To: Piedmont Environmental Council

Date: 2025-08-18

Re: Value of Solar Analysis

Value of Distributed Solar in Virginia: A Framework for Fair Net-Metering Compensation

An Analysis for the Piedmont Environmental Council

Context

The Commonwealth of Virginia stands at a pivotal moment in its energy transition. Dominion Energy is experiencing unprecedented demand growth, outpacing that of the broader PJM region. This increase is driven primarily by the rapid expansion of data centers, widespread electrification of transportation, and sustained economic development. Further, the Virginia Clean Economy Act (VCEA) has established ambitious targets, requiring Dominion Energy to deliver electricity from 100 percent renewable sources by 2045. Achieving this mandate will require diversifying the energy supply by scaling up clean energy resources, retiring fossil fuel generation, and ensuring that the electricity powering the grid remains reliable, affordable, and increasingly clean.

Customer sited solar PV will be central to this transition and alleviate demand constraints by offsetting load directly at customer sites. To ensure solar PV continue playing a growing role in Virginia's energy system, it is critical to develop frameworks that fairly recognize the full range of benefits these resources provide to both the utility and the Commonwealth.

At the request of the Piedmont Environmental Council (PEC), **Dunsky Energy + Climate Advisors** undertook a comprehensive Value of Solar (VoS) assessment. This analysis evaluates the full suite of benefits provided by distributed solar and compares these results to Dominion Energy's proposed compensation framework for customer-sited solar.

Table of Contents

Context 1
Analytical Approach 3
Results: Value of Customer-Sited Solar PV 4
Value of Solar – Utility Benefits 4
Value of Solar – Commonwealth Benefits 5
Value of Solar – Overall Benefits 6
Results: Value of Customer-Sited Solar PV + Storage 7
Qualitatively Assessed Benefits 8
Dominion NEM Proposal 9
Conclusion: Distributed Solar Supports Virginia's Policy Goals 11
Appendix: Methodology and Data Sources 12
1.1 NSPM Principles 12
1.2 Components Included for VoS Analysis 13
1.3 Result: Value of Each Component 14

Analytical Approach

Our analysis was guided by the methodology outlined in the National Standard Practice Manual (NSPM)[1]. The NSPM is a comprehensive framework developed specifically for distributed energy sources and frequently used as a guide in state-led value of solar analyses. Moreover, this methodology is designed to help jurisdictions in their decision-making process when assessing which resources to prioritize to meet their policy objectives.

This methodology applies the following principles:

- Treats distributed solar PV as integral utility system assets.
- Identifies both utility system impacts and includes all societal impacts that align with Virginia's policy objectives.
- Evaluates all relevant and material benefits on an incremental, marginal basis, consistent with other state-led VoS studies.

This comprehensive methodology produces a value stack for distributed solar that is organized into two categories:

1. Utility Benefits: These include direct and indirect monetizable benefits to the generation, transmission, and distribution systems.
2. Commonwealth Benefits: These reflect broader societal impacts that accrue to the commonwealth and align with the state's clean energy and climate policy goals.

The NSPM served as a guiding principle in identifying the value components included in this study. The rationale for selecting and quantifying these components, along with details on data sources and key assumptions, is provided in the appendix.

