BEFORE THE

NEW HAMPSHIRE PUBLIC UTILITIES COMMISSION

CONSIDERATION OF CHANGES TO THE CURRENT NET METERING TARIFF STRUCTURE, INCLUDING COMPENSATION OF CUSTOMER-GENERATORS	)	**DOCKET DE 22-060**

Direct Testimony of

Tim Woolf and Eric Borden

On Behalf of

The Office of the Consumer Advocate

December 6, 2023

Table of Contents

I. INTRODUCTION AND QUALIFICATIONS

Q Please state your name, title, and employer.

A Mr. Woolf: My name is Tim Woolf. I am a Senior Vice President at Synapse Energy Economics ("Synapse"), located at 485 Massachusetts Avenue #3, Cambridge, MA 02139.

A Mr. Borden: My name is Eric Borden. I am a Principal Associate at Synapse Energy Economics ("Synapse"), located at 485 Massachusetts Avenue #3, Cambridge, MA 02139.

Q Please describe Synapse Energy Economics.

A Synapse is a research and consulting firm specializing in electricity and gas industry regulation, planning, and analysis. Our work covers a range of issues, including economic and technical assessments of demand-side and supply-side energy resources, energy efficiency policies and programs, integrated resource planning, electricity market modeling and assessment, renewable resource technologies and policies, and climate change strategies. Synapse works for a wide range of clients, including attorneys general, offices of consumer advocates, public utility commissions, environmental advocates, the U.S. Environmental Protection Agency, the U.S. Department of Energy, the U.S. Department of Justice, the Federal Trade Commission, and the National Association of Regulatory Utility Commissioners. Synapse has over 35 professional staff with extensive experience in the electricity industry.

Q Please summarize your professional and educational experience.

A Mr. Woolf: I have over 40 years of experience analyzing technical, economic, and policy aspects of electric utility planning and regulation. In recent years, I have focused on many topics related to power sector transformation, including energy efficiency, distributed energy resources, performance-based regulation, new utility business models, grid modernization, and distribution system planning. I also address a variety of related ratemaking issues such as rate design, net metering rates, decoupling, and dynamic pricing.

Before joining Synapse Energy Economics, I was a commissioner at the Massachusetts Department of Public Utilities (DPU) from 2007 through 2011. In that capacity, I was responsible for overseeing a substantial expansion of clean energy policies, including significantly increased ratepayer-funded energy efficiency programs, an update of the DPU energy efficiency guidelines, the implementation of decoupled rates for electric and gas companies, the promulgation of net metering regulations, review and approval of smart grid pilot programs, and review and approval of long-term contracts for renewable power. I was also responsible for overseeing a variety of other dockets before the DPU, including several electric and gas utility rate cases.

I have testified as an expert witness in more than 45 state regulatory proceedings and have authored more than 60 reports on electricity industry regulation and restructuring. I represent clients in collaboratives, task forces, and settlement negotiations, and I have published articles on electric utility regulation in *Energy Policy*, *Public Utilities*

Fortnightly, *The Electricity Journal*, *Local Environment*, *Utilities Policy, Energy and Environment*, and *The Review of European Community and Environmental Law*.

I hold a Master's in Business Administration from Boston University, a Diploma in Economics from the London School of Economics, as well as a Bachelor of Science in Mechanical Engineering and a Bachelor of Arts in English from Tufts University. My resume, attached as Schedule TWEB-1, presents additional details of my professional and educational experience.

A **Mr. Borden:** I have over 10 years of experience in the energy and utility regulation space and have testified as an expert witness in multiple jurisdictions across North America. At Synapse, I conduct economic, environmental, and policy analysis of energy system technologies, policies, planning, and regulations associated with both supply- and demand-side resources. I have worked on numerous utility ratemaking, rate design, and cost allocation proceedings, and I have previously testified on net energy metering. I hold a Master's degree in Public Affairs with a concentration in Energy and Environmental Policy from the University of Texas at Austin LBJ School. My undergraduate degree is in finance and entrepreneurship from Washington University in St. Louis. My resume, attached as Schedule TWEB-2, presents additional details of my professional and educational experience.

Q Have you previously testified before the New Hampshire Public Utilities Commission?

A Mr. Woolf: Yes. I sponsored written testimony before the New Hampshire Public Utilities Commission (the Commission) in Docket DE 99-099 Phase II on January 14, 2000, in Docket DE 20-161 on August 19, 2022, and in Docket DE 23-068 on September 12, 2023.

A Mr. Borden: No.

Q On whose behalf are you testifying in this case?

A We are testifying on behalf of the Office of the Consumer Advocate (OCA).

Q What is the purpose of your testimony?

A The purpose of our testimony is to review and analyze the currently applicable Net Energy Metering (NEM) 2.0 residential tariff and recommend modifications to ensure the compensation structure is in residential ratepayers' interest.[1] Our analysis is specific to the Eversource service territory, which serves 71 percent of customers in New

[1] By "NEM 2.0," we mean the "alternative net metering tariff to be in effect for a period of years while further data is collected and analyzed, pilot programs are implemented, and a distributed energy resource (DER) valuation study is conducted," as approved by the Commission in Order No. 26,029 (2017) in Docket No. DE 16-576 at 1-2. "NEM 1.0" refers to the rate structure that applies to behind-the-meter systems installed prior to the effective date of the NEM 2.0 tariff. *See* Order No. 26,047 (2017) in Docket NO. DE 16-576 at 12-13 (discussing "grandfathering" issues and noting that systems on either NEM 1.0 or NEM 2.0 enjoy grandfathered status through December 31, 2040 pursuant to RSA 362-A:9, XV.

Hampshire.[2] We expect our general findings to be applicable to the other New Hampshire electric utilities, and our recommendations are relevant to all those utilities.

Q How did you analyze the impacts of the NEM 2.0 tariff?

A We created a spreadsheet model to estimate the rate and bill impacts of the NEM 2.0 compensation mechanism, and alternatives, on solar and non-solar customers in Eversource's service territory. We used the results of this model to support our conclusions and recommendations.

Q What materials did you rely on to develop your testimony?

