

Rhode Island  
Renewable Energy Growth Program:

Analysis & Discussion in Support of  
2<sup>nd</sup> Draft 2020 Ceiling Price Recommendations

August 28, 2019 **(REVISED FOR DELIVERY)**

Sustainable Energy Advantage, LLC

Mondre Energy, Inc.



# Changes Relative to 1<sup>st</sup> Draft Prices (Incorporating Stakeholder Feedback)

## Withdrawal of Proposal for Split of Small and Large Commercial Solar

- OER and the DG Board initially proposed to split the Commercial Solar category (251-999 kW) into Small Commercial (251-500 kW) and Large Commercial (501-999 kW)
- **Initial M.I. for 1<sup>st</sup> Draft Prices: Small Commercial prices rose to 18.55 cents/kWh, while Large Commercial remained unchanged from 1<sup>st</sup> Round proposed 2020 prices**
- However, OER has determined that this will not be its approach for 2020 REG program, and will instead return to previous approach (one capacity allocation for 251-999 kW, with costs set on a 500 kW modeled size project)
- **Revised M.I.: Proposed prices for Small Commercial, Large Commercial and Large Commercial CRDG have been withdrawn pending the final round of analysis**
  - **However, it is highly likely that Commercial Solar prices, if based on a 500 kW system as in past years, will be closer to the Small Commercial price as initially proposed (18.55 cents/kWh) than Large Commercial (since Large Commercial was based on a 999 kW proxy system)**
  - **Commercial CRDG will revert to eligibility range of 251-999 kW**

# 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** (developed as part of SMART program development process by Sustainable Energy Advantage)
- Current adder value has resulted in **35.5 MW qualified** and **2.7 MW more under qualification review** under MA SMART program (as of August 27, 2019)
- **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**

# Year-on-Year (YoY) Capital Cost Decline Rates for Solar

- 2018 NREL Annual Technology Baseline (ATB) had suggested 2019 to 2020 year-on-year capital costs (adjusted from real to nominal terms) would decline by unusually aggressive amounts (high single to low double digit % declines)
  - We deemed such a value to be too aggressive (relative to internal SEA forecast of **4% YoY**) to use as an input
  - **Initial Modeling Implication (M.I.) for 1<sup>st</sup> Draft Prices: Utilized an internal SEA forecast of 4%/year for all systems**
- [2019 NREL ATB](#) (released August 2, 2019) forecasts cost declines in Low Case very consistent with internal SEA solar capital cost decline assumptions
  - *Low Case residential solar*: **-3% YoY** (2019 to 2020) – **1% slower decline** than 1<sup>st</sup> Draft Ceiling Prices
  - *Low Case commercial solar*: **-4% YoY** (2019 to 2020) – **same as assumed** in 1<sup>st</sup> Draft Ceiling Prices
- **Revised M.I.: 3% YoY change for Small Solar (<=25 kW) and 4% YoY for >25 kW - in essence, no change for >25 kW, but a smaller decline for Small Solar I & II**

# Stakeholder Feedback on Ceiling Price Modeling (1)

- **Small Solar I Financing**
  - **Stakeholder Feedback:** 33-90% of customers finance with a solar-specific loan, and the remainder with a mix of cash or home equity lines of credit (HELOCs). Solar loans have terms of 12-20 years, 4%-9% interest, and lender fees ranging from 5%-17%.
  - **M.I.: Model financing assumptions as capital stack proportional to market share (23% cash, 23% HELOC, 54% solar loan), with loan terms equal to the weighted average of responses for HELOCs (secured by the value of the home) and unsecured solar loans (13 years, 5.6% interest, 8.5% lender fee), and expected cash/sponsor returns based on average S&P 500 returns since 2000 (~5%)**
- **Small Solar II Financing**
  - **Stakeholder Feedback:** Fewer survey responses and a greater mix of financing arrangements, coming out to on average 40% cash, 60% debt, and debt split between equity lines of credit, solar loans, and C-PACE
  - **M.I.: Model financing assumptions as capital stack proportional to market share (40% cash, 60% debt), with loan terms equal to the average of responses for equity, solar, and C-PACE loans (15 years, 6.7% interest, 3.5% fee), and sponsor returns based on IRRs for larger projects (9.7%, in order to approximate a corporate hurdle rate)**

