



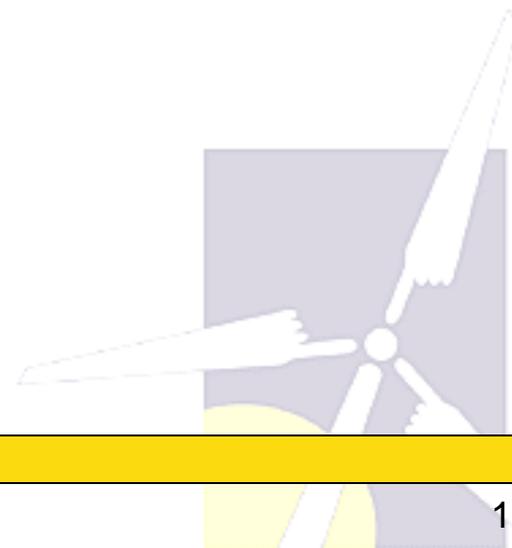
Rhode Island
Renewable Energy Growth Program:
*Calculation of Initial
2015 Ceiling Price Recommendations*

October 20, 2014
Sustainable Energy Advantage, LLC
&
Meister Consultants Group, Inc.





OVERVIEW



Background: Changes from Standard Contract to REG Program

- The 2015 Renewable Energy Growth (REG) Program supports projects installed on either side of the customer meter.
- Residential Solar Photovoltaic Systems are eligible under the 2015 REG Program
- Tariff lengths have been increased from 15 years to 20 years
 - 15-year contract still offered to residential systems
- Solar and Hydro Power Systems with capacities less than 50 kW are eligible under the 2015 REG Program
- Rules related to Net Metering and sale of (net excess) generation to National Grid ,for residential and small commercial solar systems, have been amended.
- Ceiling Price categories have been materially changed; new categories are listed in the next slide.



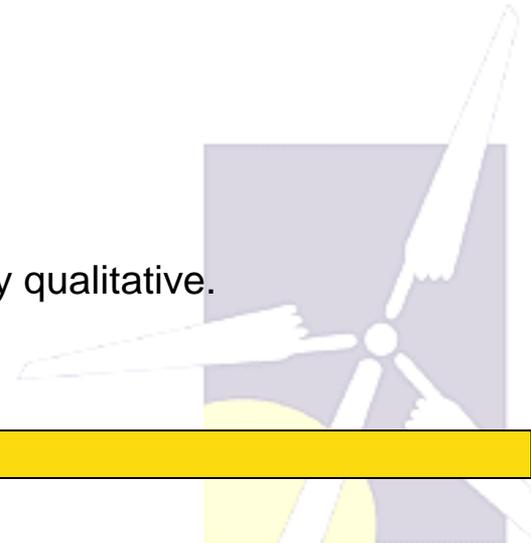
Ceiling Price Categories

Eligible Technology	System Size for CP Development	Eligible System Size Range	Tariff Length
Small Solar I*	5 kW	1 to 10 kW	15 and 20 Years Options
Small Solar II	25 kW	11 to 25 kW	20 Years
Medium Solar	140 kW	26 to 250 kW	20 Years
Commercial Solar	500 kW	251 to 999 kW	20 Years
Large Solar	1.5 MW	1 to 5 MW	20 Years
Wind I	1.65 MW	1.5 to 2.99 MW	20 Years
Wind II	3.3 MW	3 to 5 MW	20 Years
Anaerobic Digestion I	325 kW	150 to 500 kW	20 Years
Anaerobic Digestion II	750 kW	501 kW to 1 MW	20 Years
Small Scale Hydropower I	150 kW	10 to 250 kW	20 Years
Small Scale Hydropower II	500 kW	251 to 1 MW	20 Years

* The Small Solar I (5 kW) category will be used to evaluate both residential and small business installations. Residential installations will be evaluated under both homeowner and third-party ownership.

