Rhode Island
Renewable Energy Growth Program:

2020 Ceiling Price Recommendations to DG Board

September 23, 2019

Sustainable Energy Advantage, LLC
Mondre Energy, Inc.

Sustainable Energy Advantage, LLC

2020 Ceiling Price Development Process to Date

- Consulting Team emailed stakeholders on May 13, 2019 with Survey and Data Request, requested responses by June 17.
  - Informed stakeholders of the proposed split in the Commercial Solar Category to Small Commercial (251-500 kW) and Large Commercial (501-999 kW) and the proposal to create a solar carport adder.
  - Sought feedback on necessary changes to previous year's inputs and on specific issues, including the reduction of the federal Investment Tax Credit (ITC).
  - Received 31 responses - from 28 solar stakeholders and 3 non-solar stakeholders, all active industry participants.
- Circulated 1st Draft Proposed 2020 Ceiling Prices on July 1, 2019 ahead of meeting on July 19.
  - Included proposed technology categories, system sizes, and modeled system size, as well as the proposed Ceiling Prices and responses to stakeholder input.
  - Meeting attended by around a dozen solar stakeholders, one wind stakeholder and National Grid.
- Issued Supplemental Data Request on July 24, 2019 requesting responses by August 6.
  - Received responses from 12 stakeholders – 11 solar stakeholders and 1 non-solar stakeholder
  - Received written comments from National Grid on August 9, 2019
- Circulated 2nd Draft Proposed 2020 Ceiling Prices on August 14, 2019 ahead of meeting on August 28, 2019. Sought comments on the materials by August 28.
  - Received two email responses from active industry participants.
  - Meeting attended by a small handful of solar stakeholders and National Grid
- Circulated Updated 2nd Draft Proposed 2020 Ceiling Prices on August 29, 2019, and requested comment by September 4.
  - No additional comments received.

Recommended 2020 Ceiling Prices

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Summary Results (1): Solar (cents/kWh)

Technology	Size Range kW (Modeled Size kW)	2019 Approved CP	2020 1st Draft CP (% Change from 2019 Approved)	2020 2nd Draft CP (% Change from 2019 Approved)	2020 Proposed Final CP (% Change from 2019 Approved)
Small Solar I (15 year tariff)	1-10 (5)	28.45	29.25 (3%)[1]	30.45 (7%)[1]	**29.65 (4%)[1]**
Small Solar II	11-25 (25)	27.65	27.35 (-1%)	23.55 (-15%)	**23.45 (-15%)**
Medium Solar	26-250 (250)	23.55	21.35 (-14%)	22.05 (-6%)	**21.15 (-10%)**
Commercial Solar	251-999 (500)	17.85	N/A[2]	N/A	**18.25 (2%)[1]**
Commercial Solar-CRDG	251-999 (500)	20.53	N/A[2]	N/A	**20.99 (2%)[3]**
Large Solar	1,000-5,000 (2,000)	15.15	13.75 (-9%)	13.65 (-10%)	**13.65 (-10%)**
Large Solar-CRDG	1,000-5,000 (2,000)	17.42	15.81 (-9%)[3]	16.95 (-9%)[3]	**15.70 (-10%)[3]**

1. Proposed increase for Small Solar I driven by higher installed cost data, financing assumptions, and reduction in ITC. Commercial Solar increase driven mainly by ITC reduction. Proposed CPs for all other solar categories decreased despite ITC reduction, driven by lower installed cost data and other inputs (see following slides). **ITC Reduction alone (relative to 2019 CPs) increases 2020 CPs 4%-6% for Solar categories.**
2. The 1st draft 2020 CPs broke out the commercial category into small and large categories. The proposed 1st draft 2020 CPs were 17.85 for Small Commercial Solar (250-500 kW) and 16.65 for Large Commercial Solar (501-999 kW). The proposed 1st draft 2020 CP for Commercial Solar – CRDG was based on a 999 kW sized system and was 19.15.
3. This is the maximum CRDG Ceiling Price allowed by law. The calculated 2020 values are 21.85 for Commercial CRDG and 16.75 for Large CRDG. Note, however, that this CP would allow cost-competitive projects (bidding below the CP) access to > a 15% premium compared to actual project costs.

