



# Modeling the Cost of LMI Community Solar Participation: Preliminary Results

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# Overview

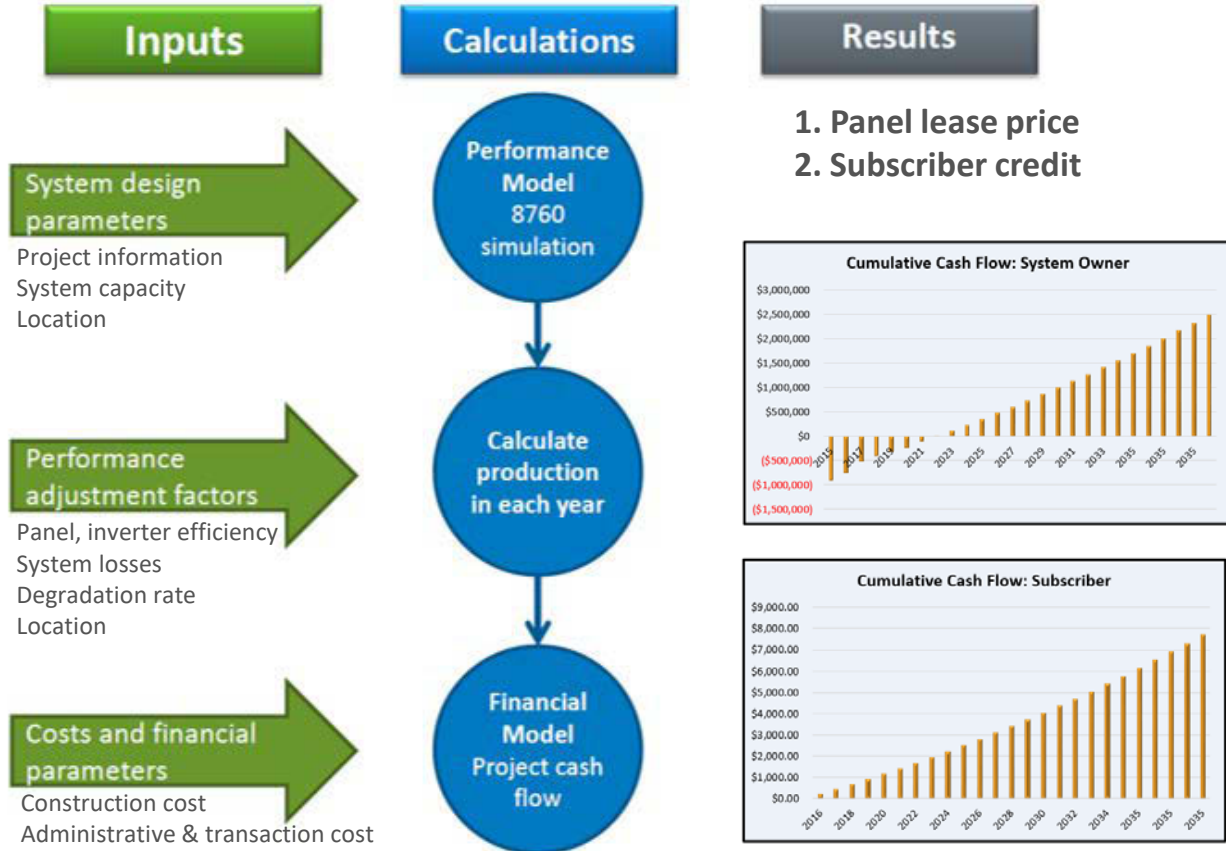
- Objectives of the Analysis
- Description of Community Solar Business Case Tool
- Scenarios Examined
- Assumptions and Model Inputs
- Model Results for Each State

# Objective

- Goal: To understand the magnitude of incentives needed to drive low-and-moderate-income (LMI) customer participation in community solar
- Approach: Used community solar finance tool to assess the cost of community solar for LMI customers in each state
  - Examined 6 states (CT, DC, MN, NM, OR, RI)
  - 3 Scenarios (20% LMI participation with anchor subscriber\*, 20% LMI with no anchor, bill credit level needed for positive net present value [NPV])
  - Standard assumptions for system cost and size
  - State specific assumptions about incentives, bill credit, generation

\*An anchor subscriber is a commercial or institutional purchaser (e.g., city or business)

