

Interim Report: Economic Valuation of Distributed Solar Power Generation and Storage in Washington State

Summary of Interested Party Perspectives and Proposed Research Plan

June 30, 2025

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EXECUTIVE SUMMARY

Net Energy Metering (NEM) in Washington State allows customers with renewable energy systems, like solar panels, to earn credits for the excess electricity they send to the grid. Established by law in 1998 and revised in 2019, NEM has supported private renewable energy investment. Under current law, utilities must offer full retail-rate NEM to eligible customers until either June 30, 2029, or until NEM systems reach 4% of the utility's 1996 peak load—whichever comes first.

As of 2024, one investor-owned utility and several public utilities have reached the 4% cap and are beginning to reconsider their rate structures. More utilities are expected to follow soon prompting the need for new methodologies to value distributed solar generation and storage.

To address this need, the Washington State Legislature directed the Department of Commerce to contract with the Washington State Academy of Sciences (WSAS) to study the value of distributed solar and storage, and to develop recommendations for future compensation methodologies. In its first year, the project focused on engaging a wide range of interested parties and creating a research plan for continued analysis.

The WSAS formed an Oversight Committee of experts to guide and review the project. The Committee interpreted its charge to focus on behind-the-meter systems, especially solar+storage systems that combine solar power production with onsite storage. The research plan proposed in this interim report includes evaluation of both technical and societal values of distributed energy, including equity, and considers how these values can inform policy, rate structures, and compensation mechanisms. The study will produce recommendations useful to state legislators, regulators, and utilities that are aligned with the state's energy strategy.

Phase 1 of the project (July 2024–June 2025) included defining key terms, gathering information and perspectives from interested parties, reviewing relevant statutes and policies, and laying the groundwork for valuation methods to be developed in later phases.

The WSAS engaged a broad range of interested parties involved in distributed solar and storage in Washington. This included utilities (investor-owned, municipal, and consumer-owned), utility regulators, the solar and storage industry, and advocacy groups focused on consumer rights, environmental justice, clean energy, climate change, and tribal interests. To gather their perspectives on the value of distributed solar and storage, WSAS collaborated with the William D. Ruckelshaus Center to conduct interviews to understand different goals and objectives for distributed solar and storage; key considerations for evaluating distributed solar rate structures; and ideas for reaching agreement on net-metering policies and desired processes for further engagement of interested parties.

Phase 2 of the project, to be conducted between July 2025 – September 2026, will focus on identifying and valuing the range of benefits—economic, societal, and environmental—that distributed solar, storage, and solar+storage can offer. This includes developing methods for estimating value, which can then inform a variety of policy mechanisms, including but not limited to rate designs. The ultimate goal is to equip state leaders, regulators, and utilities with a clear and flexible framework for understanding the value that distributed solar, energy storage, and especially solar+storage systems can provide—not only to the electricity grid but to the broader public.

Central to this effort is the creation of a “Potential Value Stack”—a comprehensive list of possible benefits that distributed solar and storage systems can offer. These benefits are not one-size-fits-all but are tailored to specific use cases. The study will examine benefit factors that affect power generation, transmission, distribution, customers, and communities.

Once the benefits are identified, the research team will map these benefits to policy mechanisms. Researchers will examine the policy tools (like retail rates, procurement programs, incentives, or planning efforts) that can enable specific benefits or combination of benefits.

The next stage focuses on developing methods to calculate the value of each benefit. Where possible, the team will create formulas that draw on Washington-specific data. These valuation methods will be designed to be flexible and adaptable across utility service areas, timeframes, and user perspectives.

The project will conclude with the drafting of a final report, summarizing the research, valuation methods, and example scenarios.

INTRODUCTION

Net energy metering (NEM) is a metering and billing program that allows customers who generate electricity from renewable energy generation assets to receive credit for excess power they export to the grid. In Washington state, NEM is used for behind the meter, or customer-sited distributed power generation, which allows for the compensation of excess solar power produced in the form of an "energy credit" worth the current market rate of a kilowatt-hour.

In 1998, the Legislature passed ESHB 2773, which stated that it is in the public interest to: (1) Encourage private investment in renewable energy resources; (2) Stimulate the economic growth of this state; and (3) Enhance the continued diversification of the energy resources used in this state. The resulting net energy metering statute RCW 80.60.020 was significantly revised in 2019 to increase the cap on how much NEM capacity utilities had to allow, and permit utilities to develop replacement rate structures for net metering customers.

Pursuant to the statute, an electric utility must make full retail rate NEM available to eligible energy-generating customers on a first-come, first-served basis until the earlier of either June 30, 2029, or the first date upon which the cumulative generating capacity of net metering systems equals 4% of the utility's peak demand during 1996. When a utility reaches either the 4% threshold or the 2029 date, it may propose a new tariff to its regulatory authority.

For the past 25 years, NEM has governed the ways that the state's electric utilities determine their proposals for rate tariffs, which include the rates customers are credited for behind-the-meter power generation. Since 2024 one investor-owned utility, as well as several public utilities and rural cooperatives have reached the 4% cumulative generating capacity threshold and began the process of reconsidering rates. Several more electric utilities are nearing the threshold, thus triggering reconsideration of the rate tariffs by most if not all utilities. As new rates are being considered, interested parties are looking for new methodologies to determine the value of solar power generation and energy storage for behind-the-meter applications.

"Value of solar" refers to the contributions of solar power generation that is distributed across multiple locations (homes, parking garages, etc.) to the electricity grid. Determining valuation methodologies and compensation rates for solar energy and storage has been a challenge because interested and impacted parties do not agree on how the electricity generated by customers at their home or business and exported onto the grid should be compensated.

Charge and Objectives

In 2024 the Washington State legislature directed (via Engrossed Substitute Senate Bill 5950 Section 130 (45)) the Department of Commerce to conduct a study of distributed solar and storage (See Box 1).

Phase 1 of the project involved two key components: (1) Engaging interested parties who work with distributed solar resources in Washington State, including representatives of consumer owned utilities, municipal-owned utilities, investor-owned utilities, utility regulators, the rooftop solar and energy storage industry, as well as advocacy organizations involved with consumer advocacy, environmental justice, clean energy, climate change, labor unions, and federally recognized Indian tribes and (2) Developing a research plan for Phase 2 of the project. In 2025, the legislature funded WSAS to proceed with Phase 2 starting in July 2025. **This report is the deliverable for Phase 1. Phase 2 entails completing the research plan scoped in this report.**

Box 1: Legislative Language

2024 Legislative Session: As directed by Engrossed Substitute Senate Bill 5950 – Section 130 (45)¹, the WSAS shall:

(a) “conduct a study to determine the value of distributed solar and storage in Washington state, including any factors the academy finds relevant, in order to create recommendations and options for a methodology or methodologies that utility regulators and governing bodies may use after the statutory four percent net metering threshold is met. In the course of their research and analysis, the academy shall engage relevant stakeholders focused on the value of distributed energy resources in Washington state, including solar, storage, vehicle to grid, and other resources. This shall include, but is not limited to, representatives from consumer-owned utilities, municipal-owned utilities, investor-owned utilities, utility regulators, the rooftop solar and storage industry, as well as advocacy organizations involved with consumer advocacy, environmental justice, clean energy, climate change, labor unions, and federally recognized Indian tribes.

(b) The Washington state academy of sciences shall submit an interim report to the department and the utilities and transportation commission by June 30, 2025. This interim report must include a plan and cost estimates for further work in the 2025-2027 fiscal biennium to develop policy recommendations and submit a final report to the department and the utilities and transportation commission.”

2025 Legislative Session: As directed by Engrossed Substitute Senate Bill 5267 – Section 133 (17)², the WSAS shall:

“complete a study to determine the value of distributed solar and storage in Washington state. Including any factors that it finds relevant, the academy shall develop policy recommendations and options for methodology or methodologies that utility regulators and governing bodies may use after the statutory four percent net metering threshold is met. The academy shall submit a final report to the department and the utilities and transportation commission by October 1, 2026.”

At the beginning of Phase 1 of this project, the WSAS established an Oversight Committee to provide independent input and guidance for the project, serve as objective and critical reviewers of work performed, and approve all final work products. The committee is composed of eleven individuals, including six WSAS members, with deep experience in energy and related policy issues (Appendix A). Several committee members served on a comprehensive national study of net metering conducted by the National Academies of Sciences, Engineering and Medicine, published in 2023.³

The Oversight Committee interpreted the study’s charge to include:

- A specific examination of the values associated with behind-the-meter solar and storage with special

¹ Washington State Office of Financial Management. (2024). *Senate Bill 5950 – Supplemental operating budget*. <https://fiscal.wa.gov/statebudgets/2024proposals/Documents/co/5950-S.SL.pdf>

² Washington State Office of Financial Management. (2025). *Senate Bill 5267 – Operating budget*. <https://lawfilesex.leg.wa.gov/biennium/2025-26/Htm/Bills/Senate%20Passed%20Legislature/5167-S.PL.htm>

³ National Academies of Sciences, Engineering, and Medicine. (2023). *The role of net metering in the evolving electricity system*. The National Academies Press. <https://doi.org/10.17226/26704>

emphasis on solar+storage (a system that combines solar power production with onsite storage), while also recognizing that distributed solar and storage technologies can be connected to the local distribution system in front of customers' meters. The committee observed that many of the debates about the value of these distributed technologies focus more on behind-the-meter locations rather than front-of-the-meter distributed technologies and therefore decided to focus this study on the former rather than the latter.

- Inclusion of community solar that is physically interconnected in front of the customer meter as part of the analysis of behind-the-meter resources, as community solar is commonly controlled by a group of customers and compensated by the utility through a tariffed rate based on the value of a generic distributed energy resource.
- Consideration of storage. Electricity consumers, utilities and other players in the utility industry have shown increased interest in deploying distributed storage to meet projected energy needs. This includes both "storage only" installations as well as co-locating storage with distributed solar (aka solar+storage).
- Identifying and accounting for the wide array of parties in the state that are interested in solar energy and energy storage.
- Identifying the set of societal, utility, and ratepayer-related factors that could be used to value solar, storage, and solar+storage, including equitable access to solar and storage.
- Exploring current models and potentially building new ones to test various value options.
- Examining how to apply valuations to various policy mechanisms and compensation schemes, including equitable access to beneficial rate designs such as net metering.

The Committee's intent is to guide the development of a product that is useful to policymakers, including state legislators, utility regulators at the Utilities and Transportation Committee, and other utilities and their governing bodies; is aligned with the goals of Washington State's Energy Strategy⁴; and can be used to develop new rates, tariffs, incentives, and/or non-rate mechanisms and programs. To this end, the research team, in collaboration with the Oversight Committee, will develop recommendations for methods that can be used for calculating the value of distributed solar, distributed storage, and distributed solar+storage, while recognizing that the value of the input variables will be unique to each utility region and according to the perspective chosen (e.g., utility, customer, society).

This interim report was required by the legislative charge and represents the completion of Phase 1 of work on the project, which began July 1, 2024. The report begins by describing key terms and providing background information about distributed solar and storage, and net energy metering. It also includes a brief discussion of the key statutes and policies in Washington's energy strategy that govern individual and system-scale decisions about energy generation, distribution, and compensation. Next is a summary of what was learned from engagement with interested parties. The appendices amplify what was explored in Phase 1. The final section lays out plans for the second phase, Phase 2, beginning with a framing of the broader objectives for the research, followed by the research plans and timeline for work to be conducted July 1, 2025 – September 30, 2026.

⁴ Washington State Department of Commerce. (2025a). *State energy strategy*. <https://www.commerce.wa.gov/energy-policy/state-energy-strategy/>. Last accessed 06/06/2025.

BACKGROUND

This section describes some key concepts used throughout this interim report to put into historical and current context the significance of distributed energy resources, net energy metering, and distributed solar and storage in Washington state. It also provides background for the research plan that will examine and develop new methodologies for valuing solar, storage, and solar+storage. Appendix C includes a glossary of key terms.

What are distributed energy resources?

Distributed energy resources (DER) are small- to medium-scale energy technologies that generate or store electricity close to where it's used, such as homes, businesses, or communities. Common types of DERs include rooftop solar panels, battery energy storage systems (BESS), small wind turbines, combined heat and power systems, electric vehicles and chargers (when used as grid resources) and demand response technologies (that manage or reduce energy use during peak times). These resources are generally located behind the retail electricity meter (BTM), meaning on the customer side of the energy meter.

Distributed solar is an example of a DER, and generally refers to solar energy systems that are located close to the point of use, such as a residence, rather than at a centralized, power plant. These systems are typically installed as panels on rooftops or small ground-mounted arrays, and are often owned or leased by individuals, small businesses, or communities. These systems are primarily connected to the grid where they allow for two-way energy flows.

Similarly, **distributed storage** refers to a kind of energy storage system—such as batteries—that are installed at or near the point of energy generation or use, rather than at large facilities, like a utility power plant. These systems can store both electricity generated on-site (e.g., by rooftop solar) and electricity from the grid and then discharge it later to meet the customer's needs, improve reliability and resilience, or support the larger grid.

What is solar+storage?

Solar+storage refers to a system that combines solar power (typically from solar panels) with energy storage (typically batteries). The storage unit stores electricity generated during the day for use when solar production is low or demand is high (e.g., at night or during power outages). A benefit of this combination is that it allows for greater control over how and when solar energy serves customer needs and impacts that grid.

What is “behind-the-meter” and “front-of-the-meter”?

Behind-the-meter (BTM) refers to the utility customer's side of an electricity meter. BTM assets and activities relevant to this study have the potential to generate, store, and export electricity to the grid, locally use the energy generated, or import and use energy from the grid.

In contrast, **front-of-the-meter** (FTM) energy generation and storage systems are connected to the utility side of the meter, meaning they supply power directly to the grid rather than being used on-site by a specific consumer. These systems are typically managed by utilities or third-party providers and serve broader energy distribution needs.

Figure 1: Example of a behind-the-meter (to the left of the “Utility Meter”) rooftop solar system without battery energy storage.⁵

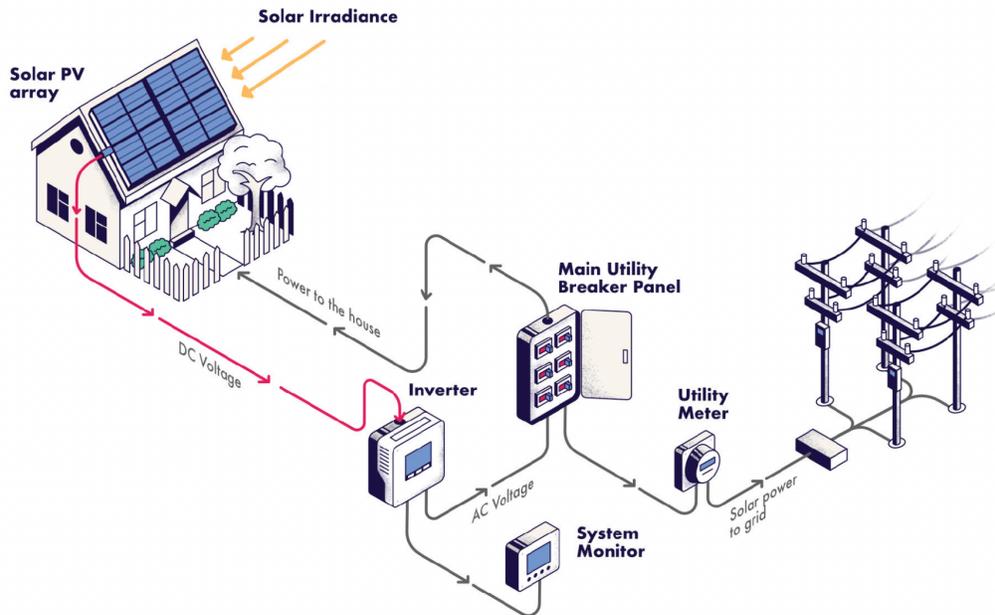
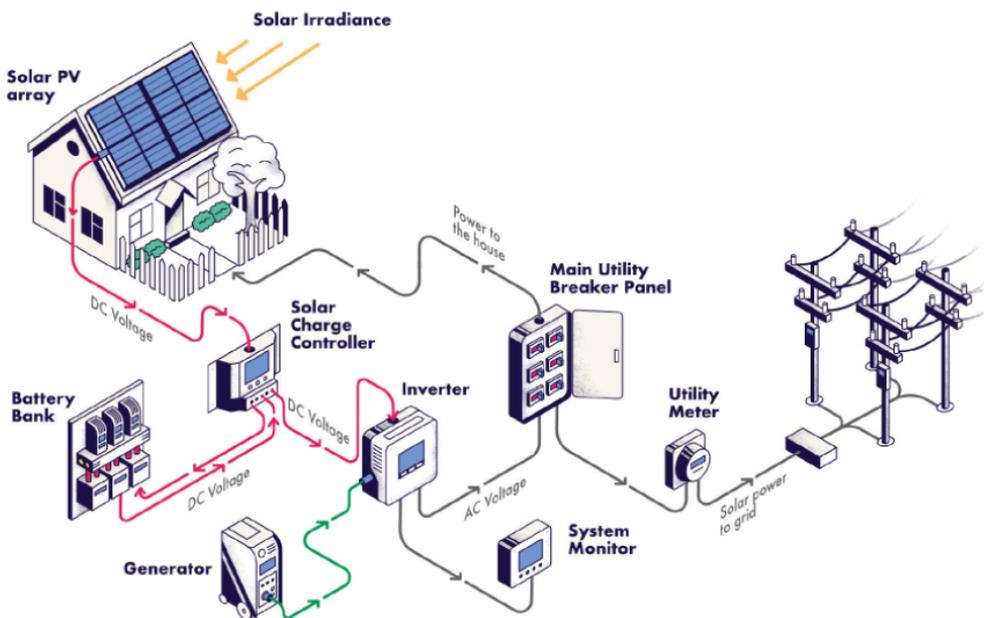


Figure 2: Example of a behind-the-meter rooftop solar system with battery energy storage.⁶



⁵ National Academies of Sciences, Engineering, and Medicine. (2023). *The role of net metering in the evolving electricity system*. p. 27. The National Academies Press. <https://doi.org/10.17226/26704>

⁶ National Academies of Sciences, Engineering, and Medicine. (2023). *The role of net metering in the evolving electricity system*. p. 31. The National Academies Press. <https://doi.org/10.17226/26704>

What is a customer-generator?

In Washington state, a customer-generator is a user of a net-metering system, meaning that the customer has installed the capacity to generate electricity on their property. In Washington state, this term applies to individual customers who have distributed generating capacity of up to 100kW ([RCW 80.60](#)⁷ – net metering statute) and to community solar projects that also meet the criteria of the net metering statute.

What is net energy metering?

Net energy metering (NEM) is a billing mechanism that allows electric customers who generate their own electricity – for example, by installing solar panels – to receive credit for excess electricity they generate and send to the grid, typically at the retail rate they pay for electricity.

NEM accounts for the flow of electricity both to and from the customer – typically through a single, bi-directional meter that tracks both the energy a customer consumes from the grid and the excess energy the customer’s equipment generates and exports into the electric system. When a customer’s generation exceeds the customer’s use, electricity from the customer’s BTM system through the meter to the FTM electrical grid. In effect, the customer exports excess generation to offset electricity that the customer otherwise would purchase at the utility’s retail rate. NEM is required by law in most U.S. states, but state policies vary widely.^{8,9}

Under most net metering tariffs, customer-generators also forgo paying a rate to the utility for electricity they generate on site and consume for themselves. Net metering has historically played a significant role in promoting renewable energy adoption, helping to develop the market for solar systems (with and without battery storage technologies) and democratizing energy production.

The value of the credit varies depending on local or state regulations. In many traditional net metering programs, such as Washington state’s, customers receive a one-to-one retail rate credit for every kilowatt-hour (kWh) they export up to certain limits established by the state. Washington state’s limit for consumer-generation capacity is 100kWh for individual systems, and 199kWh for community solar systems.

How is an energy rate different from an energy tariff?

An energy rate is the actual price that a customer pays for each unit of electricity they use, typically expressed in cents per kilowatt-hour (¢/kWh). For example, if a customer’s energy rate is 12¢/kWh, and they use 500 kWh of electricity in a month, their energy charge would be: 500 kWh × \$0.12 = \$60

An energy rate tariff is the full menu, or structure of rates, rules, terms and conditions that determine how electricity is billed, including energy rate, fixed charges, demand charges, and eligibility.

As Washington state utilities reach the 4% net metering generating capacity threshold, they will reconsider

⁷ Revised Code of Washington. (2025b). *RCW 80.60: Net metering of electricity*. <https://app.leg.wa.gov/rcw/default.aspx?cite=80.60>. Last accessed 06/20/24.

⁸ Shah, C. (2014, May 8). *Net metering* [Presentation]. Federal Utility Partnership Working Group (FUPWG) Spring 2014 Meeting, U.S. Department of Energy. https://www.energy.gov/sites/default/files/2014/05/f15/fupwg_may2014_net_metering.pdf

⁹ NC Clean Energy Technology Center. (2025). *Summary maps: Net metering*. <https://programs.dsireusa.org/system/program/maps> Last accessed 06/20/25.

their rate tariff structures, which ultimately will impact the energy rate (price) that customers pay. Some of those considerations will be how to value DERS, including distributed solar, storage, and solar+storage.

What does it mean to “value” solar and storage?

In general, to value solar means to determine the full range of benefits and costs that solar energy—especially distributed solar—provides to the electric grid, the environment, society, and individual users. The purpose of valuing solar is to put a dollar value, or a policy value, on the electricity solar produces and the other services it may offer. This process is used to inform decisions about fair compensation, as well as investments, incentives and rate design. Note that in the research plan for this project, the focus will be on valuing the full range of benefits.

Similarly, to value storage means to assess and quantify the benefits and costs of energy storage systems—such as batteries—to the electric grid, utilities, customers, and society.

What is a value stack?

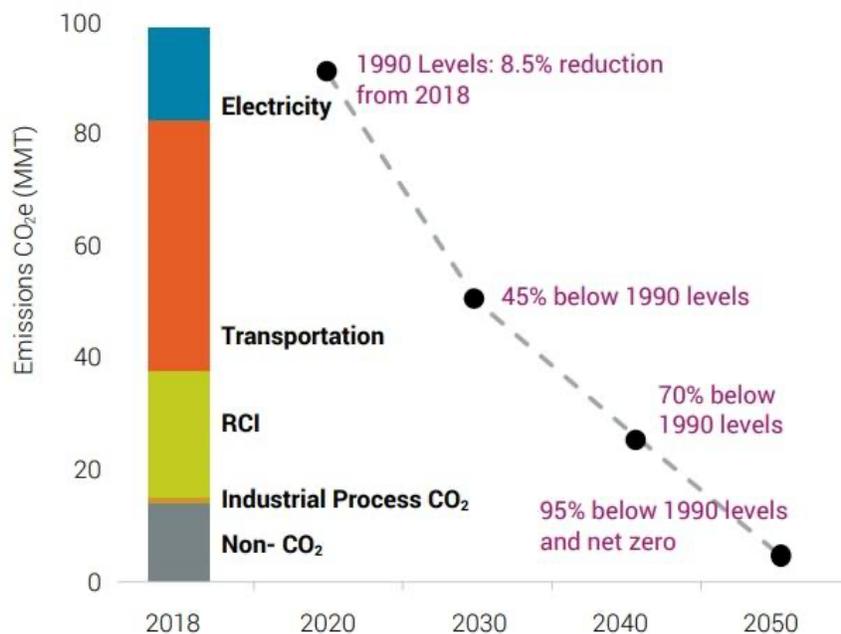
A value stack is a method used to identify, quantify, and combine the multiple distinct benefits that a distributed energy resource (DER)—like solar, storage, or solar+storage—can provide to the electric grid and to society. Each “factor” of the stack represents a specific type of value or service. These values are stacked together to estimate the total potential value of the resource, which can help in the design of policy mechanisms such as rate design. A compilation of such factors is often referred to as a “value stack”. The preliminary list of factors that may be explored during the research conducted in Phase 2 are found in Table 4.

WASHINGTON STATE'S ENERGY STRATEGY

Washington State's energy strategy reflects its commitments to economy-wide decarbonization, environmental justice and equity. Three pieces of legislation in particular codify those commitments in ways that are especially relevant to discussions about distributed solar and storage: the Clean Energy Transformation Act (CETA, 2019)¹⁰, the Climate Commitment Act (CCA, 2021)¹¹, and the Healthy Environment for All (HEAL) Act (2021)¹². Each is described briefly below.

The state has set an ambitious goal for all electricity in the state to be non-carbon emitting by 2045, with net-zero greenhouse gas emissions economy wide in Washington by 2050¹³ (Figure 3).

Figure 3: Representation of Washington State's Decarbonization Goals



Source: Washington State Department of Ecology and Washington State. Appendix A, Deep Decarbonization Pathways Modeling Technical Report, December 11, 2020 (p. 15)

Thus significant growth in electricity capacity in Washington state is needed from all non-emitting sources to meet net-zero goals by 2050 (Figure 4). Solar energy generation – a technology that is available and ready to deploy now – will be an important element to achieving the state's decarbonization and net-zero goals on time. As of the end of 2024, 506.5 MW of distributed solar has been installed in Washington under the state's

¹⁰ Washington State Department of Commerce. (2025). *Clean Energy Transformation Act (CETA)*. <https://www.commerce.wa.gov/growing-the-economy/energy/ceta/> Last accessed 06/20/25.

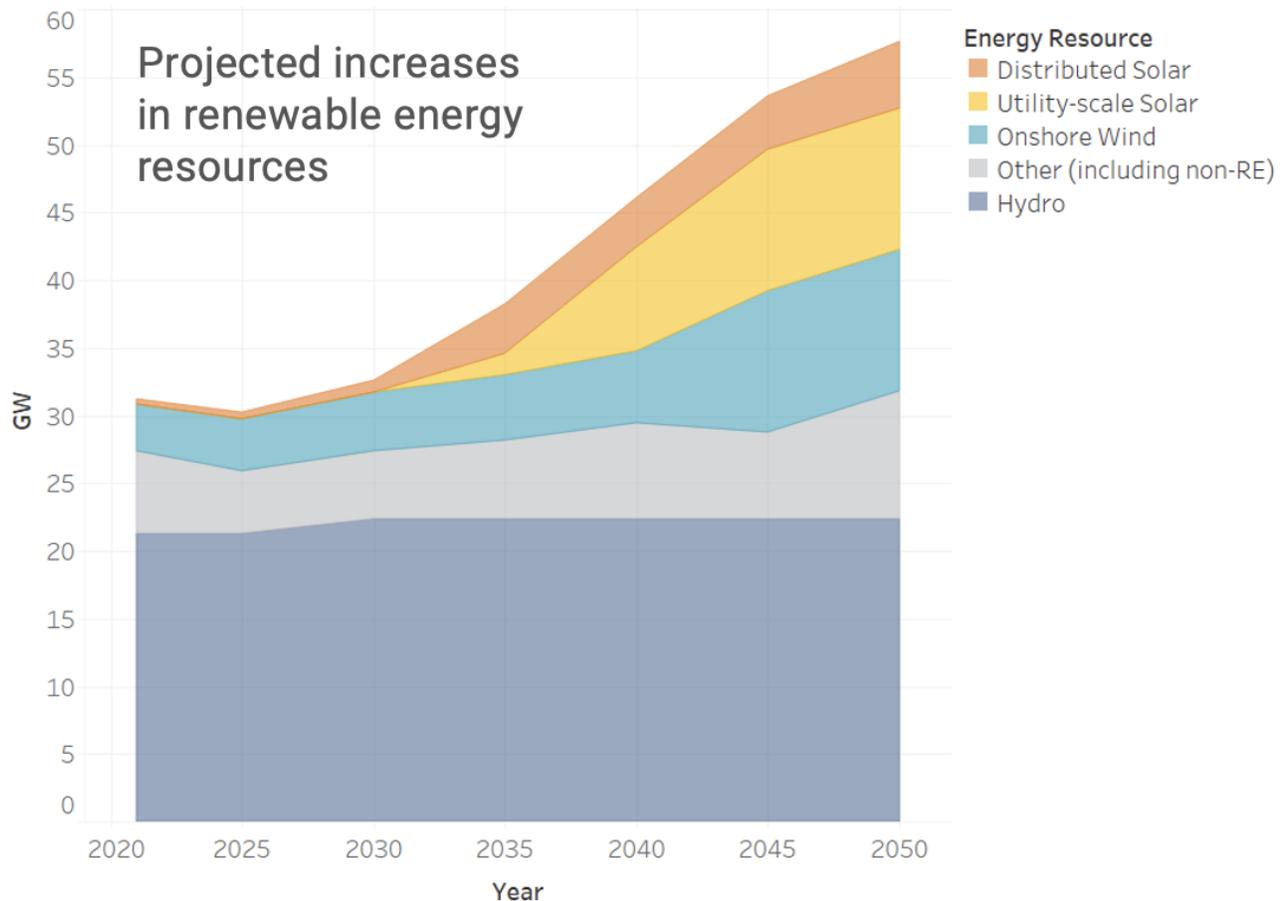
¹¹ Washington State Department of Ecology. (2025). *Climate Commitment Act*. <https://ecology.wa.gov/air-climate/climate-commitment-act> Last accessed 06/20/25.

¹² Washington State Department of Health. (2025). *Environmental justice*. <https://doh.wa.gov/community-and-environment/health-equity/environmental-justice>. Last accessed 6/13/25.

¹³ Washington State Department of Commerce. (2020, December). *Washington 2021 state energy strategy: Transitioning to an equitable clean energy future*. p. 31 <https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf>

NEM policy.¹⁴ Models developed by Net-Zero Northwest indicate that 15 GW of additional in-state solar generation – including 10.4 GW of utility-scale solar and 4.9 GW of distributed solar – will be needed to achieve the goal of net-zero by 2050.¹⁵ Simultaneously, storage capacity will need to increase by an estimated 300 MW to ensure a dispatchable supply of energy to maintain balance in the grid.¹⁶

Figure 4: Projected increases in renewable energy sources of electricity generation in Washington on the Path to Net-Zero



Source: Clean Energy Transition Institute, *Net-Zero Northwest: Technical and Economic Pathways to 2050*. June 2023. <https://www.nznw.org/>

Collectively, these actions will require community-engaged processes that lead to equitable participation in decision-making and accountability to communities and tribes, environmental justice assessments for policies and programs, and equitable distribution of benefits, as required by law.

The guiding objectives for equitable access and participation are to reduce greenhouse gas emissions, income disparities of participants in accessing clean energy investments, geographic disparities in accessing clean energy technology, and environmental health disparities caused by energy and transportation pollutants.

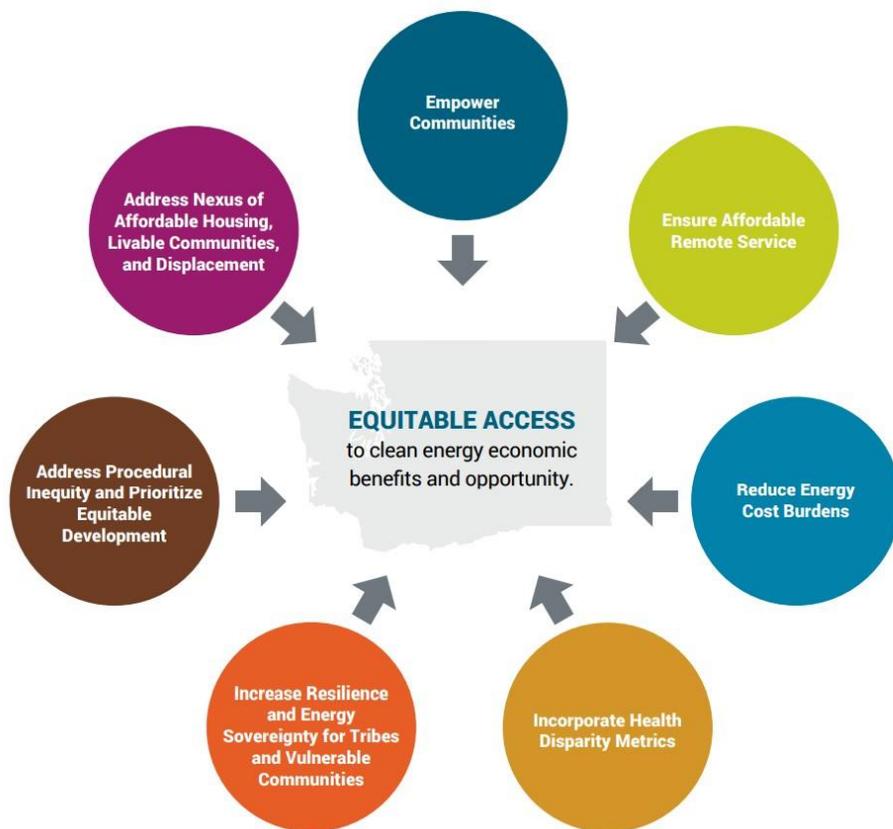
¹⁴ WSU Energy Office. (2025, June 12). *Personal communication*

¹⁵ Clean Energy Transition Institute. (2023). *Energy Pathways Data spreadsheet* [Data set]. Net-Zero Northwest. [https://www.nznw.org/files/energy-data.T1\(38\)](https://www.nznw.org/files/energy-data.T1(38))

¹⁶ Clean Energy Transition Institute. (2023). *Energy Pathways Data spreadsheet* [Data set]. Net-Zero Northwest. [https://www.nznw.org/files/energy-data.T1\(38\)](https://www.nznw.org/files/energy-data.T1(38))

Other objectives are to improve affordability, and energy and community resiliency and security (Figure 5).

Figure 5: Representation of processes to increase equitable access to energy in Washington State



Source: Washington State Department of Commerce presentation to Oversight Committee, March 19, 2025

Key Statutes Driving Washington State’s Energy Strategy

As noted above, Washington State’s energy strategy is shaped by three key statutes that currently drive energy policy, along with two others specifically related to distributed solar—one governing net energy metering and another establishing community solar programs.

Clean Energy Transformation Act (CETA)¹⁷

CETA requires that all retail electric sales in Washington be greenhouse gas (GHG) neutral by 2030, and that 100% of the electricity used for retail sales be non-emitting by 2045. To meet the 2030 target, each utility must ensure that at least 80% of its electricity for retail electric load comes from non-emitting generation or renewable resources. The remaining 20% can be met using alternative compliance options, such as unbundled renewable energy credits (RECs) or investments in energy transformation projects. Additionally, CETA mandates that utilities pursue all cost-effective, reliable, and feasible energy efficiency measures.

¹⁷ Revised Code of Washington. (2025). *RCW 19.405: Washington Clean Energy Transformation Act*. <https://app.leg.wa.gov/rcw/default.aspx?cite=19.405> Last accessed 06/13/25.

Behind-the-meter (BTM) solar systems lower a utility's retail electric sales, which in turn reduces the amount of electricity that must meet CETA requirements. These systems also generate renewable electricity that qualifies under CETA. As a result, the compliance cost savings from reduced retail load could be a key part of how the value of distributed solar is calculated. Similarly, BTM storage helps utilities meet CETA targets by shifting clean energy use to times of higher demand or emissions, and its value could also be included in valuation methodologies.

CETA also includes several provisions to ensure equity in the transition to clean energy. When complying with the greenhouse gas neutrality requirement, electric utilities must ensure that all customers benefit from the shift to clean energy.¹⁸ This includes:

- Equitable distribution of both energy and non-energy benefits;
- Reduction of burdens on vulnerable populations and highly impacted communities;
- Delivery of public health and environmental benefits—both short- and long-term;
- Reduction of costs and risks associated with energy production and use; and
- Improved energy security and resiliency.¹⁹

To meet these goals, a utility's electric resource plan must include an assessment (as outlined in RCW 19.405.140²⁰) that evaluates:

- The distribution of energy and non-energy benefits;
- The reduction of burdens on vulnerable communities;
- Health and environmental benefits, risks, and costs; and
- Energy security and resilience.²¹

As a result of CETA, many interested parties and governing bodies have developed more specific requirements, such as those listed below, which illustrate the scope of the equity requirements and means to achieve them.

