2021 REG Public Policy Adder Development Process

Second Stakeholder Meeting

Sustainable Energy Advantage, LLC
National Grid

August 28, 2020

Sustainable Energy Advantage, LLC

Outline of Presentation

- Overview of Public Policy Adder Goals, Categories and Survey Results
    - Recap of OER/DG Board/National Grid Public Policy Goals
    - Compensation Rate Adders in SMART Program
- Public Policy Adder Calculation Methodology/ Assumptions
    - How SEA Calculates RI REG Ceiling Prices
    - How SEA Calculates Proposed RI REG Public Policy Adders
    - Survey Methodology/Approach
    - Analysis of Survey Results
- Initial Incremental Cost (and NPV of Cost) Results
    - Comparison of SMART Adder values to Proposed RI Adder Values
- Appendix

Overview of Public Policy Adder Goals, Categories and Survey Results

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Near- and Medium-Term Public Policy Goals Shared by DG Board and National Grid (and Potential Adders/Subtractors)

- Near-Term Public Policy Goals (Representing Adders and/or Subtractors Under Active Consideration and Development for 2021 REG Pilot Development)
  - **Beneficial Siting (Adder(s)):** Renewable energy projects with environmentally-beneficial siting characteristics (including but not limited to projects sited on rooftops, carports/canopies, landfill and brownfields);
  - **Discouraging Detrimental Siting (Potentially a Subtractor):** Renewable energy projects that may be sited on parcels in which development would cause undue environmental damage and/or be inconsistent with the most optimal use of the land; and
  - **Low/Moderate Income (LMI, Adder):** Renewable energy projects that provide clear and tangible benefits to participants from low- or moderate-income households

Near- and Medium-Term Public Policy Goals Shared by DG Board and National Grid (and Potential Adders/Subtractors)

- Medium-Term Public Policy Goals (Representing Adders Under Consideration and Potential Development for 2022)
    - **Encouraging Energy Storage (Adder):** Renewable energy projects paired with on-site energy storage capable of shifting and/or reducing load (e.g. through demand response or other activities)
- Other Public Policy Goals (Representing Adders Not Currently Under Consideration)
    - **Net Locational/Grid Value:** Renewable energy projects that may be sited in certain locations that provide quantifiable system benefit (or incur substantial net system cost)

Case Study: Compensation Rate Adders in SMART Program

- The Solar Massachusetts Renewable Target (SMART) program includes multiple adders to compensate projects for their location, offtaker, or other attributes
- The SMART adders are meant to both compensate project types that are associated with a higher cost of development in addition to incenting project types that are favorable from a policy perspective
- All offtaker-based and other adders are subject to decreases in their value as each adder tranche is filled (except for location-based adders)

Adder Category	Adder	Tranche 1 Value ($/kWh)
Location Based	Building Mounted	$0.02
	Floating	$0.03
	Brownfield	$0.03
	Landfill	$0.04
	Canopy	$0.06
	Agricultural Solar	$0.06
Offtaker Based	Community Shared Solar	$0.05
	Low Income Property	$0.03
	Low Income Community Shared Solar	$0.06
	Public Entity	$0.04
Other	Energy Storage	Variable
	Solar Tracking	$0.01
	Pollinator	$0.003