Summary Results (2): Wind, Hydro & AD (cents/kWh)

Technology	**Size Range kW** (Modeled Size kW)	**2019 Approved CP**	**2020 1st Draft CP** (% Change from 2019 Approved)	**2020 2nd Draft CP** (% Change from 2019 Approved)	**2020 Proposed Final CP** (% Change from 2019 Approved)
Wind	0-5,000 (3,000)	19.35	20.65 (7%)[1]	22.05 (14%)[1]	**21.40 (11%)[1]**
Wind - CRDG	0-5,000 (3,000)	21.65	23.05 (6%)	24.75 (13%)	**23.85 (10%)**
Hydroelectric	1-5,000 (500)	27.15	27.55[2] (1%)	27.55[2] (1%)	**27.05 (-0.4%)[2]**
Anaerobic Digestion	1-5,000 (750)	20.85	21.35[3] (4%)	21.35[3] (4%)	**21.15 (3%)[3]**

1. The increase in 2019-2020 ceiling price for Wind is a factor of the expiration of the Production Tax Credit in 2020 and resulting changes to depreciation schedules (see subsequent slides for discussion of depreciation treatment).
2. The small change in the final proposed CP from the 2019 approved CP represents a mixture of updated (and higher) post-contract revenue estimates for the final 10 operating years of a hydro project. The 1st and 2nd Draft 2020 CPs reflect a higher interest rate, which was subsequently reduced for the third round (see subsequent slides).
3. The small change in the final proposed CP from the 2019 approved CP is a result of a slight increase in the assumed after-tax IRR. The 1st and 2nd Draft 2020 CPs reflect a higher interest rate, which was subsequently reduced for the third round (see subsequent slides).

Changes Relative to 2nd Draft Prices

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Installed Cost Data for Small Solar I and II

- Installed cost inputs are based on data from other Northeastern states (MA, CT, NY, NJ), REG bid data, and EnergySage revealed pricing data of accepted quotes in RI, MA, CT, and NY
- Current CT Residential Solar Investment Program (RSIP) data, used in past years of analysis, was not available for first two rounds. Updated dataset includes project applications through June 30, 2019.
- Consulting team acquired MA SMART Application data in August. Cost data is incomplete as DOER was not initially collecting cost data with applications, and is only available for Small Solar I and II projects.
- **Modeling Implication (M.I.) Regarding MA/CT Data: Incorporation of the MA and CT data results in a very small decrease in the installed cost input for both Small Solar I and Small Solar II (before adjustments for NEC 2017 Compliance – see later slide).**

Installed Cost Data for Small Solar I and II (Cont'd)

- OER expressed concern regarding the Revised 2nd Draft Ceiling Price for Small Solar I given assumed increases in financing costs, when purpose of program is to reduce (or mitigate increases in) solar PV soft costs over time
- **M.I.: Maintain financing assumptions, but increase weighting of the 25th percentile 1-10 kW installed costs of MA, CT and NY data in the installed cost input calculation (thereby reducing assumed installed cost assumption by approximately $100/kW$_{DC}$)**

Year-on-Year (YoY) Cost Declines

- At the request of consultants to the Division of Public Utilities and Carriers (DPUC), the installed cost inputs for Solar categories include a forecasted Year-on-Year (YoY) decline rate to reflect the expected change in installed costs not reflected in current market data
- For a separate consulting engagement, SEA recently purchased additional data regarding residential and commercial solar PV installed cost decline estimates from 2019 to 2020 from respected market analysis firm Wood Mackenzie (WoodMac)
- While we cannot publicly share the precise figures contained in the WoodMac analysis, we believe that small, across-the-board increases in the YoY decline rates for Solar categories are justifiable
- **M.I.: Adopt 3.5% YoY decline for Small Solar I and II, and increase decline rate for all other Solar categories to 4.5% (relative to 3% and 4%, respectively, from the recently-released 2019 NREL ATB)**

Impact of Trade Turbulence on Installed Cost Assumptions

- **Stakeholder Feedback:** Module costs in Q4 2018/Q1 2019 bottomed out prior to a 6-10 cent/W increase from early Q2 through today
  - Developers are concerned that Trump Administration tariffs on modules and cells will be frozen in place (rather than stepping down as scheduled) and that China is likely to open up their solar market again (increasing price pressure on modules)
- **Consulting Team Response:** Near-term increase in module prices is also likely associated with "safe harboring" of modules ahead of ITC step-down at end of 2019, which may only be a temporary effect. In addition, the other potential points of price pressure are speculative in nature, and their impacts are not broadly known, or measurable
- **M.I.: No change at this time. However, Consulting Team will investigate feasibility of breaking out installed costs in a time series to detect/understand emerging trends throughout previous year, and will continue to keep an eye on mid-term review for Section 201 tariffs on solar modules and cells (results likely to be known by early 2020)**