- Utilities must ensure that all customers, including those in vulnerable communities, receive the benefits of the clean energy transition and that energy burdens on vulnerable populations and highly impacted communities are not increased.^{22 23}
- Utilities are required to prioritize efforts that lower the percentage of household income spent on energy, prioritizing assistance to low-income households with higher energy burden.²⁴

¹⁸ Revised Code of Washington. (2025). *RCW 19.405.040(8): Greenhouse gas neutrality*. <https://app.leg.wa.gov/rcw/default.aspx?cite=19.405.040> Last accessed 06/16/2025.

¹⁹ Revised Code of Washington. (2025i). *RCW 19.405.040(8): Greenhouse gas neutrality*. <https://app.leg.wa.gov/rcw/default.aspx?cite=19.405.040> Last accessed 06/16/2025.

²⁰ Revised Code of Washington. (2025). *RCW 19.405.040(8): Greenhouse gas neutrality*. <https://app.leg.wa.gov/rcw/default.aspx?cite=19.405.040> Last accessed 06/16/2025.

²¹ Revised Code of Washington. (2025). *RCW 19.280.030(1)(k): Development of a resource plan*. <https://app.leg.wa.gov/rcw/default.aspx?cite=19.280.030> Last accessed 06/16/2025.

²² Revised Code of Washington. (2025). *RCW 19.405.040: Greenhouse gas neutrality—Responsibilities for electric utilities—Energy transformation project criteria—Penalties*. Washington State Legislature. <https://app.leg.wa.gov/RCW/default.aspx?cite=19.405.040> Last accessed 06/16/2025.

²³ Revised Code of Washington. (2025). *RCW 19.405.060: Clean energy implementation plan—Compliance criteria*. <https://app.leg.wa.gov/rcw/default.aspx?cite=19.405.060>. Last accessed 06/16/2025.

²⁴ Revised Code of Washington. (2025). *RCW 19.405.120: Energy assistance for low-income households*. <https://app.leg.wa.gov/rcw/default.aspx?cite=19.405.120>. Last accessed 06/16/2025.

- Utilities are required to conduct public participation processes to ensure that community input and input from underrepresented communities are meaningfully incorporated into CETA planning and implementation.²⁵
- Utilities must adopt inclusive procurement practices, promote diverse hiring, and invest in infrastructure that equitably distributes the benefits of the clean energy transition.^{26 27}
- Utilities must make best efforts to seek services and resource acquisitions from and equitable representation of people of color, women, and other historically underrepresented groups and must uphold labor standards.²⁸

CETA also requires electric utilities to develop Clean Energy Implementation Plans (CEIPs) every four years.²⁹ These plans outline how the utility will meet its CETA obligations by setting specific targets and actions for the upcoming four-year period.³⁰ While CEIPs are informed by a utility's Integrated Resource Planning (IRP) process, they differ by focusing on specific resources and programs that the utility aims to acquire or develop—rather than the broader, more generic resource categories typically modeled in an IRP. Therefore, the methodology used to value distributed solar and storage could support utilities in accurately assessing how these resources contribute to their CEIPs—either as individual resources or as parts of larger projects. The Washington Department of Commerce has assembled a large list of potential actions and programs for utilities to employ to address the equity considerations noted above.³¹

Potential value considerations

It may be possible to design valuation methodologies for BTM solar, community solar, and BTM storage to support these equity goals. They could align with the utility's obligation to engage with affected communities and incorporate the results of cumulative impact analyses in their planning and program development.

Climate Commitment Act (CCA)³²

CCA aims to reduce GHG emissions by requiring most major emitters to purchase emissions allowances from a shrinking pool. Over time, the total number of allowances available decreases, creating a financial incentive to cut emissions. The CCA sets ambitious statewide targets for GHG reductions: 45% below 1990 levels by 2030; 70% below 1990 levels by 2040; and 95% below 1990 levels by 2050 (Figure 1).

Distributed solar generation can help meet these goals by producing electricity that reduces demand for

²⁵ Washington Administrative Code. (2025). WAC 480-100-655: Net metering requirements. <https://app.leg.wa.gov/wac/default.aspx?cite=480-100-655>. Last accessed 06/23/2025.

²⁶ Washington Administrative Code. (2025). WAC 480-107-015: Electric companies—Resource acquisition. <https://app.leg.wa.gov/wac/default.aspx?cite=480-107-015>. Last accessed 06/23/2025.

²⁷ Revised Code of Washington. (2025). RCW 19.405.040: Greenhouse gas neutrality—Responsibilities for electric utilities—Energy transformation project criteria—Penalties. <https://app.leg.wa.gov/rcw/default.aspx?cite=19.405.040>. Last accessed 06/23/2025.

²⁸ Washington Administrative Code. (2025). WAC 480-107-015: Electric companies—Resource acquisition. <https://app.leg.wa.gov/wac/default.aspx?cite=480-107-015>. Last accessed 06/23/2025.

²⁹ Revised Code of Washington. (2025). RCW 19.405.060(1)(a)(i): Clean energy implementation plan—Compliance criteria—Incremental cost of compliance. <https://app.leg.wa.gov/RCW/default.aspx?cite=19.405.060>. Last accessed 06/23/2025.

³⁰ Revised Code of Washington. (2025). RCW 19.405.060(1)(a), (1)(b)(iii) and (2)(b)(iii): Clean energy implementation plan—Compliance criteria—Incremental cost of compliance. Washington State Legislature. <https://app.leg.wa.gov/RCW/default.aspx?cite=19.405.060>. Last accessed 06/23/2025.

³¹ Washington State Department of Commerce. (2025). CEIP equitable transition menu of ideas [Excel spreadsheet]. <https://deptofcommerce.app.box.com/s/118axq5hd783psmp3bdaq36fgik71uff/file/1737481435105> Last accessed 06/24/2025.

³² Revised Code of Washington. (2025). Chapter 70A.65 RCW: Greenhouse gas emissions—Cap and invest program. Washington State Legislature. <https://app.leg.wa.gov/rcw/default.aspx?cite=70A.65>. Last accessed 06/23/2025.

fossil-fueled power, particularly during periods when Washington utilities are generating GHG emissions. For example, the use of distributed solar to charge electric vehicle batteries can indirectly reduce emissions from the transportation sector. Distributed storage also plays a role. It can store clean electricity generated during low-emission periods (such as when solar or wind resources are abundant) and discharge that energy later, during high-emission periods—displacing dirtier generation.

Potential value considerations

When assessing the value of distributed solar and storage, methodologies could take into account the avoided costs and reduced financial risks associated with fewer required emissions allowances under the CCA.

CCA includes equity provisions that align in principle with those found in CETA. Under CCA, these provisions primarily govern how revenues from the sale of emissions allowances are used.³³ The law requires that at least 35% of total investments from the CCA Carbon Emissions Reduction Account directly and meaningfully benefit vulnerable populations.³⁴ In the fiscal year spanning July 1, 2023, through June 30, 2024, 61% of those funds—approximately \$472.5 million—were allocated to projects that provided such direct benefits.³⁵

Utilities subject to CETA's equity compliance requirements—and seeking least-cost solutions to meet their energy resource needs—are able to evaluate funding opportunities under the CCA for distributed solar projects that align with equity and carbon reduction goals.

The Healthy Environment for All (HEAL) Act³⁶

HEAL requires certain state agencies—referred to as *covered agencies*—incorporate environmental justice into their planning and budgeting decisions. These requirements build on and reinforce similar provisions in CETA and CCA, while also introducing new directives.

The UTC is not classified as a covered agency under the HEAL Act and has not opted to self-designate as one, which the Act allows. Similarly, Washington's electric utilities are not covered agencies, and none of their governing bodies have voluntarily adopted the HEAL Act as a binding obligation.

However, when covered agencies take actions that influence electric utility planning, resource choices, or operations, utilities are still expected to consider the implications of the HEAL Act in response to those actions.

Potential value considerations

Though the HEAL Act requirements do not apply directly to electric utilities or the UTC, the law will increase state agencies' decision making around, and implementation of, equity measures. The expansion of equity measures and enforcement of equity requirements are likely to inform the equity discussions in the electric

³³ Revised Code of Washington. (2025). *RCW 70A.65.230(1)(a): Investments—Legislative intent—Evaluation*. Washington State Legislature. <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65.230>. Last accessed 06/23/2025.

³⁴ Washington State Department of Ecology. (2024, November). *Distribution of funds from CCA accounts: Fiscal year 2024* (Publication No. 24-14-076). <https://apps.ecology.wa.gov/publications/documents/2414076.pdf>

³⁵ Washington State Department of Ecology. (2024, November). *Distribution of funds from CCA accounts: Fiscal year 2024, page 8* (Publication No. 24-14-076). <https://apps.ecology.wa.gov/publications/documents/2414076.pdf>

³⁶ Revised Code of Washington. (2025). *Chapter 70A.02 RCW: Environmental justice*. Washington State Legislature. <https://app.leg.wa.gov/rcw/default.aspx?cite=70A.02&full=true>. Last accessed 06/24/2025.

power sector.

Community Solar Law

Since 2017, Washington State law (RCW 82.16³⁷) has supported community solar programs with the goal of encouraging broad and equitable community participation in generating solar energy. To qualify for the state incentive, a community solar project must meet specific criteria:

- It must have a direct current (DC) nameplate capacity (maximum amount of electricity a generator can produce under ideal conditions) of no more than 1,000 kilowatts (1 MW).
- It must have at least 10 participants, or one participant for every 10 kilowatts of capacity, whichever number is greater.

Projects larger than 500 kilowatts must also enter into a standard interconnection agreement with the utility that serves the location where the project is installed. With some exceptions, each participant must also be a customer of the utility serving the area where the community solar project is located.

Net Energy Metering Law

In Washington state, NEM was established under Engrossed Substitute House Bill (ESHB) 2773, passed 1998. The law stated that it is in the public interest to: (1) encourage private investment in renewable energy resources; (2) stimulate the economic growth of this state; and (3) enhance the continued diversification of the energy resources used in this state.³⁸ Under this law, utilities must offer full retail-rate net metering to eligible customer-generators on a first-come, first-served basis, until whichever comes first: June 30, 2029, or the point when net metering systems reach four percent of the utility's 1996 peak electricity demand.

In 1999, the Washington Utilities and Transportation Commission (UTC) approved net metering rates for major utilities, including Avista, Puget Sound Energy, and Pacific Power & Light (PacifiCorp). This enabled customers generating their own electricity on-site to receive credits for excess kilowatt-hours produced within a billing period and to avoid paying the full retail rate for the demand met by their on-site electricity generation.

In 2000, Engrossed House Bill (EHB) 2334 amended net metering laws, expanding eligibility to include fuel cells alongside solar, wind, and hydropower systems. It also mandated that at least 0.05% of the cumulative generating capacity of net-metering systems come from renewable sources.

Later, in 2019, the net metering law was updated again. These changes increased the cap on how much NEM capacity utilities had to allow and permitted utilities to develop replacement rate structures for net metering customers.

These updates were intended to reflect the growing role of distributed energy resources like solar and battery storage and to give utilities more flexibility in how they structure compensation. Utilities were not required to offer net metering to systems larger than 100 kW, though they were allowed to do so voluntarily.

³⁷ Revised Code of Washington. (2025). *Chapter 82.16 RCW: Public utility tax*. Washington State Legislature. <https://app.leg.wa.gov/rcw/default.aspx?cite=82.16>. Last accessed 06/10/2025.

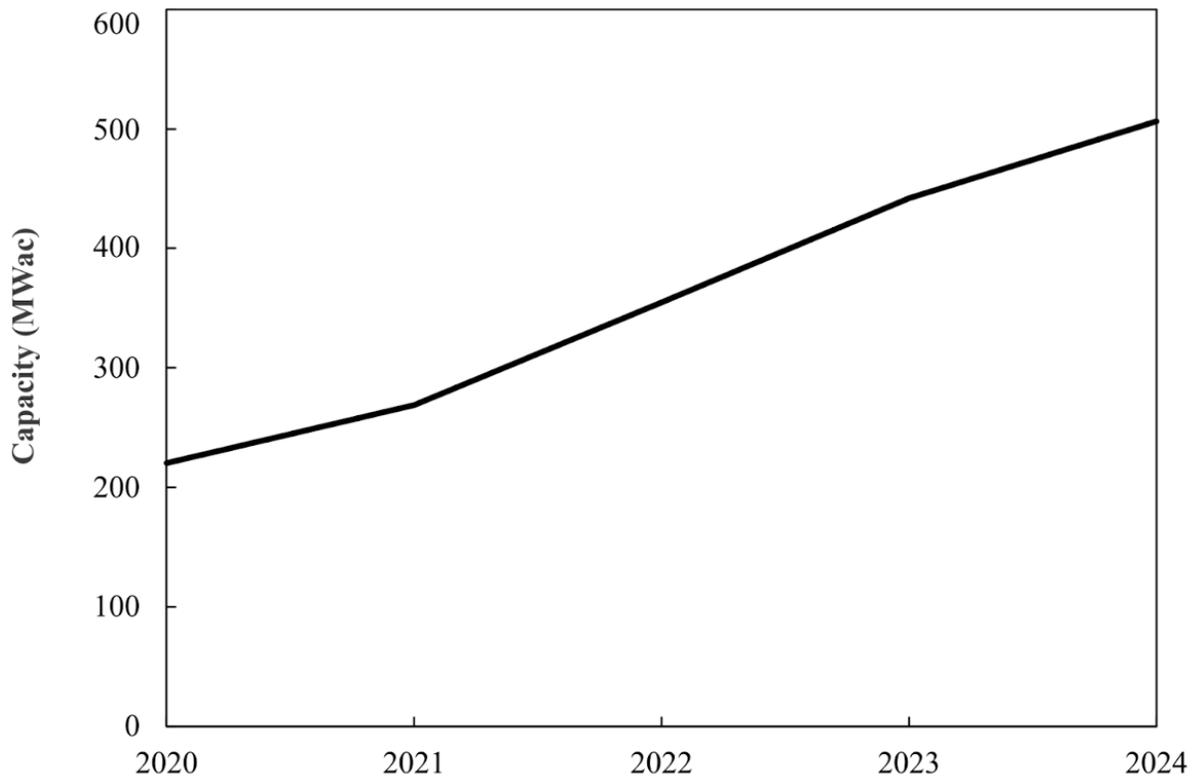
³⁸ Revised Code of Washington. (2025z). *Chapter 80.60 RCW: Net metering of electricity*. Washington State Legislature. <https://app.leg.wa.gov/rcw/default.aspx?cite=80.60>. Last accessed 06/10/2025.

The status of NEM in Washington today

NEM has been a key driver in the growth of solar energy production in Washington state, along with other incentives, including financial (such as tariffs and tax credits), declining costs for technology, and clean energy mandates as described above. In addition, offering financial and environmental benefits has prompted ongoing discussions about equity, infrastructure, and the sustainable design of electric utility systems in the new era of renewable energy.

For the entire state, NEM capacity is 1.67% of total electrical power capacity (30.98 GW)³⁹. However, given the diversity of the state’s electric utility system, NEM use varies greatly in different utility districts. Seven Washington electric utilities have surpassed the 4% threshold for net metering, with two others nearing the threshold.⁴⁰ These nine utilities provide electricity to more than two-thirds of customers in the state of Washington. NEM capacity is still growing state-wide, albeit at a slightly slower rate in the most recent calendar year (Figure 6).

Figure 6. Washington State Solar Net Metering Capacity



Source: WSU Energy Program⁴¹

For utilities that have reached the 4% threshold under the NEM program, the full-retail rate requirement is no

³⁹U.S. Department of Energy. "Net Summer Capacity of Utility Scale Units by Technology and by State, December 2024 and 2023 (Megawatts). <https://www.eia.gov/electricity/monthly/archive/february2025.pdf> Table 6.2.A

⁴⁰ Washington State University Energy Program. (2024, December). *Net metering*. <https://www.energy.wsu.edu/RenewableEnergy/NetMetering.aspx>. Last accessed 06/27/2025.

⁴¹ Ibid.

longer applicable. Of note for this study, utilities reaching the threshold have adopted widely varying compensation rates. For example, OPALCO set its compensation rate for power at approximately 70% of its marginal retail rate. Recently, Puget Sound Energy's compensation rate for community solar programs was set at approximately two-thirds of its retail rate. Kittitas PUD, which has reached 337% of the threshold, set its compensation rate at approximately one third of its marginal retail rate. While the variation in compensation levels can reflect differences in views of the value of solar, the current methodologies for valuing distributed solar are not necessarily the same. As more utilities reach the 4% threshold, new methodologies will be needed to analyze the range of factors that contribute to valuing distributed solar and storage.

Advantages, Issues and Challenges for Net Metering

NEM has several useful characteristics and some shortcomings as a system for remunerating distributed solar energy production and storage. When utilities accept and pay for excess energy generation, NEM can incentivize the adoption of renewable energy by customers by increasing their returns from and reducing the payback period for solar panel investments. In Washington state, for an average behind-the-meter solar installation cost, the payback period can be as early as 14 years.⁴² The size of the solar array, and thus the cost of installation, as well as the solar potential of a location could make self-generated clean energy more accessible and financially appealing to households and small businesses. Second, the adoption so far of distributed energy supported by NEM may support environmental goals by reducing that customer's, and in turn the system's, reliance on fossil fuels, lowering greenhouse gas and health-damaging air pollutant emissions. Third, depending upon the timing of output from rooftop solar and the customer's use of power, NEM can alleviate strain on the power grid during peak demand periods.

Ultimately NEM is just one policy instrument in a complex energy system. Critics argue that as more customers adopt solar through use of NEM, utility companies collect less revenue from these users, even though these customers still rely on the grid's infrastructure for backup power and to receive and distribute excess power injected into the system. This can lead to higher costs for non-solar customers who bear a higher share of infrastructure costs for a given electricity consumption rate. To address this criticism, some regulators have adopted (and others are considering) fixed charges or other revised rate structures that are intended to distribute grid costs more reasonably or equitably. To further complicate matters, the benefits of distributed solar and storage may vary across the grid. If this variation is not accounted for by an NEM design, some distributed solar and storage providers may be over- or under-compensated.

Policies governing NEM vary significantly across different regions and states, and the rules, caps, and compensation formulas differ widely.⁴³ Some states that have strong protections for existing net metering customers (grandfathering clauses) are now phasing out traditional net metering for new customers adopting solar systems in favor of new billing methods that reflect revised estimates of the value and cost of solar energy. Some of these newer billing mechanisms, such as "net billing" or "value-of-solar tariffs," provide a compensation rate that differs from the retail rate, often closer to the wholesale cost of electricity. In some cases, customers who install solar or solar+storage systems are required to take electricity service under a retail rate structure that reflects the actual costs of using or supplying electricity to the grid—creating price signals that influence when and how energy is consumed or generated. Illustrative examples from five states

⁴² Energysage, June 3, 2025 update, <https://www.energysage.com/local-data/solar/wa/>. Pay back periods vary greatly based on incident solar radiation and utility rate credit as well as other factors.

⁴³ National Academies of Sciences, Engineering, and Medicine. (2023). *The role of net metering in the evolving electricity system*. p. 32-57. The National Academies Press. <https://doi.org/10.17226/26704>

whose net energy metering programs have evolved are included in Appendix F.

NEM will likely evolve in other ways due to technological advances and policy reforms. For example, as technologies improve and small-scale energy storage becomes relatively more affordable, consumers may choose to store excess power rather than send it to the grid. Further, integrated smart grid technologies and time-of-use pricing models could enable more dynamic, efficient, and fair compensation structures.

Illustrative Examples of NEM in Other States

Most states have net energy metering programs, with varying approaches to subscriber limits, power limits, and compensation rates for distributed solar installations. Across the nation, these programs are in a state of flux. Quarterly updates of changes are available through the NC Clean Energy Technology Center *50 States of Solar* reports.⁴⁴ Appendix F highlights examples from five states whose net energy metering programs are evolving, in part because of key changes in policies to support the states' decarbonization goals in the last quarter century.

⁴⁴ North Carolina Clean Energy Technology Center. (2025). *The 50 States Reports*. <https://nccleantech.ncsu.edu/the-50-states-reports/>

PHASE 1 ACTIVITIES

ENGAGEMENT OF INTERESTED PARTIES

A key component of Phase 1, as directed by the legislature, was engaging interested parties who work with distributed solar resources in Washington state, including representatives of consumer owned utilities, municipal-owned utilities, investor-owned utilities, utility regulators, the rooftop solar and storage industry, as well as advocacy organizations involved with consumer advocacy, environmental justice, clean energy, climate change, labor unions, and federally recognized Indian tribes. To better understand key issues and perspectives of interested parties related to the value of distributed solar and storage and the ways in which they would like to be engaged during Phase 2, the WSAS enlisted the William D Ruckelshaus Center (the Center) to interview interested parties identified primarily by WSAS staff.

An initial list of interested parties was identified through background research conducted by graduate students from the University of Washington's Clean Energy Institute and supplemented by discussions with members of the Oversight Committee, agency personnel, and others. Additional interviewees were identified through a chain referral recruitment method where each interviewee was asked to identify individuals, interests or groups that would be important to interview. Some interested parties reached out directly to WSAS via the project's website.

The interview list was then curated to reflect a range of perspectives, and gather parties' knowledge and interest in the goals of distributed solar and storage goals, NEM, rate design, policies, and ongoing engagement. Those interviewed represented community solar advocates, environmental public interest organizations, local governments, investor-owned utilities, state agencies, public utility districts, municipal utility districts, cooperatives, trade associations, and ratepayer advocates. Some invitations to be interviewed were declined.

The project team for the interviews, which included both the Center and WSAS staff, conducted 23 interviews with a total of 48 interviewees (some included multiple representatives of one organization). Interviews occurred mid-February through April 2025. A synthesis of those interviews is included as Appendix E. Note that the project team was unable to interview representatives from all perspectives in Phase 1, but WSAS staff will interview a few more early in Phase 2. An abridged summary of the key findings from the Center's synthesis of what was heard and learned from interviewees follows below.

Goals and Objectives for Distributed Solar and Storage

Interviewees were asked to comment on the goals and priorities for distributed solar and storage in Washington state. Some key themes that emerged include:

- *Assist in Meeting Growing Electricity Demand:* Nearly all interviewees stated that distributed solar and storage has an important role to play as part of the portfolio of energy sources needed to meet the projected growth in Washington's electricity demand.
- *Advance Clean Energy and Meet CETA Goals:* Distributed solar and storage were viewed as critical to achieving the state's CETA goals, including the transition to net-zero electricity by 2050.
- *Enhance Community Resilience and Climate Adaptation:* Solar and storage can contribute to

strengthening energy resilience, especially during emergencies and extreme weather. Storage was highlighted as key for energy independence, managing changing seasonal demand patterns, and reducing reliance on the grid—particularly in communities subject to frequent extreme weather events.

- *Improve Grid Reliability and Manage Peak Load:* While acknowledging that solutions must vary regionally—especially between eastern and western Washington -- integrating storage and smart grid technologies are needed to improve grid efficiency, reduce congestion, and shift energy use away from peak demand periods.
- *Ensure Equity and Fair Compensation:* There was broad support for fair, transparent rate structures; compensation aligned with the actual value of exported solar energy; minimizing cost-shifting between solar and non-solar customers; and expanding access for renters, low-income, and historically excluded communities.
- *Promote Local Economic Development:* Distributed solar was seen as a driver of local job creation and local revenue, along with the importance of supporting small clean energy businesses and maintaining local technical expertise, especially in rural areas.
- *Expand Renewable Energy Access:* Some interviewees supported strong policies, such as but not necessarily limited to net metering, to maintain the financial viability of solar investments, especially for rural and low-income customers. They also stressed the need for clear public information on solar benefits, costs, and program rules to support informed decision-making.

Key Considerations for Evaluating Distributed Solar Rate Structures

Interviewees were asked what they thought should be key considerations for distributed solar rate design. They suggested:

- *Inclusive and Balanced Perspectives:* It is important to consider the needs of utilities, solar customers, non-solar customers, and broader societal and environmental interests, to ensure fairness and comprehensiveness in rate design.
- *Rate Design Elements:* Various rate design elements were discussed--including time-of-Use (TOU) rates, fixed charges, volumetric and demand charges, and net billing and export credit—with agreement that rate structures must be fair, transparent, and reflect the actual cost of service. High fixed charges were generally viewed as potentially inequitable and harmful to affordability.
- *Operational and Geographic Complexity:* There was broad recognition that Washington’s ~60 diverse electric utilities differ significantly in rate structures, costs, and energy sources (e.g., low hydroelectric rates in Chelan vs. higher rates in Seattle). There was also recognition that infrastructure and technology, such as aging grids and smart meters, influence rate design feasibility and costs.
- *Fairness and Equity:* Interviewees expressed concerns about cross-subsidization between solar and non-solar customers, with mixed views on the extent of cost shifting. However, there was strong support for ensuring equitable access to solar and storage, especially for low-income and underserved communities, through tools like discount programs, community solar, and tiered rates.
- *Environmental and Societal Impacts:* Distributed solar was recognized for its environmental benefits and contribution to Washington’s clean energy goals. However, views diverged on whether

environmental and societal benefits should be factored into rate structures or addressed through separate policies. Some pointed to models like California’s Societal Cost Test as a way to evaluate broader value.

- *Future-Focused Design:* There was broad support for rate structures that reflect future grid needs, not just past costs. Concepts like nodal pricing and avoided future costs were discussed as ways to better align incentives with system evolution. In addition, many emphasized the importance of taking a systems-level view of distributed energy integration.
- *Economic Development:* Stable and predictable rate structures are critical for solar businesses to thrive, create jobs, and invest confidently. Complex or rapidly changing rate designs risk stalling adoption and harming small businesses.
- *Policy Alignment:* Some believed equity and resilience goals should be addressed through legislation or standalone programs and not be baked into rate structures. Others saw rate design as an opportunity to advance state policy goals directly.
- *Valuing Storage and Resilience:* There was strong support for designing rates that incentivize pairing of solar with battery storage. Storage was seen as key to energy resilience, aligning consumption with grid needs, and addressing seasonal variability. Some expressed an interest in incorporating “value of lost load” (VOLL) to quantify resilience benefits.
- *Consistency vs. Flexibility:* While uniform statewide rates were seen as unrealistic, most supported a consistent framework or methodology for rate design. Flexibility is needed to reflect utility-specific conditions, but shared principles would improve fairness, clarity, and market stability.

Ideas for Reaching Agreement on Net-Metering Policies and Desired Processes for Further Engagement of Interested Parties

In response to questions about how to reach agreement on net metering policies and ongoing engagement, interviewees requested the following:

- *Develop a Collaborative Process:* there was widespread support for creating a collaborative, inclusive forum for dialogue. Using a trusted, facilitated process was seen as essential to overcoming past polarization and achieving buy-in. Interviewees emphasized the need to move beyond politics to shared values, principles, and data-driven analysis. They also identified some key topics to address collaboratively:
 - Cost-shifting concerns (especially impacts on low-income customers)
 - Solar’s quantifiable and hard-to-quantify benefits (e.g., environmental, resilience)
 - Utility vs. consumer benefits of distributed solar
 - Trade-offs in different valuation/rate design options
 - How solar affects grid reliability, environmental outcomes, and costs
 - Frameworks for utility-customer partnerships
 - Clear identification of decision-makers and process influence
 - Principles for equitable treatment of customers
- *Create a Viable and Trusted Process:* Interviewees offered criteria they would like to see build a credible process:

- Impartial, professional facilitation and analysis
 - Transparency in data, assumptions, and decision-making
 - Inclusive participation, especially from underrepresented communities
 - Use of robust stakeholder engagement, with multiple workshops or working groups
 - Clear outcomes and timelines
 - Communication that reaches both technical and non-technical audiences
- *Acknowledge Challenges to Agreement:* Interviewees identified challenges to reaching consensus, but many still believed that with well-structured facilitation and open dialogue, common ground, even if not full consensus, could be found. Challenges include:
 - Historical mistrust, polarized interests, and previous failed processes
 - Tensions between equity and first-come-first-served models
 - Differences between utility-industry perspectives and the perspectives of other groups
 - Resistance to change
 - Divergent perspectives on:
 - Relevance of legacy net metering
 - Cost-shifting and compensation
 - Whether statewide consistency is possible or desirable
 - Concerns about a “zero-sum” mindset in discussion
- *Use and Communicate Data Effectively:* Trusted, peer-reviewed data and transparent methods are critical, and findings must be communicated in ways that are accessible for all stakeholders. Data should reflect hard-to-quantify benefits, address real vs. perceived cost-shifting, account for different utility types (investor- vs. consumer-owned), and help legislators and decision-makers understand trade-offs and impacts.

Ideas for Ongoing Engagement

Interviewees proposed a multi-phase approach to future engagement, summarized below.

- *Early Phase 2:* Public forum to present and gather feedback on Phase 1 findings, with open comment process on the draft report.
- *During Phase 2:* Stakeholder input throughout research and analysis, with utility engagement in testing assumptions and shaping methods, and ongoing workshops with technical experts.
- *Toward End of Phase 2:* A final round of workshops and forums to review the draft 2026 report, and vet potential conclusions and recommendations.
- *Long-Term Process Design:* In-person meetings to build trust and resolve differences. The design could be a structured collaboration focused on trade-offs, shared values, and long-term goals. It would also include a transparent, action-oriented, and feedback-informed implementation path.

In summary, interviewees widely supported building trusted processes that emphasize inclusivity, transparency, and respect. They saw the value of learning from other states’ efforts while tailoring solutions to Washington’s context. Moreover, they shared a vision for a process that transitions over time from data collection, analysis and technical review to collaborative, policy-focused design with robust stakeholder involvement.

WSAS acknowledges that the interested parties expressed a strong interest in ongoing engagement as advisors to the project. However, given limited resources, Phase 2 will focus primarily on research that examines existing and develops new methodologies. While a robust engagement process is not possible within the scope of this budget, Phase 2 does include meetings with interested parties during each stage of the process to discuss progress and elicit input.

Interested parties also expressed a desire for a longer term, structured and facilitated collaborative process among stakeholders to identify, discuss, and strive to come to common understanding and agreement regarding a vision of the future for solar and storage, values, principles, explicit benefits, appropriate approaches, and guidelines for establishing rates/compensation. While resources do not currently exist for this activity, the engagements planned in Phase 2 may provide opportunities for interested parties to begin to find ways to create such a process to support future discussions.

FRAMING OF THE RESEARCH PROJECT

Phase 2 of the project will involve a study approach that is different from previous studies on this topic conducted in Washington and other states. Rather than recommend specific policy choices around the cost-effectiveness or fairness of different mechanisms, this study will begin by describing broad objectives that are not limited to the design of a successor program to net energy metering. The study will examine the various factors that can be used to determine the value of solar, storage, and solar+storage to inform the design of the full range of policy mechanisms that could realize that value.

The scope of the research project and engagement of interested parties in Phase 2 are described below. The research will focus primarily on describing benefits, developing new methodologies to value them, and providing examples of how policy mechanisms can be applied to realize and maximize benefits that will be distributed to the system and individuals. Costs that ultimately will be allocated to the system and individuals are important, but require different kinds of discussions and analyses that are outside the scope and budget of this study. However, we will include a few examples of how costing can occur once methodologies for valuing benefits are developed, as well as how cost-efficient policies can maximize benefit – the most benefits for the least, most equitable cost.

Phase 2 Context and Objectives

The context for Phase 2 of the project is rooted in state policies for reaching net-zero decarbonization goals that involve clean energy sources, as described above. These policies set the aspiration that Washingtonians may equitably realize the full potential cost-effective benefits (economic, social, and environmental) of the deployment of distributed solar and storage technologies. Such benefits can be realized through different types of policy mechanisms, including, but not limited to, the electricity rate design adopted to compensate customers who adopt distributed solar and storage. Decisions about various policy actions to advance the goals for solar and storage can be informed by understanding the value of those technologies, which can be examined by robust methods for calculating quantifiable values and for qualitatively assessing hard-to-quantify values.

The overall objective of Phase 2 is to develop methods (including formulas and calculations) for estimating the value of the benefits of distributed solar and storage that the people of Washington can realize. These methods would then be available to inform decisions about the portfolio and design of policy mechanisms to achieve the state’s deployment goals for solar and storage.

Note that the Oversight Committee’s interpretation of the charge for Phase 2 does not necessarily presume that the best way to realize the benefits of solar and storage is through specialized rate design. The final report may include a portfolio of options to help realize different potential benefits of solar and storage.

Core Concepts and Research Principles

Potential and Realized Benefits

For the design of policy mechanisms, “benefits” are considered from the perspective of the people of Washington state. These can be “grid” or “energy” benefits associated with the energy system. They can also be “social”, “economic” or “environmental” benefits for individuals, the energy system, the economy, and the

environment affecting Washington state and its people.

It is important to distinguish between *potential* benefits and *realized* benefits. Potential benefits are theoretical, based on the technical specifications and/or possible applications of the deployed hardware. Realized benefits are those that, in regular operation, impact the people of Washington. Potential benefits, of which there are many, can be realized if there exists a policy mechanism to make them viable to some major constituency such as ratepayer or utility (Figure 6). The policy mechanism used in Washington state is NEM. Other mechanisms can be used depending on how factors are valued.

Figure 6: Connection between potential and realized benefits



Note that some potential benefits are realized immediately through the installation and basic operation of an energy asset, with value based on fixed streams of benefits tied to the technical specifications of a system, such as size, orientation and expected energy output. Traditional “value of solar” studies presume the benefits are realized because solar panels generate power, without considering storage or how the energy is used.

However, with the introduction of energy storage, policy design significantly affects the private (or local BTM) benefits of storage. Table 3 provides an example of how different policy mechanisms can help realize different amounts of potential benefits of energy storage.

Table 3: Illustrative example of Realized Benefits

<p>This example shows how the realized benefit of a potential benefit can depend on the policy mechanism selected.</p> <p>One potential benefit of a 10kW rooftop solar array is increased distribution grid capacity.</p> <ul style="list-style-type: none">• Potential Benefit (10 kW) The theoretical maximum capacity benefit is 10kW if the solar array were to produce 10kW long enough and at the right timing with local peaks, enabling the asset to perform in a way that helps the utility avoid the cost of adding capacity elsewhere (<i>independent of policy mechanisms</i>).• Optimistic - No Control (7 kW) Because of the uncertainty around timing of solar production,

and the asset wouldn't be responding to dispatch signals, the distribution planners may only be able to realize 7kW of benefit (*no operational policy mechanisms* affecting the asset).

- **Worst case - No Control** (0 kW) Because the timing of the solar production does not avoid peak demand on the circuit, it does not avoid any distribution investment (*no operational policy mechanism* affecting the asset's interaction with the local grid).
- **Battery Addition** (7.5 kW) The customer installs a 10kW 2-hr battery system to complement the solar array. Assuming the owner's rate structure has time-varying rates and the owner modifies on-site electrical demand and/or use of the battery to shift energy output of the combined solar+storage assets to higher peak times. (*mechanism*: basic rate design).
- **Battery with DR** (8.5 kW) The utility launches a demand response (DR) type program to direct resources to address distribution system peaks. (*mechanism*: DR program).
- **Battery with VPP** (9 kW) The customer joins a Virtual Power Plant (VPP) or other mechanism that has a contractual obligation to respond to peak events (*mechanism*: VPP contract) from the utility.
- **Utility-owned system** (10kW) The solar+storage asset is part of a regulator approved utility program where the asset is owned and controlled by the distribution utility such that the asset can provide its full output at the most valuable times.

Calculating the value of storage or solar+storage requires a new approach that integrates the benefits of installation and the price and control signals that are provided by policy mechanisms. Examples of policy mechanisms include: retail rates, other types of tariffs, payment for service tariffs or programs, rebate/incentive/grant programs provided by a government or other entity, utility procurement programs, etc. Any of these policies can be more or less dynamic. They can be static and fixed across all user groups, or they can be designed to dynamically respond to market conditions or vary across space and user groups to better pursue policy goals.

