Sustainable Energy Advantage, LLC

Rhode Island REG Program:

Research, Analysis, & Discussion in Support of Final Recommended 2025 Program Year Small Solar Prices, MW Allocation, and Adders

Distributed Generation Board Meeting
November 4, 2024
Sustainable Energy Advantage, LLC

Overview of 2025 REG PY Considerations

- During 2024 PY development process:
  - PUC approved three-year set of ceiling prices for all classes other than Small Solar I and II ➔ **Focus on Small I and II for this year's pricing development**
  - PUC declined to approve a three-year MW allocation plan ➔ **Revised 2025 MW allocation plan proposed**
  - PUC declined to approve incentive-payment adders but directed further research to inform a **refresh of the Adder Pilot program**
- Roadmap for Presentation
  1. Small Solar I and II price recommendations
  2. 2025 MW Allocation Plan recommendations
  3. Adder Pilot recommendations
  4. Benefit-cost analysis of proposed 2025 program plan

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Small Solar I and II Price Recommendations

Stakeholder Feedback on Financing Terms

- In SEA's presentation on first draft prices, we noted that interest rates on 10 and 20-year treasury bonds have declined but that regional public rate quotes (e.g., UMassFive College Federal Credit Union) had not reduced significantly
- SEA met with a developer active in Small Solar in Rhode Island, and was provided with a confidential rate sheet from a competing lender to UMassFive which substantiated the UMassFive rates
- RI Energy recommended that SEA revise interest rates to reflect expectations of rate reductions
- The new data suggested that, in practice, most lenders are offering rates higher than those assumed by SEA
- However, SEA still expects rates to decline in 2025 to reflect federal lending trends
- **M.I.: For Small Solar I and II, SEA to shift to benchmarking estimates based on public rate quotes from UMassFive, subject to certain adjustments (see next slide)**

Stakeholder Feedback on Financing Terms

- **M.I. (cont't) Specifically, SEA to revise financing inputs as follows:**
  - **Interest Rates: SEA to adopt rates based on UMassFive 10-year offering (currently 8.88%) with 50 bps reduction to reflect expected rate cuts in 2025 ➔ 8.38%**
  - **Lenders Fee: SEA to reduce lenders fee to 0%, consistent with UMassFive lending terms**
  - **Term: SEA to reduce term to 10 years, consistent with UMassFive lending terms**

	Small I (1-15 kW)			Small II (15-25 kW)		
	2024 Final	***2025 1st Draft***	***2025 Final***	***2024 Final***	***2025 1st Draft***	***2025 Final***
Debt Term (years)	13	13	**10**	10	10	**10**
Interest Rate on Term Debt	7.63%	6.91%	**8.38%**	7.49%	6.78%	**8.38%**
Lender's Fee (% of total borrowing)	4.25%	4.25%	**0%**	2.3%	2.3%	**0%**

Stakeholder Feedback on Labor Requirements

- **HB 7015 – An Act Relating To Businesses And Professions — Electricians** and its Senate companion bill **SB 2120 – An Act Relating to Businesses and Professions – Electricians** require a licensed electrician to perform all the installation and maintenance of solar racking, among other elements ➔ Expected to increase labor costs
- SEA's internal analysis (informed by NREL residential solar labor inputs provided in NREL's 2023 cost benchmark report) suggests cost increases in the $20-40/kW range
- SEA met with a developer active in Small Solar in Rhode Island who quoted cost increases in the $30-40/kW range ➔ substantiating the mid-point of SEA's internal estimate
- **M.I.: For final draft prices, SEA will adopt the mid-point cost estimates of $30/kW for Small Solar I and II**

Other of Stakeholder Feedback Received

- RI Energy recommended that SEA derive Small Solar I and II installed cost inputs from the lowest quartile of costs in state databases (as opposed to the median values)
  - SEA has maintained the use of median values given atypically low program participation in 2023 and 2024
- RI Energy recommended SEA adjust the value adopted for the sample sizes of individual sources
  - SEA has combined two data sources (2024 RI Small REF and RI Small REG) given their limited sample size