A The sources for our testimony and exhibits are relevant New Hampshire legislation, previous Commission orders, the joint utility testimony in this docket, responses to discovery requests, public documents, and our professional knowledge and experience.

Q Was your testimony prepared by you or under your direction?

A Yes. Our testimony was prepared by us or under our direct supervision and control.

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2 New Hampshire Department of Energy, No Date. "Electric." https://www.energy.nh.gov/utilities-providers/regulated-utility-services/electric#:~:text=Eversource%2C%20serves%20approximately%2071%20percent%20of%20the%20customers%20in%20New%20Hampshire.

II. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Q Please summarize your primary conclusions.

A Our primary conclusions are as follows:

- Establishing a balanced distributed generation compensation mechanism is not a "set it and forget it" endeavor. It requires consistent monitoring and periodic changes to ensure that the mechanism continues to provide system benefits while avoiding unreasonable levels of rate impacts for non-solar customers.

- Periodic evaluations of distributed generation compensation mechanisms should be informed by quantitative analyses of the extent to which alternative compensation mechanisms will (a) encourage customer adoption of distributed generation, and (b) result in cost-shifting.

- Payback periods for solar adopters, i.e., the number of years after which the bill savings from solar will equal the upfront costs of the installation, provide a useful indication of how much customer adoption to expect from different compensation mechanisms. We estimate that the payback period under NEM 2.0 for a typical residential customer is roughly 13 years. This payback period appears to be sufficient to encourage a reasonable number of residential customers to adopt distributed PV. We estimate that by 2024 around 4.1 percent of residential customers will have participated in the NEM 1.0 and NEM 2.0 programs.

- We find that the rate impacts under NEM 2.0 are currently low and will remain low for the next several years. We estimate that by 2024 NEM 2.0 will raise rates by roughly 0.6 percent. By 2028, NEM 2.0 will raise rates by roughly 1.1 percent, as solar penetration reaches around 7.8 percent of residential customers.

- Compensation rates to solar customers under NEM 2.0 are volatile and are likely to increase over time. As compensation rates increase, the potential for rate impacts on non-solar customers under NEM 2.0 also increase.

- We analyzed several alternative designs for the distributed generation compensation mechanism. We focus on two key modifications to NEM 2.0: (a) using a compensation rate structure based on hourly netting of customer consumption and solar generation, as opposed to monthly, and (b) using a fixed export rate equal to avoided utility costs. These two modifications could reduce rate impacts of NEM 2.0 by 61 percent, while having a small (an additional two years) impact on the payback period of solar distributed generation.

Q Please summarize your primary recommendations.

A Our primary recommendations are as follows:

- The Commission should keep the NEM 2.0 compensation mechanism in place for the next two to three years, because rate impacts for non-solar customers are expected to remain reasonable.

- The Commission should require the joint utilities, by December 1, 2025, to submit an analysis of whether and how to modify NEM 2.0. This analysis should include a proposal for modifications that would maintain an appropriate level of customer adoption and a reasonable level of cost-shifting. This analysis should include quantitative forecasts of customer payback periods and rate impacts for several promising alternative compensation mechanisms. At a minimum, this analysis should include a proposal for a net billing tariff with hourly netting and a fixed compensation rate for solar distributed generation exports based on avoided costs. This mechanism better aligns power flows with compensation and hedges the price volatility of supply rates for both solar and non-solar customers.

- After the review in 2025, the Commission should periodically review solar distributed generation compensation structures as authorized by RSA 362-A:9, XVI(a) to determine whether they are resulting in an appropriate level of customer adoption and a reasonable level of cost-shifting. This review should include quantitative forecasts of payback periods and rate impacts associated with alternative distributed generation compensation mechanisms. At minimum, this review should occur every three years.

III. OVERVIEW OF NET ENERGY METERING IN NEW HAMPSHIRE

Q Please describe the net metering rates currently available to residential solar customers.

A Customers with less than 100kW of solar photovoltaics (PV) installed are on one of two rates, which we refer to as NEM 1.0 and NEM 2.0, also known as the Standard Net Metering Tariff and Alternative Net Metering Tariff, respectively. All residential NEM customers are on Rate R,[3] which consists of fixed charges and volumetric charges as shown below.

[3] NHPUC No. 10 – Electricity Delivery, Public Service Company of New Hampshire DBA Eversource Energy, Tariff for Electric Delivery Service in Various towns and cities in New Hampshire, serviced in whole or in part, 8th Revised (“Eversource Rates Tariff”), p. 41.

Table 1: Summary of Eversource Residential Rate R[4]

Type	By-passable	Component Charge Name	Value	Unit
Fixed	*Non-by-passable*	Customer	13.81	$/month
Volumetric	*By-passable*	Energy	12.582	¢/kWh
		Distribution	5.357	¢/kWh
		Transmission	2.965	¢/kWh
		Regulatory Reconciliation	0.047	¢/kWh
		Pole Plant	0.270	¢/kWh
	Non-by-passable[5]	System Benefit	0.905	¢/kWh
		Stranded Cost	0.694	¢/kWh

Net Energy Metering means that a meter "runs forwards" when electricity is being consumed by the home and "runs backwards" when electricity is being exported to the grid. At the end of the month, a customer will either have a positive net usage and pay the retail rate for that usage or have a negative net usage and receive credits for excess generation in that month. While a traditional NEM rate provides these credits at the retail rate, NEM 2.0 credits customers for a portion of the rate: the sum of the default service rate, the transmission rate, and 25 percent of the distribution rate. This equates to about 74 percent of the full retail rate.[6] Customers with a credit balance of more than $100 at

[4] 2023 Summary of Electric Rates, October 1, 2023, p. 1.
[5] Eversource Tariff, Original Page 24A
[6] Compensation of $0.17354/kWh is 74 percent of the retail rate of $0.23388.

the end of the March billing cycle can cash these credits out by receiving cash payment equal to the credit balance.[7]

In addition, as shown in the table, some volumetric charges are by-passable, meaning that even if they are incurred by a customer, they can be netted from a customer's bill due to solar generation.[8] For Eversource, the Stranded Cost Recovery Charge and System Benefits Charge are non-by-passable, meaning that they are applied to the full amount of electricity consumption without any netting from PV production.[9]

Q What is the position of the Joint Utilities regarding the future of NEM 2.0?