Value, Benefits and Costs

The "value" of a deployed solar asset is the combination of the benefit factors the asset affords to either the adopter of the technology, the grid, the economy, the environment or society. There may also be a "value" assigned to the *distribution* of these benefits and their role in advancing equitable outcomes. Determining the magnitude of an asset's value often requires a quantification of the benefits that can be realized. For the purposes of the research to be conducted in Phase 2 and future policy decisions that may use this work, "value" is considered distinct from "costs" and will be treated as separate topics. While acknowledging that realizing value for some may involve costs to others, the study of cost shifts specifically is not the focus of this project. Rather, the project will take an empirical approach to describing a large number of factors associated with valuing both solar and storage, examine the measurability of those factors, and categorize the types of benefits they represent. The project will also consider the policy and regulatory measures that could be taken to ensure that the values of solar and storage are equitably distributed.

In general, many participants in the energy industry refer to the list of benefits from a technology as its available "Value Stack" for a particular market or location. Phase 2 refers to this list of benefit categories as a Potential Value Stack that is not based solely on a technology, but also on its configuration or use case. Each

type or category of benefit in a Value Stack is called a “benefit factor”.

This project categorizes benefit factors into three main types:

- *Deployment Benefits*: realized in the deployment (i.e., installation) of the assets (e.g., jobs), but distinct from operational benefits
- *Passive Benefits*: realized from automatic operation of the asset, without active dispatch (e.g., value of energy generated based on retail rate design; GHG reduction from offsetting fossil generation; resilience benefit from automatic islanding)
- *Active Benefits*: realized from the active dispatch of the asset (e.g., participation in demand response programs) and from factors that change when it is used (e.g., time of use (TOU) rates)

These categories are useful in distinguishing what types of policy mechanisms can be implemented to realize different types of benefits.

The research and analysis conducted in Phase 2 will prioritize identifying potential benefit factors making up a value stack for “solar+storage” first, then “storage only”, and lastly “solar only”. Practically, “solar+storage” deployment can realize the largest list of potential benefits, while the other two configurations can only realize subsets of that full list of benefits.

In addition, the study of benefits will not be limited to a total number or amount of a benefit factor, but will also consider the distribution of benefits. Given the strong emphasis in Washington energy policy on an equitable transition, the question is not just how much benefit is realized but also who realizes the benefit, and how to allocate fairly the fixed cost of building and operating the electricity grid.

The potential benefit factors described in Table 4 will serve as a starting point for the research in Phase 2. Every benefit factor is potentially available to solar+storage. These benefit factors were derived from multiple sources, including value factors used in other states, the Lawrence Berkeley Laboratory’s recent review of valuing solar studies⁴⁵, the “Benefits and Costs of Net Metering in Washington” study conducted by E3 (2023)⁴⁶, as well as the benefits identified by the technical advisory committee convened to review the E3 study.⁴⁷ Definitions are found in the Glossary in Appendix C.

As noted above, the *distribution* of some of these benefits also has equity implications, and this distribution of benefits will also be considered.

⁴⁵ Lawrence Berkeley National Laboratory. (2025, February 6). *A review of value of solar studies in theory and in practice*. https://eta-publications.lbl.gov/sites/default/files/2025-02/20250206_final_vos.pdf

⁴⁶ Energy and Environmental Economics, Inc. (E3). (2023, December 21). *Benefits and costs of net energy metering in Washington* [Report]. https://www.ethree.com/wp-content/uploads/2023/12/E3_Benefits-and-Costs-of-Net-Energy-Metering-in-Washington_2023-12-21.pdf

⁴⁷ Gridworks. (2023, December 22). *WA NEM TAG corrected final report: Technical Advisory Group to Washington utilities net energy metering evaluation* [Report]. <https://gridworks.org/wp-content/uploads/2024/05/WA-NEM-TAG-corr.-Final-Report-12.22.2023-1.pdf>

Table 4: Preliminary categorization of Potential Value Stack to be considered in research conducted in Phase 2. If a factor is in this table, it is available to any installation that has solar+storage. Installations that have only solar or only storage may not have access to a factor. Definitions are provided in Appendix C.

BENEFIT FACTORS	TECHNOLOGY Solar Only Storage Only	MEASURABILITY Quantitative Qualitative Harder to quantify	TYPES Deployment benefits Passive benefits Active benefits
Generation			
Avoided capacity	Both	Quantitative	Solar: Passive Storage: Active
Avoided energy	Both	Quantitative	Solar: Passive Storage: Active
Avoided generation O&M costs	Both	Quantitative	Solar: Passive Storage: Active
Avoided cost of purchasing energy from renewable resources for CETA compliance	Solar only	Quantitative	Passive
Avoided cost of carbon (directly imposed)	Both	Quantitative	Solar: Passive Storage: Active
Reduction of criteria pollution emissions in excess of permit limits.	Both	Quantitative	Active
Resource diversity	Both	Qualitative	Deployment
Fuel hedging	Both	Quantitative	Solar: Passive Storage: Active
Market price response	Both	Quantitative	Solar: Passive Storage: Active
Ancillary services	Storage only	Quantitative	Active
Transmission			
Avoided transmission capacity	Both	Quantitative	Solar: Passive Storage: Active
Avoided line losses	Both	Quantitative	passive
Reliability	Both	Quantitative	Solar: Passive Storage: Active
Resilience	Storage only	Quantitative	Active
Distribution			
Avoided distribution capacity	Both	Quantitative	Solar: Passive Storage: Active
Reliability	Storage only	Quantitative	Storage: Active

Resilience	Both	Quantitative (for grid)/Qualitative (for individual)	
Support for de-energizing power lines for reducing fire risk	Storage only	Quantitative/Qualitative	Storage: Active
Distribution and transmission operations and maintenance	Storage only	Quantitative	Storage: Active
Voltage and power quality	Both	Quantitative	Passive
Customer/Ratepayer			
Utility bill affordability	Both	Quantitative	
Site resilience (aka Islanding)	Storage	Qualitative/Qualitative	Active
Supports customer electrifying load	Both	Quantitative	Solar: Passive Storage: Active
Societal			
Avoided cost of carbon (social cost)	Both	Harder to quantify	Solar: Passive Storage: Active
Other avoided environmental costs	Both	Harder to quantify	Passive
Land use including Tribal lands	Both	Harder to quantify	Passive
Reduction in ramping of hydroelectric dams	Storage only	Quantitative	Storage: Active
Reduction of Criteria and hazardous air pollutants (e.g. SO ₂ , NO _x , PM) due to reduced dispatch of generation plants that use carbon-based fuels	Both	Quantitative	Passive
Local tax revenue	Both	Quantitative	Passive
Workforce development	Both	Quantitative	Deployment
Jobs	Both	Quantitative	Deployment
State Tax revenue	Both	Quantitative	Deployment and Passive

The Oversight Committee discussed whether or not to consider deployment costs related to putting a technology into active use. They decided that for this phase of the project, the quantification of “value” is independent of the costs to deploy and use the asset. That is, “value” in policy design is not “net of deployment costs.” Decisions about whether to adopt a particular policy mechanism and to choose one design over another might take into consideration both value and deployment cost, but the two elements are conceptually distinct. Further, valuation of costs requires distinct methods that are beyond the scope and

budget of this project.

While the study will focus on benefit factors, the research design does recognize that the costs to ratepayers and others of a particular policy choice / design are a critical consideration in deciding which policy mechanisms most effectively realize the benefits of solar and storage. Moreover, the distribution of costs can be contentious. Phase 2 will focus on producing value methodologies as inputs to these policy decisions but will not recommend specific policy choices around the cost-effectiveness or fairness of different mechanisms. Time and resources permitting, Phase 2 will attempt to address the questions of costs impacts and distribution of costs for several of the discussed policy mechanisms to aid in policy design choices.

Research Plans and Timeline for Phase 2

Research will be executed in five stages (summarized in Table 5). The stages are organized sequentially, though in practice the research process may be iterative, where new information and ideas might cause a brief return to earlier stages if necessary and appropriate. The Oversight Committee will review progress throughout the stages. The project and research teams will report and discuss progress to interested parties in stages 1-4, while maintaining the independence of WSAS's deliberations, recommendations, and final products.

Stage 1: Finalize a Potential Value Stack that covers the major BTM use cases

The research team will develop a comprehensive Potential Value Stack for BTM solar and storage resources, building on those described in Table 4, and consisting of all the potential benefit factors that may be realizable. Where appropriate, they will label each benefit factor for its applicability to the three asset categories (solar+storage, storage only, solar only). At this stage, the Value Stack is agnostic with respect to asset size but will include benefit factors that may not be available to every customer class. Research will indicate which benefit factors would not be available to which customer classes.

Each benefit factor will be placed in one of the three major categories – Deployment Benefits, Passive Benefits and Active Benefits. Each benefit factor will be labeled as quantitative, qualitative, or difficult to quantify based on whether or not standard methods are readily available or reasonable methods can be readily developed to calculate numerical values for the factor.

The final report will identify major policies and programs in other states that also recognize these benefit factors, building on the preliminary research about solar and storage found in Appendix F. Researchers will specifically highlight other efforts within Washington to calculate and use the value of distributed solar and storage. They will also examine which benefit factors were utilized in other regulatory and/or utility settings (e.g., Distribution System Planning (DSP) efforts at the UTC, Distributional Equity Analysis (DEA) done for NEM). In this way, the Phase 2 research will encourage consistency across the state in valuing distributed energy resources (DERs).

At the conclusion of Stage 1, a meeting with interested parties will be held to provide an opportunity for them to suggest benefit factors to add, remove or revise in the Potential Value Stack. The Oversight Committee will review and approve the final Potential Value Stack before the research proceeds to Stage 2.

Stage 2: Map benefit factors to one or more mechanisms to realize benefits

For each benefit factor in the Potential Value Stack, the research team will identify the policy mechanisms (if any) that are specifically intended to realize those benefits. Some benefit factors can be realized through one

or two mechanisms (e.g., a special rate design, or a procurement program) while other benefit factors can only be realized when several mechanisms work together (e.g., to realize the deployment benefits of BTM storage, it may require rate design, an incentive and a demand response program to collectively make a project economically viable).

Policy mechanisms are broadly characterized into the following major types:

- Retail Rate Design
- Procurement Approaches
- Grid Services Programs
- Incentives / Rebates
- Integrated Resource Plans (IRP)
- Distribution System Plans (DSP)
- Financing Enabling Policies
- Other Unusual Mechanisms

Researchers will identify major examples of each type of policy mechanism that have been applied to distributed solar and storage in other parts of the U.S. Researchers will also characterize the amount of the total potential benefits that each policy mechanism could realize (see the example in Table 3 regarding realization of benefits).

Researchers will also evaluate the distribution of benefits realized via each policy mechanism. For example, low-income solar incentives may improve the equitable distribution of a benefit factor like “access to clean energy.”

At the end of Stage 2, interested parties will have the opportunity to meet with the research team to discuss the mapping of benefit factors to policy mechanisms. Interested parties may suggest additional and/or revised mechanisms and potential mappings. The Oversight Committee will review and approve the mapping of benefits to mechanisms before proceeding to the bulk of the research in Stage 3.

Stage 3: Describe or develop valuation methods for assessing benefit factors

For each combination of benefit factor and policy mechanism, the research team will identify or develop a method for calculating a value of the benefits that mechanism can realize in Washington’s electrical system. For benefit factors (such as job creation) which don’t necessarily have a specific policy mechanism, researchers will identify or develop a valuation method independent of the policy mechanism(s). The valuation method for quantitative benefits includes the calculable factors that go into a valuation formula and the sources from which the formula can get Washington-specific data. For qualitative benefits, the method may not include a specific formula but can use semi-quantitative methods to determine broader categories like high, medium, low to characterize the realized benefits.

The output of Stage 3 will be a set of valuation methods, but not a calculation of a monetary value of the benefit factors, since that value would likely vary across place and time.

A check-in meeting with interested parties may occur midway through Stage 3 to describe the valuation methods developed so far and invite interested parties to suggest additional sources of data and approaches to calculating factors.

Stage 3 will conclude with a meeting with interested parties where they may suggest additions and tweaks to the methods and then a review and approval by the Oversight Committee.

Stage 4: Develop use case Scenarios and demonstrate the calculation of value based on methods identified in Stage 3.

For each major use case, the research team will develop examples of kinds of potential values and types of policy mechanisms needed to realize those values. Time and budget permitting, Stage 4 will include examples of potential costs to ratepayers associated with several of the identified policy mechanisms.

Stage 4 will conclude with a meeting with interested parties where they may suggest additions and tweaks to the scenarios. The Oversight Committee will conduct the final review and approval of the scenarios.

Stage 5: Prepare the final report

The research team will draft and iterate on the final report with input from the Oversight Committee. Stage 5 will conclude with final signoff from the Oversight Committee, submission to the UTC, and at least one public presentation.

Table 5: Timeline for Phase 2

Stage	Output	Timeframe	Opportunity for interested parties to engage
1	Potential Value Stack that covers major behind-the-meter use cases	Late July to mid August 2025	Suggest benefit factors for the project team to consider adding, removing or revising in the Potential Value Stack
2	Map of policy mechanisms to realize benefits	Late August to early September 2025	Suggest additional and/or revised mechanisms and potential mappings
3	Valuation methods for benefit factors	Mid-September 2025 to late March 2026	Suggest additions and/or revisions to the methods
4	Use case scenarios	April to mid-June 2026	Suggest additions and/or revisions to use case scenarios
5	Final report	Mid-June to September 2026	Public presentation of the report after its release

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APPENDICES

A: OVERSIGHT COMMITTEE BIOGRAPHICAL INFORMATION

Anjan Bose, Regents Professor, School of Electrical Engineering and Computer Science, Washington State University; Site Director, Power System Engineering Research Center

Dr. Anjan Bose has over forty years of experience in industry and academia, as an engineer, educator, and administrator. He is well known as a technical leader in the power grid control industry, a researcher in electric power engineering, an educator in engineering, and an administrator in higher education. He is a Regents Professor at Washington State University (WSU), where he also served as the Dean of Engineering and Architecture (1998-2005) and in 2012-13 served as a Senior Advisor to the US Department of Energy (DOE) in the Obama administration. Dr. Bose is a Member of the US National Academy of Engineering (2003) and has served on many National Academy Committees. He is a founding Member of the Washington State Academy of Sciences and has been elected as its President. He is also a Foreign Fellow of the Indian National Academy of Engineering. He is a Fellow of the IEEE and is active in several international professional societies. He was the recipient of the Outstanding Power Engineering Educator Award (1994), the Third Millennium Medal (2000) and the Herman Halperin Electric Transmission & Distribution Award (2006), from the IEEE. He has been recognized as a distinguished alumnus of the Indian Institute of Technology, Kharagpur (2005) and the College of Engineering at Iowa State University (1993).

Mohit Chhabra, Senior Analyst, Regulatory and Economic Policy, Climate & Energy, Natural Resources Defense Council (NRDC)

Mohit Chhabra provides analysis and strategic guidance to policymakers and other stakeholders at the state, regional, and national levels. He is currently working on redesigning electricity pricing to facilitate decarbonization and enhance affordability, developing cost-effective pathways to reduce greenhouse gas emissions and pollution from California's energy sector, and serving as a technical advisor to other regional teams. He holds a master's degree in civil environmental and architectural engineering from the University of Colorado Boulder and a bachelor's degree in mechanical engineering from the University of Pune in India. He is based in NRDC's New York City office.

Daniel Kirschen, Donald W. and Ruth Mary Close Professor, University of Washington

Daniel Kirschen joined the University of Washington in 2011 as a Close Professor of Electrical Engineering after spending 16 years at the University of Manchester (previously UMIST) where he was head of the Electrical Energy and Power Systems research group. He is a member of the Renewable Energy Analysis Lab, which focuses on how to build a smart grid that will maximize the amount of energy produced from renewable energy sources at a reasonable cost while maintaining the reliability of the electricity supply at the level to which we have grown accustomed. The main objective of his research focuses on developing techniques that achieve the optimal balance between providing a reliable grid service, minimizing the cost of providing energy, and reducing the environmental impact of the electrical system while facilitating the use of renewable energy sources. Before becoming an academic, Kirschen worked for Control Data and Siemens on the development

of advanced application software for electric utility control centers. He is the author or co-author of two books and over two hundred scientific papers.

Elena Krieger, Senior Director of Research and Policy Analysis at Just Solutions

Elena Krieger, PhD, is the Senior Director of Research and Policy at Just Solutions, a national nonprofit organization focused on developing equitable energy and climate solutions. Previously, she served as director of research at an interdisciplinary energy science and policy research institute, where she explored strategies to integrate public health, equity, affordability, resilience, and other societal benefits into energy transitions. She is a member of the second cohort of New Voices at the National Academy of Sciences, Engineering, and Medicine, a member of the Disadvantaged Communities Advisory Group to the California Energy Commission and California Public Utilities Commission, and a member of the board of directors for the Center for Economic and Environmental Partnership. She has served on multiple committees for the National Academies, including the Committee on the Role of Net Metering in the Evolving Electricity System. Elena received her BA in Physics and Astronomy & Astrophysics from Harvard and her PhD in Mechanical and Aerospace Engineering from Princeton, where her research focused on optimizing energy storage for renewable energy systems.

H. Alan Love, Professor, School of Economic Sciences; and Director, Center for Institutional Research Computing, Washington State University, Pullman

Dr. Love is a Professor in the School of Economic Sciences (SES), where he served as Director between 2011 and 2019. Currently, he also serves as the Director of the Center for Institutional Research Computing (CIRC) that provides high-performance computing (HPC) resources and expertise to advance computational and data-intensive research across WSU. Dr. Love holds a doctorate in Agricultural and Resource Economics from the University of California, Berkeley. Prior to joining Washington State University, Dr. Love was a Professor in the Department of Information and Operations Management and in the Department of Agricultural Economics at Texas A&M University, College Station. His research fields include industrial organization, information economics, supply-chains, and applied econometrics. His current research focuses on electricity markets with particular interest in smart grid edge designs to enhance prosumer response for increased resilience and decarbonization of electric power services. Dr. Love's research awards include the Quality of Research Discovery Award from the Agricultural and Applied Economics Association, Outstanding Published Research Award from the Western Agricultural Economics Association, and Article of the Year Award from the Northeastern Agricultural and Resource Economics Association.

Autumn Proudlove, Managing Director – Policy & Markets, North Carolina Clean Energy Technology Center

Autumn Proudlove is the Managing Director - Policy & Markets at NCCETC, where she leads the Center's energy policy team and provides strategic direction on policy and market issues across the Center. Autumn oversees the policy team's portfolio of activities and directly manages its client-focused research services and publications, including the 50 States of Solar, 50 States of Grid Modernization, 50 States of Electric Vehicles, and 50 States of Power Decarbonization quarterly policy tracking reports. She is a co-principal investigator for the Carolinas Renewable Energy Development Assistance and Siting Hub project and oversees the Database of State Incentives for Renewables and Efficiency (DSIRE). Autumn is on the leadership committee for North Carolina's Solar for All program and serves on the technical steering committee for the National Open Data for

Electrification (NODE) Collective. Autumn previously served on the National Academies of Sciences, Engineering, and Medicine's committee on the role of net metering in the evolving electricity system. Autumn received her Master's degree in Energy Regulation and Law, *summa cum laude*, from Vermont Law School and her Bachelor's degree in Environmental Studies, with a minor in Economics, from Dartmouth College.

Dan Schwartz, Director, Clean Energy Institute; and Boeing-Sutter Professor of Chemical Engineering, University of Washington

Schwartz is the founding director of the UW Clean Energy Institute (CEI) and the Boeing-Sutter Professor of Chemical Engineering. His research explores transport and reaction in electrochemical systems, including the performance of complex electrodes used in energy storage and conversion. Schwartz served on the Technical Advisory Board for Washington's Energy Strategy in 2012 and, in 2018, he received the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring from the White House Office of Science and Technology Policy and the National Science Foundation. He is a Fellow of the Electrochemical Society and is a board and executive committee member of the Washington CleanTech Alliance.

Noel Schulz, Inaugural Director, Institute for Northwest Energy Futures

Noel N. Schulz is Washington State University's former First Lady and the inaugural director for the Institute for Northwest Energy Futures. Dr. Schulz has more than 26 years of teaching experience at 6 U.S. universities including WSU. She has taught courses in power systems, energy conversion, application of computer programs to power engineering, application of intelligent systems to engineering problems, fundamentals of electrical circuits, renewable and distributed generation, and smart grid technologies. She has graduated 45 master's students and 13 doctoral students.

Dr. Schulz's research has focused on power systems modeling and analysis, smart grid applications, microgrids, renewable energy, and shipboard power systems. The research has been funded by multiple national agencies—including the National Science Foundation and the U.S. Departments of Defense, Energy, and Homeland Security—and private power equipment companies. She has published 175 papers and two book chapters.

Prior to arriving at the University with her husband, WSU President Kirk Schulz, in mid-June 2016, she served as First Lady and associate dean for research and graduate programs in the College of Engineering at Kansas State University. She also directed the KSU Engineering Experimental Station and the Electrical Power Affiliates Program and was the Paslay Professor of Electrical and Computer Engineering. Dr. Schulz is the recipient of the 2016 Institute of Electrical and Electronics Engineers (IEEE) Fellow, the 2014 IEEE Education Society Hewlett-Packard Harriet B. Rigas Award for outstanding contributions in advancing recruitment and retention of women in IEEE and the engineering professions, and the 2014 American Society for Engineering Education (ASEE) Fellow.

Susan Tierney, Senior Advisor, Analyst Group

Dr. Tierney is an expert on energy policy and economics, specializing in the electric and gas industries. She has consulted to companies, governments, nonprofits, and other organizations on energy markets, as well as economic and environmental regulation and strategy. Her expert witness and business consulting services

have involved industry restructuring, market analyses, utility ratemaking and regulatory policy, clean energy regulatory policy, transmission issues, wholesale and retail market design, and resource planning and procurement. Dr. Tierney is a former assistant secretary for policy at the US Department of Energy, state cabinet officer for environmental affairs, and state public utility commissioner. She chairs the board of directors of Resources for the Future; chairs the National Academies' Board on Energy and Environmental Systems; serves on the external advisory board of the National Renewable Energy Laboratory; and is a member of the boards of directors of the Alfred P. Sloan Foundation, the Barr Foundation, and other organizations. She has published widely, frequently speaks at industry conferences, and has lectured at many leading universities.

Jud Virden, Associate Laboratory Director, Energy and Environment Directorate, Pacific Northwest National Laboratory

Jud Virden is the Associate Laboratory Director for the Energy and Environment Directorate at Pacific Northwest National Laboratory in Richland, WA. He leads 1,700 scientists, engineers, and staff who are delivering science and technology solutions for the nation's complex energy and environmental challenges—including modernizing the power grid, advancing energy storage technologies, increasing the energy efficiency of buildings and lighting, developing biofuels, and resolving complex issues in nuclear science and environmental management. Jud earned his Ph.D. and B.S. in chemical engineering from the University of Washington. He joined PNNL in 1991.

Jonathan Yoder, Distinguished Professor for Sustainable Development; and Director, State of Washington Water Research Centers, Washington State University

Jonathan Yoder is the Director of the State of Washington Water Research Center and Distinguished Professor for Sustainable Development in the WSU School of Economic Sciences at WSU Pullman. His research specializations include natural resource and environmental economics, focusing on policy design and impact analysis, law, and contracts. Dr. Yoder joined the Water Research Center in 2014, but has been involved in water-related economic research for about 15 years. He has contributed to research on water pricing, economic analysis of water law, water markets, economic aspects of large environmental systems modeling efforts, benefit-cost analysis of water projects and water recreation, water quality impacts of livestock waste, and more. He has a BA in Biology, a MS in Applied Economics, and a PhD in Economics. Dr. Yoder has been President of the Universities Council on Water Resources, is a Member of the Board of Directors of the National Institutes of Water Resources, is a member of the Washington State Academy of Sciences, and has served in numerous other editorial and service positions.

B: COMPENDIUM OF RESEARCH RESOURCES

The WSAS project team compiled a Zotero library to serve as a public-facing record of the reference materials that the team used as inputs to this study. The library can also serve as a public resource for other researchers both across and beyond Washington State.

Resources in this library include (but are not limited to) relevant Washington State statutes and agency policy documents, documentation of peer states' actions on distributed energy resources and/or net metering, utility resource plans, energy regulatory dockets, peer-reviewed research published in scientific journals, national laboratory publications, and Department of Energy resources. The full Zotero library of citations is available at:

https://www.zotero.org/groups/6020095/wsas_net_metering_database/library

Subscribe via the RSS reader to be notified when updates are made to the Zotero database.

Interested parties are invited to share any additional resources with the research team by emailing vos.wsas@gmail.com.

C: GLOSSARY

This report uses several key terms, which are defined as follows to enable a common understanding and foundation for the project’s Oversight Committee, research team, and interested parties.

Active Benefits	The direct advantages that come from actively managing and utilizing stored solar energy. These benefits typically include energy cost savings, grid independence, optimized energy use, demand response participation, and environmental impact reduction.
Ancillary Services	A catch-all term for services, in addition to electricity generation and capacity, that generation and storage resources provide the grid to maintain stability. These include voltage response, frequency response, spinning reserves, and operating reserves. Not all DG provide all these ancillary services; for example, dispatchable storage can provide frequency response, but distributed solar by itself typically cannot. ⁴⁸
Avoided Capacity	The reduction in the need for additional power generation infrastructure due to the deployment of distributed energy resources. Essentially, when solar and storage systems provide reliable energy during peak demand periods, utilities can avoid investing in new power plants or grid upgrades. ⁴⁹
Avoided Cost of Carbon (Directly Imposed)	The monetary savings associated with reducing carbon emissions through solar and storage deployment, particularly in cases where carbon pricing or regulatory penalties are enforced. This concept is crucial in evaluating the financial benefits of clean energy investments. ⁵⁰
Avoided Distribution Capacity	The reduction in the need for new distribution infrastructure due to the deployment of solar and storage systems. When distributed energy resources (DERs) generate and store electricity locally, they reduce the demand for additional distribution system upgrades, leading to cost savings and improved grid efficiency. ⁵¹
Avoided Energy	The reduction in electricity consumption from the grid due to the use of solar and storage systems. ⁵²
Avoided generation O&M costs	Refers to the operations and maintenance expenses that a utility or grid operator does <i>not</i> incur because distributed energy resources (like rooftop

⁴⁸ National Academies of Sciences, Engineering, and Medicine. (2023). *The role of net metering in the evolving electricity system*. The National Academies Press. <https://nap.nationalacademies.org/catalog/26704/the-role-of-net-metering-in-the-evolving-electricity-system>

⁴⁹ U.S. Energy Information Administration. (2023, April). *Levelized costs of new generation resources in the Annual Energy Outlook 2023*. https://www.eia.gov/outlooks/aeo/electricity_generation/pdf/AEO2023_LCOE_report.pdf

⁵⁰ Roussanaly, S. (2019). *Calculating CO₂ avoidance costs of carbon capture and storage from industry* [PDF]. SINTEF Energy Research. https://sln.eramet.com/wp-content/uploads/sites/5/2023/09/73_CO2-avoidance-costs-of-CCS-2019.pdf

⁵¹ California Public Utilities Commission. (2024, October 2). *2024 distributed energy resources avoided cost calculator documentation (Version 1b)*. <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/demand-side-management/acc-models-latest-version/updated-2024-acc-documentation-v1b.pdf>

⁵² Energy and Environmental Economics, Inc. (2024, December 3). *Avoided costs and the benefits of distributed resources for an evolving grid*. <https://www.ethree.com/avoided-costs/>

solar) reduce the need to generate electricity from traditional power plants.⁵³

These avoided costs are typically divided into:

- **Fixed O&M:** Costs that remain constant regardless of how much electricity is produced (e.g., staffing, scheduled maintenance).
- **Variable O&M:** Costs that scale with electricity output (e.g., consumables, wear-and-tear from operation).

Avoided Line Loss	The reduction in energy lost during transmission and distribution due to the use of solar and storage systems. When electricity travels through power lines, some of it is lost as heat due to resistance in the wires. By generating and storing energy closer to where it is consumed, solar and storage systems help minimize these losses. ⁵⁴
Avoided Renewable Portfolio Standard (RPS)	The cost savings or reduced compliance obligations that result from deploying solar and storage systems instead of purchasing renewable energy credits (RECs) or investing in additional renewable generation to meet RPS requirements. ⁵⁵
Avoided Social Cost of Carbon	The economic and societal benefits of reducing carbon emissions through solar and storage deployment. It represents the monetary value of preventing climate-related damages, such as extreme weather events, health impacts, and ecosystem degradation. ⁵⁶
Avoided Transmission Capacity	The reduction in the need for new transmission infrastructure due to the deployment of solar and storage systems. When distributed energy resources (DERs) generate and store electricity locally, they reduce the demand for long-distance power transmission, leading to cost savings and improved grid efficiency. ⁵⁷
Behind the Meter (BTM)	With respect to net metering, BTM refers to energy devices on the customer's side of the meter which have the potential to export generation and/or discharge storage to the electricity grid. (BTM devices can also include efficiency and demand response technologies that reduce customer usage.) ⁵⁸
Capacity Value	The ability of a power generation resource to reliably contribute to meeting electricity demand, particularly during peak periods. It represents the extent to which solar and storage systems can replace conventional power plants in

⁵³ U.S. Energy Information Administration. (2013, July). *Levelized cost of electricity and levelized avoided cost of electricity: Methodology supplement*. https://www.eia.gov/renewable/workshop/genccosts/pdf/methodology_supplement.pdf

⁵⁴ Fine, S. (2014, September 30). *Estimating the costs and benefits of avoided T&D (and energy)* [PowerPoint slides]. U.S. Department of Energy. <https://www.energy.gov/sites/prod/files/2014/12/f19/6-Fine-DEPresentation-2-Sep2014.pdf>

⁵⁵ Forrester, S., & O'Shaughnessy, E. (2025, January). *A review of value of solar studies in theory and in practice*. Lawrence Berkeley National Laboratory. <https://emp.lbl.gov/publications/review-value-solar-studies-theory>

⁵⁶ Burke, M., & Goulder, L. (2021, June 7). *Professors explain the social cost of carbon*. Stanford Report. <https://news.stanford.edu/stories/2021/06/professors-explain-social-cost-carbon>

⁵⁷ Fine, S. (2014, September 30). *Estimating the costs and benefits of avoided T&D (and energy)* [PowerPoint slides]. U.S. Department of Energy. <https://www.energy.gov/sites/prod/files/2014/12/f19/6-Fine-DEPresentation-2-Sep2014.pdf>

⁵⁸ National Academies of Sciences, Engineering, and Medicine. (2023). *The role of net metering in the evolving electricity system*. The National Academies Press. <https://nap.nationalacademies.org/catalog/26704/the-role-of-net-metering-in-the-evolving-electricity-system>

ensuring grid reliability. For solar energy, capacity value is influenced by how well solar generation aligns with peak electricity demand. Since solar output varies based on time of day and weather conditions, its capacity value is typically lower than that of dispatchable power sources. However, solar-plus-storage systems enhance capacity value by storing excess solar energy and discharging it when demand is highest, making them more reliable contributors to grid stability.⁵⁹

Demand Response Programs or strategies that encourage electricity consumers to reduce or shift their power use during periods of high demand, usually in response to price signals, incentives, or grid reliability needs.

Deployment Benefits In the context of solar and storage this refers to advantages gained from the widespread installation and integration of these technologies into the energy grid and individual systems. These benefits typically include grid resilience and stability, energy cost reduction, improved environmental impacts, market growth and innovation, and improved energy access and equity.⁶⁰

Distribution Operations and Maintenance The management, upkeep, and optimization of the infrastructure that delivers electricity from solar generation and storage systems to end users. It ensures reliability, efficiency, and cost-effectiveness in energy distribution. Key aspects include grid integration and stability, preventive maintenance, fault detection and repairs, load management, regulatory compliance, and cost optimization.⁶¹

Distribution System Plans Strategic frameworks for managing and modernizing the infrastructure that delivers electricity from generation sources to consumers. These plans ensure reliability, efficiency, and resilience as distributed energy resources (DERs), such as solar and battery storage, become more integrated into the grid.⁶²

First Come, First Served A policy approach where incentives, interconnection approvals, or program participation are granted in order of application until capacity or funding is exhausted.⁶³

Front of the Meter (FTM) Energy generation and storage systems that are connected to the utility side of the meter, meaning they directly supply power to the grid rather than being used on-site by a specific consumer. These systems are typically managed by utilities or third-party providers and serve broader energy distribution needs.⁶⁴

Fuel Hedging The practice of locking in fuel prices to protect against market volatility. In the context of solar and storage, fuel hedging can be used to mitigate financial risks associated with fluctuating fossil fuel costs by investing in renewable energy

⁵⁹ Denholm, P., Margolis, R., & Milford, J. (2013). *Quantifying avoided fuel use and emissions from solar photovoltaic generation in the United States*. National Renewable Energy Laboratory. <https://docs.nrel.gov/docs/fy13osti/57582.pdf>

⁶⁰ National Renewable Energy Laboratory. (2025, April 3). *Solar-plus-storage analysis*. <https://www.nrel.gov/solar/market-research-analysis/solar-plus-storage-analysis>

⁶¹ U.S. Department of Energy. (n.d.). *Solar operations and maintenance resources for plant operators*. Office of Energy Efficiency & Renewable Energy. <https://www.energy.gov/eere/solar/solar-operations-and-maintenance-resources-plant-operators>

⁶² U.S. Department of Energy. (n.d.). *Solar operations and maintenance resources for plant operators*. Office of Energy Efficiency & Renewable Energy. <https://www.energy.gov/eere/solar/solar-operations-and-maintenance-resources-plant-operators>

⁶³ Silverman, A., Jain, G., Papapolyzou, D., Rizal, K., Samant, D., & Williard, J. (2023, August 7). *FERC's interconnection reform: Why it matters for the clean energy transition*. Center on Global Energy Policy, Columbia University. <https://www.energypolicy.columbia.edu/fercs-interconnection-reform-why-it-matters-for-the-clean-energy-transition/>

⁶⁴ EnergyLink. (2024, June 9). *Behind-the-meter vs in-front-of-the-meter solar: What's the difference?* <https://goenergylink.com/blog/behind-the-meter-vs-in-front-of-the-meter-solar/>

sources.⁶⁵

Home islanding	Refers to the ability of a solar-plus-storage system to keep a home powered independently when the electric grid goes down. In this mode, the home becomes a self-sufficient “energy island,” drawing power from its solar panels and battery storage without feeding electricity back into the grid. ⁶⁶
Home Resilience	Refers to a home's ability to maintain power and functionality during disruptions, such as grid outages, extreme weather, or energy shortages. Solar panels combined with battery storage enhance resilience by providing a reliable, independent energy source. ⁶⁷
Integrated Resource Plans (IRPs)	Long-term planning documents that utilities use to determine the best mix of energy resources to meet future electricity demand. These plans evaluate different energy sources—including solar and storage—to ensure reliability, affordability, and sustainability. ⁶⁸
Integration (Utility Costs)	Integration (utility costs) refers to the expenses associated with incorporating renewable energy and battery storage into the existing utility grid. These costs arise from infrastructure upgrades, operational adjustments, and regulatory compliance. ⁶⁹
Kilowatt (kW)	A unit of power that measures 1,000 watts of electrical energy. It represents the rate at which energy is consumed or produced at a given moment. For example, a typical household appliance like a microwave might use 1 kW when running, meaning it consumes 1,000 watts of power. Kilowatts are commonly used to describe the power output of electrical devices, solar panels, and even electric vehicles. ⁷⁰
Kilowatt hour (kWh)	A unit of energy that represents the amount of electricity consumed or generated over time. Specifically, it equals 1,000 watts of power used for one hour. For example, if you run a 1,000-watt appliance (like a microwave) for one hour, it will consume 1 kWh of energy. Similarly, a 100-watt light bulb running for 10 hours would also use 1 kWh. ⁷¹
Local Economic Benefits	The positive financial impacts these technologies bring to communities, including job creation, tax revenue, and infrastructure development. ⁷²

⁶⁵ Ascend Analytics. (2023, August 11). *Hedge contracts emerge as alternative off take structure for solar and storage schemes*.

