The Solar Coaster

The Future of Solar in Mass USGBC - June 21, 2017

Caution: This is a high-speed ride with sudden twists and turns in net metering compensation.

Who is MassSolar?

MassSolar is a collaboration of Massachusetts solar businesses, solar owners, environmental advocates, community organizations and motivated citizens.

MassSolar is working to establish a renewable energy economy, ensure fair compensation for solar owners and provide equitable access to solar for everyone in the Commonwealth.





SMART Program Overview

- 1,600 MW AC Declining Block Program
- Applies to all Investor Owned Utilities (not MLPs)
- 10 year term for small projects, 20 year term for large
- Base compensation rate declines by 4% each block
- Base compensation rate varies by project size



SREC vs. SMART

<u>SREC</u>

- SRECs are a tradable commodity with a value that fluctuates based on market conditions:
 - Long-term revenue uncertainty leads to higher financing costs,
 - A large portion of the program costs are going to a 3rd party to pay for financing,
 - Total program costs and ratepayer impacts are difficult to predict.
- SRECs are an additional revenue stream independent of the value of the energy.

Example of the incentive level in a SREC program



Declining Block Program

- This program provides long-term revenue certainty (10-20 years) which reduces financing risks and in turn, lowers soft costs
 - Total program costs can be predicted with certainty.
 - Incentive declines with the declining cost of solar.
 - A solar facility receives a single compensation rate that accounts for both the energy and the incentive.
 - The resulting value of the incentive is the net difference between the all in rate and the value of the energy.

Example of the incentive level in the new program





SMART Program Overview

- Adders support diversity of project types
 - Rooftop, Canopy, Brownfield, Landfill
 - Low-income, Community Shared Solar, Public
 - Energy Storage

Location Adders		Off-taker Adders		
Туре	Value (\$/kWh)		Туре	Value (\$/kWh
Building	\$0.02		Public	\$0.02
Brownfield	\$0.03		CSS	\$0.05
Landfill	\$0.04		Low Income	\$0.03
Canopy	\$0.06		Low Income CSS	\$0.06

• Adders capped at 320 MW each



Solar + Storage

- Energy Storage Benefits
 - Shifts PV energy generation
 - Provides peak demand reduction
 - Improves power quality, reduces strain on grid
- SMART Energy Storage adders





Competitive Procurement

- Larger projects over 1 MW
 - Initial rates set by competitive procurement
- Projects under 1 MW
 - Indices (multipliers) set capacity based compensation
- Competitive procurement capped at \$0.15 / kWh





Capacity Based Rate Factors

Capacity Based Compensation Rates (kW AC)				
		Term		
Project Capacity	Capacity Based Rate Factor	Length		
(kW AC)	(% of Clearing Price)	(Years)		
Low Income <= 25 kW	230%	10		
<= 25 kW	200%	10		
25 kW to 250 kW	150%	20		
250 kW to 500 kW	125%	20		
500 kW to 1,000 kW	110%	20		
1,000 kW to 2,000 kW	100%	20		
2,000 kW to 5,000 kW	93%	20		

• Compensation rates with adders capped at 230%



SMART Compensation Block 1 300 kW Commercial Rooftop (BTM)





SMART Compensation Block 8 300 kW Commercial Rooftop (BTM)





SMART Compensation Block 1 300 kW Commercial Roof Standalone





SMART Compensation Block 8 300 kW Commercial Roof Standalone





SMART Program All-in Compensation 25 kW Commercial Rooftop Project





SMART Program All-in Compensation 150 kW Commercial Rooftop Project





SMART Program All-in Compensation 300 kW Commercial Rooftop Project





SMART Program All-in Compensation 650 kW Commercial Rooftop Project





SMART Program All-in Compensation 1,100 kW Commercial Rooftop Project





SMART Program All-in Compensation 1,100 kW Public Rooftop Project





SMART Program All-in Compensation 1,100 kW Commercial Canopy Project





SMART Program All-in Compensation 1,100 kW Public Canopy Project





SMART Program Considerations

- Our Solar Coalition has previously provided comments regarding the proposed SMART Program
- DOER expressed interest in reviewing actual project economics under the proposed SMART Program incentive structure