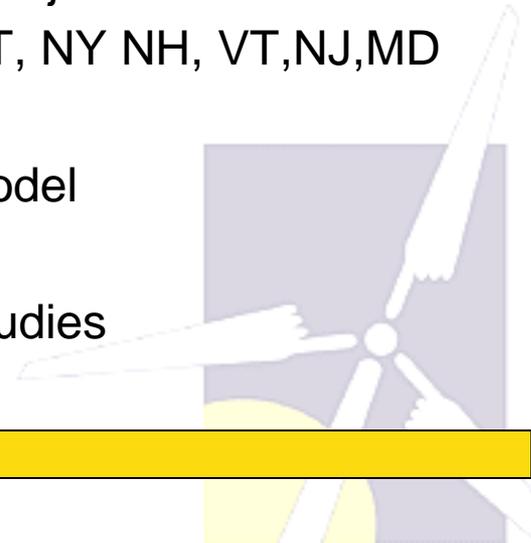
Response to Data Request

- On September 26, 2014 SEA issued a Data Request to inform its effort in ceiling price development.
- Responses to this request were extremely limited, with SEA receiving only (4) completed Requests.
- **Solar**
 - SEA received (1) Response, which provided data for a 5 kW residential system
 - The response was only partially completed, with material financing data absent.
- **Wind**
 - SEA received (1) Response, for a 1.5 MW system.
- **Anaerobic Digestion**
 - SEA received (1) Response, for a 750 kW system.
- **Small Scale Hydropower**
 - SEA received (1) Response, but the response was largely qualitative.



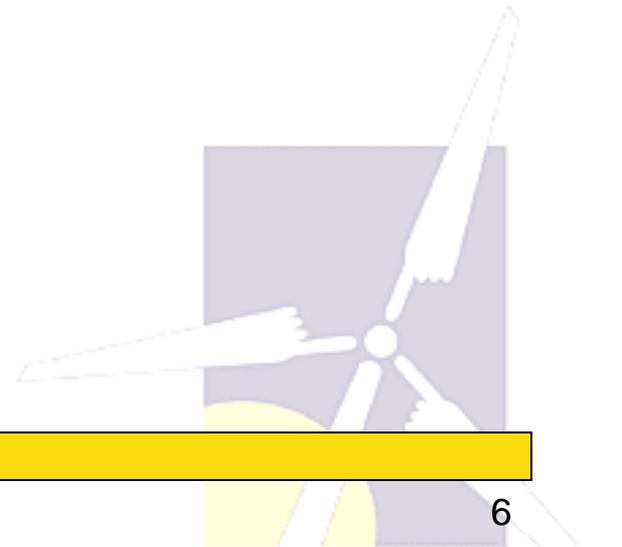
Supplemental Research

- In parallel to the Data Request, SEA & MCG conducted supplementary research
- Numerous data sources were consulted, including:
 - Past (2013 & 2014) Distributed Generation Enrollment project data
 - Rhode Island Renewable Energy Fund project data
 - Production and project information contained in the Mass SREC database
 - Massachusetts DOER RPS Solar Carve Out project data
 - LBNL's "Tracking the Sun" data, for RI, MA, CT, NY NH, VT, NJ, MD
 - NYSERDA Project information
 - NREL PV Watts and NREL System Advisor Model
 - DOE production information and data
 - Other applicable Publications, Reports, and Studies





SUMMARY RESULTS



Historical Ceiling Prices, 2014 Program Year

Tech., class (kW)	2014 CP <u>w/ITC/PTC,</u> <u>No Bonus</u>	2014 CP <u>No ITC/PTC, No</u> <u>Bonus</u>
Solar, 501-3,000	23.50	N/A
Solar, 201-500	27.30	N/A
Solar, 50-200	27.10	N/A
Wind, 1,000-3,000	17.50	20.55
Wind, 50-999	16.20	19.95
AD, 50-3,000	18.55	19.55
Hydro, 50-1,000	17.90	18.85

Draft Proposed Ceiling Prices, 2015 REG Program (1)

Technology	System Size	2015 Proposed CP w/ ITC 15 year Tariff Duration	2015 Proposed CP w/o ITC (or 10% ITC) 15 year Tariff Duration	2015 Proposed CP w/ ITC 20 year Tariff Duration	2015 Proposed CP w/o ITC (or 10% ITC) 20 year Tariff Duration
Small Solar I, Resident Owned	1 to 10 kW	39.70	55.70	36.50	50.55
Small Solar I, Third Party Owned	1 to 10 kW	34.05	43.40	29.35	37.25