Summary Results (¢/kWh)

- Proposed 2025 prices for Small Solar I and II are provided below

Class	Tariff Term	Size Range kW (Modeled Size kW)	2024 Approved Price	2025 Proposed Price	% Change (2024→ 2025)
Small Solar I	15	≤15 (5.8)	36.45	**34.55**	*-5.2%*
Small Solar II	20	>15-25 (25)	33.15	**33.35**	*+0.6%*

Note: Details regarding the cost, financing, and performance inputs used in modeling can be found in **Appendix A**

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2025 MW Allocation Plan Recommendations

2025 MW Allocation Plan Development Process

- To develop the draft 2025 MW allocation plan, SEA attempted to balance the objectives of ensuring healthy program competition with providing a robust plan that would not unnecessarily constrain the deployment of DG
- SEA's research focused on evaluating the competitive dynamics of each renewable energy class, both historic and future
- In doing so, SEA (in consultation with RI Energy) considered:
  - The number of unique developers with projects in the interconnection pipeline in each class, and the relative share of capacity owned by each developer
  - The total capacity of projects expected to be able to bid into the 2025 PY, based on
    - Each project's stage in the interconnection pipeline
    - Each project's involvement in ASO studies
    - Project-specific determinations for Large Solar II and III provided by RI Energy
  - The ability for net metering projects at various interconnection stages to switch to REG

Accounting for Interconnection Delay

- Given that a large volume of projects in Large Solar I, II, and III are implicated by the ongoing ASO#3 study, SEA proposes that **all capacity in these classes is offered in the third open enrollment only**, since doing so maximizes:
  - Potential time for ASO#3 to conclude; and
  - The likelihood of competitiveness in that Open Enrollment
- In addition, SEA believes it is necessary to plan for contingencies in which ASO#3 is further delayed ➔ two MW allocation plans:
  - Plan A assumes ASO#3 **concludes in time** for projects to bid into the 2025 PY
  - Plan B assumes ASO#3 **does not conclude 45 days prior to the opening of the third open enrollment** in the 2025 PY ➔ reduced capacity for ASO-implicated classes
- The capacities offered in Plan A and B are based on project-specific analysis to ensure healthy competition under either scenario

MW Allocation Stakeholder Feedback Received

- SEA only received one comment from an industry member, which recommended that any unused capacity in Large Solar categories be re-allocated to renewable energy classed under 1 MW
- RI Energy recommended that the Large Solar III allocation under Plan A be reduced from 30 MW to 15 MW based on an assessment of eligible projects in the interconnection queue
  - OER has adopted this recommendation
- RI Energy recommended that the MW allocation for renewable energy classes under 1 MW be reduced to the statutory minimum of 30 MW
  - OER has not adopted this recommendation
  - Resources under 1 MW are least likely to face challenges due to siting and interconnection
  - OER expects that development focus will shift to projects under 1 MW given the recently enacted solar siting law which bans development on core forests

Proposed 2025 MW Allocation Plan

Renewable Energy Class	2024 MW Allocation (PUC Approved)	2024 MW Allocation (RIE Revised)	2025 MW Allocation (Plan A)	2025 MW Allocation (Plan B)
Small Solar I and II	9	9	**9 [10**]**	**9**
Medium Solar	5	5	**7**	**7**
Commercial Solar I	7.5	7.5	**9.5**	**9.5**
Commercial Solar I CRDG	0.5	0.5	**0.5**	**0.5**
Commercial Solar II	10.5	10.5	**11.5**	**11.5**
Commercial Solar II CRDG	1	1	**1**	**1**
Large Solar I*	15	15	**20**	**10**
Large Solar I CRDG*	5	5	**5**	**5**
Large Solar II*	35	0	**30 [35**]**	**0**
Large Solar III*	15	0	**15 [30**]**	**0**
Large Solar IV*	0	0	**0**	**0**
Wind	3	3	**3**	**3**
Wind CRDG				
Small Scale Hydro	1	1	**1**	**1**
AD				
Total	**107.5**	**57.5**	**112.5**	**53.5**