A The Joint Utilities find that "the current net metering tariffs result in just and reasonable rates."[10] Moreover, the Joint Utilities "do not believe the current net metering structure is creating a clear or significant imbalance between the interests of net metered and non-metered customers,"[11] and therefore do not recommend significant modifications to the

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[7] NHPUC No. 10 – Electricity Delivery, Public Service Company of New Hampshire DBA Eversource Energy, Original Page 24A.

[8] RSA 362-A:9 sets forth the requirements applicable to distributed generation customers.

[9] NHPUC No. 10 – Electricity Delivery, Public Service Company of New Hampshire DBA Eversource Energy, Original Page 24A and Original Page 24B.

[10] Joint Testimony of Edward A. Davis, Brian J. Rice, and Dawn Coskren on behalf of Eversource Energy, Karen M. Asbury and John J. Bonazoli on behalf of Unitil, and Dilip K. Kommineni and Laura Sasso on behalf of Liberty, (tab 49) ("Joint Utility Testimony") at 24, lines 12-14.

[11] Joint Utility Testimony at 11, lines 18-21.

rate structures currently.[12] However, the Joint Utilities do propose that Distributed Generation customers pay an application fee for an as-yet determined amount.[13]

Q Do you have a recommendation regarding the Joint Utilities proposed application fee?

A The utilities have not presented sufficient information upon which to determine the reasonableness of a proposed solar fee. We recommend each utility present and justify a specific proposal in its next rate case so that the Commission can consider the issue holistically.

Q How did the Joint Utilities reach the conclusion that net metering tariffs result in just and reasonable rates?

A The Joint Utilities do not provide any quantitative evidence supporting their claims that the current NEM tariffs are just and reasonable, or that the interests of NEM and non-NEM customers are balanced.

[12] Joint IOU Testimony, p. 12, lines 20–21.

[13] Joint IOU Testimony, p. 17, lines 10–14. Joint Utility Response to Data Request TS-005 Attachment TS-005 provides an illustrative example with a potential fee of $200 for customers who install a project less than 30kW in size, which would apply to residential customers.

IV. NET ENERGY METERING COMPENSATION IS NOT APPROPRIATE OVER THE LONG TERM

Q Do you have concerns regarding NEM as a compensation mechanism?

A Yes. NEM is not appropriate for distributed generation compensation at high levels of penetration primarily due to the financial impact on non-solar customers. Under traditional net metering, a customer's generation is compensated at the retail rate. NEM 2.0 modifies this slightly, with reduced compensation for monthly excess generation (at 25 percent of the distribution rate) and certain non-by-passable charges. However, most generation is still compensated at the full retail rate for three primary reasons. First, under monthly netting, we calculate that 81 percent of solar generation is netted from load over the course each month on average, so the reduced compensation applies to only 19 percent of generation. Second, as shown in Table 1 above, the distribution portion of the rate is only 23 percent of the total volumetric charge, further mitigating the impact of reduced compensation for excess generation. Third, NEM 2.0 allows for credit balances above $100 to be cashed out on an annual basis, which decreases the effect of non-by-passable charges and reduced compensation for excess generation on a monthly basis.[14] Compensation for solar generation at or near the retail rates can cause rate and bill increases for non-solar customers, primarily for two reasons: compensation levels at the retail rate that may be higher than the financial benefit to all residential ratepayers in

[14] Eversource Rates Tariff, p. 24A.

terms of avoided costs from that generation (such as energy and capacity), and reduced sales volumes over which utilities recover their costs (referred to as "lost revenues").

Q Why may the retail rate be higher than the avoided costs?

A Distributed generation installed by customers avoids certain marginal, or incremental, costs that would otherwise be incurred by the utility, such as energy and capacity costs. The costs that can be avoided by distributed generation (or any type of distributed energy resource) are forward-looking, meaning they represent only those costs that can be avoided in the future due to incremental reductions in load. By contrast, the retail rate that is used as the basis of compensation under NEM includes costs that *cannot* be avoided, namely historical or embedded costs. For example, most of the costs incurred by the utility for poles, wires, and other distribution and transmission assets that are built to serve customers, once approved by the Commission, cannot be avoided by DERs through reductions in load. The difference between retail rates—which includes embedded costs - and forward-looking marginal costs that can be avoided by distributed resources—is the "cost shift" or rate impact for non-solar customers. The degree to which non-solar customers are impacted by this depends on the exact rate or compensation structure in place[15] and the level of solar penetration in the utility service territory. As solar distributed generation penetration increases under NEM, the embedded costs included in

[15] If avoided costs of solar generation are greater than the retail rate at a certain time, then a cost shift would occur from non-solar customers to solar customers. In this instance the solar customer would provide value to the grid above their compensation.

utility revenue requirements that were previously paid by all customers may increasingly be shouldered by non-solar customers.

Q How do reduced sales volumes impact customers?

A Energy sales decline with NEM participation, resulting in fewer sales over which to recover costs. To recover its revenue requirement, the utility has to increase rates for all customers. This rate increase may be exacerbated by the mismatch between retail rates and marginal avoided costs discussed previously, as rates go up by more than avoided costs.

Q Does NEM impact equity?

A Yes, there may be equity implications related to NEM compensation. Relatively high-income customers tend to adopt solar at higher rates than low- and middle-income customers,[16] meaning that the rate impacts of NEM compensation described above are disproportionately shouldered by lower-income customers. As stated in a recent report by the National Academy of Sciences (NAS), "to the extent that there is cost-shifting from net metering participants to net metering non-participants in particular states and utility systems, less affluent customers and disadvantaged communities risk bearing a

[16] O'Shaughnessy et al., *The impact of policies and business models on income equity in rooftop solar adoption,* January 2021, Nature Energy, https://www.nature.com/articles/s41560-020-00724-2.epdf?sharing_token=Yde5Na6qvUiiNWwsOr59jtRgN0jAjWel9jnR3ZoTv0PmwxL3pqa1MWIgqkx-XFmHfRiaNCdBbC0VLBykoLWLTWf18epCYzGB85VktXZrGBfUb0CdKJzLHxZWgTxT-Ub23FAkaz-Z_kP_miTmYIU5xfXbOv1ADns7D1k2IcKQ5oQ%3D.

disproportionate share of the cost as they are more likely to be non-participants."[17] Effectively, the already regressive nature of utility bills can be exacerbated with high levels of solar adoption coupled with continued NEM compensation.