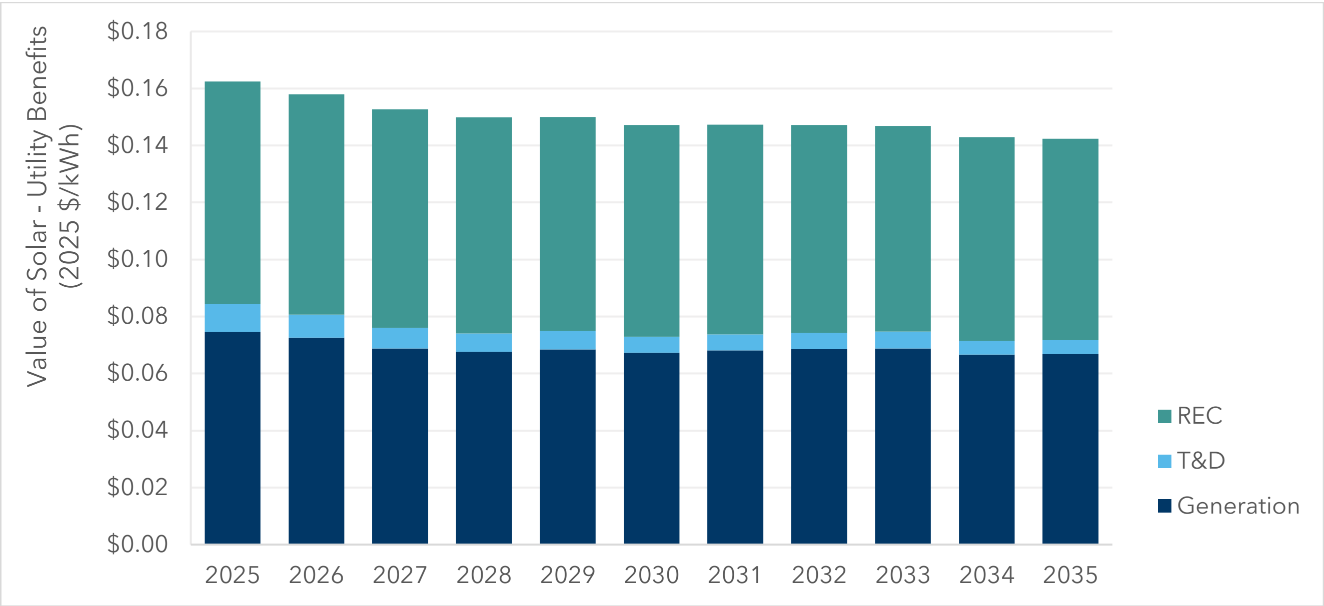
[1] National Standard Practice Manual - NESP

Results: Value of Customer-Sited Solar PV

Value of Solar – Utility Benefits

On the utility side, the primary benefits of customer-sited solar PV arise from generation-related impacts and renewable energy compliance (REC) contributions, followed by transmission and distribution (T&D) avoided costs. Combined, these utility benefits are valued at approximately 16¢/kWh in 2025. A detailed breakdown is provided in Figure 1 below.

Figure 1: Value of Utility Benefits from customer-sited Solar PV in Dominion from 2025-2035 (in real $2025)



Generation-Related Benefits: These include avoided energy costs, avoided generation capacity, ancillary services, reduced line losses, risk premium, generation reliability improvements, and Demand Reduction Induced Price Effect (DRIPE).

- Of these elements, *Avoided energy costs* are the largest driver, contributing **66%** of total generation-related benefits, followed by avoided generation capacity costs. Given Dominion's significant projected load growth, avoided energy costs are expected to remain the dominant component of generation-related benefits.
- Avoided generation capacity benefits from distributed solar, meanwhile, are projected to decline modestly over time due to a shift in the system peak.

Transmission and Distribution (T&D) Benefits: These include avoided transmission charges and T&D capacity deferral. While customer-sited solar PV provides a modest deferred capacity value in the early years of the study period, changes in system conditions over time are expected to reduce the magnitude of these benefits.

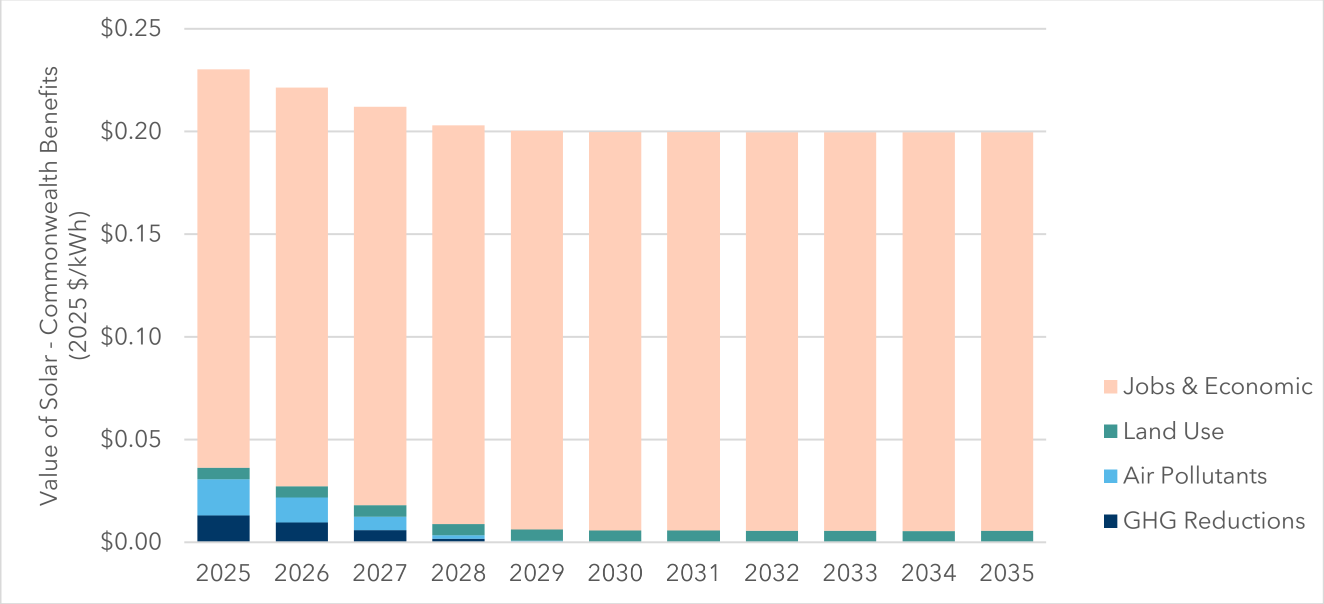
Renewable Portfolio Standard (RPS) Compliance Benefits: Customer-sited solar PV contributes to load reduction, which in turn decreases Dominion's RPS obligations. The RPS credit value is based on the Alternative Compliance Payment (ACP), reflecting the penalties Dominion would avoid meeting its obligations under the Virginia Clean Economy Act (VCEA).