# Stakeholder Feedback on Ceiling Price Modeling (2)

- **Depreciation (Wind)**

- **Stakeholder Feedback:** Projects are not always able to take 100% bonus depreciation. Even if claimed, projects may not claim bonus depreciation on state taxes.
- **Initial M.I.: Adjusted modeling to only apply 100% bonus depreciation to federal income taxes by adding federal depreciation benefits back into state taxable income.**
- **However, calculated LCOE was higher with 100% bonus (at 23.05 cents/kWh), since RI tax law appears to claw back the full depreciation expense** (which would, if true, eliminate any bonus depreciation benefit relative to 5-year MACRS)
- **Revised M.I.: Will utilize 5-year MACRS depreciation for Wind for current draft, but seek clarification from RI Dept of Revenue for final round of analysis (esp. given potential ramifications for Solar prices post-ITC)**

# Stakeholder Feedback on Ceiling Price Modeling (3)

- **Interconnection Cost Assumptions**
  - **Stakeholder Feedback:** Should use average, not median, of interconnection costs.
  - **M.I.: Comment adopted for projects above 25 kW (interconnection cost for  $\leq 25$  kW assumed to be trivial and unlikely to substantially affect ITC basis)**
- **Inverter Replacement Year**
  - **Stakeholder feedback:** Replacement is necessary between years 10 and 16.
  - **M.I.: Modeled average of responses (Year 12) for all Solar categories (moved one year back from Year 11).**
- **Project Management**
  - *Received one documented response for Medium Solar and one documented response for wind*
  - **M.I.: Modeled average of previous input (based on earlier data received) and 2019 data for Medium Solar and Small Commercial Solar. Did not increase Wind project management cost per direction from OER to limit increase in Wind Ceiling Price**



# Stakeholder Feedback on Ceiling Price Modeling (4)

- **Incorporation of disturbed siting cost for Large Solar**
  - *No specific cost estimates associated with developing on disturbed sites provided*
  - **M.I.: No feedback, therefore no change**
- **Insurance**
  - *No specific estimates offered*
  - **M.I.: No feedback, therefore no change**

# Additional Information Sought for Final Round of Ceiling Prices

- **Decommissioning**

- Received one documented response that costs are higher; however, need clarity on when decommissioning is funded from a reserve fund.
- **Consulting team will request further data and information on how decommissioning costs are structured.**

- **Solar Financing**

- **Financier Feedback:** Solar debt costs are substantially lower than 7%
- **Consulting team still trying to receive feedback from additional financiers**



# 2<sup>nd</sup> Draft 2020 Ceiling Prices



# 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
Small Solar I (15 year tariff)	1-10 (5)	28.45	29.25 / (3%) <sup>1</sup>	<b>30.45 / (7%)<sup>1</sup></b>
Small Solar II	11-25 (25)	27.65	27.35 / (-1%)	<b>23.55 (-15%)</b>
Medium Solar	26-250 (250)	23.55	21.35 / (-14%)	<b>22.05 (-6%)</b>
Small Commercial Solar	251-500 (500)	17.85 <sup>2</sup>	17.85 / (0%)	<b>TBD (Will be Based on 500 kW Modeled Size)</b>
Large Commercial Solar	501-999 (999)	17.85 <sup>2</sup>	<b>16.65 / (-7%)</b>	
Large Comm. Solar-CRDG	501-999 (999)	20.53	<b>19.15 / (-7%)<sup>3</sup></b>	
Large Solar	1,000-5,000 (2,000)	15.15	<b>13.75 / (-9%)</b>	<b>No Change</b>
Large Solar-CRDG	1,000-5,000 (2,000)	17.42	<b>15.81** / (-9%)<sup>3</sup></b>	<b>No Change</b>

1. Proposed 2020 CP increased for Small Solar I driven by higher installed cost data as available for 2020 first draft. Proposed CPs for all other solar categories decreased despite the reduction of the ITC, driven by lower installed cost data and other inputs (see Appendix).

2. Represents 2019 Ceiling Price for Commercial Solar (a category proposed to be subdivided into Small Commercial and Large Commercial as shown above)

3. This is the maximum CRDG Ceiling Price allowed by law. The calculated 2020 values are 20.85 for Commercial CRDG and 17.05 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
Wind	0-5,000 (3,000)	19.35	<b>20.65<sup>1</sup> / (7%)</b>	<b>22.05 (14%)</b>
Wind - CRDG	0-5,000 (3,000)	21.65	<b>23.05 / (6%)</b>	<b>24.75 (13%)</b>
Hydroelectric	1-5,000 (500)	27.15	<b>27.55<sup>2</sup> / (1%)</b>	<b>27.55<sup>2</sup> (1%)</b>
Anaerobic Digestion	1-5,000 (750)	20.55	<b>21.35<sup>3</sup> / (4%)</b>	<b>21.35<sup>3</sup> / (4%)</b>

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 and financing assumptions.