Q Are there any advantages of NEM over other compensation structures?

A Yes. NEM is relatively simple to explain to the solar customers and the public. Customers can easily understand how it functions and solar installers can fairly easily estimate annual savings based on a match of expected generation with retail rate compensation. Second, rates of compensation are generally high with NEM compensation, which may be appropriate as the solar industry becomes established in a state and to support certain policy goals associated with solar distributed generation.

<u>Options to Evolve Solar Compensation to Be More Equitable</u>

Q Should New Hampshire plan to transition from NEM to other compensation structures?

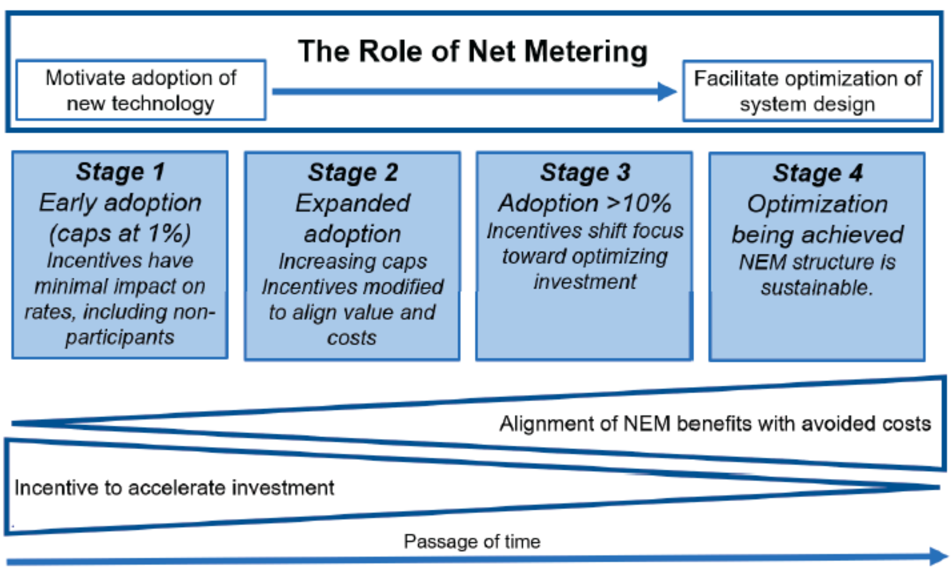
A As noted above, at relatively low levels of solar penetration, NEM structures can be helpful to allow the solar market the ability to establish itself and to avoid unnecessary administrative burden. However, over time, rate increases associated with NEM are likely to become unreasonable. As this occurs, compensation levels should move towards avoided costs, while also considering the cost of installing solar. More precisely, if it is

[17] National Academies of Sciences, Engineering, and Medicine. 2023. *The Role of Net Metering in the Evolving Electricity System*. Washington, DC: The National Academies Press https://doi.org/10.17226/26704 (referred to herein as "NAS Study"), at 94.

possible to set compensation levels that better reflect avoided costs but at a level sufficient to support continued distributed generation adoption, solar distributed generation will provide net benefits to ratepayers while mitigating rate impacts.

This concept is illustrated in the graphic below, which was recently published by the National Academies of Sciences. The figure shows how compensation for solar distributed generation should evolve over time as adoption levels increase. At low levels of penetration, NEM is appropriate due to having minimal impact on rates while encouraging solar adoption. However, as adoption increases, jurisdictions should shift towards compensation at avoided costs.

Figure 1: Illustrative Evolution of Net Metering for Solar Compensation



Source: National Academies of Sciences, Engineering, and Medicine. 2023. *The Role of Net Metering in the Evolving Electricity System*. Washington, DC: The National Academies Press https://doi.org/10.17226/26704 (referred to herein as "NAS Study"), p. 12.

Based on our analysis in Section V, the Eversource service territory, with 2 percent of residential customers on NEM in 2022, may be reasonably considered in Stage 2 of adoption, a later stage of evolution than the introductory phase.

Q Please describe the various credit options for exports under net billing.

A As discussed above, New Hampshire's NEM 2.0 structure compensates generation at the full retail rate, other than the non-by-passable System Benefit charge and Stranded Cost charge, unless total generation exceeds total consumption over the course of the billing period (approximately one month). If generation exceeds consumption, the excess generation is credited at 25 percent of the distribution rate plus the full retail rate for other rate components.

There are several ways in which the compensation level for exports can be adjusted to continue to support solar distributed generation while mitigating rate impacts. First, the wholesale energy price is likely the lowest option as it represents just the value that would be awarded any market resource. The second option is utility-system avoided costs. These include both energy costs and broader ratepayer impacts due to solar generation such as distribution and transmission capacity, as well as demand reduction induced price effect (DRIPE). Third, a value-of-solar rate of compensation includes utility-system avoided costs but also may incorporate additional benefits of solar such as greenhouse gas reductions, air quality improvements, and other societal benefits resulting from greater solar adoption.

Q How should the Commission select among these various options?

A We recommend that the Commission set compensation rates based on consideration of two primary indicators: (1) the expected payback period for solar adopters, which is an indicator of the financial viability of solar for such customers, and (2) the expected rate impacts on non-solar customers. Understanding the expected payback period will allow the Commission to set compensation rates at a level that supports the continued adoption of cost-effective distributed generation in New Hampshire. An analysis of bill impacts on non-adopters will enable the Commission to ensure that non-solar customers do not experience burdensome rate increases. In the following section we describe these indicators in more detail and quantify them for Eversource's territory.

We also recommend that these indicators be examined periodically over time as electricity rates, avoided costs, and solar costs change. Importantly, establishing a balanced distributed generation compensation mechanism is not a "set it and forget it" endeavor; it requires periodic revisiting to ensure assumptions were correct and to monitor changes in the market and utility landscape. For example, if solar costs plunge below expected levels, and/or supply costs increase more than expected, then the compensation mechanism would become unduly generous to solar customers, which could increase rate impacts to levels that are unreasonable.