Value of Solar – Commonwealth Benefits

Customer-sited solar PV systems deliver a range of benefits that extend beyond their direct contributions to the electric grid, encompassing broader societal, environmental, and economic outcomes. These impacts align with the objectives established under the Virginia Clean Economy Act (VCEA) and support the Commonwealth's transition to a more sustainable, equitable energy system.

As shown in Figure 2, the combined commonwealth benefits contribute an additional ~24 ¢/kWh of value from customer-sited solar PV in 2025. A detailed breakdown of these benefits is provided in Appendix 1.3.

Figure 2: Value of Commonwealth Benefits from customer-sited Solar PV in Dominion from 2025- 2035 (in real $2025)



- **Net GHG and Air Pollutant Reduction Benefits:** Distributed solar generation reduces greenhouse gas (GHG) emissions by displacing fossil fuel-based generation on the grid. The net GHG benefit accounts for reductions beyond those already captured within Renewable Portfolio Standard (RPS) compliance, in the utility benefits section, thereby avoiding double-counting. These benefits are projected to decline over time as Virginia's grid becomes increasingly powered by clean energy.

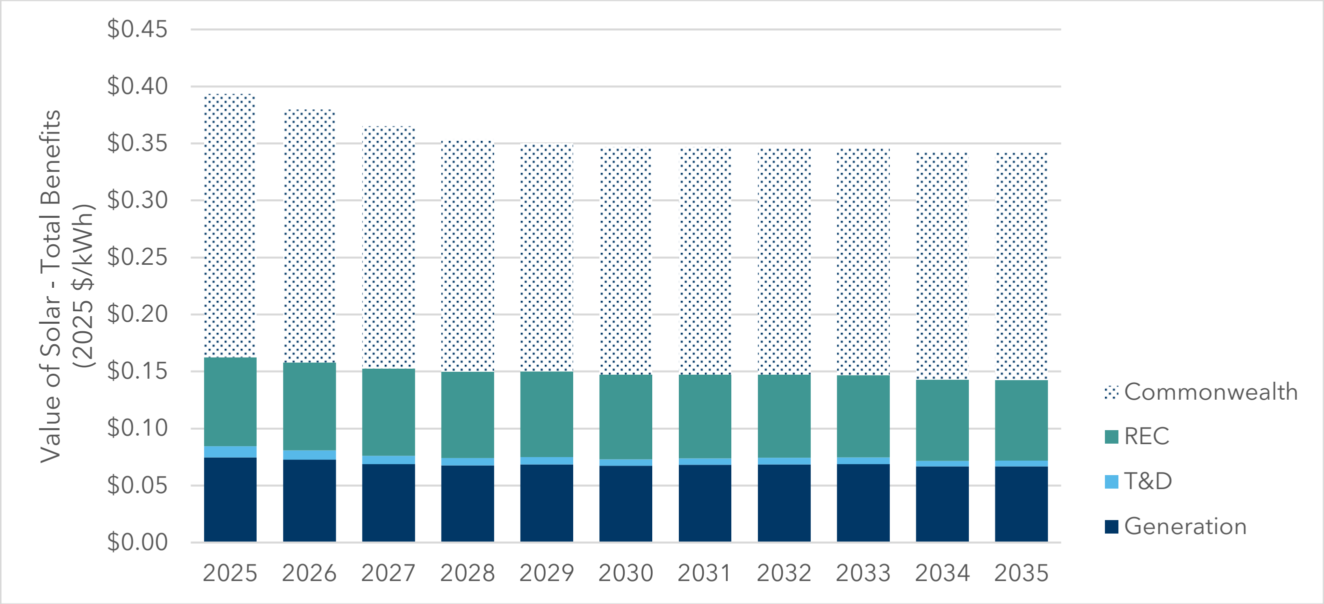
  Similarly, customer-sited solar reduces harmful air pollutant emissions (NO_X, SO_X, particulate matter) providing public health and environmental benefits by improving air quality and decreasing pollution-related health risks. Like GHG benefits, air pollutant reduction benefits are expected to diminish as the grid decarbonizes further.