*Capacity offered in Third Open Enrollment only

**Values in [purple brackets] represent the previous proposed 2025 allocation during the 2024 PY Development process

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Adder Pilot Recommendations

Background: REG Remediation Adders

- Per the PUC's directives at the April 29 open meeting and August 29 written Order, OER engaged SEA to complete the research necessary to revise the proposed pilot program for remediation adders
- SEA's research focused on:
  - Program design (e.g., incentive format, size, duration)
  - The ability for a pilot to leverage third-party funding sources (e.g., other state/federal funds or incentives)
- With respect to program design, research concluded that a cent/kWh adder continues to be the optimal incentive format
  - Ease of implementation
  - Avoids risk of upfront incentives if project fails to deliver benefits
- With respect to leveraging third-party funding, research concluded that
  - For REG projects, no additional state incentives/funding could reasonably be leveraged in combination with the adder
  - For brownfield projects, it was reasonable to assume that projects could receive the 10% Federal Investment Tax Credit "Energy Communities" bonus ➔ **reduction in calculated adder**

Revised Adder Pilot Program

- Details on the proposed Adder Pilot Program are provided below:
  - **Classes:** Large Solar I or Large Solar II
  - **Value:** 1.6 cents/kWh
    - Value to be scaled from 0-100% based on the percentage of a site overlapping a parcel requiring remediation, based on DEM's determination
  - **Duration**: 2 Program Years (PY 2025 and PY 2026)
  - **Size**:
    - Max 10 MW of Large Solar I
    - Max 10 MW of Large Solar II
    - These allocations would still operate under the "base" MW Allocation plan with **no "carve-out" for adder-only projects**
  - **Eligible Sites**: OER proposes a single adder applicable to projects on brownfields or superfund sites requiring remediation
    - Given the limited number of landfills that are uncapped (e.g., requiring remediation) that could be pursuing solar during capping, **OER has decided to not pursue an adder unique to landfills**
    - However, landfills requiring remediation that are also classified as brownfields could still qualify for the brownfields adder

Comparison of Adder Values

- A comparison of the adder values proposed during the PY 2024 development process vs currently proposed adders is provided below (all values in c/kWh)
  - Details regarding the cost inputs used in modeling can be found in Appendix A

Resource Class	Previously Proposed Landfill	Final Proposed Landfill	Previously Proposed Brownfield/ Superfund	Final Proposed Brownfield/ Superfund*
Non-Large Solar (<1 MW)	**4.30**	**N/A**	**3.60**	**N/A**
Large Solar (1-<5 MW)	**4.30**	**N/A**	**3.60**	**1.60**
Large Solar II (5-<10 MW)	**3.60**	**N/A**	**2.90**	**1.60**
Large Solar III (10-<15 MW)	**3.40**	**N/A**	**2.80**	**N/A**
Large Solar IV (15-<39 MW)	**3.30**	**N/A**	**2.70**	**N/A**

Pilot program would target Large Solar I and II only

*landfills requiring remediation that are also classified as brownfields could still qualify for the brownfields adder

Additional Implementation Details

- **Informational Reporting Requirements**: RI Energy to collect information via program application regarding:
  - Bidder's plans to pursue third-party funding (e.g., other state incentives)
  - Total project installed cost
  - Estimated costs associated with site remediation
  - (as requested in the DPUC's comments) Estimated operating expenses associated with the site in question, including:
    - Estimated incremental O&M expenses due to the siting type; and
    - Land lease expenses
- **Coordination with DEM**:
  - DEM to provide records regarding any renewable projects selected through brownfields Remediation and Economic Development Fund to RI Energy
  - DEM to make all final determinations regarding if a project is on a preferred site requiring remediation, and what percentage of the project are within the preferred site