<https://www.ascendanalytics.com/blog/hedge-contracts-emerge-as-alternative-off-take-structure-for-solar-and-storage-schemes>

⁶⁶ EnergySage. (2019, August 2). *Islanding and batteries: What you need to know*. <https://www.energysage.com/energy-storage/islanding-and-batteries-what-you-need-to-know/>

⁶⁷ <https://www.energy.gov/eere/solar/solar-and-resilience-basics>

⁶⁸ Driscoll, W. (2024, June 18). *NREL guide for anyone seeking more solar and storage in utility resource plans*. PV Magazine USA. <https://pv-magazine-usa.com/2024/06/18/nrel-guide-for-anyone-seeking-more-solar-and-storage-in-utility-resource-plans/>

⁶⁹ National Renewable Energy Laboratory. (2025, April 3). *Solar-plus-storage analysis*. <https://www.nrel.gov/solar/market-research-analysis/solar-plus-storage-analysis>

⁷⁰ Solar SME, Inc. (2024, February 30). *What's the difference between a kilowatt and a kilowatt-hour?* <https://solarsme.com/understanding-kilowatt-and-kilowatt-hour/>

⁷¹ Solar SME, Inc. (2024, February 30). *What's the difference between a kilowatt and a kilowatt-hour?* <https://solarsme.com/understanding-kilowatt-and-kilowatt-hour/>

⁷² Markham, D. (2025, April 15). *Community solar is booming — and bringing big economic benefits with it*. CleanTechnica. <https://cleantechnica.com/2025/04/15/community-solar-is-booming-and-bringing-big-economic-benefits-with-it/>

Lost Utility Revenue	The financial impact on utilities when customers generate their own electricity or store energy, reducing their reliance on grid-supplied power. As more consumers adopt solar and battery storage, utilities may experience revenue declines due to lower electricity sales. ⁷³
Market Price Response	How electricity prices react to changes in supply and demand, particularly when renewable energy and battery storage are integrated into the grid. This concept is crucial for understanding how solar and storage impact energy markets. ⁷⁴
Net Billing	A system where solar customers are compensated for excess energy at a lower rate (often wholesale or avoided cost) rather than the full retail rate. ⁷⁵
Net Energy Metering	A billing mechanism that allows solar customers to receive credit for excess electricity they generate and send to the grid, typically at the retail rate. ⁷⁶
Passive Benefits	The indirect advantages that arise from deploying renewable energy systems, even without active intervention. These benefits contribute to overall energy efficiency, environmental sustainability, and long-term cost savings. ⁷⁷
Policy Mechanisms	Tools, strategies, and frameworks that governments and organizations use to implement and enforce policies. They help shape behavior, regulate industries, and achieve specific policy goals. They are broadly characterized into: <ul style="list-style-type: none">Retail Rate Design The structure of electricity pricing for consumers, determining how they are charged for energy usage. It includes fixed charges, time-of-use rates, demand charges, and dynamic pricing models to align costs with grid needs.⁷⁸Procurement Approaches Strategies used by utilities and policymakers to acquire energy resources, including competitive bidding, power purchase agreements (PPAs), and auctions. These approaches ensure cost-effective and reliable energy supply.⁷⁹Grid Services Programs Initiatives that compensate energy providers or consumers for supporting grid stability, such as demand response, frequency regulation, and voltage support. These programs enhance reliability and

⁷³ Casey, J. P. (2024, March 14). *Raptor Maps: Asset underperformance and equipment issues cost the solar sector US\$4.6 billion in 2023*. PV Tech. <https://www.pv-tech.org/raptor-maps-asset-underperformance-cost-solar-us4-6-billion/>

⁷⁴ Markham, D. (2025, May 9). *Solar gets cheaper, systems get bigger: EnergySage report maps a shifting market*. CleanTechnica. <https://cleantechnica.com/2025/05/09/solar-gets-cheaper-systems-get-bigger-energysage-report-maps-a-shifting-market/>

⁷⁵ McDevitt, C. (2022, November 30). *Net metering vs. net billing explained*. EnergySage. <https://www.energysage.com/solar/net-metering-vs-net-billing/>

⁷⁶ Shah, C. (2014, May 8). *Net metering* [Presentation]. U.S. Department of Energy. https://www.energy.gov/sites/default/files/2014/05/f15/fupwg_may2014_net_metering.pdf

⁷⁷ U.S. Department of Energy. (n.d.). *Passive solar homes*. Office of Energy Efficiency & Renewable Energy. <https://www.energy.gov/energysaver/passive-solar-homes>

⁷⁸ Energy Markets & Policy. (n.d.). *Rate design & evaluation*. Lawrence Berkeley National Laboratory. <https://emp.lbl.gov/rate-design-evaluation>

⁷⁹ Olson, A., Cutter, E., Bertrand, L., Venugopal, V., Spencer, S., Walter, K., & Gold-Parker, A. (2023, March). *Rate design for the energy transition: Getting the most out of flexible loads on a changing grid* [White paper]. Energy Systems Integration Group. <https://www.esig.energy/wp-content/uploads/2023/04/ESIG-Retail-Pricing-dynamic-rates-E3-wp-2023.pdf>

	efficiency in electricity distribution. ⁸⁰
Incentives / Rebates	Financial mechanisms, such as tax credits, rebates, and grants, designed to encourage the adoption of solar and storage technologies by reducing upfront costs. ⁸¹
Integrated Resource Plans (IRP)	Long-term planning documents developed by utilities to forecast future energy needs and outline strategies for meeting demand through a mix of generation, efficiency, and storage solutions. ⁸²
Distribution System Plans (DSP)	Utility plans focused on modernizing and optimizing the distribution grid, integrating distributed energy resources (DERs), and improving reliability and resilience. ⁸³
Financing Enabling Policies	Regulations and programs that facilitate access to funding for solar and storage projects, including green banks, loan guarantees, and third-party financing models. ⁸⁴
Potential Benefits	Expected advantages of solar and storage, such as cost savings, grid resilience, environmental impact, and energy independence. ⁸⁵
Program Administration	Management, oversight, and execution of initiatives that support the deployment of renewable energy and battery storage systems. Effective administration ensures that programs run smoothly, meet regulatory requirements, and achieve their intended goals. ⁸⁶
Realized Benefits	The actual, measurable advantages achieved after implementation, which may differ from potential benefits due to policy, market conditions, or technical limitations. ⁸⁷
Resilience and Reliability	Refers to the ability of energy systems to withstand disruptions and consistently provide power under various conditions. These qualities are essential for ensuring grid stability, reducing outage risks, and maintaining

⁸⁰ Satchwell, A. J., Cappers, P. A., & Barbose, G. L. (2019, July). *Current developments in retail rate design: Implications for solar and other distributed energy resources*. Lawrence Berkeley National Laboratory.

https://www.canr.msu.edu/ipu/uploads/migration/2019/07/sein_rate_design_trends_report_final_doe_approved.pdf

⁸¹ Satchwell, A. J., Cappers, P. A., & Barbose, G. L. (2019, July). *Current developments in retail rate design: Implications for solar and other distributed energy resources*. Lawrence Berkeley National Laboratory.

https://www.canr.msu.edu/ipu/uploads/migration/2019/07/sein_rate_design_trends_report_final_doe_approved.pdf

⁸² Olson, A., Cutter, E., Bertrand, L., Venugopal, V., Spencer, S., Walter, K., & Gold-Parker, A. (2023, March). *Rate design for the energy transition: Getting the most out of flexible loads on a changing grid* [White paper]. Energy Systems Integration Group. <https://www.esig.energy/wp-content/uploads/2023/04/ESIG-Retail-Pricing-dynamic-rates-E3-wp-2023.pdf>

⁸³ Satchwell, A. J., Cappers, P. A., & Barbose, G. L. (2019, July). *Current developments in retail rate design: Implications for solar and other distributed energy resources*. Lawrence Berkeley National Laboratory.

https://www.canr.msu.edu/ipu/uploads/migration/2019/07/sein_rate_design_trends_report_final_doe_approved.pdf

⁸⁴ Energy Markets & Policy. (n.d.). *Rate design & evaluation*. Lawrence Berkeley National Laboratory. <https://emp.lbl.gov/rate-design-evaluation>

⁸⁵ Consumer Energy Center. (2025, February 8). *Storing solar energy: Options and technologies*. <https://www.consumerenergycenter.org/storing-solar-energy/>

⁸⁶ Energy Solutions. (n.d.). *Solar & storage program administration*. <https://energy-solution.com/solar-storage-program-administration/>

⁸⁷ U.S. Department of Energy. (n.d.). *Solar integration: Solar energy and storage basics*. Office of Energy Efficiency & Renewable Energy.

<https://www.energy.gov/eere/solar/solar-integration-solar-energy-and-storage-basics>

energy security.⁸⁸

Resource diversity Refers to the strategic use of a mix of energy sources, technologies, and geographic locations to improve the reliability, resilience, and efficiency of the power grid and to reduce price risk. It typically can mean combining different types of solar technologies (e.g., rooftop PV, utility-scale solar farms), various storage solutions, (e.g., lithium-ion batteries, thermal storage), geographic diversity (solar installations spread across regions with different weather patterns), and temporal diversity (systems that generate or store energy at different times of day or year).⁸⁹

Social Benefits In the context of solar and storage refers to the positive societal impacts that arise from the adoption of clean energy technologies. These benefits extend beyond environmental advantages and contribute to economic growth, public health, and community development.⁹⁰

Solar Installation Cost The total expense involved in setting up a solar energy system, covering everything from equipment to labor and permitting. This cost is shaped by several factors, including system size, panel type, installation complexity, and local regulations.⁹¹

Storage Technologies Systems that capture, store, and release energy to enhance the efficiency, reliability, and economic benefits of solar power. These technologies help maximize the value of solar by ensuring energy is available when needed, even when sunlight isn't.⁹²

Utility Bill Affordability (Total Energy Costs and Bill Consistency) The financial accessibility and predictability of electricity costs for consumers, particularly in relation to solar and storage solutions. It encompasses both total energy costs and bill consistency, ensuring households and businesses can manage expenses effectively.⁹³

Value-of-Solar Tariffs (VOST) A rate structure designed to compensate solar generation based on its calculated value to the grid, considering factors like avoided costs, environmental benefits, and grid support.⁹⁴

Value Stack The compensation structure used to determine the financial value of energy generated by distributed energy resources (DERs), such as solar and storage systems. It replaces traditional net metering in some regions and accounts for multiple factors that contribute to the overall worth of renewable energy.⁹⁵

⁸⁸ Hotchkiss, E., & Kroposki, B. (2018, March). *Valuing the resilience provided by solar and battery energy storage systems*. U.S. Department of Energy. <https://www.energy.gov/sites/prod/files/2018/03/f49/Valuing-Resilience.pdf>

⁸⁹ U.S. Department of Energy. (n.d.). *Solar integration: Solar energy and storage basics*. Office of Energy Efficiency & Renewable Energy. <https://www.energy.gov/eere/solar/solar-integration-solar-energy-and-storage-basics>

⁹⁰ Biswas, A. (2024, September 17). *Social benefits of solar energy (8+ benefits)*. The Renewables. <https://therenewables.org/social-benefits-of-solar-energy/>

⁹¹ Solar.com. (2025). *Solar panel cost in 2025: How to estimate the cost of solar*. <https://www.solar.com/learn/solar-panel-cost/>

⁹² National Renewable Energy Laboratory. (n.d.). *Storage futures study*. <https://www.nrel.gov/analysis/storage-futures>

⁹³ Marcacci, S. (2025, March 18). *Solar-plus-storage: The fastest, cheapest way to meet surging power demand*. Forbes.

<https://www.forbes.com/sites/energyinnovation/2025/03/18/solar-plus-storage-the-fastest-cheapest-way-to-meet-surging-power-demand/>

⁹⁴ Denholm, P., & Margolis, R. (2015). *Evaluating the value of solar power for reliability and resilience* (NREL/TP-6A20-62902). National Renewable Energy Laboratory. <https://docs.nrel.gov/docs/gen/fy15/62902.pdf>

⁹⁵ New York State Energy Research and Development Authority. (n.d.). *Value stack resources*. <https://www.nysedra.ny.gov/All-Programs/NY-Sun/Contractors/Value-of-Distributed-Energy-Resources/Value-Stack-Resources>

Voltage and Power Quality

How the aging of energy infrastructure affects the stability, efficiency, and reliability of electricity delivery. As solar panels, batteries, and grid components age, their ability to maintain high power quality can decline.⁹⁶

Virtual Power Plant (VPP)

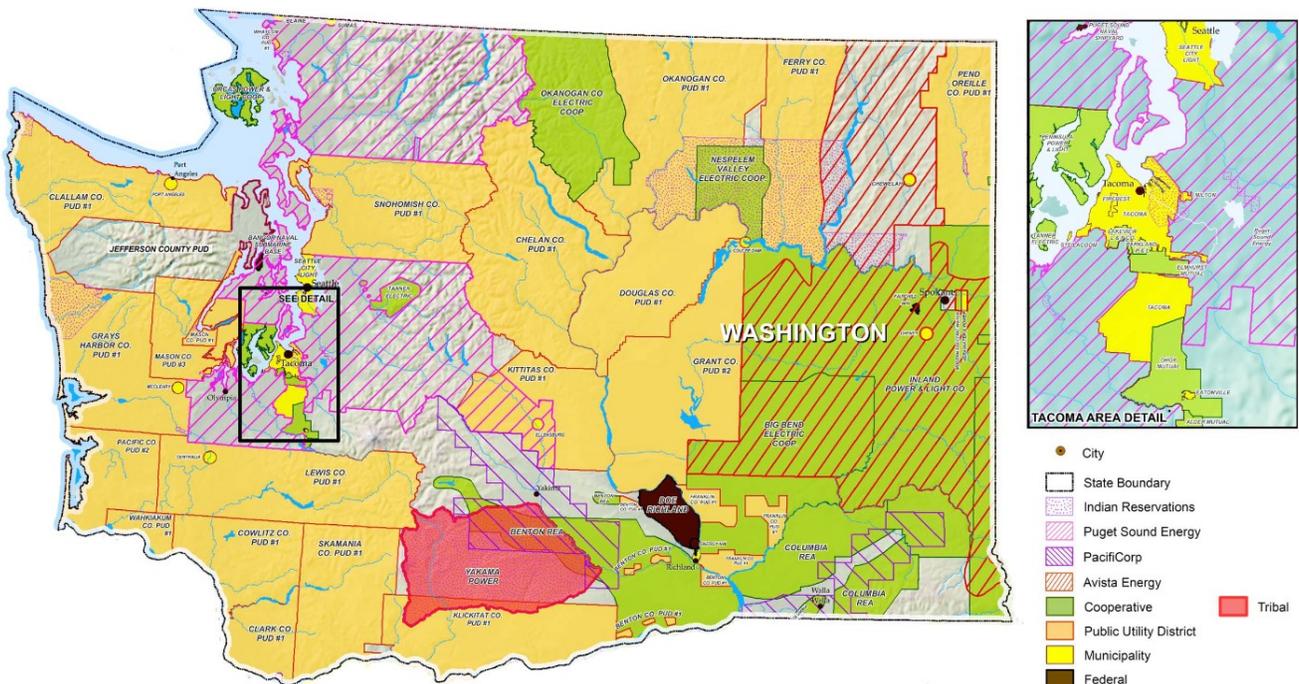
A network of decentralized energy resources—like rooftop solar panels, battery storage systems, electric vehicles, and demand response programs—that are coordinated through advanced software to act like a single power plant.

⁹⁶ Tumilowicz, N. (2024, October 3). *How our aging grid can manage the surge in solar energy*. PV Magazine USA. <https://pv-magazine-usa.com/2024/10/03/how-our-aging-grid-can-manage-the-surge-in-solar-energy/>

D: WASHINGTON STATE ELECTRIC UTILITIES

Electricity service in Washington is provided by sixty-four utilities with varied governing and business structures. Washington is served by three investor-owned utilities whose terms and conditions of service, including NEM, are governed by the Washington Utilities and Transportation Commission. The majority of electric utilities in Washington state are public utility districts, consumer-owned (cooperatives, or co-ops) utilities governed by elected boards or city-owned utilities governed by city councils. Figure 4 shows the distribution of utilities in the state.

Figure D1: Map of Washington’s Utilities



Source: Solar Washington⁹⁷

⁹⁷ Solar Washington. (n.d.). Utilities in Washington. https://www.solarwa.org/utilities_washington_state

Table D1: Overview of Washington State Electric Utilities

<ul style="list-style-type: none"> Investor-Owned Utilities (IOUs): Washington State has three major IOUs, serving approximately 1.28 million customers. Public Utility Districts (PUDs): There are 28 PUDs, with 23 providing electric service. Collectively, PUDs serve about 831,660 customers. Rural Cooperatives & Mutual Utilities: There are 16 cooperative and mutual utilities, serving around 142,433 customers. Municipal & Local Utilities: Washington has 19 municipal utilities, serving approximately 587,674 customers. <p>Publicly owned utilities (PUDs and municipal utilities) together serve 49% of the state’s population, while cooperatives and mutual utilities serve an additional 5%.</p>
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The following table lists the 64 electric utilities serving Washington State.⁹⁸ Utilities with bolded text have reached the 4% net energy metering threshold. The WSU Energy Program updates this list regularly.⁹⁹ Note that this list focuses on the state’s *electric* utilities; sewer and water utilities are not included here.

Table D2: Electric Utilities in Washington State

Type	Name
Investor-owned utility	Avista Utilities
Investor-owned utility	Puget Sound Energy
Investor-owned utility	PacifiCorp (Pacific Power)
Public Utility District	Benton County PUD
Public Utility District	Chelan County PUD
Public Utility District	Clallam County PUD
Public Utility District	Clark County Utilities
Public Utility District	Cowlitz County PUD
Public Utility District	Douglas County PUD
Public Utility District	Ferry County PUD
Public Utility District	Franklin County PUD
Public Utility District	Grant County PUD
Public Utility District	Grays Harbor PUD
Public Utility District	Jefferson County PUD
Public Utility District	Kittitas County PUD
Public Utility District	Klickitat County PUD
Public Utility District	Lewis County PUD
Public Utility District	Mason County PUD No. 1
Public Utility District	Mason County PUD No. 3

⁹⁸Northwest Clean Energy Atlas. (n.d.). *Northwest electric utilities overview*. <https://www.nwceatlas.org/visualization/northwest-electric-utilities-overview>

⁹⁹ Washington State University Energy Program. (n.d.). *Net metering*. <https://www.energy.wsu.edu/RenewableEnergy/NetMetering.aspx>

Public Utility District	Okanogan County PUD
Public Utility District	Pacific County PUD
Public Utility District	Pend Oreille County PUD
Public Utility District	Skamania County PUD
Public Utility District	Snohomish County PUD
Public Utility District	Wahkiakum County PUD
Public Utility District	Whatcom County PUD
Local Utility	City of Blaine
Local Utility	City of Centralia
Local Utility	City of Chewelah
Local Utility	City of Cheney
Local Utility	City of Coulee Dam
Local Utility	City of Ellensburg
Local Utility	City of McCleary
Local Utility	City of Milton
Local Utility	City of Port Angeles
Local Utility	City of Richland
Local Utility	City of Sumas
Local Utility	City of Tacoma (Tacoma Public Utilities)
Local Utility	Kalispel Tribal Utilities
Local Utility	Lakeview Light & Power
Local Utility	Modern Electric Water Company
Local Utility	Seattle City Light
Local Utility	Town of Eatonville
Local Utility	Town of Ruston
Local Utility	Town of Steilacoom
Local Utility	Town of Yelm
Local Utility	Vera Water and Power
Local Utility	Yakama Power
Rural Cooperative	Benton Rural Electric Association
Rural Cooperative	Big Bend Electric Coop Inc
Rural Cooperative	Clearwater Power Co.
Rural Cooperative	Columbia Rural Electric Association
Rural Cooperative	Elmhurst Mutual Power & Light Co
Rural Cooperative	Inland Power & Light Co.
Rural Cooperative	Kootenai Electric Cooperative
Rural Cooperative	Nespelem Valley Elec Coop Inc
Rural Cooperative	Northern Lights
Rural Cooperative	Ohop Mutual Light Co
Rural Cooperative	Okanogan County Elec Coop Inc
Rural Cooperative	Orcas Power & Light Co
Rural Cooperative	Pacific County PUD No. 2
Rural Cooperative	Parkland Light & Water Co
Rural Cooperative	Peninsula Light Co
Rural Cooperative	Tanner Electric Coop

Source: <https://www.nwceatlas.org/visualization/northwest-electric-utilities-overview>;
<https://www.energy.wsu.edu/RenewableEnergy/NetMetering.aspx>

E: VALUE OF DISTRIBUTED SOLAR AND STORAGE ENGAGEMENT ASSESSMENT

WASHINGTON STATE UNIVERSITY

THE
WILLIAM D. RUCKELSHAUS CENTER

UNIVERSITY OF WASHINGTON

Value of Distributed Solar and Storage Engagement Assessment

Prepared for the Washington State Academy of Sciences by the William D. Ruckelshaus Center

The William D. Ruckelshaus Center is an impartial resource for collaborative problem solving in the State of Washington and the Pacific Northwest, dedicated to assisting public, private, tribal, non-profit, and other community leaders in their efforts to build consensus and resolve conflicts around difficult public policy issues. It is a joint effort of Washington State University and the University of Washington.

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APPENDICES

- A. Interview List**
- B. Interview Questions**

I. BACKGROUND AND OVERVIEW

Net energy metering (NEM) is a metering and billing arrangement that allows grid-tied solar energy system owners to receive credit for excess power they generate from renewable energy sources exported to the grid. In Washington State, NEM is being used for behind the meter or customer-sited solar energy generation, which allows the compensation of excess solar energy produced in the form of an "energy credit" worth equal to the current market rate of a kilowatt-hour. In 1998, the Legislature passed ESHB 2773 which stated that it is in the public interest to: (1) Encourage private investment in renewable energy resources; (2) Stimulate the economic growth of this state; and (3) Enhance the continued diversification of the energy resources used in this state. The law was significantly revised in 2019 to raise utility NEM thresholds and allow for utility-specific NEM replacement rates.

Pursuant to [RCW 80.60.020](#), an electric utility shall make full retail rate NEM available to eligible customer-generators on a first-come, first-served basis until the earlier of either June 30, 2029, or the first date upon which the cumulative generating capacity of net metering systems equals four percent of the utility's peak demand during 1996. When a utility reaches either the 4% threshold or the 2029 date, it may propose a new tariff to its regulatory authority.

Value of solar refers to a form of valuing distributed generation interactions with and contributions to the electricity grid. Determining the value of a solar methodology and a compensation rate has been a challenge in that there is not agreement amongst interested and impacted parties on how the electricity generated by customers at their home or business and exported onto the grid should be compensated.

In 2024 the Legislature directed (via Engrossed Substitute Senate Bill 5950 Section 130 (45)) the Department of Commerce to "...contract with the Washington State Academy of Sciences (WSAS) to conduct a study to determine the value of distributed solar and storage in Washington State, including any factors the academy finds relevant, in order to create recommendations and options for a methodology or methodologies that utility regulators and governing bodies may use after the statutory four percent net metering threshold is met. During their research and analysis, the academy shall engage relevant stakeholders focused on the value of distributed energy resources in Washington state, including solar, storage, vehicle to grid, and other resources".

A key component of this study in the first year was engaging interested parties who work with distributed solar resources in Washington State, including representatives of consumer owned utilities, municipal-owned utilities, investor-owned utilities, utility regulators, the rooftop solar and storage industry, as well as advocacy organizations involved with consumer advocacy, environmental justice, clean energy, climate change, labor unions, and federally recognized Indian tribes. WSAS contracted the William D. Ruckelshaus Center (Ruckelshaus Center) to assist with this first phase of engagement, as directed in the proviso. The Ruckelshaus Center recommended conducting an engagement assessment involving a series of unstructured and semi-structured interviews and conversations with parties impacted by NEM rate decisions about behind the meter or customer-sited solar energy generation. The purpose of the assessment was to better understand key issues and perspectives of interested parties about the value of distributed solar and storage, and NEM in Washington State and the level of engagement interested parties desire for the WSAS's next phase of work.

II. SITUATION ASSESSMENT PROCESS AND PROTOCOLS

The Washington State Legislature funded WSAS to conduct a study to determine the value of distributed solar and storage in Washington State in order to create recommendations and options for a methodology or methodologies that utility regulators and governing bodies may use after the statutory four percent net metering threshold is met. A key component of this study is engaging interested parties who work with distributed energy resources in Washington State. To better understand key issues and perspectives of interested parties about the value of distributed solar and storage in Washington State and ways in which interested parties would like to be engaged as part of Phase 2 of this study, the WSAS contracted with the Ruckelshaus Center to conduct a situation assessment consisting of a series of interviews with interested parties.

The Ruckelshaus Center staff was scoped to conduct up to 40 interviews between mid-February 2025 thru April 2025. WSAS staff identified individuals to interview, beginning with a summary list of key stakeholder groups put together by the cohort of [Clean Energy Institute Advanced Experience Program](#) Fellows. To develop a list that as much as possible represented a range of perspectives, the Ruckelshaus Center staff and WSAS staff (Project Team) used a chain referral recruitment method to identify additional potential interviewees. In accordance with this method, the Project Team asked each interviewee to identify individuals, interests, or groups that would be important to interview. Interviews were then scheduled with individuals identified via this referral sampling method.

WSAS staff contacted people to determine their willingness to participate and to schedule an interview. Individuals either agreed to participate, declined to participate, suggested an alternate interviewee from their organization, or did not respond to the invitation. If a given person did not respond, the team followed up with additional invitations by phone and/or email, including a final invitation near the conclusion of the interview stage of the process.

The Project Team conducted 23 interviews with a total of 48 interviewees (some included multiple representatives of one organization). Appendix A is the list of people interviewed and their affiliations. Interviews lasted approximately 60 minutes and the Project Team provided a copy of the interview questions to interviewees in advance of the interview (Appendix B). The Project Team informed each interviewee that their participation was voluntary and that they could choose at any time to decline to answer a question or end the interview. Interviewees were also informed that the summary report would summarize the information gathered from interviews, but not attribute any specific statements to any individuals or organizations.

The Project Team convened several times for discussions regarding observations and key findings. Ruckelshaus Center staff then analyzed, organized, and synthesized key findings from the interviews. The recommendations in this report are based on the Ruckelshaus Center's analysis of what was heard and learned from interviewees about what they would like to see for engagement in Phase 2 and the Ruckelshaus Center's expertise in stakeholder engagement and collaborative processes.

III. KEY FINDINGS FROM INTERVIEWS

Key findings summarized in this section comprise a synthesis of what was heard and learned from interviewees, relevant to the questions that were asked during interviews (see Appendix B). The questions asked of interviewees were intended for two purposes: (1) to inform WSAS's Phase 2 by better understanding key issues and perspectives of interested parties about the value of distributed solar and storage in Washington State and perspectives on NEM; and (2) to identify how interested parties would like to be

engaged as part of Phase 2. Included in this report is a high-level synthesis of what was heard regarding the complexity of technical and policy issues discussed. This high-level summary of key findings, summarized in this section of the report helps to set the context for understanding the interests, perspectives, and underlying values of the interviewees. This understanding creates the foundation for further engagement opportunities. The comprehensive and technical information shared in the interviews, while not summarized in detail in this report, was documented by WSAS staff, which is being used to inform Phase 2 work.

A. Goals And Objectives for Distributed Solar and Storage

Interviewees were asked to share their overall goals and objectives for distributed solar and storage. It is helpful to understand whether and where there might be commonalities and differences in the interviewees' goals and objectives. The following specific themes emerged from the conversations.

Assist in Meeting Projected Increased Future Demand for Electricity

Nearly all interviewees talked about how energy demand in Washington is projected to increase by 30% in the next decade. Interviewees see distributed solar and storage as having a role to play in helping to meet this increased demand and being an important part of the portfolio of energy sources.

Meet Clean Energy Transformation Act (CETA) Goals

Interviewees talked about how promoting distributed solar and storage helps to promote clean energy, which is an important tool for mitigating climate change and important components of meeting Washington State's Clean Energy Transformation Act (CETA), which requires electric utilities to fully transition to clean, renewable and non-emitting resources by 2045.

Build Community Resilience Especially Regarding Hazards and Changing Climate Conditions

Interviewees spoke about ways solar and storage can support the nexus of emergency management and community resilience, considering the projected load growth to the grid and natural climate hazards. Interviewees emphasized that storage enhances energy independence as customers become more energy independent by being able to store excess solar power for later use and reducing reliance on the grid. Also, mentioned was that distributed solar and storage can help meet the emerging energy demands as historically in Washington, there has been high production, lower use in the spring and summer, and low production, much higher use in the late fall and winter. Some talked about how this pattern is changing due to climate changes and increasing temperatures in Washington, where more people are installing air conditioner systems in their homes and businesses, resulting in greater electric energy usage in the spring and summer months.

Many interviewees suggested revising and/or adding on to NEM some type of incentive structure to support battery energy storage. Expanding access to resilient, battery-backed systems for communities vulnerable to grid outages, including those in wildfire or storm-prone areas would increase community resilience. Some also talked about how storage would help to support the dispatch ability and flexibility of solar for customer and utility use.

Improve Grid Reliability and Reducing Peak Loads

Interviewees noted that as more renewable energy is added to our system, which is variable, there needs to be rates that can provide an incentive for customers to shift their consumption of grid energy away from peak demand periods. Distributed solar and storage can aid in managing this energy demand as well as address congestion within the grid while also optimizing solar distributed through the system. They noted that it will be

important to integrate storage and smart grid technology where it improves reliability and operational efficiency. Interviewees emphasized that within these objectives it is important to acknowledge that the approaches to improving grid reliability and reducing peak loads through distributed solar and storage could be quite different depending upon particular circumstances. These circumstances include the differences between when peak loads occur in Western vs Eastern Washington. Solar plus storage could be beneficial to address some of these issues.

Establish Equitable and Affordable Energy Costs for All Customers Including Fair Compensation for Exported Solar Energy

Interviewees mentioned several goals as well as approaches to meet these objectives. Examples of goals and objectives included:

- Maintain rate fairness and transparency, as well as minimize cross-subsidization.
- Create a sustainable rate structure that fairly compensates distributed solar and storage without overcompensating customers at retail rates. This ensures that all customers—both participants and non-participants—benefit equitably while aligning compensation with actual grid value and prevents cost shifting to non-participant customers.
- Establish opportunities where everyone should be able to invest in solar, but compensation should reflect the actual value to the grid and avoid cost shifts.
- Balance the supply side and demand side with the aim of finding the most cost-effective way to meet customer needs while ensuring reliable service.
- Create policies that support clean energy ownership and long-term benefits to be accessible to every electric customer in the state, particularly the renters and lower income households that have been historically excluded from benefiting from clean energy technology.

Support Local Economic Development

A key objective discussed was to continue to support local economies through distributed solar projects as they create jobs in installation and maintenance and provide tax revenue for local communities. Some interviewees noted the importance of establishing and maintaining policies and opportunities that sustain small business participation in the clean energy transition — without which rural communities may be left behind. Interviewees expressed support for the preservation and expansion of Washington’s distributed solar sector, to retain decades of technical expertise and ensure a just energy transition statewide.

Increase the Access to and Use of Renewable Energy

To meet the objective of increasing access to and use of renewable energy, many interviewees suggested that the viability of distributed solar and storage for rural customers should be ensured by maintaining strong incentives and policies like net metering. Without net metering, customers who have installed residential solar panels could be looking at many decades before they can recoup their investment. It was also noted that clean energy should be considered a tool to promote economic justice and equity through delivering cost savings. Interviewees emphasized the importance of developing approaches and policies that help low-income and multi-family residences access solar. An important component of increasing access and use of renewable energy is ensuring that customers are receiving accurate information about the benefits, installer charges, rate structure, and how processes and programs work.

B. Key Considerations for Evaluating Rate Structure for Distributed Solar

Interviewees were asked to share their thoughts about what is important to consider when evaluating rate structure for distributed solar and storage, including how important consistency in rate structure is for different programs. Nearly everyone interviewed talked about the importance of understanding and considering all perspectives including those from ratepayers and utilities. They also stated it was important to include societal and environmental considerations in the evaluation of rate structure. It was noted that the inclusion of all interests ensures a comprehensive and balanced approach. Interviewees talked in detail about a number of complexities that make designing an effective rate structure for distributed solar challenging in Washington State including that with more than 60 utilities in Washington, the issues vary depending on the utility. Nearly all interviewees talked about cross-subsidization and the need to consider whether the rate structure prevents undue cost shifts between solar and non-solar customers. Some talked about the challenges of balancing the costs of grid infrastructure with the benefits of distributed solar generation. Many talked about the differences between solar generation in Western vs. Eastern Washington and that the rate structure may need to consider the timing of when there is an increased demand for electricity and when solar generation is maximized.

Interviewees frequently referenced rate structure design in other states, such as California and Texas and opinions varied as to their applicability to Washington. Some interviewees found lessons on rate structure and distributed solar valuation useful, while others cautioned against adopting policies that fail to align with Washington's unique energy ecosystem.

The following are key considerations interviewees shared. The ordering does not reflect prioritization nor frequency of mention.

Rate Design Elements

Many elements of rate structure design were talked about by interviewees. For example:

- Time-of-Use (TOU) Rates: prices vary based on demand and supply conditions.
- Fixed Charges: a base rate that helps recover fixed costs such as infrastructure and administrative costs.
- Grid Access Charge: a standard fee all customers pay regardless of how much electricity they use.
- Volumetric rates: rate based on how much electricity the customer uses.
- Demand Charges: prices based on peak usage.
- Net Billing: energy credits are often equal to the wholesale rate of electricity, which is less than the retail rate.
- Variable Energy Charges: prices fluctuate based on market conditions, demand, or other factors.
- Export credits that reflect avoided costs.

While preferences for rate design elements varied, interviewees frequently stressed the importance of establishing a rate structure that is fair, transparent, and reflects the actual cost of service. This included energy generation, transmission, and distribution. Many also noted it important to consider the costs of maintaining grid infrastructure and administrative costs that need to be covered, such as billing services.

Interviewees cautioned against high fixed charges, which impact affordability for all customers and many thought such charges should be the same for both solar and non-solar customers. Frequently mentioned by interviewees were time-varying rate structures, where rates are aligned with TOU or real time pricing and reflects when energy is most valuable.

Operational, Geographic, and Infrastructure Considerations

Interviewees frequently talked about the complexity of rate structures in Washington State. The State has roughly 60 electric utilities, which are a mix of private or investor-owned utilities, Public Utility Districts (PUDs), and rural electric cooperations or co-ops. Each has its own rate structures and regulatory processes. Some utilities use TOU rates, others use tiered rates, and billing charges differ based on the utility. Washington's residential electricity rates are much lower than the national average, partially due to hydroelectric power, however, rates vary amongst utilities and based on geographic location. Interviewees often compared electric rates in Seattle with those in Chelan County to emphasize this point. The average rate in Seattle is around 13.9 cents per kilowatt hour, while in Chelan, the average residential rate is 3.76 cents per kilowatt hour. Chelan County PUD can subsidize local rates by selling excess hydropower. Interviewees frequently stressed the importance of considering such variation in rates when looking at the value of solar and storage and whether compensation based on retail rate makes sense state-wide.

Interviewees also talked about how infrastructure challenges such as aging systems impact distributed solar valuation and rate design. Technological changes like automatic metering systems and their cost implications were mentioned as critical yet under-discussed aspects. Insights were shared on the role of automatic metering systems in facilitating dynamic pricing and better capturing energy flow between distributed generation and the grid. However, it was mentioned that the complexity and cost implications of implementing such systems remain barriers to widespread adoption.

Fairness and Equity Considerations

Nearly all interviewees talked about fairness and equity as key considerations for rate design. Frequently mentioned was cross-subsidization and the importance of balancing fair compensation for solar participants with avoiding cost-shifting to non-participants. However, views differed about whether current rate structures are preventing undue cost shifts between solar and non-solar customers.

Nearly all interviewees also talked about the importance of providing equitable access to solar and storage. Interviewees stressed the importance of access for low-income customers and for vulnerable and underserved communities. Suggestions included robust discount programs, tiered rates, and outreach initiatives aimed at ensuring low-income households can benefit from distributed solar. Additionally, equity-focused mechanisms were proposed to minimize financial burdens on non-participants while incentivizing solar adoption in economically constrained areas. Progressive rate designs, where rates reflect socioeconomic conditions, was another suggestion to address historical disparities in access to renewable energy.