Public Policy Adder Calculation Methodology/ Assumptions

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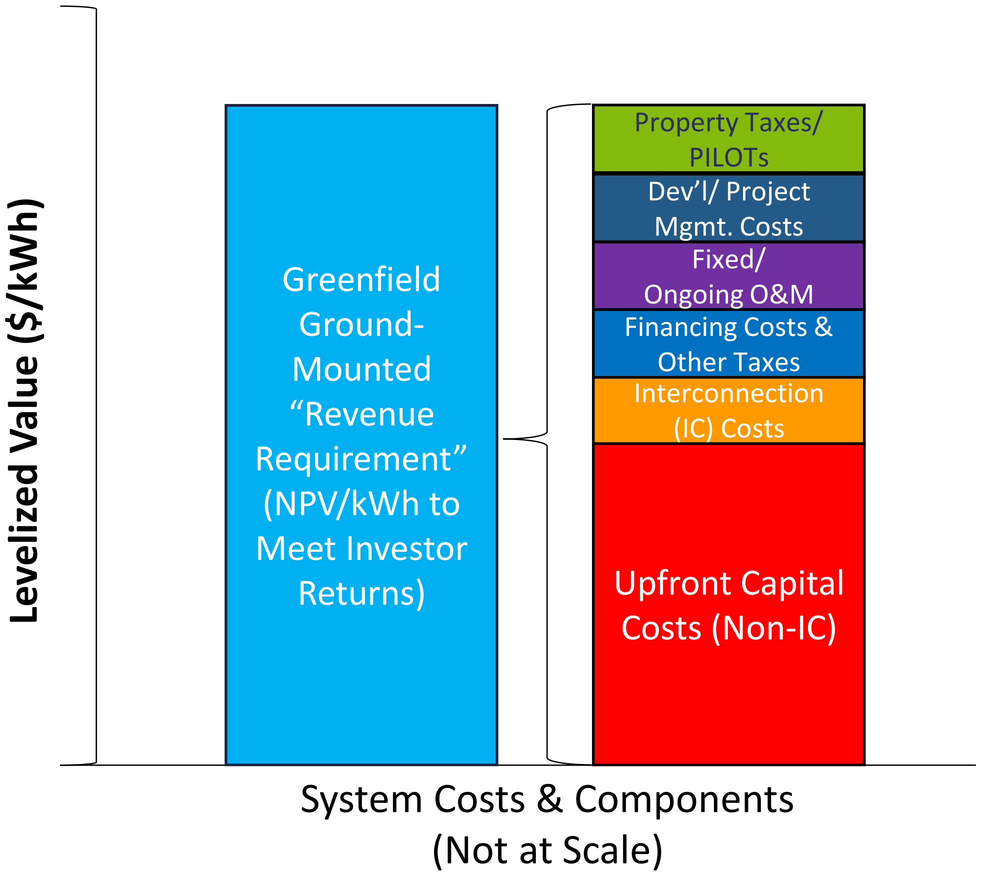
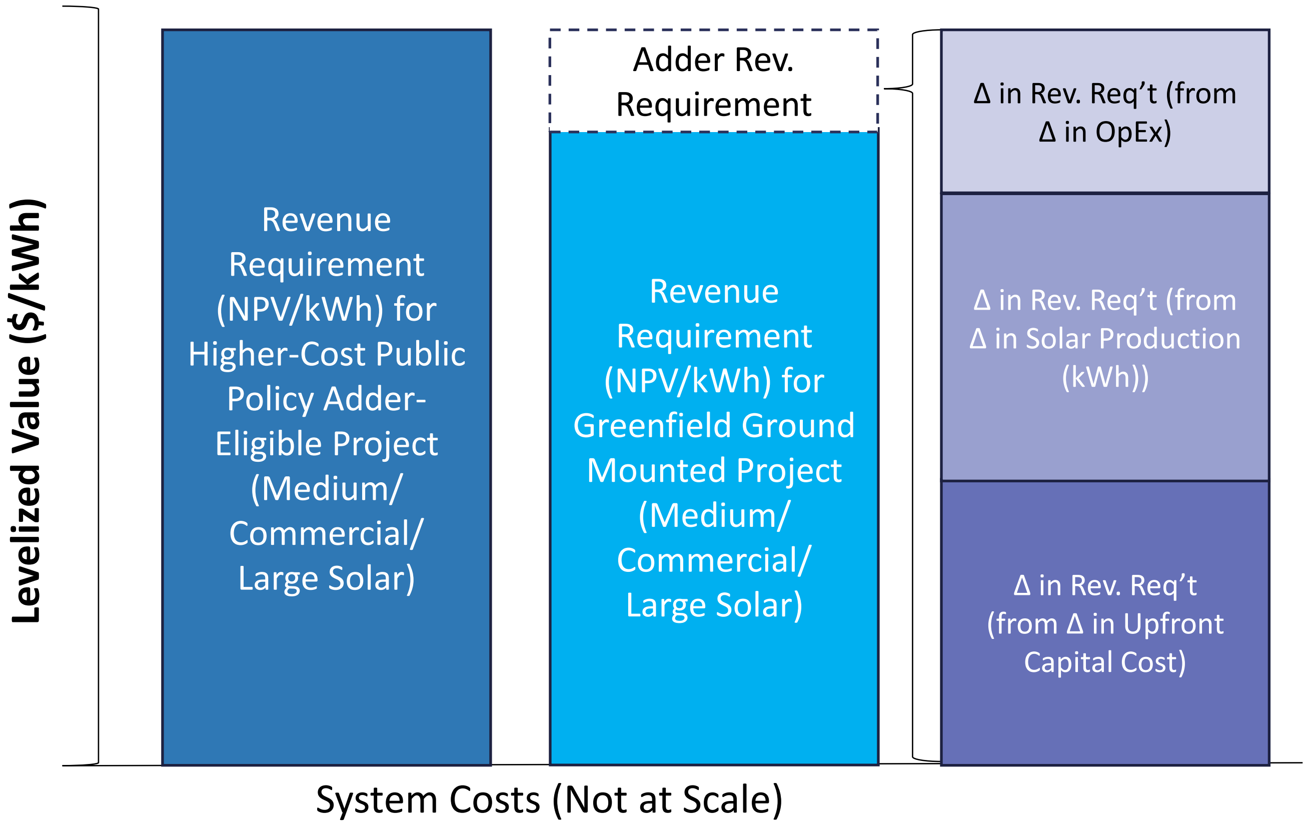
How SEA Calculates RI REG Ceiling Prices