Technology	System Size	2015 Proposed CP w/ ITC 20 year Tariff Duration	2015 Proposed CP w 10% ITC 20 year Tariff Duration
Small Solar II,	10 to 25 kW	31.95	39.55
Medium Solar	26-250 kW	28.05	34.70
Commercial Solar	251 -999 kW	21.95	25.55
Large Solar	1-5 MW	18.20	20.75

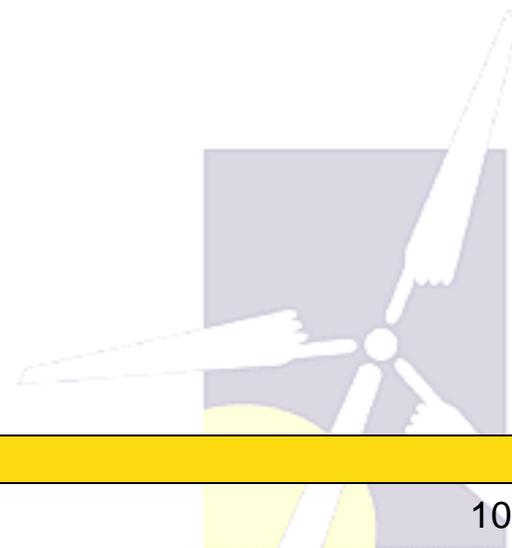
Draft Proposed Ceiling Prices, 2015 REG Program (2)

Technology	System Size	2015 Proposed CP w/ ITC ILO PTC 20 year Tariff Duration	2015 Proposed CP w PTC 20 year Tariff Duration	2015 Proposed CP w/o PTC or ITC 20 year Tariff Duration
Wind I,	1.5 to 2.99 MW	17.30	19.75	22.75
Wind II	3-5 MW	17.00	19.35	22.35

Technology	System Size	2015 Proposed CP w/ PTC 20 year Tariff Duration	2015 Proposed CP w/o PTC 20 year Tariff Duration
Anaerobic Digestion I	150 to 500 kW	18.65	20.15
Anaerobic Digestion II	501 kW to 1 MW	18.65	20.15
Hydro I	10 -250 kW	18.65	20.20
Hydro II	251 kW -1 MW	18.65	20.20



SOLAR





Proposed Installed Cost*

Class	Small Solar I (1-10 kW)	Small Solar II (11-25 kW)	Medium Solar (26-250 kW)	Commercial Solar (251-1,000 kW)	Large Solar (1-5 MW)
Value	\$4,281	\$4,216	\$3,566	\$2,676	\$2,151
Source	Average of REF Data	Average of REF Data	Average of REF and DG Pilot Bid Data	Average of DG Pilot Bid Data	Average of DG Pilot Bid Data

- Cost data is in \$/kW of Installed Capacity, DC

*Including Interconnection Costs



Interconnection Cost Research (1)*

Massachusetts and Rhode Island Solar Interconnection Costs

	Number of Projects	Average Cost (\$/kW DC)
Small Solar I ≤ 10	0	\$0
Small Solar II ≤ 25	0	\$0
Medium Solar	20	\$31
Commercial Solar	25	\$86
Large Solar	32	\$155

*Based on National Grid Data



Interconnection Cost Research (2)*

Rhode Island Solar Interconnection Costs

	Number of Projects	Average Cost (\$/kW DC)
Small Solar I ≤ 10	0	\$0
Small Solar II ≤ 25	0	\$0
Medium Solar	6	\$58
Commercial Solar	11	\$108
Large Solar	4	\$137