The goal of expanding access to solar energy was noted by some as a key consideration when creating a rate structure. Community solar was highlighted as a mechanism to expand access to renewable energy for renters, low-income households, and those without suitable rooftops for solar installation. Dynamic pricing for battery storage was suggested as a tool for incentivizing fair energy usage.

Environmental and Societal Considerations

Nearly all interviewees talked about the importance of considering the environmental benefits of distributed solar. However, opinions differed on whether such benefits should be considered as part of the rate structure and if so, how they would be quantified.

A number of interviewees saw distributed solar and storage as essential tools to aid in the mitigation of climate impacts and for supporting Washington's clean energy goals. Some talked about how Washington's reliance on hydropower and constrained transmission capacity underscores the necessity of incorporating more distributed renewables to meet future energy demands.

Some interviewees argued externalities, such as environmental and economic benefits, should be excluded from rate structures, suggesting these are best addressed through policy mechanisms, by policymakers. Others maintained that incorporating these benefits directly into the rate design is essential to achieving policy goals.

Interviewees often talked about how California incorporated a Societal Cost Test (SCT), in addition to its Total Resource Cost (TRC), into its evaluation of distributed energy resources. An SCT for solar evaluates the net cost-benefit of a solar program by incorporating broader societal benefits and costs. A TRC primarily considers costs and benefits directly related to the utility and participants of a program. Perspectives varied on whether Washington should adopt a similar approach.

Future-Oriented Considerations

Insights into nodal pricing for distributed solar valuation were discussed, including challenges in aligning future cost signals with historical costs. Opinions differed regarding whether rate structures should focus on past costs or future avoided costs. Many cautioned against compensating based on historical costs, which may misalign with future grid needs and cost signals.

Interviewees emphasized the need for a systems-level view of distributed solar integration. Nearly all talked about future rate structures needing to consider dynamic factors such as increasing electrical demand, grid congestion, the role of hydropower, and the evolution of utility infrastructure.

Economic Development Considerations

Interviewees talked about how solar businesses, such as solar installers, need stability and predictability in rate structures to sustain investments, create and maintain jobs, and serve customers effectively. This included avoiding complex rate designs, which creates confusion amongst customers and can negatively impact the adoption of solar. The loss of technical knowledge and workforce capacity in the solar sector was flagged as a risk when policies abruptly shift and become unfavorable to small businesses.

Policy Considerations

Interviewees talked about how the Legislature and various policy decisions can play a key role in setting and ensuring societal benefits, like equity and resilience, are adequately addressed when it comes to supporting distributed solar and storage. However, many noted there can be a disconnect between policy aspirations and the technical feasibility of achieving them. Others cautioned against tying solar incentives to rate structures, noting that changes to the structure directly impact the value of the incentives. Some suggested that policy incentives be standalone programs or tax benefits, and not tied to electric rates.

Solar Storage and Resilience Considerations

Many interviewees suggested that the rate structure should incentivize pairing solar with battery storage. Interviewees talked about the need to shift away from valuing solar in isolation and instead better understand and value solar and storage as an integrated system.

Some talked about ways battery storage enables dynamic pricing and time-varying rates. The value of pairing solar with battery storage was noted by some as a potential way to mitigate seasonal energy supply fluctuations and to address peak energy demand. Battery storage would allow customers to better optimize energy use, which would better align with broader grid needs, shifting the focus from solar-specific value to the value of energy as a whole.

Interviewees talked about the potential for Washington State to lead in valuing resilience within its energy rate structures, particularly by exploring frameworks like the “value of lost load” (VOLL) to better account for grid reliability during disruptions. VOLL represents the monetary value of lost power and is used to quantify the economic impact of power outages. VOLL can determine the value of backup power from solar-plus-storage systems during outages. Interviewees highlighted that resilience is often an overlooked value, but has gained increased focus, in particular solar-plus-storage, in the face of extreme weather events and rising energy demands.

Consistency Considerations

When asked about the importance of consistency in rate structure for different solar programs, most interviewees thought statewide uniformity in rate structures would not be feasible nor desirable. However, interviewees emphasized that having a consistent framework or methodology for determining rate structure for solar and storage was important to ensure that rate design across different programs is fair, transparent, and grounded in shared principles. Interviewees suggested standardizing methodologies for calculating costs and benefits across programs while allowing flexibility to reflect local conditions and priorities.

Interviewees talked about how different programs—such as net metering, community solar, or commercial solar projects—serve distinct goals, and therefore necessitate tailored rate structures that reflect the unique purpose and value of each program. Some noted that utilities face challenges in coordinating diverse methodologies across programs, adding complexity to ratemaking and customer communications.

Some interviewees noted that for many in the solar business, predictability in compensation structures is critical to adequately pricing the cost of solar installation, educating customers, and being able to be transparent with customers about payback periods and returns on their investment. Inconsistent rate structures present challenges for solar businesses such as complexities in tracking programs, navigating administrative requirements, and understanding variations across utilities. Stable and predictable rate structures are necessary for businesses to invest, hire employees, and adequately serve customers and unpredictability in rate structures undermines market confidence and slows progress.

Technological advancements like dynamic pricing, virtual net metering, and battery storage introduces additional complexity. While some interviewees saw these as tools for achieving consistency, others highlighted the administrative and technical challenges they pose, especially for smaller utilities.

Interviewees talked about how diversity in utility operating models, borrowing costs, and energy sources, make uniform rates across utilities difficult to achieve. Many noted the east-west divide in Washington, with its limited transmission capacity and reliance on eastern hydropower versus western consumption, are complicating factors for uniform rate design, underscoring the need for tailored solutions rather than a one-

size-fits-all approach. Many favored methodologies that consider these differences while providing consistent principles for rate design.

C. Key Considerations for Net Metering Policies and Determining Compensation for Distributed Solar Production

Interviewees responses to the question about what should be considered when determining compensation for distributed solar production and the question about what the principles should be when creating policies for net-metering tended to overlap. And many responses mirror what was stated when asked about evaluating rate structure.

Alignment with Clean Energy Goals and Targets

Washington State’s Clean Energy Transformation Act (CETA) requires electric utilities to fully transition to clean, renewable, and non-emitting resources by 2045. CETA sets the following targets:

- **2025** – All electric utilities must eliminate coal-fired generation serving Washington State customers.
- **2030** – All electric utilities must be greenhouse gas neutral—for example, remaining carbon emissions are offset by renewable energy, energy efficiency, carbon reduction project investments, or payments funding low-income assistance.
- **2045** – All electric utilities must generate 100% of their power from renewable or zero-carbon resources.

When asked about what principles should be considered when creating policies for NEM many talked about the need for a broader policy conversation about how distributed solar and NEM aid in meeting the goals and targets the State has set forth. Some questions interviewees posed included:

- What is the vision for distributed energy in Washington State?
- Given that vision, what is the role of distributed solar and storage today and in the future?
- How do NEM policies support this vision?
- What were the reasons for and goals of NEM? Are they still relevant today?
- What is the purpose and desired outcome of NEM?
- What is the problem that is trying to be addressed with NEM policies?
- What is the vision for solar AND storage?

Interviewees spoke about how the conditions in place in the 1990’s when NEM laws were created are not the same conditions that exist today or in the future. Many talked about how energy demand in Washington is projected to increase by 30% in the next decade, due to factors such as rapid expansion of data centers, expansion of electric vehicles, increased high-tech manufacturing, increased development, and greater electrification in homes and buildings. Some questioned whether to incentivize individual roof-top solar given current and changing conditions, suggesting that incentivizing utility-scale solar instead would be more productive and capital efficient. Others cautioned against relying solely on large scale generation, noting potential increases to utility rates, siting challenges, and environmental impacts. Others thought a more balanced approach to incentives was needed, and to ensure that incentives continue to make renewable energy more accessible and affordable, while avoiding cost-shifting to non-solar customers, and that distributed solar is an important component of the State’s overall portfolio for contributing to a more

sustainable energy future.

Equity, Fairness, and Accessibility

Equity, fairness, and accessibility were recurring themes when asked what should be considered for net-metering policies and determining compensation for distributed solar. In particular, interviewees were interested in ensuring fair compensation and avoiding cross-subsidization. Interviewees talked about the importance of net-metering policies and incentive-based solar programs not disproportionately benefiting more affluent individuals while shifting costs to lower-income communities. This included cross-subsidization, ensuring compensation for solar participants is fair and avoiding cost-shifting to non-participants.

In Washington State, net-metering credits solar customers by allowing them to “sell” the energy they generate back on to the grid at the full retail rate. Many referenced the [2023 study conducted by Energy and Environmental Economics \(E3\)](#) that found that the compensation provided through retail rate net-metering exceeds the value that is being provided to the electric system. Interviewees explained that non-solar customers pay for the infrastructure and maintenance costs to the grid that support these systems, therefore creating a cost shift from solar participants to non-participants. However, some interviewees raised several [critiques about the E3 study](#), including that concepts of cost shift and revenue shifts were inflated and that a number of the qualitative benefits of NEM were not included.

Interviewees also talked about the importance of ensuring policies create access to solar, particularly for low-income, disadvantaged, and underserved communities. Some suggested greater engagement and involvement of community-based organizations in policy discussions. Others talked about needing to consider the role of distributed energy resources for rural communities and how removing or devaluing NEM could have a disproportionate impact in these communities where grid reliability is limited, and upgrades are costly.

Retail Rates, Avoided Costs, and Fixed Costs

In Washington State, utilities are required to offer NEM at the full retail rate for systems up to 100kw. Solar customers receive credit for excess energy they feed back to the grid at the same rate they pay for non-solar generated electricity. This means that solar customers could reduce their electricity bill by generating and exporting excess energy. Electric utilities are required to offer the retail rate for NEM until either June 30, 2029, or until the total generating capacity of NEM systems connected to the utility reaches 4% of the utility’s 1996 peak demand, whichever comes first. Once a utility reaches one of the thresholds, they can continue to offer the retail rate NEM or propose an alternative tariff schedule. Avoided cost is the cost a utility company can avoid by not having to purchase or generate new power or purchase it from a third party. Fixed costs are the inherent charges a utility incurs to maintain the entire grid infrastructure and provide basic services - including transmission and distribution lines, meter reading, and billing services - regardless of how much electricity an individual customer uses.

Perspectives varied when asked whether excess solar electricity should be credited at the full retail rate, or at a lower rate that considers the utilities avoided costs and fixed costs. A number of interviewees thought it important that compensation was based on the actual avoided cost to the utility, and they spoke in great detail about the various costs to the utility and their complexity. This included reflecting the marginal cost of generation, transmission and distribution deferral, grid services such as peak shaving and grid support, and operational and administrative costs. Other interviewees thought it important that compensation not be

based solely on avoided costs to the utility. They explained how compensation based solely on avoided costs does not reflect the full value of solar, such as environmental benefits and reduced grid congestion. Some talked about how strict avoided cost compensation can create market distortions that do not fully incentivize solar adoption and therefore hinder the adoption of distributed solar and growth of DERs. When asked about models that consider avoided costs, interviewees frequently referenced the California Public Utility Commission's Avoided Cost Calculator.

Interviewees highlighted the challenges of balancing compensation with ensuring utilities recover fixed costs in a manner that is equitable. Many talked about fixed infrastructure costs and, depending on the utility and the price the utility purchases electricity, how compensation based on the energy a utility avoids purchasing may not cover the costs of maintaining the grid that these customers still rely on. A few interviewees felt strongly that compensation should continue to be based on the retail rate.

Societal Benefits

Perspectives amongst those interviewed differed on whether societal benefits should be reflected in compensation for distributed solar. Those that supported including such benefits spoke about the environmental benefits, such as reduction in greenhouse gas emissions and air pollutant emissions as well as reducing the need for large tracts of land for solar infrastructure. Some thought that the environmental scale of impacts of distributed solar vs. grid scale solar generation should be considered. They noted that the impact of putting solar panels on an already existing structure is less impactful than grid scale generation, which requires a sizable portion of land, where siting is controversial, may disrupt the ecosystems, and required large-scale transmission that may impact species corridors and networks. Others talked about community resiliency and economic benefits. This included such things as the value of solar and storage in disaster preparedness and in job creation and supporting local economies. Renewable energy credits and being mindful of double counting – when the environmental benefits of a single renewable energy credit are claimed by more than one entity – was also flagged as a topic for discussion.

Several interviewees thought a more robust conversation was needed about whether compensation and rate structure were the appropriate means to be incentivizing solar deployment and achieving various societal and environmental benefits, or whether other policy and incentive-based program structures would be more appropriate. Some suggested completely detaching distributed solar incentives from rate-based compensation structures. Others suggested no longer incentivizing solar alone, but solar plus battery storage. And some suggested a better blending of state policy incentives with a dynamic tariff structure.

Seasonal Variability and Grid Reliability and Sustainability

According to a number of interviewees, Eastern Washington has better solar potential compared to Western Washington. Many utilities experience annual peak load during winter months. However, summer peaks are becoming more significant, largely due to increased air conditioning use. Solar production tends to peak at midday while demand for electricity tends to peak in the evening. While solar energy helps offset summer consumption, it cannot do so as effectively in winter. This mismatch between solar generation and peak demand was frequently noted by interviewees as important to consider when developing policies for NEM and determining compensation structures. Interviewees spoke in great detail and in length about various strategies that should be considered, including incentivizing battery storage, increasing solar capacity, and implementing demand response programs. TOU rates and “time-varying rates” were frequently mentioned. Essentially the same concept, customers pay different rates for electricity depending on the time of day, with higher rates during peak hours and lower rates during off-peak hours. Several interviewees suggested NEM

policies and compensation models better reflect peak demand times and regional grid needs rather than using a static rate across all locations.

Interviewees suggested various incentive and compensation models aimed at aligning with real-time grid needs, such as:

- Incentivizing southwest-facing solar installations over traditional south-facing solar panels. Traditional south facing panels may produce excess energy midday, coinciding with an oversupply of solar that is less valuable to the grid, while south-west facing panels provide higher energy production during late-afternoon peak hours when system demand is highest.
- Localized grid congestion pricing, where areas with high grid stress during peak hours receive higher compensation, while regions with excessive solar generation face lower compensation to discourage oversupply.
- Zonal pricing adjustments, akin to locational marginal pricing (LMP) in wholesale markets, where distributed solar compensation varies based on real-time congestion and voltage support needs.

Resilience & Storage Integration

Another recurring theme mentioned by nearly all interviewees was energy storage. Many suggested that future NEM policies should include an incentive structure to support battery energy storage, which would support the dispatch ability and flexibility of solar for both customers and the utility. Also suggested was to create incentives to expand access to battery-backed systems for communities in fire, storm, and other hazard prone areas that are vulnerable to grid outages. Many spoke about resilience as a value, in particular, when coupled with storage, allows for uninterrupted power during grid outages.

Consumer Protection and Long-Term Predictability

Some interviewees raised concerns that with more than 60 utilities in Washington State, different compensation rates and tariff structures would be difficult to navigate for the customers and for promoting solar adoption. When creating policies for NEM some noted the importance of considering how new policies would impact current NEM solar customers and solar businesses. Interviewees suggested grandfathering policy protections for customers and businesses that made investments under existing rules.

A few interviewees emphasized that energy independence is a right for home and business owners. They shared how customers are entitled to consume the energy they generate with no obligation to pay the utility any portion of the retail rate beyond the direct service connection to the grid.

Hydroelectricity Production

The role and impact of hydroelectricity was also discussed by some interviewees. They talked about how climate change and drought are straining hydroelectricity production, creating volatility in wholesale market prices. They saw NEM solar generation as a way to reduce loads, allowing for hydroelectric plants to be able to export more power to California, thus reducing rates, and to release more water at the dams, benefiting fisheries. Others noted that while reduced hydroelectricity need in the summer due to NEM solar production may be true, this reduced consumption in the summer does not reduce system peaks in the winter months.

A number of interviewees talked about how electricity rates are low in Washington State, partially due to hydroelectric power. Interviewees talked about how rates vary amongst utilities, noting that in Chelan County offers some of the lowest electricity rates in the country - the average residential rate is 3.76 cents per kilowatt

hour. Chelan County PUD can subsidize local rates by selling excess hydropower. Interviewees talked about how such low rates impact the financial return of solar installations and that solar customers are not able to recoup their investment through energy savings. However, some noted that there is still a demand for installing residential solar in Chelan County and that federal tax credits and state and local incentive programs are available to help reduce upfront costs. It was mentioned that solar installation is still a financially viable option for those in rural areas where homes are far from existing power lines and connecting to the grid would be too expensive.

D. Benefits and Adverse Effects of Net Energy Metering

When asked about benefits of NEM, interviewees responses mirrored closely with the benefits listed and described by the [Net Energy Metering Technical Advisory Group](#). Benefits mentioned by interviewees included:

- Reduces energy bills for solar system owners.
- Reduces criteria pollutant emissions.
- Reduces greenhouse gas emissions.
- Reduces land use impacts.
- Reduces Utilities' purchase of energy that would otherwise be needed.
- Helps to meet CETA goals.
- Avoids transmission and distribution line losses.
- Increases energy independence and reliability.
- Makes solar financially viable.
- Supports local economic development.
- Reduces peak capacity needs and deferral of new generation resources.
- Reduces the draw from dams, leaving more hydroelectricity for utilities to sell regionally or keep in reserve.
- Supports local employment – green jobs, apprenticeship opportunities, local living wage employment and training in the electrical field.
- Reduces energy burden over time and stabilizes energy costs. As electricity rates fluctuate over the multiple decade lifetime of a solar installation, NEM participants may be able to avoid some impact of those fluctuations because the rates they pay to utilities will only apply to a fraction of the energy they use.
- Improves community resilience, where solar and storage systems can sustain power during outages.

When asked about adverse effects of NEM, responses were similar to those given when asked about considerations for creating NEM policies and compensation for distributed solar and storage. These included:

- NEM does not incentivize energy storage.
- Cost shifts to non-solar customers. Utilities are required to credit solar generation at retail rates,

which are higher than wholesale rates. This practice may lead to increased rates for non-solar customers in order to cover the fixed costs of grid maintenance and infrastructure.

- Retail rate NEM does not account for time of use or grid congestion.
- Equity and Accessibility – NEM benefits are more accessible to homeowners who can afford the upfront costs of solar installations. Renter, low-income households, and those in unsuitable solar locations are unable to participate and reduce their utility bills through NEM.
- Any changes to current NEM laws could affect the financial viability of the solar industry.
- Washington’s cloudy climate is a challenge in that solar production peaks during midday, while demand often peaks in the evening. This mismatch of peak and demand can strain the grid.
- Solar energy production is highly seasonal in Washington State and geographic locations – east vs. west of the Cascades – present different conditions. In winter months, especially west of the Cascades, reduced sunlight significantly lowers solar output, however this is when energy demand is peaking and when excess solar is needed. This seasonal variability can impact the payback period for solar investments.

E. Ideas for Reaching Agreement on Net-Metering Policies and Desired Processes for Further Engagement of Interested Parties

Interviewees were asked to share their ideas on how agreement could be reached on net-metering policies. Interviewees focused their comments mainly on four areas: developing a collaborative process to come to common understanding and dialogue; creating a viable process; identifying challenges to reaching agreement; and utilizing and communicating information, data, and analysis.

Developing a Collaborative Process

Many interviewees acknowledged that coming to agreement on methodology and policies for net metering has been challenging. They commented that part of the challenge is the lack of a trusted process for dialogue among interested parties. They also emphasized that developing a methodology and policies for net metering brings up broader issues and questions around the value of solar, changing conditions since previous policies were established more than 15 years ago, and the need to engage differing interests to find shared values and principles.

There was widespread interest in creating a collaborative process that engages a broad group of interested parties to identify, discuss, and strive to come to mutual understanding and agreement regarding a vision of the future, principles, values, explicit benefits, appropriate approaches, and guidelines for establishing rates/compensation. Interviewees stated that these broader issues were essential to discuss among interested parties in order to strive towards agreement and “buy in” regarding potential methodologies and policies. Interviewees stated that establishing a collaborative process is important as it is the first step to minimize further conflict down the road. Some interviewees stated the importance of developing a process for engagement that moves beyond the politics of solar and focuses on data-driven analysis.

There were a number of suggestions for topics that interviewees stated would be important to discuss in a collaborative process, for example:

- Unpack the concerns and issues about cost shifting to low-income customers.
- Find agreement on the list of benefits of residential and community solar including those that are hard to quantify.
- Find agreement on the assets and benefits of residential and community solar to the utilities as well as the consumers.
- Identify and discuss the trade-offs of different options for determining the value of solar.
- Discuss and explore perspectives and impacts regarding the rate structure: Is this environmentally friendly? Will it increase or decrease costs? Will it increase or decrease reliability?
- Develop a new framework to support a partnership between utilities and customers in how the grid is managed in a cleaner energy future.
- Identify how any agreements or collaborative solutions will inform and involve decision-makers.
- Identify who the decision-makers are.
- Provide input into the analysis and approaches taken in determining the value of solar.
- Identify approaches to treating similar customers similarly.

Some interviewees discussed what has and has not worked in previous engagement processes including those in other states. They emphasized the importance of learning from these similar processes about what worked and did not work to design an appropriate process for Washington. Especially considering the concerns raised over past processes, several interviewees stated that it would be important to include input from interested parties to assist with the design of a collaborative process.

Creating a Viable Process

Many interviewees provided ideas and considerations for what would contribute to a process that is viable and trusted. These included:

- Any process should have skilled facilitators/mediators (impartial)
- Facilitators as well as analysts (scientists, economists, and social scientists) must be seen as non-biased.
- Process needs to be transparent and well communicated and understood by interested parties.
- Different viewpoints need to be acknowledged and genuinely heard.
- Be clear and agree upon the desired outcomes of the process.
- Stakeholders from impacted communities need to be involved and thought of in the discussions.
- All data and analysis utilized in the process needs to be broad and transparent and available/shared throughout the process.
- Base any agreements or decisions as much as possible on data.
- Use participants' time well.
- Communicate information for both those who understand the technical aspects and those who do

not.

- Identify a broad range of stakeholders, communicate the criteria for who participates in the process(s), and what the stakeholder engagement plan is.
- Share updates about the process and discussions often.
- Process needs to be robust and inclusive.
- Multiple workshops or on-going meetings (like an on-going working group) would be helpful.
- Utilize experts (consultants) for technical analysis.
- Strive for agreement on accepted compromises.
- Identify key questions to be answered when bringing people together.
- Ensure broad utility involvement.

Challenges to Reaching Agreement

Interviewees shared a number of challenges that they perceived to reaching agreement on the methodology and policies for net metering. These perceptions were often informed by interviewees' engagement with previous processes, analyses, studies, or knowledge of processes and studies in other states. Some interviewees expressed skepticism and stated that they held low expectations regarding the ability for interested parties to come to agreement, especially because of past experiences of processes, other state's contentious processes, and arguments and differing opinions over previous studies, data, analysis, and misinformation. The history of conflicting interests, fear of change, and parties looking out for their own interests complicates the likelihood of reaching agreement. Some examples of the conflicting interests included differing views on economic and environmental benefits; maintenance vs. reduction of the compensation rate of net metering; first come first served vs. equity; consistency among utilities vs. individualized approaches to net metering; and concerns about cost-shifting. Even though many interviewees noted that conflict would be present and getting to agreement could be difficult in a collaborative process, they stated that a trusted and professionally managed process could create an opportunity to find common ground. It would be important to manage expectations, and the different things participants would want out of the process.

Other challenges that interviewees brought up included tensions that exist between equity goals and first come, first served, the different positions of the solar industry and the utilities, that the status quo for some interested parties may be the most comfortable, differing perspectives on the relevancy of net metering to current conditions and the importance of storage, and the difficulty of coming to agreement when everything is a zero sum game. Also expressed was concern that all utilities in the State will take different approaches.

Some interviewees suggested that agreement is more likely if utilities have a meaningful seat at the table and participate in analysis and data collection; there is transparency in assumptions (green house gas reductions, avoided cost, capacity value); and that interested parties recognize that legacy net metering is outdated (particularly for future customers), and better models exist.

Utilizing and Communicating Information, Data, and Analysis

Interviewees stressed the importance that data, analysis, and information plays in the discussions regarding the methodology and policies for net metering and even more importantly in the broader discussion regarding

the value of solar. They emphasized the importance of striving to come to common understanding of the analysis and data, and that information needs to be communicated in a way that all interested parties understand. Interviewees stated that any research/technical information/data that is being utilized to develop a methodology needs to be peer reviewed, as well as made available for review and comment by interested parties during the process and before being finalized. Interviewees gave examples of what needs to be considered when developing a methodology for net metering and determining the value of solar. These examples included:

- Consider the benefits that are hard to quantify in determining the value of solar.
- Need more information and analysis on the data around cost shifts to non-solar customers.
- Consider different processes between investor-owned and consumer-owned utilities.
- Need to show what is the most valuable to the end user and the customer.
- Legislators will need to understand the key technical information, the goals, and vision behind the outcomes.
- Need better information in understanding what the benefits, costs, and consequences truly are.

Interviewees noted that policymakers will need to understand the key technical information that informs the analysis as well as the vision of the future, the goals, values, and principles that are discussed in a collaborative process.

Engagement of Interested Parties in Phase 2

Interviewees were also asked what they thought would be a meaningful follow-on process for engagement of interested parties in WSAS's next phase of work. Interviewees' responses to this question were often redundant to the answers they gave for the question about how agreement could be reached on the methodology and policies for net metering. The findings from these two sections should be considered together. Responses coalesced around the value of engagement at various stages of the analytic process that both includes continuous engagement from a diversity of interested parties as well as opportunities for broad engagement and input. Most interviewees also stated that it is important to establish a collaborative process to dialogue and work through differences on the broader issues regarding the value of solar, changing conditions since previous policies were established, and the need to engage differing interests to find shared values and principles, as mentioned in the previous section. The following are ideas suggested by interviewees for meaningful follow-on processes for the project going forward.

1. Initial engagement with interviewees and open to others (a public forum) to discuss Phase 1 report, findings from the interviewees, and recommendations/scope of work for next steps. Establish a way to collect comments on the 2025 Phase 1 report.
2. Establish a process for the duration of Phase 2 that provides on-going guidance and input by interested parties into the research, analysis, and development of methodologies/frameworks. Provide utilities opportunities to challenge assumptions and to ask questions. Process(s) would be designed to provide input and feedback to WSAS while Phase 2 is occurring. This may include workshops with experts on specific subjects.
3. Towards the end of Phase 2 repeat engagement opportunities to collect comments on the 2026 report

and hold moderated workshops, open forums to discuss specific components and to vet ideas/potential recommendations and conclusions.

4. Establish a collaborative process as stated in the findings of the previous question, either during Phase 2 or once Phase 2 is complete. Interviewees added the following comments to those provided in the previous question:

- Best if the process is in-person.
- Focus on resolution and addressing differences.
- As part of the process agree on goals and how to find win-wins.
- Process needs to have integrity, and facilitation needs to be impartial.
- Design process where participants discuss mix of values, benefits, costs that can go into valuing solar and to provide input. Could be a series of workshops.
- Needs to be a range of participants including the utilities. A full gamut of perspectives needs to be involved.
- Create shared understanding of terms and technical information.
- A structured process with robust stakeholder engagement needs to occur. Establishing forum(s) for continuous engagement ultimately will be important to maintain cooperation.
- Process should be transparent, action-oriented and state the facts.
- Need to move from study to collaborative design that includes working group and workshops, then into implementation, and identification of feedback loops (monitoring) to make adjustments, if needed to policies.
- Trade-offs need to be discussed.
- Will need to design for how to engage decision-makers in the process.
- Collaborative process needs to include agreement on information and that there is shared understanding of background information and agreement on facts.
- It will be important to identify what information is needed to assist the process.
- Create a design that encourages people who have different viewpoints to come together and understand their differences.
- Identify the salient points of disagreement.

IV. RECOMMENDATIONS FOR NEXT PHASE OF ENGAGEMENT

The previous section (Section III.) provides a brief summary of what interviewees stated in response to the interview questions. The following recommendations are based on what was heard, learned, and emphasized by interviewees. The Ruckelshaus Center staff utilized these comments to inform the design of potential engagement processes going forward.

Interviewees acknowledged that there is a lot of information, data, studies, and methodologies, both

Washington specific as well as from other states, that currently address the value of solar, net metering, and distributed solar and storage. They emphasized the importance of learning from these similar processes about what worked and what did not work to design an appropriate process or processes for Washington. Additional methodologies and data can be helpful to guide decision-making. Interviewees emphasized that what has been missing is the opportunity for interested parties to work together to identify, dialogue, and strive to come to mutual understanding and agreement regarding the vision of the future, values, principles, explicit benefits, appropriate approaches, and guidelines for establishing rates/compensation.

Interviewees expressed interest in learning from one another and having the opportunity to resolve differences and see if there can be agreement on methodologies and potential policies. An asset within Washington is that there are many individuals and entities that have deep technical knowledge and understand the complexity and nuances of the energy system in Washington. In addition to wanting the opportunity to engage with each other across differences, interviewees also were interested in helping to guide and have input into Phase 2 of this project as well as next steps once Phase 2 is completed. The following recommendations reflect these interests for engagement going forward.

Recommendation 1: Create a Phase 2 Advisory Committee

- 1.** Create an advisory committee to enable ongoing engagement and input between interested parties and the WSAS Value of Distributed Solar and Storage Project during Phase 2 of its work. Include on the advisory committee all interested parties who participated in the interviews in Phase 1 to be part of the advisory committee. Also, solicit ideas for additional members who may be important to the process from the interviewees.
 - a.** Convene an initial meeting to discuss the Phase 1 report, findings from the interviewees, recommendations/scope of work for next steps, and a process for soliciting comments on the Phase I report.
 - b.** Establish a charter and hold, at a minimum, quarterly meetings of the advisory committee to provide guidance at key stages of Phase 2 and to provide periodic updates from the WSAS research team.
 - c.** Towards the end of the Phase 2 analysis, repeat engagement opportunities to collect comments on the 2026 report and hold moderated workshops/open forums to discuss specific components, and to vet ideas/potential recommendations and conclusions.
 - d.** Task the advisory committee with helping to create the process for soliciting comments on the Phase 2 draft report. Also, task the advisory committee with providing ideas for the design of a collaborative process (if it has not yet been established), as several interviewees stated that it would be important to include input from interested parties in the design.

Recommendation 2: Create a Collaborative Task Force

Create a collaborative task force that consists of representatives of the advisory committee and other interested parties. The purpose would be to identify, discuss, and strive to come to common understanding and agreement regarding a vision of the future for solar and storage, values, principles, explicit benefits, appropriate approaches, and guidelines for establishing rates/compensation. If the task force is created after Phase 2 is completed, utilize the Phase 2 framework/methodology to inform the dialogue and to provide policy

and programmatic recommendations. The task force could be established by the State Legislature or a state agency. It is recommended that the task force meet a minimum of one year.

The following should be considered in establishing and managing a task force.

- Enlist skilled and impartial facilitators/mediators for the task force.
- Develop a process that is transparent and well communicated and understood by interested parties.
- Establish a task force charter that describes the “rules of engagement” that includes having respect for and genuinely consider different viewpoints, how data and analysis is utilized and shared/accessed throughout the process, striving for agreement on facts, and encourages people who have different viewpoints to come together and understand their differences.
- Establish a scope of work for the task force that identifies desired outcomes of the process and goals, recommendations for implementation, and development of feedback loops that inform future adjustments.
- Involve stakeholders from impacted communities.
- Communicate information for both those who understand the technical aspects and those who do not.
- Identify a broad range of stakeholders, communicate the criteria for who participates in the process(s), and what the broader engagement plan is.
- Develop mechanisms to share updates about the process and discussions often.
- Meet regularly for an extended period of time to ensure that participants have the opportunity for robust conversations and problem-solving.
- Identify the salient points of disagreement and strive for agreement on accepted compromises.
- Identify key questions to be answered when bringing people together.
- Ensure broad involvement including utilities.
- As much as is feasible, hold task force meetings in person.
- Create shared understanding of terms and technical information.
- Develop strategies for how to engage decision-makers in the process.
- Identify what information is needed to assist the process.

Additional ideas, rationale for, and creation of a collaborative process are reflected in section E of this report.

APPENDIX E.1 – INTERVIEW LIST

Entity Type	Organization Name	Individual(s)	Interview Date
Investor Owned Utility	Avista Utilities	Rendall Farley, John Rothlin, Mike Diedesch, Shawn Bonfield, Josie Cummings, James Gall, Dan Burgess,	April 3, 2025

		Amanda Ghering, Lisa Garrett	
Consultancy	Building Potential	Kerry Meade	April 22, 2025
Consultancy	Cascadia Renewables	Markus Virta	February 20, 2025
Public Utility District	Chelan PUD	Jim White	March 24, 2025
Public Utility District	Cowlitz PUD	Dever Haffner-Ratliffe	April 17, 2025
State Agency	Washington Department of Commerce	Nora Hawkins, Glenn Blackmon, Talia Mirel	February 14, 2025
Consultancy	E3 – Energy and Environmental Economics, Inc.	Ari Gold-Parker, Arne Olson	March 17, 2025
Solar Installer	Fire Mountain Solar	Alana Nelson	March 28, 2025
	NW Energy Coalition	Charlee Thompson	March 4, 2025
Solar Installer	Olympia Solar	Mason Rolph, Derek Chernow	April 1, 2025
Rural Coop	Orcas Power and Light Co. (OPALCO)	Foster Hildreth, Vince Dauciuinas	March 25, 2025
State Agency	Oregon PUC	Curtis Dlouhy, Jean Falconer, Peter Kernan	March 18, 2025
IOU	PacifiCorp	Robert Meredith, Lee Elder, Dan MacNeil	May 19, 2025
Consultancy	Protogen Energy	Adam Morse	March 10, 2025
IOU	Puget Sound Energy (PSE)	Heather Mulligan, Michael Wehling, Leslie Monynihan, Christopher Mickelson	March 3, 2025
Local utility	Seattle City Light	Jennifer Finnegan, Alex Porteshawver	March 4, 2025
Nonprofit	Spark NW	John Seng	April 17, 2025
	<i>Unaffiliated</i>	Nathaniel Nichol	March 5, 2025
	<i>Unaffiliated</i>	Mike Nelson	March 26, 2025
State Agency	Washington Utilities and Transportation	Joel Nightingale	February 19, 2025

	Commission (UTC)		
Trade Association	Washington Solar Energy Industries Association (WASEIA), A-R Solar, M-Cubed	Bill Will, Gavin Tenold, Richard McCann, Reeves Clippard	April 4, 2025
State program	WSU Energy Program	Phil Lou	April 4, 2025
Trade Association	Washington PUD Association (WPUDA)	Nicolas Garcia	April 15, 2025

APPENDIX E.2 – INTERVIEW QUESTIONS

General Background

1. Please tell us about your background, affiliation, and interests with respect to net metering rates and the value of distributed solar and storage.
2. What are your organizations’ goals and objectives for the development of distributed solar and/or distributed energy storage in Washington state?

Rate structure for distributed solar and storage

3. Many perspectives could be considered to evaluate the rate structure for distributed solar, for example, ratepayer, utility, and inclusions of externalities. What perspective(s) do you think should be used?
4. What considerations should be used to determine compensation for distributed solar production?
5. Should compensation for community solar projects be different from behind-the-meter solar projects? If so, why?
6. How important is consistency in rate structure (compensation) for different programs, for example net metering, community solar, commercial driven distributed solar and storage projects?

Net Metering

7. What principles should be considered in creating policies for net-metering?
8. What components of the rate structure should be considered when developing options for the rate structure?
9. What components for net metering do you think should be considered when developing options for the rate structure?
10. What are examples of potential adverse effects of net metering?

11. What are some of the potential community or customer benefits?
12. What needs to be considered related to the impacts/burdens on low-income customers?
13. How do you think agreement can be reached on the methodology and policies for net-metering?

Wrap-Up

14. Is there anyone in particular you think it is important we interview? Why is it important to speak to them?
15. What do you think would be a meaningful follow-on process for additional engagement of interested parties?