- SEA utilizes Cost of Renewable Energy Spreadsheet Tool (CREST), which it developed for NREL
- The model takes as inputs all of the capital and operating costs of a greenfield ground-mounted project of a given size category
- It then outputs the net present value (NPV) of the revenue requirement per kWh needed to meet investor returns
- When calculating the RI REG ceiling prices, the model calculates the following over the full term of the tariff payment:
  - The total revenue the project needs; ***LESS***
  - Federal tax benefits and post-contract revenue in the ISO-NE energy markets



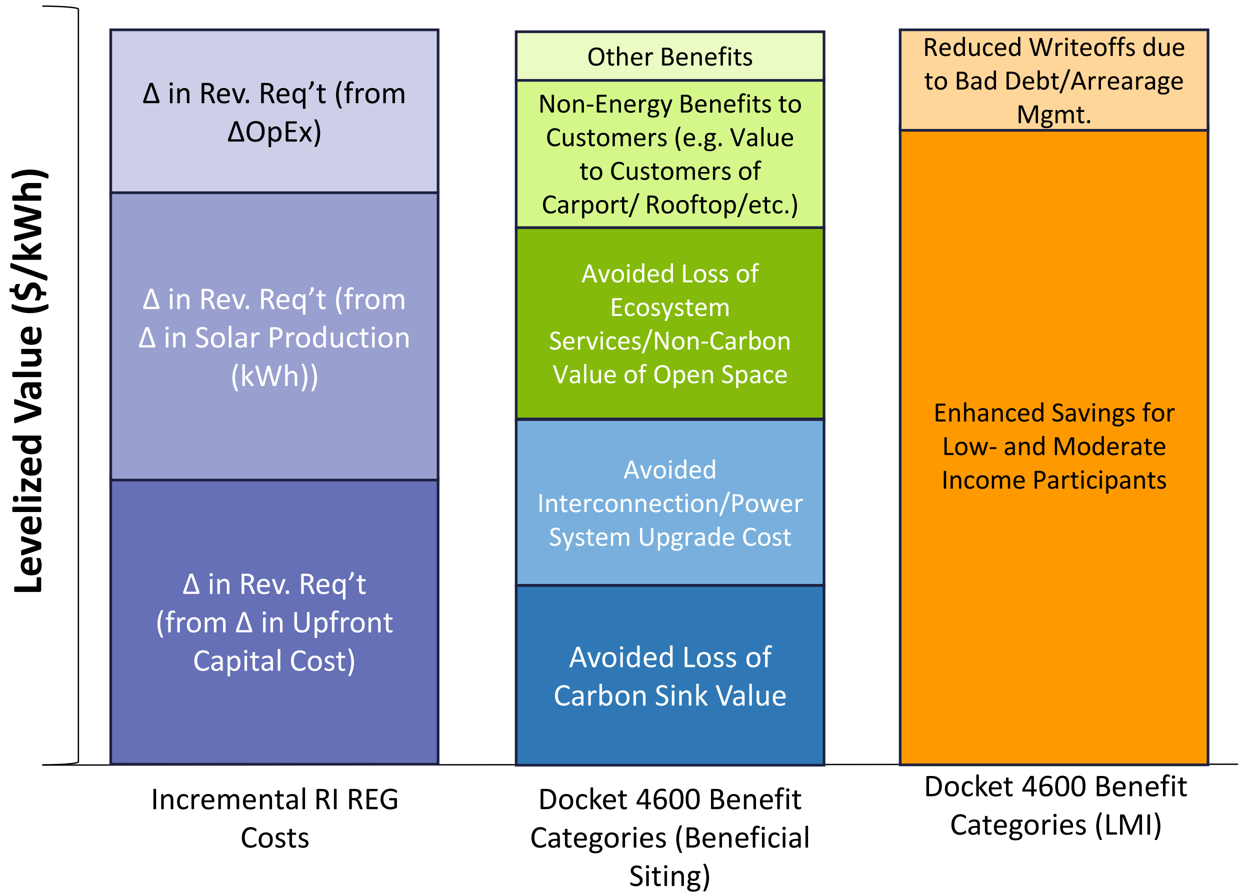
How SEA Calculates Proposed RI REG Public Policy Adders