- **Local Job and Economic Benefits:** The deployment of distributed solar generates direct, indirect, and induced employment opportunities and stimulates economic activity. These impacts were estimated using the National Renewable Energy Laboratory's (NREL) Jobs and Economic Development Impact (JEDI) model and reflect the economic value of customer-sited solar to Virginia's communities.
- **Land Use Impacts:** Rooftop solar systems minimize land-use impacts by utilizing existing built environments. This avoids the need for additional land conversion, which is often required for utility-scale solar development, and helps preserve agricultural and natural landscapes.

Value of Solar – Overall Benefits

The combined utility and commonwealth value of customer-sited solar in Dominion represent a value of about ~ 40¢/kWh in 2025, dropping steadily to ~34¢/kWh by 2035. The following chart captures the value of solar in Dominion from 2025 to 2035.

Figure 3: Value of customer-sited Solar PV in Dominion from 2025- 2035 (in real $2025)



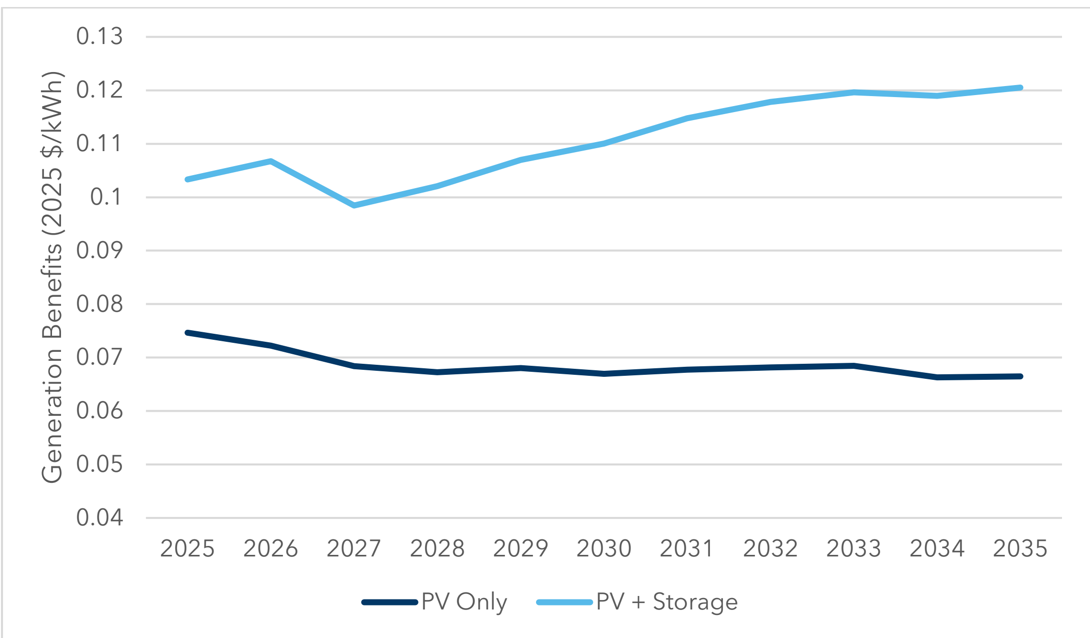
Results: Value of Customer-Sited Solar PV + Storage

When paired with energy storage, the value of BTM solar installations is bolstered by the reliability, capacity, and flexibility benefits obtained from storage technologies. Storage can reduce and potentially eliminate the intermittency of solar generation, increasing benefits by nearly 12%, and bringing the value of solar closer to 45¢/kWh, as shown in Figure 5.