Stakeholder Feedback Received

- The DPUC offered numerous detailed suggestions regarding the adder, including:
  - Setting the adder equal to the lowest calculated value for Large Solar I and II
    - SEA maintains the adder value at the higher of the two calculated values to ensure the adder is sufficient to incent Large Solar II Projects (which cannot include interconnection costs in their calculation of ITC benefits)
  - Requiring that the selection process consider the extent to which projects have pursued and secured additional state and federal incentives
    - SEA is supportive of RI Energy collecting information regarding bidder's plans to pursue third-party funding via program application
  - The collection of additional information from adder-eligible bidders regarding operational expenses
    - SEA has adopted this recommendation
- RI Energy requested additional information from SEA regarding the data used to derive cost assumptions for adder-eligible projects
  - SEA derived inputs based on a survey of market participants, including research conducted through prior engagements (see presentations from 2024 PY development process linked in Appendix A)

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REG 2025 PY & Brownfield Adder Pilot Benefit-Cost Analysis Results

NOTE: Values herein may be subject to change based on evidence acquired prior to (and during) REG 2025 PY docket process

Overview of Benefit-Cost Analysis (1)

- As a component of SEA's filing before the PUC during the 2024 ceiling price development process, SEA conducted a benefit-cost analysis of the **solar classes** under the proposed program plan
  - Non-solar was not tested given the REG program predominantly focuses on solar
- The analysis utilizes inputs and assumptions from the 2024 Avoided Energy Supply Cost (AESC) study
  - The AESC study is conducted once every three years to establish assumptions regarding the benefits of DG and demand-side management/energy efficiency programs
  - Development is overseen by EDCs (including RI Energy), state energy offices and other regulators, and select stakeholders
  - Overall, AESC is accepted as a high-quality source for benefit-cost analysis data, and is currently utilized to assess RI Energy's various energy efficiency programs
- SEA conducted analysis from two perspectives (or "tests"), which are described on the following slides

Overview of Benefit-Cost Analysis (2)

- The total benefits or costs (from either a market value or societal perspective) are the product of:
  - The total capacity assumed to be deployed; and
  - The net present value (NPV) of benefits or REG tariff costs per MW of deployed capacity (including assumed delay from selection to commercial operation)
- SEA also conducted its analysis assuming the following bounded range of benefits and costs:
  - **Assumed low bound:** Historical average deployment levels in the program, which are equivalent to 51% of the capacity in the total MW Allocation Plan
    - 51% is equivalent to 78% of the total plan ultimately being selected, and 66% of that population reaching commercial operation
    - SEA notes that this is a conservative assumption of a lower bound given that in recent years selection has been even lower than this historical average
  - **Assumed high bound:** Full selection and deployment of available capacity in the MW Allocation Plan
    - According to RI Energy data, the full subscription of available capacity AND the 100% attainment of commercial operation by all selected projects has never happened in the history of the REG program
    - In SEA's experience, it is rare (to the point of being functionally unheard of) for a multifaceted portfolio of selected projects in a procurement to **all** reach commercial operation, given many (if not most) projects in development fail to reach critical milestones

Overview of Benefit-Cost Analysis (3)

- RI Energy's ratepayer impact analysis assumes all **available program capacity is selected** and that **all selected capacity reaches commercial operation**
  - Historically, it is very rare for the full program capacity to be selected
  - Furthermore, SEA is unaware of any instance in which all the selected capacity reached commercial operation
    - Historically, attrition has averaged 34% of the selected capacity
- In addition, RI Energy's analysis presents the cumulative cost of all remaining program years (through 2033) assuming prices equal to PY 2025 prices for that entire period
  - This is inconsistent with the 2026 prices approved by the PUC in Docket 23-44-REG
  - Historically, annual price declines were the norm COVID-19 pandemic, but SEA anticipates that prices will continue to decline year-over-year to at least a modest degree, if not more
    - This outlook is consistent with the findings of the NREL Annual Technology Baseline (ATB) report

BCA Methodology – Rhode Island Test

- First, SEA conducted analysis using the Rhode Island Test (RI Test)
- The PUC adopted the test in Docket 4600, and considers a range of benefits and costs that go beyond those realized by ratepayers
- The test is intended to represent the following:
  - All monetizable energy and capacity benefits
  - Benefits associated with avoided GHG emissions
  - Reliability benefits
- The RI Test is presented to the Distributed Generation Board both with and without economic development to provide the full range of benefits that the Distributed Generation Board, state agencies and stakeholders may want to consider