- To set appropriate adder values, we compare the greenfield ground-mounted project to a project expected to create a certain degree of public policy value (e.g. rooftop, carport, LMI, etc.) of the same size
- Projects suspected to offer enhanced public policy value **tend to have incremental capital and operating costs relative to greenfield ground-mounted projects of the same size** (as well as reduced energy production)
- The adder revenue requirement is intended to represent **the net difference in capital costs, operating costs and production needed** to help preferred projects reach investor returns
- To establish these values, SEA undertook a survey of Rhode Island and regional market participants

Objective: Balancing Benefits with Costs in Line with Docket 4600 Benefit Categories

- However, RIPUC has required adder costs to be weighed against the Societal, Power System and Customer benefits in its Benefit-Cost Framework (developed in Docket 4600)
- Provision of "identifiable benefits to customers" (per the REG law) is *sine qua non* for adder proposal/adoption
- Thus, degree of benefits must scale relatively closely (or preferably exceed) incremental costs of certain potentially preferred projects



NOTE: Benefits/Costs in Graphic Not Necessarily to Scale

Survey Methodology/Approach

- To determine the incremental capital, OpEx and production impacts associated with systems that could notionally be eligible for Public Policy Adders, SEA conducted a survey of 27 different solar project developers
- All developers had experience (and often significant experience) in each of the market sectors in which they provided information
- Survey utilized prior SEA data regarding the costs of Greenfield Ground Mount, Carport, Rooftop, LMI, Landfill and Brownfield
- SEA then requested survey respondents to verify the accuracy of the data, or otherwise provide more accurate data regarding the overall cost and production profile of each project type
- We summarize (in the next several slides) the categories surveyed, as well as our findings regarding the drivers of incremental project costs

Categories of Potential Preferred Projects Included in Survey

- Categories
  - Rooftop Solar
  - Carport Solar
  - LMI (Rooftop and Ground Mount)
  - Landfill Solar
  - Brownfield Solar
- Project Sizes
  - 25-250 kW (RI REG Medium Solar range)
  - 251-999 kW
  - 1-5 MW
  - <=25 kW assumed not eligible (most already are roof-mounted)

Survey Results in Comparison to SEA Expected Values

- Mean estimates of installed cost premiums for each project type provided by survey respondents were generally in line with SEA's initial estimates
- Notable departures from SEA initial estimates include:
  - Higher estimates for Commercial Ground-mounted LMI (+$0.22/W)
  - Lower estimates for Rooftop LMI (all sizes)
  - High variance in Carport estimates (+$0.30/W for Medium, -$0.19/W for Commercial, -$0.30/W for Large)
  - Higher estimates for Medium and Commercial Landfill (+$0.25/W-$0.31/W)
- Estimates regarding operating cost premiums reported the largest cost premiums were for project management of LMI projects and O&M for Carport projects
- For a complete account of inputs derived from the survey and utilized in analysis, please see Appendix

Major Drivers of Incremental Costs for Potential Preferred Projects (Informed in Part by Incremental Cost Survey) (1)