V. SOLAR ADOPTION AND RATE IMPACTS OF NEM 2.0

Current and Forecast Solar Distributed Generation Adoption Rates

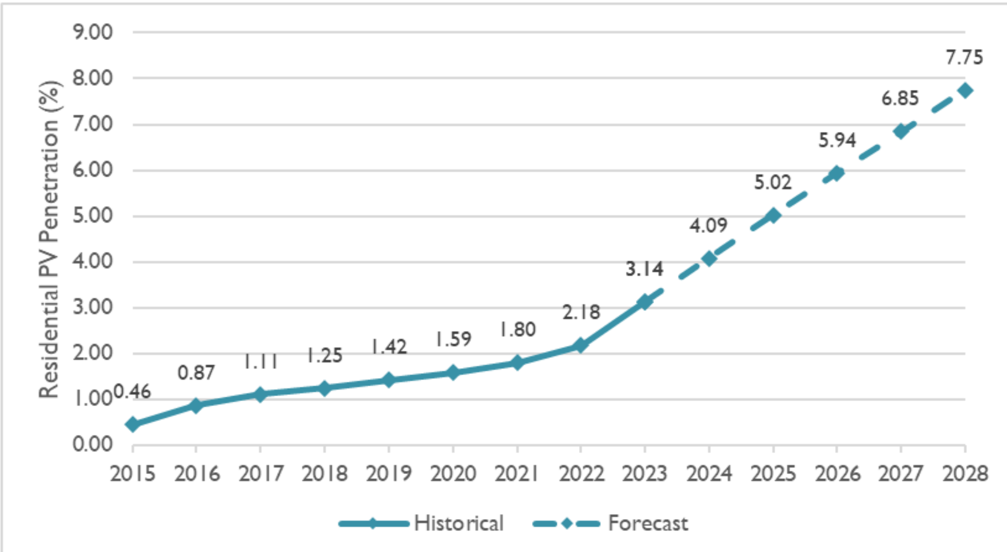
Q What are the historical and near-term solar adoption rates in Eversource's service territory?

A The number of residential solar customers on Eversource's system has increased by an average of 1,132 customers per year from 2015 to 2022. In 2022, the solar penetration rate, defined as the total number of residential solar customers divided by the total number of residential customers, equaled approximately 2 percent.

In Figure 2 we provide an illustrative forecast of solar distributed generation penetration over the next five years if current conditions continue.[18] We assume that the number of incremental solar customers from 2022 to 2023 remains constant from 2023 through 2028. This suggests that roughly 7.8 percent of residential customers will have installed solar by 2028. (Our forecast is meant to be illustrative of potential near-term growth in solar distributed generation; the actual growth could vary as conditions change.)

[18] Residential customer count sourced from EIA Annual Electric Power Industry Report Form 861, https://www.eia.gov/electricity/data/eia861/. Residential solar customer count sourced from EIA Monthly Electric Power Industry Report – Net Metering, https://www.eia.gov/electricity/data/eia861m/.

Figure 2: Historical and Forecast Residential Solar PV Customers as a Percentage of Total Residential Customers



<u>Payback Period</u>

Q Please define payback period.

A The payback period is the length of time required for a customer to recover the investment in their solar installation based on the compensation structure in place. It is calculated as the following ratio:

$$Payback\ Period\ (Years) = \frac{Upfront\ Cost\ of\ Solar\ Installation\ (\$)}{Annual\ Bill\ Savings\ Attributable\ to\ Solar\ Installation\ \left(\frac{\$}{year}\right)}$$

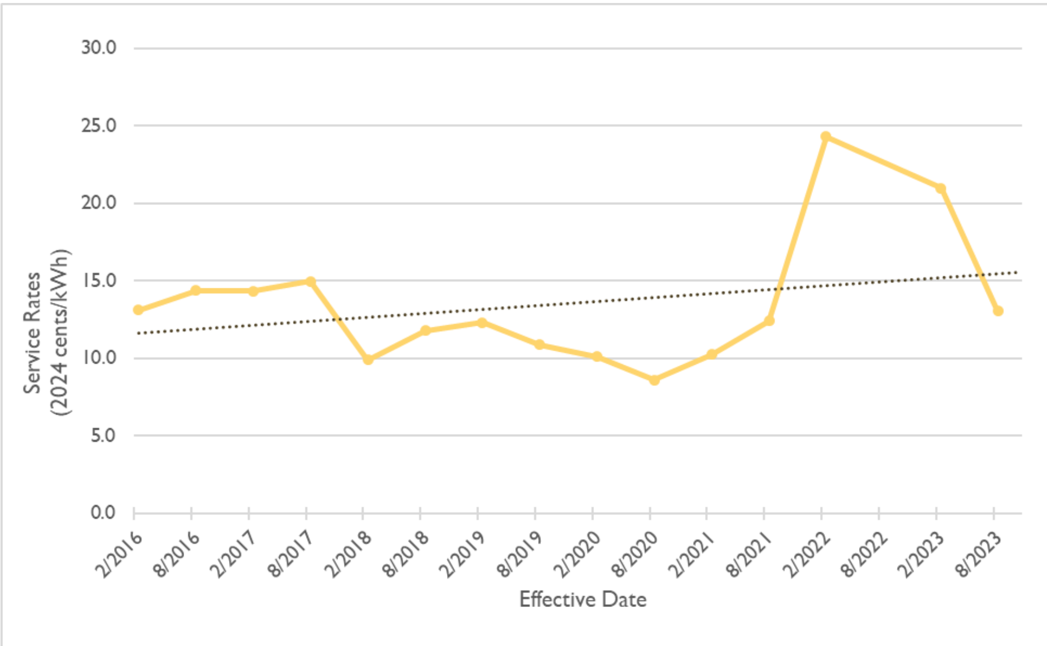
Q How does the payback period inform customer decisions to install solar?

A Customers use the payback period to gauge whether an investment in solar panels is a prudent financial investment. However, it is important to recognize that the payback period does not include other factors that may motivate a consumer's decision to install solar panels, such as a desire to reduce the environmental impacts of electricity consumption.