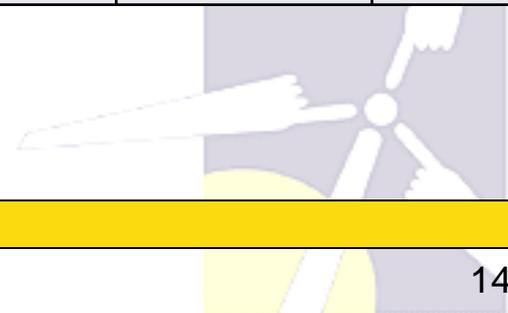
*Based on National Grid Data



Production and Capital Costs Assumptions

Modeled Parameters

		Small Solar I Resi (1-10 kW)	Small Solar I Comm (1-10 kW)	Small Solar II (11-25 kW)	Medium Solar (26-250 kW)	Commercial Solar (251-1,000 kW)	Large Solar (1-5 MW)
Nameplate Capacity	kW	5		25	140	500	1500
Annual Degradation	%	0.5%					
Cost Excluding Interconnection	\$/kW	\$4,250		\$4,185	\$3,535	\$2,590	\$1,996
Interconnection	\$/kW	\$31				\$86	\$155





Capacity Factor Research & Assumptions

Modeled Parameters

Size Class	PV Watts CF	SAM	Proposed CF for 2015*
1-10	15.21%	10.5%	13.49%
11-25	15.21%	14.71%	13.79%
25-250	15.21%	15.19%	13.49%
251-1,000	15.21%	15.23%	13.59%
1,001-5,000	15.21%	15.25%	14.18%

**Based on Massachusetts system performance database multiplied by 1.0221 correction factor for RI insolation*



Operation & Maintenance Research

Total fixed overhead*: \$/kW-Yr	Source
\$30.00	DOE 2013
\$19.93	DOE SETP 2012
\$23.50	DOE SETP 2012
\$32.80	DOE SETP 2012
\$20.69	Mai et al., 2012
\$23.27	Mai et al., 2012
\$32.47	Mai et al., 2012
\$26.00	DOE 2012
\$30.00	DOE 2012

Initial CP Inputs sum to \$25 - \$30/kW-Year.

* Includes project and site maintenance, insurance and G&A. Excludes property taxes.



Ongoing Cost Assumptions

Modeled Parameters

		Small Solar I Resi (1-10 kW)	Small Solar I Comm (1-10 kW)	Small Solar II (11-25 kW)	Medium Solar (26-250 kW)	Commercial Solar (251- 1,000 kW)	Large Solar (1-5 MW)
Fixed O&M Expense, Yr 1	\$/kW- yr	\$10.00			\$12.50	\$15.00	\$15.00
O&M Cost Inflation	%	2%					
Insurance, Yr 1 (% of Total Cost)	%	0.00%		0.25%			
Management Yr 1	\$/yr	\$0	\$250	\$500	\$3,300	\$10,000	
Land Lease	\$/yr	\$0	\$417	\$1,500	\$10,000	\$30,000	



Financing Assumptions

Modeled Parameters

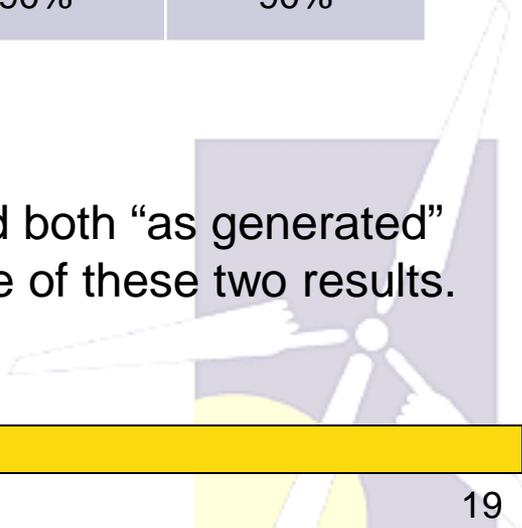
		Small Solar I Resi (1-10 kW)	Small Solar I Comm (1-10 kW)	Small Solar II (11-25 kW)	Medium Solar (26-250 kW)	Commercial Solar (251- 1,000 kW)	Large Solar (1-5 MW)
% Debt	%	0%	50%	60%	50%		
Debt Term	yrs	N/A	13/18	18			
Interest Rate on Term Debt	%	N/A	6.0%			5.5%	5.0%
Lender's Fee (% of total borrowing)	%	N/A	2.25%				
Required Minimum Annual DSCR		N/A	1.00				
Required Average DSCR		N/A	1.35				
Target After-Tax Equity IRR	%	8%	10%			7%	7%
Reserve Requirement	\$	\$0	\$0	\$0	\$0	\$0	\$200,000