- Rooftop Solar
  - **Capital:** Can include some amount of residual roof/site maintenance costs (which can also be offset by lower permitting costs relative to greenfield ground-mounted development)
  - **Operating Expenses (OpEx):** On-site nature of project can incur additional O&M and insurance expense (esp. since maintenance requires access to premises and to rooftops, as well as specialized labor and equipment)
  - **Production:** Rooftops cannot be as easily selected for maximizing system production relative to greenfield ground mounts (as they often cannot be oriented as close to due south, or cannot be tilted to maximize system production based on latitude when placed on a flat roof)
- Carport Solar
  - **Capital:** Substantially increased mounting costs (associated with steel structure for shading vehicles), as well as initial structural engineering costs (to ensure proper snow/wind loading)
  - **OpEx:** Increased costs of maintenance (required for accessing larger mounting system)
  - **Production:** Similar to rooftops, tilt of Carport structure makes optimum tilting and orientation nearly impossible (given dual use as shading for vehicles)

Drivers of Incremental Costs for Potential Preferred Projects (Informed in Part by Incremental Cost Survey) (2)

- LMI Ground Mounted Solar
  - **Capital:** Incremental upfront cost of initial customer acquisition (which can often be somewhat higher for LMI participants)
  - **OpEx:** Incremental ongoing cost of customer billing/customer care
  - **Production:** N/A (the nature of the offtaker has no material bearing on the quality of the site, which determines the quantity of production).
- LMI Rooftop Solar
  - **Capital:** Similar to Rooftop, but inclusive of initial customer acquisition costs associated with LMI/CRDG ground-mounted projects
  - **OpEx:** Similar to the combination of both LMI/CRDG ground-mounts, but also inclusive of additional expense associated with Rooftop projects
  - **Production:** Similar issue with non-optimal tilt and orientation as for other Rooftop projects

Drivers of Incremental Costs for Potential Preferred Projects (Informed in Part by Incremental Cost Survey) (3)

- Landfill Solar
  - **Capital:** Increased labor/capital costs associated with complexity/safety requirements of installations and specialized foundations needed, as well as cost of capping landfill (if not done already) and the capitalization of a decommissioning reserve
  - **OpEx:** Maintenance and insurance can be higher given more stringent monitoring requirements (to ensure ongoing safety/minimization of methane leakage)
  - **Production:** Depending on slope and orientation of cap upon landfill, production can be relatively similar to a greenfield ground mount, but evidence suggests it is a tiny bit lower
- Brownfield Solar
  - **Capital:** Increased permitting and (in many cases) initial remediation costs, and the capitalization of a decommissioning reserve
  - **OpEx:** Insurance can be expensive-to-impossible to get, monitoring costs also high (similar to Landfill)
  - **Production:** Unlikely to be highly different, but evidence also suggests (like Landfill) that it is a tiny bit lower

Range of Inputs Derived from Survey (for Potential Adders)

	Lowest/Highest Cost Input Range						Lowest/Highest Production Input Range
Project Type	*Capital Cost ($/kW$_{DC}$, Incl. IC)*	*Capital Cost Premia ($/kW$_{DC}$, Incl. IC)*	*O&M Premia %*	*Insurance Premia (%)*	*Land/Site Lease Premia (%)*	*Project Mgmt. Premia (%)*	*Capacity Factors (%)*
Greenfield Ground Mounted	$1,384-$2,288	N/A (Serves as Basis for Comparison, Except as Indicated)					13.4%-14.6%
Rooftop	$1,474-$2,288	($110)-$250	15%	10%	23%	10%	13.3%-14.6%
LMI Rooftop	$1,754-$2,888	$310-$620	23%*	5%*	9%	58%	13.3%-14.6%
LMI Ground Mounted	$1,664-$2,888	$280-$660	23%	5%	9%	58%	14.7%-15.2%
Carport	$2,105-$3,388	$700-$1,100	36%	16%	20%	9%	13.1%-14.6%
Landfill	$1,624-$2,838	$240-$510	9%	13%	0%	10%	14.0%-15.2%
Brownfield	$1,584-$2,738	$80-$450	16%	13%	2%	7%	14.0%-15.2%

*Premium is relative to a non-LMI rooftop project.