SMART Program Host Customer Economics Summary

- Host Customer Economics Are Troubling
 - Max clearing price of \$0.15/kWh provides marginal returns even with best case (conservative) project assumptions which do not include: utility infrastructure upgrades, import tariffs, and MMRC
 - Declining Block pushes breakeven past 8 years
- Host Customer's Decision Criteria
 - 6.5 Year breakeven time or better
 - Bankable projects



Solar Rooftop Project Cost Assumptions

kW DC	per watt		
20	\$ 3.10		
40	\$ 2.93		
70	\$ 2.55		
100	\$ 2.52		
150	\$ 2.36		
300	\$ 2.28		
650	\$ 2.27		

Notes:

- LG NeON premium efficiency panels to maximize kWh output
- String inverters with rapid shutdown to meet 2017 code



Solar Project Cost Assumptions

Additional Notes:

- 10 degree racking with ballast blocks
- Blend between 480 VAC and 208 VAC system costs (impacts inverter and balance of system costs)
- Freight and storage fees at \$0.035 per watt
- Permit fees included at \$0.03 per watt
- Waste removal, and equipment rental fees of \$0.05 per watt
- No additional distribution equipment or transformers
- One year of O&M in base cost
- Legal fee of \$0.03 per watt for contract negotiations
- System Impact Study fee of \$20,000 included for 650 kW;
 Supplemental fee of \$4,500 included for 300 kW



Solar Rooftop Project Modelling Assumptions

- Production factor = 1,120 kWh / kW DC
- Behind the meter install No exported power, No off taker
- Financing = Cash purchase
- Customer eligible for ITC and MACRS, No bonus depreciation
- Asset management fee = \$0 < 100kW, \$500 + \$5 / kW DC >100kW
- Site lease = \$0 & Property tax = \$0
- O&M costs = \$10 / kW DC with a 2.5% escalator
- Insurance costs = \$12 / kW DC with a negative 3% escalator
- Inverter replacement = \$0.15 / watt in year 13
- No MMRC costs included
- Eversource / NSTAR territory B2 Commercial rate
- No interconnection charges
- Federal tax rate 35%, State tax rate 8%
- NPV 20 year value, Discount rate 6%



Host Customer Breakeven Time 40kW Rooftop SMART Economics \$117K Cash Purchase



Note: Requires use of \$43K in Tax benefits Year 1 at \$2.93 / watt



Host Customer Breakeven Time 150kW Rooftop SMART Economics \$354K Cash Purchase



Note: Requires use of \$130K in Tax benefits Year 1 at \$2.36 / watt



Host Customer Breakeven Time 300kW Rooftop SMART Economics \$684K Cash Purchase



Notes: Requires use of \$250K in Tax benefits Year 1 at \$2.28 / watt



300kW Rooftop SMART Economics EPC Cost for 8 Yr Customer Breakeven



Note: Requires use of \$250K in Tax benefits Year 1 at \$2.28 / watt



Host Customer Breakeven Time 300kW Canopy SMART Economics \$984K Cash Purchase



Note: Requires use of \$355K in Tax benefits Year 1 at \$3.28 / watt



Host Customer Breakeven Time 650kW Rooftop SMART Economics \$1,475K Cash Purchase



Note: Requires use of \$530K in Tax benefits Year 1 at \$2.27 / watt



650kW Rooftop SMART Economics EPC Cost for 6 Yr Customer Breakeven



Note: Requires use of \$386K in Tax benefits Year 1 at \$1.65 / watt



650kW Rooftop SMART Economics EPC Cost for 8 Yr Customer Breakeven



Note: Requires use of \$520K in Tax benefits Year 1 at \$2.23 / watt



650kW Rooftop SMART Breakeven EPC Cost w \$0.10 Interconnection Cost



Note: Requires use of \$460K in Tax benefits Year 1 at \$1.89 / watt



SMART Program Host Customer Economics Summary

- Host Customer Economics Are Troubling
 - Max clearing price of \$0.15/kWh provides marginal returns even with best case (conservative) project assumptions which do not include: utility infrastructure upgrades, import tariffs, and MMRC
 - Declining Block pushes breakeven past 8 years
 - Similar results for Low Income, CSS, and Residential
- Host Customer's Decision Criteria
 - 6.5 Year breakeven time or better
 - Bankable projects