# Community Solar Business Case Tool



1. Panel lease price
2. Subscriber credit

## Community Solar Business Case Tool

- Financial model that estimates costs and benefits of a community solar project
- Benefits to:
  - Developer
  - Subscriber
- Developed by Elevate Energy with DOE funding

# Community Solar Tool

## Critical System Inputs

System Owner Financials	
Business Model:	Panel Leasing
Monthly Panel Lease Price:	\$3.10
Project Information	
City:	Hartford
State:	CT
System Size - DC (Gross kW):	1000
Panel Size (W):	300
Installation Type:	Ground Mount
Ownership Entity:	Non Tax-Exempt Entity
Panels per Subscriber:	10
Years to Full Subscription:	1

## Photovoltaic System Cost Assumptions

Construction Costs	Input Unit	Input Value (2016 USD)
PV Modules:	\$/W	\$0.90
Inverters:	\$/W	\$0.28
Racking:	\$/W	\$0.30
Balance of System:	\$/W	\$0.25
Engineering and Design:	\$/W	\$0.08
Permitting and Interconnection:	\$/W	\$0.09
Installation Labor:	\$/W	\$0.50
Equipment Rental and Freight:	\$/W	\$0.05
Development Overhead:	\$/W	\$0.45
<b>Total Installed Cost of PV System (Ground Mount)</b>	<b>\$/W</b>	<b>\$2.90</b>

Site Costs	Input Unit	Input Value (2016 USD)
Purchase Cost of Site:	\$	\$0.00
Site Land Preparation Costs:	\$/W	\$0.00
Annual Lease Payments for Site:	\$/year	\$1,500.00
Removal Cost:	\$	\$0.00

O&M Costs	Input Unit	Input Value (2016 USD)
Annual System Operations & Maintenance:	\$/kW/year	\$20.00

## Community Solar Program Assumptions

Community Shared Solar Program	
System Life (years):	25
% of System Subscribed by Anchor Subscriber:	40%
Annual Subscriber Retirement/Acquisition Rate (%):	1.5%
Panel Price/Lease Escalator (%):	0%

Solar Project Financial Metrics	
Annual Energy & Demand Cost Increase:	2.00%
Subscriber NPV Discount Rate:	10.00%
Developer NPV Discount Rate:	8.00%

## Financing Assumptions

Solar Project Financing Options		
	Developer	Subscriber
Percent of Costs Financed:	20%	50%
Interest Rate:	6%	8%
Financing Term (years):	5	5

## Incentive Assumptions

Incentive	Input Unit	Input Value
Federal Investment Tax Credit (ITC):	% of qualified costs	30%
State/Local Generation Incentives, if Applicable:	\$/kWh	\$0.00
State/Local Capacity Subsidy, if Applicable:	\$/Watt	\$0.00
State/Local Lump Sum Incentive, if Applicable:	\$	\$0.00
SREC Value:	\$/SREC (MWh)	\$210.00
SREC Lifetime:	years	8
SREC Payout Schedule:	years	5
Tax Rate for MACRS Depreciation:	%	35%
Salvage Value:	% of system cost	0.00%

## Administrative and Transactional Cost Assumptions

Subscriber Acquisition Assumptions	Input Unit	Input Value
Subscriber Acquisition Difficulty:	N/A	Moderate
Labor rate for Acquisition Activities:	\$	\$50
Labor Rate Escalator:	%	2%
Upfront Billing Software Costs:	\$	\$0
Ongoing Billing Software Licensing Costs:	\$/year	\$0

# Community Solar Business Model and Design

Community solar structures vary considerably.

Ownership model influences: financing costs, available incentives, and returns needed.

- Developer-owned
- Utility-owned (most popular)
- Non-profit- or special-entity-owned

Subscription model influences acquisition costs and customer participation cost.

- Upfront payment versus monthly lease payment
- LMI-only or open to all subscribers (non-LMI, businesses)
- Anchor subscriber vs. smaller subscriptions only

In our analysis, we examined a structure where:

- a third-party owns the array,
- a **mix of subscribers** are participating (LMI, non-LMI, and businesses),
- subscribers pay a **monthly lease payment** to the third-party,
- subscribers receive a bill credit for the generation of their share.