Public Policy Adders Case Matrix

Project Type	Size Category	Modeled Size (kW_{DC})	Case #1: Low Cost/ High Production	Case #2: Low Cost/ Low Production	Case #3: High Cost/ High Production	Case #4: High Cost/ Low Production
Rooftop	25-250 kW	250	• 1st **Quartile** Upfront Cost • Production @ **Highest End** of Rooftop Range **(14.6%)** • **Mean** OpEx % Increase	• 1st **Quartile** Upfront Cost • Production @ **Lowest End** of Rooftop Range **(13.3%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Rooftop Range **(14.6%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost Production @ **Highest End** of Rooftop Range **(13.3%)** • **Mean** OpEx % Increase
Rooftop	251-999 kW	500				
Rooftop	1-5 MW	4,500				
Carport	25-250 kW	250	• 1st **Quartile** Upfront Cost • Production @ **Highest End** of Carport Range **(14.6%)** • **Mean** OpEx % Increase	• 1st **Quartile** Upfront Cost • Production @ **Lowest End** of Carport Range **(13.1%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Carport Range **(14.6%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Rooftop Range **(13.1%)** • **Mean** OpEx % Increase
Carport	251-999 kW	500				
Carport	1-5 MW	4,500				
LMI Rooftop	25-250 kW	250	• 1st **Quartile** Upfront Cost • Production @ **Highest End** of Rooftop Range **(14.6%)** • **Mean** OpEx % Increase	• 1st **Quartile** Upfront Cost • Production @ **Lowest End** of Rooftop Range **(13.3%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Rooftop Range **(14.6%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Rooftop Range **(13.3%)** • **Mean** OpEx % Increase
LMI Rooftop	251-999 kW	500				
LMI Rooftop	1-5 MW	4,500				
LMI Ground	25-250 kW	250	• 1st **Quartile** Upfront Cost • Production @ **Highest End** of Ground Mount Range **(15.2%)** • **Mean** OpEx % Increase	• 1st **Quartile** Upfront Cost • Production @ **Lowest End** of Ground Mount Range **(14.7%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Ground Mount Range **(15.2%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Ground Mount Range **(14.7%)** • **Mean** OpEx % Increase
LMI Ground	251-999 kW	500				
LMI Ground	1-5 MW	4,500				
Landfill	25-250 kW	250	• 1st **Quartile** Upfront Cost • Production @ **Highest End** of Landfill Range **(15.2%)** • **Mean** OpEx % Increase	• 1st **Quartile** Upfront Cost • Production @ **Lowest End** of Landfill Range **(14.5%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Landfill Range **(15.2%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Landfill Range **(14.5%)** • **Mean** OpEx % Increase
Landfill	251-999 kW	500				
Landfill	1-5 MW	4,500				
Brownfield	25-250 kW	250	• 1st **Quartile** Upfront Cost • Production @ **Highest End** of Landfill Range **(15.2%)** • **Mean** OpEx % Increase	• 1st **Quartile** Upfront Cost • Production @ **Lowest End** of Landfill Range **(14.5%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Landfill Range **(15.2%)** • **Mean** OpEx % Increase	• 3rd **Quartile** Upfront Cost • Production @ **Highest End** of Landfill Range **(14.5%)** • **Mean** OpEx % Increase
Brownfield	251-999 kW	500				
Brownfield	1-5 MW	4,500				