NEC 2017 Compliance Installed Cost Premium

- **Stakeholder Feedback:** National Electric Code (NEC) 2017 taking effect November 1 (following grace period) requires optimizers that allow for rapid shutdown at module level, which cost 3-5 cents/W more than previously-compliant modules
- **Consulting Team Response:** Installed cost figures collected through canvas of state databases will not have included this RI-specific compliance cost will be fully in effect during 2020 Program Year
- **M.I.: Installed cost for Solar categories increased $40/kW (4 cents/W) to incorporate new code compliance cost**

Capacity Factor

- **Stakeholder Feedback:** Projects in Commercial (251-999 kW) range currently being proposed range from 12.5%-13.5%, while >1 MW projects are closer to Consulting Team 14% estimate (13.5%-14.5%), but closer to low end
- **Consulting Team Response:** Historically, REG capacity factors have been based on data from mix of PVWatts estimates, as well as from operating projects in RI, but we see the validity in the approach of basing estimates on modeled production from projects in the proposal phase
- **M.I.: No change for final round of prices, particularly given timing of the feedback, but capacity factor variations likely to be explored in 2021 process via stakeholder data requests**

Small Solar I and II Size Limits

- **National Grid Feedback:** Small Solar I projects should have a maximum limit of 15 kW_{DC}, rather than 10 kW_{DC} (which would increase the minimum size for Small Solar II to 15.1 kW_{DC} or greater) in order to align maximum sizes with the Simiplified interconnection process in National Grid's RI interconnection tariff
- **M.I.: Feedback was received too late in the process to revise 2020 prices and categories, but OER and the Board will consider proposing Small Solar I as a 1-15 kW_{DC} category for the 2021 Program Year.**

Small Solar I and II Financing Terms

- **National Grid Feedback:** Given REG program intent of reducing soft costs of solar development, financing costs for Small Solar should be more focused on loans with lower dealer fees and lower interest rates (such as those secured via home equity) rather than unsecured solar loans which might have higher fees and interest rates
- **Consulting Team Response:** While the Consulting Team works diligently to incorporate revealed pricing data (e.g. from clearinghouses such as EnergySage) and other means to limit cost to ratepayers, setting debt terms equivalent to those of a home equity loan could limit the dominant form of debt financing and increase reliance on all-cash purchases (which not all consumers can provide)
  - Survey responses indicate 71% of Small Solar I projects utilized unsecured solar loans (which have a 6.2% interest rate relative to home equity rates averaging 4.3%)
- **M.I.: No change for 2020 prices, but Consulting Team will continue to monitor solar loan rates and consider adjustments during 2021 process if current secured/unsecured spread grows**

Interest on Term Debt

- **Financier Feedback and Data from New Jersey Solar Transition Survey:** 7% seems high – 5%-6% seems more reasonable (especially if based on current mortgage rates)
- **Further Solar Financier (non-NJ) Feedback:** Rates could end up even lower than 5%-6% (potentially by up to 150 additional basis points) if borrower enters into an interest rate swap contract
- **Additional Information Considered by Consulting Team:** Federal Reserve has cut federal funds rate an additional quarter point, with another quarter-point cut likely in the next several months
- **M.I. for Solar Categories: Set interest on term debt for >25 kW_{DC} to 6% (from 7%), which aligns with NJ industry (and financier) assessment, but consider investigating market share of projects with borrowers entering into swap contracts, revenue puts or other financial projects used to mitigate risk and lower cost of debt during 2021 CP process**
- **M.I. for Non-Solar Categories: Lower interest on term debt by 0.5% from 1st and 2nd drafts, in line with Federal Reserve's July rate cut and expected September rate cut. Returns interest rates to 2019 Ceiling Price input.**

Debt Term (Years)

- **Financier/Stakeholder Feedback:** Given nature of REG incentive as a fixed tariff payment, Debt term could notionally be extended to 20 years (or 18 years w/a 20 year amortization schedule)
- **Consulting Team Response:** Very well-capitalized borrowers might be able to get financing terms that generous from a bank, but such terms are unlikely to be common enough to assume as available market-wide
- **M.I.: No change (will maintain 15 year debt term estimate for Solar projects >25 kW), but will continue to monitor market in years to come. Consulting Team may request further comment during 2021 CP process on reasonableness of assuming amortization/repayment schedules that extend beyond the end of a loan term (which may include balloon payments at the end of the term)**