# Scenarios Examined

## Scenario Framework:

Each state modeled individually

- Connecticut, Rhode Island, District of Columbia, Minnesota, New Mexico, Oregon

Target return for developer

- 10% modified internal rate of return (MIRR)\*

Low-income subscriber level:

- 20% of array capacity
- Assumed 10% discount on panel lease for LMI subscribers

- Scenario 1: 20% LMI with 40% anchor
  - shows annual savings and NPV for non-LMI and for LMI with 10% discount on panel lease
- Scenario 2: 20% LMI, no anchor
  - shows annual savings and NPV for non-LMI and for LMI with 10% discount on panel lease
- Scenario 3: Breakeven bill credit based on scenario 2
  - calculates bill credit level needed to achieve positive NPV for subscribers

	Scenario 1	Scenario 2	Scenario 3
LMI Customers	20%	20%	20%
Anchor subscriber	40%	0%	0%
Non-LMI	40%	80%	80%

\*MIRR – Modified Internal Rate of Return assumes that positive cash flows are reinvested at the firm's cost of capital (rather than at the IRR).

# Financial Modeling

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Community Solar Pricing for 6 States



# Key Inputs and Assumptions

- 1 MW community solar project
- Panel leasing model (i.e. no upfront payment)
  - 10 panels (3 kW) per subscriber
  - Panel lease price calculated
- System Life
  - 25 years
- Installed cost
  - \$1.58/W, per the non-residential 2017 price in GTM's US Solar Market Insight
- Annual site lease
  - \$7,500/yr
- O&M
  - \$15/kW/yr

System Owner Financials	
Business Model:	Panel Leasing
Monthly Panel Lease Price:	\$3.38

Project Information	
City:	Hartford
State:	CT
System Size - DC (Gross kW):	1000
Panel Size (W):	300
Installation Type:	Ground Mount
Ownership Entity:	Non Tax-Exempt Entity
Panels per Subscriber:	10
Years to Full Subscription:	1

Construction Costs	Input Unit	Input Value (2016 USD)
PV Modules:	\$/W	\$0.48
Inverters:	\$/W	\$0.08
Racking:	\$/W	\$0.10
Balance of System:	\$/W	\$0.10
Engineering and Design:	\$/W	\$0.06
Permitting and Interconnection:	\$/W	\$0.04
Installation Labor:	\$/W	\$0.18
Equipment Rental and Freight:	\$/W	\$0.00
Development Overhead:	\$/W	\$0.54
<b>Total Installed Cost of PV System (Ground Mount)</b>	<b>\$/W</b>	<b>\$1.58</b>

Site Costs	Input Unit	Input Value (2016 USD)
Purchase Cost of Site:	\$	\$0.00
Site/Land Preparation Costs:	\$/W	\$0.06
Annual Lease Payments for Site:	\$/year	\$7,500.00
Removal Cost:	\$	\$0.00

O&M Costs	Input Unit	Input Value (2016 USD)
Annual System Operations & Maintenance:	\$/kW/year	\$15.00

# Key Inputs and Assumptions (continued)

- Anchor subscriber: 40% and 0%
- Annual subscriber retirement/ acquisition rate: 1.5%
- Panel lease price escalation: 2%
- Annual energy cost escalation: 2.76% (Average 2015-2017 EIA)
- Federal tax credit: 30% ITC
- SREC value: Varied by state
- Tax rate for MACRs depreciation: 21%
- Subscriber acquisition difficulty: Moderate
- Labor rate for acquisition: \$65/hr, 3% labor rate escalation

## Community Solar Program Assumptions

Community Shared Solar Program	
System Life (years):	25
% of System Subscribed by Anchor Subscriber:	40%
Annual Subscriber Retirement/Acquisition Rate (%):	1.5%
Panel Price/Lease Escalator (%):	2%

Solar Project Financial Metrics	
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## Financing Assumptions

Solar Project Financing Options		
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Percent of Costs Financed:	20%	50%
Interest Rate:	6%	6%
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## Incentive Assumptions

Incentive	Input Unit	Input Value
Federal Investment Tax Credit (ITC):	% of qualified costs	30%
State/Local Generation Incentives, if Applicable:	\$/kWh	\$0.00
State/Local Capacity Subsidy, if Applicable:	\$/Watt	\$0.00
State/Local Lump Sum Incentive, if Applicable:	\$	\$0.00
SREC Value:	\$/SREC (MWh)	\$55.00
SREC Lifetime:	years	2
SREC Payout Schedule:	years	2
Tax Rate for MACRs Depreciation:	%	21%
Salvage Value:	% of system cost	0.00%