2. The small change represents a mixture of updated (and higher) post-contract revenue estimates for the final 10 operating years of a hydro project, which reduce the needed tariff revenue, and increases in assumed interest on term debt.

3. The small change is a result of increases in assumed interest on term debt.



# Revised Modeling Parameters



# Summary: Cost & Production Assumptions (Solar)

	Small I	Small II	Medium	Small Comm'l	Large Comm'l	Lg. Comm'l CRDG	Large	Large CRDG
Nameplate Capacity (kW)	5	25	250	<b>TBD (Will be Based on 500 kW Modeled Size)</b>			2,000	2,000
Capacity Factor	14.00%	14.00%	14.00%				15.30%	15.30%
Annual Degradation	0.5%	0.5%	0.5%				0.5%	0.5%
Total Cost^ (\$/kW)	\$3,370 <del>\$3,336</del> [\$3,185]	\$2,993 <del>\$2,962</del> [\$3,027]	\$2,333 [\$2,678]				\$1,571 [\$1,876]	\$1,721* [\$2,026*]
Fixed O&M (\$/kW-yr)	\$35	\$35	\$14 [\$35]				\$12	\$37 [\$40]
O&M Inflation	2.0%	2.0%	2.0%				2.0%	2.0%
Insurance (% of Cost)	0.0%	0.0%	0.27%				0.45%	0.45%
Project Management (\$/yr)	\$0	\$0	\$2,375 \$750				\$12,000	\$12,000
Site Lease (\$/yr)	\$0	\$0	\$10,000 [\$6,250]				\$50,000	\$50,000

Values in [Brackets] represent 2019 ceiling price inputs. ~~Red-strikeout~~ text denotes 2020 1<sup>st</sup> draft input values that were updated to values in black text in 2<sup>nd</sup> draft.

^ 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	Small Comm'l	Large Comm'l	Lg. Comm'l CRDG	Large	Large CRDG
Federal Investment Tax Credit (%)	26% [30%]	26% [30%]	26% [30%]	<b>TBD (Will be Based on 500 kW Modeled Size)</b>			26% [30%]	26% [30%]
% Debt	77% <del>0%</del>	40% <del>0%</del>	55% [50%]				60% [55%]	60% [55%]
Debt Term (years)	13 <del>N/A</del>	15 <del>N/A</del>	15				15	15
Interest Rate on Term Debt	5.6% <del>N/A</del>	6.7% <del>N/A</del>	7.50% [7.00%]				7.00% [6.50%]	7.00% [6.50%]
Lender's Fee (% of total borrowing)	8.5% <del>N/A</del>	3.5% <del>N/A</del>	2.00%				2.00%	2.00%
Target After-Tax Equity IRR	5.0% <del>5.3%</del> [5.0%]	9.7% [5.0%]	9.5% [9.4%]				9.5% [9.4%]	9.5% [9.4%]
Depreciation	MACRS	MACRS	MACRS				MACRS	MACRS

Values in [Brackets] represent 2019 ceiling price inputs. ~~Red-strikeout~~ text denotes 2020 1<sup>st</sup> draft input values that were updated to values in black text in 2<sup>nd</sup> draft.





# Summary: Cost & Production Assumptions

## Wind, Hydro, and AD

	Wind	Large Wind - CRDG	Hydroelectric	Anaerobic Digestion
Nameplate Capacity (kW)	3,000	3,000	500	725
Capacity Factor	21.00%	21.00%	55.00%	92% <sup>1</sup>
Annual Degradation	0.5%	0.5%	0.0%	0.0%
Total Cost (\$/kW)	\$2,820	\$2,970	\$10,431 [ <del>\$8,750</del> ]	\$10,502
Fixed O&M (\$/kW-yr)	\$26.50	\$51.50	\$2.00	\$600
O&M Inflation	2.0%	2.0%	2.0%	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 2018 ceiling price inputs. ~~Red-strikeout~~ text denotes 2020 1<sup>st</sup> draft input values that were updated to values in black text in 2<sup>nd</sup> draft.

1. Note: For Anaerobic Digestion we use an Availability Factor
2. Note: Includes \$150 per kW for interconnection costs

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

	Wind	Large 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	7.0% [6.0%]	7.0% [6.0%]	7.5% [6.5%]	7.5% [6.5%]
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	5 year MACRS <del>100% Bonus</del>	5 year MACRS <del>100% Bonus</del>	7 year MACRS	5 year MACRS

Values in [Brackets] represent 2018 ceiling price inputs. ~~Red-strikeout~~ text denotes 2020 1<sup>st</sup> draft input values that were updated to values in black text in 2<sup>nd</sup> draft.



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