Generation-Related Benefits: With storage, generation-related benefits increase 60% on average across the forecasting period, primarily driven by the increased value of generation capacity and distribution capacity benefits. The main difference, however, is a reversal in the long-term trend of these benefits, which now gradually increase over time. This is due to a storage assets' ability to better respond to system peaks, contributing more meaningfully to the growing capacity needs projected by Dominion. As such, generation-related benefits are driven almost equally by *avoided energy costs* and *generation capacity*, accounting for a combined 80% of the total value. The inversion in the generation-related benefits trend is shown Figure 4.

Similarly, reliability benefits grow by an order of magnitude and remain constant out to 2035, whereas they gradually decrease without storage.

Figure 4: Comparison of generation-related benefits between standalone customer sited solar PV and storage + PV



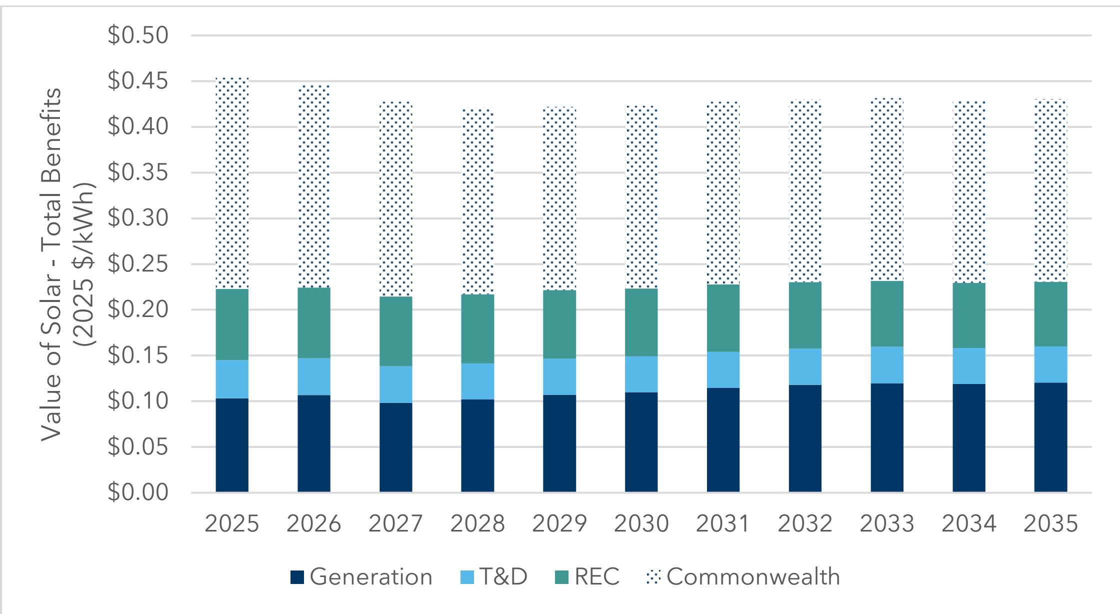
T&D Benefits: With an increased capacity factor, combined solar and storage installations show increased distribution capacity and avoided transmission charge benefits. Effectively, these benefits increase by an order of magnitude with storage, reaching 4.1¢/kWh. Still, the trend remains the same, with a gradual decline over the study period due to expected changes in system conditions.

RPS Compliance Benefits: Storage does not affect the RPS compliance benefits as it does not provide any energy generation incremental to the paired solar. Since the RPS obligations in question do not account for the varying carbon intensity of electricity over the course of the year, storage's ability to shift load to other time periods does not add value to this benefit stream.

Commonwealth Benefits: Adding storage does not materially impact the commonwealth benefits brought forth by distributed solar. Effectively, the advantages of pairing storage with solar are mainly captured by the utility; it is thus essential these benefits are recognized in a fair minimum bill and passed down to consumers via appropriate measures. Note that individuals who own or have co-located storage resources may experience an energy resilience benefit, though this benefit stream has not been quantified for the purposes of this analysis.

Overall, as shown in Figure 5 below, the total value of solar and storage starts at 45¢/kWh in 2025 and declines steadily to 43¢/kWh in 2035, a smaller decline compared to the 13% observed with standalone solar systems. Although it may not directly impact RPS compliance or Commonwealth benefits, storage meaningfully increases utility benefits from distributed solar generation.