Incentives

- Fed. Investment Tax Credit (ITC) assumed available:
 - At 30% for all solar projects operational on or before 12/31/2016.
 - At 10% for commercially-owned projects on-line beginning 1/1/2017
 - At 0% for homeowner-owned projects on-line beginning 1/1/2017
- ITC Monetization %:

Category	Res. 5 kW	Res./Com. 25 kW	140 kW	500 kW	1,500 kW
%	100%	100%	100%	90%	90%

- Ceiling prices evaluated without Bonus Depreciation
 - Benefit of Net Operating Loss at state level assessed both “as generated” and “carried-forward”. Proposed CPs are an average of these two results.
 - No federal, state, local or other grants assumed.
- 



Additional Assumptions

- COD achieved in 2015
- Project Useful Life: 25 years
- 0.5%/yr production degradation
- Debt Service Coverage Ratio Target: 1.35X
- Interconn. Costs depreciated on 15-year MACRS schedule
- All other project costs:
 - 96% depreciated on 5-year MACRS
 - 2% depreciated on 15-year MACRS
 - 2% not depreciable
- Fed. Income Tax rate 35%; State rate 9%
- *Assumed NEPOOL Membership costs either covered by NGRID as lead participant, or spread over many installations and therefore negligible*
- Market value of production (assumed revenue) post-contract = 90% of sum of **solar-weighted** energy and capacity price forecasts from 2013 Avoided Energy Supply Cost Study and \$5/REC (next slide)



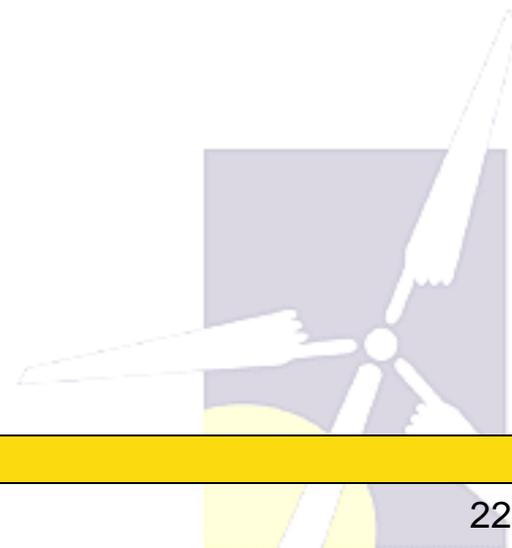
Additional Assumptions: Forecast of Market Value of Production

<u>Project Year</u>	<u>Calendar Year</u>	<u>Time-of-Production Weighted Market Value of Production (incl. energy, capacity & RECs) (cents/kWh)</u>
16	2029	12.13
17	2030	12.53
18	2031	12.94
19	2032	13.36
20	2033	13.79
21	2034	14.24
22	2035	14.7
23	2036	15.18
24	2037	15.67
25	2038	16.17





WIND





Interconnection Cost Research (1)*

Massachusetts and Rhode Island Wind Interconnection Costs

Ceiling Price Category	Number of Projects	Average Cost (\$/kW DC)
N/A	4	\$52
Wind I	3	\$107
Wind II	3	\$136

*Based on National Grid Data



Interconnection Cost Research (1)*

Rhode Island Wind Interconnection Costs

Ceiling Price Category	Number of Projects	Average Cost (\$/kW DC)
N/A	3	\$61
Wind I	1	\$120
Wind II	1	\$117

*Based on National Grid Data



Production and Capital Cost Assumptions

Modeled Parameters

		Wind I	Wind II
Nameplate Capacity	kW	1,650	3,300
Annual Degradation	%	0.0%	
Generation Equipment	\$/kW	\$3,500	\$3,400
Interconnection	\$/kW	\$107	\$136



Capacity Factor Assumptions

Modeled Parameters

Size Class	Proposed CF for 2015
Wind I	23.00%
Wind II	23.00%



Ongoing Cost Assumptions

Modeled Parameters

		Wind I	Wind II
Fixed O&M Expense, Yr 1	\$/kW-yr	\$20.00	
O&M Cost Inflation	%	2%	
Insurance, Yr 1 (% of Total Cost)	%	0.60%	
Management Yr 1	\$/yr	Included in fixed O&M	
Land Lease	\$/yr	\$30,000	\$60,000