Solar Low Income Assumptions

- Production Factor = 1,120 kWh / kW DC
- Stand alone Low Income Off taker captures 20% energy value
- Interconnection charges = \$0
- Financing = 42% Tax Equity + 58% 20 Year Debt at 6.5% interest
- Tax Equity Partner captures ITC and MACRS Depreciation
- Asset Management Fee = \$3,000 + \$10 / kW DC with a 2.5% escalator
- Site Lease & Property Tax = \$10 / kW DC with a 2.5% escalator
- O&M Costs = \$10 / kW DC with a 2.5% escalator
- Insurance Costs = \$12 / kW DC with a negative 3% escalator
- Inverter replacement = \$0.15 / watt in year 13
- No MMRC costs included
- Eversource / NSTAR territory B2 Commercial Rate
- Federal Tax Rate 35%, State Tax Rate 8%
- NPV 20 Year Value, Discount Rate 6%



Solar Low Income Assumptions

- Production Factor = 1,120 kWh / kW DC
- Stand alone Low Income Off taker captures 20% energy value
- Interconnection Costs = \$0.15 / watt
- Financing = 35% Tax Equity + 65% 20 Year Debt at 6.5% interest
- Tax Equity Partner captures ITC and MACRS Depreciation
- Asset Management Fee = \$3,000 + \$10 / kW DC with a 2.5% escalator
- Site Lease & Property Tax = \$10 / kW DC with a 2.5% escalator
- O&M Costs = \$10 / kW DC with a 2.5% escalator
- Insurance Costs = \$12 / kW DC with a negative 3% escalator
- Inverter replacement = \$0.15 / watt in year 13
- No MMRC costs included
- Eversource / NSTAR territory B2 Commercial Rate
- Federal Tax Rate 35%, State Tax Rate 8%
- NPV 20 Year Value, Discount Rate 6%



Host Customer 8 Year Breakeven 300kW Low Income SMART Economics EPC Cost w/ no Interconnection Cost



Note: Requires use of \$249K in Tax benefits Year 1 at \$2.31 / watt



Host Customer 8 Year Breakeven 1250kW Low Income SMART Economics EPC Cost w/ No Interconnection Cost



Note: Requires use of \$829K in Tax benefits Year 1 at \$1.85 / watt



Host Customer 8 Year Breakeven 1250kW Low Income SMART Economics EPC Price with Interconnection Cost



Note: Interconnection Cost \$0.15 / watt Requires use of \$829K in Tax benefits Year 1 at \$1.50 / watt



SMART Program Concerns

- Low Income SMART Economics Are Troubling
 - Even with max clearing price of \$0.15 / kWh
 - And best case (conservative) assumptions
 - Declining Block requires > 50% EPC cost reduction
- Low Income Viability
 - Even low interconnection costs can sink a project
 - Negative Net Present Value is a non-starter



Residential Solar Assumptions

- Production Factor = 1,200 kWh / kW DC
- Behind the Meter Host Receives Entire Energy & Incentive Value
- Financing = Cash purchase
- Financing = Solar Loan, 30% down, 5.25% Interest Rate
- Customer eligible for ITC
- Asset Management Fee = \$0
- Site Lease = \$0
- Property Tax = \$0
- 0&M Costs = \$0
- Insurance Costs = \$0
- Inverter replacement = \$0.15 / watt in year 13
- No MMRC costs included
- National Grid territory Residential Net Metering Credits