Figure 5: Value of customer-sited solar and storage in Dominion from 2025-2035 (in real $2025)



Qualitatively Assessed Benefits

In addition to the quantified and monetized benefits detailed in this analysis, distributed solar PV systems provide a range of qualitative and non-market benefits that are critical to both consumers and the broader energy system. While these benefits are not directly included in the value stack calculated as part of this analysis, they represent important contributions to energy resilience, equity, and long-term system transformation.

- **Energy Security and Resilience:** Distributed solar assets are less vulnerable to large-scale disruptions and, when paired with storage, can supply backup power during grid outages.

- **Energy Independence and Consumer Empowerment:** Enables customers to generate their own electricity, reducing reliance on utility power and mitigating exposure to price volatility.
- **Support for Decarbonization Goals:** Allows consumers to directly contribute to emissions reductions and state climate targets.
- **Asset Value Enhancement:** Solar installations can increase property values and marketability.
- **Community Resilience:** Supports local initiatives such as microgrids and virtual power plants that improve reliability for critical infrastructure.

Dominion NEM Proposal

In the current regulatory docket (Case No. PUR-2025-00079), Dominion Energy has proposed transitioning from the existing Net Metering framework to a Net Billing structure. This proposal advocates for:

- **Real Time Netting:** Customers would transition to real-time, 30-minute netting of electricity imports and exports.
- **Export Credit:** Exports to the grid would be credited at the most recent distributed solar Power Purchase Agreement (PPA) prices, currently set at 9.553¢/kWh.
- **RPS Obligation:** Renewable Energy Credits (RECs) associated with customer-sited generation would be transferred to the utility and applied toward meeting Dominion's Renewable Portfolio Standard (RPS) obligations.

While this proposed **framework represents a shift in how distributed energy resources (DERs) are compensated**, a key concern is that the **export credit rate is tied solely to PPA prices**. PPA prices reflect the procurement costs of utility-scale solar but fail to capture the full range of monetizable benefits that customer-sited solar provides to the utility. These overlooked benefits include:

- Avoided Energy Costs: Customer-sited solar reduces the need for energy purchases from the wholesale market.
- Generation Capacity Deferral: By supplying energy during peak periods, distributed solar can defer investments in new generation capacity.
- Transmission and Distribution (T&D) System Value: Solar reduces stress on the grid and mitigates the need for costly upgrades to transmission and distribution infrastructure.

Moreover, PPA prices are negotiated financial instruments. They reflect developer financing, contract length, and risk allocation rather than the value of solar generation to the electric grid. These prices fluctuate constantly due to various factors, including:

- Supply chain pressures (modules, labor, interest rates),
- Inflationary impacts on construction and financing, and
- Competition for project siting.

As such, tying export credits to PPA prices risks overcompensating or undercompensating solar owners, as PPA prices are underpinned mainly by broader market and financing pressures.

Switching to real-time netting, meanwhile, means monthly bills will be calculated using 15- or 30-minute measurement intervals, instead of the current 60-minute intervals. This will capture sharper fluctuations in both load and generation. With finer resolution, the meter registers more instances when generation exceeds load, which increases the amount of generation classified as exports instead of self-consumption. Since exports are compensated at a credit rate that is lower than the retail rate, this framework can reduce the value of distributed solar.

Under Dominion's current proposal, which sets the export credit rate at 9.553¢/kWh, the value of **customer-sited solar exports is significantly undervalued**. Based on our assessment, when isolating only the utility system benefits, we find that these benefits amount to roughly 15¢/kWh, over 50% higher than the proposed export rate.

Conclusion: Distributed Solar Supports Virginia's Policy Goals

As Virginia advances toward its clean energy targets under the Virginia Clean Economy Act, policy frameworks must reflect the full range of benefits provided by distributed solar and storage to avoid underinvestment in these resources and overreliance on other, less beneficial energy sources. Our analysis demonstrates that **customer-sited solar delivers substantial utility system and societal value,** which far exceeds the compensation currently proposed under Dominion's Net Billing framework.

To sustain distributed solar adoption, the full value stack these systems provide must be accurately measured, and compensation must flow back to the customers and developers who invest in these projects. An appropriate **net metering compensation policy is just one tool** that can support this outcome. Other efforts, such as efficient permitting and interconnection processes; policies to support preferred siting choices, such as agrivoltaics, rooftop, carport, and brownfield solar; avoidance of limiting minimum bill requirements; or innovation and support for local-first renewables development, can all play an important role as well.