O&M and Lender's Fee

- **O&M**
  - **Stakeholder Feedback:** Estimates for <1 MW largely on target, but >1 MW O&M closer to $14.5/kW-yr, because of region-specific costs to clear larger parcels (e.g., snow removal, other winter-related ground maintenance).
  - **M.I.: Adopt $14.50/kW-yr figure for Large Solar O&M**
- **Lender's Fee**
  - **Financier Feedback:** Medium and Commercial projects typically have origination fees between 0.5%-1.0%, while larger projects are at SEA's 2% across-the-board value
  - **M.I.: Reduce Lender's Fee for Medium and Commercial Solar to 1.0% (from 2.0%)**

Decommissioning

- **Stakeholder feedback:** Received one documented response to second stakeholder survey in advance of the second round, but needed clarity on how decommissioning costs are funded – in particular, whether a reserve account is capitalized upfront.
  - Documented response provides an average decommissioning cost of $28.58/kW for projects ~70 kW to just under 1 MW.
  - Additional feedback in line with our understanding of industry norms that decommissioning reserves are funded out of the project's cash flow from operations rather than incorporated into upfront pricing.
- **M.I.: Increase Medium and Commercial Solar decommissioning costs to $28.58/kW, but continue to model decommissioning as funded from operations.**

Depreciation

- **Stakeholder feedback:** Projects are not always able to take 100% bonus depreciation.
- **Consulting team response:** While financing structures for some projects are not conducive to claiming bonus depreciation, other projects will be able to take advantage. In fairness to ratepayers, the Consulting Team does not believe it is appropriate to assume all projects will leave an available incentive unclaimed.
- **M.I.: Set final proposed ceiling price as the average of the resulting ceiling prices assuming (1) using MACRS for both federal and state and (2) 100% bonus depreciation at the federal level and MACRS at the state level.**
- **Stakeholder feedback:** Even if claimed, projects may not claim bonus depreciation on state taxes.
- **Consulting team response:** Received confirmation from RI Department of Revenue that projects claiming 100% bonus on federal taxes may use "Any depreciation allowed under federal statute without the bonus depreciation" on their state taxes.
- **M.I.: Revised modeling so projects that claim bonus depreciation on federal returns use MACRS at the state level.**

Modeling Parameters

Sustainable Energy Advantage, LLC

Summary: Cost & Production Assumptions (Solar)

	Small I	Small II	Medium	Commercial	Commercial CRDG	Large	Large CRDG
Nameplate Capacity (kW)	5	25	250	500	500	2,000	2,000
Capacity Factor	14.00%	14.00%	14.00%	14.00%	14.00%	15.30%	15.30%
Annual Degradation	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Total Cost^ ($/kW)	$3,279 ~~$3,370~~ ~~$3,336~~ [$3,185]	$2,979 ~~$2,993~~ ~~$2,962~~ [$3,027]	$2,360 ~~$2,333~~ [$2,678]	$1,988 [$2,093]	$2,138* [$2,243*]	$1,602 ~~$1,571~~ [$1,876]	$1,752* ~~$1,721*~~ [$2,026*]
Fixed O&M ($/kW-yr)	$35	$35	$14 [$35]	$14 [$15]	$39 [$40]	$14.50 ~~$12~~ [$15]	$37 [$40]
O&M Inflation	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Insurance (% of Cost)	0.0%	0.0%	0.27%	0.27% [0.45%]	0.27% [0.45%]	0.45%	0.45%
Project Management ($/yr)	$0	$0	$2,375 ~~$750~~	$2,375 [$3,000]	$2,375 [$3,000]	$12,000	$12,000
Site Lease ($/yr)	$0	$0	$10,000 [$6,250]	$20,000 [$12,500]	$20,000 [$12,500]	$50,000	$50,000

Values in [Brackets] represent 2019 ceiling price inputs. ~~Red strikeout~~ text denotes 2020 1st draft input values that were updated. ~~Green strikeout~~ text denotes 2020 2nd draft input values that were updated.

^ **This data includes interconnection costs**. Impacts due to solar module trade tariffs are assumed to be incorporated in installed cost data.

* Reflects installed cost of non-CRDG project from same category, plus estimated cost of customer acquisition ($150/kW).