Initial Incremental Cost (and NPV of Cost) Results

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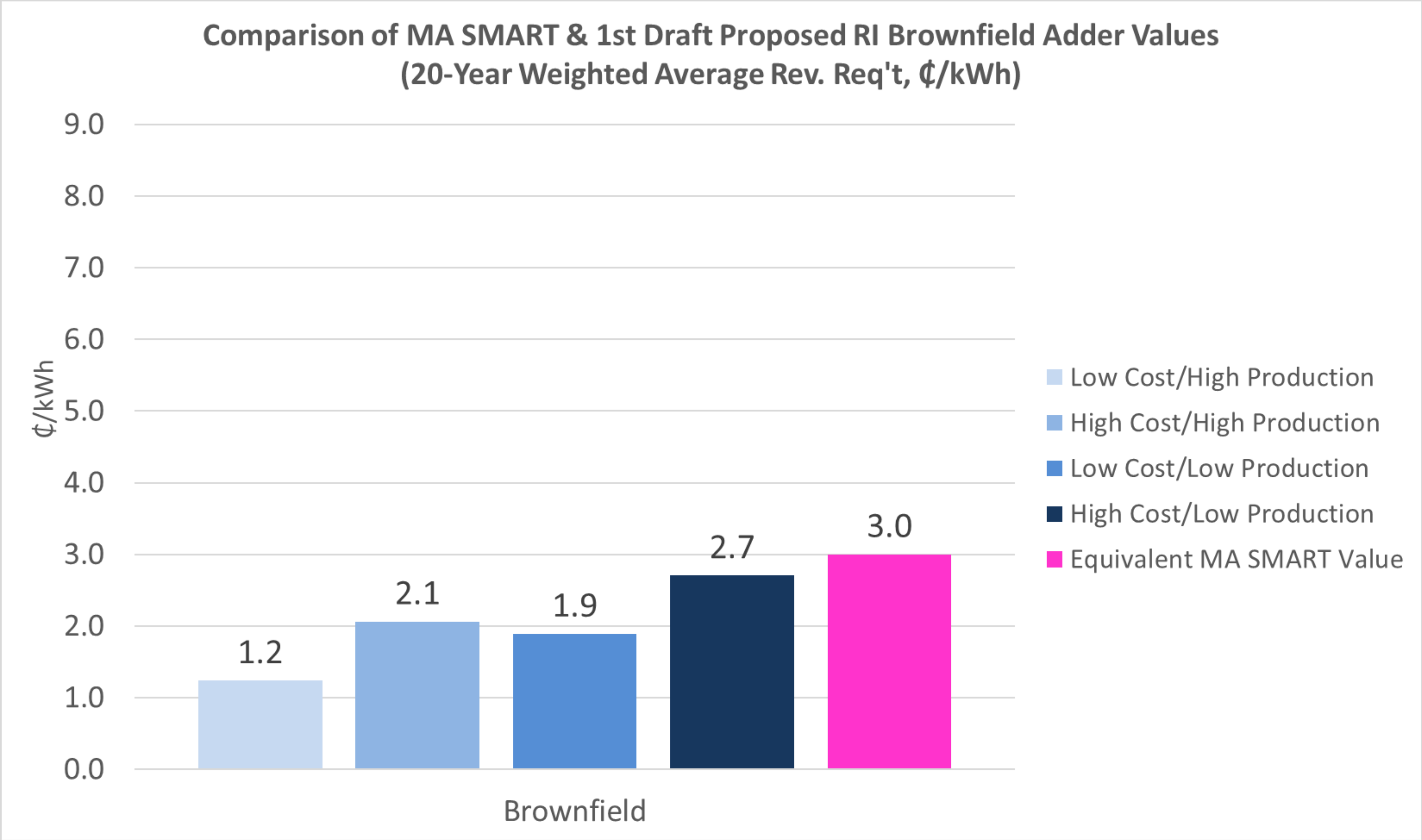
Comparison of SMART Adder values to Proposed RI Adder Values



Comparison of SMART Adder NPV to Proposed RI Adder NPV

Adder Category	Low Cost/High Production (¢/kWh)		Low Cost/Low Production (¢/kWh)		High Cost/High Production (¢/kWh)		High Cost/Low Production (¢/kWh)		MA SMART (¢/kWh)	
	Nominal	NPV[1]	Nominal	NPV[1]	Nominal	NPV[1]	Nominal	NPV[1]	Nominal	NPV[1]
Rooftop	1.5	***0.8***	2.8	***1.5***	2.3	***1.3***	3.7	***2.0***	1.9	***1.0***
LMI Rooftop	3.3	***1.6***	4.6	***2.5***	3.8	***2.0***	5.3	***2.8***	3.0	***1.6***
LMI Ground	2.4	***1.3***	2.4	***1.3***	2.5	***1.3***	2.5	***1.3***	6.0	***3.2***
Carport	5.5	***2.8***	7.5	***4.0***	5.6	***3.0***	7.6	***4.1***	6.0	***3.2***
Landfill	1.4	***0.7***	2.1	***1.1***	1.9	***1.0***	2.6	***1.4***	4.0	***2.1***
Brownfield	1.2	***0.6***	1.9	***1.0***	2.1	***1.1***	2.7	***1.4***	3.0	***1.6***

[1]Assumes 7% discount rate, but final adder values will likely reflect National Grid return on equity (ROE)

Q&A

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Appendix

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Upfront Capital Cost Premia by Type from Incremental Cost Survey