Financing Assumptions

Modeled Parameters

		Wind I	Wind II
% Debt	%	70%	
Debt Term	yrs	18	
Interest Rate on Term Debt	%	6.5%	
Lender's Fee (% of total borrowing)	%	2.25%	
Required Minimum Annual DSCR		1.00	
Required Average DSCR		1.45	
Target After-Tax Equity IRR	%	11%	
Reserve Requirement	\$	\$0	



Wind Comments & Observations

- Principle points of focus for Rhode Island wind projects are:
 - 1. Wind Resource (Capacity Factor)**
 - i. Coastal wind resources are greater, but have proven inaccessible thus far.
 - ii. Inland sites have lesser wind resource, and are *still* challenging to permit.
 - iii. Rhode Island inland topography may not correlate well to other New England states with greater elevation changes.
 - 2. Interconnection Costs**
 - i. Costs estimates change regularly and are difficult to predict
 - ii. Issues not unique to wind
 - iii. Desire to discuss the appropriate collection and payment for long-term system upgrade



Incentives

- Current Production Tax Credit (PTC) available to projects under construction as of 12/31/2013.
 - Qualifying projects may elect the PTC or ITC in lieu thereof
- Ceiling prices evaluated without Bonus Depreciation
- Ceiling prices evaluated assuming 70% monetization of ITC, or 100% monetization of PTC.
- Benefit of Net Operating Loss at state level assessed both “as generated” and “carried-forward.” Proposed ceiling prices are an average of these two results.
- No federal, state, local or other grants assumed.

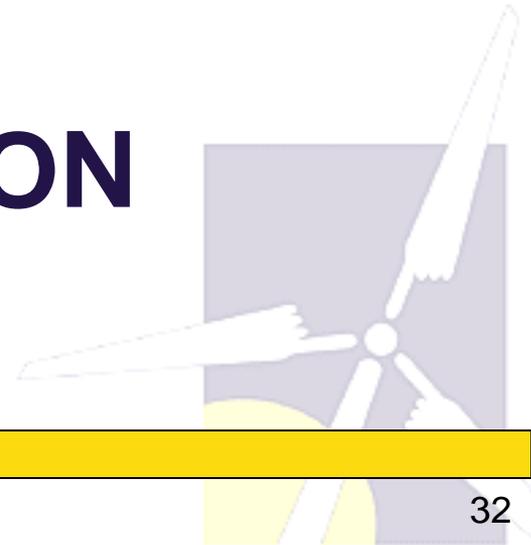


Additional Assumptions

- Commercial operation achieved in 2015
- Project Useful Life: 20 years
- Average Debt Service Coverage Ratio Target: 1.45X
- Interconnection Costs depreciated on 15-year MACRS schedule
- All other project costs:
 - 96% depreciated on 5-year MACRS
 - 2% depreciated on 15-year MACRS
 - 2% not depreciable
- Federal Income Tax rate 35%; State rate 9%



ANAEROBIC DIGESTION





PROJECT PERFORMANCE ASSUMPTIONS

Modeled Parameters

		Anaerobic Digestion I	Anaerobic Digestion II
Generator Nameplate Capacity	<i>kW</i>	325	725
Biogas Consumption per Day	<i>cubic feet/day</i>	120,066	267,840
Energy Content per Cubic Foot	<i>BTU/cubic foot</i>	600	
Heat Rate	<i>BTU/kWh</i>	8,928	
Availability	<i>%</i>	92%	
Station Service (Parasitic Load)	<i>%</i>	15%	
Annual Production Degradation	<i>%</i>	0%	
Project Useful Life	<i>years</i>	20	



CAPITAL, INTERCONNECTION AND O&M COSTS

Modeled Parameters

		Anaerobic Digestion I	Anaerobic Digestion II
Generation Equipment	<i>\$/kW</i>	\$10,000	
Interconnection Costs	<i>\$/kW</i>	\$275	
Fixed O&M Expense	<i>\$/kW-yr</i>	\$550	
Variable O&M Expense	<i>¢/kWh</i>	2.00	
O&M Cost Inflation	<i>%</i>	2%	