## Administrative and Transactional Cost Assumptions

Subscriber Acquisition Assumptions	Input Unit	Input Value
Subscriber Acquisition Difficulty:	N/A	Moderate
Labor rate for Acquisition Activities:	\$	\$65
Labor Rate Escalator:	%	3%
Upfront Billing Software Costs:	\$	\$0
Ongoing Billing Software Licensing Costs:	\$/year	\$0

# State Inputs and Assumptions

No established bill credit rate for community solar; assumed as utility retail rate

State	Connecticut	Rhode Island	District of Columbia	Minnesota	New Mexico	Oregon
City (used for PV production estimate)	Hartford	Providence	Washington	Minneapolis	Albuquerque	Portland
Applicable Subscriber Credit Rate (\$/kWh)	0.1834	0.1447	0.1103	0.103	0.1192	0.1053
SREC Value (current/avg over 10 years*) (\$/MWh)	55/22.55	20/16.86	405/162.60	25/6.75	n/a	n/a
SREC Lifetime (years)	10	10	10	10	n/a	n/a

\* Estimated average SREC over 10 years

- Production years 1-3: Use the most recent spot SREC price, reduced by 10%
- Production years 4-10: Assume the SREC payment is 20% of the solar alternative compliance payment (SACP)

# Results - Connecticut

Key inputs: Bill credit \$0.1834/kWh, average SREC \$22.55/MWh for 10-yr, 30% ITC

Scenarios Examined	Bill Credit Rate (\$/kWh)	Electricity Value (\$/year)	Monthly Panel Lease for non-LMI (\$/panel)	Annual Panel Lease for non-LMI (\$/year)	Non-LMI First Year Savings (\$)	Monthly Panel Lease for LMI, 10% discount (\$/panel)	Annual Panel Lease for LMI (\$/year)	LMI First Year Savings (\$)	Subscriber NPV* (\$)
1. Connecticut with anchor subscriber	0.1834	610	3.68	442	169	3.31	397	213	2,692
2. Connecticut without anchor subscriber	0.1834	610	4.97	596	14	4.47	537	74	452
3. Connecticut without anchor subscriber - breakeven	0.1834	610	4.97	596	14	4.47	537	74	452

Without anchor subscriber, panel lease is 35% higher due to higher cost of administration & transaction costs.

With 10% discount for LMI customers

**Scenario 1:** With an anchor tenant subscribing 40% of the array, the bill credit is \$0.1834/kWh, and the resulting panel lease price is \$3.68 per panel per month, in order to achieve a 10% MIRR for the project developer

**Scenario 2:** With no anchor tenant, the bill credit remains the same, at \$0.1834/kWh, but in order to achieve a 10% MIRR for the project developer, the panel lease price needs to increase to \$4.97 per panel per month.

**Scenario 3:** We did not need to apply this scenario, as the existing bill credit is sufficient for subscriber to achieve a positive NPV.

\*Subscriber NPV calculated directly from the software does not distinguish between LMI and non-LMI.

# Results – Rhode Island

Key inputs: Bill credit \$0.1447/kWh, average SREC \$16.86/MWh for 10-yr, 30% ITC

Scenarios Examined	Bill Credit Rate (\$/kWh)	Electricity Value (\$/year)	Monthly Panel Lease for non-LMI (\$/panel)	Annual Panel Lease for non-LMI (\$/year)	Non-LMI First Year Savings (\$)	Monthly Panel Lease for LMI, 10% discount (\$/panel)	Annual Panel Lease for LMI (\$/year)	LMI First Year Savings (\$)	Subscriber NPV* (\$)
1. Rhode Island with anchor subscriber	0.1447	510	3.29	395	115	2.96	355	155	1,476
2. Rhode Island without anchor subscriber	0.1447	510	5.09	611	-101	4.58	550	-40	-815
3. Rhode Island without anchor subscriber – breakeven	0.1660	585	5.09	611	-26	4.58	550	35	20

Bill credit is 15% higher to make subscriber NPV positive.

Without anchor subscriber, panel lease is 55% higher due to higher cost of administration & transaction costs.