Fair valuation and compensation ensure that private investment continues to drive public benefits, aligning market incentives with the Commonwealth's long-term clean energy and economic objectives. This analysis is not just about how Dominion pays for solar generation exports—it is about whether Virginia's clean energy policy will reflect the true value of local, citizen-owned energy. Ensuring a fair and comprehensive valuation of distributed energy resources will support continued investment in customer-sited solar and enable these resources to play a growing role in meeting Virginia's energy needs reliably, affordably, and sustainably.

Appendix: Methodology and Data Sources

1.1 NSPM Principles

Table 1: NSPM Guiding Principles

Principle 1	**Treat DERs as a Utility System Resource** DERs are one of many energy resources that can be deployed to meet utility/power system needs. DERs should therefore be compared with other energy resources, including other DERs, using consistent methods and assumptions to avoid bias across resource investment decisions.
Principle 2	**Align with Policy Goals** Jurisdictions invest in or support energy resources to meet a variety of goals and objectives. The primary cost-effectiveness test should therefore reflect this intent by accounting for the jurisdiction's applicable policy goals and objectives.
Principle 3	**Ensure Symmetry** Asymmetrical treatment of benefits and costs associated with a resource can lead to a biased assessment of the resource. To avoid such bias, benefits and costs should be treated symmetrically for any given type of impact.
Principle 4	**Account for Relevant, Material Impacts** Cost-effectiveness tests should include all relevant (according to applicable policy goals), material impacts including those that are difficult to quantify or monetize.
Principle 5	**Conduct Forward-Looking, Long-term, Incremental Analyses** Cost-effectiveness analyses should be forward-looking, long-term, and incremental to what would have occurred absent the DER. This helps ensure that the resource in question is properly compared with alternatives.
Principle 6	**Avoid Double-Counting Impacts** Cost-effectiveness analyses present a risk of double-counting of benefits and/or costs. All impacts should therefore be clearly defined and valued to avoid double-counting.
Principle 7	**Ensure Transparency** Transparency helps to ensure engagement and trust in the BCA process and decisions. BCA practices should therefore be transparent, where all relevant assumptions, methodologies, and results are clearly documented and available for stakeholder review and input.
Principle 8	**Conduct BCAs Separately from Rate Impact Analyses** Cost-effectiveness analyses answer fundamentally different questions than rate impact analyses. Cost-effectiveness analyses should therefore be conducted separately from rate impact analyses.

1.2 Components Included for VoS Analysis

Table 2: Components Selection

	Utility System Impact	Benefit / Cost	Consideration in the Study
Generation	**Avoided Energy Costs**	Benefit	**Considered:** Solar PV reduce the amount of energy generation required to meet system energy needs.
Generation	**Generation Capacity**	Benefit	**Considered:** Solar PV reduce the amount of generation capacity required to meet system energy needs.
Generation	**Environmental Compliance**	Benefit	**Considered:** Solar PV can reduce environmental compliance requirements
Generation	**RPS/CES Compliance**	Benefit	**Considered:** Dominion is required to meet a clean electricity compliance standard.
Generation	**Market Price Effects (DRIPE)**	Benefit	**Considered:** Solar PV generation can reduce the quantity of power purchased from wholesale markets and also lead to lower market prices.[2]
Generation	**Ancillary Services**	Benefit or Cost	**Considered:** Solar PV could impact the overall ancillary requirements for Dominion.[3]
Generation	**Risk Premium**	Benefit	**Considered:** Risk premium benefits were considered solar PV generation can reduce exposure to volatile fossil fuel commodity markets.
Transmission	**Transmission Capacity**	Benefit	**Considered:** Solar PV could avoid the need for incremental transmission capacity and thus create a benefit.
Transmission	**Transmission System Losses**	Benefit	**Considered:** Solar PV reduce the overall electricity that flows through the transmission system, thereby reducing transmission line losses.
Distribution	**Distribution Capacity**	Benefit	**Considered:** Solar PV could avoid the need for incremental distribution capacity and thus create a benefit.
Distribution	**Distribution System Losses**	Benefit	**Considered:** Solar PV reduce the overall electricity that flows through the distribution system, thereby reducing distribution line losses.
Distribution	**Distribution O&M and Voltage**	Benefit or Cost	**Not Considered:** These components were not considered in the analysis due to the lack of available data required for robust quantification. While Solar PV has the potential to impact distribution system operation and maintenance (O&M) costs, as well as voltage regulation, assessing these effects requires detailed operational data, including localized grid characteristics, historical performance metrics, and system-wide voltage stability studies.