Q How does the default service price affect the payback period?

A The default service price plays an important role in a solar customer's payback period. Since NEM 2.0 generally provides compensation at the retail rate, a higher supply rate will, all else equal, decrease the payback period for a solar system, and vice versa. Figure 3 presents Eversource's default service prices from 2016 through 2023. As indicated, the default service price has been volatile in recent years, particularly during 2022 and the beginning of 2023. Transmission and distribution rates tend to increase more slowly over time, which increases the financial attractiveness of solar through a small but steadily decreasing payback period for solar PV adoption.

Figure 3: Default Service Price for Eversource[19]



Q How does the cost of solar distributed generation affect the NEM payback period?

A As the up-front cost of solar decreases, then the payback period proportionately decreases. The cost of solar distributed generation has declined significantly in the past and is expected to continue to decline in the future.

[19] The values for these figures come from the set of orders issued for Eversource which set the supply rate for successive six-month periods. The most recent is Order No. 26,851 (June 22, 2023) in Docket No. DE 23-043.

Adjustments for inflation were made using the Consumer Price Index for All Urban Consumers: All Items in U.S. City Average, Seasonally Adjusted (Code CPIAUCSL) from the Federal Reserve Economic Data Consumer Price Index for All Urban Consumers: All Items in U.S. City Average (CPIAUCSL) | FRED | St. Louis Fed (stlouisfed.org). The most recent value was September 1, 2023. The 2023 inflation was set at the year-to-date average for 2023. Inflation for 2024 was assumed to occur at the same rate as 2023.

Q Please describe your model to estimate payback period.

A As described in the equation above, the payback period is composed of the initial cost of installation and the ongoing net savings to the customer from installing the solar panels. Estimates for the upfront costs of solar come from Lawrence Berkeley National Lab's Tracking the Sun 2023 Edition.[20] These costs were estimated to change over time according to trends from the National Renewable Energy Laboratory's Annual Technology Baseline Cost Trends.[21] We also incorporated current federal tax credits for solar installations.[22]

The annual savings due to solar installations are composed of bill savings and operation and maintenance expenses for the solar panels. We estimated bill savings using load profiles provided by Eversource,[23] generation profiles used by Dunsky Energy & Climate Advisors (Dunksy) in its calculation of the Value of DER,[24] and the most recent

[20] Galen Barbose et al., 2023. Tracking the Sun, Lawrence Berkely National Lab, https://emp.lbl.gov/tracking-the-sun.

[21] Brian Mirletz et al., 2023. Annual Technology Baseline, National Renewable Energy Laboratory, https://atb.nrel.gov/electricity/2023/residential_pv.

[22] U.S. Department of Energy, Solar Energy Technologies Office, 2023. Homeowner's Guide to the Federal Tax Credit for Solar Photovoltaics, https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics.

[23] Eversource Response to CENH 1-003(a), Attachment CENH 1-003(a), Docket DE 22-060, Date of Response October 12, 2023.

[24] Dunsky Energy + Climate Advisors, New Hampshire Value of Distributed Energy Resources Study Model Updated May 2023, https://www.energy.nh.gov/value-distributed-energy-resources-study. Residential Solar South-Facing Generation Profile.

residential rates from Eversource's current tariff.[25] Operating and maintenance expenses for solar came from estimates provided by NREL's Annual Technology Baseline.[26]

Additionally, we forecast rate increases using historical retail price data for New Hampshire from the U.S. Energy Information Administration (EIA).[27]

Q What is the payback period on NEM 2.0 for Eversource's service territory?

A We calculated the payback period using the following assumptions:

- Future default service prices over the life of the solar facility are modeled at three different values to reflect the uncertainty in forecasting these prices: (a) the current value, (b) a historical average over the period of 2016–2024, and (c) the high rate experienced in 2022.

- The cost of solar distributed generation in 2024 is set at the current cost, and the cost of solar distributed generation in 2028 is set at a lower cost to reflect declining costs over time.

[25] Eversource 2023 Summary of Electric Rates, Last Updated: October 1, 2023.
[26] Brian Mirletz et al., 2023. Annual Technology Baseline, National Renewable Energy Laboratory, https://atb.nrel.gov/electricity/2023/residential_pv
[27] U.S. EIA Electricity Browser, Report 5.3 Average retail price of electricity to ultimate consumers: New Hampshire Residential, https://www.eia.gov/electricity/data/browser/.

Table 2: NEM 2.0 Payback Period

Year Installed	Solar Cost ($ / Watt)	Supply Rate (2024 c/kWh)	Payback Period (Years)
2024	$3.64	Current (13.05 c/kWh)	13
		Historical Average (13.42 c/kWh)	13
		High (24.29 c/kWh)	9
2028	$3.08	Current (13.05 c/kWh)	12
		Historical Average (13.42 c/kWh)	11
		High (24.29 c/kWh)	8

As indicated, the payback period of solar in 2024 ranges between 9 and 13 years, depending on the default service prices over the life of solar technologies. By 2028, as solar distributed generation prices decline, the payback would be a little shorter, ranging from roughly 8 to 12 years.

Rate and Bill Impacts

Q How did you analyze the rate and bill impacts of solar compensation under NEM 2.0?

A Rate impacts of NEM are driven by two primary factors. First, the "lost revenues" from reduced electricity sales will create upward pressure on rates for non-solar customers. Second, avoided utility costs of solar distributed generation create downward pressure on rates.

Q Please describe your model to calculate rate and bill impacts.

A We used the same assumptions as our payback period estimates. However, the rate and bill impact analysis also requires an estimate of avoided costs due to solar distributed generation. We derived these values primarily from the 2021 Avoided Energy Supply Components (AESC) study,[28] which predominately matches assumptions provided by Dunsky in its NH VDER study. Avoided costs from solar distributed generation include generation capacity, transmission capacity, distribution capacity and operational expenditures, line losses, and demand reduction induced price effect (DRIPE). Our analysis also removes the portion of the supply rate that is attributable to avoided energy costs. This was estimated by identifying the portion of default service rates associated with generation capacity, which we identified based on wholesale market costs for 2016–2023 as reported in the ISO New England annual internal market monitor assessments.[29] Additionally, we estimated avoided Regional Network Services (RNS) transmission charges through an examination of solar production during ISO New England peak hours.[30] We calculated bill impacts by applying the rate impacts to average monthly consumption for the residential rate class.