BCA Results – Rhode Island Test

Result (RI Test)	Plan A Allocation		Plan B Allocation	
Deployment Case	*Historical REG Deployment (2015-23)*	*Full Allocation Deployed*	*Historical REG Deployment (2015-23)*	*Full Allocation Deployed*
MW Assumed Deployed	55.9	108.5	27.5	53.5
Total Benefits	$214.7 million	$417.1 million	$99.2 million	$192.8 million
Total Cost	$174.3 million	$338.7 million	$102.9 million	$199.8 million
Net Benefits/Costs	**$40.3 million**	**$78.3 million**	**($3.6 million)**	**($7.0 million)**
Benefit/ Cost Ratio	**1.23**		**0.96**	

Note: Totals may not equal sum of above components due to rounding

Larger resources generally have a higher net benefit/ benefit/cost ratio (BCR) **AND** Plan B includes less of these

BCA Results – Rhode Island Test + Econ. Dev. Benefits

Result (RI Test)	Plan A Allocation		Plan B Allocation	
Deployment Case	*Historical REG Deployment (2015-23)*	*Full Allocation Deployed*	*Historical REG Deployment (2015-23)*	*Full Allocation Deployed*
MW Assumed Deployed	55.9	108.5	27.5	53.5
Total Benefits	$280.1 million	$544.1 million	$139.4 million	$270.7 million
Total Cost	$174.3 million	$338.7 million	$102.9 million	$199.8 million
Net Benefits/Costs	**$105.7 million**	**$205.3 million**	**$36.5 million**	**$70.9 million**
Benefit/ Cost Ratio	**1.61**		**1.35**	

Note: Totals may not equal sum of above components due to rounding

BCA Methodology – Market Value Test

- Second, SEA utilized a "Market Value" test
  - The test considers only benefits and costs that are **monetizable** (e.g., no consideration of non-monetized societal benefits)
    - **No inclusion** of benefits associated with avoided GHG emissions
    - **No inclusion** of reliability benefits (which capture a customer's willingness to pay for uninterrupted service)
  - Starting in RIPUC Docket 23-44-REG, the PUC has used this test to determine the excess cost of the REG program
- This "Market Value" test focuses on monetizable benefits relevant to procurement of new generation – this includes benefits associated with energy, capacity, market effects of additional supply
  - A benefit/cost ratio (BCR) greater than 1 = the proposal's cost to New England ratepayers < potentially monetizable benefits

BCA Results – Market Value Test

Result (Market Value)	Plan A Allocation		Plan B Allocation	
Deployment Case	*Historical REG Deployment (2015-23)*	*Full Allocation Deployed*	*Historical REG Deployment (2015-23)*	*Full Allocation Deployed*
MW Assumed Deployed	55.9	108.5	27.5	53.5
Total Benefits	$153.6 million	$298.3 million	$69.3 million	$134.6 million
Total REG Tariff Cost	$174.3 million	$338.7 million	$102.9 million	$199.7 million
Net Benefits	**($20.8 million)**	**($40.4 million)**	**($33.5 million)**	**($65.2 million)**
Benefit/ Cost Ratio	**0.88**		**0.67**	

Note: Totals may not equal sum of above components due to rounding

Larger resources generally have a higher net benefit/ benefit/cost ratio (BCR) **AND** Plan B includes less of these (same dynamics as RI Test, but from market value perspective)

