BOARD

1. Pre-filed Testimony of R. Thomas Beach and Patrick McGuire on Behalf of **Allco Renewable Energy Limited** (Docket No. 8010 — September 26, 2014)

    - *Avoided cost pricing issues in Vermont*

EXPERT WITNESS TESTIMONY BEFORE THE VIRGINIA CORPORATION COMMISSION

Direct Testimony and Exhibits on Behalf of the Maryland – District of Columbia – Virginia Solar Energy Industries Association, (Case No. PUE-2011-00088, October 11, 2011) http://www.scc.virginia.gov/docketsearch/DOCS/2gx%2501!.PDF

    - *Cost-effectiveness of, and standby rates for, net-metered solar customers.*

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LITIGATION EXPERIENCE

Mr. Beach has been retained as an expert in a variety of civil litigation matters. His work has included the preparation of reports on the following topics:

- The calculation of damages in disputes over the pricing terms of natural gas sales contracts (2 separate cases).
- The valuation of a contract for the purchase of power produced from wind generators.
- The compliance of cogeneration facilities with the policies and regulations applicable to Qualifying Facilities (QFs) under PURPA in California.
- Audit reports on the obligations of buyers and sellers under direct access electric contracts in the California market (2 separate cases).
- The valuation of interstate pipeline capacity contracts (3 separate cases).

In several of these matters, Mr. Beach was deposed by opposing counsel. Mr. Beach has also testified at trial in the bankruptcy of a major U.S. energy company, and has been retained as a consultant in anti-trust litigation concerning the California natural gas market in the period prior to and during the 2000-2001 California energy crisis.