ONGOING EXPENSE ASSUMPTIONS

Modeled Parameters

		Anaerobic Digestion I	Anaerobic Digestion II
Insurance, Yr 1 (% of Total Cost)	%	1.0%	
Project Management Yr 1	\$/yr	\$33,621	\$75,000
Water & Sewer Expenses	\$/yr	\$0	
Digestate Disposal Cost (if handled as an expense)	\$/ton	\$0.00	
Land Lease	\$/yr	\$15,690	\$35,000



FINANCING ASSUMPTIONS

Modeled Parameters

		Anaerobic Digestion I	Anaerobic Digestion II
% Debt (% of hard costs) (mortgage-style amort.)	%	60%	
Debt Term	<i>years</i>	18	
Interest Rate on Term Debt	%	7%	
Lender's Fee (% of total borrowing)	%	0%	
Required Minimum Annual DSCR	<i>Ratio</i>	1.00	
Required Average DSCR	<i>Ratio</i>	1.50	
Target After-Tax Equity IRR	%	11%	
Other Closing Costs	\$	\$0	
Reserve Requirement	\$	\$0	



SUPPLEMENTAL REVENUE ASSUMPTIONS

Modeled Parameters

		Anaerobic Digestion I	Anaerobic Digestion II
Tipping Fee	<i>\$/ton</i>	\$25	
Quantity Received Each Year	<i>tons per year</i>	10,000	22,308
Digestate (if merchantable for additional revenue)	<i>\$/gallon</i>	\$0	



Incentives

- Current Production Tax Credit (PTC) available to projects under construction as of 12/31/2013.
 - Anaerobic digesters eligible for 50% of face value
 - Ceiling prices calculated both with and without PTC extension.
- Ceiling prices evaluated without Bonus Depreciation
- Ceiling prices evaluated assuming full monetization of federal PTC
- Benefit of Net Operating Loss at state level assessed both “as generated” and “carried-forward.” Proposed ceiling prices are an average of these two results.
- No federal, state, local or other grants assumed.

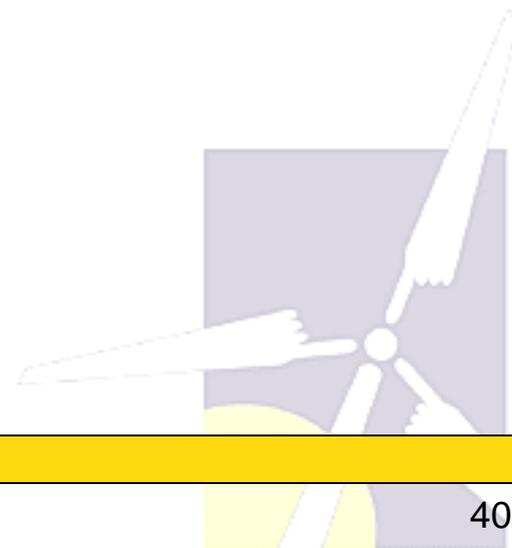


Additional Assumptions

- Commercial operation achieved in 2015
- Project Useful Life: 20 years
- Average Debt Service Coverage Ratio Target: 1.50X
- Interconnection Costs depreciated on 15-year MACRS schedule
- All other project costs:
 - 96% depreciated on 5-year MACRS
 - 2% depreciated on 15-year MACRS
 - 2% not depreciable
- Federal Income Tax rate 35%; State rate 9%



HYDRO





Interconnection Cost Research (1)*

Massachusetts and Rhode Island Hydro Interconnection Costs

Ceiling Price Category	Number of Projects	Average Cost (\$/kW DC)
Hydro I	1	\$22.59
Hydro II	0	0

*Based on National Grid Data



Interconnection Cost Research (2)*

Rhode Island Hydro Interconnection Costs

Ceiling Price Category	Number of Projects	Average Cost (\$/kW DC)
Hydro I	1	\$22.59
Hydro II	0	0

*Based on National Grid Data



Production and Capital Cost Assumptions

Modeled Parameters

		Hydro I	Hydro II
Nameplate Capacity	kW	150	500
Annual Degradation	%	0.0%	
Cost Excluding Interconnection	\$/kW	\$4,000	
Interconnection	\$/kW	\$100	