[2] Market price effects are a characteristic of wholesale electricity markets, where the final price for energy and capacity is determined through a competitive bidding mechanism. In these markets, the addition of distributed energy resources (DERs), such as Solar PV, can influence market clearing prices by reducing demand for centralized generation

[3] Ancillary services support the reliable operation of the electricity grid by maintaining system stability, frequency regulation, and voltage control. In some cases, Solar PV can reduce overall ancillary service requirements by offsetting a significant portion of the retail electric load, thereby lowering the need for certain grid support services.
However, due to its variable and intermittent nature, Solar PV can also introduce additional operational challenges. Rapid fluctuations in generation output may require increased reserves, frequency regulation, or ramping support from other resources. As a result, while Solar PV has the potential to reduce ancillary service needs under certain conditions, it may also contribute to increased requirements in specific scenarios.

	Utility System Impact	Benefit / Cost	Consideration in the Study
General	**Net Employment & Economic Impact**	Benefit	**Considered:** Growing the residential solar PV sector leads to increased job creation and trickles downstream into the wider economy due to increased spending.
	Resiliency	Benefit	**Considered:** Solar PV, when paired with storage, can improve system resilience by maintaining power availability during major disruptions, such as extreme weather events or grid failures, allowing customers to better withstand and recover from such events.
	Land Impacts	Benefit or Cost	**Considered:** Behind-the-meter solar PV requires minimal land, avoiding land development from other energy sources.
	GHG Reductions	Benefit	**Considered:** Solar PV avoids emissions from alternative power generation activities by reducing their generation needs, especially from traditional fossil facilities.
	Air Pollutant Reductions	Benefit	**Considered:** Electricity from BTM solar can reduce marginal air pollutants from fossil fuel plants such as NOx and Sox.

1.3 Result: Value of Each Component

The value of generation-related benefits in$/MWh is shown in Table 3.

Table 3: Generation Component Benefits ($/MWh)

Year	Energy	Generation Capacity	Ancillary Services	T&D Losses	DRIPE	Risk Premium	Reliability
2025	48.90	10.60	1.20	5.27	3.96	3.91	0.80
2026	47.50	10.00	1.20	4.99	3.78	3.80	1.00
2027	47.50	7.30	1.20	4.71	3.29	3.80	0.70
2028	47.50	7.00	1.20	4.63	3.09	3.80	0.10
2029	47.50	8.00	1.20	4.71	2.92	3.80	0.00
2030	47.50	7.10	1.20	4.57	2.81	3.80	0.00
2031	47.50	7.90	1.20	4.63	2.77	3.80	0.00
2032	47.50	8.30	1.20	4.67	2.73	3.80	0.00
2033	47.50	8.60	1.20	4.70	2.72	3.80	0.00
2034	47.50	6.70	1.20	4.47	2.72	3.80	0.00
2035	47.50	6.80	1.20	4.49	2.72	3.80	0.00

The value of T&D- and REC-related components in $/MWh are provided in Table 4.

Table 4: T&D and REC Component Benefits ($/MWh)

Year	Distribution Capacity	Transmission Capacity Deferral	Transmission Charge	REC
2025	0.005	1.50	8.35	78.00
2026	0.005	1.50	6.66	77.30
2027	0.005	1.50	5.84	76.50
2028	0.005	1.50	4.98	75.80
2029	0.005	1.50	5.08	75.00
2030	0.005	1.50	4.14	74.30
2031	0.005	1.50	4.21	73.60
2032	0.005	1.50	4.27	72.80
2033	0.005	1.50	4.33	72.10
2034	0.005	1.50	3.29	71.40
2035	0.005	1.50	3.34	70.70

The value of commonwealth-related benefits is shown in Table 5 in $/MWh.

Table 5: Commonwealth Component Benefits ($/MWH)

Year	GHG Reductions	Air Pollutants	Land Use	Jobs & Economic
2025	13.08	17.55	5.72	193.99
2026	9.67	12.08	5.59	193.99
2027	5.91	6.62	5.57	193.98
2028	1.76	1.65	5.55	193.98
2029	0.42	0.35	5.53	193.98
2030	0.13	0.1	5.59	193.98
2031	0.09	0.06	5.57	193.98
2032	0.06	0.02	5.55	193.98
2033	0.03	0.01	5.54	193.98
2034	0	0	5.52	193.98
2035	0	0	5.58	193.98