Please send relevant studies/analyses/materials on net metering to the VOSS Study Team. Do you have any questions for us?

F: ILLUSTRATIVE EXAMPLES OF NET ENERGY METERING IN OTHER STATES

Most states have net metering programs, with varying approaches to subscriber limits, power limits, and compensation rates for distributed solar installations. Across the nation, these programs are in a state of flux. Quarterly updates of changes are available through the NC Clean Energy Technology Center *50 States of Solar* reports.¹⁰⁰

Below are illustrative examples from six states whose net energy metering programs are evolving, in part because of key changes in policies to support the states' decarbonization goals in the last quarter century. For each state, we include examples of the kinds of value considerations used for solar + storage, and outstanding controversies.

CALIFORNIA

What are the state's key energy policies?

The Clean Energy and Pollution Reduction Act (SB 350, 2015¹⁰¹) created goals to reduce greenhouse gas emissions to 40% below 1990 levels by 2030 and to increase renewable electricity to 50% by 2030. SB 350 requires utilities to make integrated resource plans that outline utilities' plans to meet customer needs, reduce greenhouse gases (GHG), and increase clean energy resource use. SB 350 also directs state agencies to conduct research on solar energy generation and low-income customer access to renewable energy, access to energy efficiency and weatherization investments, and low- or zero-emission transportation options.

The California Renewables Portfolio Standard Program (SB 100, 2018¹⁰²) requires public utilities to obtain renewable energy resources so that renewable energy comprises a minimum of 60% of their retail sales by 2030. Further, the bill sets a goal for renewable resources to supply 100% of electricity retail sales by 2045, without increasing carbon emissions. Executive Order B-55-18 (2018¹⁰³) established a goal of carbon neutrality by 2045.

The California Energy Commission (CEC) prepares a biannual Integrated Energy Policy Report (IEPR) that assesses the state of energy, forecasts electricity demands, and provides recommendations to the Governor and Legislature. The 2024 IEPR¹⁰⁴ and 2025 IEPR¹⁰⁵ mentioned additional key policy initiatives:

¹⁰⁰ NC Clean Energy Technology Center. (n.d.). *The 50 States Reports*. North Carolina Clean Energy Technology Center. <https://nccleantech.ncsu.edu/the-50-states-reports/>

¹⁰¹ California Energy Commission. (n.d.). *Clean Energy and Pollution Reduction Act (SB 350)*. <https://www.energy.ca.gov/rules-and-regulations/energy-suppliers-reporting/clean-energy-and-pollution-reduction-act-sb-350>

¹⁰² California State Legislature. (2018). *Senate Bill No. 100*. <https://legiscan.com/CA/text/SB100/id/1819458>

¹⁰³ Office of Governor Edmund G. Brown Jr. (2018, September 10). *Executive Order B-55-18 to Achieve Carbon Neutrality*. <https://archive.gov.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf>

¹⁰⁴ California Energy Commission. (2024). 2024 Integrated Energy Policy Report. <https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report-iepr/2024-integrated-energy-policy-report>

¹⁰⁵ California Energy Commission. (2025). 2025 Integrated Energy Policy Report. <https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report-iepr/2025-integrated-energy-policy-report>

- Executive Order N-79-20 (2020) establishes zero-emissions targets for 100% of passenger vehicle and truck sales by 2035, all operating freight transportation and off-road equipment by 2035, and all medium- and heavy-duty vehicles by 2045.
- AB 1279 (2022) requires steps to ensure California reaches net-zero GHG emissions by 2045.
- SB 846 (2022) requires adoption of a goal for load shifting to reduce net-peak electrical demand, and mandates policy recommendations to increase demand response and load shifting without increasing GHG or electricity rates.
- SB 887 (2022) requires the California Public Utilities Commission (CPUC) and CEC to provide guidance and support the development of transmission capacity needed to deliver renewable or zero-carbon resources by 2035.
- SB 1020 (2022) mandates steps to ensure renewable and zero-carbon sources make up 90 percent of the state’s electricity by 2035.
- AB 1373 (2023) requires the CEC & CPUC assess barriers and provide recommendations to electricity interconnection and energization.

What net metering policies has the state implemented over time? If relevant, how have they changed? To whom do they apply?

The California Public Utilities Commission (CPUC) oversees electricity rates for investor-owned utilities (IOUs), including 3 large IOUs and 3 small IOUs. In total, about three-quarters of California’s electricity is distributed by IOUs¹⁰⁶. The main classes of customers served by the IOUs and regulated by the CPUC are residential, commercial or industrial, agricultural, and street lighting customers¹⁰⁷. The CPUC has designed and implemented the net metering tariff structure for the 3 large IOUs since the implementation of NEM 1.0 in 1995 and up through to the current policy, NEM 3.0^{108,109}.

According to the California ISO (CAISO)¹¹⁰, which serves and reports on 80% of California electricity demand, in early May 2025¹¹¹ utility-scale solar energy generation reached a new peak of 21.370 GW in CAISO territories and solar generation made up over 64% of installed renewable resources there. Installed utility-scale battery capacity was over 12.47 GW. In April 2025 alone, utility-scale solar curtailed 686,710 MWh¹¹² of energy. In 2024, combined solar and wind energy generation served an average 38.69%¹¹³ of CAISO electricity load. In comparison, in May 2025¹¹⁴ the cumulative capacity of installed distributed generation projects and approved project applications in California was 16,892 MW for net energy metering solar and 2,342 MW for energy

¹⁰⁶ Legislative Analyst’s Office. (2025, January 7). Assessing California’s Climate Policies – Residential Electricity Rates in California. <https://lao.ca.gov/reports/2025/4950/Residential-Electricity-Rates-010725.pdf>

¹⁰⁷ California Public Utilities Commission. (n.d.). *Electric Rates*. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-rates>

¹⁰⁸ California Public Utilities Commission. (n.d.). *Net Energy Metering and Net Billing*. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/customer-generation/net-energy-metering-and-net-billing>

¹⁰⁹ California Public Utilities Commission. (2025). Proposed Decision Adopting New Net Billing Tariff. <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M500/K043/500043682.PDF>

¹¹⁰ California Independent System Operator. (n.d.). Media Resources: Key Statistics. <https://www.caiso.com/about/news/media-resources#key-statistics>

¹¹¹ California Independent System Operator. (2025, April). Key Statistics – April 2025. <https://www.caiso.com/documents/key-statistics-apr-2025.pdf>

¹¹² California Independent System Operator. (2025, April). *Monthly Renewables Performance Report – April 2025*. <https://www.caiso.com/documents/monthly-renewables-performance-report-april-2025.html>

¹¹³ California Independent System Operator. (2024, December). *Monthly Renewables Performance Report – December 2024*. <https://www.caiso.com/documents/monthly-renewables-performance-report-december-2024.html>

¹¹⁴ California Distributed Generation Statistics. (n.d.). NEM Statistics. <https://www.californiadgstats.ca.gov/charts/nem/>

storage.

Net energy metering 1.0 (NEM 1.0) was implemented by the California Public Utilities Commission (CPUC) in 1995 and was in effect from 1996-2017. Customers who generated solar power under NEM 1.0 received credits for energy they exported to the grid after onsite use. Export credit rates were the same as retail rates for energy imports. At an annual true-up, the credit for net surplus energy was provided at a wholesale rate. Non-bypassable charges were determined by net energy consumed in a year, and there was no interconnection fee. The solar installation size limit was the customer's annual energy load, up to 1 MW.

Net energy metering 2.0 (NEM 2.0) eligibility lasted from 2017-2023, and solar customers who applied for NEM 2.0 by April 15, 2023, are eligible to stay on NEM 2.0 for up to 20 years. NEM 2.0 featured changes to charges and compensation based on specific time windows. Under NEM 2.0, solar customers are charged for energy imports and credited for energy exports based on a time of use (TOU) rate structure. Solar customers' non-bypassable charges are calculated from net energy consumed in metered intervals (1 hour for residential and 15 minutes for non-residential customers) rather than annual net energy consumption. Interconnection fees were added, ranging from \$94-145.

Net energy metering 3.0 (NEM 3.0)¹¹⁵, known as the net billing tariff (NBT), was implemented in 2023 in response to a 2022 CPUC study¹¹⁶ finding that NEM 2.0 negatively impacted non-participants, including low-income ratepayers, and was not cost-effective. NBT was designed to remedy these impacts and promote equity, inclusion, and electrification while complying with existing regulatory codes and policies. Notably, NBT compensation signals a shift from standalone solar to solar + storage, incentivizes customers to match their energy exportation with energy demands to improve grid reliability and reduce GHG emissions. Specific "electrification" time-of-use rates apply to NBT customers, including export credit rates based on CPUC Avoided Cost Calculator¹¹⁷ values. This rate structure compensates energy at a rate of value to the grid, usually lower than retail rate, with lower off-peak compensation and higher on-peak compensation for exports. The annual true-up on compensation for net energy surplus is still based on wholesale rates. Non-bypassable charges are calculated for all energy imports, and billing is changed from annual to monthly. The installation size limit is now up to 150% of the customer's annual load. The compensation structure is designed to generate payback for solar + storage in 8-10 years, and further, low-income customers are eligible for a 9-year payback for standalone solar. Another modification to reduce the burden on low-income customers is an income-graduated fixed charge for residential customers.

¹¹⁵ California Public Utilities Commission. (n.d.). Net Energy Metering and Net Billing. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/customer-generation/net-energy-metering-and-net-billing>

¹¹⁶ California Public Utilities Commission. (2025). *Proposed Decision Adopting New Net Billing Tariff*. <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M500/K043/500043682.PDF>

¹¹⁷ California Public Utilities Commission. (n.d.). DER Cost-Effectiveness. <https://www.cpuc.ca.gov/dercosteffectiveness>

	NEM 1.0	NEM 2.0	NBT (NEM 3.0)
Eligible import rate schedule	Any	TOU rates	Specific “electrification” TOU rates
Onsite use of generated energy avoids energy imports	Yes	Yes	Yes
Basis of credits for retail energy exports before true-up	Import rates	Import rates	CPUC Avoided Cost Calculator values (usually lower than import rates)
Basis of credits for net surplus energy at true-up	Wholesale price of energy	Wholesale price of energy	Wholesale price of energy
Basis of non-bypassable charges calculation	Net energy consumed (imports minus exports) in a year	Net energy consumed in a metered interval (1 hour for residential and 15 minutes for nonresidential customers)	All energy imports
Interconnection fee	None	\$94-145	\$94-145
Billing and true-up period	Annual billing, annual true-up (both charges and credits roll over for 12 months)	Annual billing, annual true-up (both charges and credits roll over for 12 months)	Monthly billing (pay monthly); annual true-up (credits roll over for 12 months)
Installation size limit	Customer’s annual electric load with limited exceptions; capped at 1 MW	Customer’s annual electric load with limited exceptions	Customer’s annual electric load plus up to 50% if customer attests to need

The CPUC Avoided Cost Calculator methodology models and documentation were developed by Energy + Environmental Economics (E3) and most recently updated in 2024¹¹⁸. As an example, in their illustrative example of the Avoided Cost Calculation¹¹⁹, large California IOU PG&E estimated \$71/kW-year for day-of rates

¹¹⁸ Energy and Environmental Economics, Inc. (n.d.). *Energy Efficiency Calculator*. https://www.ethree.com/public_proceedings/energy-efficiency-calculator/

¹¹⁹ Pacific Gas and Electric. (n.d.). *AMPRFO DR Reporting Template Example*. https://www.pge.com/includes/docs/word_xls/b2b/energysupply/wholesaleelectricssuppliersolicitation/AMPRFO/AMPRFO_DR_ReportingTemplateExample.xls

and \$59/kW-year for day-ahead rates. PG&E's current average residential time of use retail rates are \$0.43155/kWh¹²⁰.

Bill AB 942¹²¹, as currently proposed¹²² to the California legislature in 2025, would end the inheritance of solar agreements with the sale of property for customers of large electrical utilities, with exceptions for agricultural and public school customers. Customers who purchase property containing solar and storage facilities would be enrolled for compensation at the currently applicable net billing tariff without the glide path and would pay all applicable non-bypassable charges.

Compared to the CPUC's tariffs for the 3 large IOUs, the other 3 small IOUs in California each have their own net energy metering or net billing tariffs¹²³¹²⁴¹²⁵. They differ in their eligibility—first-come, first-served or open to all, their total volume—1 MW or 2 MW annually, and their energy export rate structures—retail rate, flat avoided cost rates, or flat on-peak/off-peak time of use rates.

In addition to the small and large investor-owned utilities in California, there are¹²⁶ 4 rural electric cooperatives, 25 community choice aggregators (CCAs), 17 registered electric service providers, and 47 publicly owned load-serving entities (LSEs), such as publicly owned utilities (POUs). POUs include city municipal districts, public utility districts, municipal utility districts, and irrigation districts. POUs provide about a quarter of CA's retail energy consumption and are required to report annually to the California Energy Commission and customers. POU and CCA rates are set¹²⁷ by local governing boards¹²⁸.

What are the current value considerations for distributed solar + storage?

Energy value

The NBT energy value corresponds to avoided cost for the utility, or the expenses the utility can avoid by not having to generate or purchase and distribute energy from another source¹²⁹.

Capacity value

Capacity value¹³⁰ of CA solar and storage installation applications for all IOUs was 16,762 MW as of April 30,

¹²⁰ Pacific Gas and Electric. (n.d.). Time-of-Use Residential Rate Tariff (Current).

<https://view.officeapps.live.com/op/view.aspx?src=https://www.pge.com/assets/rates/tariffs/res-inclu-tou-current.xlsx>

¹²¹ California State Legislature. (2024). *Assembly Bill No. 942*. <https://legiscan.com/CA/text/AB942/id/3250261>

¹²² CalMatters. (n.d.). *CA AB 942 Bill Information*. https://calmatters.digitaldemocracy.org/bills/ca_202520260ab942

¹²³ Liberty Utilities. (2017, July 13). *NEM and NEMA Tariffs*. https://california.libertyutilities.com/uploads/NEM_NEMA%20PDF%207-13-17.pdf

¹²⁴ Bear Valley Electric Service. (n.d.). *Schedule DGS – Distributed Generation Service*. <https://www.bvesinc.com/assets/documents/rates/sch-dgs.pdf>

¹²⁵ Pacific Power. (n.d.). *NB-136 Net Billing Service*. https://www.pacificpower.net/content/dam/pcorp/documents/en/pacificpower/rates-regulation/california/rates/NB-136_Net_Billing_Service.pdf

¹²⁶ California Energy Commission. (n.d.). *Electric Load-Serving Entities (LSEs)*. <https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/electric-load-serving-entities-lses>

¹²⁷ Legislative Analyst's Office. (2025, January 7). *Residential Electricity Rates*. <https://lao.ca.gov/reports/2025/4950/Residential-Electricity-Rates-010725.pdf>

¹²⁸ California Public Utilities Commission. (n.d.). *Net Energy Metering and Net Billing*. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/customer-generation/net-energy-metering-and-net-billing>

¹²⁹ Aurora Solar. (n.d.). *Explaining and Modeling California's Net Billing Tariff (NEM 3.0)*. <https://aurorasolar.com/blog/explaining-and-modeling-californias-net-billing-tariff-nem-3-0/>

¹³⁰ California Distributed Generation Statistics. (n.d.). *Charts and Data*. <https://www.californiadgstats.ca.gov/charts/>

2025. Capacity of all IOUs in 2024 was 16,199 MW. The percentage of NEM/NBT generation with storage installed in 2024 was 38% (508 MW), up from 13% in 2023, and the cumulative capacity of energy storage as of April 2024 was 2,256 MW.

Environmental value

Environmental values in consideration for distributed solar + storage include the reduction in greenhouse gas emissions, avoidance of land use impacts of utility solar or wind generation, and improvements in air quality¹³¹. The 2024 Avoided Cost Calculator combines greenhouse gas emission avoided costs and generation capacity into a single step.

Demand reduction value

Storage provides demand reduction per its power rating. Reducing peak demand charges helps energy users save on their bills; energy at peak demand costs more, so changing behaviors to improve cost savings also reduces peak demand. Models of consumption during a typical summer day showed that solar reduced peak consumption by nearly 50%, and solar + storage reduced it by about 67%¹³².

Locational system relief value

CA uses a Locational Net Benefit Analysis (LNBA) tool¹³³ to estimate the avoided costs of location-specific upgrades to distributed resources and determine the value of specific projects to the grid. “For each location with a deferral opportunity, the load growth, load shape, and system need are defined, and the cost, size, and type of traditional distribution upgrade required are specified. The LNBA tool uses these inputs, as well as CPUC-approved avoided costs, to calculate the \$/kW-year value of the deferral that could be achieved with distributed energy resource deployment.”

Are there any outstanding controversies?

Actual values of cost-shifting resulting from NEM 2.0

Costs shifting from customers participating in NEM 2.0 to non-participant customers was explored in a lookback study prepared by Verdant for the CPUC in 2021¹³⁴ and was a major consideration cited in the CPUC’s 2022 report¹³⁵ outlining revisions to NEM 2.0 for what would become NBT/NEM 3.0. The changes to the energy export compensation structure that were enacted in NBT are intended to reduce cost shifting onto non-solar and low-income customers.

How much do changes in compensation in NBT affect the long-term CA solar market?

When NBT was in the process of passage and implementation, customer and solar industry advocates sounded an alarm about the implications of reductions in compensation for solar exports for the California

¹³¹ California Public Utilities Commission. (2024). Updated 2024 ACC Documentation v1b. <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/demand-side-management/acc-models-latest-version/updated-2024-acc-documentation-v1b.pdf>

¹³² California Energy Commission. (2024). CEC-500-2024-018: Technical Report. <https://www.energy.ca.gov/sites/default/files/2024-03/CEC-500-2024-018.pdf>

¹³³ Lawrence Berkeley National Laboratory. (2021, February 8). Locational Value of Distributed Energy Resources. https://eta-publications.lbl.gov/sites/default/files/lbnl_locational_value_der_2021_02_08.pdf

¹³⁴ California Public Utilities Commission. (n.d.). *NEM 2.0 Lookback Study*. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/net-energy-metering-nem/nemrevisit/nem-2_lookback_study.pdf

¹³⁵ California Public Utilities Commission. (2025). *Proposed Decision Adopting New Net Billing Tariff*. <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M500/K043/500043682.PDF>

solar energy market. An estimated¹³⁶ 75% cut in the value of energy credits with NBT compared to NEM 2.0 was voiced as cause for an 80-90% reduction in customers applying for rooftop solar in the months after NBT was implemented; this reduction shook the solar & storage industries and led some to speculate¹³⁷ whether CA would be able to meet its energy goals under NBT. However, analyses of new residential solar applications in early 2024 show near-parity¹³⁸ with 2019 rates, and even though the number of new residential solar projects in 2024¹³⁹ falls under 2021-2023 numbers, it is greater than 2019 or 2020 numbers. A longer-term pattern of uptake of NBT is yet to be seen.

MAINE

What are the state's key energy policies?

- 2019: LD 1679¹⁴⁰—Governor Janet Mills & Maine Legislature created the Maine Climate Council¹⁴¹
 - Made of scientists, industry leaders, bipartisan local and state officials, citizens.
 - Charged to create a 4-year plan to address climate change impacts in Maine.
- 2019: Updates to Maine Renewable Portfolio Standard (RPS)¹⁴² in Maine Statute (M.R.S. 35-A §3210¹⁴³)
 - Increased RPS, the percent of electricity that must come from renewable sources, to 80% by 2030 and 100% by 2050.
 - Required Maine Public Utilities Commission (PUC) to procure long-term contracts for new clean energy generation and storage. Procurement bids were weighed with 70% consideration of ratepayer benefits and 30% towards proven benefits to the economy.
- 2020: Maine Won't Wait: A Four-Year Plan for Climate Action by the Maine Climate Council¹⁴⁴
 - Maine's first plan to build resiliency to climate effects, reduce greenhouse gas emissions by 45% by 2030 and 80% by 2050, and achieve carbon neutrality by 2045.
 - Goals include:
 - Reduce Maine's greenhouse gas emissions
 - Avoid the impacts and costs of inaction
 - Foster economic opportunity and prosperity
 - Advance equity through Maine's climate response
 - Strategies for these goals focus on transportation, buildings, energy and industry sectors, the clean energy economy, environment, communities, infrastructure, and Maine's residents.
 - Sets goal to reach 80% of electricity from renewables by 2030.

¹³⁶ EnergySage. (n.d.). *Net Metering 3.0 Overview*. <https://www.energysage.com/blog/net-metering-3-0/>

¹³⁷ CalMatters. (2024, January). California solar demand plummets amid policy and market changes. <https://calmatters.org/environment/climate-change/2024/01/california-solar-demand-plummets/>

¹³⁸ Energy Institute at Haas. (2025, January 27). Guess what didn't kill rooftop solar? <https://energyathaas.wordpress.com/2025/01/27/guess-what-didnt-kill-rooftop-solar/>

¹³⁹ California Distributed Generation Statistics. (n.d.). *Charts and data*. <https://www.californiadgstats.ca.gov/charts/>

¹⁴⁰ Maine Legislature. (n.d.). LD 214 – An Act To Modernize Maine's Solar Program. <https://www.mainelegislature.org/LawMakerWeb/summary.asp?ID=280073696>

¹⁴¹ Maine Climate Council. (n.d.). About the Council. <https://www.maine.gov/future/climate/council>

¹⁴² Maine Public Utilities Commission. (n.d.). Renewable Portfolio Standards. <https://www.maine.gov/mpuc/regulated-utilities/electricity/renewable-programs/rps>

¹⁴³ Maine Legislature. (n.d.). *Title 35-A §3210: Renewable resources*. <https://www.mainelegislature.org/legis/statutes/35-A/title35-Asec3210.html>

¹⁴⁴ Maine Climate Council. (2020, December). *Maine Won't Wait: A Four-Year Plan for Climate Action*.

https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/MaineWontWait_December2020_printable_12.1.20.pdf

- Recommends statewide vulnerability assessments including for energy infrastructure.
- 2021: LD 528¹⁴⁵—Set energy storage goals in Maine for 300 MW installed by 2025 and 400 MW by 2030.
- 2021: LD 936¹⁴⁶—Set distributed energy goal to 750 MW, limited the 2-5 MW systems eligible for net energy billing, and concluded the program at the end of 2024.
- 2023: LD 1986¹⁴⁷—Limited participation in Net Energy Billing (NEB) and established the Distributed Solar and Energy Storage (DSES) Program for continued growth of solar and storage in Maine. Also required the PUC to annually determine NEB costs and benefits based on avoided costs, demand reduction, etc.
- 2023: Maine Won't Wait Progress Report¹⁴⁸
 - Maine reached 51% clean energy use out of its 80% goal by 2030, 25% below 1990 greenhouse gas emissions, and was 75% of the way to carbon neutral out of its goal for 100% by 2045.
 - Contained updated equity metrics for low-income and high social vulnerability communities, including 7,882 new low-income heat pumps since 2019 and an average 13% energy burden in low-income households compared to 3% overall.
 - Solar generation was 204 MWac (Megawatt alternating current (MWac) is the power output of the solar panels after they have been converted to alternating current by inverters) in 2022 and 180 MWac by September. 2023, driven by projects under 5 MW. 796 MW total of solar was set up.
- 2024: Scientific Assessment of Climate Change and Its Effects in Maine¹⁴⁹
 - Documented changes to Maine's climate, human health, social and economic systems, and climate resilience. Found that solar + storage can meet residence basic power needs during outages.
- 2024: Maine Won't Wait: A Four-Year Plan for Climate Action¹⁵⁰ (next iteration)
 - Goals:
 - Reduce Maine's greenhouse gas emissions
 - Strengthen resilience to climate impacts
 - Create jobs and economic prosperity
 - Bring climate action to all Maine people
 - Transition to clean energy: 100% by 2040. Achieve this through building infrastructure, managing buildings/vehicles/industry on the grid, grow clean energy jobs to 30,000 by 2030.
 - Recommends a long-term funding and investment strategy for federal Infrastructure Investment and Jobs Act and Inflation Reduction Act funds.

¹⁴⁵ Maine Legislature. (2021). *SP0213 LD 522 – An Act To Amend the Renewable Portfolio Standard Laws*. <https://legislature.maine.gov/bills/getPDF.asp?paper=SP0213&item=3&snum=130>

¹⁴⁶ Maine Legislature. (2021). *HP0692 LD 923 – An Act To Expand Maine's Clean Energy Economy*. <https://www.mainelegislature.org/legis/bills/getPDF.asp?paper=HP0692&item=6&snum=130>

¹⁴⁷ Maine Legislature. (2023). *SP0815 LD 2044 – An Act To Update the Net Energy Billing Program*. <https://www.mainelegislature.org/legis/bills/getPDF.asp?paper=SP0815&item=3&snum=131>

¹⁴⁸ Governor's Office of Policy Innovation and the Future. (2023, December). 2023 Maine Won't Wait Progress Report. https://www.maine.gov/future/sites/maine.gov/future/files/2023-12/_2023_MWW%20Progress%20Report.pdf

¹⁴⁹ Governor's Office of Policy Innovation and the Future. (2024). *STS 2024: Strategies for a Stronger, Sustainable Maine*. https://www.maine.gov/future/sites/maine.gov/future/files/inline-files/STS_2024_digital.pdf

¹⁵⁰ Maine Climate Council. (2024, November). *Maine Won't Wait 2024 Update*. https://www.maine.gov/climateplan/sites/maine.gov.climateplan/files/2024-11/MWW_2024_Book_112124.pdf

- 2025: Maine Pathways to 2040: Analysis and Insights¹⁵¹ – Brattle technical report
 - First of its kind report modeling Maine’s hourly energy needs out to 2050.
 - Found Maine’s goal of 100% clean energy by 2040 is achievable, cost-effective, and beneficial.
- 2025: Maine Energy Plan¹⁵² by Maine Governor’s Energy Office
 - Set forward recommended strategies toward established goals of 80% renewable energy by 2030, 100% renewable energy by 2040, 750 MW distributed generation, 400 MW energy storage by 2030.
 - The five objectives of the Energy Plan are:
 - Deliver affordable energy for Maine people and businesses
 - Ensure Maine's energy systems are reliable and resilient in the face of growing challenges
 - Responsibly advance clean energy
 - Deploy efficient technologies to reduce energy costs
 - Expand clean energy career opportunities for Maine people and advance innovation
- 2025: An Act to Advance a Clean Energy Economy by Updating Renewable and Clean Resource Procurement Laws¹⁵³
 - Set goal of 90% retail electricity sales from renewable sources by 2040 and 10% from clean resources by 2040.
 - Directs the Governor’s Energy Office and the PUC to issue procurements for renewable and clean energy.

What net metering policies has the state implemented over time? If relevant, how have they changed? To whom do they apply?

The Maine Public Utilities Commission (PUC) regulates residential electric rates¹⁵⁴ for 3 investor-owned utilities (IOUs): Central Maine Power (78% of state residential load), Versant Power – Bangor Hydro District (14%), and Versant Power – Maine Public District (4%). 10 cooperatives and municipal-owned utilities also file rates with the PUC and supply 4% of the residential load in sum. There are 272 licensed retail electricity providers¹⁵⁵, some of which only supply industrial electricity. IOUs in 2023¹⁵⁶ provided 6,073 GWh of electricity, which was over 53% of the state’s total energy (and energy providers were the other major group with 42%). Public providers made 233 GWh (2%) and coops made 112 GWh (1%). Main classes of customers include residential, commercial, and industrial customers¹⁵⁷.

¹⁵¹ Maine Governor’s Energy Office. (2025, January). Maine Pathways to 2040: Analysis and Insights.

<https://www.maine.gov/energy/sites/maine.gov.energy/files/2025-01/Maine%20Pathways%20to%202040%20Analysis%20and%20Insights.pdf>

¹⁵² Maine Governor’s Energy Office. (2025, January). *Maine Energy Plan: January 2025*.

<https://www.maine.gov/energy/sites/maine.gov.energy/files/2025-01/Maine%20Energy%20Plan%20January%202025.pdf>

¹⁵³ Maine Legislature. (2025). *SP0738 LD 1881 – An Act To Support State Energy Goals*.

<https://legislature.maine.gov/legis/bills/getPDF.asp?paper=SP0738&item=3&snum=132>

¹⁵⁴ Maine Public Utilities Commission. (n.d.). *Electricity Delivery Rates*. <https://www.maine.gov/mpuc/regulated-utilities/electricity/delivery-rates>

¹⁵⁵ Maine Public Utilities Commission. (n.d.). *Maine Retail Electricity Suppliers*. <https://www.maine.gov/mpuc/regulated-utilities/electricity/maine-retail-electricity-suppliers/all-suppliers>

¹⁵⁶ Maine Governor’s Energy Office. (n.d.). *Solar Distributed Generation Initiatives*. <https://www.maine.gov/energy/initiatives/renewable-energy/solar-distributed-generation>

¹⁵⁷ U.S. Energy Information Administration. (n.d.) <https://www.eia.gov/electricity/state/Maine/xls/SEP%20Tables%20for%20ME.xlsx>

Per the Maine Governor’s Energy Office¹⁵⁸, as of April 2025, Maine’s solar size was 1,589 MWac and 16,969 projects. In 2023, over 9% of the total electric power industry capacity and over 4% of total electricity generation in Maine was provided by solar¹⁵⁹.

The 2019 Public Law, Chapter 478 (LD 1711¹⁶⁰), “An Act to Promote Solar Energy Projects and Distributed Generation Resources in Maine”, defined two programs to support the development of renewable energy: Net Energy Billing (NEB) and Distributed Generation (DG) for renewable generators up to 5 MW. Generators must be located on a customer’s property or another property in the same utility service territory.

Net Energy Billing (NEB)¹⁶¹ in Maine is available for residential, commercial, and industrial customers. Bill credits are issued for excess energy not consumed on-site. The NEB program includes both solar that customers own themselves and community solar. There are 2 NEB pathways: the kWh Credit program and the Tariff Rate program. The kWh Credit program is available to all electric utility customers; customers receive a kWh credit for every kWh provided to the grid. The kWh credits offset future charges during periods of net consumption, but the customer’s bill can’t go below \$0, and credits expire after 12 months. The Tariff Rate program is only available to non-residential customers. Tariff Rate customers receive dollar credits at a rate the Maine Public Utilities Commission (PUC) sets annually. Like the kWh Credit, one’s bill can’t drop below \$0 in a billing period, and credits expire after 12 months.

The Distributed Generation (DG) programs¹⁶² outlined by 2019 Public Law, Chapter 478 have undergone many changes in a short time. Shortly after the PUC solicited competitive proposals¹⁶³ for distributed generation resources in 2020 pursuant to 2019 Public Law, Chapter 478¹⁶⁴, the PUC halted the solicitation¹⁶⁵ because proposals did not meet standards. In 2021 LD 936¹⁶⁶ established a Distributed Generation Stakeholder Group tasked with considering other distributed generation programs. Their 2023 Final Report¹⁶⁷ outlined proposals for new competitive procurements, community access, and consideration of energy storage. Later in 2023, LD 1986¹⁶⁸ established that a future Distributed Generation program for solar and storage would use federal

¹⁵⁸ Maine Governor’s Energy Office. (n.d.). *Solar Distributed Generation Initiatives*. <https://www.maine.gov/energy/initiatives/renewable-energy/solar-distributed-generation>

¹⁵⁹ U.S. Energy Information Administration. (n.d.). *Maine – State Electricity Profile*. <https://www.eia.gov/electricity/state/Maine/>

¹⁶⁰ Maine Legislature. (2019). *Public Law Chapter 478: An Act To Promote Renewable Energy Resources*. https://legislature.maine.gov/legis/bills/bills_129th/chapters/PUBLIC478.asp

¹⁶¹ Maine Public Utilities Commission. (n.d.). *Net Energy Billing (NEB)*. <https://www.maine.gov/mpuc/regulated-utilities/electricity/neb>

¹⁶² Maine Public Utilities Commission. (n.d.). *Distributed Generation (DG) Renewable Programs*. <https://www.maine.gov/mpuc/regulated-utilities/electricity/renewable-programs/dg>

¹⁶³ Maine Public Utilities Commission. (n.d.). *Distributed Generation Procurement – Awarded Contracts*. <https://www.maine.gov/mpuc/regulated-utilities/electricity/rfp-awarded-contracts/dg-procurement>

¹⁶⁴ Maine Legislature. (2019). *Public Law Chapter 478: An Act To Promote Renewable Energy Resources*. https://legislature.maine.gov/legis/bills/bills_129th/chapters/PUBLIC478.asp

¹⁶⁵ Maine Public Utilities Commission. (n.d.). *Report on Public Law 2019 Chapter 478 (Distributed Generation)*. <https://www.maine.gov/mpuc/sites/maine.gov/mpuc/files/inline-files/PUC-Report-PL-2019-ch-478-%28DG%29.pdf>

¹⁶⁶ Maine Legislature. (2021). *HP0692 LD 923 – An Act To Expand Maine’s Clean Energy Economy*. <https://legislature.maine.gov/bills/getPDF.asp?paper=HP0692&item=6&snum=130>

¹⁶⁷ Maine Governor’s Energy Office. (n.d.). *Final Report of the Distributed Generation Stakeholder Group with Appendix*. https://www.maine.gov/energy/sites/maine.gov/energy/files/inline-files/Final%20Report%20of%20the%20DG%20Stakeholder%20Group_with%20appendix.pdf

¹⁶⁸ Maine Legislature. (2023). *SP0815 LD 2044 – An Act To Update the Net Energy Billing Program*. <https://www.mainelegislature.org/legis/bills/getPDF.asp?paper=SP0815&item=3&snum=131>

funds, such as through Maine’s Solar for All Proposal (see below).

Several amendments have been issued to the NEB and DG programs. 2021 Public Law, Chapter 390 (LD 936¹⁶⁹) amended NEB and DG by setting the DG goal to 750 MW, limited the 2-5 MW systems eligible for NEB, and determined that 2024 was the end date for eligibility of DG programs for NEB. 2023 Public Law, Chapter 411 (LD 1986¹⁷⁰) further limited the eligibility of 1-2 MW generators and updated eligibility for the Tariff rate program.

Additional proposals to reform NEB policies and rates were introduced in the Maine Legislature in spring 2025¹⁷¹. By June 2025, multiple bills were passed related to rate structures, as well as others on renewable and clean energy¹⁷² and allocation of related funding¹⁷³¹⁷⁴. To lower consumer electricity costs, LD 839¹⁷⁵ prohibited including kilowatt-hour credit program costs in transmission/distribution utility rates and established a Net Energy Billing Cost Stabilization Fund. LD 905¹⁷⁶ updated the processes for unused net energy billing kilowatt-hour credits, including their remittance to benefit individuals receiving low-income assistance. LD 1792¹⁷⁷ restructured the aggregate customer classes for IOUs and the rate design for recovering stranded costs until July 2028, notably increasing by 10% the cost allocation to residential, small & medium commercial customers and an equal monetary reduction from large commercial customers. LD 1777¹⁷⁸ changed nonresidential customer net energy billing rates from a rate schedule to a “just and reasonable” rate allowance that must not exceed 1.5 times the average tariffs for other states in the region.

In addition to net energy billing, all Maine electric customers can purchase local renewable energy for their home and business by enrolling in Maine Green Power¹⁷⁹. The program purchases Renewable Energy Certificates (REC) from the renewable energy facility in Maine on the customer’s behalf, and a set block charge is an added line item on the customer’s monthly bill. Maine Green Power does not count toward Maine’s Renewable Portfolio Standard (RPS) of statewide minimum renewable energy use.