Production and Capital Cost Assumptions

Modeled Parameters

Size Class	Proposed CF for 2015*
Hydro I	40.00%
Hydro II	40.00%



ONGOING EXPENSES

Modeled Parameters

		Hydro I	Hydro II
Fixed O&M Expense, Yr 1	\$/kW-yr	\$13.00	
O&M Cost Inflation	%	3%	
Insurance, Yr 1 (% of Total Cost)	%	0.50%	
Management Yr 1	\$/yr	\$5,000	\$15,000
Land Lease	\$/yr	\$2,500	\$10,000



FINANCING ASSUMPTIONS

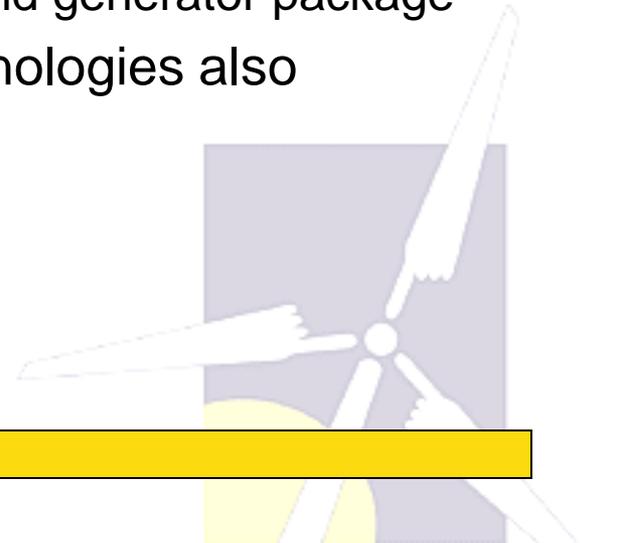
Modeled Parameters

		Hydro I	Hydro II
% Debt	%	50%	
Debt Term	yrs	18	
Interest Rate on Term Debt	%	6.5%	
Lender's Fee (% of total borrowing)	%	2.25%	
Required Minimum Annual DSCR		1.00	
Required Average DSCR		1.45	
Target After-Tax Equity IRR	%	11%	
Reserve Requirement	\$	\$0	



Hydro Comments & Observations

- **New hydro development potential is limited**
- **Efficiency development** – the increase of output/capacity at existing facilities through operating/capital improvements – is likely to be both faster and cheaper than new development
 - Conduit upgrades.
- **Hydro is extremely site specific.**
 - As a result, the costs can vary widely;
 - Attributable to civil works required, not turbine and generator package
- Substantially longer lead times than other technologies also increases costs due to time value of money.
 - However, hydro useful life is 30+ years.





Incentives

- Current Production Tax Credit (PTC) available to projects under construction as of 12/31/2013.
 - Hydro is eligible for 50% of face value
 - Ceiling prices calculated both with and without PTC extension.
- Ceiling prices evaluated without Bonus Depreciation
- Ceiling prices evaluated assuming full monetization of federal PTC
- Benefit of Net Operating Loss at state level assessed both “as generated” and “carried-forward.” Proposed ceiling prices are an average of these two results.
- No federal, state, local or other grants assumed.



Additional Assumptions

- Commercial operation achieved in 2016
- Project Useful Life: 30 years
- Interconnection Costs depreciated on 15-year MACRS schedule
- All other project costs:
 - 96% depreciated on 5-year MACRS
 - 2% depreciated on 15-year MACRS
 - 2% not depreciable
- Federal Income Tax rate 35%; State rate 9%
- Market value of production (assumed revenue) post-contract = 75% of sum of energy and capacity price forecasts from 2013 Avoided Energy Supply Cost Study and \$5/REC (see next slide)



Additional Assumptions: Forecast of Market Value of Production

Project Year	Calendar Year	Market Value of Production (incl. energy, capacity & RECs) (cents/kWh)
21	2034	13.28
22	2035	13.67
23	2036	14.07
24	2037	14.49
25	2038	14.91
26	2039	15.35
27	2040	15.80
28	2041	16.26
29	2042	16.74
30	2043	17.23



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