BCA Methodology – Brownfield Adder

- The remediation of brownfields offers numerous potential societal benefits, including (see EPA Handbook on the Benefits, Costs, and Impacts of Land Cleanup and Reuse):
  - Human health benefits
  - Ecological Benefits
  - Aesthetic Improvements
  - Increased Land Productivity
- To quantify such benefits, SEA conducted a literature review and adopted the results of Haninger et al. 2017
  - Peer-reviewed study published in the *Journal of the Association of Environmental and Resource Economists*
  - Most comprehensive nationwide study assessing value of brownfield remediation
  - Utilizes study of property values which EPA handbook endorses as "the best prospect for defensible studies of the social benefits of land cleanup and reuse"
- SEA adopted the values recommended by the study for use in benefit-cost analysis, which utilize the lowest-end of the estimated value
  - SEA discounted benefits assuming this value would be realized ten years into the future (based on housing turnover data reported by the National Association of Realtors)
- Consistent with SEA's analysis in Docket 23-44-REG, SEA also included conservation benefits related to the preservation of open space, based on the findings of a 2011 study prepared for the Delaware Valley Regional Planning Commission
  - However, SEA is **not** including a benefit associated with avoided property value losses from solar, as was done in its Docket 23-44-REG analysis, based on the PUC's feedback during the proceeding
- **NOTE:** The adders were evaluated using the RI Test, given that the REG law requires consideration of conservation benefits that are not included in the Market Value test

BCA Results – Brownfield Adder

Incremental Adder Results	RI Test – Historical Subscription Levels	RI Test – Fully Subscribed
MW Assumed Deployed	10.3	20
Total Benefits	$4.5 million	$8.8 million
Total REG Tariff Cost	$1.9 million	$3.7 million
Net Benefits	**$2.6 million**	**$5.1 million**
Benefit/Cost Ratio	**2.40**	

Note: Totals may not equal sum of above components due to rounding

SEA's analysis finds that, on an NPV basis, for every $1 spent on REG tariff payments for adder compensation, Rhode Island realizes **$2.40** in net societal benefits from brownfield remediation

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Appendix A: Detailed Cost, Performance and Financing Assumptions

Summary: Solar <=25 kW Financing Assumptions

	Small I (1-15 kW)			Small II (15-25 kW)		
	2024 Final	***2025 1st Draft***	***2025 Final Draft***	***2024 Final***	***2025 1st Draft***	***2025 Final Draft***
Federal Investment Tax Credit (%)	30%	30%	**30%**	30%	30%	**30%**
% Debt	51.0%	51.0%	**43.4%**	45%	46.1%	**45.2%**
Debt Term (years)	13	13	**10**	10	10	**10**
Interest Rate on Term Debt	7.63%	6.91%	**8.38%**	7.49%	6.78%	**8.38%**
Lender's Fee (% of total borrowing)	4.25%	4.25%	**0%**	2.3%	2.3%	**0%**
Target After-Tax Equity IRR	7%	7%	**7%**	12.5%	12.5%	**12.5%**

Summary: Solar Cost & Production Assumptions

	Small I	Small II
Nameplate Capacity (kW)	5.8	25
Capacity Factor	13.4%	13.4%
Annual Degradation	1.0%	1.0%
Useful Life (Years)	25	25
Total Capital Cost ($/kW)	$4,270 [$4,260] [$4,449]	$3,942 [$3,940] [$3,946]
Fixed O&M ($/kW-yr)	$29	$24
O&M Escalation Factor	2.0%	2.0%
Non-O&M Escalation %	2.0%	2.0%
Insurance (% of Cost)	0.0%	0.0%
Project Management ($/yr)	$0	$0
Site Lease ($/yr)	$0	$0

Values in [Purple Brackets] represent 2024 ceiling price inputs, value in [blue brackets] represent first draft 2025 ceiling price inputs

Adopted Adder Incremental Cost Assumptions

- Adopted adder cost inputs are provided below
- A discussion of research and stakeholder feedback related to these inputs can be found in the following presentations related to the 2024-2026 ceiling price development process:
  - Discussion of Initial Adder Research
  - Discussion of Revised Adder Inputs

Category	Unit	Brownfield/ Superfund
Upfront Capital Cost	Inc. $/kW vs. Greenfield	$372
Upfront Permitting Costs (incremental to above $/kW input)	Inc. $ vs. Greenfield	$190,833
Year 1 DC CF	% Change vs. Greenfield	-2.5%
O&M	”	16%
Project Mgmt.	”	7%
Insurance	”	15%
Land/Site Lease	”	0%
ITC Bonus	%	10% [0%]

Values in [Purple Brackets] represent 2024 adder price inputs

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