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[28] AESC 2021, Synapse et al., https://www.synapse-energy.com/project/aesc-2021-materials.

[29] ISO New England, 2023. *ISO New England Monthly Wholesale Load Cost Analysis,* https://www.iso-ne.com/static-assets/documents/2023/02/lcm_jan2023_13feb23.csv.

[30] We assume the same south-facing solar profile as the rest of our analysis. Peak hours based on 2022 data from ISO-NE, *Energy, Load, and Demand Reports*, https://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/net-ener-peak-load.

Q Do avoided energy costs create downward pressure on rates?

A Avoided energy costs do not create downward pressure on rates because this value is simply passed through to the solar customer as compensation, so it has no impact on rates.

Q What are the rate and bill impacts for an average residential customer under the current NEM 2.0 tariff in 2024?

A To assess the impact of the NEM 2.0 tariff on solar and non-solar customers, we assume all historical and forecast customers subscribe to NEM 2.0. Our estimated rate and bill impacts for the cumulative amount of solar distributed generation installed from 2024 through 2028 are provided in Table 3.

Table 3: NEM 2.0 Rate and Bill Impacts from 2024 through 2028

Year	2024	2025	2026	2027	2028
Rate Impact (c/kWh)	0.16	0.20	0.24	0.28	0.31
Bill Impact ($/Month)	1.02	1.22	1.47	1.74	1.91
Percent Bill Impact (%)	0.64%	0.76%	0.91%	1.06%	1.16%

The table shows that we estimate average customers in Eversource's territory will experience a 0.64 percent bill impact due to NEM 2.0 in 2024 (a 0.16 cent per kWh rate impact that results in about a $1 per month bill increase for average non-solar customers). We expect these impacts to grow over time and approach 1.16 percent in 2028 (a 0.31 cent rate impact or $1.91 per month increase for non-solar customers).

Q Please summarize your conclusions from the payback period and rate and bill impact analyses.

A We find that the rate impacts under NEM 2.0 are currently low and will remain low for the next several years. We estimate that by 2024 NEM 2.0 will raise rates by roughly 0.6 percent. By 2028, NEM 2.0 will raise rates by roughly 1 percent, as solar penetration reaches around 8 percent of residential customers. We also find that the payback period under NEM 2.0 for a typical residential customer is roughly 13 years. This payback period appears to be sufficient to encourage a reasonable number of residential customers to adopt distributed PV. We estimate that by 2024 roughly 4.1 percent of residential customers will have participated in the NEM 1.0 and NEM 2.0 programs.

Overall, while we believe these are relatively modest rate impacts on non-solar customers, we recommend that the Commission begin to consider changes to NEM that are more sustainable for the long term, while maintaining a reasonable payback period for solar customers in order to incentivize customer investment. The goal is to find a reasonable tradeoff between the tension of rate impacts for non-solar customers on the one hand and solar customer payback periods on the other. As stated throughout this testimony, the issue requires periodic, consistent vigilance to monitor energy and solar market conditions, and to adjust compensation mechanisms over time as factors change.

VI. HOURLY NETTING AND A FIXED COMPENSATION RATE FOR SOLAR EXPORTS

Q Why are you introducing the concepts of hourly netting and fixed compensation rates?

A These two modifications to a NEM compensation mechanism can significantly reduce the likely rate impacts of solar distributed generation. If designed properly, they could be important modifications to NEM 2.0 and could be used to strike a balance between reducing rate impacts while maintaining reasonable customer adoption of solar.

Q Please describe how a solar distributed generation compensation mechanism can be applied using hourly netting.

A Under NEM 2.0, distributed generation solar exports are determined on a monthly basis, where the exports (the difference between solar generation and customer consumption) are calculated at the end of each month. Instead, the distributed generation solar exports could be determined on an hourly basis, where the net exports are calculated for every hour. This compensation is currently applied in New Hampshire for large solar customers.

Q Does hourly netting provide advantages over monthly netting?

A Yes. Hourly netting provides a more accurate depiction of the portion of solar generation that is exported to the grid relative to what is used to offset the host customer's consumption. For example, if a solar customer consumes 1 kWh at 11:00 p.m. and exports 1 kWh to the grid at 12:00 p.m., under current monthly netting the customer is assumed to have exported zero kilowatt-hours, but under hourly netting the customer is assumed to have exported 1 kWh and reduced consumption by 1 kWh. Hourly netting provides a more accurate accounting of the actual power flows in and out of a household and the impact of those power flows on the grid and non-solar customers.

Q Why is it important to develop an accurate depiction of the portion of distributed generation solar that is exported to the grid?

A As described above, residential solar customers are compensated at lower rates for solar exports than they are for solar generation that offsets their consumption. With hourly netting, the compensation rates are more accurately tied to the amount of exports, resulting in a compensation mechanism that is fairer for both solar and non-solar customers. Hourly netting will typically result in a much larger portion of solar distributed generation being exported to the grid. For example, under current monthly netting, we estimate that 24 percent of solar generation by an average residential customer is exported, while under hourly netting 59 percent of solar is exported. In sum, hourly netting provides a more accurate depiction of the actual solar distributed generation exports and will result in a lower amount of compensation to solar customers, which will in turn result in lower rate impacts of NEM.

Q Please explain how the solar distributed generation compensation mechanism could be designed so that exports are compensated at a fixed amount.

A Under NEM 1.0 and 2.0, the compensation mechanism is based on portions of the electricity rates, which will change over time. While rates can increase and decrease over time, especially the default service prices, they generally increase over time. The costs of installing solar distributed generation, on the other hand, are typically incurred up front and do not change after installation.[31] These trends mean that customers incur fixed costs for procuring the solar distributed generation, but they are compensated at variable prices that tend to increase, perhaps significantly, over time. Solar distributed generation compensation mechanisms could instead provide fixed rates for the exports, where the solar customer would receive the same payment exports each year, regardless of actual fluctuations in retail rates or marginal prices.