Maine’s Solar for All Proposal was selected by the EPA for a \$62 million grant for technical and financial

¹⁶⁹ Maine Legislature. (2021). *HP0692 LD 923 – An Act To Expand Maine’s Clean Energy Economy*. <https://legislature.maine.gov/bills/getPDF.asp?paper=HP0692&item=6&snum=130>

¹⁷⁰ Maine Legislature. (2023). *SP0815 LD 2044 – An Act To Update the Net Energy Billing Program*. <https://www.mainelegislature.org/legis/bills/getPDF.asp?paper=SP0815&item=3&snum=131>

¹⁷¹ Mainely Energy. (2025, April 11). *List of proposals to reform Maine’s clean energy program continues to grow*. <https://mainemorningstar.com/2025/04/11/list-of-proposals-to-reform-maines-clean-energy-program-continues-to-grow/>

¹⁷² Maine Legislature. (2025). *LD 1868 – An Act Relating to Energy Policy* (via LegiScan). <https://legiscan.com/ME/bill/LD1868/2025>

¹⁷³ Maine Legislature. (2025). *LD 210 – An Act Concerning Solar Development* (via LegiScan). <https://legiscan.com/ME/bill/LD210/2025>

¹⁷⁴ Maine Legislature. (2025). *LD 609 – An Act Relating to Solar Access and Equity* (via LegiScan). <https://legiscan.com/ME/bill/LD609/2025>

¹⁷⁵ Maine Legislature. (2025). *LD 839 – An Act Regarding Community Solar Participation* (via LegiScan). <https://legiscan.com/ME/bill/LD839/2025>

¹⁷⁶ Maine Legislature. (2025). *LD 905 – An Act To Support Solar Workforce Development* (via LegiScan). <https://legiscan.com/ME/bill/LD905/2025>

¹⁷⁷ Maine Legislature. (2025). *LD 1792 – An Act To Expand Renewable Energy Goals* (via LegiScan). <https://legiscan.com/ME/bill/LD1792/2025>

¹⁷⁸ Maine Legislature. (2025). *LD 1777 – An Act Regarding Distributed Energy Resources Planning* (via LegiScan). <https://legiscan.com/ME/bill/LD1777/2025>

¹⁷⁹ Maine Public Utilities Commission. (n.d.). *Green Power Program*. <https://www.maine.gov/mpuc/regulated-utilities/electricity/renewable-programs/green-power>

assistance for low-income and disadvantaged households to access solar and energy storage¹⁸⁰. The program has not yet been implemented; Maine lost and regained access to the fund in early 2025, and remains in the planning stages pending further guidance from the EPA¹⁸¹.

Efficiency Maine Trust is the independent, quasi-state agency established to plan and implement energy efficiency programs in Maine¹⁸². While Solar Electric¹⁸³ is not currently offering state rebates for solar projects, customers can earn incentives in Maine's Small Battery Management Program¹⁸⁴. This pays residential or volumetric small commercial customers to share electricity from their batteries when there is high demand on the electric grid at \$100 for each kW of discharge during events. Commercial, nonprofits, institutions, and government customers with demand metering are eligible to participate in Energy Storage System Projects¹⁸⁵, which provide \$200/kW during events for up to 5 years, with \$4,000-600,000 per project per year.

What are the current value considerations for distributed solar + storage?

Energy value

ISO New England, which operates the grid, administrates markets, and plans power systems for New England, reported that behind-the-meter solar reduced net load in New England by over 3% in 2023 and projected a reduction of over 4% in 2025¹⁸⁶.

In Maine specifically, the typical electric customer implementing energy storage could save an average of \$1.50-1.77 per month over the first ten years¹⁸⁷. At 2025 rates of \$0.23-26 per kWh, the dollar savings corresponds to approximately 5.85-7.7 kWh in energy savings per customer per month¹⁸⁸.

Capacity value

Maine's total cumulative capacity of installed solar projects was 1,589 MWac in April 2025¹⁸⁹. Solar energy development in Maine through 2024 was estimated to provide a capacity benefit of \$2.66 million¹⁹⁰. In December 2024, 63.1 MW of energy storage capacity were operating in the state¹⁹¹.

¹⁸⁰ Maine Governor's Energy Office. (n.d.). *Solar for All Initiative*. <https://www.maine.gov/energy/initiatives/infrastructure/solar-for-all>

¹⁸¹ Maine Public. (2025, March 5). *Feds restore Maine's Solar for All grant funding*. <https://www.maine-public.org/climate/2025-03-05/feds-restore-maine-solar-for-all-grant-funding>

¹⁸² Efficiency Maine. (n.d.). *About Efficiency Maine*. <https://www.energymaine.com/about/>

¹⁸³ Efficiency Maine. (n.d.). *Solar Electric (Photovoltaic) Systems*. <https://www.energymaine.com/renewable-energy/solar-electric/>

¹⁸⁴ Efficiency Maine. (n.d.). *Small Battery Management*. <https://www.energymaine.com/small-battery-management/>

¹⁸⁵ Efficiency Maine. (n.d.). *Energy Storage System Projects*. <https://www.energymaine.com/energy-storage-system-projects/>

¹⁸⁶ [2024 CELT Report](#)

¹⁸⁷ Maine Governor's Energy Office. (2024, February 26). *Energy Storage Program Recommendations*. https://www.maine.gov/energy/sites/maine.gov/energy/files/inline-files/GEO%20Energy%20Storage%20Program%20Recommendations_Feb%2026_2024.pdf

¹⁸⁸ Maine Public Utilities Commission. (n.d.). *Electricity Delivery Rates*. <https://www.maine.gov/mpuc/regulated-utilities/electricity/delivery-rates>

¹⁸⁹ Maine Governor's Energy Office. (n.d.). *Solar Distributed Generation*. <https://www.maine.gov/energy/initiatives/renewable-energy/solar-distributed-generation>

¹⁹⁰ Maine Public Utilities Commission. (2024). *Cost-Benefit Analysis of Maine's Solar Program, Year 2024*. https://www.maine.gov/mpuc/sites/maine.gov/mpuc/files/inline-files/Maine-Solar-Y2024_CBA_Final%20V3.pdf

¹⁹¹ Maine Governor's Energy Office. (n.d.). *Energy Storage Initiatives*. <https://www.maine.gov/energy/initiatives/renewable-energy/energy-storage>

Environmental value

In 2023, Maine's emissions in lbs/MWh were 0.7 each for sulfur dioxide and for nitrogen oxide and 428 for carbon dioxide¹⁹². Modeling in the 2024 Maine Energy Storage Program Recommendations indicated that battery systems could reduce carbon dioxide emissions by 500-100 short tons/MW over 20 years¹⁹³.

Greenhouse gas and environmental benefits of Maine's solar projects in 2024 were estimated at \$50.51 million¹⁹⁴.

Demand reduction value

In 2024, Maine's energy price suppression benefit, including energy demand reduction-induced price effects and reducing demand for gas-generated electricity, was \$67.11 million from a societal perspective and \$9.13 million from a ratepayer perspective¹⁹⁵. Avoided capacity buyout costs to meet peak demands also are a corresponding benefit of solar.

Locational system relief value

Transmission and distribution benefits of solar for Maine in 2024 were estimated at \$74.44 million. Regionally, in 2024, solar and battery storage made up 56% (22.3GW) of the capacity of interconnection proposals to the ISO-New England¹⁹⁶. While this appears inverse to how locational system relief value is usually expressed, the high import rate of Maine's energy (10-30%¹⁹⁷) means that solar and storage both regionally and locally would both offset Maine's dependence on imported natural gas and also bring Maine's energy production closer to home.

Are there any outstanding controversies?

Concern about the cost of electricity in Maine is tied to its sourcing of electricity. Maine's electricity prices increased 55% from 2014-2024¹⁹⁸, more than twice the national average and the third fastest rate in the country. Maine generates the 6th-lowest amount of electricity in the US¹⁹⁹, but Maine's electricity prices are

¹⁹² Maine Governor's Energy Office. (n.d.). *Energy Storage Program Recommendations Initiatives*.

<https://www.eia.gov/electricity/state/Maine/xls/SEP%20Tables%20for%20ME.xlsx>

¹⁹³ Maine Governor's Energy Office. (2024, February 26). *Energy Storage Program Recommendations*

https://www.maine.gov/energy/sites/maine.gov/energy/files/inline-files/GEO%20Energy%20Storage%20Program%20Recommendations_Feb%2026.2024.pdf

¹⁹⁴ Maine Public Utilities Commission. (2024). *Cost-Benefit Analysis of Maine's Solar Program, Year 2024*

https://www.maine.gov/mpuc/sites/maine.gov/mpuc/files/inline-files/Maine-Solar-Y2024_CBA_Final%20V3.pdf

¹⁹⁵ Maine Public Utilities Commission. (2024). *Cost-Benefit Analysis of Maine's Solar Program, Year 2024*

https://www.maine.gov/mpuc/sites/maine.gov/mpuc/files/inline-files/Maine-Solar-Y2024_CBA_Final%20V3.pdf

¹⁹⁶ Maine Governor's Energy Office. (2024, February 26). *Energy Storage Program Recommendations*

https://www.maine.gov/energy/sites/maine.gov/energy/files/inline-files/GEO%20Energy%20Storage%20Program%20Recommendations_Feb%2026.2024.pdf

¹⁹⁷ U.S. Energy Information Administration. (2024, November 21). *Maine: State energy profile overview*.

<https://www.eia.gov/state/analysis.php?sid=ME>

¹⁹⁸ Turkel, T. (2025, April 27). *Maine's electricity prices grew at the third fastest rate in the country*. The Maine Monitor.

<https://www.newscentermaine.com/article/news/regional/the-maine-monitor/maine-electricity-utility-prices-grew-third-fastest-rate-analysis/97-5644ceec-e7cb-4249-9c66-846af65156e1>

¹⁹⁹ U.S. Energy Information Administration. (2024, November 21). *Maine: State energy profile overview*.

<https://www.eia.gov/state/analysis.php?sid=ME>

the 6th highest in the US²⁰⁰. As recently as 2023, Maine had an energy generation deficit such that 10-30% of its electricity was imported from the US and Canada²⁰¹. In the energy mix, Maine gets 30% of its electricity power from natural gas²⁰²; Maine's history of reliance on natural gas dates back 25 years. As the political winds have shifted, however, new pipeline projects have received opposition that led to their abandonment, including the \$3 billion Northeast Energy Direct in 2016 that would have added to Maine's supply²⁰³.

The Net Energy Billing program has been characterized as well-intentioned but carrying harmful side effects, and policymakers are on the fence²⁰⁴ about whether to scrap it²⁰⁵ or reform the program²⁰⁶. Some legislators described the program as growing too large too quickly and that it became a "job-killing solar tax". Analyses from the Office of the Public Advocate estimated a ratepayer cost of net billing projects to be over \$240 million²⁰⁷, whereas the PUC estimated a net benefit to ratepayers²⁰⁸. The Maine Policy Institute called for NEB reform in 2024²⁰⁹, as did community members and small business owners who highlighted that the Tariff Rate program attracted large businesses from out of state and added to ratepayer costs²¹⁰. Other industry voices²¹¹ favored reform in recognition of the growing energy demands of the state and the growth of the renewable energy sector in Maine.

MARYLAND

What are the state's key energy policies?

- 2004: Renewable Portfolio Standard²¹² – Established a requirement for 7.5% of renewable resources by 2019. The RPS was amended 10 times by 2022²¹³.
- 2008: Climate Action Plan²¹⁴ – Set incremental goals toward a 90% reduction in 2006 greenhouse gas levels by 2050. Mandated a science-based review of the goals every 4 years.
- 2009: Regional Greenhouse Gas Initiative²¹⁵ – A market-based regulatory program was formed to stabilize and reduce greenhouse gas emissions such as CO₂ in the power sector using a cap-and-

²⁰⁰ U.S. Energy Information Administration. (2025, April). *Average price of electricity to ultimate customers by end-use sector, by state* (Table 5.6.A). https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a

²⁰¹ U.S. Energy Information Administration. (2024, November 21). *Maine: State energy profile overview*. <https://www.eia.gov/state/analysis.php?sid=ME>

²⁰² U.S. Energy Information Administration. (2024, November 21). *Maine: State energy profile overview*. <https://www.eia.gov/state/analysis.php?sid=ME>

²⁰³ Bell, T. (2016, April 27). *Hearings begin Thursday on plan to expand natural gas pipeline capacity*. Portland Press Herald.

<https://www.pressherald.com/2016/04/27/hearings-begin-thursday-on-plan-to-expand-natural-gas-pipeline-capacity/>

²⁰⁴ Hilton, A. (2025, February 27). *Many believe Maine's net energy billing needs reform, but diverge on whether to tweak or toss*. Maine Morning Star. <https://mainemorningstar.com/2025/02/27/many-believe-maines-net-energy-billing-needs-reform-but-diverge-on-whether-to-tweak-or-toss/>

²⁰⁵ Fischer, A. (2025, February 24). *Net metering under fire in Maine*. PV Magazine USA. <https://pv-magazine-usa.com/2025/02/24/net-metering-under-fire-in-maine/>

²⁰⁶ <https://mainemorningstar.com/2025/04/11/list-of-proposals-to-reform-maines-clean-energy-program-continues-to-grow/>

²⁰⁷ <https://legislature.maine.gov/legis/bills/getTestimonyDoc.asp?id=184431>

²⁰⁸ [Costs and Benefits of Net Energy Billing \(NEB\)](#)

²⁰⁹ [Net Energy Billing: Isn't it time for reform? - Maine Policy Institute](#)

²¹⁰ [Opinion: Don't throw solar energy out with net energy billing bathwater](#)

²¹¹ [Maine's energy future should include improved net energy billing system](#)

²¹² [A review of the impacts of power plants and transmission lines on Maryland's natural resources](#)

²¹³ <https://www.psc.state.md.us/electricity/wp-content/uploads/sites/2/MD-RPS-Fact-Sheet-2.pdf>

²¹⁴ <https://msa.maryland.gov/megafile/msa/speccol/sc5300/sc5339/000113/005000/005152/unrestricted/20080043e.pdf>

²¹⁵ [Elements of RGGI | RGGI, Inc.](#)

trade approach. State emissions budgets were established.

- 2009: Greenhouse Gas Emissions Reduction Act²¹⁶ – Required 25% reduction in greenhouse gases from 2006 levels by 2020.
- 2010: Generating Clean Horizons Initiative²¹⁷ – Enabled Power Purchase Agreements of utility-scale renewable developments.
- 2016: Greenhouse Gas Emissions Reduction Act Reauthorization²¹⁸ – Set a goal of a 40% reduction in greenhouse gases from 2006 levels by 2030.
- 2019: Clean Energy Jobs Act²¹⁹ – Increased the solar Renewable Portfolio Standard to 50% by 2030 and the solar carve-out to 14.5% by 2030. State must conduct a study on achieving 100% renewable energy by 2040.
- 2021: 2030 Greenhouse Gas Emissions Reduction Act Plan²²⁰ – Proposed a Clean and Renewable Energy Standard (CARES).
- 2022: Climate Solutions Now Act²²¹ – Reduce state to zero emissions by 2045 and require 52.5% of electricity providers’ retail sales come from renewable energy by 2030. In addition, 14.5% of electricity sales must come from solar energy by 2030.
- 2023: Climate Pollution Reduction Plan²²² – Proposed policies to reduce greenhouse gases 60% by 2013 and achieve net zero by 2045.
- 2023: Maryland’s Climate Pathway²²³ – Outlines new policy steps to fill the gaps in projected greenhouse gas reduction to meet the 60% by 2031 goals.
- 2025: Renewable Energy Certainty Act²²⁴ – Support faster development of solar projects by creating uniform standards for siting and design, project requirements and compliance.

What net metering policies has the state implemented over time? If relevant, how have they changed? To whom do they apply?

The Maryland Public Services Commission regulates the service areas of 4 main investor-owned utilities, 4 cooperatives, and 5 municipal utilities²²⁵. Of the IOUs, Baltimore Gas & Electric (BGE) serves the biggest peak load demand served by electric suppliers in April 2025²²⁶ at 2,658 MW, followed by Potomac Electric Power at 1,307 MW, Potomac Edison at 458 MW, and Delmarva Power & Light at 298 MW. Broad customer classes include residential, commercial, and industrial classes.

As of 2023, electric utilities generated 7,637 MW of solar energy, comprising 0.17% of their electric power generation²²⁷. Solar net metering capacity was 1.02 GW as of 2023²²⁸.

²¹⁶<https://mde.maryland.gov/programs/air/ClimateChange/Documents/2030%20GGRA%20Plan/Appendices/Appendix%20A%20-%20The%20Greenhouse%20Gas%20Emissions%20Reduction%20Act%20of%202009.pdf>

²¹⁷<https://msa.maryland.gov/megafile/msa/speccol/sc5300/sc5339/000113/012000/012166/unrestricted/20100044e.docx>

²¹⁸ [2016 Regular Session - Senate Bill 323 Third Reader](#)

²¹⁹ <https://mgaleg.maryland.gov/2019RS/bills/sb/sb0516E.pdf>

²²⁰ [2030 GGRA Plan](#)

²²¹ [2022 Regular Session - Senate Bill 528 Chapter](#)

²²² [Maryland's Climate Pollution Reduction Plan](#)

²²³ [Maryland's Climate Pathway Report](#)

²²⁴ [Senate Bill 931 Enrolled](#)

²²⁵ <https://opc.maryland.gov/Portals/0/Images/MDfull.jpg?ver=e1qMiW9zon0FXQOg-w-mZg%3d%3d>

²²⁶ <https://www.psc.state.md.us/electricity/wp-content/uploads/sites/2/Electric-Choice-Enrollment-04-2025-April.xlsx>

²²⁷ <https://www.eia.gov/electricity/state/Maryland/xls/SEP%20Tables%20for%20MD.xlsx>

²²⁸ [Report on the Status of Net Energy Metering In the State of Maryland Prepared by the Public Service Commission of Maryland Prepa](#)

Solar net metering in Maryland²²⁹ has undergone incremental adjustments since it started in 1997, and now compensates residential and commercial customers with systems up to 5 MW (CH581/HB 440 2022²³⁰). Customers are compensated on their electricity bills for their offset energy consumption and excess generation either with a 1:1 kWh credit or retail rate dollar credit. Credits can now roll over indefinitely (SB143 2023²³¹) unless customers want to have their balance of credits for excess generation paid out at an annual true-up; in this case, credits are paid at a commodity rate often less than retail rate. There is no limit to the electricity credited to one's account through net metering. Electric utilities cannot charge other fees associated with net metering. Customers also earn Renewable Energy Credits for every 1,000 kWh generated and have 3 years to sell the credit. Maryland's net metering program is limited to 3,000 MW (HB 569 2021²³²) of capacity statewide; 1,033 MW were installed as of January 2023²³³.

The Community Solar Energy Generating Program was approved in 2015 (HB 1087²³⁴), and a pilot program birthing 139 community solar projects and 204 MW of capacity ran through 2024²³⁵. A permanent Community Solar program was passed in 2023 (HB 908²³⁶) for implementation in 2025 and 2026. Residential and commercial customers of BGE, Delmarva Power, Pepco, or Potomac Edison can pay a subscription fee to a buy share of a community solar project in their service territory²³⁷. Customers receive dollar or kWh bill credits for each kWh of community solar electricity they subscribe to and these reduce kWh charges on the customer's electric bill²³⁸. Low- and moderate-income subscribers may receive discounts²³⁹. Community solar pilot program capacity contributed to the 3,000 MW net metering limit in the state²⁴⁰.

Net metering is not available for energy storage systems, but Maryland did offer a fully subscribed, first-come/first-served Energy Storage Tax Income Credit for residential and commercial customers through the end of 2024²⁴¹. A redesigned energy storage program is planned to launch in summer 2025.

What are the current value considerations for distributed solar + storage?

Energy value

6.98% of Maryland power was generated from solar in 2024²⁴². Maryland solar generation in 2020 was 1,859,976 MWh²⁴³. Further, Maryland Department of the Environment Solar page²⁴⁴ links customers to a PVWatts Calculator from NREL²⁴⁵ to estimate energy production with rooftop solar. Using default settings, an array centered in Baltimore City was estimated to generate 5,568 kWh/year (range 5,321-5,782 kWh/year). For comparison, an equal array in Seattle was estimated at 4,375 kWh/year (range 4,175-4,523).

²²⁹ [Residential Solar](#)

²³⁰ https://mgaleg.maryland.gov/2022RS/chapters_noln/Ch_581_hb0440T.pdf

²³¹ [Bill Text: MD SB143 | 2023 | Regular Session | Chaptered | LegiScan](#)

²³² [MD HB569 | 2021 | Regular Session | LegiScan](#)

²³³ [Residential Solar](#)

²³⁴ [Bill Text: MD HB1087 | 2015 | Regular Session | Chaptered | LegiScan](#)

²³⁵ [Community Solar Program - Electricity](#)

²³⁶ [Bill Text: MD HB908 | 2023 | Regular Session | Chaptered | LegiScan](#)

²³⁷ [Maryland Community Solar](#)

²³⁸ [Community Solar in Maryland](#)

²³⁹ [Maryland Community Solar](#)

²⁴⁰ [Net Metering](#)

²⁴¹ [Maryland Energy Storage Income Tax Credit](#)

²⁴² [MD SOLAR State](#)

²⁴³ [A review of the impacts of power plants and transmission lines on Maryland's natural resources](#)

²⁴⁴ [Solar](#)

²⁴⁵ [Solar Resource Data](#)

Capacity value

The total installed solar capacity by the end of 2024 was 2,416 MW, which is enough to power almost 289,000 homes²⁴⁶. 5.77% of Maryland homes had solar in 2024²⁴⁷.

Environmental value

Electricity generation accounted for 30% of Maryland's greenhouse gas emissions in 2017²⁴⁸; by 2020, greenhouse gases had been reduced by 36.7 MMTCO₂e, or 30%, from 2006 levels²⁴⁹. In addition to emissions, changing power generation sources could impact water resources, land use, and power generation byproducts²⁵⁰.

Demand reduction value

Added supply or reduced demand impacts of behind the meter solar can cause market price effects of between \$0.20-\$1.20 per MWh, based on scenarios in a 2018 modeling study²⁵¹.

Locational system relief value

According to calculations in 2018, projects can provide locational relief by avoiding distribution investments²⁵². For example, a 2 MW project that is locationally based and helps a utility avoid investing \$2 million in distribution could provide \$0.11 per kWh in benefits to the utility²⁵³.

Are there any outstanding controversies?

Who should have the authority to approve or deny solar projects?

The Renewable Energy Certainty Act was signed into law in late May 2025²⁵⁴, and has stirred up concern over threats to farmland²⁵⁵. The law only turns authority to approve or deny solar projects over to local jurisdictions after 5% of lands in a county's designated Priority Protection Areas are converted to solar. The agricultural community expressed worry that this will facilitate misallocation of lands²⁵⁶. Further, some counties lack Priority Protection Areas, so would not regain local input into land siting for solar²⁵⁷. As the implementation of this law moves forward, the economic and environmental impacts on communities will continue to be considered.

MASSACHUSETTS

What are the state's key energy policies?

- 2007: Governor Patrick announced a goal of 250 MW of solar power by 2017²⁵⁸. This goal was

²⁴⁶ [MD SOLAR State](#)

²⁴⁷ [MD SOLAR State](#)

²⁴⁸ [2030 GGRA Plan](#)

²⁴⁹ [Maryland's Climate Pathway Report](#)

²⁵⁰ [A review of the impacts of power plants and transmission lines on Maryland's natural resources](#)

²⁵¹ [Benefits and Costs of Utility Scale and Behind the Meter Solar Resources in Maryland](#)

²⁵² [Benefits and Costs of Utility Scale and Behind the Meter Solar Resources in Maryland](#)

²⁵³ [Locational Value of Distributed Energy Resources](#)

²⁵⁴ [Legislation - SB0931](#)

²⁵⁵ [UPDATE: Maryland Solar Bill Sparks Backlash from Local Leaders, Activists | Latest News | wbc.com](#)

²⁵⁶ [UPDATE: Maryland Solar Bill Sparks Backlash from Local Leaders, Activists | Latest News | wbc.com](#)

²⁵⁷ <https://www.eslc.org/update-renewable-energy-certainty-act-sb931-hb1036/>

²⁵⁸ [History of Solar in Massachusetts | MassSolar](#)

surpassed by 2013 and reset to 1600 MW by 2020²⁵⁹.

- 2008: Green Communities Act²⁶⁰ – Set 2020 goals of 25% of electric load to be provided by demand-side resources and 20% of load met through renewable and alternative energies²⁶¹.
- 2008: Global Warming Solutions Act²⁶² – Set 2020 emissions level to 10-25% below 1990 emissions levels, interim limits in 2030 and 2040, and 80% reduction by 2050.
- 2010: Determination of a Greenhouse Gas Limit for 2020²⁶³: Set emissions limit to 25% below 1990 levels.
- 2018: An Act to Advance Clean Energy²⁶⁴
 - Mandated the creation of a Clean Peak Energy Standard (CPS) by the Department of Energy Resources (DOER) to establish a minimum percentage of sales needing to come from qualified clean peak resources dispatched to the grid during seasonal peaks or that reduces load on the grid.
 - CPS Guidelines were released in 2020 and have been updated/reviewed²⁶⁵ periodically.
- 2020: Executive Order 569²⁶⁶ - Set greenhouse gas emissions limit of 45% below 1990 level by 2030.
- 2021: An Act Creating A Next-Generation Roadmap For Massachusetts Climate Policy²⁶⁷
 - Requires Secretary of the Executive Office of Energy and Environmental Affairs (EEA) to set an interim emissions limit and sector-specific sublimits every 5 years.
 - Emissions limits set to 50% reduction below 1990 level by 2030, 75% by 2040, and net zero emissions by 2050.
- 2022: Massachusetts Clean Energy and Climate Plan²⁶⁸ for 2025 and 2030 – Set emissions reductions to 33% by 2025 and 50% by 2030.
- 2024: An Act Promoting A Clean Energy Grid, Advancing Equity, And Protecting Ratepayers²⁶⁹ – [Reforms](#) clean energy siting and permitting processes, including equitable siting, improved environmental standards, and community engagement.

What net metering policies has the state implemented over time? If relevant, how have they changed? To whom do they apply?

The Massachusetts Department of Public Utilities (DPU) regulates 3 investor-owned electric utility companies²⁷⁰: Eversource, National Grid, and Unitil. The DPU has limited oversight over 41 communities²⁷¹ with established municipal light plants that provide services to their residents.

Maximum historical net loads of the IOUs as of December 2024 were 5.83 GW for Eversource, 5.13 GW for National Grid Massachusetts, 58.13 MW for National Grid Nantucket, and 102.39 MW for Unitil²⁷².

²⁵⁹ [Massachusetts Hits 2017 Solar Goal 4 Years Early](#)

²⁶⁰ [Session Law - Acts of 2008 Chapter 169](#)

²⁶¹ [Massachusetts Enacts Sweeping Energy Legislation](#)

²⁶² [Session Law - Acts of 2008 Chapter 298](#)

²⁶³ [Determination of Greenhouse Gas Limit for 2020](#)

²⁶⁴ [Bill H.4857 190th \(2017 - 2018\)](#)

²⁶⁵ [Clean Peak Energy Standard History of Program Development | Mass.gov](#)

²⁶⁶ [The Commonwealth of Massachusetts](#)

²⁶⁷ [Session Law - Acts of 2021 Chapter 8](#)

²⁶⁸ [Massachusetts Clean Energy and Climate Plan for 2025 and 2030](#)

²⁶⁹ [Session Law - Acts of 2024 Chapter 239](#)

²⁷⁰ [Net metering guide | Mass.gov](#)

²⁷¹ [Massachusetts municipally-owned electric companies | Mass.gov](#)

²⁷² [Net metering guide | Mass.gov](#)

In 2023, 24% of the state’s energy supply was generated by solar energy²⁷³, and by the end of 2024 this rose to 25.6%²⁷⁴. The state installed a total of 5,388 MW of solar by 2024²⁷⁵.

Massachusetts’ history of net metering²⁷⁶ started in 1981 when the Massachusetts Department of Public Utilities (DPU) created DPU 535 in response to the Public Utilities Regulatory Policy Act of 1978. DPU 535 determined that the avoided cost for renewable energy facilities under 30 kW was the retail electricity rate. Generating customers ran their meters backward when they exported electricity to the grid. In 1997, DPU/DTE 96-100²⁷⁷ increased eligibility from 30 kW to 60 kW.

Chapter 164 in 1997²⁷⁸ created the MA Renewable Energy Trust Fund²⁷⁹, supported by a non-bypassable, per-kWh charge to all IOU and municipal utility customers. The MA Clean Energy Center was created in 2009 to administer the fund with oversight from the Dept. of Energy Resources (DOER)²⁸⁰. Among other functions, the Fund provides credits and rebates to customers.

In 2008, the Green Communities Act²⁸¹ and its interpretation by DPU²⁸² imposed a load cap on net metering to total 1% of the company’s historic peak load, increased the net metering credit values, made 2 MW projects eligible, permitted credits to roll over and transfer, enabled virtual net metering, and allowed distribution companies to build, own, and operate solar facilities. Acts²⁸³ in 2010²⁸⁴, 2012²⁸⁵, 2014²⁸⁶, and 2016²⁸⁷ increased the private and public load caps. Acts in 2021²⁸⁸ and 2022²⁸⁹ expanded cap-exemptions for net metering. Chapter 239 in 2024²⁹⁰ directed the DPU to investigate additional net crediting solutions for net metering and solar facilities that are eligible for bill crediting.

The current net metering policy²⁹¹ covers any behind the meter electricity generation, including that generated by both on-site customer solar panels and community solar. Importing electricity spins the customer meter forward and exporting spins it backward. The customer is credited at \$ per kWh on their electric bill for billing period net exports. Solar generator capacity is limited to 2 MW for private facilities and 10 MW for public facilities (i.e. municipalities and governmental entities). Then, based on their capacity, generators fall into Class I, II, or III net metering facilities.

Each electric company has a separate cap for public and private net metering facilities in their general net metering programs based on a percentage of highest historical net load. The private cap is 7% and the public cap is 8%. Once the company cap is reached, new customers can’t participate in net metering. Select cap-

²⁷³ [Massachusetts Profile](#)

²⁷⁴ [Massachusetts – SEIA](#)

²⁷⁵ <https://seia.org/wp-content/uploads/2025/03/Massachusetts-1.pdf>

²⁷⁶ [History of Solar in Massachusetts | MassSolar](#)

²⁷⁷ <https://fileservice.eea.comacloud.net/V1.4.0/FileService.Api/file/FileRoom/dffbjbde>

²⁷⁸ [Session Law - Acts of 1997 Chapter 164](#)

²⁷⁹ [Massachusetts Renewable Energy Trust Fund](#)

²⁸⁰ [General Law - Part I, Title II, Chapter 23J, Section 9](#)

²⁸¹ [Net metering laws and regulations | Mass.gov](#)

²⁸² [History of Solar in Massachusetts | MassSolar](#)

²⁸³ [Net metering laws and regulations | Mass.gov](#)

²⁸⁴ [Session Law - Acts of 2010 Chapter 359](#)

²⁸⁵ [Session Law - Acts of 2012 Chapter 209](#)

²⁸⁶ [Acts of 2014 Chapter 251 - Session Laws](#)

²⁸⁷ [Acts of 2016 Chapter 75 - Session Law](#)

²⁸⁸ [Session Law - Acts of 2021 Chapter 8](#)

²⁸⁹ [Session Law - Acts of 2022 Chapter 179](#)

²⁹⁰ [Session Law - Acts of 2024 Chapter 239](#)

²⁹¹ [Net metering guide | Mass.gov](#)

exempt (renewable) facilities can still participate if they are a nameplate cap exempt facility or facility serving on-site load. As of May 2024, National Grid and Unitil had filled their private and public caps, and Eversource was approaching their limits as well²⁹².

Net metering credits can bring a bill down to \$0 and 0 kWh. Excess credits roll over to the next bill and never expire. Credits for solar generators differ depending on when they were applied for and granted. Per DPU 21-100 in 2024²⁹³, net metering credits can be sent to other accounts of different electric distribution companies.

Market net metering (Act 2016, Chapter 75²⁹⁴) differs from standard net metering in that it provides credits that are equal to 60% of net excess generation and per-kWh rates. This applies to all new solar projects, except where the customer is a municipality or governmental entity.

Credits are based on basic service charges, distribution, transmission, and transition charges. Basic service pricing for residential and small commercial & industrial customers defaults to a 6-month fixed-price option, but monthly is also available. Medium and large commercial & industrial customers default to a monthly pricing option and can also elect a 3-month fixed-price option.

Standalone systems that are constructed through the Solar Massachusetts Renewable Target (SMART) Program²⁹⁵ and that do not serve behind-the-meter load are not eligible for net metering but may be eligible for an Alternative On-Bill Credit (AOBC)²⁹⁶. Similarly, solar facilities that are on the waitlist for the cap allocation under net metering may generate AOBC²⁹⁷. The AOBC energy compensation value is set as the basic service rate per kWh for the system's rate class during the billing period. As a unique feature of the SMART Program, AOBC facilities are not subject to the same regulation as net metering facilities.

In addition, DPU 21-100 in 2024²⁹⁸ allowed municipal or state-owned facilities under 60 kW to qualify for the public cap, gives net metering cap exemption to private 60 kW to 2 MW and public 60 kW to 10 MW facilities that serve on-site load, and changed the Net Metering Recovery Surcharge (NMRS) to reduce costs of the program to ratepayers and promote bill transparency.

Per DPU 17-146-A in 2019²⁹⁹, some energy storage became eligible for net metering. All energy storage that can't export to the grid is eligible, but storage systems that export to the grid are only eligible if they only charge from the net metering facility but not the electrical grid³⁰⁰.

What are the current value considerations for distributed solar + storage?

Energy value

Energy exported to the grid is equivalent to 100% or 60% of retail value defined either monthly or during 3- or 6-month terms³⁰¹. For storage, a 4 MWh battery participating in the Clean Peak program could make \$140-

²⁹² <https://youtu.be/NUOG9oANc9w>

²⁹³ [Dashboard – Mass DPU Fileroom](#)

²⁹⁴ [Acts of 2016 Chapter 75 - Session Law](#)

²⁹⁵ [Solar Massachusetts Renewable Target \(SMART\) Program | Mass.gov](#)

²⁹⁶ <https://www.mass.gov/doc/alternative-on-bill-credit-faq/download>

²⁹⁷ [Net metering guide | Mass.gov](#)

²⁹⁸ [DPU Updates Net Metering Regulations | Mass.gov](#)

²⁹⁹ <https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/10333338>

³⁰⁰ [Energy storage and net metering | Mass.gov](#)

³⁰¹ [Acts of 2016 Chapter 75 - Session Law](#)

160/kW of gross margin³⁰².

Capacity value

Massachusetts reported 5,389 MW of solar installed through the end of 2024, which is enough to power almost 936,000 homes³⁰³. 1,843 MW of growth is projected over the next 5 years. Massachusetts had 569 MWh of electric storage capacity in 2023³⁰⁴.

Environmental value

The carbon emissions of electric power have dropped from 28.16 MMT <https://www.energy.gov/eere/solar/solar-and-resilience-basics> CO₂e in 1990 to 12.49 MMT CO₂e in 2021³⁰⁵. Modeling of the value of energy storage on emissions projected that storage could reduce the winter need for carbon-emitting energy generation from 27 TWh down to 9 TWh³⁰⁶. A separate study found that Massachusetts' solar potential was more than enough to support decarbonization needs³⁰⁷.

Demand reduction value

Battery storage during discharge events across summer 2023 reduced peak demand load by 24.5 MW on average³⁰⁸.

Locational system relief value

The Solar Massachusetts Renewable Target (SMART) program allows for location-based adders, but only for projects above 25 kW. These adders apply to the location of the system by type³⁰⁹: building, floating, brownfield, landfill, canopy, and agricultural land. These ranged from \$0.03-0.08/kWh in 2025³¹⁰.

Are there any outstanding controversies?

The delay in implementation of the 2022 expansion of some net-metering-eligible solar residential arrays from 10 kW to 25 kW until 2025 has limited the eligibility of some solar panels and frustrated customers³¹¹ who implemented larger arrays thinking that they would be covered in the intervening years. There is debate about whether the implementation of the 2022 Act should have included retroactive payments to such customers, although the DPU ultimately ruled against retroactive credits³¹².

Siting is also somewhat controversial, as some groups advocated against the development of lands for solar arrays as solar development was stalling in 2024³¹³. Related to land use, the DPU has issued recent exception updates to the single-parcel rule allowing only for generating equipment on a single parcel of land behind a single meter³¹⁴. The development of land use for solar and storage in Massachusetts is an emergent area.