With 10% discount for LMI customers

**Scenario 1:** With an anchor tenant subscribing 40% of the array, the bill credit is \$0.1447/kWh, and the resulting panel lease price is \$3.29 per panel per month, in order to achieve a 10% MIRR for the project developer

**Scenario 2:** With no anchor tenant, the bill credit remains the same, at \$0.1447/kWh, but in order to achieve a 10% MIRR for the project developer, the panel lease price needs to increase to \$5.09 per panel per month

**Scenario 3:** With no anchor tenant and panel lease price at \$5.09 per month, the bill credit needs to increase to \$0.1660/kWh for subscriber to achieve a positive NPV

\*Subscriber NPV calculated directly from the software does not distinguish between LMI and non-LMI.

# Results – District Columbia

Key inputs: Bill credit \$0.1103/kWh, average SREC \$162.60/MWh for 10-yr, 30% ITC

Scenarios Examined	Bill Credit Rate (\$/kWh)	Electricity Value (\$/year)	Monthly Panel Lease for non-LMI (\$/panel)	Annual Panel Lease for non-LMI (\$/year)	Non-LMI First Year Savings (\$)	Monthly Panel Lease for LMI, 10% discount (\$/panel)	Annual Panel Lease for LMI (\$/year)	LMI First Year Savings (\$)	Subscriber NPV* (\$)
1. Washington DC with anchor subscriber	0.1103	390	0	0	390	0.00	0	390	4,327
2. Washington DC without anchor subscriber	0.1103	390	0	0	390	0.00	0	390	4,327
3. Washington DC without anchor subscriber - breakeven	0.1103	390	0	0	390	0.00	0	390	4,327

Panel lease is zero all cases; developer can get a **>10% MIRR** return from incentives without relying on revenue from panel lease.

**Scenarios 1,2,3:** at bill credit \$0.1103/kWh, panel lease is not needed.

**All cases - Developer achieves more than 10% MIRR without getting panel lease revenue due to high SREC incentive**

\*Subscriber NPV calculated directly from the software does not distinguish between LMI and non-LMI.

# Results – Minnesota

Key inputs: Bill credit \$0.103/kWh, average SREC \$6.75/MWh for 10-yr, 30% ITC

Scenarios Examined	Bill Credit Rate (\$/kWh)	Electricity Value (\$/year)	Monthly Panel Lease for non-LMI (\$/panel)	Annual Panel Lease for non-LMI (\$/year)	Non-LMI First Year Savings (\$)	Monthly Panel Lease for LMI, 10% discount (\$/panel)	Annual Panel Lease for LMI (\$/year)	LMI First Year Savings (\$)	Subscriber NPV* (\$)
1. Minnesota with anchor subscriber	0.103	362	3.48	418	-55	3.13	376	-14	-418
2. Minnesota without anchor subscriber	0.103	362	5.37	644	-282	4.83	580	-218	-2,823
3. Minnesota without anchor subscriber - breakeven	0.176	617	5.37	644	-27	4.83	580	37	20

Bill credit is 71% higher to make subscriber NPV positive.

Without anchor subscriber, panel lease is 54% higher due to higher cost of administration & transaction costs.

With 10% discount for LMI customers

**Scenario 1:** With an anchor tenant subscribing 40% of the array, the bill credit is \$0.1030/kWh, and the resulting panel lease price is \$3.48 per panel per month, in order to achieve a 10% MIRR for the project developer

**Scenario 2:** With no anchor tenant, the bill credit remains the same, at \$0.1030/kWh, but in order to achieve a 10% MIRR for the project developer, the panel lease price needs to increase to \$5.37 per panel per month

**Scenario 3** With no anchor tenant and panel lease price at \$5.37 per month, the bill credit needs to increase to \$0.1760/kWh for subscriber to achieve a positive NPV

\*Subscriber NPV calculated directly from the software does not distinguish between LMI and non-LMI.