5kW SMART Cash Purchase Breakeven Time @\$3.50 / watt



Note: 7.5 Year Breakeven = \$0 Net Present Value



5kW SMART Cash Purchase Cost for 7.5 Year Customer Breakeven



Note: 7.5 Year Breakeven = \$0 Net Present Value



5kW SMART Solar Loan Breakeven Time @\$3.50 / watt



Note: 7.5 Year Breakeven = \$0 Net Present Value



5kW SMART Solar Loan Cost for Customer Breakeven



Note: 7.5 Year Breakeven = \$0 Net Present Value



5kW SMART Solar Loan Net Present Value @ \$3.50 / watt



Note: 7.5 Year Breakeven = \$0 Net Present Value



SMART Program Concerns

- Residential SMART Economics Are Troubling
 - Even with max clearing price of \$0.15 / kWh
 - And best case (conservative) assumptions
 - Declining Block requires > \$0.80 EPC cost reduction
 - Not including peak demand charges & MMRC
- Residential Viability
 - 7 to 15 year breakeven times and negative NPVs



SMART Program Recommendations

- DOER expressed interest in understanding our recommendations for adjusting capacity base rate factors and breakpoints which would allow host customers to achieve 6 to 8 year breakeven on their solar projects
- DOER asked to review actual project economics under the proposed SMART Program incentive structure
- We recommend incentive levels required for commercial rooftop, canopy, ground mount and CSS projects to achieve 7 year breakeven – for market conditions expected in Declining Block 1.
- We would recommend repeating this analysis for each Declining Block and adjusting incentive levels based on then current market conditions.



Commercial Rooftop Cash Purchase SMART Compensation for 6 to 8 Year Host Customer Breakeven





Commercial Rooftop Cash Purchase Proposed SMART Capacity Factor for 7 Year Host Customer Breakeven





Commercial Canopy Cash Purchase SMART Incentive for 6 to 8 Year Canopy Customer Breakeven





Commercial Canopy Cash Purchase Proposed SMART Capacity Factor for 7 Year Canopy Customer Breakeven





Interconnection Cost Effects

Interconnection Cost Effect on After-tax Cost					
System Cost (\$/watt)	\$2.00	\$1.85	\$1.70	\$1.55	
Interconnection Cost (\$/watt)	\$0.00	\$0.10	\$0.20	\$0.30	
EPC / ITC Eligible Cost (\$/watt)	\$2.00	\$1.75	\$1.50	\$1.25	

Pre-tax Cost to Customer (\$)	\$1,000,000	\$925,776	\$851,553	\$777,329
ITC Benefit (\$)	\$300,000	\$262,733	\$225 <i>,</i> 466	\$188,199
Depreciation Benefit (\$)	\$297,500	\$260,543	\$223 <i>,</i> 587	\$186,630
After-tax Cost to Customer (\$)	\$402,500	\$402,500	\$402,500	\$402,500

Every \$0.10 per watt in Interconnection costs results in a \$0.25 per watt reduction in EPC costs

Notes: 500 kW System Size – 35% Federal Tax Rate



Throwing a Giant Wrench into Panel Prices

The key point to recognize here is that a 201 filing in this case has a strong potential to move forward...

we see tariffs in the realm of 30-100% per industry experts as quite plausible given Suniva's high cost structure for Mono panels & rapid declines in the US. 🗱 UBS

Global Research

US Solar Flash Throwing a Giant Wrench into Panel Prices

Source: UBS



Recommendations

- Build in the ability to adjust SMART rates to respond to market forces and program performance
 - Monitor applications in each class and ensure blocks are being filled at similar rates
 - Changes to the Federal ITC
 - Rising Interconnection Charges
 - Rising Interest Rates
 - Rising Import Tariffs
 - MMRC and other Rate Changes
- Evaluate Program performance early and often



Recommendations

- Remove arbitrary 320 MW adder caps
- Remove caps on combinations of adders
- Raise competitive procurement cap
- Allow on bill credits to cross load zones
- Evaluate Program performance early and often
- Adjust compensation rates to achieve program goals
 - Improved Certainty for projects
 - Enhanced Diversity of projects
 - Solar job growth
 - Transition to a renewable energy economy



Recommendations

- Get your Massachusetts solar projects started now
- Viable SMART project economics won't last for long



SMART Program Comments

- Public Hearings
 - Tower Auditorium, MassART
 - 621 Huntington Ave, Boston, MA
 - July 11, 2017 from 1:00 to 3:00 PM
- Public Comments due by 5PM July 11, 2017
 - DOER.SMART@state.ma.us
 - SMART COMMENTS in the subject line