³⁰² [Value of Distributed Energy Resources for Distribution System Grid Services](#)

³⁰³ [Massachusetts – SEIA](#)

³⁰⁴ [Massachusetts Clean Energy and Climate Metrics | Mass.gov](#)

³⁰⁵ [Massachusetts Clean Energy and Climate Metrics | Mass.gov](#)

³⁰⁶ [Charging Forward: Energy Storage in a Net Zero Commonwealth](#)

³⁰⁷ [Technical Potential of Solar Study | Mass.gov](#)

³⁰⁸ [Massachusetts Residential Energy Storage Demand Reduction Offering Evaluation](#)

³⁰⁹ [Using the SMART Solar Incentives Calculator : Clean Energy : Center for Agriculture, Food, and the Environment at UMass Amherst](#)

³¹⁰ [Solar Massachusetts Renewable Target \(SMART\) Straw Proposal | Mass.gov](#)

³¹¹ [Solar Snub: Thousands of Mass. solar customers denied retroactive payments as 2022 law takes effect](#)

³¹² [D.P.U. 23-140-A: Final Order & Apps. a & B](#)

³¹³ [As Massachusetts solar growth lags, stakeholders debate changes to state incentives](#)

³¹⁴ [Net metering guide | Mass.gov](#)

MINNESOTA

What are the state's key energy policies?

- 2001: Renewable Energy Objective³¹⁵ (216B.1691) – Electric utilities must make an effort to provide 10% of retail electricity sales from renewables by 2015, including 0.5% from biomass. Xcel Energy was required to meet the 10% standard.
- 2001: Minnesota B3 Benchmarking³¹⁶ – Benchmarked energy use in State buildings to help achieve sustainable goals and energy efficiency. Current tools use building and meter information to model usage, costs, and carbon emissions³¹⁷.
- 2007: Renewable Energy Standard³¹⁸ (216B.1691) – Replaced Renewable Energy Objective. Mandated 25% of utility electricity sales come from renewable resources by 2025, except Xcel at 30%.
- 2007: Next Generation Energy Act³¹⁹ – Set goal to reduce greenhouse gas emissions by 80% from 2005 level by 2050. Requires 1.5% annual retail sales reduction for electric and gas utilities starting in 2010 as an energy efficiency resource standard.
- 2013: Solar Energy Standard³²⁰ (216B. 1691, Subd. 2f) – Requires investor-owned electric utilities to generate at least 1.5% of electric sales from solar by 2020, and 10% by 2030.
- 2021: Energy Conservation and Optimization (ECO) Act³²¹ – Allowed utilities to optimize energy use through load management and fuel switching programs, raised energy savings goals for IOUs from 1.5 to 2.5%, doubled (+) low-income spending requirement for IOUs, enabled planning flexibility for municipal and co-op utilities.
- 2022: Climate Action Framework³²² – Outlines steps for Minnesota to achieve carbon neutrality by 2050. Goals³²³ include a standard for carbon-free electricity by 2040, upping the Renewable Energy Standard to 40% by 2025 and 55% by 2035, upgrading the grid and promoting renewables research & development, and supporting energy storage, among others.
- 2023: Senate File 4³²⁴ – Sets goal of 100% carbon-free electricity by 2040.
- 2024: Minnesota Energy Infrastructure Permitting Act³²⁵ – Streamlines large-scale energy projects at MPUC.

What net metering policies has the state implemented over time? If relevant, how have they changed? To whom do they apply?

33% of Minnesota's electricity came from renewable sources in 2024 for a total of 19.23TWh of renewable electricity³²⁶. Solar accounts for almost a third of Minnesota's 7.2 GW of renewable energy capacity. In 2023, the capacity of interconnected solar systems was 1,472 MW, with community solar gardens contributing 905

³¹⁵ [Sec. 216B.1691 MN Statutes](#)

³¹⁶ [B3 Benchmarking for Public Buildings / Minnesota Department of Commerce - Energy](#)

³¹⁷ [Building Data in your Hands](#)

³¹⁸ [Sec. 216B.1691 MN Statutes](#)

³¹⁹ [SF 145A Conference Committee Report - 85th Legislature \(2007 - 2008\)](#)

³²⁰ [Sec. 216B.1691 MN Statutes](#)

³²¹ [ECO - Energy Conservation and Optimization / Minnesota Department of Commerce](#)

³²² [Climate Action Framework](#)

³²³ <https://climate.state.mn.us/sites/climate-action/files/State%20action%20steps.pdf>

³²⁴ [https://assets.senate.mn/summ/bill/2023/0/SF4/Bill%20Summary%20-%20SF%204%20\(1st%20Engrossment\).pdf](https://assets.senate.mn/summ/bill/2023/0/SF4/Bill%20Summary%20-%20SF%204%20(1st%20Engrossment).pdf)

³²⁵ [Energy Infrastructure Permitting \(EIP\) / Public Utilities Commission](#)

³²⁶ [2025 ENERGY](#)

MW, while storage capacity was an additional 16.7 MW³²⁷.

Minnesota has 4 investor-owned, 47 cooperative, and 125 municipal electric utilities in operation³²⁸. The Minnesota Public Utilities Commission (MPUC) regulates 3 investor-owned electric utilities as well as municipal and cooperative utilities whose members opted in to rate regulation. In 2023, investor-owned utilities contributed 89.9% of the state's electric solar capacity³²⁹. Investor-owned utilities serve over 1.5 million customers³³⁰, municipal utilities serve 386,000 customers³³¹, and cooperatives serve about 853,000 customers. Customers are classed as residential, commercial, and industrial.

Net metering³³² compensation for distributed energy resources dates to 1983 and varies per the size of the system and per the type of utility. Solar generation systems up to 1 MW for IOU customers or 100 kW for cooperative or municipal utility customers choose their rate based on system qualifications. The average utility energy retail rate (total revenue less fixed charges, divided by annual kWh sales) is an option for all systems under 40 kW AC.

IOU customers with systems under 1 MW and cooperative/municipal customers with systems under 40 kW have the option of compensation under a simultaneous purchase and sale rate that is either a flat rate or time-of-day rate. These rates are based on a utility's avoided costs and are usually less than retail rates. To be eligible for simultaneous purchase and sale rates, a customer's solar energy production can't exceed 120% of their on-site energy use in combination with Community Solar Garden subscriptions, and solar systems must export energy with 65+% capacity during peak times. There are two options for calculating compensation: net metering and net billing. Net metering compensates based on the net electricity generated in a month after subtracting energy used on-site. Net billing calculates bills for consumption and credits for exports instantaneously.

On the other hand, set time of day rates are also an option for IOU systems under 1 MW and cooperative/municipal systems between 40 kW and 1 MW. Time of day rates are calculated from on-peak and off-peak costs based on avoided capacity cost averaged over on-peak hours.

To receive compensation, customers for systems under 40 kW can receive a check by mail or bill credits, and systems between 40 kW and 1 MW also qualify for banking their credits for later use. Customers with systems between 1 and 20 MW have the same full suite of options based on negotiated utility avoided cost rates.

Enacted in 2013, H.F. 729 required the Minnesota Department of Commerce (DOC) to develop a distributed solar value methodology³³³. The Value of Solar Tariff (VOST) methodology³³⁴ was submitted by 2014 and as of November 2024 was adopted by Minnesota Power and Xcel Energy in lieu of net metering. VOST also applied to all community solar gardens under a legacy rate. The VOST calculation centered on 10 factors including avoided costs related to the following values³³⁵: energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value.

³²⁷https://mn.gov/puc/assets/MN%20PUC%20DER%20in%20Minnesota%20graphics%20%28published%209-10-2024%29_tcm14-643877.pdf

³²⁸ [Idaho Fire Map](#)

³²⁹https://mn.gov/puc/assets/MN%20PUC%20DER%20in%20Minnesota%20graphics%20%28published%209-10-2024%29_tcm14-643877.pdf

³³⁰ <https://www.eia.gov/electricity/state/minnesota/xls/SEP%20Tables%20for%20MN.xlsx>

³³¹ [Minnesota Municipal Utilities Association](#)

³³² [Net Metering & Compensation / Public Utilities Commission](#)

³³³ [Value of Solar Tariff](#)

³³⁴ [Minnesota Value of Solar Methodology](#)

³³⁵ [Minnesota Value of Solar Methodology](#)

As an example of low- to moderate-income accommodations, Minnesota Power operates an Income Qualified Solar Program³³⁶ on a first-come-first-served basis for people with an income below 60% of the median who spend at least 3% of annual income on electric bills (program currently at capacity in May 2025³³⁷). Seniors and people living with a disability are automatically enrolled for a flat discount.

As of 2024, IOU customers can also receive \$/kWh incentives for battery storage up to 50 kWh paired with solar up to a maximum dollar cap³³⁸. Funds are available as first-come-first-served until June 30, 2027³³⁹. There is an Income Qualified Pilot Program as well as a carve-out for Tribal Nations.

Community solar gardens (CSG)³⁴⁰ are available to subscribe to for IOU customers, up to 120% of their annual electricity usage. Monthly solar credits are calculated by customer class based on fractions of annual average retail rates³⁴¹; bill credits must exceed or equal the subscription cost. 30% of each CSG is reserved for income-eligible households making under 150% median area income, and 25% additionally for income-eligible/affordable housing/public interest subscribers. Customers can apply through a Low and Moderate-Income Accessible Community Solar Garden Program. These projects are owned by private developers.

What are the current value considerations for distributed solar + storage?

Energy value

A 2019 Minnesota energy storage cost-benefit analysis³⁴² projected slightly lower energy prices in 2032 with high renewables, and an energy change savings value of ~\$200/kW-year in a solar-plus-storage model.

Capacity value

At the end of 2023, 24,310 Minnesota distributed energy resources totaled 1,538 MWac, including 1,470 MW of solar—400 MW of which is customer-sited and 905 MW of which is community solar gardens. 16.7 MW of energy storage are installed as well³⁴³.

The 2014 Value of Solar Tariff methodology estimated capacity value at an amortized \$86/kw-year of avoided generation capacity cost, \$13 avoided reserve capacity cost at 15% reserve capacity margin, and \$33 avoided transmission capacity cost³⁴⁴.

Environmental value

Renewable energy credits and solar renewable energy credits represent the value of environmental benefits associated with renewable energy production. Each credit unit is equal to 1 MWh, and customers own these credits from their system by default. The 2014 Value of Solar Tariff methodology estimated environmental externality costs at \$3.50/MMBtu in 2025, corresponding to a \$45 value of avoided environmental cost³⁴⁵.

Demand reduction value

The percent of customers with installed distributed energy resources ranges from 0.9-3.0% in the top 19

³³⁶ [Minnesota Power's Income Qualified Solar Program - Minnesota Power is an ALLETE Company](#)

³³⁷ <https://www.mnpower.com/CustomerService/CAREProgram>

³³⁸ [Energy Storage Incentives / Minnesota Department of Commerce](#)

³³⁹ [Eligibility and Guidelines / Minnesota Department of Commerce - Energy](#)

³⁴⁰ [Community Solar Gardens / Minnesota Department of Commerce - Energy](#)

³⁴¹ [Community Solar Gardens - For Consumers / Minnesota Department of Commerce - Energy](#)

³⁴² [Minnesota Energy Storage Cost-Benefit Analysis](#)

³⁴³ [DER Data Dashboard / Public Utilities Commission](#)

³⁴⁴ [Minnesota Value of Solar Methodology](#)

³⁴⁵ [Minnesota Value of Solar Methodology](#)

utilities in this category³⁴⁶. The 2014 Value of Solar Tariff methodology estimated peak load reduction value by avoided distribution values at peak, and calculated this to be \$14 annually in their example³⁴⁷. The 2019 Minnesota energy storage cost-benefit analysis projected a demand charge savings of ~\$230/kw-year for solar plus storage³⁴⁸.

Locational system relief value

The 2014 Value of Solar Tariff methodology names location-specific costs as an alternative to system-wide distribution costs incorporating distribution costs for each planning area, distribution loads, peak load growth rates and capital costs, local fleet production shapes, and area capital investments³⁴⁹. This inclusion is important because of the order-of-magnitude population and distributed energy resource differences between zip codes in MN³⁵⁰.

Are there any outstanding controversies?

Is current net metering compensation for co-ops and municipal utilities inequitable?

Minnesota is the only state in the country³⁵¹ requiring municipal and cooperative electric utilities to compensate distributed generation at a retail rate, which industry and government representatives argue shifts costs unfairly to non-generating utilities members. Critics argue that the compensation structure also incentivizes overbuilding of solar arrays used for community solar. Bill HF845³⁵² was introduced to the 2025-2026 Legislature to change the compensation structure for IOU generators under 1,000 kW and municipal/co-op generators under 40 kW. HF845 includes provisions for compensation structures based on avoided costs and as kWh credits, in addition to compensation at average retail rates. Opponents of the bill warn it could crush the solar industry, while others argue it is based on too little data of cost-shifting.

NEW YORK

What are the state's key energy policies?

- 2009 - The New York State Energy Planning Board³⁵³ was established to develop a State Energy Plan.
- 2014 – Article 6 of the Energy Law³⁵⁴ established a State Energy Planning Board to create a State Energy Plan. Goals of the policy and programs were:
 - Improve reliability of state's energy systems
 - Insulating consumers from market price volatility
 - Reduce overall cost of energy in the state
 - Minimize public health and environmental impacts, especially environmental impacts related to climate change.
 - Note: The Energy Plan must comply with Article 15A of the executive law concerning utilization and participation of certified minority and women-owned business enterprises.

³⁴⁶https://mn.gov/puc/assets/MN%20PUC%20DER%20in%20Minnesota%20graphics%20%28published%209-10-2024%29_tcm14-643877.pdf

³⁴⁷ [Minnesota Value of Solar Methodology](#)

³⁴⁸ [Minnesota Energy Storage Cost-Benefit Analysis](#)

³⁴⁹ [Minnesota Value of Solar Methodology](#)

³⁵⁰ [DER Data Dashboard / Public Utilities Commission](#)

³⁵¹ [Energy committee sends proposed solar metering changes to House Floor - Session Daily - Minnesota House of Representatives](#)

³⁵² [HF 845 Status in the House for the 94th Legislature \(2025 - 2026\)](#)

³⁵³ [New York State Energy Plan Process](#)

³⁵⁴ <https://www.nysenate.gov/legislation/laws/ENG/6-102>

- 2015 - The New York State Energy Plan³⁵⁵ was published, setting 2030 goals of 40% reduction in greenhouse gas (GHG) emissions from 1990 levels, 50% of electricity generated by renewables, and a 600 trillion Btu increase in energy efficiency from 2012 levels.
- 2017 – Public Service Law Section 74³⁵⁶ required the New York State Public Service Commission (PSC) to establish a statewide energy storage goal for 2030 and a deployment strategy.
- 2018 – The Department of Public Service (DPS) and New York State Energy Research and Development Authority (NYSERDA) published the “New York State Energy Storage Roadmap and DPS/NYSERDA Recommendations”³⁵⁷ outlining analysis and recommendations for customer-sited, distribution system, and bulk system energy storage to achieve 1.5GW by 2025 and 3 GW by 2030.
- 2018 - PSC issued the Order Establishing Energy Storage Goal and Deployment Policy (Energy Storage Order)³⁵⁸ that detailed programs to develop and deploy 3GW energy storage by competitive solicitations by investor-owned utilities (IOUs).
- 2019 - The Climate Leadership & Community Protection Act (Climate Act)³⁵⁹ was passed and published. This law aims to reduce greenhouse gas emissions, promote climate change mitigation and adaptation, advance climate justice, and help grow the state’s economy. It includes 100% zero-emission electricity by 2040.
- 2020 - State Energy Plan was updated³⁶⁰ to comply with the Climate Act.
- 2021 - Governor Hochul expanded the distributed solar program³⁶¹ from 6GW to 10GW.
- 2022 – PSC approved the NYSEERDA and DPS solar roadmap for 10GW of distributed solar by 2030³⁶².
- 2022 - Governor Hochul directed an update of Energy Storage Roadmap³⁶³ to a deployment of 6GW of energy storage by 2030.
- 2022 - New York State Climate Action Council finalized the Scoping Plan³⁶⁴, which includes recommendations and actions to meet Climate Act goals such as a NY economywide greenhouse gas reduction of 40% from 1990 levels by 2030 and 85% reduction by 2050. The State Energy Plan will be updated in accordance.
- 2022 - NY Department of Public Service (DPS) and NY State Energy Research and Development Authority (NYSERDA) filed “New York’s 6 GW Energy Storage Roadmap: Policy Options for Continued Growth in Energy Storage”³⁶⁵. This recommends actions for 6GW bulk energy storage goal by 2030, indicating 12GW of storage needed to reach 2040 decarbonized and reliable electric system and 17GW by 2050. It also recommends updates to programs in the Energy Storage Order.
- 2024 - DPS & NYSEERDA filed an update to 2022 Roadmap updating recommendations for inflation³⁶⁶.
- 2024 - NY PSC “Grid of the Future”³⁶⁷ proceeding enables Department of Public Service Staff to study grid for current and future capabilities for renewables.

³⁵⁵ [2015 New York State Energy Plan](#)

³⁵⁶ <https://www.nysenate.gov/legislation/laws/PBS/74>

³⁵⁷ <https://www.ethree.com/wp-content/uploads/2018/06/NYS-Energy-Storage-Roadmap-6.21.2018.pdf>

³⁵⁸ [STATE OF NEW YORK PUBLIC SERVICE COMMISSION CASE 18-E-0130 - In the Matter of Energy Storage Deployment Program. ORDER ESTABLISH](#)

³⁵⁹ [NY State Senate Bill 2019-S6599](#)

³⁶⁰ [New York State Energy Plan](#)

³⁶¹ [Governor Hochul Announces Expanded NY-Sun Program to Achieve at Least 10 Gigawatts of Solar Energy by 2030](#)

³⁶² [Governor Hochul Announces Approval of New Framework to Achieve at Least Ten Gigawatts of Distributed Solar by 2030 - NYSEERDA](#)

³⁶³ [Governor Hochul Announces New Framework to Achieve Nation-Leading Six Gigawatts of Energy Storage by 2030](#)

³⁶⁴ [Scoping Plan - New York’s Climate Leadership & Community Protection Act](#)

³⁶⁵ [New York’s 6 GW Energy Storage Roadmap](#)

³⁶⁶ [Updated Order for Energy Storage Goal, 6/20/2024](#)

³⁶⁷ [Grid of the Future Proceeding](#)

- 2024 - NYS PSC Order Establishing Updated Energy Storage Goal and Deployment Policy³⁶⁸ sets interim goal of 1.5GW storage by 2025, expands state goal to 6GW storage by 2030, and authorized funds to support 200MW of residential solar, 1.5MW of commercial and community-scale energy storage, and 3 GW of large-scale storage. Per the climate act, over 35% of benefits of these new energy storage projects will accrue to disadvantaged communities.
- 2025 – The final Scope for the New York State Energy Plan³⁶⁹ was published and adopted, including specifics on distributed generation, advanced metering infrastructure, and energy storage. High-level goals include those from Article 6 in 2014 plus maximizing energy conservation, energy efficiency, and load management; and supporting economic development and the ability of the state to compete economically.
Specific goals to meet the Climate Act commitments of renewables making up 70% of statewide electricity by 2030 and zero state emissions by 2040 are: 6GW of distributed solar by 2025 and 10GW by 2030, 6GW energy storage by 2030, and 9GW offshore wind by 2035.
- Additional sources: NY Energy Plan landing page³⁷⁰

What net metering policies has the state implemented over time? If relevant, how have they changed? To whom do they apply?

NY has 49 electric utility companies³⁷¹, including 39 municipalities, and around 150 Energy Services Companies (ESCOs) which are third-party suppliers of electricity and natural gas³⁷². 6 IOUs are regulated by the New York State Public Service Commission (PSC) and its staff arm, the Department of Public Service (DPS)³⁷³. PSEG Long Island/LIPA, a large municipal utility, is not regulated by PSC but makes rules often in line with PSC regulations.

The sizes of the customer bases for PSC-regulated utilities in NY were noted in Appendix C³⁷⁴ of the New York Power Grid Study³⁷⁵ in 2020: Central Hudson had 307,000 customers, ConEd had 3.5 million customers, PSEG Long Island had 1.1 million customers, National Grid had 1.6 million customers, NYSEG serves 900,000 electricity customers, Rochester Gas & Electric (RG&E) had 380,000 customers, and Orange & Rockland Utilities³⁷⁶ has 309,000 electric customers.

In 1997, New York first legislatively mandated net metering for residential photovoltaic (PV) systems up to 10 kW on a first-come, first-served basis^{377,378}. Utilities provided credits to participating customers on a volumetric (kWh credit) basis. Net metering was expanded to individual farm waste electric generators up to 400kW in 2002 and 25kW residential and farm service wind generators in 2004. In 2008, net metering changed to include commercial solar and wind up to 2MW, and a cap per project of 1% of the utility's peak load from 2005. Credits were calculated at a retail rate for excess generation used in 12 months, and at a market or wholesale rate of credits for residential and farm excess generation every 12 months. Non-residential

³⁶⁸ [Updated Order for Energy Storage Goal, 6/20/2024](#)

³⁶⁹ [Scope for the New York State Energy Plan](#)

³⁷⁰ [New York State Energy Plan](#)

³⁷¹ [Electric | Department of Public Service](#)

³⁷² [Listing of ESCO Companies Regulated by the NY PSC](#)

³⁷³ [About Us | Department of Public Service](#)

³⁷⁴ <https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/NY-Power-Grid/Appendix-C.pdf>

³⁷⁵ [New York Power Grid Study - NYSERDA](#)

³⁷⁶ <https://www.oru.com/en/about-us/company-information>

³⁷⁷ <https://www.energy.senate.gov/services/files/1C99F753-AF58-2FEF-DB11-79DCE359D08A>

³⁷⁸ [Net Metering](#)

customers had excess electricity generation credits rolled over to the next 12-month cycle indefinitely.

Governor Andrew Cuomo recommended DPS and NYSEERDA evaluate and reform net metering policies in the New York Energy Highway Blueprint in 2012³⁷⁹, the same year he launched the NY-Sun program³⁸⁰—a “dynamic public-private partnership” to boost the solar industry and make solar accessible for New Yorkers. \$1 billion was allocated to NY-Sun in 2014 to add 3MW of solar by 2023. The MW Block Incentive program was a means to disburse this funding for Residential projects up to 25 kW, small non-residential projects up to 200 kW, and large non-residential projects 200kW-2MW. The Block has declining incentives for each level of contracts, such that early adopters benefitted more.

The 2015 E3 Benefits & Costs of Net Energy Metering in New York study³⁸¹ included the 6 IOUs & PSEG Long Island, and 3 customer classes—residential, small non-residential, and large non-residential. The study found a \$10 to 60 million cost of NEM to non-participants. However, NEM installations targeted to higher-value locations reduced non-participant cost by over 40% and provide a net benefit to society. Participants were also found to have an average 33% higher incomes than non-participants.

In 2015 the PSC released Reforming the Energy Vision³⁸², a strategy to reform government-utility relationships, create customer-centric innovation, and spur investment-driven models.

Following this, the PSC released a 2017 Order on Net Energy Metering Transition, Phase One of Value of Distributed Energy Resources, and Related Matters³⁸³ that re-visioned net metering policies and introduced the Value Stack methodology. This policy tailored compensation for distributed energy based on the calculated benefit of the resource to the NY grid.

4 market segments were targeted with the Value of Distributed Energy Resources (VDER) policy: 1) Residential or small commercial customers, 2) Non-residential community solar, 3) Non-residential remote net metered projects and residential farms, and 4) Large non-residential customers.

The transitions from NEM to the VDER tariffs are outlined below and began in 2017³⁸⁴. Distributed energy projects previously under NEM would continue under NEM unless the customer opted into VDER. The VDER Phase One tariff comprised both Phase One NEM and the Phase One Value Stack.

The NEM to Phase One NEM Transition: March 9, 2017 – Jan 1, 2022

- Set project terms to 20 years.
- Applied to all mass market DER projects and remote net metered customers, large on-site customers, and community distributed generation projects that paid at least 25% of interconnection costs or have Standard Interconnection Contract.
- Successor tariff in July 2020 added a capacity-based Customer Benefits Contribution charge, effective Jan 1, 2022.

Phase One Value Stack tariff: March 9, 2017 – May 31, 2019

³⁷⁹ [New York Energy Highway Blueprint](#)

³⁸⁰ [New York State is making solar more affordable while building a sustainable solar industry](#)

³⁸¹ [The Benefits and Costs of Net Energy Metering in New York](#)

³⁸² [Reforming the Energy Vision](#)

³⁸³ <https://documents.dps.ny.gov/public/MatterManagement/MatterFilingItem.aspx?FilingSeq=180197&MatterSeq=49770>

³⁸⁴ [Net Metering](#)

- Set project terms to 25 years.
- Only applied to projects that were previously eligible for net metering.
- Monetary crediting, rather than volumetric credit, is provided for net hourly exports to grid based on a Value Stack calculated from Energy Value, Capacity Value, Environmental Value, Demand Reduction Value, and Locational System Relief Value (all detailed in Section 3 below).
- Community distributed generation projects are eligible for a Market Transition Credit (MTC) equal to the difference between the base retail rate and estimated value stack.
- Excess credit is rolled over to monthly billing and annual periods and unused credits are forfeited at the end of contract.

Phase Two Value Stack tariff: June 1, 2019- present

- Effective in June 2019³⁸⁵ for projects that qualified for Value Stack after 7/26/2018.
- Eligible technologies and system size limits are same as Phase 1, and publicly owned utilities are not required to offer net metering.
 - Solar size limits: 25 kW residential, 100kW farms, 2 MW non-residential.
 - Community distributed generation, Remote Net Metered, and large on-site projects are compensated via the Value Stack.
 - An Order Implementing Hybrid Energy Storage System Tariff³⁸⁶ was effective Jan 1, 2019 for distributed energy systems incorporating battery storage, with 4 options of tariff depending on source of injected energy. Hybrid distributed energy resources + storage are eligible for Phase 1 NEM or the Value Stack.
- There is no aggregate capacity cap since the 2017 Order³⁸⁷, although any project should not impact more than 2% of each utility's net annual revenue. Utilities must report to PSC when they hit 85% of recommended capacity allocations.
- Net excess generation continues to be credited to the customer's next month bill as a monetary credit. The annual credit for excess energy generation for residential solar is paid at the avoided cost rate and is rolled forward rather than compensated for non-residential customers.
- Remote Net Metering credits can carry over month to month.

The US Energy Information Administration noted that in 2023, solar energy accounted for about 5% of New York's total power generation, with about 2/3 of the power generated from systems up to 1 MW in capacity³⁸⁸. The Climate Act Dashboard reported that at the end of 2024³⁸⁹, solar installations were 97% of the way to 10 GW of power by 2030, and storage installations were 18% of the way to the 6 GW goal by 2030³⁹⁰.

What are the current value considerations for distributed solar + storage?

Energy value

Energy Value is based on Day Ahead hourly, zonal, locational-based marginal price (LBMP) provided by the

³⁸⁵<https://www.oru.com/-/media/files/oru/documents/saveenergyandmoney/using-private-generation-energy-sources/value-stack-calculation.pdf>

³⁸⁶<https://documents.dps.ny.gov/public/MatterManagement/MatterFilingItem.aspx?FilingSeq=217514&MatterSeq=49770>

³⁸⁷<https://documents.dps.ny.gov/public/MatterManagement/MatterFilingItem.aspx?FilingSeq=180197&MatterSeq=49770>

³⁸⁸ [New York State Energy Profile](#)

³⁸⁹ [Climate Act Dashboard](#)

³⁹⁰ <https://climate.ny.gov/Our-Impact/Our-Progress/Distributed-Solar>

New York Independent System Operator (NYISO)³⁹¹. It changes hourly and varies by geographic zone.

Capacity value

Capacity Value (ICAP) has 3 alternate plans based on retail capacity rate related to performance during the peak hour in the previous year. ICAP is based on how well the resource reduces statewide energy consumption during periods of high energy load³⁹². ICAP 1 & 3 change monthly, and ICAP 2 changes annually. The Cumulative capacity as of January 31, 2025 was 6.692 GW DC across NY³⁹³.

Environmental value

Environmental value (E) is the value of how much environmental benefit the energy brings to the grid and society. It is based on the higher of the Clean Energy Standard Tier 1 Renewable Energy Credit (REC) price or the Social Cost of Carbon (SCC). This is locked in for 25 years when the interconnection agreement is fully executed or when projects make a 25% upgrade payment to the utility.

Demand reduction value

Demand Reduction Value (DRV) is based on how much a project reduces the utility's future needs to make grid upgrades. This is locked in for 10 years when the interconnection agreement is fully executed or when projects make a 25% upgrade payment to the utility.

Locational system relief value

Locational System Relief Value (LSRV) is determined by utility designation of areas where distributed energy can provide extra benefits to the grid. This is locked in for 10 years when the interconnection agreement is fully executed or when projects make a 25% upgrade payment to the utility.

Sources: Value Stack Overview³⁹⁴, Value Stack Resources³⁹⁵, Value Stack Frequently Asked Questions³⁹⁶

³⁹¹ [Energy Market & Operational Data - NYISO](#)

³⁹² [Frequently Asked Questions - Value of Distributed Energy Resources - NYSERDA](#)

³⁹³ [Statewide Distributed Solar Projects - NYSERDA](#)

³⁹⁴ [The Value Stack - Compensation for Distributed Energy Resource](#)

³⁹⁵ [Value Stack Resources - NYSERDA](#)

³⁹⁶ New York State Energy Research and Development Authority. (n.d.). *Frequently asked questions: Value of distributed energy resources*. NYSERDA. <https://www.nyserd.org/All-Programs/NY-Sun/Contractors/Value-of-Distributed-Energy-Resources/Frequently-Asked-Questions>

How the Value Stack is calculated

Value Name	Description	Eligible DERs
Energy Value (LBMP)	LBMP is the day-ahead wholesale energy price as determined by NYISO. It changes hourly and is different according to geographic zone.	All technologies: PV, storage, CHP, digesters, wind, hydro, and fuel cells.
Capacity Value (ICAP)	ICAP is the value of how well a project reduces New York State's energy usage during the most energy-intensive days of the year. Developers can choose from three payout alternatives and most ICAP rates change monthly.*	All technologies receive ICAP. Dispatchable technologies (stand-alone storage, CHP, digesters, and fuel cells) will receive Alternative 3.
Environmental Value (E)	E is the value of how much environmental benefit a clean kilowatt-hour brings to the grid and society. The E value is locked in for 25 years.**	PV, wind, hydro, and storage charged exclusively from PV or wind energy. Stand-alone storage is not eligible at this time.
Demand Reduction Value (DRV)	DRV is determined by how much a project reduces the utility's future needs to make grid upgrades. DRV is locked in for 10 years.**	All technologies.
Locational System Relief Value (LSRV)	LSRV is available in utility-designated locations where DERs can provide additional benefits to the grid. Each location has a limited number of MW of LSRV capacity available. The LSRV is locked in for 10 years.**	All technologies. Project must be on a utility-specified substation.
Community Credit (CC)	CC is available on a limited basis to encourage the development of Community Distributed Generation (CDG) projects. CC is the successor to the Market Transition Credit (MTC) and is similar in structure. The CC is locked in for 25 years.** PV projects in utility territories that have fully expended their CC may be eligible for the Community Adder – an upfront incentive administered by NY-Sun.	Available for CDG projects including PV and digesters. Wind, hydro, and fuel cells receive CC at a derated value. Not available for stand-alone storage or CHP.

*For more information on the three ICAP alternatives, view the most recent Value Stack presentation slides on the Value Stack Resources page at nysersda.ny.gov/value-stack-resources

**Projects will lock in their E, DRV, LSRV, and CC values when they make their 25% upgrade payment to the utility. If no utility upgrade costs are required, the values are locked in when the interconnection agreement is fully executed.

Are there any outstanding controversies?

One controversy is how VDER impacts community solar development in New York State. After VDER was implemented in 2017, in 2018 the Alliance for a Green Economy reported³⁹⁷ solar developers estimated it caused a loss of \$800 million of community solar investment and called for the return of net metering policy that was less utility-centric. However, one presentation by the National Renewable Energy Laboratory in 2024 showed that NY community solar grew from 14MW in 2018 to over 1700MW, with over 2400MW planned, in early 2024, comprising growth of 1.56GW from 2019-2023³⁹⁸. This suggests that the initial dip in investment may not have been sustained.

Summary Table of State Progress in Key Metrics

Of the distributed energy resources currently in use and under development across the below states, this section provides a snapshot specific to solar photovoltaic (PV) energy and energy storage.

³⁹⁷ Alliance for a Green Economy. (n.d.). *CNY projects on the line*. <https://www.allianceforagreenconomy.org/cny-projects-on-the-line/>

³⁹⁸ [Sharing the Sun: Community Solar Deployment and Subscriptions \(as of June 2024\)](#)

	Net solar energy generation, all sectors in 2024 (1,000 MWh) ³⁹⁹	Percent change in solar energy in all sectors from 2023-2024 ⁴⁰⁰	Net solar energy generation, residential sector in 2024 (1,000 MWh) ⁴⁰¹	Percent change in solar energy in the residential sector from 2023-2024 ⁴⁰²	Total storage capacity (MW) [date of data]
California	77,498	15.5	21,979	14.8	2,256 ⁴⁰³ [Apr. 2025]
Maine	2,092	81.6	153	40.3	63.1 ⁴⁰⁴ [Dec. 2024]
Maryland	2,603	12.0	1,145	8.5	5.5 ⁴⁰⁵ [Jul. 2024]
Massachusetts	6,310	10.2	1,693	12.8	569 ⁴⁰⁶ [2023]
Minnesota	2,758	14.1	268	27.0	16.7 ⁴⁰⁷ [Dec. 2023]
New York	7,905	27.4	2,036	14.3	445 ⁴⁰⁸ [Jun. 2025]
Washington	1,070	21.2	546	21.9	10 ⁴⁰⁹ [2024]

³⁹⁹ U.S. Energy Information Administration. (2025, February). *Electric Power Monthly: February 2025*. <https://www.eia.gov/electricity/monthly/archive/february2025.pdf>

⁴⁰⁰ U.S. Energy Information Administration. (2025, February). *Electric Power Monthly: February 2025*. <https://www.eia.gov/electricity/monthly/archive/february2025.pdf>

⁴⁰¹ U.S. Energy Information Administration. (2025, February). *Electric Power Monthly: February 2025*. <https://www.eia.gov/electricity/monthly/archive/february2025.pdf>

⁴⁰² U.S. Energy Information Administration. (2025, February). *Electric Power Monthly: February 2025*. <https://www.eia.gov/electricity/monthly/archive/february2025.pdf>

⁴⁰³ California Distributed Generation Statistics. (n.d.). Charts and data. <https://www.californiadgstats.ca.gov/charts/>

⁴⁰⁴ Maine Governor’s Energy Office. (n.d.). Energy Storage Initiatives. <https://www.maine.gov/energy/initiatives/renewable-energy/energy-storage>

⁴⁰⁵ Maryland Public Service Commission. (n.d.). Energy Storage Pilot Program: Interim Report. <https://www.psc.state.md.us/wp-content/uploads/Energy-Storage-Pilot-Program-Interim-Report.pdf>

⁴⁰⁶ Massachusetts Executive Office of Energy and Environmental Affairs. (n.d.). Clean Energy and Climate Metrics. <https://www.mass.gov/info-details/massachusetts-clean-energy-and-climate-metrics>

⁴⁰⁷ Minnesota Public Utilities Commission. (n.d) *Distributed Energy Resources in Minnesota (2023 data)* https://mn.gov/puc/assets/MN%20PUC%20DER%20in%20Minnesota%20graphics%20%28published%209-10-2024%29_tcm14-643877.pdf

⁴⁰⁸ New York State Climate Action Council. (n.d.). *New York State climate dashboard*. <https://climate.ny.gov/dashboard>

⁴⁰⁹ Environment America Research & Policy Center. (n.d.). *The state of renewable energy dashboard*. <https://environmentamerica.org/center/resources/the-state-of-renewable-energy-dashboard/>