# Results – New Mexico

Key inputs: Bill credit \$0.1192/kWh assumed as utility rate, SREC n/a, 30% ITC

Scenarios Examined	Bill Credit Rate (\$/kWh)	Electricity Value (\$/year)	Monthly Panel Lease for non-LMI (\$/panel)	Annual Panel Lease for non-LMI (\$/year)	Non-LMI First Year Savings (\$)	Monthly Panel Lease for LMI, 10% discount (\$/panel)	Annual Panel Lease for LMI (\$/year)	LMI First Year Savings (\$)	Subscriber NPV* (\$)
1. New Mexico with anchor subscriber	0.1192	565	3.89	467	98	3.50	420	144	1,319
2. New Mexico without anchor subscriber	0.1192	565	6.00	720	-155	5.40	648	-83	-1,367
3. New Mexico without anchor subscriber - breakeven	0.1450	687	6.00	720	-33	5.40	648	39	6

Bill credit is 22% higher to make subscriber NPV positive.

Without anchor subscriber, panel lease is 54% higher due to higher cost of administration & transaction costs.

With 10% discount for LMI customers

**Scenario 1:** With an anchor tenant subscribing 40% of the array, the bill credit is \$0.1192/kWh, and the resulting panel lease price is \$3.89 per panel per month, in order to achieve a 10% MIRR for the project developer

**Scenario 2:** With no anchor tenant, the bill credit remains the same, at \$0.1192/kWh, but in order to achieve a 10% MIRR for the project developer, the panel lease price needs to increase to \$6.00 per panel per month

**Scenario 3** With no anchor tenant and panel lease price at \$6.00 per month, the bill credit needs to increase to \$0.1450/kWh for subscriber to achieve a positive NPV

\*Subscriber NPV calculated directly from the software does not distinguish between LMI and non-LMI.



# Results – Oregon

Key inputs: Bill credit \$0.1053/kWh assumed as utility rate, SREC n/a, 30% ITC

Scenarios Examined	Bill Credit Rate (\$/kWh)	Electricity Value (\$/year)	Monthly Panel Lease for non-LMI (\$/panel)	Annual Panel Lease for non-LMI (\$/year)	Non-LMI First Year Savings (\$)	Monthly Panel Lease for LMI, 10% discount (\$/panel)	Annual Panel Lease for LMI (\$/year)	LMI First Year Savings (\$)	Subscriber NPV* (\$)
1. Oregon with anchor subscriber	0.1053	326	3.73	448	-121	3.36	403	-77	-1,125
2. Oregon without anchor subscriber	0.1053	326	5.77	692	-366	5.19	623	-297	-3,721
3. Oregon without anchor subscriber - breakeven	0.2140	663	5.77	692	-29	5.19	623	40	18

Bill credit is 103% higher to make subscriber NPV positive.

Without anchor subscriber, panel lease is 55% higher due to higher cost of administration & transaction costs.

With 10% discount for LMI customers

**Scenario 1:** With an anchor tenant subscribing 40% of the array, the bill credit is \$0.1053/kWh, and the resulting panel lease price is \$3.73 per panel per month, in order to achieve a 10% MIRR for the project developer

**Scenario 2:** With no anchor tenant, the bill credit remains the same, at \$0.1053kWh, but in order to achieve a 10% MIRR for the project developer, the panel lease price needs to increase to \$5.77 per panel per month

**Scenario 3** With no anchor tenant and panel lease price at \$5.77 per month, the bill credit needs to increase to \$0.2140/kWh for subscriber to achieve a positive NPV

\*Subscriber NPV calculated directly from the software does not distinguish between LMI and non-LMI.

# Summary and Key Takeaways

- In most states, subscribers achieve a positive NPV if an anchor subscriber is participating (taking 40% of project output)
- Having no anchor subscriber can increase the panel lease price by 55%
  - Without an anchor there are a larger number of subscribers, which increases the total subscriber acquisition cost
- Discount on the panel lease price for LMI customers could come from state incentives
- To achieve a positive NPV for customers, the increase in the bill credit rate needed ranged from 7% to 103% across states
- States could use this tool to determine the level of LMI incentives that may be needed to make community solar financially viable for LMI customers

# Discussion and Next Steps

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# References & Contact Information

## References

- Community Solar Business Tool, [www.elevateenergy.org/programs/solar-energy/community-solar/communitysolarbusinesscasetool/](http://www.elevateenergy.org/programs/solar-energy/community-solar/communitysolarbusinesscasetool/)
- PVWatts Calculator, <https://pvwatts.nrel.gov/>
- Database of State Incentives for Renewables & Efficiency, <http://www.dsireusa.org/>
- Solar Renewable Energy Credit, <https://srectrade.com/>

## Contact Information

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# Thank You

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