Q What is the advantage of using a fixed rate to pay for solar exports?

A Fixing the export rate has advantages for both solar customers and ratepayers because it hedges the risk of supply rate volatility discussed above. Fixing the export rate hedges the downside risk to solar customers, in the event that supply rates drop below expected levels. On the other hand, it hedges the upside risk to non-solar customers in the event that supply rates increase above expected levels. We see this as a win-win opportunity for both solar and non-solar customers.

Further, electricity rates, for default energy supply and other portions of the rates, are more likely to increase over the long run than decrease. This means that non-solar customers are paying increasing amounts over the long run for what is essentially fixed price generation. Depending upon how much electricity rates increase over time, this

[31] With the exception of operation and maintenance costs that can occur over the life of the distributed generation technology. These costs are small relative to the installation costs.

might result in overpaying for the solar distributed generation exports, which would increase the long-term rate impacts on non-solar customers.

Q How would a fixed rate for exports be determined?

A A fixed export rate could be determined in several different ways.[32] One option would be to use the electricity prices that are in place at the time the solar distributed generation is installed. Another option would be to use a forecast of avoided costs estimated at the time the solar distributed generation is installed. We recommend this latter approach because it provides a more accurate value of the exports to non-solar customers.

Q What are the implications of modifying NEM 2.0 to (a) use an hourly netting mechanism and (b) pay for exports at a fixed price based on avoided costs?

A We estimate the payback periods and the rate impacts of making these two changes to NEM 2.0. For this purpose, we assume a fixed export rate of 16 cents per kWh based on a forecast of avoided costs, primarily derived from AESC 2021. Table 4 and Table 5 present the results of our analysis.

[32] The period over which the export compensation value is fixed should be considered along with other facets of the revised tariff. This could be designed in several ways. For example, it could match the period over which the rate structure is meant to stay in place, or be shorter (e.g. 10 years), after which export compensation could be trued up periodically to actual avoided cost values.

Table 4: Hourly Netting Recommendation Payback Periods

Year Installed	Solar Cost ($ / Watt)	Supply Rate (2024 c/kWh)	Payback Period (Years)
2024	$3.64	Current (13.05 c/kWh)	15
		Historical Average (13.42 c/kWh)	15
		High (24.29 c/kWh)	12
2028	$3.08	Current (13.05 c/kWh)	13
		Historical Average (13.42 c/kWh)	13
		High (24.29 c/kWh)	10

Table 5: Hourly Netting Recommendation
Rate and Bill Impacts from 2024 through 2028

Year	2024	2025	2026	2027	2028
Rate Impact (c/kWh)	0.07	0.08	0.10	0.12	0.12
Bill Impact ($/Month)	0.45	0.51	0.61	0.73	0.74
Percent Bill Impact (%)	0.29%	0.32%	0.38%	0.45%	0.45%

Our results indicate that the payback period increases by about 2 years compared to the current NEM 2.0, which might result in slightly lower adoption of solar distributed generation. However, they also indicate that the rate impacts are likely to be much lower.

Under NEM 2.0 the bill impact is about 1.16 percent by 2028, while under these two modifications the rate impact is about 40 percent lower, at roughly 0.45 percent.

VII. RECOMMENDATIONS

Q What do you recommend based on your analysis and conclusions?

A Our primary recommendations are as follows:

- The Commission should keep the NEM 2.0 compensation mechanism in place for the next two to three years, because rate impacts for non-solar customers are expected to remain reasonable.

- The Commission should require the joint utilities, by December 1, 2025, at the latest, to submit an analysis of whether and how to modify NEM 2.0. This analysis should include a proposal for modifications that would maintain an appropriate level of customer adoption and a reasonable level of cost-shifting. The analysis should include quantitative forecasts of customer payback periods and rate impacts for several promising alternative compensation mechanisms. The utilities should include a proposal for a net billing tariff with hourly netting and a fixed compensation rate for solar distributed generation exports based on expected avoided costs. This mechanism better aligns power flows with compensation and hedges the price volatility of supply rates for both solar and non-solar customers.

    - Since we expect the Commission will periodically review and further modify solar compensation rates, customers subject to our proposed compensation rate after 2025 should be "grandfathered" with respect to future solar compensation changes for a period of thirty years, the expected lifetime of solar distributed generation.

- After its review in 2025, the Commission should periodically review solar distributed generation compensation structures to determine whether they are resulting in an appropriate level of customer adoption and a reasonable level of rate impacts. This review should include quantitative forecasts of payback periods and rate impacts associated with alternative distributed generation compensation mechanisms. At minimum, this review should occur every three years.

Q Are you proposing a specific export value for the Commission to adopt at the next NEM review?

A No. The price paid for solar distributed generation exports should be based on the most recent information available. For example, the AESC study is currently being updated, and other values will continue to change as the energy and solar market evolve. Our intention is to recommend the process for analyzing and proposing modifications that the Commission should adopt in the future, rather than recommending details of those modifications.

Q What information should the utilities provide, and the Commission consider, when the utilities provide their analysis of NEM modifications?

A We recommend that, at minimum, the utilities provide estimates of the payback periods and rate impacts of alternative compensation mechanisms and compare the results with those of the current NEM 2.0 compensation structure. This analysis should include several sensitivities for some of the key assumptions driving payback periods and rate impacts. The analysis should present additional relevant information such as current penetration rates of solar distributed generation, current and expected solar distributed generation costs, and any demographic information known or collected by utilities regarding the adoption of solar.

Q Why have you proposed a grandfathering period?

A As we have described throughout this testimony, it is necessary to balance the interests of solar and non-solar ratepayers when designing distributed generation compensation structures. Since significant changes to solar compensation may alter financial outcomes for solar distributed generation adopters, it is reasonable to set expectations about the underlying compensation structure that will be in place so that customers can make informed decisions at the time of purchase.

Q What data should utilities collect from customers to support their analysis of NEM modifications?

A For utilities that do not have smart meters, utilities should use applicable load research data to estimate the portion of solar generation that will be consumed behind the meter versus that which will be exported to the grid for a variety of load shapes in addition to the average residential customer.

Q Does this conclude your testimony?

A Yes, it does.