Estimates of Premia Over Greenfield Ground-Mounted Solar Installed Costs ($/$W_{DC}$ from Incremental Cost Survey)						
Type	*Size*	*N*	*SEA Initial Estimate*	*Mean Response from Survey*	*Mean Δ from SEA Estimate*	*25th-75th Range (from Survey)*
Ground-Mounted LMI	25-250 kW	4	$0.40	**$0.42**	**$0.02**	$0.38-$0.40
	251-999 kW	6	$0.40	**$0.62**	**$0.22**	$0.47-$0.66
	1-5 MW	8	$0.40	**$0.37**	**-$0.03**	$0.28-$0.45
Rooftop LMI	25-250 kW	4	$0.60	**$0.50**	**-$0.10**	$0.31-$0.60
	251-999 kW	7	$0.62	**$0.55**	**-$0.07**	$0.54-$0.62
	1-5 MW	6	$0.62	**$0.49**	**-$0.13**	$0.37-$0.47
Rooftop	25-250 kW	14	$0.00	**-$0.04**	**-$0.04**	($0.11)-0.00
	251-999 kW	17	$0.22	**$0.24**	**$0.02**	$0.20-$0.22
	1-5 MW	14	$0.22	**$0.21**	**-$0.01**	$0.09-$0.25
Solar Canopy	25-250 kW	9	$0.45	**$0.75**	**$0.30**	$0.70-$1.10
	251-999 kW	15	$1.37	**$1.18**	**-$0.19**	$1.18-$1.37
	1-5 MW	12	$1.54	**$1.24**	**-$0.30**	$1.19-$1.48
Landfill	25-250 kW	3	$0.17	**$0.42**	**$0.25**	$0.25-$0.55
	251-999 kW	6	$0.16	**$0.47**	**$0.31**	$0.29-$0.51
	1-5 MW	8	$0.38	**$0.27**	**-$0.11**	$0.24-$0.30
Brownfield	25-250 kW	3	$0.13	**$0.18**	**$0.05**	$0.08-$0.45
	251-999 kW	3	$0.13	**$0.29**	**$0.16**	$0.17-$0.23
	1-5 MW	4	$0.27	**$0.28**	**$0.01**	$0.20-$0.34

O&M Cost Premia by Type (from Incremental Cost Survey)

Percentage Difference in Annual Operating Costs ($/kW-yr, Based on Incremental Cost Survey)					
Project Type	*Project Size*	*Cost Category*	*N*	*25th-75th Range*	*Mean*
LMI Greenfield/Rooftop (Relative to Greenfield/Rooftop)	*All Sizes*	*O&M*	8	8%-29%	**23%**
		Insurance	7	0%-7.5%	**5%**
		Land/Site Lease	7	0%-18%	**9%**
		Project Management	7	18%-64%	**58%**
Rooftop (Relative to Greenfield)	*All Sizes*	*O&M*	10	5%-25%	**15%**
		Insurance	11	0%-14%	**10%**
		Land/Site Lease	12	0%-25%	**23%**
		Project Management	6	0%-13%	**10%**
Solar Canopy (Relative to Greenfield)	*All Sizes*	*O&M*	9	20%-50%	**36%**
		Insurance	9	5%-20%	**16%**
		Land/Site Lease	9	0%-20%	**20%**
		Project Management	6	0%-15%	**9%**
Brownfield Solar (Relative to Greenfield)	*All Sizes*	*O&M*	8	8%-20%	**16%**
		Insurance	7	0%-15%	**13%**
		Land/Site Lease	6	(3%)-0%	**2%**
		Project Management	5	0%-10%	**7%**
Landfill Solar (Relative to Greenfield)	*All Sizes*	*O&M*	5	0%-15%	**9%**
		Insurance	5	10%-20%	**13%**
		Land/Site Lease	5	0%-0%	**0%**
		Project Management	5	5%-10%	**10%**

Summary of Incremental Cost Survey Results

Proposed Capacity Factors (%)			
Project Type	*Project Sizes*	*Low End of Range (for "Low Production" Cases)*	*High End of Range (for "High Production" Cases)*
Greenfield Ground Mounted	All Sizes (25-250 kW, 251-999 kW, 1-5 MW)	14.7%	15.2%
LMI Ground Mounted		14.7%	15.2%
Rooftop LMI		13.3%	14.6%[1]
Rooftop		13.3%	14.6%[1]
Solar Canopy		13.1%	14.6%[1]
Landfill		14.5%	15.2%
Brownfield		14.5%	15.2%

[1]See National Renewable Energy Laboratory (NREL). 2020 Annual Technology Baseline (ATB). Available at: https://atb.nrel.gov/electricity/2020/data.php. Utilized production data associated with Chicago, IL, which has a very similar latitude to Providence, RI.

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