Summary: Financing Assumptions (Solar)

	Small I	Small II	Medium	Commercial	Commercial CRDG	Large	Large CRDG
Federal Investment Tax Credit (%)	26% [30%]	26% [30%]	26% [30%]	26% [30%]	26% [30%]	26% [30%]	26% [30%]
% Debt	77% ~~0%~~	40% ~~0%~~	55% [50%]	60% [55%]	60% [55%]	60% [55%]	60% [55%]
Debt Term (years)	13 ~~N/A~~	15 ~~N/A~~	15	15	15	15	15
Interest Rate on Term Debt	5.6% ~~N/A~~	6.7% ~~N/A~~	6.00% ~~7.50%~~ [7.00%]	6.00% [6.50%]	6.00% [6.50%]	6.00% ~~7.00%~~ [6.50%]	6.00% ~~7.00%~~ [6.50%]
Lender's Fee (% of total borrowing)	9.00% ~~8.50%~~ ~~N/A~~	4.00% ~~3.50%~~ ~~N/A~~	1.00% ~~2.00%~~	1.00% [2.00%]	1.00% [2.00%]	2.00%	2.00%
Target After-Tax Equity IRR	5.0% ~~5.3%~~ [5.0%]	9.7% [5.0%]	9.5% [9.4%]	9.5% [9.4%]	9.5% [9.4%]	9.5% [9.4%]	9.5% [9.4%]
Depreciation	MACRS	MACRS	MACRS	MACRS	MACRS	MACRS	MACRS

Values in [Brackets] represent 2019 ceiling price inputs. ~~Red strikeout~~ text denotes 2020 1st draft input values that were updated. ~~Green strikeout~~ text denotes 2020 2nd draft input values that were updated.

Summary: Cost & Production Assumptions
Wind, Hydro, and AD

	Wind	Wind - CRDG	Hydroelectric	Anaerobic Digestion
Nameplate Capacity (kW)	3,000	3,000	500	725
Capacity Factor	21.00%	21.00%	55.00%	92%[1]
Annual Degradation	0.5%	0.5%	0.0%	0.0%
Total Cost[2] ($/kW)	$2,820	$2,970	$9,931	$10,150
Fixed O&M ($/kW-yr)	$26.50	$51.50	$2.00	$600
O&M Inflation	2.0%	2.0%	1.0%	2.0%
Insurance (% of Cost)	0.20%	0.20%	2.0%	1.0%
Project Management ($/yr)	$18,000	$18,000	$3,000	$75,000
Site Lease ($/yr)	$162,000	$162,000	$8,750	$35,000

Values in [Brackets] represent 2019 ceiling price inputs. ~~Red strikeout~~ text denotes 2020 1st draft input values that were updated. ~~Green strikeout~~ text denotes 2020 2nd draft input values that were updated.

1. Note: For Anaerobic Digestion we use an Availability Factor

2. Note: Includes interconnection costs

Summary: Financing Assumptions (Wind, Hydro, and AD)

	Wind	Wind - CRDG	Hydroelectric	Anaerobic Digestion
Federal Investment Tax Credit	None	None	None	None
% Debt	70% [65%]	70% [65%]	70%	60%
Debt Term (years)	15	15	20	15
Interest Rate on Term Debt	6.5% ~~7.0%~~ [6.5%]	6.5% ~~7.0%~~ [6.5%]	7.0% ~~7.5%~~ [7.0%]	7.0% ~~7.5%~~ [7.0%]
Lender's Fee (% of total borrowing)	1.0%	1.0%	1.88%	1.5%
Target After-Tax Equity IRR	10% [9.4%]	10% [9.4%]	10% [9.4%]	10% [9.4%]
Depreciation	Average of 100% bonus and MACRS ~~5 year MACRS~~ ~~100% Bonus~~	Average of 100% bonus and MACRS ~~5 year MACRS~~ ~~100% Bonus~~	7 year MACRS	5 year MACRS

Values in [Brackets] represent 2019 ceiling price inputs. ~~Red strikeout~~ text denotes 2020 1st draft input values that were updated. ~~Green strikeout~~ text denotes 2020 2nd draft input values that were updated.

Carport Adder

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Proposed Solar Carport Adder

- Very little data available to base Carport adder on actual costs of carport systems in Rhode Island
- Current MA SMART Solar Canopy Adder: **$0.06/kWh**
- Value developed as part of SMART program development process by Sustainable Energy Advantage
- Current adder value has resulted in **33.7 MW qualified** and **4.1 MW more under qualification review** under MA SMART program
- **OER/DG Board Objectives for 2020 Program Year:**
  - **Initially utilize $0.06/kWh value now available under MA SMART for Solar Canopies for Carport adder during 2020 Program Year**
  - **Commercial and Large Solar projects eligible for adder**
  - **Use results to gather more data for the 2021 Ceiling Price process**

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